

# NEET Mock Test 5

**Total Time:** 3 Hour : 20 Minute

**Total Marks:** 720

## Instructions

### Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

### Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

## Physics Section A

1. According to Curie's law, the magnetic susceptibility of a substance at an absolute temperature  $T$  is proportional to (+4, -1)
- a.  $1/T$
  - b.  $T$
  - c.  $1/T^2$
  - d.  $T^2$
- 
2. An electron is accelerated from rest through a potential difference of  $V$  volt. If the de Broglie wavelength of the electron is  $1.227 \times 10^{-2} \text{ nm}$ , the potential difference is : (+4, -1)
- a. 10 V
  - b.  $10^2$  V
  - c.  $10^3$  V
  - d.  $10^4$  V
- 
3. In an A.C. circuit, the current flowing is  $I = 5 \sin(100t - \frac{\pi}{2})$  ampere and the potential difference is  $V = 200 \sin(100t)$  volts. The power consumption is equal to (+4, -1)
- a. 20 W
  - b. 0 W
  - c. 1000W
  - d. 40 W.
- 
4. Percentage error in the measurement of mass and speed are 2% and 3% respectively. The error in the estimation of kinetic energy obtained by measuring mass and speed will be (+4, -1)

- a. 12%
- b. 10%
- c. 2%
- d. 8%

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5. Two nuclei have their mass numbers in the ratio of 1 : 3. The ratio of their nuclear densities would be (+4, -1)

- a.  $(3)^{1/3} : 1$
- b. 1 : 1
- c. 1 : 3
- d. 3 : 1

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6. A radioactive nucleus  ${}^A_ZX$  undergoes spontaneous decay in the sequence  ${}^A_ZX \rightarrow {}^{Z-1}_B \rightarrow {}^{Z-3}_C \rightarrow {}^{Z-2}_D$ , where Z is the atomic number of element X. The possible decay particles in the sequence are (+4, -1)

- a.  $\beta^-$ ,  $\alpha$ ,  $\beta^+$
- b.  $\alpha$ ,  $\beta^-$ ,  $\beta^+$
- c.  $\alpha$ ,  $\beta^+$ ,  $\beta^-$
- d.  $\beta^+$ ,  $\alpha$ ,  $\beta^-$

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7. When three identical bulbs of 60 watt 200 volt rating are connected in series to a 200-volt supply, the power drawn by them will be (+4, -1)

- a. 180 watt
- b. 10 watt
- c. 20 watt

d. 60 watt

- 
8. A force acts on a 3 g particle in such a way that the position of the particle as a function of time is given by  $x = 3t - 4t^2 + t^3$ , where  $x$  is in metres and  $t$  is in seconds. The work done during the first 4 second is (+4, -1)

a. 490 mJ

b. 450 mJ

c. 576 mJ

d. 530 mJ

- 
9. Three equal resistors connected in series across a source of e.m.f. together dissipate 10 watt of power. What will be the power dissipated in watt if the same resistors are connected in parallel across the same source of e.m.f. ? (+4, -1)

a. 30

b.  $\frac{10}{3}$

c. 10

d. 90

- 
10. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass =  $5.98 \times 10^{24} \text{ kg}$ ) have to be compressed to be a black hole? (+4, -1)

a.  $10^{-9} \text{ m}$

b.  $10^{-6} \text{ m}$

c.  $10^{-2} \text{ m}$

d.  $100 \text{ m}$

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11. A man fires a bullet of mass  $200\text{ gm}$  at a speed of  $5\text{ m/s}$ . The gun is of one  $\text{kg}$  mass. By what velocity the gun rebounds backward? (+4, -1)

- a.  $1\text{ m/s}$
- b.  $0.01\text{ m/s}$
- c.  $0.1\text{ m/s}$
- d.  $10\text{ m/s}$

12. The frequency of sinusoidal wave  $y = 0.40\cos [2000 t + 0.80]$  would be (+4, -1)

- a.  $1000\pi\text{ Hz}$
- b.  $2000\text{ Hz}$
- c.  $20\text{ Hz}$
- d.  $\frac{1000}{\pi}\text{ Hz}$

13. A body is executing simple harmonic motion. When the displacements from the mean position is  $4\text{ cm}$  and  $5\text{ cm}$ , the corresponding velocities of the body is  $10\text{ cm/sec}$  and  $8\text{ cm/sec}$ . Then the time period of the body is (+4, -1)

- a.  $\frac{2\pi}{2}\text{ sec}$
- b.  $\pi/2\text{ sec}$
- c.  $\pi\text{ sec}$
- d.  $(3\pi/2)\text{ sec}$

14. A car moving with a speed of  $40\text{ km/h}$  can be stopped by applying brakes after at least  $2\text{ m}$ . If the same car is moving with a speed of  $80\text{ km/h}$ , what is the minimum stopping distance? (+4, -1)

- a.  $4\text{ m}$

b. 6 m

c. 8 m

d. 2 m

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15. A thin conducting ring of radius  $R$  is given a charge  $+Q$ . The electric field at the center  $O$  of the ring due to the charge on the part  $AKB$  of the ring is  $E$ . The electric field at the center due to the charge on the part  $ACDB$  of the ring is (+4, -1)

a.  $E$  along  $KO$

b.  $3E$  along  $OK$

c.  $3E$  along  $KO$

d.  $E$  along  $OK$

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16. A hoop of radius  $2\text{ m}$  weighs  $100\text{ kg}$ . It rolls along a horizontal floor so that its centre of mass has a speed of  $20\text{ cm s}^{-1}$ . How much work has to be done to stop it? (+4, -1)

a.  $2\text{ J}$

b.  $4\text{ J}$

c.  $6\text{ J}$

d.  $8\text{ J}$

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17. A long solenoid of  $50\text{ cm}$  length having  $100\text{ turns}$  carries a current of  $2.5\text{ A}$ . The magnetic field at the centre of the solenoid is : ( $\mu_0 = 4\pi \times 10^{-7}\text{ T m A}^{-1}$ ) (+4, -1)

a.  $6.28 \times 10^{-4}\text{ T}$

b.  $3.14 \times 10^{-4}\text{ T}$

c.  $6.28 \times 10^{-5}\text{ T}$

d.  $3.14 \times 10^{-5} T$

- 
18. A particle of mass  $m$  is projected with velocity  $v$  making an angle of  $45^\circ$  with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be (+4, -1)

- a.  $mv \sqrt{2}$
- b. zero
- c.  $2mv$
- d.  $mv / \sqrt{2}$

- 
19. An object is placed at a distance of  $40\text{ cm}$  from a concave mirror of focal length  $15\text{ cm}$ . If the object is displaced through a distance of  $20\text{ cm}$  towards the mirror, the displacement of the image will be (+4, -1)

- a.  $36\text{ cm}$  towards the mirror
- b.  $30\text{ cm}$  away from the mirror
- c.  $30\text{ cm}$  towards the mirror
- d.  $36\text{ cm}$  away from the mirror

- 
20. Given the value of Rydberg constant is  $10^7\text{ m}^{-1}$ , the wave number of the last line of the Balmer series in hydrogen spectrum will be : (+4, -1)

- a.  $0.5 \times 10^7\text{ m}^{-1}$
- b.  $0.25 \times 10^7\text{ m}^{-1}$
- c.  $2.5 \times 10^7\text{ m}^{-1}$
- d.  $0.025 \times 10^4\text{ m}^{-1}$
-

21. In an ac circuit , an alternating voltage  $e = 200\sqrt{2} \sin 100t$  volts is connected to a capacitor of capacitance  $1 \mu F$ . The rms value of the current in the circuit is: (+4, -1)
- 10 mA
  - 100 mA
  - 200 mA
  - 20 mA
- 
22. The electric field associated with an e. m. wave in vacuum is given by  $\vec{E} = \hat{i}40 \cos(kz - 6 \times 10^8 t)$ , where  $E, z$  and  $t$  are in volt /m, meter and seconds respectively. The value of wave vector  $k$  is: (+4, -1)
- $2 m^{-1}$
  - $0.5 m^{-1}$
  - $6 m^{-1}$
  - $3 m^{-1}$
- 
23. A  $n - p - n$  transistor is connected to common emitter configuration in a given amplifier. A load resistance of  $800 \Omega$  is connected in the collector circuit and the voltage drop across it is  $0.8 V$ . If the current amplification factor is  $0.96$  and the input resistance of the circuit is  $192 \Omega$ , the voltage gain and the power gain of the amplifier will respectively be (+4, -1)
- 3.69, 3.84
  - 4, 4
  - 4, 3.69
  - 4, 3.84
- 
24. An electron is accelerated through a potential difference of  $10,000 V$ . Its de Broglie wavelength is. (nearly): (mt. =  $9 \times 10^{-31} kg$ ) (+4, -1)

- a.  $12.2 \times 10^{11} \text{ m}$
- b.  $12.2 \text{ nm}$
- c.  $12.2 \times 10^{13} \text{ m}$
- d.  $12.2 \times 10^{-12} \text{ m}$

25. An iron rod of susceptibility 599 is subjected to a magnetising field of  $1200 \text{ A m}^{-1}$ . The permeability of the material of the rod is:  $(\mu_o = 4\pi \times 10^{-7} \text{ T m A}^{-1})$  (+4, -1)

- a.  $2.4\pi \times 10^{-4} \text{ T m A}^{-1}$
- b.  $8.0\pi \times 10^{-5} \text{ T m A}^{-1}$
- c.  $2.4\pi \times 10^{-5} \text{ T m A}^{-1}$
- d.  $2.4\pi \times 10^{-7} \text{ T m A}^{-1}$

26. A slab of stone of area  $0.36 \text{ m}^2$  and thickness  $0.1 \text{ m}$  is exposed on the lower surface to steam at  $100^\circ \text{C}$ . A block of ice at  $0^\circ \text{C}$  rests on the upper surface of the slab. In one hour  $4.8 \text{ kg}$  of ice is melted. The thermal conductivity of slab is (Given latent heat of fusion of ice =  $3.36 \times 10^5 \text{ J kg}^{-1}$ ) (+4, -1)

- a.  $1.24 \text{ J/m/s/}^\circ \text{C}$
- b.  $1.29 \text{ J/m/s/}^\circ \text{C}$
- c.  $2.05 \text{ J/m/s/}^\circ \text{C}$
- d.  $1.02 \text{ J/m/s/}^\circ \text{C}$

27. The main scale of a vernier callipers has  $n$  divisions/cm.  $n$  divisions of the vernier scale coincide with  $(n - 1)$  divisions of main scale. The least count of the vernier callipers is, (+4, -1)

- a.  $\frac{1}{(n+1)(n-1)} \text{ cm}$
- b.  $\frac{1}{n} \text{ cm}$

c.  $\frac{1}{n^2}cm$

d.  $\frac{1}{n(n+1)}cm$

28. The value of quality factor is

(+4, -1)

a.  $\frac{\omega L}{R}$

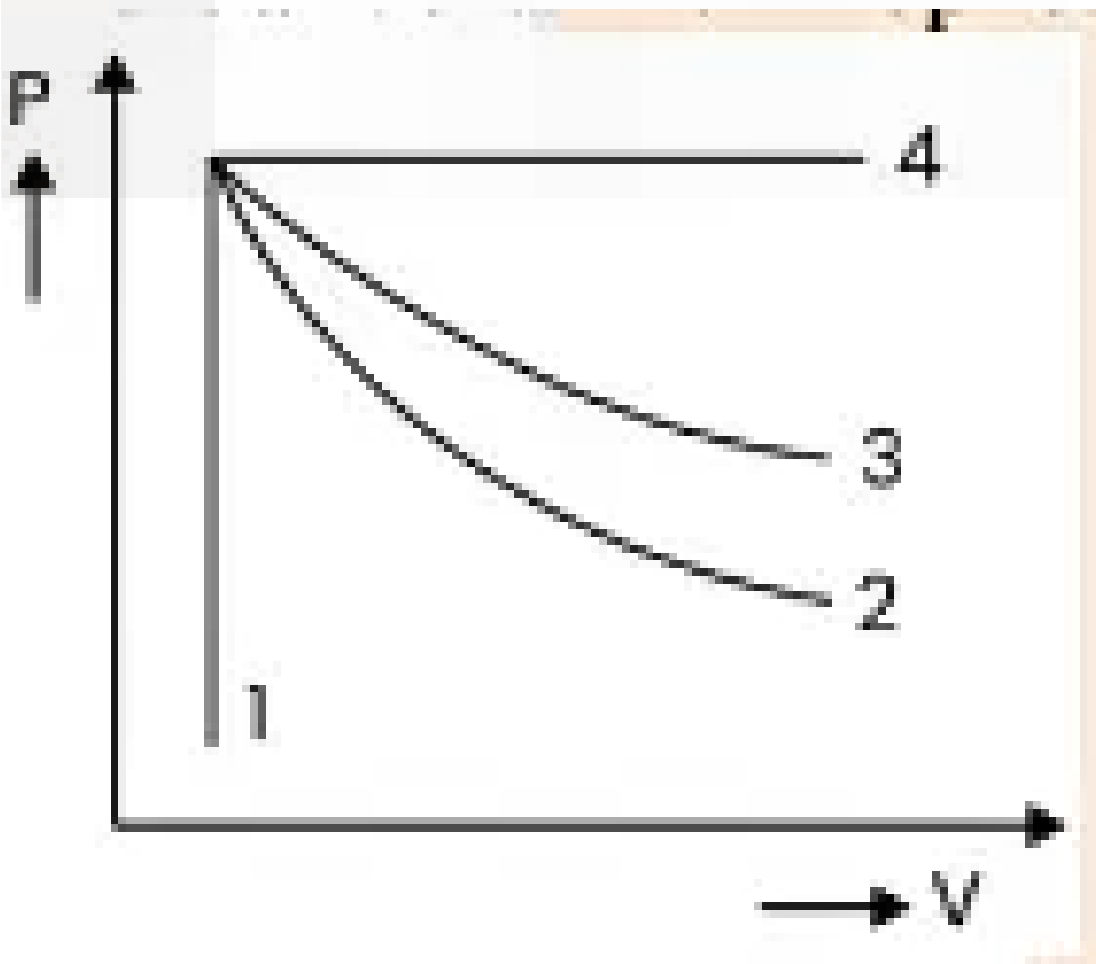
b.  $\frac{1}{\omega RC}$

c.  $\sqrt{LC}$

d.  $L/R$ .

29. An ideal gas undergoes four different processes from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is:

(+4, -1)



- a. 1
- b. 2
- c. 3
- d. 4

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30. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is (+4, -1)

- a. 216 MeV
- b. 0.9 MeV
- c. 9.4 MeV
- d. 804 MeV

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31. A square surface of side  $L$  m is in the plane of the paper. A uniform electric field  $\rightarrow E \left( \frac{V}{m} \right)$ , also in the plane of the paper, is limited only to the lower half of the square surface, (see figure). The electric flux in SI units associated with the surface is : (+4, -1)

- a.  $\frac{EL^2}{(2\epsilon_0)}$
- b.  $\frac{EL^2}{2}$
- c. Zero
- d.  $EL^2$

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32. A shell, in flight, explodes into four unequal parts. Which of the following is conserved? (+4, -1)

- a. Potential energy

- b. Momentum
- c. Kinetic energy
- d. Both (a) and (c)

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33. Two batteries, one of emf 18 volts and internal resistance  $2\Omega$  and the other of emf 12 volts and internal resistance  $1\Omega$  are connected as shown. The voltmeter V will record a reading of (+4, -1)

- a. 30 volt
- b. 18 volt
- c. 15 volt
- d. 14 volt

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34. The distance of two planets from the sun are  $10^{13}$  m and  $10^{12}$  m respectively. The ratio of time periods of the planets is (+4, -1)

- a.  $\sqrt{10}$
- b.  $10\sqrt{10}$
- c. 10
- d.  $\frac{1}{\sqrt{10}}$

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35. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the propagation direction are (+4, -1)

- a. energy, momentum and mass
- b. energy
- c. energy and mass
- d. energy and linear momentum

## Physics Section B

36. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain that can hang over one edge of the table is (+4, -1)
- a. 0.2
  - b. 0.25
  - c. 0.35
  - d. 0.15
- 
37. The bob of simple pendulum having length  $l$ , is displaced from mean position to an angular position  $\theta$  with respect to vertical. If it is released, then velocity of bob at equilibrium position (+4, -1)
- a.  $\sqrt{2gl(1 - \cos \theta)}$
  - b.  $\sqrt{2gl(1 + \cos \theta)}$
  - c.  $\sqrt{2gl \cos \theta}$
  - d.  $\sqrt{2gl}$
- 
38. A charge  $Q$  is situated at the corner of a cube, the electric flux passed through all the six faces of the cube is (+4, -1)
- a.  $\frac{Q}{6\epsilon_0}$
  - b.  $\frac{Q}{8\epsilon_0}$
  - c.  $\frac{Q}{\epsilon_0}$
  - d.  $\frac{Q}{2\epsilon_0}$
- 
39. A long straight wire of radius  $a$  carries a steady current  $I$ . The current uniformly distributed over its cross-section. The ratio of the magnetic fields B (+4, -1)

and B', at radial distance  $\frac{a}{2}$  and  $2a$  respectively, from the axis of the wire is :

- a.  $\frac{1}{2}$
- b. 1
- c. 4
- d.  $\frac{1}{4}$

40. A man throws balls with the same speed vertically upwards one after the other at an interval of  $2s$ . What should be the speed of the throw so that more than two balls are in the sly at any time? (Given  $g = 9.8 m/s^2$ ) (+4, -1)

- a. Any speed less than  $19.6 m/s$
- b. Only with speed  $19.6 m/s$
- c. More than  $19.6 m/s$
- d. At least  $9.8 m/s$

41. A mass  $m$  moves in a circle on a smooth horizontal plane with velocity  $v_0$  at a radius  $R_0$ . The mass is attached to a string which passes through a smooth hole in the plane as shown. The tension in the string is increased gradually and finally  $m$  moves in a circle of radius  $\frac{R_0}{2}$ . The final value of the kinetic energy is (+4, -1)

- a.  $2mv_0^2$
- b.  $\frac{1}{2}mv_0^2$
- c.  $mv_0^2$
- d.  $\frac{1}{4}mv_0^2$

42. A particle shows distance - time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point (+4, -1)

- a. D

b. A

c. B

d. C

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**43.** Assume that light of wavelength  $600\text{ nm}$  is coming from a star. The limit of resolution of telescope whose objective has a diameter of  $2\text{ m}$  is : (+4, -1)

a.  $3.66 \times 10^{-7}\text{ rad}$

b.  $1.83 \times 10^{-7}\text{ rad}$

c.  $7.32 \times 10^{-7}\text{ rad}$

d.  $6.00 \times 10^{-7}\text{ rad}$

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**44.** Hydrogen atom in ground state is excited by a monochromatic radiation of  $\lambda = 975\text{ \AA}$ . Number of spectral lines in the resulting spectrum emitted will be (+4, -1)

a. 3

b. 2

c. 6

d. 10

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**45.** In which of the following devices, the eddy current effect is not used ? (+4, -1)

a. electromagnet

b. electric heater

c. induction furnace

d. magnetic braking in train

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46. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is : ( $c$  = speed of electromagnetic waves) (+4, -1)

- a.  $c : 1$
- b.  $1 : 1$
- c.  $1 : c$
- d.  $1 : c^2$

47. A  $p - n$  photodiode is made of a material with a band gap of  $2 \text{ eV}$ . The minimum frequency of the radiation that can be absorbed by the material is nearly ( $h = 1240 \text{ eV nm}$ ) (+4, -1)

- a.  $1 \times 10^{14} \text{ Hz}$
- b.  $20 \times 10^{14} \text{ Hz}$
- c.  $10 \times 10^{14} \text{ Hz}$
- d.  $5 \times 10^{14} \text{ Hz}$

48. An electron of mass  $m$  and a photon have same energy  $E$ . The ratio of de-Broglie wavelengths associated with them is : (+4, -1)

- a.  $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$
- b.  $c(2mE)^{\frac{1}{2}}$
- c.  $\frac{1}{c} \left(\frac{2m}{E}\right)^{\frac{1}{2}} c$
- d.  $\frac{1}{c} \left(\frac{E}{2m}\right)^{\frac{1}{2}} c$

49. At a point  $A$  on the earth's surface the angle of dip.  $\delta = +25^\circ$ . At a point  $B$  on the earth's surface the angle of dip,  $\delta = -25^\circ$ . We can interpret that: (+4, -1)

- a. A is located in the northern hemisphere and B is located in the southern hemisphere.
- b. A and B are both located in the southern hemisphere.
- c. A and B are both located in the northern hemisphere.
- d. A is located in the southern hemisphere and B is located in the northern hemisphere.

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50. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are  $39^{\circ}\text{W}$  and  $239^{\circ}\text{W}$  respectively. What will be the temperature on the new scale, corresponding to a temperature of  $39^{\circ}\text{C}$  on the Celsius scale?

(+4, -1)

- a.  $78^{\circ}\text{W}$
- b.  $117^{\circ}\text{W}$
- c.  $200^{\circ}\text{W}$
- d.  $139^{\circ}\text{W}$

## Chemistry Section A

51. The maximum number of electrons, present in an orbit that is represented by azimuthal quantum number ( $l$ ) = 3, will be (+4, -1)

- a. 8
- b. 2
- c. 14
- d. 6

52. Which of the following is correct about  $H$ -bonding in  $DNA$ ? (+4, -1)

- a.  $A - T, G - C$
- b.  $A - G, T - C$
- c.  $G - T, A - C$
- d.  $A - A, T - T$

53. It is possible to obtain oxygen from air by fractional distillation because (+4, -1)

- a. oxygen is in a different group of the periodic table from nitrogen
- b. oxygen is more reactive than nitrogen
- c. oxygen has higher boiling point than nitrogen
- d. oxygen has a lower density than nitrogen

54. Iron carbonyl,  $Fe(CO)_5$  is (+4, -1)

- a. dinuclear
- b. tetranuclear
- c. trinuclear

d. mononuclear

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55. Absolute zero is defined as the temperature (+4, -1)

- a. at which all molecular motion ceases
- b. at which liquid helium boils
- c. at which ether boils
- d. All of the above

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56. An aqueous solution is 1.00 molal in  $KI$ . Which change will cause the vapour pressure of the solution to increase? (+4, -1)

- a. Addition of water
- b. Addition of  $NaCl$
- c. Addition of  $Na_2SO_4$
- d. Addition of 1.00 molal  $KI$

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57. Aqueous solution of acetic acid contains (+4, -1)

- a.  $CH_3COO^-$  and  $H^+$
- b.  $CH_3COO^-$ ,  $H_3O^+$  and  $CH_3COOH$
- c.  $CH_3COO^-$ ,  $H_3O^+$  and  $H^+$
- d.  $CH_3COOH$ ,  $CH_3COO^-$  and  $H^+$

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58. Assuming fully decomposed, the volume of  $CO_2$  released at STP on heating 9.85 g of  $BaCO_3$  (at. mass of Ba = 137) will be (+4, -1)

- a. 1.12 L
- b. 0.84 L

c. 2.24 L

d. 4.96 L

59.  $Cu^+(aq)$  is unstable in solution and undergoes simultaneous oxidation and reduction according to the reaction  $2Cu^+(aq) \rightleftharpoons Cu^{2+}(aq) + Cu(s)$  Choose the correct  $E^0$  for above reaction if  $E^0_{Cu^{2+}/Cu^+} = 0.34 V$  and  $E^0_{Cu^{2+}/Cu} = 0.15V$  (+4, -1)

a. - 0.38 V

b. #ERROR!

c. #ERROR!

d. - 0.19 V

60. During the kinetic study of the reaction,  $2A + B \rightarrow C + D$ , following results were obtained . Based on the above data which one of the following is correct? (+4, -1)

| Run | $A/mol L^{-1}$ | $B/mol L^{-1}$ | Initial rate of formation of $D/mol L^{-1} min^{-1}$ |
|-----|----------------|----------------|------------------------------------------------------|
| I   | 0.1            | 0.1            | $6.0 \times 10^{-3}$                                 |
| II  | 0.3            | 0.2            | $7.2 \times 10^{-2}$                                 |
| III | 0.3            | 0.4            | $2.88 \times 10^{-1}$                                |
| IV  | 0.4            | 0.1            | $2.40 \times 10^{-2}$                                |

a. Rate =  $k[A]^2[B]$

b. Rate =  $k[A][B]$

c. Rate =  $k[A]^2[B]^2$

d. Rate =  $k[A][B]^2$

61. For vaporization of water at 1 atmospheric pressure, the values of  $\Delta H$  and  $\Delta S$  are  $40.63 \text{ kJ mol}^{-1}$  and  $108.8 \text{ JK}^{-1}\text{mol}^{-1}$ , respectively. The temperature when Gibbs energy change ( $\Delta G$ ) for this transformation will be zero, is (+4, -1)

- a. 393.4 K
- b. 373.4 K
- c. 293.4 K
- d. 273.4 K

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62. Which of the following compounds has the lowest boiling point? (+4, -1)

- a.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- b.  $\text{CH}_3\text{CH}=\text{CH}-\text{CH}_2\text{CH}_3$
- c.  $\text{CH}_3\text{CH}=\text{CH}-\text{CH}=\text{CH}_2$
- d.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

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63. Zerevitinov?? determination of active hydrogen in a compound is based upon its reaction with (+4, -1)

- a. Na
- b.  $\text{CH}_3\text{MgI}$
- c. Zn
- d. Al

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64. Which one of the following orders of acidic strength is correct ? (+4, -1)

- a.  $\text{RCOOH} > \text{HOH} > \text{HC} \equiv \text{CH} > \text{ROH}$
- b.  $\text{RCOOH} > \text{HC} \equiv \text{CH} > \text{HOH} > \text{ROH}$

c.  $\text{RCOOH} > \text{ROH} > \text{HOH} > \text{HC} \equiv \text{CH}$

d.  $\text{RCOOH} > \text{HOH} > \text{ROH} > \text{HC} \equiv \text{CH}$

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65. Among the lanthanides, the one obtained by synthetic method is (+4, -1)

a. Lu

b. Pm

c. Pr

d. Gd

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66. Clemmensen reduction of a ketone is carried out in the presence of which of the following? (+4, -1)

a.  $\text{Zn} - \text{Hg}$  with  $\text{HCl}$

b.  $\text{LiAlH}_4$

c.  $\text{H}_2$  and  $\text{Pt}$  as catalyst

d. Glycol with  $\text{KOH}$

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67. Correct order of 1st ionisation potential (IP) among following elements Be, B, C, N, O is (+4, -1)

a.  $\text{B} < \text{Be} < \text{C} < \text{O} < \text{N}$

b.  $\text{B} < \text{Be} < \text{C} < \text{N} < \text{O}$

c.  $\text{Be} < \text{B} < \text{C} < \text{N} < \text{O}$

d.  $\text{Be} < \text{B} < \text{C} < \text{O} < \text{N}$

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68. Which one is formed when sodium phenoxide is heated with ethyl iodide? (+4, -1)

a. Phenetole

- b. Ethyl phenyl alcohol
- c. Phenol
- d. None of the above

69. Which of the following statements is not correct? (+4, -1)

- a. Be and Mg give characteristic colour to the flame.
- b. Be and Mg have high ionisation energy
- c. Sulphates of Be and Mg are readily soluble in water.
- d. All are correct

70. Formula of nickel oxide with metal deficiency defect in its crystal is  $A_{0.8}O$ . The crystal contains  $A^{2+}$  and  $A^{3+}$  ions. The fraction of nickel existing as  $A^{2+}$  ions in the crystal is (+4, -1)

- a. 0.96
- b. 0.04
- c. 0.5
- d. 0.31

71. On the basis of the following  $E^0$  values, the strongest oxidising agent is (+4, -1)



- a.  $[Fe(CN)_6]^{4-}$
- b.  $Fe^{2+}$
- c.  $Fe^{3+}$
- d.  $[Fe(CN)_6]^{3-}$

---

72. Intermediates formed during reaction of  $\text{RCNH}_2||\text{O}$  with  $\text{Br}_2$  and  $\text{KOH}$  are (+4, -1)

- a.  $\text{RCONHBr}$  and  $\text{RNCO}$
- b.  $\text{RNHCOBr}$  and  $\text{RNCO}$
- c.  $\text{RNH-Br}$  and  $\text{RCONHBr}$
- d.  $\text{RCONBr}_2$

---

73.  $\text{H}_2\text{O}$  is dipolar, whereas  $\text{BeF}_2$  is not. It is because (+4, -1)

- a.  $\text{H}_2\text{O}$  involves hydrogen bonding whereas  $\text{BeF}_2$  is a discrete molecule
- b.  $\text{H}_2\text{O}$  is linear and  $\text{BeF}_2$  is angular
- c.  $\text{H}_2\text{O}$  is angular and  $\text{BeF}_2$  is linear
- d. The electronegativity of F is greater than that of O

---

74. The radioisotope, tritium  $^3\text{H}$  has a half-life of 12.3 years. If the initial amount of tritium is 32 mg, how many milligrams of it would remain after 49.2 years: (+4, -1)

- a. 1 mg
- b. 2 mg
- c. 4 mg
- d. 8 mg

---

75. A plot of  $\log \frac{x}{m}$  versus  $\log p$  for the adsorption of a gas on a solid gives a straight line with slope equal to: (+4, -1)

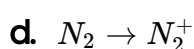
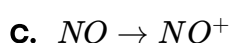
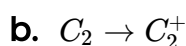
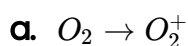
- a.  $-\log k$
- b.  $n$

c.  $\frac{1}{n}$

d.  $\log k$

---

76. In which of the following ionization processes the bond energy increases and the magnetic behaviour changes from paramagnetic to diamagnetic : (+4, -1)



---

77. In a given atom no two electrons can have the same values of all the four quantum numbers. This is called (+4, -1)

a. Hund's rule

b. Aufbau principle

c. Uncertainty principle

d. Pauli- exclusion principle

---

78. Which one of the following gives positive Fehling's solution test? (+4, -1)

a. Sucrose

b. Glucose

c. Fats

d. Protein

---

79. The gases respectively absorbed by alkaline pyrogallol and oil of cinnamon are (+4, -1)

- a.  $O_3, CH_4$
- b.  $O_2, O_3$
- c.  $SO_2, CH_4$
- d.  $N_2O, O_3$

---

80. The type of isomerism shown by the complex  $[CoCl_2(en)_2]$  is (+4, -1)

- a. Linkage isomerism
- b. Geometrical isomerism
- c. Ionization isomerism
- d. Coordination isomerism

---

81. In van der Waals equation of state for a non-ideal gas, the term that accounts for inter molecular forces is (+4, -1)

- a.  $(V - b)$
- b.  $(RT)^{-1}$
- c.  $\left(p + \frac{a}{V^2}\right)$
- d.  $RT$

---

82. An ideal solution is formed when its components (+4, -1)

- a. have no volume change on mixing
- b. have no enthalpy change on mixing
- c. have both the above characteristics
- d. have high solubility

83. Aqueous solution of which of the following compounds is the best conductor of electric current? (+4, -1)

- a. Ammonia,  $NH_3$
- b. Fructose,  $C_6H_{12}O$
- c. Acetic acid,  $C_2H_4O_2$
- d. Hydrochloric acid,  $HCl$

84. At STP, the density of  $CCl_4$  vapour in g/L will be nearest to (+4, -1)

- a. 6.87
- b. 3.42
- c. 10.26
- d. 4.57

85. During the electrolysis of molten sodium chloride, the time required to produce 0.10 mol of chlorine gas using a current of 3 amperes is (+4, -1)

- a. 55 minutes
- b. 110 minutes
- c. 220 minutes
- d. 330 minutes

## Chemistry Section B

86. For a first order reaction,  $A \rightarrow B$ , the reaction rate at reactant concentration of  $0.01\text{ M}$  is found to be  $2.0 \times 10^{-5}\text{ mol L}^{-1}\text{ s}^{-1}$ . The half-life period of the reaction is (+4, -1)
- a. 220 s
  - b. 30 s
  - c. 300 s
  - d. 347 s
- 
87. Formation of a solution from two components can be considered as : (i) Pure solvent  $\rightarrow$  separated solvent molecules,  $\Delta H_1$  (ii) Pure solvent  $\rightarrow$  separated solvent molecules,  $\Delta H_2$  (iii) Separated solvent and solute molecules  $\rightarrow$  solution,  $\Delta H_3$  Solution so formed will be ideal if (+4, -1)
- a.  $\Delta H_{\text{Soln}} = \Delta H_1 + \Delta H_2 + \Delta H_3$
  - b.  $\Delta H_{\text{Soln}} = \Delta H_1 + \Delta H_2 - \Delta H_3$
  - c.  $\Delta H_{\text{Soln}} = \Delta H_1 - \Delta H_2 - \Delta H_3$
  - d.  $\Delta H_{\text{Soln}} = \Delta H_3 - \Delta H_1 - \Delta H_2$
- 
88. With respect to the conformers of ethane, which of the following statements is true ? (+4, -1)
- a. Bond angle changes but bond length remains same
  - b. Both bond angle and bond length change
  - c. Both bond angles and bond length remains same
  - d. Bond angle remains same but bond length changes
- 

89. Which one is most reactive towards  $S_N1$  reaction? (+4, -1)

- a.  $C_6H_5CH_2Br$
- b.  $C_6H_5CH(C_6H_5)Br$
- c.  $C_6H_5CH(CH_3)Br$
- d.  $C_6H_5C(CH_3)(C_6H_5)Br$

---

90. Among the following compound one that is most reactive towards electrophilic nitration is (+4, -1)

- a. Benzoic acid
- b. Nitrobenzene
- c. Toluene
- d. Benzene

---

91. An atom has electronic configuration  $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^3, 4s^2$ , you will place it in which group : - (+4, -1)

- a. fifth
- b. fifteenth
- c. second
- d. third

---

92. Consider the following compounds: (i)  $C_6H_5COCl$  The correct decreasing order of their reactivity towards hydrolysis is: (+4, -1)

- a. (ii) > (iv) > (i) > (iii)
- b. (ii) > (iv) > (iii) > (i)
- c. (i) > (ii) > (iii) > (iv)

d. (iv) > (ii) > (i) > (iii)

93. What is the value of electron gain enthalpy of  $Na^+$  if  $IE_1$  of  $Na = 5.1 \text{ eV}$ ? (+4, -1)

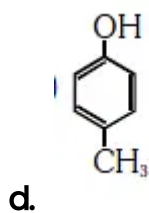
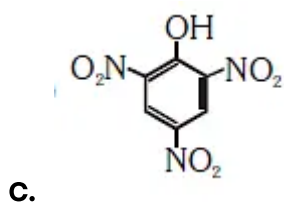
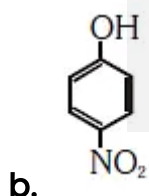
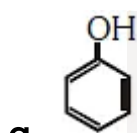
a. +10.2 eV

b. -5.1 eV

c. -10.2 eV

d. +2.55 eV

94. Which one is the most acidic compound? (+4, -1)



95. HCl was passed through a solution of  $CaCl_2$ ,  $MgCl_2$  and  $NaCl$ . Which of the following compound(s) crystallise(a)? (+4, -1)

- a. Both  $MgCl_2$  and  $CaCl_2$
- b. Only  $NaCl$
- c. Only  $MgCl_2$
- d.  $NaCl$ ,  $MgCl_2$  and  $CaCl_2$

96. In calcium fluoride, having the fluorite structure, the coordination numbers for calcium ion ( $Ca^{2+}$ ) and fluoride ion ( $F^-$ ) are (+4, -1)

- a. 4 and 2
- b. 6 and 6
- c. 8 and 4
- d. 4 and 8

97. Match List-I with List-II. (+4, -1)

|     | List - I (Ores) |       | List - II (Composition) |
|-----|-----------------|-------|-------------------------|
| (a) | Haematite       | (i)   | $Fe_3O_3$               |
| (b) | Magnetite       | (ii)  | $ZnCO_3$                |
| (c) | Calamine        | (iii) | $Fe_2O_3$               |
| (d) | Kaolinite       | (iv)  | $[Al_2(OH)_4Si_2O_5]$   |

Choose the correct answer from the options given below:

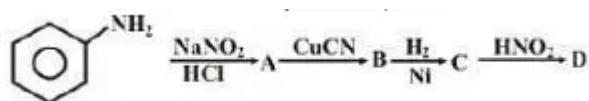
- a. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
- b. (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

c. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

d. (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

98. Aniline in a set of reactions yielded a product D.

(+4, -1)



The structure of the product D would be:

a.  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$

b.  $\text{C}_6\text{H}_5\text{NHCH}_2\text{CH}_3$

c.  $\text{C}_6\text{H}_5\text{NHOH}$

d.  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$

99. The pair of species that has the same bond order in the following is :

(+4, -1)

a.  $\text{CO}, \text{NO}^+$

b.  $\text{NO}^-, \text{CN}^-$

c.  $\text{O}_2, \text{N}_2$

d.  $\text{O}_2, \text{B}_2$

100. The orientation of an atomic orbital is governed by

(+4, -1)

a. azimuthal quantum number

b. spin quantum number

c. magnetic quantum number



## Zoology Section A

101. Nitrogenous waste is excreted in the form of pellet or paste by: (+4, -1)

- a. Ornithorhynchus
- b. Salamandra
- c. Hippocampus
- d. Pavo

---

102. Lysosome contains: (+4, -1)

- a. Oxidative enzymes
- b. Hydrolytic enzymes
- c. Reductive enzymes
- d. Anabolic enzymes

---

103. What does lac refer to in what we call the lac operon: (+4, -1)

- a. Lactose
- b. Lactase
- c. Lac insect
- d. The number 1,00,000

---

104. The excretory structures of flatworms/ Taenia are (+4, -1)

- a. flame cells
- b. protonephridia
- c. malpighian tubules

d. green glands.

