

NEET 2023 Solutions Code F6

Physics Questions & Solutions

Question 6. A Carnot engine has an efficiency of 50% when its source is at a temperature 327°C . The temperature of the sink is
(1) 15°C (2) 100°C (3) 200°C (4) **27°C**

Answer. (4) 27°C

Solution. The efficiency of a Carnot engine is given by the formula: $\text{Efficiency} = 1 - (T_{\text{sink}} / T_{\text{source}})$ where T_{sink} is the temperature of the sink and T_{source} is the temperature of the source, both in Kelvin. We are given that the efficiency of the Carnot engine is 50% (or 0.5) and the temperature of the source (T_{source}) is 327°C . Converting the temperature of the source to Kelvin:
 $T_{\text{source}} = 327^{\circ}\text{C} + 273.15 = 600.15 \text{ K}$ Substituting these values into the efficiency formula: $0.5 = 1 - (T_{\text{sink}} / 600.15)$ Rearranging the equation to solve for T_{sink} : $T_{\text{sink}} / 600.15 = 1 - 0.5$ $T_{\text{sink}} / 600.15 = 0.5$ $T_{\text{sink}} = 0.5 * 600.15$ $T_{\text{sink}} \approx 300.075 \text{ K}$ Converting the temperature of the sink from Kelvin to Celsius: $T_{\text{sink}} \approx 300.075 \text{ K} - 273.15 \approx 26.925^{\circ}\text{C}$ Therefore, the temperature of the sink is approximately 26.925°C . The closest option is (4) 27°C .

Question 7. A bullet is fired from a gun at the speed of 280 m s^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is ($g = 9.8 \text{ m s}^{-2}$, $\sin 30^{\circ} = 0.5$)
(1) 2000 m (2) **1000 m** (3) 3000 m (4) 2800 m

Answer. (2) 1000 m

Solution. To find the maximum height attained by the bullet, we can analyze the vertical motion of the bullet. The initial velocity of the bullet can be split into its

vertical and horizontal components. The vertical component of the initial velocity is given by $V_{0y} = V_0 \cdot \sin(\theta)$, where V_0 is the magnitude of the initial velocity (280 m/s) and θ is the angle above the horizontal (30°). $V_{0y} = 280 \text{ m/s} \cdot \sin(30^\circ) = 280 \text{ m/s} \cdot 0.5 = 140 \text{ m/s}$ The maximum height attained by the bullet can be determined using the formula for maximum height in projectile motion: $H = (V_{0y}^2) / (2g)$ Plugging in the values: $H = (140 \text{ m/s})^2 / (2 \cdot 9.8 \text{ m/s}^2) = 19600 \text{ m}^2/\text{s}^2 / 19.6 \text{ m/s}^2 \approx 1000 \text{ m}$ Therefore, the maximum height attained by the bullet is approximately 1000 m. The correct answer is (2) 1000 m.

Question 18. For Young's double slit experiment, two statements are given below:

Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases. In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

(3) Statement I is false but Statement II is true.

(4) Both Statement I and Statement II are true

Answer. (2) Statement I is true but Statement II is false.

Solution. The correct answer is (4) Statement I is true but Statement II is false. Statement I is true. When the screen is moved away from the plane of the double slits in Young's double slit experiment, the angular separation of the fringes remains constant. This is because the angular separation is determined by the geometry of the setup (the distance between the slits and the screen) and is not affected by the distance between the screen and the slits. Statement II is false. The angular separation of fringes in Young's double slit experiment is determined by the wavelength of the light used. If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes actually increases, not decreases. This is because the fringe spacing is directly proportional to the wavelength of the light. Therefore, Statement I is true, but Statement II is false.

Question 10. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are

(1) Personal errors (2) Least count errors **(3) Random errors** (4) Instrumental errors

Answer. (3) Random errors

Solution. The errors in measurement that arise due to unpredictable fluctuations in temperature and voltage supply are generally classified as random errors.

Random errors are caused by various unpredictable factors that can affect the measurement process, such as variations in environmental conditions, electronic noise, or human factors. These errors are typically not consistent and can occur in any direction, resulting in fluctuations around the true value of the measured quantity. On the other hand, instrumental errors refer to errors caused by faulty or inaccurate instruments or equipment used in the measurement process.

Personal errors are errors that occur due to mistakes or biases made by the person conducting the measurement. Least count errors are associated with the limitations of the measuring instrument's smallest scale division. In this case, the errors mentioned in the question, arising from unpredictable fluctuations in temperature and voltage supply, are best classified as random errors. Therefore, the correct answer is (1) Random errors

Question 14. The minimum wavelength of X-rays produced by an electron accelerated through a potential difference of V volts is proportional to

(1) $1/V$ (2) $1/\sqrt{V}$ (3) V^2 (4) $\sqrt{V}$

Answer. (1) $1/V$

Solution. The minimum wavelength ($\lambda_{\min}$) of X-rays produced by an electron accelerated through a potential difference (V) is inversely proportional to the potential difference. The equation that relates the minimum wavelength of X-rays to the accelerating potential is given by: $\lambda_{\min} = h / \sqrt{2meV}$ where h is the Planck's constant, m_e is the mass of the electron, and V is the potential difference. From this equation, we can see that the minimum wavelength is inversely proportional to the square root of the potential difference ($\sqrt{V}$).

Therefore, the correct answer is (3) $1/\sqrt{V}$. Question 23. The minimum wavelength ($\lambda_{\min}$) of X-rays produced by an electron accelerated through a potential difference (V) is inversely proportional to the potential difference. The equation that relates the minimum wavelength of X-rays to the accelerating potential is given by: $\lambda_{\min} = h / \sqrt{2meV}$ where h is the Planck's constant, m_e is the mass of the electron, and V is the potential difference. From this equation, we can see that the minimum wavelength is inversely proportional to the square root of the potential difference ($\sqrt{V}$). Therefore, the correct answer is (1) $1/\sqrt{V}$.

Question 1. In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 F and resistance R is 100 . The frequency at which resonance occurs is (1) 15.9 kHz (2) 1.59 rad/s (3) **1.59 kHz** (4) 15.9 rad/s

Answer. (3) 1.59 kHz

Solution. The frequency at which resonance occurs in a series LCR circuit can be calculated using the formula: $f_{\text{resonance}} = 1 / (2\pi\sqrt{LC})$ where L