---

105. Artificial selection to obtain cows yielding higher milk output represents : (+4, -1)

- a. Directional as it pushes the mean of the character in one direction
- b. Disruptive as it splits the population into two, one yielding higher output and the other lower output
- c. Stabilizing followed by disruptive as it stabilizes the population to produce higher yielding cows
- d. Stabilizing selection as it stabilizes this character in the population

---

106. Common cold is not cured by antibiotics because it is (+4, -1)

- a. caused by a virus
- b. caused by a Gram-positive bacterium
- c. caused by a Gram-negative bacterium
- d. not an infectious disease.

---

107. Deep black soil is productive due to high proportion of (+4, -1)

- a. sand and zinc
- b. gravel and calcium
- c. clay and humus
- d. silt and earthworm.

---

108. DNA replication in bacteria occurs: (+4, -1)

- a. Within nucleolus
- b. Prior to fission

- c. Just before transcription
- d. During S phase

---

109. Ectopic pregnancies are referred to as (+4, -1)

- a. implantation of defective embryo in the uterus
- b. pregnancies terminated due to hormonal imbalance
- c. pregnancies with genetic abnormality
- d. implantation of embryo at site other than uterus.

---

110. Globulins contained in human blood plasma are primarily involved in (+4, -1)

- a. Clotting of blood
- b. Osmotic balance of body fluids
- c. Defence mechanism of body
- d. Oxygen transport in the blood

---

111. If for some reason our goblet cells are non- functional, this will adversely affect (+4, -1)

- a. production of somatostatin
- b. secretion of sebum from the sebaceous glands
- c. maturation of sperms
- d. smooth movement of food down the intestine.

---

112. In gobar gas, the maximum amount is that of (+4, -1)

- a. butane

- b. methane
- c. propane
- d. carbon dioxide.

---

113. Which of the following is incorrect regarding vasectomy ? (+4, -1)

- a. No sperm occurs in seminal fluid
- b. No sperm occurs in epididymis
- c. Vasa deferentia is cut and tied
- d. Irreversible sterility

---

114. A woman has an  $X$  -linked condition on one of her  $X$  chromosomes. This chromosome can be inherited by (+4, -1)

- a. Both sons and daughters
- b. Only daughters
- c. Only grandchildren
- d. Only sonB

---

115. Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres (+4, -1)

- a. Metaphase I
- b. Metaphase II
- c. Anaphase I
- d. Anaphase II

---

116. What is the name of joint between ribs and sternum? (+4, -1)

- a. cartilaginous joint
- b. angular joint
- c. gliding joint
- d. fibrous joints.

---

117. Which of the following statements is correct?

(+4, -1)

- a. Cornea is convex, transparent layer which is highly vascularised.
- b. Cornea consists of dense matrix of collagen and is the most sensitive portion of the eye.
- c. Cornea is an external, transparent and protective proteinacious covering of the eye-ball.
- d. Cornea consists of dense connective tissue of elastin and can repair itself.

---

118. Which hormone possesses anti-insulin effect?

(+4, -1)

- a. cortisol
- b. calcitonin
- c. oxytocin
- d. aldosterone.

---

119. Antiparallel strands of a DNA molecule means that

(+4, -1)

- a. One strand turns anti-clockwise
- b. The phosphate groups of two DNA strands at their ends, share the same position

- c. The phosphate groups at the start of two DNA strands are in opposite position (pole)
- d. One strand turns clockwise

---

120. Biological organisation starts with

(+4, -1)

- a. cellular level
- b. organismic level
- c. atomic level
- d. submicroscopic molecular level.

---

121. Which one of the following is correct pairing of a body part with the kind of muscle tissue present in it?

(+4, -1)

- a. Biceps of upper arm ? Smooth muscle fibres
- b. Abdominal wall ? Voluntary smooth muscle
- c. Iris? Involuntary smooth muscle
- d. Heart wall ? Involuntary unstriated muscle

---

122. Which kind of therapy was given in 1990 to a four-year-old girl with adenosine deaminase [ADA] deficiency ?

(+4, -1)

- a. Gene therapy
- b. Chemotherapy
- c. Immunotherapy
- d. Radiation therapy

---

123. Which of the following is not a feature of the plasmids ?

(+4, -1)

- a. Circular structure
- b. Transferable
- c. Single-stranded
- d. Independent replication

---

124. Oxygen dissociation curve of haemoglobin is

(+4, -1)

- a. Sigmoid
- b. Hyperbolic
- c. Linear
- d. Hypobolic

---

125. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

(+4, -1)

**Assertion A:** Nephrons are of two types: Cortical & Juxta medullary, based on their relative position in cortex and medulla.

**Reason R:** Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.

In the light of the above statements, choose the correct answer from the options given below:

- a. Both A and R are true but R is NOT the correct explanation of A.
- b. A is true but R is false.
- c. A is false but R is true.
- d. Both A and R are true and R is the correct explanation of A.

---

126. Telomerase is an enzyme which is a:

(+4, -1)

- a. Repetitive DNA

- b. RNA
- c. Simple protein
- d. Ribonucleoprotein

---

127. During transcription, the DNA site at which RNA polymerase binds is called: (+4, -1)

- a. Promoter
- b. Regulator
- c. Receptor
- d. Enhancer

---

128. Bladderworm/cysticercus is the larval stage of (+4, -1)

- a. tapeworm
- b. roundworm
- c. pinworm
- d. liver fluke.

---

129. Common origin of man and chimpanzee is best shown by (+4, -1)

- a. binocular vision
- b. chromosome number
- c. dental formula
- d. cranial capacity.

---

130. Diphtheria is caused by (+4, -1)

- a. nematodes

- b. bacteria
- c. virus
- d. none of these.

---

131. During adverse season, therophytes survive by (+4, -1)

- a. rhizomes
- b. seeds
- c. bulbs
- d. corms.

---

132. Egg is liberated from ovary in (+4, -1)

- a. secondary oocyte stage
- b. primary oocyte stage
- c. oogonial stage
- d. mature ovum stage.

---

133. Ergot of rye is caused by a species of (+4, -1)

- a. Uncinula
- b. Ustilago
- c. Claviceps
- d. Phytophthora

---

134. If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect ? (+4, -1)

- a. The 'Pacemaker' will stop working
- b. The blood will tend to flow back into the left atrium
- c. The flow of blood into the pulmonary artery will be reduced
- d. The flow of blood into the aorta will be slowed down

---

135. If pancreas is removed, the compound which remain undigested is

(+4, -1)

- a. proteins
- b. carbohydrates
- c. fats
- d. all of these.

## Zoology Section B

136. The biofertilizers are (+4, -1)
- a. Anabaena and Azolla
  - b. cow dung, manure and faryard waste
  - c. quick growing crop ploughed under soil
  - d. none of these.
- 
137. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly? (+4, -1)
- a. Gonorrhoea
  - b. Hepatitis-B
  - c. HIV Infection
  - d. Genital herpes
- 
138. A person with the sex chromosomes XXY suffers from (+4, -1)
- a. gynandromorphism
  - b. Klinefelter's syndrome
  - c. Down's syndrome
  - d. Turner's syndrome.
- 
139. In a somatic cell cycle, DNA synthesis takes place in (+4, -1)
- a. G<sub>1</sub> phase
  - b. prophase of mitosis ;
  - c. S-phase

d. G2 phase.

---

**140.** What will happen if ligaments are cut or broken :- (+4, -1)

- a. Bones will move freely at joints
- b. No movement at joint
- c. Bone will become unfix
- d. Bone will become fixed

---

**141.** Which part of the human ear plays no role in hearing as such but is otherwise very much required? (+4, -1)

- a. Eustachian tube
- b. Organ of Corti
- c. Vestibular apparatus
- d. Ear ossicles

---

**142.** Which of the following statements is correct in relation to the endocrine system ? (+4, -1)

- a. Releasing and inhibitory hormones are produced by the pituitary gland
- b. Adenohypophysis is under direct neural regulation of the hypothalamus
- c. Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones
- d. Non-nutrient chemicals produced by the body in trace amount that act as intercellular messenger are known as hormones

---

**143.** Barr body in mammals represents (+4, -1)

- a. all the heterochromatin in male and female cells
- b. the Y-chromosome in somatic cells of male i
- c. all the heterochromatin in female cells
- d. one of the two X-chromosomes in somatic cells of females. \

---

**144.** Cell recognition and adhesion occur due to biochemicals of cell membranes named (+4, -1)

- a. proteins
- b. lipids
- c. proteins and lipids
- d. glycoproteins and glycolipids.

---

**145.** Goblet cells of alimentary canal are modified from (+4, -1)

- a. Squamous epithelial cells
- b. Columnar epithelial cells
- c. Chondrocytes
- d. Compound epithelial cells

---

**146.** Which part of the tobacco plant is infected by *Meloidogyne incognita*? (+4, -1)

- a. Leaf
  - b. Stem
  - c. Root
  - d. Flower
-

147. Which of the following is a restriction endonuclease ?

(+4, -1)

- a. Protease
- b. DNase I
- c. RNase I
- d. Hind II

---

148. Skin is an accessory organ of respiration in

(+4, -1)

- a. humans
- b. frog
- c. rabbit
- d. lizard.

---

149. Which of the following statements are correct?

(+4, -1)

- A. An excessive loss of body fluid from the body switches off osmoreceptors.
- B. ADH facilitates water reabsorption to prevent diuresis.
- C. ANF causes vasodilation.
- D. ADH causes increase in blood pressure.
- E. ADH is responsible for decrease in GFR.

Choose the correct answer from the options given below:

- a. B, C and D only
  - b. A, B and E only
  - c. C, D and E only
  - d. A and B only
-

**150.** Which one of the following hydrolyses internal phosphodiester bonds in a polynucleotide chain ? **(+4, -1)**

- a.** Lipase
- b.** Exonuclease
- c.** Endonuclease
- d.** Protease



## Botany Section A

151. Four radial V.B. are found in (+4, -1)

- a. Dicot root
  - b. Monocot root
  - c. Dicot stem
  - d. Monocot stem
- 

152. As compared to a  $C_3$  plant, how many additional molecules of ATP are needed for net production of one molecule of hexose sugar by  $C_4$  plants : (+4, -1)

- a. 2
  - b. 6
  - c. 0
  - d. 12
- 

153. The most abundant element present in the plant is (+4, -1)

- a. Nitrogen
  - b. Manganese
  - c. Iron
  - d. Carbon
- 

154. A terrestrial animal must be able to (+4, -1)

- a. Conserve water
- b. Actively pump salts out through the skin

- c. Excrete large amounts of salts in urine
- d. Excrete large amounts of water in urine

---

155. Conifers differ from grasses in the- (+4, -1)

- a. Formation of endoperm before fertilization
- b. Production of seeds from ovules
- c. Lack of xylem tracheids
- d. Absence of pollen tube

---

156. Inflorescence is racemose in (+4, -1)

- a. Tulip
- b. Soyabean
- c. aloe
- d. Brinjal

---

157. Which ones produce androgenic haploids in anther cultures? (+4, -1)

- a. Anther wall
- b. Tapetal layer of anther wall
- c. Connective tissue
- d. Young pollen grains

---

158. What happens in plants during vascularisation: (+4, -1)

- a. Differentiation of procambium, formation of primary phloem followed by formation of primary xylem

- b. Differentiation of procambium followed by the formation of primary phloem and xylem simultaneously
- c. Formation of procambium, primary phloem and xylem simultaneously
- d. Differentiation of procambium followed by the formation of secondary xylem

---

159. Plants adapted to low light intensity have (+4, -1)

- a. Higher rate of CO<sub>2</sub> fixation than the sun plants
- b. More extended root system
- c. Leaves modified to spines
- d. Larger photosynthetic unit size than the sun plants

---

160. Which one of the following concerns photophosphorylation: (+4, -1)

- a.  $ADP + AMP \xrightarrow{\text{Light Energy}} ATP$
- b.  $ADP + \text{Inorganic } PO_4 \xrightarrow{\text{Light Energy}} ATP$
- c.  $ADP + \text{Inorganic } PO_4 \longrightarrow ATP$
- d.  $AMP + \text{Inorganic } PO_4 \xrightarrow{\text{Light Energy}} ATP$

---

161. Which one of the following is not used for construction of ecological pyramids? (+4, -1)

- a. Dry weight
  - b. Number of individuals
  - c. Rate of energy flow
  - d. Fresh weight
-

**162.** Floridean starch has structure similar to: (+4, -1)

- a. Starch and cellulose
- b. Amylopectin and glycogen
- c. Mannitol and algin
- d. Laminarin and cellulose

---

**163.** is the floral formula of (+4, -1)

- a. Petunia
- b. Brassica
- c. Allium
- d. Sesbania.

---

**164.** Which one of the following statements regarding post-fertilization development in flowering plants is incorrect ? (+4, -1)

- a. Central cell develops into endosperm
- b. Ovules develop into embryo sac
- c. Ovary develops into fruit
- d. Zygote develops into embryo

---

**165.** Ectophloic siphonostele is found in: (+4, -1)

- a. Adiantum and Cucurbitaceae
- b. Osmunda and Equisetum
- c. Marsilea and Botrychium
- d. Dicksonia and maiden hair fern

---

166. Differentiation of shoot is controlled by: (+4, -1)

- a. High auxin : cytokinin ratio
- b. High cytokinin : auxin ratio
- c. High gibberellin : auxin ratio
- d. High gibberellin : cytokinin ratio

---

167. Which one of the following is wrong in relation to photorespiration: (+4, -1)

- a. It occurs in chloroplasts
- b. It occurs in daytime only
- c. It is a characteristic of C<sub>4</sub> plants
- d. It is a characteristic of C<sub>3</sub> plants

---

168. Gymnosperms are also called soft wood spermatophytes because they lack (+4, -1)

- a. Cambium
- b. Phloem fibres
- c. Thick-walled tracheids
- d. Xylem fibres

---

169. Keel is characteristic of the flowers of (+4, -1)

- a. gulmohur
- b. Cassia
- c. Calotropis

d. bean.

---

170. Which one of the following statements is not true? (+4, -1)

- a. The flowers pollinated by flies and bats secrete foul odour to attract them.
- b. Honey is made by bees by digesting pollen collected from flowers.
- c. Pollen grains are rich in nutrients, and they are used in the form of tablets and syrups.
- d. Pollen grains of some plants cause severe allergies and bronchial afflictions in some people.

---

171. An ovule which becomes curved so that the nucellus and embryo sac lie at right angles to the funicle is (+4, -1)

- a. Campylotropous
- b. Anatropous
- c. Orthotropous
- d. Hemitropous

---

172. Plants deficient of element zinc, show its effect on the biosynthesis of plant growth hormone: (+4, -1)

- a. Auxin
- b. Cytokinin
- c. Ethylene
- d. Absciscic acid

---

173. In photosystem-I, the first electron acceptor is : (+4, -1)

- a. ferredoxin
- b. cytochrome
- c. plastocyanin
- d. an iron-sulphur protein

---

**174.** How many organisms in the list given below are autotrophs ? Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter Streptomyces, Saccharomyces, Trypanosoma, Porphyra, Wolffia (+4, -1)

- a. Four
- b. Five
- c. Six
- d. Three

---

**175.** Keel is the characteristic feature of flower of (+4, -1)

- a. Aloe
- b. Tomato
- c. Tulip
- d. Indigofera

---

**176.** Which one of the following is surrounded by a callose wall? (+4, -1)

- a. male gamete
- b. egg
- c. pollen grain
- d. microspore mother cell.

177. Which fractions of the visible spectrum of solar radiations are primarily absorbed by carotenoids of the higher plants: (+4, -1)

- a. Blue and green
- b. Green and red
- c. Red and violet
- d. Violet and blue

178. In a longitudinal section of a root, starting from the tip upward, the four zones occur in the following order (+4, -1)

- a. Root cap, cell division, cell maturation, cell enlargement
- b. Cell division, cell enlargement, cell maturation, root cap
- c. Cell division, cell maturation, cell enlargement, root cap
- d. Root cap, cell division, cell enlargement, cell maturation

179. Which of the following statements is incorrect (+4, -1)

- a. Cyclic photophosphorylation involves both PS I and PS II.
- b. Both ATP and  $\text{NADPH} + \text{H}^+$  are synthesized during non-cyclic photophosphorylation
- c. Stroma lamellae have PS I only and lack NADP reductase
- d. Grana lamellae have both PS I and PS II

180. In a moss, the sporophyte- (+4, -1)

- a. Manufactures food for itself as well as for the gametophyte
- b. is partially parasitic on the gametophyte

- c. produces gametes that give rise to the gametophyte
- d. Arises from a spore produced from the gametophyte.

---

181. Radial symmetry is found in the flowers of -

(+4, -1)

- a. Brassica
- b. Trifolium
- c. Pisum
- d. Cassia

---

182. Which one of the following fruits is parthenocarpic?

(+4, -1)

- a. Jackfruit
- b. Banana
- c. Brinjal
- d. Apple

---

183. *Nicotiana sylvestris* flowers only during long days and *N. tabacum* flowers only during short days. If raised in the laboratory under different photoperiods, they can be induced to flower at the same time and can be cross-fertilized to produce self-fertile offspring. What is the best reason for considering *N. sylvestris* and *N. tabacum* to be separate species:

(+4, -1)

- a. They cannot interbreed in nature
- b. They are reproductively distinct
- c. They are physiologically distinct
- d. They are morphologically distinct

---

184. Which of the following statements is incorrect

(+4, -1)

- a. Oxidation-reduction reactions produce proton gradient in respiration
- b. During aerobic respiration, role of oxygen is limited to the terminal stage
- c. In ETC (Electron Transport Chain), one molecule of  $\text{NADH} + \text{H}^+$  gives rise to 2 ATP molecules, and one  $\text{FADH}_2$  gives rise to 3 ATP molecules
- d. ATP is synthesized through complex V

---

185. A common structural feature of vessel elements and sieve tube elements is: (+4, -1)

- a. thick secondary walls
- b. pores on lateral walls
- c. presence of P-protein
- d. enucleate condition

## Botany Section B

186. In gymnosperms, the pollen chamber represents (+4, -1)

- a. a cavity in the ovule in which pollen grains are stored after pollination
- b. an opening in the megagametophyte through which the pollen tube approaches the egg
- c. the microsporangium in which pollen grains develop
- d. a cell in the pollen grain in which the sperms are formed.

---

187. Velamen is found in (+4, -1)

- a. roots of screwpine
- b. aerial and terrestrial roots of orchids
- c. leaves of *Ficus elastica*
- d. aerial roots of orchids.

---

188. Which of the following propagates through leaf-tip? (+4, -1)

- a. walking fern
- b. sprout-leaf plant
- c. *Marchantia*
- d. moss.

---

189. Farmers in a particular region were concerned that pre-mature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield? (+4, -1)

- a. Frequent irrigation of the crop

- b. Treatment of the plants with cytokinin's along with a small dose of nitrogenous fertilizer
- c. Removal of all yellow leaves and spraying the remaining green leaves with 2, 4, 5- trichlorophenoxy acetic acid
- d. Application of iron and magnesium to promote synthesis of chlorophyll

---

190. During photorespiration, the oxygen consuming reaction(s) occur in: (+4, -1)

- a. stroma of chloroplasts and mitochondria
- b. stroma of chloroplasts and peroxisomes
- c. grana of chloroplasts and peroxisomes
- d. stroma of chloroplasts

---

191. In Pinus/Cycas/gymnosperms, the endosperm is (+4, -1)

- a. triploid
- b. haploid
- c. diploid
- d. tetraploid.

---

192. vexillary aestivation is characteristic of the family (+4, -1)

- a. Fabaceae
- b. Asteraceae
- c. Solanaceae
- d. Brassicaceae

---

193. Which of the following has proved helpful in preserving pollen as fossils ? (+4, -1)

- a. Sporopollenin
- b. Pollenkitt
- c. Oil Content
- d. Cellulosic intine

---

194. Coconut milk factor is: (+4, -1)

- a. An auxin
- b. A gibberellin
- c. Absciscic acid
- d. Cytokinin

---

195. The gametophyte is not an independent, free living generation in : (+4, -1)

- a. Polytrichum
- b. Pinus
- c. Adiantum
- d. Marchantia

---

196. Vivipary is characteristic of (+4, -1)

- a. mesophytes
- b. xerophytes
- c. hydrophytes
- d. halophytes.

---

197. Meiosis is best observed in dividing (+4, -1)

- a. cells of apical meristem
- b. cells of lateral meristem
- c. microspores and anther wall
- d. microsporocytes.

---

198. How does pruning help in making the hedge dense ? (+4, -1)

- a. It induces the differentiation of new shoots from the rootstock
- b. It frees axillary buds from apical dominance
- c. The apical shoot grows faster after pruning
- d. It releases wound hormones

---

199. Isogamous condition with non flagellated gametes is found in (+4, -1)

- a. Fucus
- b. Chlamydomonas
- c. Spirogyra
- d. Volvox

---

200. Vivipary is (+4, -1)

- a. seed germination with subterranean cotyledons
- b. seed germination with epiterranean cotyledons
- c. druit development without pollination
- d. seed germination inside the fruit while attached to the plant.

## Answers

### 1. Answer: a

#### Explanation:

According to Curie's law  $\chi \propto \frac{1}{T}$

#### Concepts:

##### 1. Magnetism & Matter:

**Magnets** are used in many devices like electric bells, telephones, radio, loudspeakers, motors, fans, screwdrivers, lifting heavy iron loads, super-fast trains, especially in foreign countries, **refrigerators**, etc.

Magnetite is the world's first magnet. This is also called a **natural magnet**. Though magnets occur naturally, we can also impart magnetic properties to a substance. It would be an artificial magnet in that case.

Read More: [Magnetism and Matter](#)

#### Some of the properties of the magnetic field lines are:

- The lines are continuous and outside the magnet, the field lines originate from the North pole and terminate at the South pole
- They form closed loops traversing inside the magnet.
- But here the lines seem to originate from the South pole and terminate at the North pole to form closed loops.
- More number of close lines indicate a stronger **magnetic field**
- The lines do not intersect each other
- The tangent drawn at the field line gives the direction of the field at that point.

---

### 2. Answer: d

#### Explanation:

$$\begin{aligned}\lambda &= 1.227 \times 10^{-2} \text{ m} \\ &= 0.1227 \text{ ?} \\ \lambda &= \frac{12.27}{\sqrt{V}} \text{ ?} \\ 0.1227 &= \frac{12.27}{\sqrt{V}} \text{ ?} \\ \sqrt{V} &\times 10^2 \\ \Rightarrow V &= 10^4\end{aligned}$$

## Concepts:

### 1. Dual Nature of Radiation and Matter:

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20<sup>th</sup> century, scientists untangled one of the best-kept secrets of nature – the wave-particle duality or the [dual nature of matter and radiation](#).

#### Electronic Emission

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

#### Photoelectric Effect

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

### Heisenberg's Uncertainty Principle

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

---

### 3. Answer: b

#### Explanation:

$$\text{Power, } P = I_{\text{r.m.s}} \times V_{\text{r.m.s}} \times \cos \phi$$

Here, the phase difference between voltage and current is  $\pi/2$ .

$$\text{Hence, } P = I_{\text{r.m.s}} \times V_{\text{r.m.s}} \times \cos \pi/2 = 0$$

## Concepts:

### 1. Alternating Current:

An [alternating current](#) can be defined as a current that changes its magnitude and polarity at regular intervals of time. It can also be defined as an electrical current that repeatedly changes or reverses its direction opposite to that of Direct Current or DC which always flows in a single direction as shown below.

## Alternating Current Production

Alternating current can be produced or generated by using devices that are known as alternators. However, alternating current can also be produced by different methods where many circuits are used. One of the most common or simple ways of generating AC is by using a basic single coil AC generator which consists of two-pole magnets and a single loop of wire having a rectangular shape.

## Application of Alternating Current

AC is the form of current that are mostly used in different appliances. Some of the examples of alternating current include audio signal, radio signal, etc. An alternating current has a wide advantage over DC as AC is able to transmit power over large distances without great loss of energy.

---

### 4. Answer: d

#### Explanation:

Kinetic energy =  $\frac{1}{2}mv^2$  Fractional error in kinetic energy  $\frac{\Delta K}{K} = \frac{\Delta m}{m} + \frac{2\Delta v}{v}$  Percentage error in kinetic energy is  $= \frac{\Delta m}{m} \times 100 + \frac{2\Delta v}{v} \times 100$  As we know,  $\frac{\Delta m}{m} \times 100 = 2\%$  and  $\frac{\Delta v}{v} \times 100 = 3\%$  So, percentage error in kinetic energy  $= 2 + 2 \times 3 = 2 + 6 = 8\%$

## Concepts:

### 1. Units and Measurement:

## Unit:

A unit of a physical quantity is an arbitrarily chosen standard that is broadly acknowledged by the society and in terms of which other quantities of similar nature may be measured.

## Measurement:

The process of measurement is basically a comparison process. To measure a physical quantity, we have to find out how many times a standard amount of that physical quantity is present in the quantity being measured. The number thus obtained is known as the magnitude and the standard chosen is called the unit of the physical quantity.

Read More: [Fundamental and Derived Units of Measurement](#)

## System of Units:

1. CGS system
2. FPS system
3. MKS system
4. SI units

## Types of Units:

### Fundamental Units –

The units defined for the fundamental quantities are called fundamental units.

### Derived Units –

The units of all other physical quantities which are derived from the fundamental units are called the derived units.

---

5. Answer: b

**Explanation:**

Given :

$$A_1 : A_2 = 1 : 3$$

Their radii will be in the ratio

$$R_0 A_1^{1/3} : R_0 A_2^{1/3} = 1 : 3^{1/3}$$

$$\text{Now, Density} = \frac{A}{\frac{4}{3}\pi R^3}$$

$$\therefore \rho_{A_1} : \rho_{A_2} = \frac{1}{\frac{4}{3}\pi R_0^3 \cdot 1^3}$$

$$= \frac{3}{\frac{4}{3}\pi R_0^3 (3^{1/3})^3}$$

Hence, their nucleus densities will be the same.

Therefore, the correct option is (B) : 1 : 1.

## Concepts:

### 1. Nuclei:

In the year 1911, Rutherford discovered the atomic nucleus along with his associates. It is already known that every atom is manufactured of positive charge and mass in the form of a nucleus that is concentrated at the center of the atom. More than 99.9% of the mass of an atom is located in the nucleus. Additionally, the size of the atom is of the order of  $10^{-10}$  m and that of the nucleus is of the order of  $10^{-15}$  m.

Read More: [Nuclei](#)

Following are the terms related to nucleus:

1. Atomic Number
2. Mass Number
3. Nuclear Size
4. Nuclear Density
5. Atomic Mass Unit

### 6. Answer: d

### Explanation:

The correct answer is option (D):  $\beta^+$ ,  $\alpha$ ,  $\beta^-$

### Concepts:

## 1. Nuclei:

In the year 1911, Rutherford discovered the atomic nucleus along with his associates. It is already known that every atom is manufactured of positive charge and mass in the form of a nucleus that is concentrated at the center of the atom. More than 99.9% of the mass of an atom is located in the nucleus. Additionally, the size of the atom is of the order of  $10^{-10}$  m and that of the nucleus is of the order of  $10^{-15}$  m.

Read More: [Nuclei](#)

**Following are the terms related to nucleus:**

1. Atomic Number
  2. Mass Number
  3. Nuclear Size
  4. Nuclear Density
  5. Atomic Mass Unit
- 

## 7. Answer: c

**Explanation:**

If rated voltage = supply voltage then in a series combination of bulbs

$$\frac{1}{P_{eq}} = \frac{1}{P_1} + \frac{1}{P_2} + \frac{1}{P_3} + \dots$$

For this question  $\frac{1}{60} + \frac{1}{60} + \frac{1}{60} = \frac{3}{60} = \frac{1}{20} \Rightarrow P_{eq} = 20\text{watt}$

**Concepts:**

## 1. Electric Current:

### Defining Electric Current

It is the rate of flow of electrons in a conductor. SI Unit – Ampere (A).

Electrons are negatively charged particles hence when they move a number of charges moves.

**Note:-** The ability of a particular substance to conduct electricity depends on the number of electrons that are able to move . Some of the materials allow current to flow better than others.

## What is an Electromotive Force?

If a force acts on electrons to make them move in a particular direction, then up to some extent random motion of the electrons will be eliminated. An overall movement in one direction. The force which acts on the electrons to move them in a certain direction is known as electromotive force and its quantity is known as voltage and is measured in V.

---

### 8. Answer: d

#### Explanation:

The correct option is(D): 530 mJ.

We have,

$$\text{mass, } m = 3g = 0.003kg$$

$$x = 3t - 4t^2 + t^3$$

Now,

$$v = \frac{dx}{dt} = 3 - 8t + 3t^2 \Rightarrow dx = (3 - 8t + 3t^2) dt$$

$$\Rightarrow a = \frac{dv}{dt} = 0 - 8 + 6t$$

$$\text{Now, } dw = Fdx$$

$$\Rightarrow dw = (ma)dx$$

$$\Rightarrow dw = (0.003)(-8 + 6t)(3 - 8t + 3t^2) dt$$

$$\Rightarrow dw = (0.003)(18t^3 - 72t^2 + 82t - 24) dt$$

$$\Rightarrow w = (0.003) \int_0^4 (18t^3 - 72t^2 + 82t - 24) dt$$

$$\Rightarrow w = 0.003 \times 176 = 0.528J$$

$$\Rightarrow w = 530 mJ$$


---

### 9. Answer: d

#### Explanation:

For series,  $R_{eq} = 3r$

$$\text{Power} = \frac{V^2}{3r} = 10 \Rightarrow \frac{V^2}{r} = 30.$$

For parallel  $R_{eq} = r/3$

$$\text{Power} = \frac{V^2}{r/3} = \frac{3V^2}{r} = 3 \times 30 = 90 \text{ watt}.$$

## Concepts:

### 1. Current Electricity:

[Current electricity](#) is defined as the flow of [electrons](#) from one section of the circuit to another.

## Types of Current Electricity

There are two [types of current](#) electricity as follows:

### Direct Current

The current electricity whose direction remains the same is known as direct current. Direct current is defined by the constant flow of electrons from a region of high electron density to a region of low electron density. DC is used in many household appliances and applications that involve a battery.

### Alternating Current

The current electricity that is bidirectional and keeps changing the direction of the charge flow is known as alternating current. The bi-directionality is caused by a sinusoidally varying current and voltage that reverses directions, creating a periodic back-and-forth motion for the current. The electrical outlets at our homes and industries are supplied with [alternating current](#).

---

## 10. Answer: c

### Explanation:

Light cannot escape from a black hole,

$$v_{esc} = c$$

$$\sqrt{\frac{2GM}{R}} = c \text{ or } R = \frac{2GM}{c^2}$$

$$R = \frac{2 \times 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2} \times 5.98 \times 10^{24} \text{ kg}}{(3 \times 10^8 \text{ ms}^{-1})^2}$$

$$= 8.86 \times 10^{-3} \text{ m} \approx 10^{-2} \text{ m}$$

## Concepts:

### 1. Gravitation:

In mechanics, the universal force of attraction acting between all matter is known as **Gravity**, also called **gravitation**. It is the weakest known force in nature.

### Newton's Law of Gravitation

According to Newton's law of gravitation, "Every particle in the universe attracts every other particle with a force whose magnitude is,

- $F \propto (M_1 M_2) \dots (1)$
- $(F \propto 1/r^2) \dots (2)$

On combining equations (1) and (2) we get,

$$F \propto M_1 M_2 / r^2$$

$$F = G \times [M_1 M_2] / r^2 \dots (7)$$

$$\text{Or, } f(r) = GM_1 M_2 / r^2$$

The dimension formula of G is  $[M^{-1} L^3 T^{-2}]$ .

---

## 11. Answer: a

### Explanation:

Mass of bullet ( $m_1$ ) = 200 gm = 0.2 kg;

Speed of bullet ( $v_1$ ) = 5 m/sec. and mass of gun ( $m_2$ ) = 1 kg. Before firing, total momentum is zero.

$\therefore$  After firing total momentum is  $m_1 v_1 + m_2 v_2$

From the law of conservation of momentum  $m_1 v_1 + m_2 v_2 = 0$

$$\text{Or } v_2 = \frac{-m_1 v_1}{m_2}$$

$$= \frac{-0.2 \times 5}{1}$$

$$-1 \text{ m/sec.}$$

## Concepts:

### 1. Laws of Motion:

The [laws of motion](#), which are the keystone of classical mechanics, are three statements that defined the relationships between the forces acting on a body and its motion. They were first disclosed by English physicist and mathematician Isaac Newton.

#### Newton's First Law of Motion

[Newton's 1<sup>st</sup> law states](#) that a body at rest or uniform motion will continue to be at rest or uniform motion until and unless a net external force acts on it.

#### Newton's Second Law of Motion

[Newton's 2<sup>nd</sup> law of motion](#) deals with the relation between force and acceleration. According to the second law of motion, the acceleration of an object as built by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

#### Newton's Third Law of Motion

[Newton's 3<sup>rd</sup> law of motion](#) states when a body applies a force on another body that there is an equal and opposite reaction for every action.

## 12. Answer: d

### Explanation:

Compare with the equation

$$y = a \cos(2\pi vt + \phi)$$

This give  $2\pi v = 2000$

$$v = \frac{1000}{\pi} \text{ Hz}$$

## Concepts:

### 1. Waves:

[Waves](#) are a disturbance through which the energy travels from one point to another. Most acquainted are surface waves that tour on the water, but sound, mild, and the movement of subatomic particles all exhibit wavelike properties. Inside the most effective waves, the disturbance oscillates periodically (see periodic movement) with a set [frequency and wavelength](#).

## Types of Waves:

### Transverse Waves –

Waves in which the medium moves at right angles to the direction of the wave.

Examples of transverse waves:

- Water waves (ripples of gravity waves, not sound through water)
- Light waves
- S-wave earthquake waves
- Stringed instruments
- Torsion wave

The high point of a transverse wave is a crest. The low part is a trough.

### Longitudinal Wave –

A longitudinal wave has the movement of the particles in the medium in the same dimension as the direction of movement of the wave.

Examples of longitudinal waves:

- Sound waves
- P-type earthquake waves
- Compression wave

## Explanation:

For a body executing SHM, velocity,

$v = \sqrt{\omega^2 (a^2 - y^2)}$  we have

$$10^2 = \omega^2 (a^2 - 4^2)$$

$$\text{and } 8^2 = \omega^2 (a^2 - 5^2)$$

$$\text{So, } 10^2 - 8^2 = \omega^2 (5^2 - 4^2) = (3\omega)^2$$

$$\text{or } 6 = 3\omega$$

$$\text{or } \omega = 2$$

$$\therefore \text{Time, } t = 2\pi/\omega$$

$$\therefore t = 2\pi/2 = \pi \text{ sec}$$

## Concepts:

### 1. Oscillations:

**Oscillation** is a process of repeating variations of any quantity or measure from its **equilibrium** value in time. Another definition of oscillation is a periodic variation of a matter between two values or about its central value.

The term vibration is used to describe the mechanical oscillations of an object. However, oscillations also occur in dynamic systems or more accurately in every field of science. Even our heartbeats also creates oscillations. Meanwhile, objects that move to and fro from its equilibrium position are known as oscillators.

**Read More:** [Simple Harmonic Motion](#)

### Oscillation- Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of examples of oscillations are vibrations caused by the guitar strings or the other instruments having strings are also and etc. The movements caused by oscillations are known as oscillating movements. For example, oscillating movements in a sine wave or a spring when it moves up and down.

The maximum distance covered while taking oscillations is known as the amplitude. The time taken to complete one cycle is known as the time period of the oscillation.

The number of oscillating cycles completed in one second is referred to as the frequency which is the reciprocal of the time period.

## 14. Answer: c

### Explanation:

For the 1<sup>st</sup> case,  $u = 40 \text{ km/h} = 40 \times \frac{5}{18} \text{ m/s}$

From **motion's** third equation, we get

$$v^2 - u^2 = 2as$$

$$v^2 = u^2 + 2as$$

$$0 = \left(40 \times \frac{5}{18}\right)^2 + 2a(2)$$

$$a = -\frac{1}{4} \left(\frac{100}{9}\right)^2 - 1$$

For the 2nd case -

$$u = 80 \text{ km/h}$$

$$v^2 - u^2 = 2as$$

$$v^2 = u^2 + 2as$$

$$0 = \left(80 \times \frac{5}{18}\right)^2 + 2as$$

On solving the equation, we get  $s = 8\text{m}$ .

Hence, option (C) is the correct answer.

### Concepts:

#### 1. Motion in a straight line:

The **motion in a straight line** is an object changes its position with respect to its surroundings with time, then it is called in motion. It is a change in the position of an object over time. It is nothing but linear motion.

#### Types of Linear Motion:

Linear motion is also known as the **Rectilinear Motion** which are of two types:

1. **Uniform linear motion with constant velocity or zero acceleration:** If a body travels in a straight line by covering an equal amount of distance in an equal interval of time then it is said to have uniform motion.
  2. **Non-Uniform linear motion with variable velocity or non-zero acceleration:** Not like the uniform acceleration, the body is said to have a non-uniform motion when the velocity of a body changes by unequal amounts in equal intervals of time. The rate of change of its velocity changes at different points of time during its movement.
- 

## 15. Answer: d

### Explanation:

The fields at O due to AC and BD cancel each other.

The field due to CD is acting in the direction OK and equal in magnitude to E due to AKB.

### Concepts:

#### 1. Electrostatic Potential and Capacitance:

### Electrostatic Potential

The potential of a point is defined as the **work done** per unit charge that results in bringing a charge from infinity to a certain point.

Some major things that we should know about electric potential:

- They are denoted by  $V$  and are a scalar quantity.
- It is measured in volts.

### Capacitance

The ability of a **capacitor** of holding the energy in form of an **electric charge** is defined as capacitance. Similarly, we can also say that capacitance is the storing ability of capacitors, and the unit in which they are measured is "farads".

Read More: [Electrostatic Potential and Capacitance](#)

**The capacitor is in Series and in Parallel as defined below;**

### In Series

Both the Capacitors  $C_1$  and  $C_2$  can easily get connected in series. When the **capacitors are connected in series** then the total capacitance that is  $C_{\text{total}}$  is less than any one of the capacitor's capacitance.

### In Parallel

Both Capacitor  $C_1$  and  $C_2$  are connected in parallel. When the capacitors are connected parallelly then the total capacitance that is  $C_{\text{total}}$  is any one of the capacitor's capacitance.

## 16. Answer: b

### Explanation:

Total energy of the hoop = Translational Kinetic energy + Rotational Kinetic energy =  $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

For hoop,  $I = mr^2$

Also  $v = r\omega$

Thus total energy =  $\frac{1}{2}mv^2 + \frac{1}{2}mr^2 \left(\frac{v}{r}\right)^2 = mv^2$

Hence the work required to stop the hoop = Its total energy =  $mv^2 = 100 \times 0.2^2 J = 4J$

## 17. Answer: a

### Explanation:

Magnetic field at centre of solenoid =  $\mu_0 n I$

$$n = \frac{N}{L}$$

$$= \frac{100}{50 \times 10^{-2}}$$

$$= 200 \text{ turns/m}$$

$$I = 2.5 \text{ A}$$

On putting the values,

$$B = 4\pi \times 10^{-7} \times 200 \times 2.5$$

$$= 6.28 \times 10^{-4} T$$

## Concepts:

### 1. Moving Charges and Magnetism:

Moving charges generate an electric field and the rate of flow of charge is known as **current**. This is the basic concept in **Electrostatics**. Another important concept related to moving **electric charges** is the magnetic effect of current. Magnetism is caused by the current.

## Magnetism:

- The relationship between a [Moving Charge and Magnetism](#) is that Magnetism is produced by the movement of charges.
- And Magnetism is a property that is displayed by Magnets and produced by moving charges, which results in objects being attracted or pushed away.

## Magnetic Field:

Region in space around a magnet where the Magnet has its Magnetic effect is called the Magnetic field of the Magnet. Let us suppose that there is a point charge  $q$  (moving with a velocity  $v$  and, located at  $r$  at a given time  $t$ ) in presence of both the electric field  $E(r)$  and the magnetic field  $B(r)$ . The force on an electric charge  $q$  due to both of them can be written as,

$$F = q [ E(r) + v \times B(r) ] \equiv F_{\text{Electric}} + F_{\text{magnetic}}$$

This force was based on the extensive experiments of Ampere and others. It is called the Lorentz force.

## 18. Answer: a

### Explanation:

The horizontal momentum does not change. The change in vertical momentum is  $mv \sin \theta - (-mv \sin \theta) = 2mv \frac{1}{\sqrt{2}} = \sqrt{2} mv$ .

## Concepts:

### 1. Motion in a Plane:

It is a vector quantity. A vector quantity is a quantity having both magnitude and direction. Speed is a scalar quantity and it is a quantity having a magnitude only. Motion in a plane is also known as motion in two dimensions.

### Equations of Plane Motion

The equations of motion in a straight line are:

$$v = u + at$$

$$s = ut + \frac{1}{2} at^2$$

$$v^2 - u^2 = 2as$$

Where,

- $v$  = final velocity of the particle
- $u$  = initial velocity of the particle
- $s$  = displacement of the particle
- $a$  = acceleration of the particle
- $t$  = the time interval in which the particle is in consideration

---

### 19. Answer: d

### Explanation:

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v_1} + \frac{1}{u} \\ -\frac{1}{15} &= \frac{1}{v_1} - \frac{1}{40} \\ \Rightarrow \frac{1}{v_1} &= \frac{1}{-15} + \frac{1}{40} \\ v_1 &= -24 \text{ cm}\end{aligned}$$

When object is displaced by 20 cm towards mirror.

Now,

$$\begin{aligned}u_2 &= -20 \\ \frac{1}{f} &= \frac{1}{v_2} + \frac{1}{u_2}\end{aligned}$$

$$\frac{1}{-15} = \frac{1}{v_2} - \frac{1}{20}$$

$$\frac{1}{v_2} = \frac{1}{20} - \frac{1}{15}$$

$$v_2 = -60 \text{ cm}$$

So, image shifts away from mirror by  $= 60 - 24 = 36 \text{ cm}$ .

## Concepts:

### 1. Ray Optics and Optical Instruments:

**Optics**, deals with the determination of behaviour and the properties of light, along with its interactions with the matter and also with the instruments that are used to detect it.

**Ray optics** is also known as the geometrical optics and it is a branch of science which describes light propagation.

**Reflection** is the change in direction of light at an interface in-between two different media so that the wave-front returns into a medium from which it was originated.

**Speed of light** is the rate at which the light travels in free space.

A phenomenal change in image formed when the light is passed from one medium to another which is called [Refraction](#).

**Total Internal Reflection** is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

Read More: [Ray Optics and Optical Instruments](#)

## 20. Answer: b

### Explanation:

$$\frac{1}{\lambda} = RZ^2 \left( \frac{1}{n_2^2} - \frac{1}{n_1^2} \right) = 10^7 \times 1^2 \left( \frac{1}{2^2} - \frac{1}{\infty^2} \right)$$

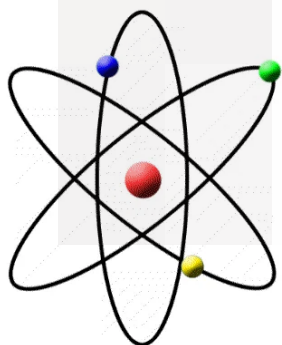
$$\Rightarrow \text{wave number} = \frac{1}{\lambda} = 0.25 \times 10^7 \text{ m}^{-1}$$

### Concepts:

## 1. Atoms:

- The smallest unit of matter indivisible by chemical means is known as an **atom**.
- The fundamental building block of a chemical **element**.
- The smallest possible unit of an element that still has all the chemical properties of that element.
- An atom is consisting of a nucleus surrounded by one or more shells of **electron s**.
- **Word origin:** from the Greek word *atomos*, which means uncuttable, something that cannot be divided further.

All matter we encounter in everyday life consists of smallest units called atoms – the air we breath consists of a wildly careening crowd of little groups of atoms, my computer's keyboard of a tangle of atom chains, the metal surface it rests on is a crystal lattice of atoms. All the variety of matter consists of less than hundred species of atoms (in other words: less than a hundred different chemical elements).



Atom

Every atom consists of an nucleus surrounded by a cloud of electrons. Nearly all of the atom's mass is concentrated in its nucleus, while the structure of the electron cloud determines how the atom can bind to other atoms (in other words: its chemical properties). Every chemical element can be defined via a characteristic number of protons in its nucleus. Atoms that have lost some of their usual number of electrons are called ions. Atoms are extremely small (typical diameters are in the region of tenths of a billionth of a metre =  $10^{-10}$  metres), and to describe their properties and behaviour, one has to resort to quantum theory.

## 21. Answer: d

### Explanation:

$$\text{given } e = 200\sqrt{2} \sin 100t$$

$$\omega = 100 \frac{\text{rad}}{\text{sec}}$$

$$E_{rms} = \frac{200\sqrt{2}}{\sqrt{2}}$$

$$C = 1 \times 10^{-6}$$

$$Z = X_c = \frac{1}{\omega C} = \frac{1}{100 \times 10^{-6}} = 10^4 \Omega$$

$$I = \frac{E_{rms}}{Z} = \frac{\frac{200\sqrt{2}}{\sqrt{2}}}{10^4} = 2 \times 10^{-2} A = 20mA$$

### Concepts:

#### 1. Electromagnetic Induction:

Electromagnetic Induction is a current produced by the voltage production due to a changing [magnetic field](#). This happens in one of the two conditions:-

1. When we place the [conductor](#) in a changing magnetic field.
2. When the conductor constantly moves in a stationary field.

### Formula:

The [electromagnetic induction](#) is mathematically represented as:-

$$e = N \times \frac{d\phi}{dt}$$

Where

- e = induced voltage
- N = number of turns in the coil
- $\phi$  = Magnetic flux (This is the amount of magnetic field present on the surface)
- t = time

## Applications of Electromagnetic Induction

1. Electromagnetic induction in AC generator
2. Electrical Transformers
3. Magnetic Flow Meter

**22. Answer: a****Explanation:**

Equation of Electromagnetic wave is  $E = E_0 \cos(kz - \omega t)$  and speed of EM wave  $V = \frac{\omega}{k}$   
By comparing  $k = \omega/v = \frac{6 \times 10^8}{3 \times 10^8} = 2m^{-1}$  is the wave vector.

**Concepts:****1. Electromagnetic waves:**

The waves that are produced when an electric field comes into contact with a magnetic field are known as [Electromagnetic Waves](#) or EM waves. The constitution of an oscillating magnetic field and electric fields gives rise to electromagnetic waves.

**Types of Electromagnetic Waves:**

Electromagnetic waves can be grouped according to the direction of disturbance in them and according to the range of their frequency. Recall that a wave transfers energy from one point to another point in space. That means there are two things going on: the disturbance that defines a wave, and the propagation of wave. In this context the waves are grouped into the following two categories:

- **Longitudinal waves:** A wave is called a [longitudinal wave](#) when the disturbances in the wave are parallel to the direction of propagation of the wave. For example, sound waves are longitudinal waves because the change of pressure occurs parallel to the direction of wave propagation.
- **Transverse waves:** A wave is called a [transverse wave](#) when the disturbances in the wave are perpendicular (at right angles) to the direction of propagation of the wave.

---

**23. Answer: d****Explanation:**

Given  $\alpha = 0.96$

$$\text{so, } \beta = \frac{\alpha}{1-\alpha} = \frac{0.96}{0.04} \Rightarrow \beta = 24$$

Voltage gain for common emitter configuration

$$A_V = \beta \cdot \frac{R_L}{R_i} = 24 \times \frac{800}{192} = 100$$

Power gain for common emitter configuration

$$P_V = \beta A_V = 24 \times 100 = 2400$$

Voltage gain for common base configuration

$$A_V = \alpha \cdot \frac{R_L}{R_p} = 0.96 \times \frac{800}{192} = 4$$

Power gain for common base configuration

$$P_V = A_V \alpha = 4 \times 0.96 = 3.84$$

\* In the question it is asked about common emitter configuration but we got above answer for common base configuration.

## Concepts:

### 1. Semiconductors:

**Semiconductors** are a crystalline solid materials, whose electrical conductivity lies between a conductor and an insulator. Semiconductors are mainly used in the manufacturing of electronic devices like capacitors, transistors, diodes, Integrated circuits, etc.

### Properties of Semiconductor:

1. Semiconductor acts like an insulator at Zero Kelvin. On increasing the temperature, it works as a conductor.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.
3. Lesser power losses.

### Uses of Semiconductor:

1. Semiconductors are widely used in manufacturing electronics devices like transistors, diodes, sensors, integrated circuits.
2. Semiconductors are widely used in all electronic devices, like mobile phones, digital cameras, communication devices, trains, ATMs, etc.

**Explanation:**

For an electron accelerated through a potential  $V$   $\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA} = \frac{12.27 \times 10^{-10}}{\sqrt{10000}} = 12.27 \times 10^{-12} m$

**Concepts:****1. Dual Nature of Radiation and Matter:**

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20<sup>th</sup> century, scientists untangled one of the best-kept secrets of nature – the wave-particle duality or the [dual nature of matter and radiation](#).

**Electronic Emission**

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

**Photoelectric Effect**

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

**Heisenberg's Uncertainty Principle**

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

---

**25. Answer: a****Explanation:**

Given,  $\chi_m = 599$

Also,  $\mu_r = 1 + \chi_m = 600$

We know,  $\mu = \mu_r \mu_o$

$\mu = 600 \times 4\pi \times 10^{-7}$

$$\mu = 2400\pi \times 10^{-7}$$

$$\mu = 2.4\pi \times 10^{-4} T m A^{-1}$$

## Concepts:

### 1. Magnetism & Matter:

**Magnets** are used in many devices like electric bells, telephones, radio, loudspeakers, motors, fans, screwdrivers, lifting heavy iron loads, super-fast trains, especially in foreign countries, **refrigerators**, etc.

Magnetite is the world's first magnet. This is also called a **natural magnet**. Though magnets occur naturally, we can also impart magnetic properties to a substance. It would be an artificial magnet in that case.

Read More: [Magnetism and Matter](#)

### Some of the properties of the magnetic field lines are:

- The lines are continuous and outside the magnet, the field lines originate from the North pole and terminate at the South pole
- They form closed loops traversing inside the magnet.
- But here the lines seem to originate from the South pole and terminate at the North pole to form closed loops.
- More number of close lines indicate a stronger **magnetic field**
- The lines do not intersect each other
- The tangent drawn at the field line gives the direction of the field at that point.

## 26. Answer: a

### Explanation:

Heat flows through the slab in t s is  $Q = \frac{KA(T_1 - T_2)t}{L} = \frac{K \times 0.36 \times (100 - 0) \times 3600}{0.1} = \frac{K \times 0.36 \times 100 \times 3600}{0.1}$   
 $\text{\hspace{20mm}} \dots\dots\dots (i)$  So ice melted by this heat is  $m_{ice} = \frac{Q}{L_f}$   
 $\text{\hspace{20mm}} \dots\dots\dots (ii)$  or  $Q = m_{ice} L_f = 4.8 \times 10^5$  From (i) and (ii), we get  $\frac{K \times 0.36 \times (100 - 0) \times 3600}{0.1} = 4.8 \times 3.36 \times 10^5$   
 $K = \frac{4.8 \times 3.36 \times 10^5 \times 0.1}{0.36 \times 100 \times 3600} = 1.24 J/m/s/^\circ C$

## Concepts:

## 1. Thermal Properties of Matter:

Anything that has mass or occupies space in the universe is commonly known as matter. There are five [properties of matters](#) namely chemical, mechanical, thermal, dimensional, and physical properties.

Read More: [Thermal Properties of Matter](#)

### Heat Capacity:

The quantity of heat needed to change the temperature of the matter by  $1^\circ$  is known as the heat capacity of a material. The temperature is indicated in kelvin or Celsius and the amount of heat is shown in calories or joules. Specific heat capacity or molar heat capacity is used to calculate the heat capacity of the matter with the stated dimension.

Linear expansion is the situation when change takes place in one dimension or dimensional.

### Thermal Expansion:

When heat is passed through the material, the change in the area, volume, and shape is recognized as the thermal expansion property of the material. The expansion of the railway tracks due to maximal heat which leads to accidents is an example of thermal expansion.

### Thermal Conductivity:

This property is interconnected to the conductivity of heat. The amount of heat regulated by the material is directly proportional to the conductivity of the material. Not all objects have the capacity to conduct heat throughout their bodies. Insulators are such objects which do not have the property to conduct heat throughout their body.

### Thermal Stress:

The stress due to thermal contraction or expansion of the body is known as thermal stress. The explosion of materials takes place due to thermal stress which is dangerous. The cracks on the truck tyres are caused by an outcome of thermal

stress. Trucks at high speed generate heat which is caused by the friction of the truck tyres and the road surface.

---

## 27. Answer: c

### Explanation:

$$n(VSD) = (n - 1)MSD \Rightarrow 1 VSD = \frac{(n-1)}{n}MSD \text{ Least count} = 1 MSD - 1 VSD = [1 - \frac{(n-1)}{n}] MSD = \frac{1}{n}MSD = \frac{1}{n}(\frac{1}{n})cm = \frac{1}{n^2}cm$$

### Concepts:

#### 1. Units and Measurement:

##### Unit:

A unit of a physical quantity is an arbitrarily chosen standard that is broadly acknowledged by the society and in terms of which other quantities of similar nature may be measured.

##### Measurement:

The process of measurement is basically a comparison process. To measure a physical quantity, we have to find out how many times a standard amount of that physical quantity is present in the quantity being measured. The number thus obtained is known as the magnitude and the standard chosen is called the unit of the physical quantity.

Read More: [Fundamental and Derived Units of Measurement](#)

### System of Units:

1. CGS system
2. FPS system
3. MKS system
4. SI units

### Types of Units:

## Fundamental Units –

The units defined for the fundamental quantities are called fundamental units.

## Derived Units –

The units of all other physical quantities which are derived from the fundamental units are called the derived units.

---

### 28. Answer: b

#### Explanation:

Quality factor  $Q = \frac{\omega L}{R}$  Since  $\omega^2 = \frac{1}{LC} \therefore \text{Quality factor } Q = \frac{1}{\omega RC}$

#### Concepts:

##### 1. Alternating Current:

An [alternating current](#) can be defined as a current that changes its magnitude and polarity at regular intervals of time. It can also be defined as an electrical current that repeatedly changes or reverses its direction opposite to that of Direct Current or DC which always flows in a single direction as shown below.

## Alternating Current Production

Alternating current can be produced or generated by using devices that are known as alternators. However, alternating current can also be produced by different methods where many circuits are used. One of the most common or simple ways of generating AC is by using a basic single coil AC generator which consists of two-pole magnets and a single loop of wire having a rectangular shape.

## Application of Alternating Current

AC is the form of current that are mostly used in different appliances. Some of the examples of alternating current include audio signal, radio signal, etc. An alternating current has a wide advantage over DC as AC is able to transmit power over large distances without great loss of energy.

## 29. Answer: b

### Explanation:

- 1 - Isochoric
- 2 - Adiabatic
- 3 - Isothermal
- 4 - Isobaric

### Concepts:

#### 1. Thermodynamics:

**Thermodynamics** in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

## Important Terms

### System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

### Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

## Laws of Thermodynamics

### Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

### First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

### Second Law of Thermodynamics

The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

### Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

**30. Answer: a****Explanation:**

The correct answer is option (A): 216 MeV

**Concepts:****1. Nuclear Physics:**

**Nuclear physics** is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of nuclear matter. Nuclear physics should not be confused with atomic physics, which studies the atom as a whole, including its electrons

**Radius of Nucleus**

'R' represents the radius of the nucleus.  $R = R_0 A^{1/3}$

Where,

- $R_0$  is the proportionality constant
- A is the **mass number** of the element

**Total Number of Protons and Neutrons in a Nucleus**

The mass number (A), also known as the nucleon number, is the total number of neutrons and protons in a nucleus.

$$A = Z + N$$

Where, N is the neutron number, A is the mass number, Z is the proton number

**Mass Defect**

Mass defect is the difference between the sum of masses of the nucleons (neutrons + protons) constituting a nucleus and the rest mass of the nucleus and is given as:

$$\Delta m = Zm_p + (A - Z) m_n - M$$

Where  $Z$  = atomic number,  $A$  = mass number,  $m_p$  = mass of 1 proton,  $m_n$  = mass of 1 neutron and  $M$  = mass of nucleus.

## 31. Answer: c

### Explanation:

$$\begin{aligned}\text{Electric flux, } E &= \int \vec{E} \cdot d\vec{s} \\ &= \int E ds \cos 0 \\ &= \int E ds \cos 90^\circ = 0.\end{aligned}$$

Therefore, the correct option is (C): Zero

### Concepts:

#### 1. Gauss Law:

Gauss law states that the total amount of [electric flux](#) passing through any closed surface is directly proportional to the enclosed [electric charge](#).

#### Gauss Law:

According to the Gauss law, the total flux linked with a closed surface is  $1/\epsilon_0$  times the charge enclosed by the closed surface.

$$\oint \vec{E} \cdot d\vec{s} = \frac{1}{\epsilon_0} q$$

For example, a point charge  $q$  is placed inside a cube of edge ' $\alpha$ '. Now as per Gauss law, the flux through each face of the cube is  $q/6\epsilon_0$ .

#### Gauss Law Formula:

As per the Gauss theorem, the total charge enclosed in a closed surface is proportional to the total flux enclosed by the surface. Therefore, if  $\phi$  is total flux and  $\epsilon_0$  is electric constant, the total [electric charge](#)  $Q$  enclosed by the surface is;

$$Q = \phi \epsilon_0$$

The Gauss law formula is expressed by;

$$\phi = Q/\epsilon_0$$

Where,

$Q$  = total charge within the given surface,

$\epsilon_0$  = the electric constant.

---

## 32. Answer: b

### Explanation:

Answer (b) Momentum

---

## 33. Answer: d

### Explanation:

From Kirchhoff's law.

$$I \times 2 + I \times 1 = 18 - 12$$

Current in the circuit,

$$I = \frac{V}{R} = \frac{6}{3} = 2 A$$

Voltage drop across  $2 \Omega$ ,

$$V_1 = 2 \times 2 = 4 V$$

Voltmeter reading =  $18 - 4 = 14 V$ .

### Concepts:

#### 1. Current Electricity:

[Current electricity](#) is defined as the flow of [electrons](#) from one section of the circuit to another.

### Types of Current Electricity

There are two [types of current](#) electricity as follows:

## Direct Current

The current electricity whose direction remains the same is known as direct current. Direct current is defined by the constant flow of electrons from a region of high electron density to a region of low electron density. DC is used in many household appliances and applications that involve a battery.

## Alternating Current

The current electricity that is bidirectional and keeps changing the direction of the charge flow is known as alternating current. The bi-directionality is caused by a sinusoidally varying current and voltage that reverses directions, creating a periodic back-and-forth motion for the current. The electrical outlets at our homes and industries are supplied with [alternating current](#).

---

### 34. Answer: b

#### Explanation:

Distance of two planets from sun ( $r_1$ ) =  $10^{13} m$  and ( $r_2$ ) =  $10^{12} m$

Relation between time period (T) and distance of the planet from the sun is  $T^2 \propto r^3$  or  $T \propto r^{3/2}$ .

$$\text{Therefore } \frac{T_1}{T_2} = \left( \frac{r_1}{r_2} \right)^{3/2} = \left( \frac{10^{13}}{10^{12}} \right)^{3/2} = 10^{3/2} = 10\sqrt{10}.$$

#### Concepts:

##### 1. Gravitation:

In mechanics, the universal force of attraction acting between all matter is known as **Gravity**, also called **gravitation**. It is the weakest known force in nature.

## Newton's Law of Gravitation

According to Newton's law of gravitation, "Every particle in the universe attracts every other particle with a force whose magnitude is,

- $F \propto (M_1 M_2) \dots (1)$
- $(F \propto 1/r^2) \dots (2)$

On combining equations (1) and (2) we get,

$$F \propto M_1 M_2 / r^2$$

$$F = G \times [M_1 M_2] / r^2 \dots (7)$$

$$\text{Or, } f(r) = G M_1 M_2 / r^2$$

The dimension formula of  $G$  is  $[M^{-1} L^3 T^{-2}]$ .

---

### 35. Answer: d

#### Explanation:

In case of longitudinal wave, the particles maximum parallel or antiparallel to the velocity of wave. Hence they transmit energy and momentum in the direction of propagation.

#### Concepts:

##### 1. Waves:

[Waves](#) are a disturbance through which the energy travels from one point to another. Most acquainted are surface waves that tour on the water, but sound, mild, and the movement of subatomic particles all exhibit wavelike properties. inside the most effective waves, the disturbance oscillates periodically (see periodic movement) with a set [frequency and wavelength](#).

#### Types of Waves:

##### Transverse Waves –

Waves in which the medium moves at right angles to the direction of the wave.

Examples of transverse waves:

- Water waves (ripples of gravity waves, not sound through water)
- Light waves
- S-wave earthquake waves

- Stringed instruments
- Torsion wave

The high point of a transverse wave is a crest. The low part is a trough.

## Longitudinal Wave -

A longitudinal wave has the movement of the particles in the medium in the same dimension as the direction of movement of the wave.

Examples of longitudinal waves:

- Sound waves
- P-type earthquake waves
- Compression wave

### 36. Answer: a

#### Explanation:

Let  $M$  is the mass of the chain of length  $L$ . If  $y$  is the maximum length of chain which can hang outside the table without sliding, then for equilibrium of the chain, the weight of hanging part must be balanced by the force of friction on the portion on the table

$$W = f_L \dots (i)$$

But from figure

$$W = \frac{M}{L}yg \text{ and } R = W' = \frac{M}{L}(L - y)g$$

So that

$$f_L = \mu R = \mu \frac{R}{L}(L - y)g$$

Substituting these values of  $W$  and  $f_L$  in eqn.(i),

$$\text{we get } \mu \frac{M}{L}(L - y)g = \frac{M}{L}yg$$

$$\text{or } \mu(L - y) = y \text{ or } y = \frac{\mu L}{\mu + 1} = \frac{0.25L}{1.25} = \frac{L}{5}$$

$$\text{or } \frac{y}{L} = \frac{1}{5} = \frac{1}{5} \times 100$$

$$= 20\%$$

#### Concepts:

### 1. Laws of Motion:

The [laws of motion](#), which are the keystone of classical mechanics, are three statements that defined the relationships between the forces acting on a body and its motion. They were first disclosed by English physicist and mathematician Isaac Newton.

## Newton's First Law of Motion

[Newton's 1<sup>st</sup> law states](#) that a body at rest or uniform motion will continue to be at rest or uniform motion until and unless a net external force acts on it.

## Newton's Second Law of Motion

[Newton's 2<sup>nd</sup> law of motion](#) deals with the relation between force and acceleration. According to the second law of motion, the acceleration of an object as built by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

## Newton's Third Law of Motion

[Newton's 3<sup>rd</sup> law of motion](#) states when a body applies a force on another body that there is an equal and opposite reaction for every action.

### 37. Answer: a

#### Explanation:

In  $\triangle, OAC$ ,  $\cos \theta = A/l$

or,  $OA = l \cos \theta$

$\therefore AB = l(1 - \cos \theta) = h$

At point, C the velocity of bob  
= 0.

The vertical acceleration = g

$\therefore v^2 = 2gh$  or,  $v = \sqrt{2gl(1 - \cos \theta)}$ .

#### Concepts:

### 1. Oscillations:

**Oscillation** is a process of repeating variations of any quantity or measure from its **equilibrium** value in time. Another definition of oscillation is a periodic variation of a matter between two values or about its central value.

The term vibration is used to describe the mechanical oscillations of an object. However, oscillations also occur in dynamic systems or more accurately in every field of science. Even our heartbeats also create oscillations. Meanwhile, objects that move to and fro from its equilibrium position are known as oscillators.

**Read More:** [Simple Harmonic Motion](#)

## Oscillation- Examples

The tides in the sea and the movement of a simple pendulum of the clock are some of the most common examples of oscillations. Some of the examples of oscillations are vibrations caused by the guitar strings or the other instruments having strings are also and etc. The movements caused by oscillations are known as oscillating movements. For example, oscillating movements in a sine wave or a spring when it moves up and down.

The maximum distance covered while taking oscillations is known as the amplitude. The time taken to complete one cycle is known as the time period of the oscillation. The number of oscillating cycles completed in one second is referred to as the frequency which is the reciprocal of the time period.

## 38. Answer: b

### Explanation:

As at a corner, 8 cubes can be placed symmetrically, flux linked with each cube (due to a charge  $Q$  at the corner) will be  $\frac{Q}{8\epsilon_0}$ .

Now for the faces passing through the edge  $A$ , electric field  $E$  at a face will be parallel to area of face and so flux for these three faces will be zero. Now as the cube has six faces and flux linked with three faces (through  $A$ ) is zero, so flux linked with remaining three faces will be  $\frac{Q}{8\epsilon_0}$ . Hence, electric flux passed through all the six faces of the cube is  $\frac{Q}{8\epsilon_0}$ .

### Concepts:

## 1. Electrostatic Potential and Capacitance:

### Electrostatic Potential

The potential of a point is defined as the **work done** per unit charge that results in bringing a charge from infinity to a certain point.

Some major things that we should know about electric potential:

- They are denoted by  $V$  and are a scalar quantity.
- It is measured in volts.

### Capacitance

The ability of a **capacitor** of holding the energy in form of an **electric charge** is defined as capacitance. Similarly, we can also say that capacitance is the storing ability of capacitors, and the unit in which they are measured is “farads”.

Read More: [Electrostatic Potential and Capacitance](#)

**The capacitor is in Series and in Parallel as defined below;**

#### In Series

Both the Capacitors  $C_1$  and  $C_2$  can easily get connected in series. When the **capacitors are connected in series** then the total capacitance that is  $C_{\text{total}}$  is less than any one of the capacitor's capacitance.

#### In Parallel

Both Capacitor  $C_1$  and  $C_2$  are connected in parallel. When the capacitors are connected parallelly then the total capacitance that is  $C_{\text{total}}$  is any one of the capacitor's capacitance.

---

39. Answer: b

Explanation:

For points inside the wire

$$B = \frac{\mu_0 I r}{2\pi R^2} (r \leq R)$$

For points outside the wire

$$B = \frac{\mu_0 I}{2\pi r} (r \geq R)$$

according to the question

$$\frac{B}{B'} = \frac{\frac{\mu_0 I (a/2)}{2\pi (a/2)^2}}{\frac{\mu_0 I}{2\pi (2a)}} = 1 : 1$$

## Concepts:

### 1. Moving Charges and Magnetism:

Moving charges generate an electric field and the rate of flow of charge is known as **current**. This is the basic concept in **Electrostatics**. Another important concept related to moving **electric charges** is the magnetic effect of current. Magnetism is caused by the current.

### Magnetism:

- The relationship between a [Moving Charge and Magnetism](#) is that Magnetism is produced by the movement of charges.
- And Magnetism is a property that is displayed by Magnets and produced by moving charges, which results in objects being attracted or pushed away.

### Magnetic Field:

Region in space around a magnet where the Magnet has its Magnetic effect is called the Magnetic field of the Magnet. Let us suppose that there is a point charge  $q$  (moving with a velocity  $v$  and, located at  $r$  at a given time  $t$ ) in presence of both the electric field  $E(r)$  and the magnetic field  $B(r)$ . The force on an electric charge  $q$  due to both of them can be written as,

$$F = q [E(r) + v \times B(r)] \equiv F_{\text{Electric}} + F_{\text{magnetic}}$$

This force was based on the extensive experiments of Ampere and others. It is called the Lorentz force.

## Explanation:

The correct option is (C): More than  $19.6 \text{ m/s}$

Time taken by ball to reach maximum height

$$v = u - gT$$

at maximum height, final speed is zero ie,  $v = 0$

$$\text{so, } u = gT$$

$$\text{or } T = u/g$$

$$\text{In } 2s, u = 2 \times 9.8 = 19.6 \text{ ms}^{-1}$$

If man throws the ball with velocity of  $19.6 \text{ ms}^{-1}$  then after  $2s$  it will reach the maximum height. When he throws  $2^{nd}$  ball,  $1^{st}$  is at top. When he throws third ball,  $1^{st}$  will come to ground and  $2^{nd}$  will be at the top. Therefore, only 2 balls are in air. If he wants to keep more than 2 balls in air he should throw the ball with a speed greater than  $19.6 \text{ ms}^{-1}$

## Concepts:

### 1. Motion in a straight line:

The **motion in a straight line** is an object changes its position with respect to its surroundings with time, then it is called in motion. It is a change in the position of an object over time. It is nothing but linear motion.

### Types of Linear Motion:

Linear motion is also known as the **Rectilinear Motion** which are of two types:

1. **Uniform linear motion with constant velocity or zero acceleration:** If a body travels in a straight line by covering an equal amount of distance in an equal interval of time then it is said to have uniform motion.
  2. **Non-Uniform linear motion with variable velocity or non-zero acceleration:** Not like the uniform acceleration, the body is said to have a non-uniform motion when the velocity of a body changes by unequal amounts in equal intervals of time. The rate of change of its velocity changes at different points of time during its movement.
-

## 41. Answer: a

### Explanation:

The correct answer is A:  $2mv_0^2$

According to law of conservation of angular momentum

$$mvr = mv'r'$$

$$v_0 R_0 = v \left( \frac{R_0}{2} \right); v = 2v_0 \dots (i)$$

$$\therefore \frac{K_0}{K} = \frac{\frac{1}{2}mv_0^2}{\frac{1}{2}mv^2} = \left( -\frac{v_0}{v} \right)^2$$

$$\text{or } \frac{K}{K_0} = \left( \frac{v}{v_0} \right)^2 = (2)^2 \dots \text{(Using (i))}$$

$$K = 4K_0 = 2mv_0^2$$

## 42. Answer: d

### Explanation:

Because the slope is highest at C,  $v = \frac{dx}{dt}$  is maximum.

### Concepts:

#### 1. Motion in a Plane:

It is a vector quantity. A vector quantity is a quantity having both magnitude and direction. Speed is a scalar quantity and it is a quantity having a magnitude only. Motion in a plane is also known as motion in two dimensions.

#### Equations of Plane Motion

The equations of motion in a straight line are:

$$v = u + at$$

$$s = ut + \frac{1}{2} at^2$$

$$v^2 - u^2 = 2as$$

Where,

- $v$  = final velocity of the particle

- $u$  = initial velocity of the particle
  - $s$  = displacement of the particle
  - $a$  = acceleration of the particle
  - $t$  = the time interval in which the particle is in consideration
- 

### 43. Answer: a

#### Explanation:

Limit of resolution,

$$\theta_R = 1.22 \frac{\lambda}{d};$$

$$\lambda = 600 \times 10^{-9} \text{ m}$$

$$d = 2 \text{ m}$$

$$\theta_R = \frac{1.22 \times 600 \times 10^{-9}}{2}$$

$$\theta_R = 3.66 \times 10^{-7} \text{ rad}$$

#### Concepts:

### 1. Ray Optics and Optical Instruments:

**Optics**, deals with the determination of behaviour and the properties of light, along with its interactions with the matter and also with the instruments that are used to detect it.

**Ray optics** is also known as the geometrical optics and it is a branch of science which describes light propagation.

**Reflection** is the change in direction of light at an interface in-between two different media so that the wave-front returns into a medium from which it was originated.

**Speed of light** is the rate at which the light travels in free space.

A phenomenal change in image formed when the light is passed from one medium to another which is called [Refraction](#).

**Total Internal Reflection** is the reflection of light when the light ray enters into a rarer medium from a denser medium and the angle of incidence is higher than the critical angle of incidence then that light ray will be reflected back to the denser medium.

Read More: [Ray Optics and Optical Instruments](#)

**44. Answer: c****Explanation:**

Energy of the photon,  $E = \frac{hc}{\lambda}$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{975 \times 10^{-10}} \text{ J}$$
$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{975 \times 10^{-10} \times 1.6 \times 10^{-19}} \text{ eV} = 12.75 \text{ eV}$$

After absorbing a photon of energy 12.75 eV, the electron will reach to third excited state of energy -0.85 eV, since energy difference corresponding to  $n = 1$  and  $n = 4$  is 12.75 eV.

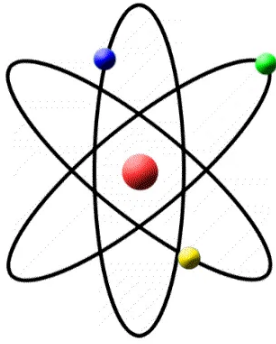
$\therefore$  Number of spectral lines emitted

$$= \frac{(n)(n-1)}{2} = \frac{(4)(4-1)}{2} = 6$$

**Concepts:****1. Atoms:**

- The smallest unit of matter indivisible by chemical means is known as an **atom**.
- The fundamental building block of a chemical **element**.
- The smallest possible unit of an element that still has all the chemical properties of that element.
- An atom is consisting of a nucleus surrounded by one or more shells of **electrons**.
- **Word origin:** from the Greek word *atomos*, which means uncuttable, something that cannot be divided further.

All matter we encounter in everyday life consists of smallest units called atoms – the air we breath consists of a wildly careening crowd of little groups of atoms, my computer's keyboard of a tangle of atom chains, the metal surface it rests on is a crystal lattice of atoms. All the variety of matter consists of less than hundred species of atoms (in other words: less than a hundred different chemical elements).



Atom

Every atom consists of a nucleus surrounded by a cloud of electrons. Nearly all of the atom's mass is concentrated in its nucleus, while the structure of the electron cloud determines how the atom can bind to other atoms (in other words: its chemical properties). Every chemical element can be defined via a characteristic number of protons in its nucleus. Atoms that have lost some of their usual number of electrons are called ions. Atoms are extremely small (typical diameters are in the region of tenths of a billionth of a metre =  $10^{-10}$  metres), and to describe their properties and behaviour, one has to resort to quantum theory.

#### 45. Answer: b

#### Explanation:

Electric heater does not involve Eddy currents. It uses Joule's heating effect.

#### Concepts:

##### 1. Electromagnetic Induction:

Electromagnetic Induction is a current produced by the voltage production due to a changing [magnetic field](#). This happens in one of the two conditions:-

1. When we place the [conductor](#) in a changing magnetic field.
2. When the conductor constantly moves in a stationary field.

#### Formula:

The [electromagnetic induction](#) is mathematically represented as:-

$$e = N \times \frac{d\phi}{dt}$$

Where

- $e$  = induced voltage
- $N$  = number of turns in the coil
- $\Phi$  = Magnetic flux (This is the amount of magnetic field present on the surface)
- $t$  = time

## Applications of Electromagnetic Induction

1. Electromagnetic induction in AC generator
  2. Electrical Transformers
  3. Magnetic Flow Meter
- 

46. Answer: b

### Explanation:

In an electromagnetic wave, half of the intensity is provided by the electric field and half by the magnetic field. Hence, required ratio should be 1 : 1

### Concepts:

#### 1. Electromagnetic waves:

The waves that are produced when an electric field comes into contact with a magnetic field are known as [Electromagnetic Waves](#) or EM waves. The constitution of an oscillating magnetic field and electric fields gives rise to electromagnetic waves.

## Types of Electromagnetic Waves:

Electromagnetic waves can be grouped according to the direction of disturbance in them and according to the range of their frequency. Recall that a wave transfers energy from one point to another point in space. That means there are two things going on: the disturbance that defines a wave, and the propagation of wave. In this context the waves are grouped into the following two categories:

- **Longitudinal waves:** A wave is called a [longitudinal wave](#) when the disturbances in the wave are parallel to the direction of propagation of the wave. For

example, sound waves are longitudinal waves because the change of pressure occurs parallel to the direction of wave propagation.

- **Transverse waves:** A wave is called a [transverse wave](#) when the disturbances in the wave are perpendicular (at right angles) to the direction of propagation of the wave.

---

#### 47. Answer: d

##### Explanation:

Here,  $E_g = 2 \text{ eV}$

Wavelength of radiation corresponding to this energy is

$$\begin{aligned}\lambda &= \frac{hc}{E_g} \\ &= \frac{1240 \text{ eV nm}}{2 \text{ eV}} \\ &= 620 \text{ nm}\end{aligned}$$

Frequency  $\nu = \frac{c}{\lambda}$

$$\begin{aligned}&= \frac{3 \times 10^8 \text{ ms}^{-1}}{620 \times 10^{-9}} \\ &= 5 \times 10^{14} \text{ Hz}\end{aligned}$$

##### Concepts:

#### 1. Semiconductors:

**Semiconductors** are a crystalline solid materials, whose electrical conductivity lies between a conductor and an insulator. Semiconductors are mainly used in the manufacturing of electronic devices like capacitors, transistors, diodes, Integrated circuits, etc.

#### Properties of Semiconductor:

1. Semiconductor acts like an insulator at Zero Kelvin. On increasing the temperature, it works as a conductor.
2. Due to their exceptional electrical properties, semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.
3. Lesser power losses.

#### Uses of Semiconductor:

1. Semiconductors are widely used in manufacturing electronics devices like transistors, diodes, sensors, integrated circuits.
  2. Semiconductors are widely used in all electronic devices, like mobile phones, digital cameras, communication devices, trains, ATMs, etc.
- 

**48. Answer: d**

**Explanation:**

$$\begin{aligned} \text{For electron } \lambda_e &= \frac{h}{\sqrt{2mE}} \\ \text{for Photon } E &= pc \Rightarrow \lambda_{Ph} = \frac{hc}{E} \\ \Rightarrow \frac{\lambda_e}{\lambda_{Ph}} &= \frac{h}{\sqrt{2mE}} \times \frac{E}{hc} = \left(\frac{E}{2m}\right)^{1/2} \frac{1}{c} \end{aligned}$$

**Concepts:**

## 1. Dual Nature of Radiation and Matter:

The dual nature of matter and the dual nature of radiation were throughgoing concepts of physics. At the beginning of the 20<sup>th</sup> century, scientists untangled one of the best-kept secrets of nature – the wave-particle duplexity or the [dual nature of matter and radiation](#).

### Electronic Emission

The least energy that is needed to emit an electron from the surface of a metal can be supplied to the loose electrons.

### Photoelectric Effect

The photoelectric effect is a phenomenon that involves electrons getting away from the surface of materials.

## Heisenberg's Uncertainty Principle

Heisenberg's Uncertainty Principle states that both the momentum and position of a particle cannot be determined simultaneously.

---

## 49. Answer: a

### Explanation:

Angle of dip is the angle between earth's resultant magnetic field from horizontal. Dip is zero at equator and positive in northern hemisphere. In southern hemisphere dip angle is considered as negative.

### Concepts:

#### 1. Magnetism & Matter:

**Magnets** are used in many devices like electric bells, telephones, radio, loudspeakers, motors, fans, screwdrivers, lifting heavy iron loads, super-fast trains, especially in foreign countries, **refrigerators**, etc.

Magnetite is the world's first magnet. This is also called a **natural magnet**. Though magnets occur naturally, we can also impart magnetic properties to a substance. It would be an artificial magnet in that case.

Read More: [Magnetism and Matter](#)

#### Some of the properties of the magnetic field lines are:

- The lines are continuous and outside the magnet, the field lines originate from the North pole and terminate at the South pole
- They form closed loops traversing inside the magnet.
- But here the lines seem to originate from the South pole and terminate at the North pole to form closed loops.
- More number of close lines indicate a stronger **magnetic field**
- The lines do not intersect each other
- The tangent drawn at the field line gives the direction of the field at that point.

---

## 50. Answer: b

### Explanation:

In general, whenever we are to go from any known scale to any unknown scale, then we follow the equation 
$$\frac{(Temperature\ on\ known\ scale)-(LFP\ for\ known\ scale)}{(UFP-LFP)_{known}} = \frac{(Temperature\ on\ unknown\ scale)-(LFP\ for\ unknown\ scale)}{(UFP-LFP)_{unknown}}$$
 or  $\frac{39-0}{100-0} = \frac{t-39}{239-39}$  or  $t = 117^{\circ}W$  Note : LFP - Lower fixed point UFP - Upper fixed point

## Concepts:

### 1. Thermal Properties of Matter:

Anything that has mass or occupies space in the universe is commonly known as matter. There are five [properties of matters](#) namely chemical, mechanical, thermal, dimensional, and physical properties.

Read More: [Thermal Properties of Matter](#)

### Heat Capacity:

The quantity of heat needed to change the temperature of the matter by  $1^{\circ}$  is known as the heat capacity of a material. The temperature is indicated in kelvin or Celsius and the amount of heat is shown in calories or joules. Specific heat capacity or molar heat capacity is used to calculate the heat capacity of the matter with the stated dimension.

Linear expansion is the situation when change takes place in one dimension or dimensional.

### Thermal Expansion:

When heat is passed through the material, the change in the area, volume, and shape is recognized as the thermal expansion property of the material. The expansion of the railway tracks due to maximal heat which leads to accidents is an example of thermal expansion.

### Thermal Conductivity:

This property is interconnected to the conductivity of heat. The amount of heat regulated by the material is directly proportional to the conductivity of the material. Not all objects have the capacity to conduct heat throughout their bodies. Insulators are such objects which do not have the property to conduct heat throughout their body.

### Thermal Stress:

The stress due to thermal contraction or expansion of the body is known as thermal stress. The explosion of materials takes place due to thermal stress which is dangerous. The cracks on the truck tyres are caused by an outcome of thermal stress. Trucks at high speed generate heat which is caused by the friction of the truck tyres and the road surface.

---

#### 51. Answer: d

#### Explanation:

When azimuthal quantum number is 3

$$m = (2l + 1)$$

$$l = 3$$

$$m = (2 \times 3 + 1)$$

$$= 7 \text{ orbitals}$$

then total values of  $m = (2 \times 3 + 1) = 7$  orbitals. We know that, one orbital contains two electrons. Hence, total number of electrons =  $7 \times 2 = 14$

Alternative Total number of electrons =  $4l + 2$

$$= 4 \times 3 + 2 = 12 + 2 = 14 \text{ electrons}$$

#### Concepts:

##### 1. Structure of Atom:

### Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of [protons](#), electrons and neutrons.

### Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- **Atoms** undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

## Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of **isotopes**.
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

## Subatomic Particles

1. **Protons** - are positively charged subatomic particles.
2. **Electron** - are negatively charged subatomic particles.
3. **Neutrons** - are electrically neutral particles and carry no charge

## Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

---

### 52. Answer: a

#### Explanation:

In DNA double helix, the correct bonding (hydrogen bonding) between nitrogenous bases of two helix is



## Concepts:

### 1. Biomolecules:

**Biomolecules** are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living molecules are the actual foot-soldiers of the battle of sustenance of life.

**There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.**

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.
4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.

---

### 53. Answer: c

#### Explanation:

Oxygen gas is prepared by fractional distillation of air. During this process, dinitrogen with less boiling point (78 K) distills as vapours while dioxygen with higher boiling point (90 K) remains in the liquid state and can be separated.

## Concepts:

## 1. P-Block Elements:

- P block elements are those in which the last electron enters any of the three p-orbitals of their respective shells. Since a p-subshell has three degenerate p-orbitals each of which can accommodate two electrons, therefore in all there are six groups of p-block elements.
- P block elements are shiny and usually a good conductor of electricity and heat as they have a tendency to lose an electron. You will find some amazing properties of elements in a P-block element like gallium. It's a metal that can melt in the palm of your hand. Silicon is also one of the most important metalloids of the p-block group as it is an important component of glass.

### P block elements consist of:

- [Group 13 Elements](#): Boron family
- [Group 14 Elements](#): Carbon family
- [Group 15 Elements](#): Nitrogen family
- [Group 16 Elements](#): Oxygen family
- [Group 17 Elements](#): Fluorine family
- [Group 18 Elements](#): Neon family

54. Answer: d

### Explanation:

??Based on the number of metal atoms present in a complex, they are classified into mononuclear, dinuclear, trinuclear and so on.

eg:  $Fe(CO)_5$  : mononuclear

$Co_2(CO)_8$  : dinuclear

$Fe_3(CO)_{12}$  : trinuclear

### Concepts:

## 1. Coordination Compounds:

A coordination compound holds a central metal atom or ion surrounded by various oppositely charged ions or neutral molecules. These molecules or ions are re-bonded to the metal atom or ion by a coordinate bond.

## **Coordination entity:**

A coordination entity composes of a central metal atom or ion bonded to a fixed number of ions or molecules.

## **Ligands:**

A molecule, ion, or group which is bonded to the metal atom or ion in a complex or coordination compound by a coordinate bond is commonly called a ligand. It may be either neutral, positively, or negatively charged.

---

### **55. Answer: a**

#### **Explanation:**

At absolute zero temperature, the entropy of substance becomes zero, it means that all the molecular motions are stopped or ceased.

## **Concepts:**

### **1. States of Matter:**

The matter is made up of very tiny particles and these particles are so small that we cannot see them with naked eyes.

## **There are three States of Matter:**

The [three states of matter](#) are as follows:

### **Solid State:**

- The solid-state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.

- The molecules of solids are tightly packed because of ***strong intermolecular forces***, they only oscillate about their mean positions.

## Liquid State:

- The molecules in a liquid are closely packed due to ***weak intermolecular forces***.
- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.

## Gaseous State:

- In this [state of matter](#), distances between the molecules are large (intermolecular distance is in the range of  $10^{-7}$ – $10^{-5}$  cm).
- The ***intermolecular forces experienced between them are negligible***.
- Thus, translatory, rotatory and vibratory motions are observed prominently in gases.

---

56. Answer: a

### Explanation:

With addition of water, concentration decreases thus vapour pressure increases

## Concepts:

### 1. Solutions:

A [solution](#) is a homogeneous mixture of two or more components in which the particle size is smaller than 1 nm.

For example, salt and sugar is a good illustration of a solution. A solution can be categorized into several components.

## Types of Solutions:

The solutions can be classified into three types:

- **Solid Solutions** – In these solutions, the [solvent](#) is in a Solid-state.

- **Liquid Solutions**– In these solutions, the solvent is in a Liquid state.
- **Gaseous Solutions** – In these solutions, the solvent is in a Gaseous state.

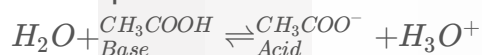
On the basis of the amount of solute dissolved in a solvent, solutions are divided into the following types:

1. **Unsaturated Solution**– A solution in which more solute can be dissolved without raising the temperature of the solution is known as an unsaturated solution.
2. **Saturated Solution**– A solution in which no solute can be dissolved after reaching a certain amount of temperature is known as an unsaturated saturated solution.
3. **Supersaturated Solution**– A solution that contains more solute than the maximum amount at a certain temperature is known as a supersaturated solution.

## 57. Answer: b

### Explanation:

The aqueous solution of acetic acid ionise as follows:



So, the aqueous solution of acetic acid contains  $CH_3COO^-$ ,  $H_3O^+$  and  $CH_3COOH$ .

### Concepts:

#### 1. Equilibrium:

An **equilibrium** represents a state in a process when the observable properties such as color, temperature, pressure, concentration etc do not show any change.

The word equilibrium means 'balance' which indicates that a **chemical reaction** represents a balance between the reactants and products taking part in the reaction. The equilibrium state is also noticed in certain physical processes such as the **melting point** of ice at  $0^\circ\text{C}$ , both ice and water are present at equilibrium.

In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as **chemical equilibrium**.

## Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

## Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

### Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. [Homogenous equilibrium](#) can be further divided into two types: Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

### Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of [heterogeneous equilibrium](#) are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

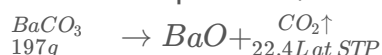
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## 58. Answer: a

### Explanation:

The correct answer is A:1.12 L

On decomposition,  $BaCO_3$  liberates  $CO_2$  as



$\therefore 197g \text{ of } BaCO_3 \text{ gives } = 22.4L \text{ of } CO_2 \text{ at STP}$

$\therefore 9.85g \text{ of } BaCO_3 \text{ will give } = \frac{22.4 \times 9.85}{197} = 1.12L$

### Concepts:

#### 1. Some Basic Concepts of Chemistry:

Chemistry is a vast subject and for understanding its significance we can take help of following points:

- Chemistry plays an important role in understanding various subjects like physics, geology and biology.
- Chemistry is a core branch of science that explains us about the various compositional properties and interaction of **matter**. It also helps to understand various **chemical reactions**.
- Chemistry is important in order to understand the behaviour of **fertilizers**, alkenes, acids, salts, dyes, **polymers**, drugs, soaps and alloys in organic and **inorganic chemistry**.
- Chemistry plays an important role in various fields like healthcare, industrial, research, food, and farm activities.

Read More: [Some Basic Concepts of Chemistry](#)

## Classification of Matter

There are two ways of classifying the matter:

## (A) Physical Classification:

Matter can exist in three physical states:

1. **Solids** – have definite volume and definite shape
2. Liquids – have definite volume but not definite shape.
3. Gases – have neither definite volume nor definite shape.

## (B) Chemical Classification:

Based upon the composition, matter can be divided into two main types:

1. **Pure Substances** are defined as a single substance (or matter) which cannot be separated by simple physical methods. Pure substances can be further classified as (i) Elements (ii) Compounds
2. Mixtures are the combination of two or more elements or **compounds** which are not chemically combined together and may also be present in any proportion.

59. Answer: c

Explanation:

$$\Delta G^0 = -nFE^0$$

From given data,

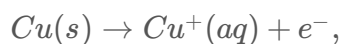


$$\Delta G_1^0 = -2(-0.34) \times F$$



$$\Delta G_2^0 = -1(0.15) \times F$$

On addition,



$$\Delta G_3^0 = -1 \times E^0 \times F$$

$$\Delta G_3^0 = \Delta G_1^0 + \Delta G_2^0$$

$$-n_3FE^0 = -n_1FE_1^0 - n_2FE_2$$

$$-E^0 = -2(-0.34) - 1(0.15)$$

$$= (-2 \times -0.34) + (-1 \times 0.15)$$

$$-E^0 = +0.68 - 0.15 = 0.53$$

$$\text{or } E^0 = -0.53 V$$

Reaction  $2Cu^+(aq) \rightleftharpoons Cu^{2+}(aq) + Cu(s)$ ,

$E^0 = ?$

So,  $Cu^+(aq) + e^- \rightleftharpoons Cu(s)$ ,  $E^0 = 0.53 V$

$Cu^+(aq) \rightleftharpoons Cu^{2+}(aq) + e^-$ ,

$E^0 = -0.15 V$

$2Cu^+(aq) \rightleftharpoons Cu^{2+}(aq) + Cu(s)$ ,

$E^0 = +0.38 V$

## Concepts:

### 1. Electrochemical Cells:

An **electrochemical cell** is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

### Classification of Electrochemical Cell:

#### Cathode

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

#### Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

### Types of Electrochemical Cells:

#### Galvanic cells (also known as Voltaic cells)

- Chemical energy is transformed into electrical energy.
- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.

- The electrons originate from the species that undergo oxidation.

## Electrolytic cells

- Electrical energy is transformed into chemical energy.
- The redox reactions are non-spontaneous.
- These cells are positively charged anode and negatively charged cathode.
- Electrons originate from an external source.

### 60. Answer: d

#### Explanation:

Let the order of reaction with respect to A is  $x$   
and with respect to B is  $y$ . Thus,

$$\text{rate} = k[A]^x[B]^y$$

( $x$  and  $y$  are stoichiometric coefficient)

For the given cases,

$$\text{I. rate} = k(0.1)^x(0.1)^y = 6.0 \times 10^{-3}$$

$$\text{II. rate} = k(0.3)^x(0.2)^y = 7.2 \times 10^{-2}$$

$$\text{III. rate} = k(0.3)^x(0.40)^y = 2.88 \times 10^{-1}$$

$$\text{IV. rate} = k(0.34)^x(0.1)^y = 2.40 \times 10^{-2}$$

Dividing E (I) by E (IV), we get

$$\left(\frac{0.1}{0.4}\right)^x \left(\frac{0.1}{0.1}\right)^y = \frac{6.0 \times 10^{-3}}{2.4 \times 10^{-2}}$$

$$\text{or } \left(\frac{1}{4}\right)^x = \left(\frac{1}{4}\right)^1$$

$$\therefore x = 1$$

On dividing E (II) by E (III), we get

$$\left(\frac{0.3}{0.3}\right)^x \left(\frac{0.2}{0.4}\right)^y = \frac{7.2 \times 10^{-2}}{2.88 \times 10^{-1}}$$

$$\text{or } \left(\frac{1}{2}\right)^y = \frac{1}{4}$$

$$\text{or } \left(\frac{1}{2}\right)^y = \left(\frac{1}{2}\right)^2$$

$$\therefore y = 2$$

Thus, rate law is,

$$\text{rate} = k[A]^1[B]^2$$

$$= k[A][B]^2$$

#### Concepts:

### 1. Chemical Kinetics:

**Chemical kinetics** is the description of the **rate of a chemical reaction**. This is the rate at which the reactants are transformed into products. This may take place by abiotic or by biological systems, such as microbial metabolism.

## Rate of a Chemical Reaction:

The speed of a reaction or the rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. To be more specific, it can be expressed in terms of: (i) the rate of decrease in the concentration of any one of the reactants, or (ii) the rate of increase in concentration of any one of the products. Consider a hypothetical reaction, assuming that the volume of the system remains constant.  $R \rightarrow P$

Read More: [Chemical Kinetics MCQ](#)

## Factors Affecting The Reaction Rate:

- **The concentration of Reactants** – According to **collision theory**, which is discussed later, reactant molecules collide with each other to form products.
  - **Nature of the Reactants** – The reaction rate also depends on the types of substances that are reacting.
  - **Physical State of Reactants** – The physical state of a reactant whether it is solid, liquid, or gas can greatly affect the rate of change.
  - **Surface Area of Reactants** – When two or more reactants are in the same phase of fluid, their particles collide more often than when either or both are in the solid phase or when they are in a heterogeneous mixture. In a heterogeneous medium, the collision between the particles occurs at an interface between phases. Compared to the homogeneous case, the number of collisions between reactants per unit time is significantly reduced, and so is the reaction rate.
  - **Temperature** – If the temperature is increased, the number of collisions between reactant molecules per second. Increases, thereby increasing the rate of the reaction.
  - **Effect Of Solvent** – The nature of the **solvent** also depends on the reaction rate of the solute particles.
  - **Catalyst** – **Catalysts** alter the rate of the reaction by changing the reaction mechanism.
-

**61. Answer: b****Explanation:**

$$\Delta G = \Delta H - T\Delta S \quad \Delta G = 0$$

$$\text{Given } \Delta H = T\Delta S,$$

$$T = \frac{40.63 \times 10^3}{108.8} = 373.4K$$

**Concepts:****1. Thermodynamics:**

**Thermodynamics** in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

**Important Terms****System**

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

**Thermodynamic Process**

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and

internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

## Laws of Thermodynamics

### Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

### First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

### Second Law of Thermodynamics

The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

### Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

**Explanation:**

Boiling points of alkanes increase as the number of carbon atom increase or molecular mass increase. Alkenes have high boiling point, so  $CH_3CH_2CH_2CH_3$  has the lowest boiling point.

**Concepts:****1. Hydrocarbons:**

Hydrocarbons can be described as **organic compounds** that consists only hydrogen and carbon atoms. These compounds are of different types and thereby have distinct natures. Hydrocarbons are colorless gases and are known for discharging faint odours. These have been categorized under four major classes named as alkynes, alkanes, alkenes, and aromatic hydrocarbons.

**Types of Hydrocarbons**

1. **Saturated hydrocarbons** – Saturated hydrocarbons are those compounds where there is a single bond exists between carbon atoms and are saturated with atoms of hydrogen.
2. **Unsaturated hydrocarbons** – Hydrocarbons comprises of at least one double or triple bond between carbon atoms are known as unsaturated hydrocarbons.
3. **Aliphatic hydrocarbons** – The term denotes the hydrocarbons formed as an outcome of the chemical degradation of fats. **Aliphatic hydrocarbons** are basically chemical compounds.
4. **Aromatic hydrocarbons** – They are distinguished because of the presence of benzene rings in them. They give away distinct types of aroma. These hydrocarbons comprises of only hydrogen and carbon atoms.

---

**63. Answer: b****Explanation:**

Number of active hydrogen in a compound corresponds to the number of moles of  $CH_4$  evolved per mole of the compound.

$-OH, -NH_2, -SH, -OH$  or  $-C=CH-$   $\rightarrow [CH_3Mgl]CH_4$  2 $CH_4$  from  $-NH_2$ )

## Concepts:

### 1. Haloalkanes and Haloarenes:

The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are derived from aromatic hydrocarbons.

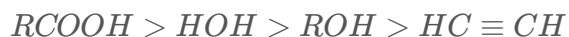
- Haloalkanes have hydrocarbons made up of aliphatic alkanes and one or more hydrogen atoms replaced by [halogens](#) (elements such as Chlorine, Bromine, Fluorine, Iodine, etc.) whereas, haloarenes consist of aromatic ring or rings and one or more hydrogen atoms replaced by halogens.
- In haloalkanes, the halogen atom is attached to the  $sp^3$  hybridized carbon atom of the alkyl group whereas, in haloarenes, the halogen atom is attached to the  $sp^2$  hybridized carbon atom of the alkyl group.
- Haloalkanes are saturated organic compounds where all the chemical bonds are attached to the carbon atom with single bonds and a single carbon atom is attached to the Halogen atom, whereas, the haloarenes differ from Haloalkanes by their method of preparation and properties.
- Haloalkanes are made by aliphatic alkanes by the process of free radical halogenation, whereas, haloarenes are made by direct halogenation of aromatic rings.
- Haloalkanes are odorless compounds, whereas, haloarenes have a sweet odor.
- Haloalkanes precipitate in  $SN^2$  substitution reactions, whereas, haloarenes do not precipitate in  $SN^2$  substitution reactions.
- Example of haloalkanes is  $CH_3Cl$  (Methyl Chloride) and  $CH_3CH_2Br$  (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.

---

### 64. Answer: d

#### Explanation:

Carboxylic acid is stronger than alcohol and water because after removal of proton, carboxylate ion is stabilised by resonance. Hence, correct order of acid strength is



Which is based upon the rate of donation of proton or strength of base, thus order of basic strength is



## 65. Answer: b

### Explanation:

Promethium (Pm) is the element which prepared only by synthetic methods. It is not present in nature. It is the only synthetic radioactive lanthanoid.

### Concepts:

#### 1. D and F Block Elements:

The d-block elements are placed in groups 3-12 and f-block elements with 4f and 5f orbital filled progressively. The general [electronic configuration](#) of [d block elements](#) and [f- block elements](#) are  $(n-1) d^{1-10} ns^{1-2}$  and  $(n-2) f^{1-14} (n-1) d_1 ns_2$  respectively. They are commonly known as transition elements because they exhibit multiple oxidation states because of the d-d transition which is possible by the availability of vacant d orbitals in these elements.

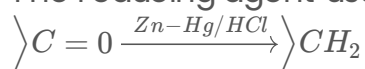
They have variable Oxidation States as well as are good catalysts because they provide a large surface area for the absorption of reaction. They show variable oxidation states to form intermediate with reactants easily. They are mostly lanthanoids and show lanthanoid contraction. Since differentiating electrons enter in an anti-penultimate f subshell. Therefore, these elements are also called inner transition elements.

Read More: [The d and f block elements](#)

## 66. Answer: a

### Explanation:

The reducing agent used in Clemmensen reduction is  $Zn - Hg$  and  $HCl$ .



## Concepts:

### 1. Aldehydes, Ketones, and Carboxylic Acids:

**Aldehydes, Ketones, and Carboxylic Acids** are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

## Aldehydes:

Aldehydes are organic compounds that have the functional group  $-CHO$ .

### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

## Ketones:

Ketones are organic compounds that have the functional group  $C=O$  and the structure  $R-(C=O)-R'$ .

### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

## Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(C=O)OH$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

## 67. Answer: a

### Explanation:

The amount of energy required to remove an electron from the outermost orbit of a gaseous atom is known as ionisation potential. Elements having half-filled or completely filled orbitals are more stable than partially filled orbitals. In a period from left to right ionisation potential decreases as the atomic number increases. The given elements (Be, B, C, N, O) are present in II period as

```

\begin{array}{ccccccccc}
\text{Be} & & & & & & & & \text{B} & & \\
& \text{Ionisation} & & & & & & & & & \\
& \text{potential} & & & & & & & & & \\
& \text{increases} & & & & & & & & & 
\end{array}

```

But in case of Be and B, Be has higher ionisation potential due to stable configuration. So, the correct order of increasing ionisation potential will be  $B < Be < C < O < N$

### Concepts:

#### 1. Haloalkanes and Haloarenes – Classification:

[Classification of Haloalkanes and Haloarenes](#) are as follows:

**Haloalkanes and Haloarenes are Classified on the Basis of the Number of Halogen Atoms:**

These are further classified as mono, di, or polyhalogen (tri-,tetra-, etc.) compounds depending on whether they contain one, two or more halogen atoms in their structures. For example;

- Monohaloalkane
- Dihaloalkane
- Trihaloalkane

**Haloalkanes and Haloarenes are Classified on Compounds Containing  $sp^3$  C—X Bond (X= F, Cl, Br, I)**

This class includes:

- Alkyl halides or haloalkanes ( $R-X$ )
- Allylic halides
- Benzylic halides

**Haloalkanes and Haloarenes are Classified on Compounds Containing  $sp^2$  C—X Bond**

This class includes:

- Vinylic halides
  - Aryl halides
- 

## 68. Answer: a

### Explanation:

When sodium phenoxide ( $C_6H_5ONa$ ) is heated with ethyl iodide ( $C_2H_5I$ ) it forms ethyl phenyl ether which is also called phenetole. This reaction is called Williamson's synthesis.

### Concepts:

#### 1. Alcohols:

### What is Alcohol?

Alcohol is a derivative of water ( $H_2O$ ) that has one, two, or more hydroxyl groups that are attached to a carbon atom of a hydrocarbon chain (an alkyl group). It is one of the most common organic compounds used in sweeteners, fragrances, and medicine.

Read More: [Types of Alcohol](#)

### Uses of Alcohol:

- Ethanol is the alcohol used in alcoholic drinks. It can be used as an industrial methylated spirit where methanol is used very little in quantity as it can be

dangerous.

- It is used as fuel to produce carbon dioxide and water by the process of fermentation. Whereas methanol burns carbon dioxide and water to facilitate combustion.
  - Alcohol is an organic compound used as a solvent that is insoluble in water.
  - It can be used to lower the level of sugar.
  - Alcohol is used as a preservative in laboratories.
- 

## 69. Answer: a

### Explanation:

Be and Mg do not impart characteristic colour to the flame.

### Concepts:

#### 1. Group 1 Elements:

Group one of alkali metals is [s-block elements](#) with just one electron in their s-orbital. They are alkali metals. They are named so because of the alkaline nature of the hydroxides and oxides.

Alkali metals are characterized by one s-electron in the valence shell of their atoms.

Alkali metals have a corresponding [Noble gas]  $ns^1$  [electronic configuration](#). They occupy the first column of the periodic table. Alkali elements are:

- Lithium (Li)
- Sodium (Na)
- Potassium (K)
- Rubidium (Ru)
- Cesium (Cs)
- Francium (Fr)

They have occupied successive periods from first to seven. Francium is a radioactive element with very low half-life.

### Electronic Configuration:

- Alkali metals have **one electron in their valence shell**.
- The electronic configuration is given by  $ns^1$ . For example, the electronic configuration of lithium is given by  $1s^2 2s^1$ .
- They tend to lose the outer shell electron to form cations with charge +1 (monovalent ions).

This makes them the **most electropositive elements** and due to the same reason, they are not found in the pure state.

## 70. Answer: c

### Explanation:

So the ratio of  $A : O = 80 : 100$  Thus, if there are 100 atoms of oxygen then 80 atoms of A. Let  $x$  be the no. of atoms of  $A^{+2}$ . No. of atoms of  $A^{+3} = 80 - x$  Charge on A =

$$2x + 3(80 - x) = 2 \times 100$$

Charge on O Since oxygen has charge  $-2$ . Therefore,  $2x + 240 - 3x = 200$

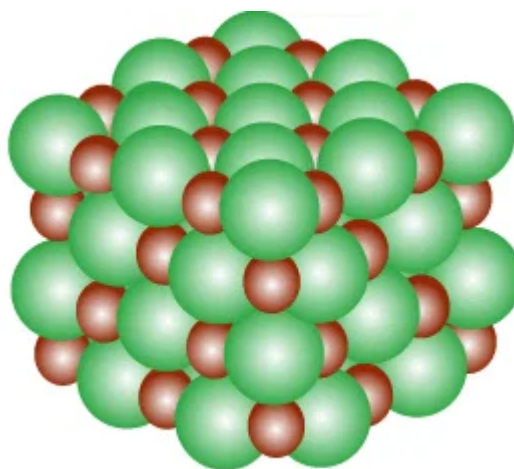
$$\Rightarrow x = 40$$

Therefore, Fraction of  $A^{+2} = \frac{\text{Atoms of } A^{+2}}{\text{Total no. of atoms}} \Rightarrow \text{Fraction of } A^{+2} = \frac{40}{80} = 0.50$

### Concepts:

#### 1. Solid State:

**Solids** are substances that are featured by a definite shape, volume, and high density. In the solid-state, the composed particles are arranged in several manners. Solid-state, in simple terms, means "no moving parts." Thus **solid-state** electronic devices are the ones inclusive of solid components that don't change their position. Solid is a state of matter where the composed particles are arranged close to each other. The composed particles can be either atoms, molecules, or ions.



Solid state

## Types of Solids:

Based on the nature of the order that is present in the arrangement of their constituent particles solids can be divided into two types;

- **Amorphous solids** behave the same as super cool liquids due to the arrangement of constituent particles in short-range order. They are isotropic and have a broad melting point (range is about greater than 5°C).
- **Crystalline solids** have a fixed shape and the constituent particles are arranged in a long-range order.

71. Answer: c

### Explanation:

Substance which have higher reduction potential are stronger oxidising agent.

$[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-} + e^-$ ,  $E^0 = -0.35 \text{ V}$ ,  $Fe^{2+} \rightarrow Fe^{3+} + e^-$ ,  $E^0 = -0.77 \text{ V}$  because  $E^0_{\text{oxi}} = -E^0_{\text{red}}$   $\therefore [Fe(CN)_6]^{3-} + e^- \rightarrow [Fe(CN)_6]^{4-}$ ,  $E^0 = 0.35 \text{ V}$   $Fe^{3+} + e^- \rightarrow Fe^{2+}$ ,  $E^0 = 0.77 \text{ V}$  Hence,  $Fe^{3+}$  has maximum tendency to reduced, so it is the strongest oxidising agent.

### Concepts:

#### 1. Redox Reactions:

#### Redox Reaction:

[Redox reactions](#) are chemical reactions where oxidation and reduction take place simultaneously. In this type of reaction, there is a gain of electrons for one chemical species while the other loses electrons or simply involves transfer of electrons. The species that loses electrons is oxidized while the one that gains electrons is reduced.

## Types of Redox Reactions:

Redox reactions can be differentiated into [4 categories](#) namely combination reactions, decomposition reactions, displacement reactions, and disproportionation reactions. Each is explained separately below:

### Combination Reaction:

In this, the molecules combine to form new compounds. For example, when magnesium reacts to nitrogen.

### Decomposition Reaction:

Opposite to the combination reaction, here there is a breakdown of compounds to simpler substances. For example, electrolysis of water.

### Displacement Reaction:

In this, the more reactive metal will displace the less reactive one in a chemical reaction. The reactivity of an element is represented in a series called the reactivity series (arranged in decreasing order of reactivity) which makes it easier to determine the chemical reaction and its products.

### Disproportionation Reaction:

This is a peculiar type of reaction where an element showing a particular oxidation state will be oxidized and reduced simultaneously. Another thing to note is that these reactions will always have an element that can exhibit three oxidation states.

---

72. Answer: a

Explanation:

The correct option is (A):  $\text{RCONHBr}$  and  $\text{RNCO}$ . The process underlying the Hoffmann hypobromite reaction's mechanism. The mechanism involves the conversion of an amide ( $\text{RCONH}_2$ ) into an isocyanate ( $\text{RNCO}$ ) through the reaction with bromine and sodium hydroxide ( $\text{NaOH}$ ). This process results in the formation of  $\text{RCONHBr}$  (an intermediate) and eventually leads to the desired isocyanate product,  $\text{RNCO}$ .

## Concepts:

### 1. Amines:

[Amine](#) is a type of compound which is derived from ammonia ( $\text{NH}_3$ ). According to Organic chemistry, they are basically classified as the functional groups of the organic nitrogen compounds that contain nitrogen atoms with a lone pair.

## Amine – Types

### Primary Amines:

It is formed when one hydrogen atom in ammonia is substituted by an alkyl or aromatic group. Amino acids and methyl amine are the best examples that why aromatic amines include aniline.

### Secondary Amines:

Amines that have two organic substitutes either alkyl or aryl ones or both and are bound to the nitrogen together with one hydrogen are termed as secondary amines. For Example, Dimethylamine.

### Tertiary Amines:

Tertiary Amines are the amines where the nitrogen consists of three organic substitutes. For example, Trimethylamine and EDTA.

---

73. Answer: c

### Explanation:

$\text{H}_2\text{O}$  is dipolar, whereas  $\text{BeF}_2$  is not. It is because:  $\text{H}_2\text{O}$  has polar covalent bonds, while  $\text{BeF}_2$  has purely ionic bonds.

## Concepts:

### 1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

### Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

### Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
- Multiplicity of Bonds
- Number of Lone Pair of Electrons Present
- Bond Angle

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74. Answer: b

Explanation:

radioactive decay formula:

$$N(t) = N_0 \times \left(\frac{1}{2}\right)^{\left(\frac{t}{T}\right)}$$

Given,

$$N_0 = 32 \text{ mg}$$

$$t = 49.2 \text{ years}$$

$$T = 12.3 \text{ year}$$

Put these values into the formula:

$$N(49.2) = 32 \text{ mg} \times \left(\frac{1}{2}\right)^{\left(\frac{49.2}{12.3}\right)}$$

$$N(49.2) = 32 \text{ mg} \times \left(\frac{1}{2}\right)^{(4)}$$

$$N(49.2) = 32 \text{ mg} \times \left(\frac{1}{16}\right)$$

$$N(49.2) = 2 \text{ mg}$$

So, after 49.2 years, there would be 2 mg of tritium remaining.

The correct answer is (B) 2 mg.

## Concepts:

### 1. Translocation of Solutes:

- Translocation of organic solutes deals with the movement of organic food components or soluble solutes from one location to another in higher plants.
- These organic solutes include the soluble products of photosynthesis, amino acids, and other substances.
- It is a process that takes place in the sieve tubes with the help of adjacent companion cells in both upwards and downwards direction.

### Downward translocation:

It is the transportation of the products of photosynthesis from the leaves to the stems and roots for consumption and storage. This process takes place in the sieve tubes with the help of adjacent companion cells.

### Upward translocation:

It happens or occurs primarily during the germination of seeds, tubers, and other plants. When food is stored and converted into a soluble form, it is transported to the young seedling's upper growth section until it develops green leaves.

- Solutes are also moved upward from the stem to the branch's tip, where young leaves, buds, and flowers are found. Although translocation of organic solutes

takes place through the phloem, under certain conditions, it may occur through the xylem.

---

## 75. Answer: c

**Explanation:**

$$\frac{x}{m} = k_p^{\frac{1}{n}}$$

$$\therefore \frac{\log x}{m} = \log k + \frac{1}{n} \log p$$

$\therefore$  plot of  $\log \frac{x}{m}$  vs  $\log p$  will be linear with slope =  $\frac{1}{n}$ .

So, the correct option is (C):  $\frac{1}{n}$

**Concepts:**

### 1. Motion in a straight line:

The **motion in a straight line** is an object changes its position with respect to its surroundings with time, then it is called in motion. It is a change in the position of an object over time. It is nothing but linear motion.

### Types of Linear Motion:

Linear motion is also known as the **Rectilinear Motion** which are of two types:

1. **Uniform linear motion with constant velocity or zero acceleration:** If a body travels in a straight line by covering an equal amount of distance in an equal interval of time then it is said to have uniform motion.
  2. **Non-Uniform linear motion with variable velocity or non-zero acceleration:** Not like the uniform acceleration, the body is said to have a non-uniform motion when the velocity of a body changes by unequal amounts in equal intervals of time. The rate of change of its velocity changes at different points of time during its movement.
- 

## 76. Answer: c

**Explanation:**

- A) Going from  $N_2$  to  $N_2^+$ , bond order decreases from 3 to 2.5.
- B) Going from  $C_2$  to  $C_2^+$ , bond order decreases from 2 to 1.5.
- C) Going from NO to  $NO^+$ , bond order increases from 2.5 to 3, and the magnetic behavior changes from paramagnetic to diamagnetic.
- D) Going from  $O_2$  to  $O_2^+$ , bond order increases from 2 to 2.5, but magnetic behavior does not change. Both of these species are paramagnetic.

**Concepts:****1. Chemical Bonding and Molecular Structure:**

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

**Types of Chemical Bonds:**

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.
- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

**Factors Affecting Bond Enthalpy in Chemical Bonding:**

- Size of the Atom
- Multiplicity of Bonds
- Number of Lone Pair of Electrons Present

- Bond Angle

## 77. Answer: d

### Explanation:

According to Pauli's exclusion principle - no two electrons in an atom can have the same values of all the four quantum numbers. In  $1s^2$  for I electron  $n = 1, l = 0, m = 0, s = \frac{1}{2}$  for II electron  $n = 1, l = 0, m = 0, s = -\frac{1}{2}$ . It means if the values of  $n, l$ , and  $m$  are same, then the value of spin quantum number must be different, i.e.  $+\frac{1}{2}$  and  $-\frac{1}{2}$ .

### Concepts:

#### 1. Structure of Atom:

#### Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of [protons](#), electrons and neutrons.

#### Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.
- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- [Atoms](#) undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

#### Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of [isotopes](#).

- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

## Subatomic Particles

1. Protons – are positively charged subatomic particles.
2. Electron – are negatively charged subatomic particles.
3. Neutrons – are electrically neutral particles and carry no charge

## Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

---

**78. Answer: b**

### Explanation:

Only glucose gives positive Fehling's solution test due to the presence of aldehyde group. All other (sucrose, protein and fats) do not show positive test with Fehling's solution as they do not contain aldehydic group.

## Concepts:

### 1. Biomolecules:

**Biomolecules** are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living molecules are the actual foot-soldiers of the battle of sustenance of life.

**There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.**

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.
4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.

79. Answer: b

### Explanation:

Pyrogallol absorbs the oxygen gas and oil of cinnamon absorbs the ozone (O<sub>3</sub>).

### Concepts:

#### 1. P-Block Elements:

- P block elements are those in which the last electron enters any of the three p-orbitals of their respective shells. Since a p-subshell has three degenerate p-orbitals each of which can accommodate two electrons, therefore in all there are six groups of p-block elements.
- P block elements are shiny and usually a good conductor of electricity and heat as they have a tendency to lose an electron. You will find some amazing properties of elements in a P-block element like gallium. It's a metal that can melt in the palm of your hand. Silicon is also one of the most important metalloids of the p-block group as it is an important component of glass.

#### P block elements consist of:

- [Group 13 Elements](#): Boron family

- [Group 14 Elements](#): Carbon family
  - [Group 15 Elements](#): Nitrogen family
  - [Group 16 Elements](#): Oxygen family
  - [Group 17 Elements](#): Fluorine family
  - [Group 18 Elements](#): Neon family
- 

80. Answer: b

### Explanation:

In  $[CoCl_2(en)_2]$ , Coordination number of  $Co$  is 6 and this compound has octahedral geometry.

??As per given option, type of isomerism is geometrical isomerism.

### Concepts:

#### 1. Coordination Compounds:

A coordination compound holds a central metal atom or ion surrounded by various oppositely charged ions or neutral molecules. These molecules or ions are re-bonded to the metal atom or ion by a coordinate bond.

#### Coordination entity:

A coordination entity composes of a central metal atom or ion bonded to a fixed number of ions or molecules.

#### Ligands:

A molecule, ion, or group which is bonded to the metal atom or ion in a complex or coordination compound by a coordinate bond is commonly called a ligand. It may be either neutral, positively, or negatively charged.

---

81. Answer: c

## Explanation:

The van der Waals' equation is

$$\left(p + \frac{a}{V^2}\right)(V - b) = RT$$

the term  $\left(p + \frac{a}{V^2}\right)$  is used for pressure correction it measures the intermolecular forces between the molecules of gas.

## Concepts:

### 1. States of Matter:

The matter is made up of very tiny particles and these particles are so small that we cannot see them with naked eyes.

### There are three States of Matter:

The [three states of matter](#) are as follows:

#### Solid State:

- The solid-state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.
- The molecules of solids are tightly packed because of ***strong intermolecular forces***; they only oscillate about their mean positions.

#### Liquid State:

- The molecules in a liquid are closely packed due to ***weak intermolecular forces***.
- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.

#### Gaseous State:

- In this [state of matter](#), distances between the molecules are large (intermolecular distance is in the range of  $10^{-7}$ – $10^{-5}$  cm).
- The ***intermolecular forces experienced between them are negligible***.

- Thus, translatory, rotatory and vibratory motions are observed prominently in gases.

---

## 82. Answer: c

### Explanation:

For ideal solution,

$$\Delta V_{\text{mixing}} = 0 \text{ and } \Delta H_{\text{mixing}} = 0$$

### Concepts:

#### 1. Solutions:

A [solution](#) is a homogeneous mixture of two or more components in which the particle size is smaller than 1 nm.

For example, salt and sugar is a good illustration of a solution. A solution can be categorized into several components.

#### Types of Solutions:

The solutions can be classified into three types:

- **Solid Solutions** – In these solutions, the [solvent](#) is in a Solid-state.
- **Liquid Solutions**– In these solutions, the solvent is in a Liquid state.
- **Gaseous Solutions** – In these solutions, the solvent is in a Gaseous state.

On the basis of the amount of solute dissolved in a solvent, solutions are divided into the following types:

1. **Unsaturated Solution**– A solution in which more solute can be dissolved without raising the temperature of the solution is known as an unsaturated solution.
  2. **Saturated Solution**– A solution in which no solute can be dissolved after reaching a certain amount of temperature is known as an unsaturated saturated solution.
  3. **Supersaturated Solution**– A solution that contains more solute than the maximum amount at a certain temperature is known as a supersaturated solution.
-

**83. Answer: d****Explanation:**

Aqueous solution of HCl is the best conductor of electric current because HCl is strong acid, so it dissociates completely into ions.

**Concepts:****1. Equilibrium:**

An **equilibrium** represents a state in a process when the observable properties such as color, temperature, pressure, concentration etc do not show any change.

The word equilibrium means 'balance' which indicates that a **chemical reaction** represents a balance between the reactants and products taking part in the reaction. The equilibrium state is also noticed in certain physical processes such as the **melting point** of ice at  $0^\circ\text{C}$ , both ice and water are present at equilibrium.

In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as **chemical equilibrium**.

## Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

## Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

## Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. **Homogenous equilibrium** can be further divided into two types: Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

## Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of **heterogeneous equilibrium** are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

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**84. Answer: a**

### Explanation:

1 mole  $\text{CCl}_4$  vapours =  $12 + 4 \times 35.5 = 154\text{g}$

At STP, volume of 1 mole of a gas = 22.4 L

Thus,  $154\text{g} = 22.4\text{L}$

$\therefore$  Density of  $\text{CCl}_4$  vapours =  $\frac{154}{22.4}\text{gL}^{-1}$   
=  $6.87\text{gL}^{-1}$

## Concepts:

### 1. Some Basic Concepts of Chemistry:

Chemistry is a vast subject and for understanding its significance we can take help of following points:

- Chemistry plays an important role in understanding various subjects like physics, geology and biology.
- Chemistry is a core branch of science that explains us about the various compositional properties and interaction of **matter**. It also helps to understand various **chemical reactions**.
- Chemistry is important in order to understand the behaviour of **fertilizers**, alkenes, acids, salts, dyes, **polymers**, drugs, soaps and alloys in organic and **inorganic chemistry**.
- Chemistry plays an important role in various fields like healthcare, industrial, research, food, and farm activities.

Read More: [Some Basic Concepts of Chemistry](#)

## Classification of Matter

There are two ways of classifying the matter:

### (A) Physical Classification:

Matter can exist in three physical states:

1. **Solids** – have definite volume and definite shape
2. Liquids – have definite volume but not definite shape.
3. Gases – have neither definite volume nor definite shape.

### (B) Chemical Classification:

Based upon the composition, matter can be divided into two main types:

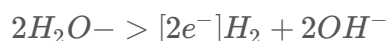
1. **Pure Substances** are defined as a single substance (or matter) which cannot be separated by simple physical methods. Pure substances can be further classified as (i) Elements (ii) Compounds

2. Mixtures are the combination of two or more elements or **compounds** which are not chemically combined together and may also be present in any proportion.

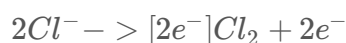
## 85. Answer: b

### Explanation:

At Cathode:



At anode:



$$\frac{W}{E} = \frac{It}{96500}$$

$$0.1 \times 2 = \frac{3 \times t(\text{sec})}{96500}$$

$$t = 6433 \text{ sec}$$

$$t = 107.2 \text{ min}$$

$$\sim 110 \text{ min.}$$

### Concepts:

#### 1. Electrochemical Cells:

An **electrochemical cell** is a device that is used to create electrical energy through the chemical reactions which are involved in it. The electrical energy supplied to electrochemical cells is used to smooth the chemical reactions. In the electrochemical cell, the involved devices have the ability to convert the chemical energy to electrical energy or vice-versa.

#### Classification of Electrochemical Cell:

##### Cathode

- Denoted by a positive sign since electrons are consumed here
- A reduction reaction occurs in the cathode of an electrochemical cell
- Electrons move into the cathode

##### Anode

- Denoted by a negative sign since electrons are liberated here
- An oxidation reaction occurs here
- Electrons move out of the anode

## Types of Electrochemical Cells:

### Galvanic cells (also known as Voltaic cells)

- Chemical energy is transformed into electrical energy.
- The redox reactions are spontaneous in nature.
- The anode is negatively charged and the cathode is positively charged.
- The electrons originate from the species that undergo oxidation.

### Electrolytic cells

- Electrical energy is transformed into chemical energy.
- The redox reactions are non-spontaneous.
- These cells are positively charged anode and negatively charged cathode.
- Electrons originate from an external source.

86. Answer: d

### Explanation:

For first order reaction,



$$\text{rate} = k \times [A]$$

$$\text{Rate} = 2.0 \times 10^{-5} \text{ mol l}^{-1} \text{ s}^{-1}$$

$$[A] = 0.01 \text{ M}$$

$$\text{So, } 2.0 \times 10^{-5} = k \times 0.01$$

$$k = \frac{2.0 \times 10^{-5}}{0.01} \text{ s}^{-1}$$

$$k = 2.0 \times 10^{-3} \text{ s}^{-1}$$

For first order reaction,

$$t_{1/2} = \frac{0.693}{k}$$

$$t_{1/2} = \frac{0.693}{2.0 \times 10^{-3}}$$

$$t_{1/2} = 346.5 \approx 347 \text{ s}$$

### Concepts:

## 1. Chemical Kinetics:

**Chemical kinetics** is the description of the **rate of a chemical reaction**. This is the rate at which the reactants are transformed into products. This may take place by abiotic or by biological systems, such as microbial metabolism.

### Rate of a Chemical Reaction:

The speed of a reaction or the rate of a reaction can be defined as the change in concentration of a reactant or product in unit time. To be more specific, it can be expressed in terms of: (i) the rate of decrease in the concentration of any one of the reactants, or (ii) the rate of increase in concentration of any one of the products. Consider a hypothetical reaction, assuming that the volume of the system remains constant.  $R \rightarrow P$

Read More: [Chemical Kinetics MCQ](#)

### Factors Affecting The Reaction Rate:

- **The concentration of Reactants** – According to **collision theory**, which is discussed later, reactant molecules collide with each other to form products.
- **Nature of the Reactants** – The reaction rate also depends on the types of substances that are reacting.
- **Physical State of Reactants** – The physical state of a reactant whether it is solid, liquid, or gas can greatly affect the rate of change.
- **Surface Area of Reactants** – When two or more reactants are in the same phase of fluid, their particles collide more often than when either or both are in the solid phase or when they are in a heterogeneous mixture. In a heterogeneous medium, the collision between the particles occurs at an interface between phases. Compared to the homogeneous case, the number of collisions between reactants per unit time is significantly reduced, and so is the reaction rate.
- **Temperature** – If the temperature is increased, the number of collisions between reactant molecules per second. Increases, thereby increasing the rate of the reaction.
- **Effect Of Solvent** – The nature of the **solvent** also depends on the reaction rate of the solute particles.

- **Catalyst** – **Catalysts** alter the rate of the reaction by changing the reaction mechanism.

---

## 87. Answer: a

### Explanation:

For ideal solution,  $\Delta H_{\text{solution}} = \Delta H_1 + \Delta H_2 + \Delta H_3$

### Concepts:

#### 1. Thermodynamics:

**Thermodynamics** in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

## Important Terms

### System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System** – An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System** – Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System** – In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

### Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

## Laws of Thermodynamics

### Zeroth Law of Thermodynamics

The [Zeroth law of thermodynamics](#) states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

### First Law of Thermodynamics

The [First law of thermodynamics](#) is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

### Second Law of Thermodynamics

The [Second law of thermodynamics](#) is a physical law of thermodynamics about heat and loss in its conversion.

### Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

**88. Answer: c****Explanation:**

There is no change in bond angles and bond lengths in the conformations of ethane. There is only change in dihedral angle.

**Concepts:****1. Hydrocarbons:**

Hydrocarbons can be described as **organic compounds** that consists only hydrogen and carbon atoms. These compounds are of different types and thereby have distinct natures. Hydrocarbons are colorless gases and are known for discharging faint odours. These have been categorized under four major classes named as alkynes, alkanes, alkenes, and aromatic hydrocarbons.

**Types of Hydrocarbons**

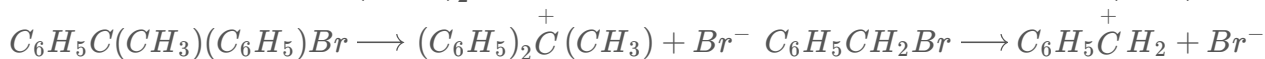
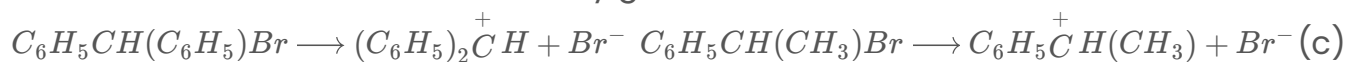
1. **Saturated hydrocarbons** – Saturated hydrocarbons are those compounds where there is a single bond exists between carbon atoms and are saturated with atoms of hydrogen.
2. **Unsaturated hydrocarbons** – Hydrocarbons comprises of at least one double or triple bond between carbon atoms are known as unsaturated hydrocarbons.
3. **Aliphatic hydrocarbons** – The term denotes the hydrocarbons formed as an outcome of the chemical degradation of fats. **Aliphatic hydrocarbons** are basically chemical compounds.
4. **Aromatic hydrocarbons** – They are distinguished because of the presence of benzene rings in them. They give away distinct types of aroma. These hydrocarbons comprises of only hydrogen and carbon atoms.

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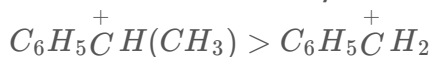
**89. Answer: d****Explanation:**

$S_N1$  reaction involves the formation of carbonation intermediate. More the stability of carbonation, more is the reactivity of alkyl/aryl halides towards  $S_N1$  reaction. The

intermediate carbonations formed by given halides are as:



The order of stability of these carbocations is as  $(C_6H_5)_2\overset{+}{C}(CH_3) > (C_6H_5)_2\overset{+}{C}H >$



Thus,  $C_6H_5C(CH_3)(C_6H_5)Br$  is most reactive towards  $S_N1$  reaction.

## Concepts:

### 1. Haloalkanes and Haloarenes:

The hydrocarbons such as [Haloalkanes and Haloarenes](#) are the ones, in which one or more [hydrogen](#) atoms are replaced with halogen atoms. The main difference between Haloalkanes and Haloarenes is that Haloalkanes are derived from open chained hydrocarbons, also called alkanes, and Haloarenes are derived from aromatic hydrocarbons.

- Haloalkanes have hydrocarbons made up of aliphatic alkanes and one or more hydrogen atoms replaced by [halogens](#) (elements such as Chlorine, Bromine, Fluorine, Iodine, etc.) whereas, haloarenes consist of aromatic ring or rings and one or more hydrogen atoms replaced by halogens.
- In haloalkanes, the halogen atom is attached to the  $sp^3$  hybridized carbon atom of the alkyl group whereas, in haloarenes, the halogen atom is attached to the  $sp^3$  hybridized carbon atom of the alkyl group.
- Haloalkanes are saturated organic compounds where all the chemical bonds are attached to the carbon atom with single bonds and a single carbon atom is attached to the Halogen atom, whereas, the haloarenes differ from Haloalkanes by their method of preparation and properties.
- Haloalkanes are made by aliphatic alkanes by the process of free radical halogenation, whereas, haloarenes are made by direct halogenation of aromatic rings.
- Haloalkanes are odorless compounds, whereas, haloarenes have a sweet odor.
- Haloalkanes precipitate in  $SN^2$  substitution reactions, whereas, haloarenes do not precipitate in  $SN^2$  substitution reactions.
- Example of haloalkanes is  $CH_3Cl$  (Methyl Chloride) and  $CH_3CH_2Br$  (Ethyl Bromide) and the example of haloarenes is Chlorobenzene, Bromobenzene.

**90. Answer: c****Explanation:**

Due to  $+R$  effect of methyl group

is more reactive towards ESR (Nitration).

---

**91. Answer: a****Explanation:**

An atom has electronic configuration

$1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^3, 4s^2$

It is a member of d-block element because the last electron is filled in d-subshell as  $3d^3$  and the following electronic configuration is possible for d-subshell as  $(n-1)d^{1 \text{ to } 10}$

Hence, it is member of fifth group.

**Concepts:****1. D and F Block Elements:**

The d-block elements are placed in groups 3-12 and f-block elements with 4f and 5f orbital filled progressively. The general [electronic configuration](#) of [d block elements](#) and [f-block elements](#) are  $(n-1) d^{1-10} ns^1-2$  and  $(n-2) f^{1-14} (n-1) d_1 ns_2$  respectively. They are commonly known as transition elements because they exhibit multiple oxidation states because of the d-d transition which is possible by the availability of vacant d orbitals in these elements.

They have variable Oxidation States as well as are good catalysts because they provide a large surface area for the absorption of reaction. They show variable oxidation states to form intermediate with reactants easily. They are mostly lanthanoids and show lanthanoid contraction. Since differentiating electrons enter in an anti-penultimate f subshell. Therefore, these elements are also called inner transition elements.

Read More: [The d and f block elements](#)

---

## 92. Answer: a

### Explanation:

Decreasing order of their reactivity toward hydrolysis is:

### Concepts:

#### 1. Aldehydes, Ketones, and Carboxylic Acids:

[Aldehydes, Ketones, and Carboxylic Acids](#) are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

#### Aldehydes:

Aldehydes are organic compounds that have the functional group  $\text{-CHO}$ .

##### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with [hydrogen](#) in the presence of palladium catalyst spread on barium sulfate.

#### Ketones:

Ketones are organic compounds that have the functional group  $\text{C=O}$  and the structure  $\text{R-(C=O)-R'}$ .

##### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

#### Carboxylic Acid:

[Carboxylic acids](#) are organic compounds that contain a  $\text{(C=O)OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

---

### 93. Answer: b

#### Explanation:

The electron gain enthalpy of sodium cation is equal in magnitude and opposite in sign to the first ionization energy of sodium atom. It is equal to  $-5.1\text{eV}$ .

#### Concepts:

##### 1. Haloalkanes and Haloarenes – Classification:

[Classification of Haloalkanes and Haloarenes](#) are as follows:

**Haloalkanes and Haloarenes are Classified on the Basis of the Number of Halogen Atoms:**

These are further classified as mono, di, or polyhalogen (tri-,tetra-, etc.) compounds depending on whether they contain one, two or more halogen atoms in their structures. For example;

- Monohaloalkane
- Dihaloalkane
- Trihaloalkane

**Haloalkanes and Haloarenes are Classified on Compounds Containing  $\text{sp}^3$  C—X Bond (X= F, Cl, Br, I)**

This class includes:

- Alkyl halides or haloalkanes ( $\text{R—X}$ )
- Allylic halides
- Benzylic halides

**Haloalkanes and Haloarenes are Classified on Compounds Containing  $\text{sp}^2$  C—X Bond**

This class includes:

- Vinylic halides
  - Aryl halides
- 

**94. Answer: c**

**Explanation:**

$-NO_2$  group has very strong  $-I$  &  $-R$  effects.

**Concepts:**

**1. Alcohols, Phenols, and Ethers:**

**Alcohol** is formed when a saturated carbon atom bonds to a hydroxyl ( $-OH$ ) group. It is an organic compound that contains a hydroxyl functional group attached to a carbon atom.

**Phenol** is formed when the  $-OH$  group replaces the hydrogen atom in benzene. It is an organic compound in which a hydroxyl group directly attaches to an aromatic hydrocarbon.

**Ether** is formed when oxygen atom bonds to two alkyl or aryl groups. It is an organic compound that has an oxygen atom that is connected to two aryl and alkyl groups.

Read More: [Alcohol, Phenol, and Ethers](#)

---

**95. Answer: b**

**Explanation:**

On passing  $HCl$  through aqueous solution of  $CaCl_2$ ,  $MgCl_2$  and  $NaCl$ , crystals of pure  $NaCl$  separate out. Calcium and magnesium chloride being more soluble than  $NaCl$ , remain in solution.

**Concepts:**

## 1. Group 1 Elements:

Group one of alkali metals is [s-block elements](#) with just one electron in their s-orbital. They are alkali metals. They are named so because of the alkaline nature of the hydroxides and oxides.

Alkali metals are characterized by one s-electron in the valence shell of their atoms.

Alkali metals have a corresponding [Noble gas]  $ns^1$  [electronic configuration](#). They occupy the first column of the periodic table. Alkali elements are:

- Lithium (Li)
- Sodium (Na)
- Potassium (K)
- Rubidium (Rb)
- Cesium (Cs)
- Francium (Fr)

They have occupied successive periods from first to seven. Francium is a radioactive element with very low half-life.

## Electronic Configuration:

- Alkali metals have **one electron in their valence shell**.
- The electronic configuration is given by  $ns^1$ . For example, the electronic configuration of lithium is given by  $1s^2 2s^1$ .
- They tend to lose the outer shell electron to form cations with charge +1 (monovalent ions).

This makes them the **most electropositive elements** and due to the same reason, they are not found in the pure state.

## 96. Answer: c

### Explanation:

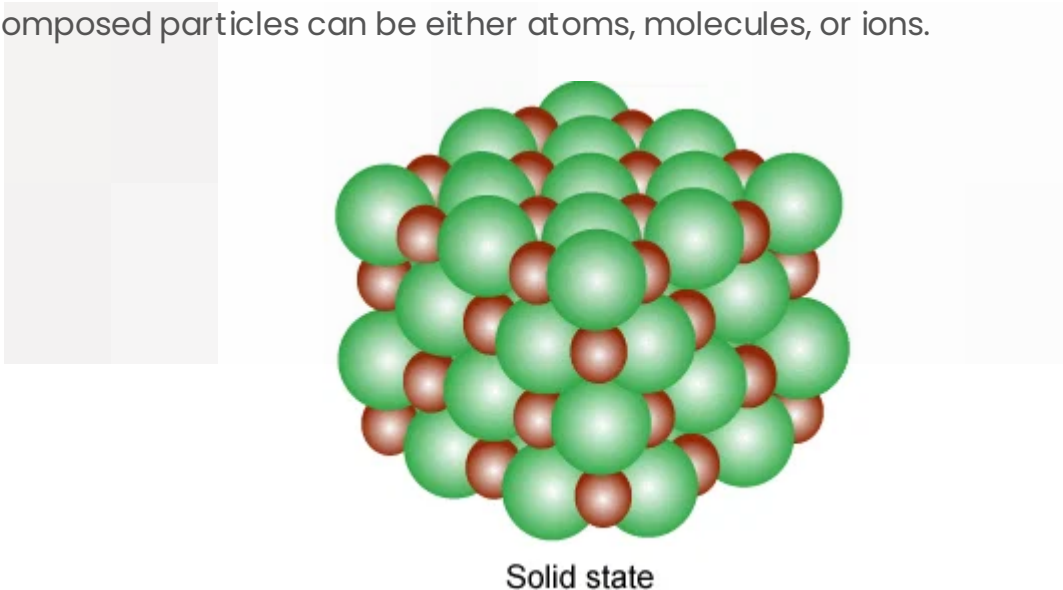
Calcium fluoride crystallizes in a Face-Centered Cubic unit cell (FCC) having an edge length of 5.463 Angstroms. The cell is displayed here with calcium cations (in blue)

defining FCC lattice sites, and fluoride anions (in green) occupying all tetrahedral sites. Fluoride anions have 4 neighbors of opposite charge arranged at vertices of a tetrahedron. Calcium cations have EIGHT neighbors of opposite charge arranged at corners that outline a smaller cube. So the Ca: F coordination ratio is 8 : 4 or 2 : 1. In  $4CaF_2$  the coordination number of  $Ca^{+2}$  is 8

## Concepts:

### 1. Solid State:

[Solids](#) are substances that are featured by a definite shape, volume, and high density. In the solid-state, the composed particles are arranged in several manners. Solid-state, in simple terms, means "no moving parts." Thus [solid-state](#) electronic devices are the ones inclusive of solid components that don't change their position. Solid is a state of matter where the composed particles are arranged close to each other. The composed particles can be either atoms, molecules, or ions.



## Types of Solids:

Based on the nature of the order that is present in the arrangement of their constituent particles solids can be divided into two types;

- **Amorphous solids** behave the same as super cool liquids due to the arrangement of constituent particles in short-range order. They are isotropic and have a broad melting point (range is about greater than  $5^{\circ}\text{C}$ ).
- **Crystalline solids** have a fixed shape and the constituent particles are arranged in a long-range order.

**97. Answer: b****Explanation:**

- i.  $\text{Fe}_3\text{O}_4 \Rightarrow$  Magnetite
- ii.  $\text{ZnCO}_3 \Rightarrow$  Calamine
- iii.  $\text{Fe}_2\text{O}_3 \Rightarrow$  Haematite
- iv.  $[\text{Al}_2(\text{OH})_4\text{Si}_2\text{O}_5] \Rightarrow$  Kaolinite

**Concepts:****1. Redox Reactions:****Redox Reaction:**

[Redox reactions](#) are chemical reactions where oxidation and reduction take place simultaneously. In this type of reaction, there is a gain of electrons for one chemical species while the other loses electrons or simply involves transfer of electrons. The species that loses electrons is oxidized while the one that gains electrons is reduced.

**Types of Redox Reactions:**

Redox reactions can be differentiated into [4 categories](#) namely combination reactions, decomposition reactions, displacement reactions, and disproportionation reactions. Each is explained separately below:

**Combination Reaction:**

In this, the molecules combine to form new compounds. For example, when magnesium reacts to nitrogen.

**Decomposition Reaction:**

Opposite to the combination reaction, here there is a breakdown of compounds to simpler substances. For example, electrolysis of water.

**Displacement Reaction:**

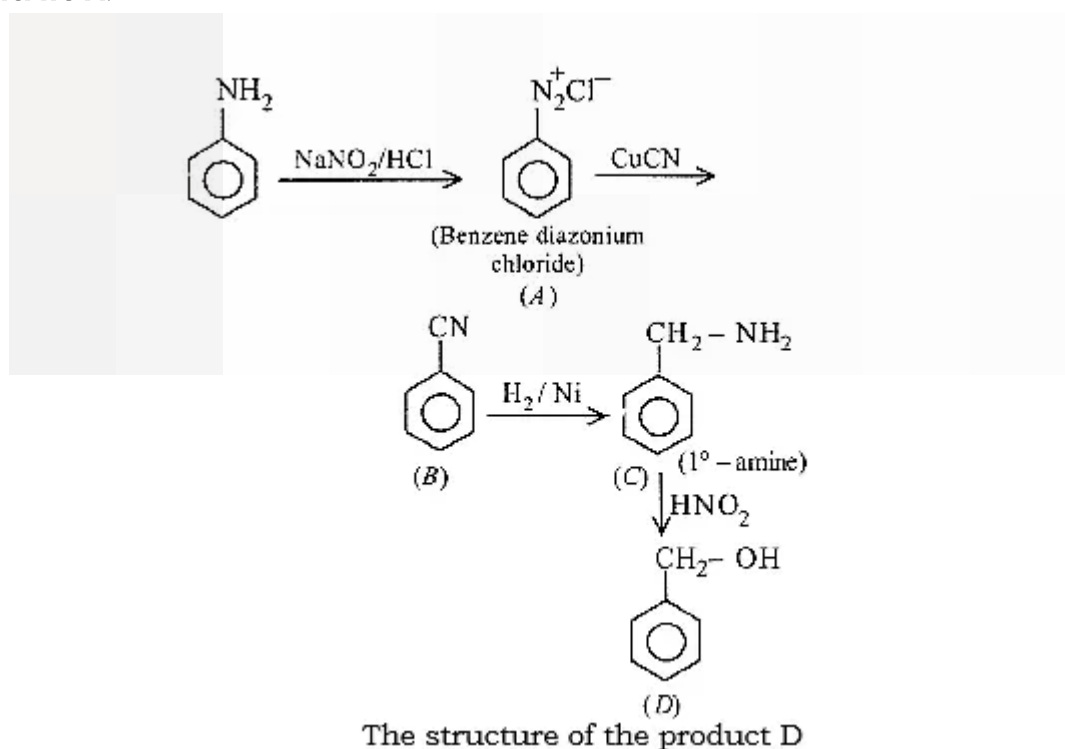
In this, the more reactive metal will displace the less reactive one in a chemical reaction. The reactivity of an element is represented in a series called the reactivity series (arranged in decreasing order of reactivity) which makes it easier to determine the chemical reaction and its products.

## Disproportionation Reaction:

This is a peculiar type of reaction where an element showing a particular oxidation state will be oxidized and reduced simultaneously. Another thing to note is that these reactions will always have an element that can exhibit three oxidation states.

98. Answer: d

Explanation:



Therefore, the correct option is (D):  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$

**Concepts:**

### 1. Amines – Chemical Properties:

There are many chemical properties of amines.

The primary and secondary amines, including several amine derivatives, have a direct impact on their properties due to the presence of hydrogen bonding. The compounds containing phosphorus have a lower boiling point and the compounds containing amines and alcohol have a higher boiling point. The structure of alkanols is immensely similar to that of amine except the presence of the hydroxyl group. In such a case, oxygen has a higher electronegativity than that of nitrogen, so alkanol compounds are more acidic in nature in comparison to the amines.

On account of the ability to form hydrogen bonds, the amines have tendencies of high solubility in water. The amine molecules such as Ethyl, diethyl, triethyl, and Methyl are gaseous in nature. Whereas, higher weight amines have a solid structure and alkyl amines have a liquid structure. There is an ammonia smell to gaseous amines and a fishy smell to liquid amines. The solubility of amines entirely depends upon the number of carbon atoms in the molecule.

---

**99. Answer: a**

**Explanation:**

Answer (a)  $CO, NO^+$

**Concepts:**

### 1. Chemical Bonding and Molecular Structure:

Such a group of atoms is called a **molecule**. Obviously, there must be some force that holds these constituent atoms together in the molecules. The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a **chemical bond**.

### Types of Chemical Bonds:

There are 4 types of chemical bonds which are formed by atoms or molecules to yield compounds.

- **Ionic Bonds** – Ionic bonding is a type of chemical bonding which involves a transfer of electrons from one atom or molecule to another.
- **Covalent Bonds** – Compounds that contain carbon commonly exhibit this type of chemical bonding.

- **Hydrogen Bonds** – It is a type of polar covalent bonding between oxygen and hydrogen wherein the hydrogen develops a partial positive charge
- **Polar Bonds** – In Polar Covalent chemical bonding, electrons are shared unequally since the more electronegative atom pulls the electron pair closer to itself and away from the less electronegative atom.

## Factors Affecting Bond Enthalpy in Chemical Bonding:

- Size of the Atom
  - Multiplicity of Bonds
  - Number of Lone Pair of Electrons Present
  - Bond Angle
- 

100. Answer: c

### Explanation:

The orientation of an atomic orbital is governed by magnetic quantum number.

### Concepts:

#### 1. Structure of Atom:

### Atomic Structure:

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it. Primarily, the atomic structure of matter is made up of [protons](#), electrons and neutrons.

## Dalton's Atomic Theory

Dalton proposed that every matter is composed of atoms that are indivisible and indestructible.

The following are the postulates of his theory:

- Every matter is made up of atoms.
- Atoms are indivisible.

- Specific elements have only one type of atoms in them.
- Each atom has its own constant mass that varies from element to element.
- **Atoms** undergo rearrangement during a chemical reaction.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

## Cons of Dalton's Atomic Theory

- The theory was unable to explain the existence of **isotopes**.
- Nothing about the structure of atom was appropriately explained.
- Later, the scientists discovered particles inside the atom that proved, the atoms are divisible.

## Subatomic Particles

1. Protons - are positively charged subatomic particles.
2. Electron - are negatively charged subatomic particles.
3. Neutrons - are electrically neutral particles and carry no charge

## Atomic Structure of Isotopes

Several atomic structures of an element can exist, which differ in the total number of nucleons. These variants of elements having a different nucleon number (also known as the mass number) are called isotopes of the element. Therefore, the isotopes of an element have the same number of protons but differ in the number of neutrons. For example, there exist three known naturally occurring isotopes of hydrogen, namely, protium, deuterium, and tritium.

---

**101. Answer: d**

### Explanation:

Reptiles, birds, land snails and insects excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water and are called uricotelic animals.

Pavo (Peacock) belongs to class aves (birds). Hence, it excretes nitrogenous wastes in the form of pellets or paste.

Ornithorhynchus (Platypus) is a mammal and is ureotelic (excretes urea).

Salamandra (Salamander) is an amphibian and is ammonotelic (excretes ammonia).  
Hippocampus is a bony fish and is ammonotelic.

## Concepts:

### 1. Excretory products and their elimination:

The physiological process of the elimination of metabolic waste from the body is called **excretion**. The excretory products comprise amino acids, carbon dioxide, urea, uric acid, water, and ammonia. Some of the Molluscs and Echinoderms excrete waste products from the body in the form of amino acids. Ammonia is the foremost excretory product in animals, it is derived from the proteins exists in the food we eat.

### Excretory Products in Different Organisms:

| Organisms   | Excretory Products | Excretory Organs                |
|-------------|--------------------|---------------------------------|
| Paramecium, | Ammonia            | Contractile vacuole             |
| Amoeba      | Ammonia            | Contractile vacuole             |
| Hydra       | Ammonia            | General body surface            |
| Ascaris     | Ammonia            | Renette cells                   |
| Periplaneta | Uric acid          | Malpighian tubule               |
| Palaemon    | Uric acid          | Antennary gland                 |
| Pheretima   | Ammonia            | Nephridial system               |
| Spider      | Uric acid          | Coxal glands, Malpighian tubule |
| Taenia      | Ammonia            | Protonephridia                  |
| Leucon      | Ammonia            | General body surface            |

Read More: [Excretion in Human Beings](#)

102. Answer: b

### Explanation:

Lysosome contains Hydrolytic enzymes. Lysosomes are membrane-bound organelles containing enzymes that break down various macromolecules and cellular waste materials through hydrolysis.

So, the correct option is (B): Hydrolytic enzymes

## Concepts:

### 1. Biomolecules:

**Biomolecules** are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. These non-living molecules are the actual foot-soldiers of the battle of sustenance of life.

**There are four major classes of Biomolecules – Carbohydrates, Proteins, Nucleic acids and Lipids.**

1. **Carbohydrates** are chemically defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.
2. **Proteins** are another class of indispensable biomolecules, which make up around 50 per cent of the cellular dry weight. Proteins are polymers of amino acids arranged in the form of polypeptide chains. The structure of proteins is classified as primary, secondary, tertiary and quaternary in some cases.
3. **Nucleic acids** refer to the genetic material found in the cell that carries all the hereditary information from parents to progeny. There are two types of nucleic acids namely, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The main function of nucleic acid is the transfer of genetic information and synthesis of proteins by processes known as translation and transcription.
4. **Lipids** are organic substances that are insoluble in water, soluble in organic solvents, are related to fatty acids and are utilized by the living cell.

---

### 103. Answer: a

## Explanation:

The lac operon is a group of genes in bacteria that are involved in the metabolism of lactose, a type of sugar.

So, the correct option is (A): Lactose

## Concepts:

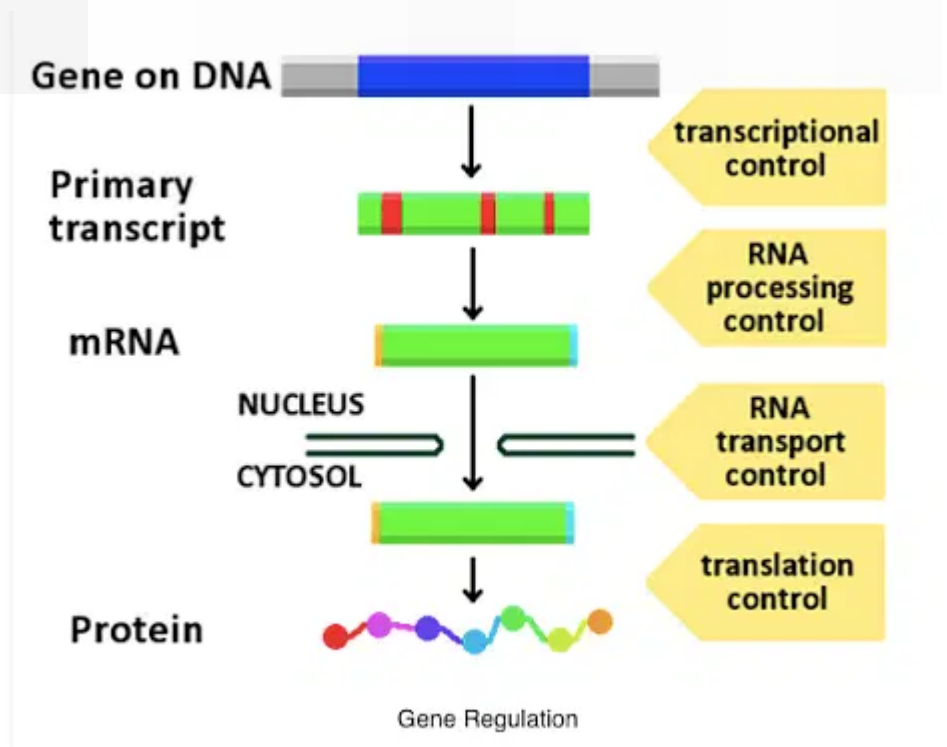
## 1. Regulation of Gene Expression:

The process by which the instructions present in our DNA are converted into a functional product, such as a protein is called **Gene Expression**. It is a tightly coordinated process that allows a cell to respond to its changing environment.

In the meanwhile process, genetic codes from the DNA code are converted into a protein with the help of translation and transcription. The genetic expression shows the process of the genetic makeup of an organism as its physical traits. All over the process, the information flows from genes to proteins.

For a better understanding, let us take the example of the Keratin genes. Keratin is a protein that helps in the formation of our hairs, nails, and skin. Usually, these things grow at a continuous speed as our hairs, nails, and skin get worn down over a period of time. The production of excessive keratin could form many hairs on the skin, dry and hard skin, and thick and long nails. To avoid this, it is necessary to regulate the expression of the keratin gene.

[Regulation of gene](#) expression includes different mechanisms through which our cells manage the amount of produced protein by our genes.



## Explanation:

Flame cells are scattered throughout parenchyma from which they remove metabolic wastes. A flame cell is of irregular shape, with granular cytoplasm and a nucleus. Bundle of cilia, or flame, arises from basal granules near nucleus. Cilia are enclosed into a funnel-shaped lumen formed by the terminal blind end of a capillary. Protonephridia are found in flatworms, malpighian tubules in insects and green glands in crustaceans.

## Concepts:

### 1. Animal Kingdom:

Animals are eukaryotic, multicellular species that belong to the [Kingdom Animalia](#). Every animal has a distinct characteristic. They get energy either by feeding on plants or on other animals. There are millions of species that have been recognized, few shares similar characteristics while others vary drastically.

Kingdom Animalia comprises all animals. In the midst of the five kingdoms, the largest kingdom is the animal kingdom. Animals are multicellular eukaryotes. Though, like plants, they do not possess chlorophyll or a cell wall. Therefore, members of the animal kingdom indicate a heterotrophic mode of nutrition. Kingdom Animalia is further classified into ten different subphyla based on their body designs or differentiations.

**The different phyla of the Kingdom Animalia are as follows:**

1. Porifera
2. Coelenterata (Cnidaria)
3. Platyhelminthes
4. Nematoda
5. Annelida
6. Arthropoda
7. Mollusca
8. Echinodermata
9. Hemichordata
10. Chordata

**Read More:** [Classification of Animal Kingdom](#)

105. Answer: a

**Explanation:**

Artificial selection to obtain cow yielding higher milk output will shift the peak to one direction, hence, will be an example of Directional selection. In stabilizing selection, the organisms with the mean value of the trait are selected. In disruptive selection, both extremes get selected.

**Concepts:**

**1. Evolution:**

**Evolution** is a process that occurs in changes in the genetic content of a population over time. Evolutionary change is generally classified into two: microevolution and macroevolution. The process of changes in allele frequencies in a population over time is a microevolutionary process. Three main mechanisms that cause allele frequency change are natural selection, genetic drift, and gene flow. On the other hand, macroevolution refers to change at or above the level of the species.

---

106. Answer: a

**Explanation:**

Common cold is caused by some 100 types of Rhino viruses. It is one of the most common infectious disease in human. Antibiotics are substances that destroy or inhibit the growth of microorganisms, particularly disease-producing bacteria and fungi. Antibiotics are obtained from microorganisms (especially moulds) or synthesized. Many antibiotics interfere with the pathogen protein synthesis. Some (e.g. Penicillin) prevent cross-linking of the glycan chains of peptidoglycan molecules in bacterial cell walls. Since the viruses do not possess cell wall and their own protein synthesising apparatus, they are not attacked by antibiotics.

**Concepts:**

**1. Human Health and Disease:**

**Health** is described as a state of complete physical, mental and social well-being.

The **disease** is a circumstance where malfunctioning of the body organs occurs leading to uneasiness and discomfort.

## Differences between Infectious Diseases and Non-Infectious Diseases:

| Infectious diseases                                                                                                                                 | Non-infectious diseases                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>•These diseases are easily transmitted from one person to another.</li><li>•Examples: AIDS, Typhoid</li></ul> | <ul style="list-style-type: none"><li>•These diseases remain restricted to the person and are not easily transmitted from one person to another.</li><li>•Examples: Diabetes, Cancer</li></ul> |

## Common Diseases in Humans:

| Diseases      | Pathogen                                                            | Signs and Symptoms                                                                                           |
|---------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Typhoid       | <i>Salmonella typhi</i>                                             | High fever, low pulse rate, abdominal pain, frequent stools                                                  |
| Pneumonia     | <i>Streptococcus pneumoniae</i> ,<br><i>Haemophilus influenzae</i>  | Lymph and mucus collect in the alveoli and bronchioles                                                       |
| Common cold   | Viruses like <i>Rhino viruses</i>                                   | Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness                          |
| Malaria       | <i>Plasmodium</i>                                                   | Fever, restlessness, less appetite, slight sleeplessness, muscular pains, headache and feeling of chilliness |
| Amoebiasis    | <i>Entamoeba histolytica</i>                                        | Blood along with faeces and abdominal pain                                                                   |
| Ascariasis    | <i>Ascaris</i>                                                      | Obstruction of intestinal passage, abdominal discomfort                                                      |
| Elephantiasis | <i>Wuchereria bancrofti</i>                                         | Inflammation of lymphatic vessels of the lower limbs                                                         |
| Ringworms     | <i>Microsporum</i> , <i>Trichophyton</i> ,<br><i>Epidermophyton</i> | Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp                  |

Read More: [Human Health and Disease](#)

107. Answer: c

**Explanation:**

Deep black soil is productive due to high proportion of clay and humus. The organic matter present in the soil is contributed by the death and decay of living organisms. These are the richest in nutrients and therefore these soils are the most fertile.

108. Answer: b

**Explanation:**

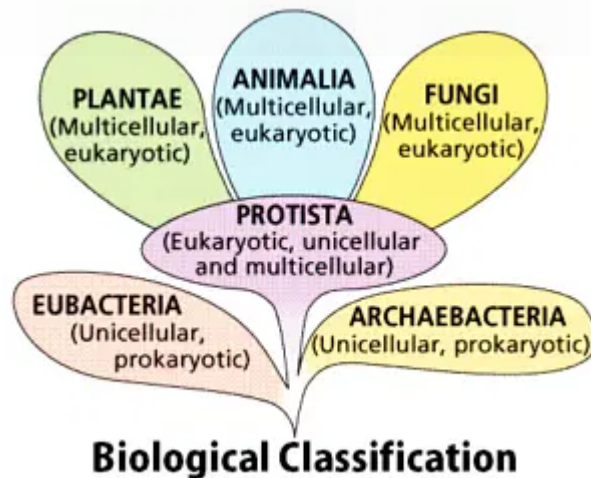
DNA replication in bacteria occurs prior to fission. Prokaryotes do not show well marked S-phase due to their primitive nature.

## Concepts:

### 1. Biological Classification:

The process of grouping living organisms into categories is called [biological classification](#). The most modern 5-kingdom classification was put ahead by an eminent scientist R.H. Whittaker. The [five-kingdom classification](#) is based on the criteria like [cell structure](#), mode of nutrition, body form, and [reproduction](#). One of the most important characteristics of this system is that it follows the evolutionary sequence of living organisms. The organisms are classified into distinct taxa or levels like Kingdom, Phylum, Division, Class, Order, Family, [Genus](#), and [Species](#). The 5 kingdoms are as follows:

- [Kingdom Monera](#)
- [Kingdom Protista](#)
- [Kingdom Fungi](#)
- [Kingdom Plantae](#)
- [Kingdom Animalia](#)



109. Answer: d

Explanation:

The correct answer is D:implantation of embryo at site other than uterus. It is the implantation of the embryo at the site other than the uterus, usually the fallopian tubes. This is a medical condition that should be taken care of as the ectopic pregnancies are not viable. This can lead to complications, the cause is not known. The symptoms that are observed in this condition is unusual vaginal bleeding, pain in the pelvic and lower abdominal level and also some gastrointestinal symptoms like vomiting and nausea.

## Concepts:

### 1. Human Reproduction:

[Reproduction in human](#) beings involves the fusion of male and female gametes that produces in their [reproductive system](#).

#### Male Reproductive System:

The male reproductive system comprises:

- **Testicles (testes):** A pair of oval-shaped organs masked in a pouch known as the scrotum. They manage the production of sperms and the male hormone testosterone.
- **Scrotum:** It is a sac-like organ that hangs under the penis and behind it. It is the house of the testes, or testicles, and maintains a temperature that is needed for the production of sperm by it.
- **Vas deferens:** The sperms produced in testes are stored in a tube known as the epididymis. Here the sperms get matured and pass to the urethra via the muscular tube known as vas deferens.
- **Accessory glands:** This includes three glands, namely the prostate gland, seminal vesicles, and Cowper's gland. The secretions from the mentioned three glands mix to form a fluid known as semen. Semen nourishes the sperm, raises the volume, and helps in lubrication.
- **Penis:** The penis is a cylindrical tube that serves as both an excretory organ, and a reproductive organ. It transfers sperms into the vagina during sexual intercourse.

#### Female Reproductive System:

The **female reproductive system** is active before, during, and after fertilization as well. It comprises the following parts:

- **A pair of ovaries:** A pair of ovaries produce and stores ovum in them. They also produce a female hormone known to be estrogen.
- **Fallopian tubes (Oviducts):** They are the area of fertilization. They connect both the ovaries with the uterus.
- **Uterus:** Uterus is the place of development for the embryo.
- **Vagina:** The part that connects the cervix to the external female body parts is called a vagina. It is the passage for the penis during coitus as well as a fetus during transfer.

## 110. Answer: c

### Explanation:

Globulins in human blood plasma are primarily involved in defence mechanisms of body. Globulins like ; immunoglobulins act as antibodies that destroy bacteria, ; viruses and toxic substances that may enter into the blood from outside.

### Concepts:

#### 1. Body Fluids and Circulation:

Liquid substances in the animal or human body are known as **body fluids**. The human body consists of about 60–67% body fluids. The chief components of the human body fluids are blood and lymph. **Blood** comprises a matrix called plasma with blood corpuscles floating in it. The blood cells are white blood cells, red blood cells, and platelets. **Lymph** consists of lymph cells.

Read More: [Body Fluids and Circulation](#)

### Types of Body Fluids:

The different types of body fluids:

#### Blood

The main components of blood involve;

1. Plasma
2. Red Blood Cells
3. White Blood Cells
4. Platelets

## Lymph

A colorless fluid present in the interstitial tissues is **lymph**. It circulates all over the lymphatic system. It can be described as blood without the RBCs. The exchange of hormones, nutrients, and gases occurs via this fluid. It contains lymphocytes that play a major function in the immune responses of the body.

The movement of blood across the vessels of the body that carries nutrients and gases along with it and removes waste from the different parts of the body is **circulation**.

## Types of Circulatory Systems:

There are two types of circulatory systems:

- Open Circulatory system
- Closed circulatory system

---

111. Answer: d

### Explanation:

The intestinal mucosal epithelium has goblet cells which secrete mucus. The mucus lubricates the food for an easy passage. Thus, if for some reason goblet cells become non-functional, it will adversely affect smooth movement of food down the intestine. It along with bicarbonates from the pancreas also protects the intestinal mucosa from acid as well as provide an alkaline medium for enzymatic activities.

### Concepts:

#### 1. Digestion and Absorption – Alimentary Canal:

Digestion can be defined as the process of breakdown of large, insoluble and complex food molecules into smaller ones for its absorption and circulation in the

body. This process involves the usage of a variety of digestive fluids and [enzymes](#), including saliva, mucus, bile and hydrochloric acid, among others.

**Read More:** [Digestion and Absorption](#)

The alimentary canal is mainly referred to as **the pathway by which food enters our body and moves out through the anus after digestion**. It is a tube-like structure that starts from the mouth and ends in the anus. The alimentary canal plays a primary role in human digestion and is also termed as the digestive tract.

**Peristalsis** is a series of wave-like muscle contractions that move food through the digestive tract.

---

## 112. Answer: b

### Explanation:

Biogas or gobar gas is a [methane](#)-rich fuel gas produced by anaerobic breakdown or digestion of [biomass](#) with the help of methanogenic bacteria. It is made up of methane (50 – 70%), [carbon dioxide](#) (30 – 40%) with traces of nitrogen, hydrogen sulphide, and [hydrogen](#).

Therefore, the correct option is C) methane.

### Concepts:

#### 1. Microbes in Human Welfare:

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

#### In Household Products

1. Fermentation of milk to produce yogurt.
2. Milk curdling to compose curd, cheese, and paneer.

#### In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.

2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

## Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

## Antibiotics

1. The term antibiotic means "against life". These materials can kill or destroy the growth of other microbes.

---

113. Answer: b

### Explanation:

Vasa deferens transports sperms from epididymis to ejaculatory duct. Vasectomy refers to the surgical method in which vasa deferentia in human males are cut and sealed. After this, the seminal fluid devoid of sperms. Sperms are present in epididymis but not in the ejaculate. It is an irreversible method of surgical contraception.

### Concepts:

#### 1. Reproductive Health:

- The biological process by which a new individual or an offspring is produced from a parent or parents that are biologically similar or identical is known as [reproduction](#). It is the elemental trait of all known forms of life. In fact, each and every individual have life because of reproduction.
- The state or position of male and female reproductive systems during their lifetime refers to their reproductive health. The system comprises organs and glands, including the pituitary gland in our brain, which are responsible for the production and release of hormones.

- In other words, reproductive health can be described as a state of physical, mental, and social well-being in all aspects relating to the reproductive system. It includes the liberation and appropriate capacity to reproduce as and when one decides to do so, apart from having a safe and satisfying sex life.

Read More: [Reproductive Health](#)

---

114. Answer: a

### Explanation:

- Woman is a carrier
- Both son & daughter inherit  $X$  -chromosome
- Although only son be the diseased

### Concepts:

#### 1. Principles of Inheritance and Variation - Mutation:

A **Mutation** is a change in the sequence of our DNA base pairs caused by numerous environmental stimuli such as UV light or mistakes during DNA replication. Germline mutations take place in the eggs and sperm and can be passed onto offspring, whereas somatic mutations take place in body cells and are not passed on.

## Types of Mutations

There are three [types of mutations](#), which are as follows:

### Silent mutation

It refers to any change in DNA sequence that has no effect on the amino acid sequence in a protein or the functions that a protein performs. There is no phenotypic indication that a mutation has occurred.

### Nonsense mutation

When there is a change in the sequence of base pairs due to a point mutation, that results in a stop codon. This leads to a protein that is either shortened or non-functional.

## Missense mutation

A missense mutation occurs when a point mutation causes a change in the codon, which then codes for another amino acid.

## The mutation is caused by the following factors:

### Internal Causes

When DNA copies incorrectly, the majority of mutations occur. Evolution occurs as a result of all of these mutations. DNA makes a copy of itself during cell division. When a copy of DNA isn't flawless, it's called a mutation since it differs somewhat from the original DNA.

### External Causes

When certain chemicals or radiations are used to break down DNA, it causes the DNA to break down. The thymine dimers are broken by UV radiation, resulting in altered DNA.

---

115. Answer: c

### Explanation:

During anaphase I, from each tetrad two chromatids of a chromosome move as a unit (dyad) to one pole of a spindle, and the remaining two chromatids of its homologue migrate to the opposite pole. Thus, the homologous chromosomes of each pair, rather than the chromatids of a chromosome, are separated. As a result, half of the chromosomes, which appear in early prophase, go to each pole. Thus the paternal and maternal chromosomes of each homologous pair segregate during anaphase I independently of the other chromosomes.

### Concepts:

#### 1. Cell Cycle and Cell Division:

### Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

## Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase – "Gap 1 Phase"
2. S Phase – "Synthesis Phase"
3. G2 Phase – "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

## Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

## Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
2. Meiosis

---

116. **Answer: a**

### Explanation:

Cartilaginous joint is present between ribs and sternum. It allows only limited movement. An angular joint allows movement in two directions – side to side and

back and forth. Wrist and metacarpophalangeal joints are of this type. Gliding joint permits sliding movements of two bones over each other, e.g. joints between sternum and clavicles. Fibrous joints do not allow movement and are present between the bones of cranium.

## Concepts:

### 1. Locomotion and Movement:

#### Locomotion

The movement of a creature from one place to another is known as locomotion. During the process, there is the action of appendages such as wings, limbs, and flagella. In some animals, like fish, whales, and sharks, locomotion upshots from a wave-like series of muscle contractions. Locomotion helps an **organism** in finding their food, avoid harsh weather conditions, escape from their predators, etc.

Some examples of locomotion are walking, running, swimming, etc. Movement, on the other hand, refers to any type of motion that need not be localized.

Read More: [Locomotion and Movement](#)

#### Movement

Movement is generally described as a state of changing the position from rest to motion or vice-versa. Movement can be both voluntary movement and involuntary movement. Movement helps an organism perform essential functions, such as pumping **blood** to the different parts of the body, etc.

Read More: [Difference between Locomotion and Movement](#)

---

### 117. Answer: b

#### Explanation:

Cornea consists of dense matrix of collagen, it is the transparent continuation of the sclera, that covers the iris and lens. It protects the eye ball from damage and prevents entry of micro-organisms into the eye

## Concepts:

### 1. Neural Control and Coordination:

#### Neural System:

Neurons are the most specialised cells in the nervous system of all animals, and they are responsible for detecting, accepting, and conveying numerous types of motives. The neurological system of low-spinal animals like Hydra is incredibly simple, consisting of a network of neurons. When the brain of an insect comprises a vast number of ganglia and neural tissues, it is optimally structured.

#### Coordination System:

Coordination is the process by which two or more organs work together to accomplish each other's duties. Increased muscle activity increases the supply of oxygen and the demand for energy while we exercise. When we cease exercising, our nerves, heart, lungs, and kidneys all return to normal. As a result, all of the organs' functions are properly integrated in order to conduct the exercise and supply the appropriate conditions while exercising. Similarly, in the human body, the neurological and endocrine systems work together to coordinate all of the organ activities.

---

### 118. Answer: a

#### Explanation:

Insulin decreases the level of glucose in the blood while cortisol (secreted by middle region of adrenal cortex) increases the blood-glucose level by converting proteins and fats into carbohydrates which are, in turn, converted to glucose.

## Concepts:

### 1. Chemical Coordination and Integration:

The [chemical coordination and integration](#) of all physiological functions in the animal body are jointly synchronized by the neural and endocrine systems. The [control and coordination](#) of body functions are executed by the [endocrine glands](#). They are

ductless glands that secrete several hormones to control and coordinate body functions.

## Human Endocrine System:

The human body has several endocrine glands located in different parts. They cover the pituitary gland, thymus, thyroid gland, pineal gland, parathyroid, pancreas (dual gland), adrenal gland, and gonads (testes and ovaries). The liver, kidney, heart, and gastrointestinal tract also produce hormones in small traces to harmonize the functioning of these organs.

The [Hypothalamus](#) comprises groups of secretory cells called nuclei which secrete various hormones. These hormones released by the hypothalamus are important in regulating the synthesis and secretion of pituitary hormones.

### Functions of Endocrine Glands:

- Pituitary Gland
- Pineal Gland
- Thyroid Gland
- Parathyroid Gland
- Thymus
- Adrenal Gland
- Pancreas
- Testes
- Ovary
- Hormones of Kidney, Heart, and Gastrointestinal Tract

---

119. **Answer: c**

### Explanation:

The antiparallel strands of a DNA molecule means that the **phosphate groups at the start of two DNA strands are in opposite position (pole)**.

Watson and Crick (1953) showed that **structure of DNA** is a double helical containing two polynucleotide chains connected by hydrogen bonds and running antiparallel. **Antiparallel means that the two strands of a DNA molecule run in opposite directions,**

parallel to one another. One strand is in the direction of 5' to 3' and another is in 3' to 5'. The main purpose behind the antiparallel direction of the two strands is to provide stability to the DNA.

## Concepts:

### 1. The Molecular Basis of Inheritance:

#### DNA Replication:

DNA synthesis is commenced at particular points within the DNA strand referred to as 'origins', which are certain coding regions. There are numerous origin sites, and when replication of DNA starts, these sites are mentioned as replication forks. Within the replication, the complex is the enzyme DNA Helicase, so that they can be utilized as a template for replication. DNA Primase is another enzyme that's essential in DNA replication.

#### RNA:

Ribonucleic acid (RNA) is an essential biological macromolecule that exists all together in biological cells. It is principally involved in the synthesis of proteins, that carry the messenger instructions from DNA, which itself contains the genetic instructions needed for the event and maintenance of life. In some viruses, RNA, in spite of DNA, carries genetic information.

#### Genetic Code:

Genetic code is the term we use in the manner that the four bases of DNA--the A, C, G, and Ts--are strung together in a way that the ribosome, the cellular machinery, can read them and switch them into a protein. In the ordering, every three nucleotides during a row count as a triplet and code for one amino alkanoic acid.

Read More: [Molecular Basis of Inheritance](#)

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120. Answer: d

Explanation:

Molecular assemblies are large organised sets of molecular units that make up parts of organelles. For example one common macromolecular assembly is the microtubule which is important in forming structure in the cell related to maintaining the cell structure or related to cell movement. The cell (plasma) membrane that surrounds many organelles and the cell is a highly organised molecular assembly.

## Concepts:

### 1. Cell: The Unit of Life:

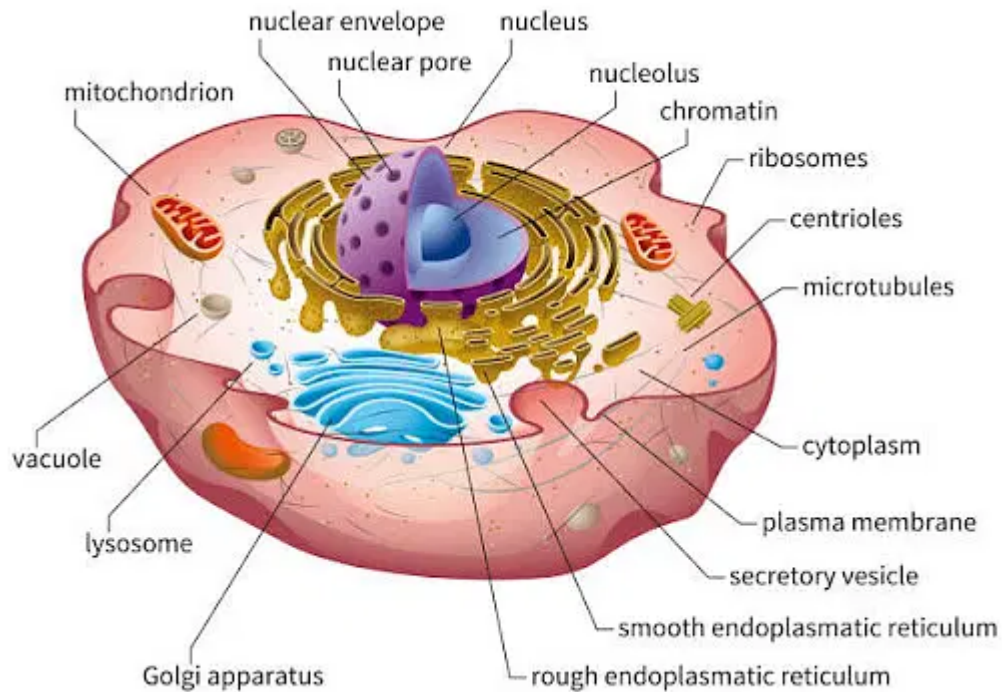
- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal environments of the cell. The interior environment of a cell is called the cytoplasm.
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

Read More: [Fundamental Unit of Life: Cell](#)

### Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane
- Cell Wall
- Nucleus
- Cytoplasm



121. Answer: c

### Explanation:

Involuntary smooth muscles are those muscles that are not under the control of our will and are without any striations (stripes). Iris has involuntary smooth muscle. Biceps of upper arm have striated muscle fibres and abdominal wall has involuntary smooth muscles. Heart wall has involuntary striated muscle.

122. Answer: a

### Explanation:

Gene therapy was given in 1990 to a four year old girl child with ADA deficiency.

### Concepts:

#### 1. Applications of Biotechnology:

Biotechnology is the technology that utilizes biological systems, living organisms, or parts of this to develop or create different products.

For example, brewing and baking bread fall within the concept of biotechnology (use of yeast (= living organism) to produce the desired product).

## **Agriculture**

Alternative to conventional farming: A possible solution is the use of genetically modified crops which is an alternative path to conventional farming.

## **Medicine**

In the area of healthcare, recombinant DNA technological processes have made an immense impact which enables the mass production of safe and more effective therapeutic drugs.

## **Gene Therapy**

A collection of methods that allows the correction of a gene defect that has been diagnosed in a child/embryo is called Gene Therapy.

## **CRISPR technology**

For editing genomes, CRISPR is a simple yet powerful tool which allows researchers to easily alter DNA sequences and modify gene function.

---

### **123. Answer: c**

#### **Explanation:**

Plasmid is double strand circular DNA

#### **Concepts:**

##### **1. Biotechnology:**

[Biotechnology](#) is a vast field of biology that involves the creation, production, and modification of useful products for human welfare using both the technology and the execution of living organisms and their components. An agricultural engineer, Karoly Ereky, coined the word "biotechnology" in 1919, achieving him the title of "Father of Biotechnology."

## Principles of Biotechnology:

Among many, the two core techniques that entitled the birth of modern biotechnology are :

1. **Genetic Engineering** is one of the methods of direct modifications of an organism's genome (i.e., DNA and RNA). It requires the introduction of new genes into host species to escalate function or trait, hence altering the host organism's phenotype.
2. **Bioprocess Engineering** is one of the methods of maintaining sterile conditions to facilitate the growth of large quantities of desired microbes and other eukaryotic cells for the development of new or modified biotechnological products such as enzymes, vaccines, antibiotics, and other biotechnological products.

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124. Answer: a

### Explanation:

Answer (a) Sigmoid

### Concepts:

#### 1. Breathing and Exchange of Gases:

A metabolic process, which is carried out by all living organisms including plants, animals, and humans for the production of energy and to stay alive is Respiration. Except for required anaerobes, every other organism from amoeba to humans needs oxygen for survival. And evolution has reported a number of systems that allows the exchange of gases in organisms.

#### There are two types of respiration such as;

1. **Aerobic respiration** — to produce energy, it occurs in the presence of oxygen
2. **Anaerobic respiration** — to produce energy, occurs in the absence of oxygen

Breathing can be simply derived as the process of inhaling oxygen gas from the atmosphere and exhaling the carbon dioxide gas back into the atmosphere is termed breathing and the process is commonly known as respiration.

Read More: [Breathing and Exchange of Gases](#)

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**125. Answer: b**

### Explanation:

Henle loop of cortical nephron is small in comparison to loop of juxta medullary nephrons, which is longer.

The correct option is (B): A is true but R is false.

---

**126. Answer: d**

### Explanation:

Telomerase is an enzyme that is a Ribonucleoprotein.

Telomerase is composed of both protein and RNA components, making it a ribonucleoprotein complex. It plays a crucial role in maintaining the length and integrity of telomeres at the ends of eukaryotic chromosomes.

So, the correct option is (D): Ribonucleoprotein

### Concepts:

#### 1. Enzymes – Biology:

Enzymes are proteins that help accelerate metabolism or the chemical reactions in our bodies. They build some substances and decompose others. All living creatures have enzymes.

Our bodies naturally build enzymes. But enzymes are also in mass produce products and food.

One of the most important roles of enzymes is to succor digestion. The process of turning the food that we eat into energy is called digestion. For instance, there are enzymes in our saliva, pancreas, stomach, and intestines. They decompose fats, proteins, and carbohydrates. Enzymes make use of these nutrients for growth and cell repair.

127. Answer: a

## Explanation:

Promoters are regulatory regions of DNA located upstream (toward the 5' end) of the gene they control, and they play a crucial role in gene expression by facilitating the binding of RNA polymerase and other transcription factors.

So, the correct option is (A): Promoter

## Concepts:

### 1. Transcription:

The very first stage of gene expression is the procedure of [transcription](#). In this procedure, mRNA is the place where the genetic information is stored which later aids in encoding a protein. In this process, the DNA strand acts as a guide in the making of mRNA. Despite the fact that there is one exception which is adenine base pairs with uracil instead of thymine.

### Transcription Unit:

The transcription unit is a set of freshly combined RNA molecules that have been transcribed from DNA. The cause is to encode at least one gene. A protein that has been encoded or encrypted with a DNA transcription unit may have a coding sequence. Transcription has a lower copying fidelity rate when differentiated from DNA replication.

### The Stages of Transcription:

The procedure of transcription is enzymatically catalyzed into three steps:

1. Initiation
2. Elongation
3. Termination

---

128. Answer: a

## Explanation:

Cysticercus is the larval stage of tapeworm which is characterised by a large vesicle and one scolex. Cysticercus develops in adult tapeworm only when ingested by the human host. In pig's body it leads quite an inactive life and remains viable for several years, after which it dies and becomes calcified. Pork (pig's flesh) containing viable cysticerci is called measly pork for its spotted appearance.

## Concepts:

### 1. Animal Kingdom:

Animals are eukaryotic, multicellular species that belong to the [Kingdom Animalia](#). Every animal has a distinct characteristic. They get energy either by feeding on plants or on other animals. There are millions of species that have been recognized, few shares similar characteristics while others vary drastically.

Kingdom Animalia comprises all animals. In the midst of the five kingdoms, the largest kingdom is the animal kingdom. Animals are multicellular eukaryotes. Though, like plants, they do not possess chlorophyll or a cell wall. Therefore, members of the animal kingdom indicate a heterotrophic mode of nutrition. Kingdom Animalia is further classified into ten different subphyla based on their body designs or differentiations.

**The different phyla of the Kingdom Animalia are as follows:**

1. Porifera
2. Coelenterata (Cnidaria)
3. Platyhelminthes
4. Nematoda
5. Annelida
6. Arthropoda
7. Mollusca
8. Echinodermata
9. Hemichordata
10. Chordata

**Read More:** [Classification of Animal Kingdom](#)

---

129. Answer: d

**Explanation:**

A close relationship of apes with man is revealed by their relatively larger brain and cranial capacity, efficient memory. Cranial capacity of apes is under 650 cc. Cranial capacity of man is 1350 to 1600 cc.

**Concepts:**

**1. Evolution:**

**Evolution** is a process that occurs in changes in the genetic content of a population over time. Evolutionary change is generally classified into two: microevolution and macroevolution. The process of changes in allele frequencies in a population over time is a microevolutionary process. Three main mechanisms that cause allele frequency change are natural selection, genetic drift, and gene flow. On the other hand, macroevolution refers to change at or above the level of the species.

---

130. Answer: b

**Explanation:**

Diphtheria is caused by *Corynebacterium diphtheriae* (bacteria) usually affecting children up to five years of age. It may start as sore throat, chills with mild fever, sometimes vomiting and headache. Throat ; and or tonsils show a grey membrane which may spread down and cause hoarseness and difficulty in breathing. Nose may be affected giving rise to a blood-tinged ; nasal discharge from one nostril. If the disease is not treated early and properly the toxin produced by the germs affects the heart and the nervous system, and proves fatal. The germs are present in the discharges from the nose and throat of patients and also of healthy people who act as the 'carriers'. The patients and the carriers spread the disease through acts like kissing, talking, coughing and sneezing. Incubation period is of 2 - 5 days. The patient should be kept in a well- ventilated room if there is no isolation hospital in the town. The most important preventive measure-against this disease is that all babies should be immunised within the first six weeks of birth using DPT vaccine.

## Concepts:

### 1. Human Health and Disease:

**Health** is described as a state of complete physical, mental and social well-being.

The **disease** is a circumstance where malfunctioning of the body organs occurs leading to uneasiness and discomfort.

### Differences between Infectious Diseases and Non-Infectious Diseases:

| Infectious diseases                                                                                                                                    | Non-infectious diseases                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>•These diseases are easily transmitted from one person to another.</li> <li>•Examples: AIDS, Typhoid</li> </ul> | <ul style="list-style-type: none"> <li>•These diseases remain restricted to the person and are not easily transmitted from one person to another.</li> <li>•Examples: Diabetes, Cancer</li> </ul> |

### Common Diseases in Humans:

| Diseases      | Pathogen                                                            | Signs and Symptoms                                                                                           |
|---------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Typhoid       | <i>Salmonella typhi</i>                                             | High fever, low pulse rate, abdominal pain, frequent stools                                                  |
| Pneumonia     | <i>Streptococcus pneumoniae</i> ,<br><i>Haemophilus influenzae</i>  | Lymph and mucus collect in the alveoli and bronchioles                                                       |
| Common cold   | <i>Viruses like Rhino viruses</i>                                   | Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness                          |
| Malaria       | <i>Plasmodium</i>                                                   | Fever, restlessness, less appetite, slight sleeplessness, muscular pains, headache and feeling of chilliness |
| Amoebiasis    | <i>Entamoeba histolytica</i>                                        | Blood along with faeces and abdominal pain                                                                   |
| Ascariasis    | <i>Ascaris</i>                                                      | Obstruction of intestinal passage, abdominal discomfort                                                      |
| Elephantiasis | <i>Wuchereria bancrofti</i>                                         | Inflammation of lymphatic vessels of the lower limbs                                                         |
| Ringworms     | <i>Microsporum</i> , <i>Trichophyton</i> ,<br><i>Epidermophyton</i> | Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp                  |

Read More: [Human Health and Disease](#)

131. Answer: b

**Explanation:**

Therophytes are those plants that survive the winter as a seed and complete their life cycle between the spring and autumn.

132. Answer: a

**Explanation:**

In humans, ovum is released from the ovary in the secondary oocyte stage. The wall of the ovary gets ruptured to release the oocyte. In humans ovulation occurs about 14 days before the onset of the next menstruation. Ovulation is induced by LH.

## Concepts:

### 1. Human Reproduction:

[Reproduction in human](#) beings involves the fusion of male and female gametes that produces in their [reproductive system](#).

#### Male Reproductive System:

The male reproductive system comprises:

- **Testicles (testes):** A pair of oval-shaped organs masked in a pouch known as the scrotum. They manage the production of sperms and the male hormone testosterone.
- **Scrotum:** It is a sac-like organ that hangs under the penis and behind it. It is the house of the testes, or testicles, and maintains a temperature that is needed for the production of sperm by it.
- **Vas deferens:** The sperms produced in testes are stored in a tube known as the epididymis. Here the sperms get matured and pass to the urethra via the muscular tube known as vas deferens.
- **Accessory glands:** This includes three glands, namely the prostate gland, seminal vesicles, and Cowper's gland. The secretions from the mentioned three glands mix to form a fluid known as semen. Semen nourishes the sperm, raises the volume, and helps in lubrication.
- **Penis:** The penis is a cylindrical tube that serves as both an excretory organ, and a reproductive organ. It transfers sperms into the vagina during sexual intercourse.

#### Female Reproductive System:

The [female reproductive system](#) is active before, during, and after fertilization as well. It comprises the following parts:

- **A pair of ovaries:** A pair of ovaries produce and stores ovum in them. They also produce a female hormone known to be estrogen.

- **Fallopian tubes (Oviducts):** They are the area of fertilization. They connect both the ovaries with the uterus.
  - **Uterus:** Uterus is the place of development for the embryo.
  - **Vagina:** The part that connects the cervix to the external female body parts is called a vagina. It is the passage for the penis during coitus as well as a fetus during transfer.
- 

133. **Answer: c**

### Explanation:

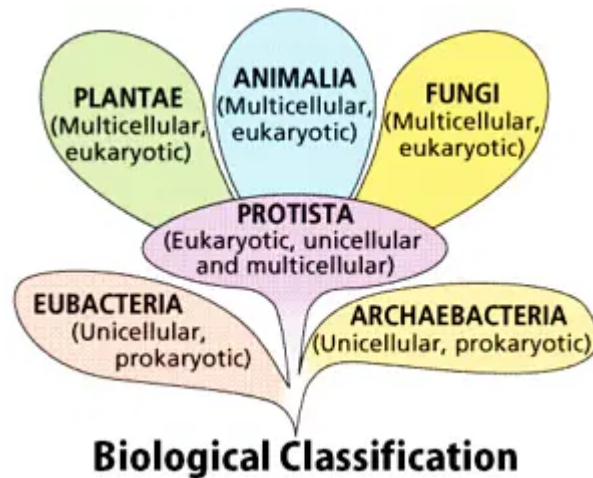
The fungus *Claviceps purpurea* is responsible for Ergot disease of rye which lowers the yield of rye plant.

### Concepts:

#### 1. Biological Classification:

The process of grouping living organisms into categories is called [biological classification](#). The most modern 5-kingdom classification was put ahead by an eminent scientist R.H. Whittaker. The [five-kingdom classification](#) is based on the criteria like [cell structure](#), mode of nutrition, body form, and [reproduction](#). One of the most important characteristics of this system is that it follows the evolutionary sequence of living organisms. The organisms are classified into distinct taxa or levels like Kingdom, Phylum, Division, Class, Order, Family, [Genus](#), and [Species](#). The 5 kingdoms are as follows:

- [Kingdom Monera](#)
- [Kingdom Protista](#)
- [Kingdom Fungi](#)
- [Kingdom Plantae](#)
- [Kingdom Animalia](#)



134. Answer: c

## Explanation:

Tricuspid valve is the valve in the heart between the right atrium and right ventricle. It consists of three cusps that channel the flow of blood from the atrium to the ventricle. When the right ventricle contracts, forcing blood into the pulmonary artery, the tricuspid valve closes the aperture to the atrium, thereby preventing any backflow of blood. The valve reopens to allow blood to flow from the atrium into the ventricle. Thus, if tricuspid valve is partially non-functional the flow of blood into the pulmonary artery will be reduced.

## Concepts:

### 1. Body Fluids and Circulation:

Liquid substances in the animal or human body are known as **body fluids**. The human body consists of about 60–67% body fluids. The chief components of the human body fluids are blood and lymph. **Blood** comprises a matrix called plasma with blood corpuscles floating in it. The blood cells are white blood cells, red blood cells, and platelets. **Lymph** consists of lymph cells.

Read More: [Body Fluids and Circulation](#)

## Types of Body Fluids:

The different types of body fluids:

## Blood

The main components of blood involve;

1. Plasma
2. Red Blood Cells
3. White Blood Cells
4. Platelets

## Lymph

A colorless fluid present in the interstitial tissues is **lymph**. It circulates all over the lymphatic system. It can be described as blood without the RBCs. The exchange of hormones, nutrients, and gases occurs via this fluid. It contains lymphocytes that play a major function in the immune responses of the body.

The movement of blood across the vessels of the body that carries nutrients and gases along with it and removes waste from the different parts of the body is **circulation**.

## Types of Circulatory Systems:

There are two types of circulatory systems:

- Open Circulatory system
- Closed circulatory system

---

135. Answer: d

### Explanation:

Pancreas secretes pancreatic juice that acts on all type of foods. It contains pancreatic amylase for the digestion of carbohydrates; trypsinogen, chymotrypsinogen and procarboxypeptidases for the digestion of proteins, pancreatic lipase for the digestion of fats and nuclease for nucleic acid.

### Concepts:

#### 1. Digestion and Absorption – Alimentary Canal:

Digestion can be defined as the process of breakdown of large, insoluble and complex food molecules into smaller ones for its absorption and circulation in the body. This process involves the usage of a variety of digestive fluids and [enzymes](#), including saliva, mucus, bile and hydrochloric acid, among others.

**Read More:** [Digestion and Absorption](#)

The alimentary canal is mainly referred to as **the pathway by which food enters our body and moves out through the anus after digestion**. It is a tube-like structure that starts from the mouth and ends in the anus. The alimentary canal plays a primary role in human digestion and is also termed as the digestive tract.

**Peristalsis** is a series of wave-like muscle contractions that move food through the digestive tract.

---

**136. Answer: a**

### **Explanation:**

Biofertilizers are organisms which bring about nutrient enrichment of the soil. Azotobacter is a free living, aerobic, nitrogen fixing bacteria. Anabena is a nitrogen fixing cyanobacteria that occurs in both free living and symbiote associations with Azolla, Cycas roots etc. Rhizobium lives symbiotically in root nodules of legumes and non-legumes. Vesicular-arbuscular mycorrhiza (VAM) is an example of endomycorrhiza in which fungal hyphae penetrate the cortical cells of grasses to form vesicles.

### **Concepts:**

#### **1. Microbes in Human Welfare:**

There are several valuable [microorganisms that are beneficial to humans](#) in various manners such as:

#### **In Household Products**

1. Fermentation of milk to produce yogurt.
2. Milk curdling to compose curd, cheese, and paneer.

## In Industrial Products

1. Production of beverages such as wine, beer, whiskey, brandy, or rum.
2. Production of antibiotics such as Penicillin and other chemical substances to kill or retard the expansion of disease-causing microbes.

## Fermented Beverages

1. A fermentor is used to produce microbes on a large scale for industrial purposes.
2. The brewer's yeast (*Saccharomyces cerevisiae*) is used to make ethanol. At this time, the yeast ferments malted cereals and fruit juices.

## Antibiotics

1. The term antibiotic means "against life". These materials can kill or destroy the growth of other microbes.

---

137. Answer: a

### Explanation:

There are no permanent treatments for hepatitis B, HIV infection, or genital herpes. A cure exists for gonorrhea.

The correct option is (A): Gonorrhoea

---

138. Answer: b

### Explanation:

Klinefelter's syndrome is an aneuploid condition with 3 sex chromosomes (trisomy). Klinefelter's syndrome is caused by XXY genotype. This genotype results from the union of a nondisjunct XX egg and a normal Y sperm or normal X egg and abnormal XY sperm. The individual has 47 chromosomes ( $2n + 1$ ). The person having Klinefelter's syndrome is a sterile male with small testes, unusually long legs, obesity, and sparse body hair, and with many female characteristics such as breasts. The

victim usually has normal intelligence. The more the X chromosomes, the greater is the mental defect. Klinefelter's syndrome occurs about once in 2000 live births. Turner's syndrome is formed by the union of an abnormal O egg and a normal X sperm or a normal egg and an abnormal O sperm. The individual has 45 chromosomes ( $44 + X$ ). Down's syndrome is caused by the presence of an extra chromosome number 21. Gynandromorphism is a phenomenon by which one part of the body of an animal is male and the other part is female.

## Concepts:

### 1. Principles of Inheritance and Variation - Mutation:

A **Mutation** is a change in the sequence of our DNA base pairs caused by numerous environmental stimuli such as UV light or mistakes during DNA replication. Germline mutations take place in the eggs and sperm and can be passed onto offspring, whereas somatic mutations take place in body cells and are not passed on.

## Types of Mutations

There are three [types of mutations](#), which are as follows:

### Silent mutation

It refers to any change in DNA sequence that has no effect on the amino acid sequence in a protein or the functions that a protein performs. There is no phenotypic indication that a mutation has occurred.

### Nonsense mutation

When there is a change in the sequence of base pairs due to a point mutation, that results in a stop codon. This leads to a protein that is either shortened or non-functional.

### Missense mutation

A missense mutation occurs when a point mutation causes a change in the codon, which then codes for another amino acid.

**The mutation is caused by the following factors:**

## Internal Causes

When DNA copies incorrectly, the majority of mutations occur. Evolution occurs as a result of all of these mutations. DNA makes a copy of itself during cell division. When a copy of DNA isn't flawless, it's called a mutation since it differs somewhat from the original DNA.

## External Causes

When certain chemicals or radiations are used to break down DNA, it causes the DNA to break down. The thymine dimers are broken by UV radiation, resulting in altered DNA.

---

139. **Answer: c**

### Explanation:

Interphase is the stage between two successive cell divisions. During interphase, chromosomes are decondensed and are distributed throughout the nucleus. It is the largest period in the cell cycle and is divided into three phases - G1, S, and G2. During G1 phase the cell grows and synthesis of tRNA, mRNA, ribosomes, enzymes and proteins necessary for DNA synthesis occurs. During S phase replication of DNA takes place. The nucleotides get assembled and DNA molecules are synthesized. During G2 phase organelles like centrioles are doubled and mitochondria, chloroplasts etc. divide.

### Concepts:

#### 1. Cell Cycle and Cell Division:

### Cell Cycle:

The sequence of events by which a cell copies itself synthesizes other constituents of the cell and eventually splits into two daughter cells is termed the cell cycle. The cell synthesizes all its constituents in a sequential pattern to make sure the proper division and distribution of components that occurs between the two daughter cells. Therefore, we can say that the cell cycle is the period of time between the development of new daughter cells and their further division.

## Stages of Cell Cycle:

The cell cycle can be sub-divided into an additional category of Interphase. Meanwhile, the Interphase can be branched into 3 further stages, such as:

1. G1 Phase - "Gap 1 Phase"
2. S Phase - "Synthesis Phase"
3. G2 Phase - "Gap 2 Phase"

Read More: [Cell Cycle and Cell Division](#)

## Cell Division:

The division of the parent cells into two or more cells is called daughter cell, [cell division](#) takes place. In general, it occurs as a part of a larger cell cycle. All the cell reproduces by dividing into two, wherein each parental cell produces two daughter cells.

## Stages of Cell Division:

Cell division can be widely divided into several sub-segments that result from Mitosis and Meiosis.

1. Mitosis or (M Phase)
2. Meiosis

---

140. Answer: c

## Explanation:

Ligaments join a bone with another bone in movable/synovial joints. Torn ligaments make movement at joints very painful and restricted.

## Concepts:

### 1. Locomotion and Movement:

#### Locomotion

The movement of a creature from one place to another is known as locomotion. During the process, there is the action of appendages such as wings, limbs, and flagella. In some animals, like fish, whales, and sharks, locomotion upshots from a wave-like series of muscle contractions. Locomotion helps an **organism** in finding their food, avoid harsh weather conditions, escape from their predators, etc.

Some examples of locomotion are walking, running, swimming, etc. Movement, on the other hand, refers to any type of motion that need not be localized.

**Read More:** [Locomotion and Movement](#)

## Movement

Movement is generally described as a state of changing the position from rest to motion or vice-versa. Movement can be both voluntary movement and involuntary movement. Movement helps an organism perform essential functions, such as pumping **blood** to the different parts of the body, etc.

**Read More:** [Difference between Locomotion and Movement](#)

---

**141. Answer: c**

### Explanation:

Vestibular apparatus is a part of inner ear which is located above the cochlea. It consists of three semicircular canals, which detect movements of the head, and the utricle and saccule which detect the position of head. It does not play any role in hearing but is responsible for maintaining the balance of the body and posture, thus necessary.

### Concepts:

#### 1. Neural Control and Coordination:

##### Neural System:

Neurons are the most specialised cells in the nervous system of all animals, and they are responsible for detecting, accepting, and conveying numerous types of motives. The neurological system of low-spinal animals like Hydra is incredibly simple,

consisting of a network of neurons. When the brain of an insect comprises a vast number of ganglia and neural tissues, it is optimally structured.

### **Coordination System:**

Coordination is the process by which two or more organs work together to accomplish each other's duties. Increased muscle activity increases the supply of oxygen and the demand for energy while we exercise. When we cease exercising, our nerves, heart, lungs, and kidneys all return to normal. As a result, all of the organs' functions are properly integrated in order to conduct the exercise and supply the appropriate conditions while exercising. Similarly, in the human body, the neurological and endocrine systems work together to coordinate all of the organ activities.

---

## **142. Answer: d**

### **Explanation:**

Hormones are non-nutrient chemicals, which act as intracellular messengers and are produced in trace amounts. Endocrine cells are present in different parts of the gastrointestinal tract, e.g., gastric, secretin, GIP. Atrial wall of our heart secretes a peptide hormone called ANF (Atrial Natriuretic Factor), RH/IR are produced by hypothalamus. Adenohypophysis is not directly under neural control, it is under the control of hypothalamic hormones, brought by portal system.

### **Concepts:**

#### **1. Chemical Coordination and Integration:**

The [chemical coordination and integration](#) of all physiological functions in the animal body are jointly synchronized by the neural and endocrine systems. The [control and coordination](#) of body functions are executed by the [endocrine glands](#). They are ductless glands that secrete several hormones to control and coordinate body functions.

### **Human Endocrine System:**

The human body has several endocrine glands located in different parts. They cover the pituitary gland, thymus, thyroid gland, pineal gland, parathyroid, pancreas (duodenal gland), adrenal gland, and gonads (testes and ovaries). The liver, kidney, heart, and

gastrointestinal tract also produce hormones in small traces to harmonize the functioning of these organs.

The [Hypothalamus](#) comprises groups of secretory cells called nuclei which secrete various hormones. These hormones released by the hypothalamus are important in regulating the synthesis and secretion of pituitary hormones.

### Functions of Endocrine Glands:

- Pituitary Gland
  - Pineal Gland
  - Thyroid Gland
  - Parathyroid Gland
  - Thymus
  - Adrenal Gland
  - Pancreas
  - Testes
  - Ovary
  - Hormones of Kidney, Heart, and Gastrointestinal Tract
- 

**143. Answer: d**

### Explanation:

Barr body is a condensed heterochromatic copy of the X chromosome, visible by staining the interphase nucleus of somatic cells of the homogametic sex, for example the human female. Named after M. Barr, these condensed chromosomes offer an easy way of determining the true genetic sex of individuals with intermediate secondary sexual characteristics. The total number of Barr bodies is always one less than the total number of X chromosomes present in the cell or the organism.

### Concepts:

#### 1. The Molecular Basis of Inheritance:

#### DNA Replication:

DNA synthesis is commenced at particular points within the DNA strand referred to as 'origins', which are certain coding regions. There are numerous origin sites, and when replication of DNA starts, these sites are mentioned as replication forks. Within the replication, the complex is the enzyme DNA Helicase, so that they can be utilized as a template for replication. DNA Primase is another enzyme that's essential in DNA replication.

## **RNA:**

Ribonucleic acid (RNA) is an essential biological macromolecule that exists all together in biological cells. It is principally involved in the synthesis of proteins, that carry the messenger instructions from DNA, which itself contains the genetic instructions needed for the event and maintenance of life. In some viruses, RNA, in spite of DNA, carries genetic information.

## **Genetic Code:**

Genetic code is the term we use in the manner that the four bases of DNA--the A, C, G, and Ts--are strung together in a way that the ribosome, the cellular machinery, can read them and switch them into a protein. In the ordering, every three nucleotides during a row count as a triplet and code for one amino alkanoic acid.

Read More: [Molecular Basis of Inheritance](#)

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## **144. Answer: d**

### **Explanation:**

Cell recognition and adhesion occur due to biochemicals of cell membranes named glycoproteins and glycolipids. These are formed due to small carbohydrate molecules present on lipids and extrinsic proteins.

### **Concepts:**

#### **1. Cell: The Unit of Life:**

- A cell is derived as the functional and structural unit of life. Every cell is surrounded by a cell membrane that dissects the external and internal

environments of the cell. The interior environment of a cell is called the cytoplasm.

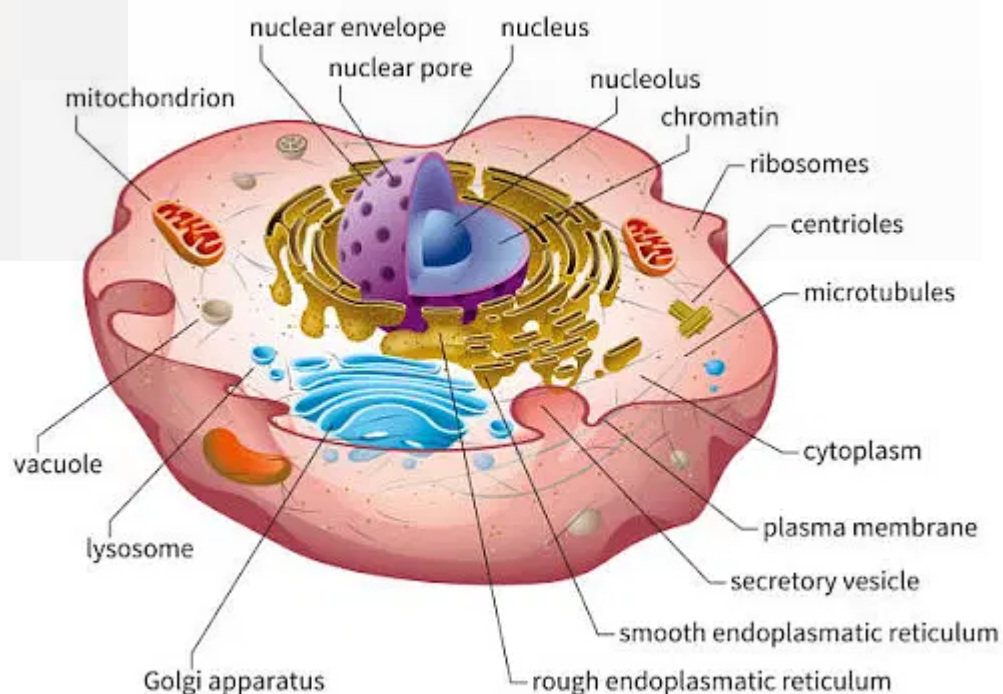
- It carries cellular machinery and structural elements. The nucleus is present in the center of the cell, which includes all the hereditary information of an organism. Some of the molecules present in the cell are protein, carbohydrates, starch, and sugar.

Read More: [Fundamental Unit of Life: Cell](#)

## Parts of Cell:

The different parts of a cell and their functions are as follows:

- Cell Membrane
- Cell Wall
- Nucleus
- Cytoplasm



145. Answer: b

Explanation:

Goblet cells of alimentary canal secrete mucus and are modified from columnar epithelial cells.

---

**146. Answer: c**

### **Explanation:**

Meloidogyne incognita cause root node disease

### **Concepts:**

#### **1. Applications of Biotechnology:**

Biotechnology is the technology that utilizes biological systems, living organisms, or parts of this to develop or create different products.

For example, brewing and baking bread fall within the concept of biotechnology (use of yeast (= living organism) to produce the desired product).

#### **Agriculture**

Alternative to conventional farming: A possible solution is the use of genetically modified crops which is an alternative path to conventional farming.

#### **Medicine**

In the area of healthcare, recombinant DNA technological processes have made an immense impact which enables the mass production of safe and more effective therapeutic drugs.

#### **Gene Therapy**

A collection of methods that allows the correction of a gene defect that has been diagnosed in a child/embryo is called Gene Therapy.

#### **CRISPR technology**

For editing genomes, CRISPR is a simple yet powerful tool which allows researchers to easily alter DNA sequences and modify gene function.

147. Answer: d

### Explanation:

Hind II is first discovered restriction enzyme by Warner Arber.

### Concepts:

#### 1. Biotechnology:

[Biotechnology](#) is a vast field of biology that involves the creation, production, and modification of useful products for human welfare using both the technology and the execution of living organisms and their components. An agricultural engineer, Karoly Ereky, coined the word "biotechnology" in 1919, achieving him the title of "Father of Biotechnology."

### Principles of Biotechnology:

Among many, the two core techniques that entitled the birth of modern biotechnology are :

1. **Genetic Engineering** is one of the methods of direct modifications of an organism's genome (i.e., DNA and RNA). It requires the introduction of new genes into host species to escalate function or trait, hence altering the host organism's phenotype.
2. **Bioprocess Engineering** is one of the methods of maintaining sterile conditions to facilitate the growth of large quantities of desired microbes and other eukaryotic cells for the development of new or modified biotechnological products such as enzymes, vaccines, antibiotics, and other biotechnological products.

---

148. Answer: b

### Explanation:

In addition to lungs, skin is also an organ of respiration in frog. It is practically the only mode of respiration when the frog is under water or hibernating. Skin is richly

supplied with blood and is permeable to gases. That is why frogs always stay near water to keep their skin moist. It is further kept moist by secretion of mucus from its glands, and does not become dry out of water.

## Concepts:

### 1. Breathing and Exchange of Gases:

A metabolic process, which is carried out by all living organisms including plants, animals, and humans for the production of energy and to stay alive is Respiration. Except for required anaerobes, every other organism from amoeba to humans needs oxygen for survival. And evolution has reported a number of systems that allows the exchange of gases in organisms.

#### There are two types of respiration such as;

1. **Aerobic respiration** — to produce energy, it occurs in the presence of oxygen
2. **Anaerobic respiration** — to produce energy, occurs in the absence of oxygen

Breathing can be simply derived as the process of inhaling oxygen gas from the atmosphere and exhaling the carbon dioxide gas back into the atmosphere is termed breathing and the process is commonly known as respiration.

Read More: [Breathing and Exchange of Gases](#)

---

### 149. Answer: a

#### Explanation:

- A. Excessive fluid loss from the body can activate osmoreceptors, which in turn trigger the release of ADH from the hypothalamus.
- B. ADH facilitates water reabsorption to prevent diuresis.
- C. ANF causes vasodilation.
- D. ADH causes increase in blood pressure.
- E. ADH affects kidney function by tightening blood arteries, which raises blood pressure and, in turn, increases glomerular blood flow and GFR.

The correct option is (A): B, C and D only

150. Answer: c

**Explanation:**

Endonucleases are enzymes that hydrolyze internal phosphodiester bonds in a polynucleotide chain, cleaving the DNA or RNA at specific locations within the molecule. Exonucleases, on the other hand, remove nucleotides from the ends of the molecule, not from internal positions. Lipases and proteases are not involved in nucleic acid hydrolysis; lipases are involved in lipid metabolism, and proteases are enzymes that cleave peptide bonds in proteins.

So, the correct option is (C): Endonuclease

**Concepts:**

**1. Enzymes – Biology:**

Enzymes are proteins that help accelerate metabolism or the chemical reactions in our bodies. They build some substances and decompose others. All living creatures have enzymes.

Our bodies naturally build enzymes. But enzymes are also in mass produce products and food.

One of the most important roles of enzymes is to succor digestion. The process of turning the food that we eat into energy is called digestion. For instance, there are enzymes in our saliva, pancreas, stomach, and intestines. They decompose fats, proteins, and carbohydrates. Enzymes make use of these nutrients for growth and cell repair.

---

151. Answer: a

**Explanation:**

The correct option is (A) : Dicot root

A radial vascular bundle, also known as a radial bundle, is a vascular bundle in which the principal xylem and primary phloem strands are placed on alternating radii of an axis and are isolated from one another by non-vascular tissues. The distinctive feature of roots is their bundles. The secondary thickening is carried out by the secondary cambium, which only develops at the time of secondary growth in dicotyledonous roots, as there is no primary cambium in this bundle. In contrast to monocot roots, which often have many xylem poles (more than six), dicot roots typically contain four to six protoxylem poles.

## Concepts:

### 1. Anatomy of Flowering Plants:

[Anatomy of flowering plants](#) is the study of the structure and organization of the different parts of the plant body that are involved in reproduction, growth, and development. The flowering plants, also known as angiosperms, are the largest and most diverse group of plants on Earth, and their anatomy is highly specialized to meet the specific needs of these organisms.

The anatomy of flowering plants can be divided into two main parts: the root system and the shoot system. The root system is responsible for anchoring the plant in the soil, absorbing water and nutrients, and storing food. The shoot system, on the other hand, consists of the stem, leaves, flowers, and fruits, and is responsible for [photosynthesis](#), [reproduction](#), and growth.

The stem of a flowering plant is composed of several layers of tissue, including the epidermis, cortex, and vascular tissue, which are specialized for different functions such as support, transport, and storage. The leaves are also composed of several layers of tissue, including the epidermis, mesophyll, and vascular tissue, and are specialized for photosynthesis and gas exchange.

**Read More:** [Reproduction in Plants](#)

The flowers of flowering plants are the reproductive structures that produce seeds, and their anatomy is highly diverse and specialized to attract pollinators and facilitate fertilization. The different parts of the flower, such as the sepals, petals, stamens, and pistil, are arranged in specific patterns and shapes that are unique to each species.

Understanding the anatomy of flowering plants is essential for plant scientists, farmers, and gardeners, as it provides insights into the growth, development, and reproductive biology of these organisms, and can help to improve crop yields and plant breeding efforts.

---

**152. Answer: d**

### **Explanation:**

In  $C_4$  plants, each  $CO_2$  molecule must undergo fixation twice, resulting in a higher energy requirement for the synthesis of hexose sugar molecules compared to  $C_3$  plants, where  $CO_2$  is fixed only once.  $C_3$  plants require 18 ATP molecules to synthesize one molecule of hexose sugar, whereas  $C_4$  plants require 30 ATP molecules for the same process. Therefore,  $C_4$  plants require an additional 12 ATP molecules compared to  $C_3$  plants to produce one molecule of hexose sugar.

So, the correct option is (D); 12

### **Concepts:**

#### **1. Photosynthesis in Higher Plants:**

### **Processes Of Photosynthesis in Higher Plants:**

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

#### **Light Reaction:**

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

#### **Dark Reaction:**

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
  2. C4 Cycle (Hatch and Slack Pathway)
- 

**153. Answer: d**

### Explanation:

Carbon is a vital macronutrient within plants, constituting the most prevalent element in their composition. This element falls under the category of non-mineral components and is a fundamental building block of organic compounds. Among these organic compounds, carbohydrates such as sugars, starches, and cellulose play a significant role, serving as essential carbon-containing molecules found in plants.

### Concepts:

#### 1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

#### Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They secure their food in the form of starch-like **algae**.

- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

## 154. Answer: a

### Explanation:

Osmoregulators use physiological mechanisms to sustain a relatively stable internal osmolarity. Terrestrial animals engage in osmoregulation because they naturally lose water through processes like evaporation and excretion, and it's not always possible to immediately replace this lost water.

### Concepts:

#### 1. Ecosystem:

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

### Structure of the Ecosystem:

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

155. Answer: a

### Explanation:

Conifers belong to gymnosperms. They are seed bearing plants in which the sporophylls are aggregated to form cones and the seeds develop in exposed state over the surface of megasporophylls. Vascular strand consists of tracheids and sieve cells. Female gametophyte forms archegonia, provides nourishment to developing embryo and later gets transformed into food-laden tissue or endosperm inside the seed. This endosperm is formed before fertilization so it is haploid in nature. It provides nourishment for growth of seedlings at the time of seed germination. Grass is an angiospermic plant and endosperm is produced after fertilization.

### Concepts:

#### 1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

#### Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.

- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

156. Answer: b

### Explanation:

Racemose inflorescence is also called indefinite and indeterminate type. Growth of the peduncle is indefinite. Here the terminal bud will not modify into a flower. Flowers develop in acropetal succession i.e., mature flowers are towards the base and the younger ones towards the tip of the peduncle. Flowers open in centripetal succession i.e., opening of flowers proceeds from the periphery to the centre of the inflorescence. Peduncle may be unbranched or branched. Soybean belongs to family Fabaceae which has racemose inflorescence.

### Concepts:

#### 1. Morphology of Flowering Plants:

**Morphology in flowering plants** tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

#### Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

There are three types of root systems found in plants are as follows:

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

## Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

---

### 157. Answer: d

#### Explanation:

Haploid production through a culture has been referred to as androgenesis. The androgenic method of haploid production is from the male gametophyte of an angiosperm plant i.e., microspore (immature pollen). Young pollen grains produced androgenic haploids in anther cultures while anther wall, tapetal layer of anther wall and connective tissue are the parts of anther. Tapetal layer is the nutritive tissue.

#### Concepts:

### 1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

**An individual flower comprises the following parts -**

- Pedicle
- Calyx
- Petals

- Sepals
  - Stamen
  - Pistil
  - Receptacle
- 

**158. Answer: b**

**Explanation:**

Vascularization refers to the process of vascular bundle formation from procambium in plants. Initially, thin-walled, elongated procambium strands are generated during early growth and differentiation. These strands subsequently undergo immediate differentiation, giving rise to both primary xylem and primary phloem simultaneously. Following procambium development, primary vascular tissues are formed. It's important to note that secondary xylem arises from the vascular cambium during secondary growth, rather than originating directly from procambium.

So, the correct option is (B): Differentiation of procambium followed by the formation of primary phloem and xylem simultaneously

**Concepts:**

**1. Secondary Growth:**

[Secondary growth](#) is an increase in girth or thickness of the axis due to activity of lateral meristem. The [tissues](#) involved in secondary growth are two lateral meristems: vascular cambium and cork cambium.

**Secondary Growth in Stem:**

**Formation of Cambium Ring-**

1. The cambium present between the xylem and phloem in vascular bundles is called Fascicular or Interfascicular cambium.
2. In secondary growth, few medullary ray cells that are located between vascular bundles also become meristematic, and it is known as Interfascicular cambium.

## Formation of the secondary tissues-

1. The cambium ring cuts off cells on both sides. It produces secondary phloem outwardly and secondary xylem inwardly.
2. The amount of secondary xylem cut off is more than the secondary phloem.

## Secondary Growth in Root:

### Vascular Cambium-

1. The cambium is absent initially but develops later at the time of secondary growth.
2. The pericycle cells lying outside the protoxylem and the conjunctive parenchyma cells on the lateral side of the phloem bundle become meristematic to form many cambial strips.

### Cork Cambium-

1. The cork cambium develops because of the tangential division of cells of the pericycle.
2. The activity of cork cambium is like that found in the dicot stem, so it produces cork cells or phellem towards the outside and phelloderm or secondary cortex towards the inside.

## Abnormal secondary growth:

1. Due to absence of the cambium in monocots, monocots don't show secondary growth and the vascular system is totally composed of primary tissues.
2. The vascular bundles are irregularly scattered in the ground tissues, such that the cortex and other ground tissues can't be differentiated.
3. Dracaena, Yucca, Agave are examples of monocots that exhibit a peculiar type of secondary growth in thickness.

---

159. Answer: d

Explanation:

These plants possess a greater photosynthetic unit size compared to sun-exposed plants. This larger unit size enables them to capture the maximum available amount of photosynthetically active radiation (PAR) light for the process of photosynthesis.

## Concepts:

### 1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

### Several features of Kingdom Plantae are as follows:

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- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

160. Answer: b

Explanation:

During photophosphorylation, ADP (adenosine diphosphate) and inorganic phosphate ( $PO_4$ ) are combined to form ATP (adenosine triphosphate) using the energy from light.

So, the correct option is (B):  $ADP + \text{Inorganic } PO_4 \xrightarrow{\text{Light Energy}} ATP$

## Concepts:

### 1. Electron Transport System :

The **electron transport chain or system** is the sequence of electron carriers, enzymes, and cytochrome that passes electrons from one to another through the redox reaction. It is electron transport-linked phosphorylation.

It contains flavin nucleotides (FAD), nicotinamide adenine dinucleotide (NAD), coenzyme Q, and cytochromes localized in F<sub>1</sub> particles of mitochondria. It occurs in the inner mitochondrial membrane along with cristae.

In this process five (5) complexes are involved namely, I- NADH-UQ reductase, II- Succinate-UQ reductase, III- UQH<sub>2</sub> -cytochrome C reductase, IV- Cytochrome C oxidase, and V is connected with F<sub>0</sub>-F<sub>1</sub> particles.

In this process, NAD and FAD are minimized.

#### Steps:

- **Redox at complex I:** Four (4) protons are pumped from the matrix to intermembrane space.
  - **Redox at complex II:** Coenzyme Q collects the electrons from complex I and II, and goes to complex III.
  - **Redox of complex III:** Four (4) protons are again pumped from matrix to intermembrane space and cytochrome C transports electrons to the complex IV.
  - **Redox of complex IV:** Two (2) protons are pumped from the matrix to intermembrane space and the formation of water occurs in the matrix.
  - **ATP synthase action:** It pumps protons from intermembrane space to matrix and generates ATP. It is associated with oxidative phosphorylation.
-

**161. Answer: d**

**Explanation:**

Fresh weight is not commonly used for the construction of ecological pyramids. Ecological pyramids typically use measures such as dry weight (biomass), the number of individuals, or the rate of energy flow (productivity) to represent the trophic levels in an ecosystem. Fresh weight includes the weight of water content in organisms, which can vary greatly and is not as consistent or informative for ecological studies as dry weight.

So, the correct option is (D): Fresh Weight

**Concepts:**

**1. Ecosystem:**

An **ecosystem** is a structural and functional unit of ecology where the living organisms come in to interact with each other and the surrounding environment.

**Structure of the Ecosystem:**

The structure of an ecosystem is distinguished by the organization of both biotic and abiotic components. This involves the distribution of energy in **our environment**. It also comprises the climatic conditions prevailing in that particular environment.

There are two **main components of the structure of an ecosystem**, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interconnected in an ecosystem. It is an open system where the energy and components can flow through the boundaries.

---

**162. Answer: b**

**Explanation:**

Floridean starch has structure similar to amylopectin and glycogen (being branched).

## Concepts:

### 1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

### Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition that** simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They secure their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

163. Answer: a

Explanation:

The given floral formula is of Family Solanaceae. Among the given options, only Petunia belongs to Family Solanaceae. Allium is a member of Family Liliaceae, Sesbania is of Family Leguminosae and Brassica is a member of Family Brassicaceae or Cruciferae.

## Concepts:

### 1. Morphology of Flowering Plants:

**Morphology in flowering plants** tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

#### Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

**There are three types of root systems found in plants are as follows:**

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

#### Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

## Explanation:

Following are the post-fertilisation changes.

- Ovule → Seed
- Ovary → Fruit
- Zygote → Embryo
- Central cell → Endosperm

## Concepts:

### 1. Sexual Reproduction in Flowering Plants:

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

#### An individual flower comprises the following parts -

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

---

### 165. Answer: b

## Explanation:

An ectophloic siphonostele is a specific type of siphonostele, which itself is a stele consisting of a central core of pith surrounded by concentric layers of xylem and phloem. In the case of an ectophloic siphonostele, there is a ring of xylem surrounding the pith, with a ring of phloem located outside the xylem. This type of

stele is exemplified by plants like *Osmunda* and *Equisetum*. Therefore, *Osmunda* and *Equisetum* are examples of plants that possess an ectophloic siphonostele.

So, the correct option is (B): *Osmunda* and *Equisetum*

## Concepts:

### 1. The Tissue System:

#### Epidermal Tissue System:

The epidermal tissue system forms the outer-most covering of the whole plant body and comprises epidermal cells, stomata, and the epidermal appendages – the trichomes and hairs. The epidermis is the outermost layer of the primary plant body. It is made up of elongated, compactly arranged cells, which form a continuous layer. The epidermis is usually single-layered.

#### Ground Tissue System:

All tissues except the epidermis and vascular bundles constitute the ground tissue. It consists of simple tissues such as parenchyma, collenchyma, and sclerenchyma. Parenchymatous cells are usually present in the cortex, pericycle, pith, and medullary rays, in the primary stems and roots. In leaves, the ground tissue consists of thin-walled chloroplast-containing cells and is called mesophyll.

#### Vascular Tissue System:

The vascular system consists of complex tissues, the phloem, and the xylem. The xylem and phloem together constitute vascular bundles. In dicotyledonous stems, cambium is present between phloem and xylem. Such vascular bundles because of the presence of cambium possess the ability to form secondary xylem and phloem tissues and hence are called open vascular bundles. In the monocotyledons, the vascular bundles have no cambium present in them. Hence, since they do not form secondary tissues they are referred to as closed.

Read More: [Plant Tissue](#)

## Explanation:

A high ratio of cytokinins to auxins promotes shoot differentiation. Cytokinins and auxins are plant hormones that play essential roles in regulating various aspects of plant growth and development, including the formation and differentiation of shoots and roots. A higher concentration of cytokinins relative to auxins encourages shoot formation and growth.

So, the correct option is (B): High cytokinin : auxin ratio

## Concepts:

### 1. Plant Growth Regulators:

## What is a plant growth regulator?

[Plant growth regulators \(PGRs\)](#) are chemicals used to modify plant growth such as increasing branching, suppressing shoot growth, increasing return bloom, removing excess fruit, or altering fruit maturity.

## Types of Plant Growth:

There are the following types of plant growth.

- **Primary and Secondary Growth:** The growth of a plant is termed primary when the same happens through the mitotic division of the meristematic [cells](#) which are present at the root and the shoot of the plants.

Whereas, the secondary growth in a plant takes place through the division of the secondary meristem, which, in turn increases the diameter of the body of the plants.

- **Primary and Secondary Plant Growth**
- [Unlimited Growth](#)
- [Limited Growth](#)
- [Vegetative Growth](#)
- [Reproductive Growth](#)

**The five groups of plant growth regulators used in fruit crops include:**

1. **Auxins:** [Auxins](#) are one of the most important plant hormones. The chief naturally occurring auxin is indole-3 acetic acid – IAA and other related compounds.
  2. **Gibberellins:** [Gibberellins](#) are an extensive chemical family based on the ent-gibberellane structure. The first gibberellin to be discovered was gibberellic acid. Now there are more than 100 types of gibberellins.
  3. **Cytokinins:** These are produced in the regions where cell division occurs; mostly in the roots and shoots. They help in the production of new leaves, lateral shoot growth, chloroplasts in leaves etc.
  4. **Abscissic Acid:** Abscissic acid controls the dormancy of buds and seeds, inhibits shoot growth and is involved in regulating water loss from plants.
  5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.
- 

167. Answer: c

### Explanation:

Photorespiration is primarily a characteristic of  $C_3$  plants, not  $C_4$  plants.  $C_3$  and  $C_4$  plants have different carbon fixation pathways. Photorespiration occurs more prominently in  $C_3$  plants due to the oxygenase activity of ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO), which leads to the wasteful breakdown of carbon compounds in the presence of oxygen.  $C_4$  plants have evolved mechanisms to minimize photorespiration, making it less common in these plants.

So, the correct option is (C): It is a characteristic of  $C_4$  plants

### Concepts:

#### 1. Photorespiration:

Photorespiration is a wasteful process in plants in which plants intake oxygen, and sunlight and release carbon dioxide and no glucose is formed. Photorespiration generally takes place when the concentration of oxygen in the leaves is very high and that of carbon dioxide is very low.

In Calvin cycle carbon dioxide fixation does not take place. Hence, instead of carbon dioxide oxygen reacts with RuBP.

## Photorespiration in C<sub>3</sub> and C<sub>4</sub> Plants:

- C<sub>4</sub> plants do not undergo photorespiration due to their special mechanism to increase the CO<sub>2</sub> level for enzyme binding.
  - In Hatch and Slack Pathway, C<sub>4</sub> acid and oxaloacetic acid breaks down to release CO<sub>2</sub>.
  - This ensures a high concentration of intercellular CO<sub>2</sub>.
  - Thus, in C<sub>4</sub> plants, RuBisCO is more active as a carboxylase enzyme rather than as an oxygenase.
  - This is why C<sub>4</sub> plants have better productivity.
- 

168. Answer: d

### Explanation:

xylem fibres.

### Concepts:

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- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

169. Answer: d

### Explanation:

The flowers of family papilionaceae have 1 butterfly shaped corolla (papilionaceous corolla), Posterior or outermost petal is the largest and is called standard or vexillum, two lateral petals are similar and generally clawed called wings or allae and the two anterior petals called keel are fused enclosing stamens and carpels. This type of petal arrangement is found in bean, gram, pea etc.

### Concepts:

#### 1. Morphology of Flowering Plants:

**Morphology in flowering plants** tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

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---

170. Answer: b

### Explanation:

Honey is made from nectar through a process of regurgitation and evaporation. Honey bees transform saccharides (carbohydrates) into honey by regurgitating it a number of times, until it is partially digested. The bees do the regurgitation and digestion as a group. After the last regurgitation, the aqueous solution is still high in water, the process continues by evaporation of much of the water and enzymatic transformation. Honey is produced by bees as a food source.

### Concepts:

#### 1. Sexual Reproduction in Flowering Plants:

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**An individual flower comprises the following parts -**

- Pedicle

- Calyx
  - Petals
  - Sepals
  - Stamen
  - Pistil
  - Receptacle
- 

171. **Answer: d**

### Explanation:

A hemitropous ovule is an ovule that becomes curved, positioning the nucellus and embryo sac at a right angle to the funicle. In this type of ovule, the body of the ovule is oriented transversely, with the micropyle and chalaza aligned in a straight line. An anatropous ovule is one that is completely inverted, turned 180 degrees on its stalk. An orthotropous ovule is a completely straight ovule with the micropyle located at the apex. A campylotropous ovule is an ovule in which the body is curved and bent so that the micropyle and chalaza are not in a straight line.

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Read More: [Classification of Plants](#)

---

## 172. Answer: a

### Explanation:

Zinc deficiency can lead to reduced auxin synthesis or impaired auxin transport within the plant, which can result in various growth abnormalities and symptoms such as stunted growth and leaf distortion. Zinc is essential for various enzymatic reactions and processes in plants, including those related to hormone biosynthesis and function.

So, the correct option is (A): Auxin

### Concepts:

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### What is a plant growth regulator?

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4. **Abscissic Acid:** Abscissic acid controls the dormancy of buds and seeds, inhibits shoot growth and is involved in regulating water loss from plants.
5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.

---

173. Answer: d

### Explanation:

Photosystem I contains a complex of proteins and pigments that capture and transfer electrons during the light-dependent reactions of photosynthesis. The first electron acceptor in PS I is an iron-sulfur protein that receives electrons from the reaction center chlorophyll molecule. These electrons are then transferred through

a series of carriers, including ferredoxin and eventually contribute to the reduction of  $\text{NADP}^+$  to NADPH.

So, the correct option is (D): an iron-sulphur protein

## Concepts:

### 1. Photosynthesis in Higher Plants:

## Processes Of Photosynthesis in Higher Plants:

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

### Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

### Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
2. C4 Cycle (Hatch and Slack Pathway)

---

## 174. Answer: c

### Explanation:

Autotrophic nutrition involves manufacture of organic materials from inorganic raw materials with the help of energy obtained from outside sources. It is of two types - chemosynthesis and photosynthesis. The organisms which are able to manufacture

their organic food from inorganic raw materials with the help of energy derived from exergonic chemical reactions are called chemoautotrophs. Nitrosomonas and Nitrobacter are chemoautotrophic nitrifying bacteria. Those organisms who can manufacture organic compounds from inorganic raw materials with the help of solar energy in the presence of photosynthetic pigments are called photoautotrophs. For e.g., Nostoc, Chara, Porphyra and Wolffia. Nostoc is a cyanobacterium which contains photosynthetic pigments chlorophyll a, carotenoids and phycobilins. Chara is a green alga having chlorophyll a, b, carotenes and xanthophylls. Porphyra is a red alga containing chlorophyll a, carotenoids and phycobilins and Wolffia is an aquatic angiosperm which consists of photosynthetic pigments, chlorophyll a, b, carotenoids and xanthophylls.

## Concepts:

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Read More: [Classification of Plants](#)

---

175. Answer: d

### Explanation:

**Keel is the characteristic feature of flowers belonging to the family Papilionaceae.** Indigofera belongs to this family, hence keel is seen in Indigofera.

The **flowers** of family Papilionaceae have butterfly-shaped corolla (papilionaceous corolla). Their posterior or outermost petal is the largest and is called standard or vexillum. The two lateral petals are similar and generally clawed, they are called wings or alae and the two anterior petals known as keel are united to enclose stamens and carpels. **This type of petal arrangement is seen in bean, gram, pea, indigofera etc.**

### Concepts:

#### 1. Morphology of Flowering Plants:

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---

### 176. Answer: d

#### Explanation:

Anther consists of microsporangia or pollen sacs. The archesporium gives rise to parietal cells and primary sporogenous tissue. Sporogenous cells divide to form pollen grain or microspore mother cells. They are diploid and connected by plasmodesmata. The microspore, mother cells consists of a callose wall inner to the cell wall. The mother cell then undergoes meiosis and forms tetrads of microspores. Finally the wall of the mother cell degenerates and pollen grains are separated.

#### Concepts:

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### An individual flower comprises the following parts -

- Pedicle
- Calyx

- Petals
  - Sepals
  - Stamen
  - Pistil
  - Receptacle
- 

177. Answer: d

### Explanation:

**Carotenoids** in higher plants primarily absorb violet and blue fractions of the visible spectrum of solar radiation. These pigments absorb light in the blue and violet regions and play a role in photosynthesis by capturing energy from these wavelengths and transferring it to chlorophyll for photosynthetic processes.

So, the correct option is (D): **Violet and Blue**

### Concepts:

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5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.

---

178. Answer: d

### Explanation:

The root tip is divided into four distinct zones, each characterized by primary meristematic tissues serving unique functions. The first zone is the root cap, consisting of parenchyma cells at the tip. The second zone is the zone of cell division, housing the apical meristem where cell division occurs approximately every 12-36 hours. In the third zone, known as the zone of elongation or enlargement, cells increase in length. Finally, in the fourth zone, called the zone of maturation, cells differentiate into specific cell types like epidermal cells and cortex cells. So, the accurate sequence is 'Root cap, cell division, cell enlargement, cell maturation.'

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---

179. Answer: a

### Explanation:

Cyclic photophosphorylation actually involves only Photosystem I (PS I), not both PS I and PS II. In cyclic photophosphorylation, electrons are cyclically passed through PS I to generate ATP without the production of NADPH. PS II is not involved in this process.

So, the correct option is (A): Cyclic photophosphorylation involves both PS I and PS II.

## Concepts:

### 1. Electron Transport System :

The **electron transport chain or system** is the sequence of electron carriers, enzymes, and cytochrome that passes electrons from one to another through the redox reaction. It is electron transport-linked phosphorylation.

It contains flavin nucleotides (FAD), nicotinamide adenine dinucleotide (NAD), coenzyme Q, and cytochromes localized in F1 particles of mitochondria. It occurs in the inner mitochondrial membrane along with cristae.

In this process five (5) complexes are involved namely, I- NADH-UQ reductase, II- Succinate-UQ reductase, III- UQH<sub>2</sub> -cytochrome C reductase, IV- Cytochrome C oxidase, and V is connected with F<sub>0</sub>-F<sub>1</sub> particles.

In this process, NAD and FAD are minimized.

#### Steps:

- **Redox at complex I:** Four (4) protons are pumped from the matrix to intermembrane space.
- **Redox at complex II:** Coenzyme Q collects the electrons from complex I and II, and goes to complex III.
- **Redox of complex III:** Four (4) protons are again pumped from matrix to intermembrane space and cytochrome C transports electrons to the complex IV.
- **Redox of complex IV:** Two (2) protons are pumped from the matrix to intermembrane space and the formation of water occurs in the matrix.
- **ATP synthase action:** It pumps protons from intermembrane space to matrix and generates ATP. It is associated with oxidative phosphorylation.

---

180. Answer: b

Explanation:

Mosses like Funaria are bryophytes. They are non-vascular plants. The main plant body is gametophytic (n) which is independent and foliose. It forms major part of the life cycle. The sporophytic 44 phase starts with zygote which divides to form sporogenous tissue that is differentiated into foot, seta and capsule. The sporophytic phase is short lived. The foot absorbs nutrients and provides support to the sporophyte.

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---

181. Answer: a

### Explanation:

Radial or actinomorphic symmetry is found in flowers like mustard. Datura, Chilli.

### Concepts:

#### 1. Morphology of Flowering Plants:

[Morphology in flowering plants](#) tells us that every plant has two systems such as a **root system** and a **shoot system**. The root system digs deep into the ground and structures a system of its own. On the other hand, the shoot system is the one that is above ground level and includes various plant parts.

#### Root System

The descending part of the plant grows under the soil roots. During the germination process, the radicle from the seed grows earthward and branches out. The branches along with the primary root are called the root system. Roots lack chlorophyll and therefore they are not green in color. Roots are positively geotropic and hydrotropic, that is, they grow downwards ground and water, and negatively phototropic, which is growing away from light.

**There are three types of root systems found in plants are as follows:**

1. TapRoot System
2. Fibrous Root System
3. Adventitious Root System

#### Shoot System

The stem is also an essential element of the plant. It is the ascending portion of the plant axis that bears branches, flowers, leaves, and fruits, as well as aiding in water and mineral conduction. It is the plant's aerial portion, brought about from an embryo's plumule or germinating seeds. Young stems are ordinarily green, but they finally turn woody and brown.

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182. Answer: b

**Explanation:**

Parthenocarpic fruits are the fruits which are formed without fertilisation. These fruits are naturally seedless, e.g., banana.

**Concepts:**

**1. Sexual Reproduction in Flowering Plants:**

[Sexual reproduction in flowering plants](#) takes place or happens when the production of a new organism occurs from two parents by making use of their gametes or sex cells. Both [sexual and asexual reproduction](#) can be found in plants. Nearly all flowering plants reproduce sexually. Flowers play a captious role in the process as it carries both the male and female reproductive parts commonly known as [androecium](#) and gynoecium respectively.

**An individual flower comprises the following parts -**

- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

---

183. Answer: a

**Explanation:**

The primary reason for considering *Nicotiana sylvestris* and *Nicotiana tabacum* as separate species is indeed that they cannot interbreed in nature due to their different flowering responses to photoperiods.

So, the correct option is (A): They cannot interbreed in nature

**Concepts:****1. Photoperiodism:**

Photoperiodism, the functional or behavioral response of an organism to changes of duration in daily, seasonal, or yearly cycles of light and darkness. Photoperiodic reactions can be reasonably predicted, but temperature, nutrition, and other environmental factors also modify an organism's response. In animals, the regular activities of migration, reproduction, and the changing of coats or plumage can be induced out of season by artificially altering daylight. Birds, for example, have migrated north in the winter after having been exposed to reversed seasonal lighting in laboratories.

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**184. Answer: c****Explanation:**

In the electron transport chain (ETC), the exact number of ATP molecules generated per molecule of  $\text{NADH} + \text{H}^+$  and  $\text{FADH}_2$  varies depending on the specific conditions and organism. In general, each molecule of  $\text{NADH} + \text{H}^+$  produces approximately 3 ATP molecules, while each molecule of  $\text{FADH}_2$  typically produces about 2 ATP molecules. So, the statement as presented is not entirely accurate, and it varies based on the specific details of the system.

So, the correct option is (C): In ETC (Electron Transport Chain), one molecule of  $\text{NADH} + \text{H}^+$  gives rise to 2 ATP molecules, and one  $\text{FADH}_2$  gives rise to 3 ATP molecules

**Concepts:****1. Photosynthesis in Higher Plants:****Processes Of Photosynthesis in Higher Plants:**

Photosynthesis in higher plants involves the following processes:

- Light Reaction

- Dark Reaction

## Light Reaction:

- This phenomenon occurs in the presence of light.
- The pigment absorbs light and produces energy in the form of ATP.
- The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

## Dark Reaction:

This process occurs in the absence of light in the stroma of the chloroplasts. The following cycles are involved in the process:

1. Calvin Cycle (C3 Cycle)
2. C4 Cycle (Hatch and Slack Pathway)

---

185. Answer: b

## Explanation:

Both vessel elements in xylem and sieve tube elements in phloem have pores on their lateral walls. These pores facilitate the movement of water and nutrients through these cells. Vessel elements have pits, and sieve tube elements have sieve plates with pores to allow for transport.

So, the correct option is (B): pores on lateral walls.

## Concepts:

### 1. Anatomy of Flowering Plants:

[Anatomy of flowering plants](#) is the study of the structure and organization of the different parts of the plant body that are involved in reproduction, growth, and development. The flowering plants, also known as angiosperms, are the largest and most diverse group of plants on Earth, and their anatomy is highly specialized to meet the specific needs of these organisms.

The anatomy of flowering plants can be divided into two main parts: the root system and the shoot system. The root system is responsible for anchoring the plant in the soil, absorbing water and nutrients, and storing food. The shoot system, on the other hand, consists of the stem, leaves, flowers, and fruits, and is responsible for [photosynthesis](#), [reproduction](#), and growth.

The stem of a flowering plant is composed of several layers of tissue, including the epidermis, cortex, and vascular tissue, which are specialized for different functions such as support, transport, and storage. The leaves are also composed of several layers of tissue, including the epidermis, mesophyll, and vascular tissue, and are specialized for photosynthesis and gas exchange.

**Read More:** [Reproduction in Plants](#)

The flowers of flowering plants are the reproductive structures that produce seeds, and their anatomy is highly diverse and specialized to attract pollinators and facilitate fertilization. The different parts of the flower, such as the sepals, petals, stamens, and pistil, are arranged in specific patterns and shapes that are unique to each species.

Understanding the anatomy of flowering plants is essential for plant scientists, farmers, and gardeners, as it provides insights into the growth, development, and reproductive biology of these organisms, and can help to improve crop yields and plant breeding efforts.

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**186. Answer: a**

### **Explanation:**

In gymnosperms, the pollen chamber is a cavity in the ovule in which pollen grains are stored after pollination. Within the pollen chamber, the generative cell nucleus divides to form two gametic nuclei and the tube cell elongates to form the pollen tube. The pollen tube penetrates the female gametophyte and the gametic nuclei (also known as sperm nuclei) pass through the tube. One of them unites with an oosphere (the female gamete) and forms the zygote ( $2n$ ). Hence, option B is correct.

### **Concepts:**

## 1. Plant Kingdom:

The Plant Kingdom comprises all the plants that have some shared characteristics. These are **bacteria** (prokaryotes), photosynthetic plants, **fungi**, and several non-photosynthetic plants.

Read Also: [Two Kingdom Classification](#)

### Several features of Kingdom Plantae are as follows:

- They are stationary. They are static and usually remain in one place only.
- They have branches that expanded and green leaves due to the presence of **chlorophyll**.
- They are an **autotrophic mode of nutrition** that simply means they prepare their food with the help of water, sunlight and carbon dioxide. It is further known as self-nutrition.
- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.
- They store their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **cellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

187. Answer: d

### Explanation:

Velamen is found in aerial roots of orchids. In many epiphytic orchids, the aerial roots are covered by a hygroscopic velamen tissue. They absorb water from the atmosphere.

### Concepts:

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### Root System

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---

188. **Answer: a**

### Explanation:

In *Adiantum caudatum*, adventitious buds develop at the leaf tips. When such leaf tips happen to touch the soil, they form new plant. This process helps in propagation of this fern to a large area. *Adiantum caudatum* is commonly called as walking j fern.

## Concepts:

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**An individual flower comprises the following parts –**

- Pedicle
  - Calyx
  - Petals
  - Sepals
  - Stamen
  - Pistil
  - Receptacle
- 

189. Answer: d

### Explanation:

Premature yellowing of leaves is often associated with chlorophyll deficiency, which can be caused by a lack of essential nutrients like iron and magnesium. Chlorophyll is crucial for photosynthesis, and its synthesis depends on the availability of these nutrients. By applying iron and magnesium, you can potentially address the underlying issue of chlorophyll deficiency and promote healthy green leaves capable of photosynthesis, ultimately contributing to better seed yield. While the other options may have some benefits, addressing the nutrient deficiency is a more direct approach to combat leaf yellowing and improve overall plant health and seed yield.

So, the correct option is (D): Application of iron and magnesium to promote synthesis of chlorophyll

## Concepts:

### 1. Plant Growth and Development:

#### Growth in Plants:

Plants have the distinctive ability to grow throughout their life. The meristem cells present there in the [roots](#) and shoot apical lead to the primary growth of the plant. The primary growth which happens or takes place at the tips of the stem and roots of the plant contributes to the elongation of the plant along its axis.

In the later stages of growth in plants, the growth in dicotyledonous, [vascular cambium](#), [gymnosperms](#), and cork-cambium are also caused by the existence of meristems in them. These intercalary meristems are put up to increase the girth of the organs of the plant in which they are active. Such type of growth is commonly known as secondary growth.

Many parameters such as area, volume, fresh weight, cell number, dry weight, length, etc are utilized to measure the growth in plants as increase in the amount of protoplasm is responsible for the growth in plants.

Read More: [Plant Growth and Development](#)

---

### 190. Answer: b

#### Explanation:

Photorespiration primarily takes place in the chloroplasts and peroxisomes of plant cells. In the chloroplasts, it involves the oxygenase activity of ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO), and in the peroxisomes, the glycolate pathway is involved in processing the products of oxygenation.

So, the correct option is (B): stroma of chloroplasts and peroxisomes

## Concepts:

### 1. Biodiversity and Conservation:

The term 'biodiversity' is derived from the two words- 'bios' which means life and 'diversity' i.e, differentiation or variation. Edward Wilson, the sociobiologist was the first to popularise the term 'biodiversity' in the year 1992. The term implies the occurrence of various plants and animals along with their variants such as biotypes, ecotypes and genes on earth. In our biosphere, the immense diversity or heterogeneity remains not only at the species level but also, at every level of biological organization that ranges from macromolecules in the cells to biomes.

[Biodiversity and Conservation](#) is a topic covered under the fifteenth chapter and Unit 5 of NCERT class 12 biology.

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## 191. Answer: b

### Explanation:

In Pinus! Cycas! gymnosperms the endosperm is haploid because it is produced before fertilization.

### Concepts:

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- They indulge in photosynthesis during the day and therefore more carbon dioxide is needed during the day and at night it is released.

- They secure their food in the form of starch-like **algae**.
- They have an inelastic wall around their cell known as a cell wall comprised of **c ellulose**.
- There is an absence of the nervous system and excretory system.
- Reproduction is entirely dependent on air, insects and water. Asexual and vegetative method of reproduction is noticed or detected.
- The non-photosynthetic plants acquire their food through **parasitism**, i.e through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

192. Answer: a

### Explanation:

Vexillary or descending imbricate aestivation is a characteristic of family fabaceae. In it, the posterior largest petal (standard) overlaps two lateral petals (wings) which in turn overlap two anterior petals (keel). It is also called pailionaceous corolla.

### Concepts:

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---

193. Answer: a

### Explanation:

Sporopollenin cannot be degraded by enzyme; strong acids and alkali, therefore it is helpful in preserving pollen as fossil.

Pollenkitt – Help in insect pollination.

Cellulosic Intine – Inner sporoderm layer of pollen grain known as intine made up cellulose & pectin.

Oil content – No role is pollen preservation.

### Concepts:

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**An individual flower comprises the following parts –**

- Pedicle
- Calyx

- Petals
  - Sepals
  - Stamen
  - Pistil
  - Receptacle
- 

194. Answer: d

### Explanation:

Coconut milk factor is commonly associated with being a source of cytokinins, which are a type of plant hormone. Cytokinins are involved in various plant growth and development processes, including cell division and differentiation.

So, the correct option is (D): Cytokinin

### Concepts:

#### 1. Plant Growth Regulators:

### What is a plant growth regulator?

[Plant growth regulators \(PGRs\)](#) are chemicals used to modify plant growth such as increasing branching, suppressing shoot growth, increasing return bloom, removing excess fruit, or altering fruit maturity.

### Types of Plant Growth:

There are the following types of plant growth.

- **Primary and Secondary Growth:** The growth of a plant is termed primary when the same happens through the mitotic division of the meristematic [cells](#) which are present at the root and the shoot of the plants.

Whereas, the secondary growth in a plant takes place through the division of the secondary meristem, which, in turn increases the diameter of the body of the plants.

- **Primary and Secondary Plant Growth**
- Unlimited Growth

- Limited Growth
- Vegetative Growth
- Reproductive Growth

## The five groups of plant growth regulators used in fruit crops include:

1. **Auxins:** [Auxins](#) are one of the most important plant hormones. The chief naturally occurring auxin is indole-3 acetic acid – IAA and other related compounds.
2. **Gibberellins:** [Gibberellins](#) are an extensive chemical family based on the ent-gibberellane structure. The first gibberellin to be discovered was gibberellic acid. Now there are more than 100 types of gibberellins.
3. **Cytokinins:** These are produced in the regions where cell division occurs; mostly in the roots and shoots. They help in the production of new leaves, lateral shoot growth, chloroplasts in leaves etc.
4. **Abscissic Acid:** Abscissic acid controls the dormancy of buds and seeds, inhibits shoot growth and is involved in regulating water loss from plants.
5. **Ethylene:** Ethylene is a simple, gaseous plant growth regulator, synthesised by most of the plant organs includes ripening fruits and ageing tissues.

---

195. Answer: b

### Explanation:

In gymnosperms (like Pinus), the male and female gametophyte do not have an independent free living existence. They remain within the sporangia retained on the sporophytes i.e., female gametophyte (within megasporangium) and male gametophyte (within microsporangium). In bryophytes like Marchantia and Funaria, the main plant body is a gametophyte which is independent and the sporophyte is partially or fully dependent on gametophytic generation. In pteridophytes (like Pteris), gametophyte is usually independent and sporophyte is the dominant phase in the life cycle.

### Concepts:

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- The non-photosynthetic plants acquire their food through **parasitism**, i.e. through their host like Indian pipe.

Read More: [Classification of Plants](#)

---

196. Answer: d

### Explanation:

Vivipary is a characteristic of halophytes. Halophytes grow in saline conditions, and hence are adapted for viviparous germination. It is germination of seed inside the fruit while it is attached to plant.

### Concepts:

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---

**197. Answer: d**

### Explanation:

Meiosis is best observed in dividing microsporocytes. Microsporocytes or microspore mother cell after meiosis give rise to microspore. Other cells do not divide by meiosis.

### Concepts:

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- Pedicle
- Calyx
- Petals
- Sepals
- Stamen
- Pistil
- Receptacle

---

198. Answer: b

### Explanation:

When you prune a hedge, especially by cutting the main or apical shoot, it removes the dominant growth point and allows the dormant axillary buds along the branches to start growing. These axillary buds give rise to new shoots and branches, creating a denser and bushier hedge over time. This process is often referred to as "breaking apical dominance" and is a common technique used in hedge maintenance and shaping.

So, the correct option is (B): It frees axillary buds from apical dominance

### Concepts:

## 1. Plant Growth and Development:

### Growth in Plants:

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In the later stages of growth in plants, the growth in dicotyledonous, [vascular cambium](#), [gymnosperms](#), and cork-cambium are also caused by the existence of meristems in them. These intercalary meristems are put up to increase the girth of the organs of the plant in which they are active. Such type of growth is commonly known as secondary growth.

Many parameters such as area, volume, fresh weight, cell number, dry weight, length, etc are utilized to measure the growth in plants as increase in the amount of protoplasm is responsible for the growth in plants.

Read More: [Plant Growth and Development](#)

---

199. Answer: c

### Explanation:

Isogamy is found in Spirogyra in which both gametes are non-motile. In Chlamydomonas, all three conditions, isogamy anisogamy and oogamy are found. Both motile and non-motile gametes are found. In Volvox and Fucus, oogamy is present, where non-motile egg fuses with motile sperm.

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Read More: [Classification of Plants](#)

200. Answer: d

**Explanation:**

Some plants (for example mangroves) are viviparous in which the seed germinates within the fruit, while attached to the plant.

**Concepts:**

## 1. Morphology of Flowering Plants:

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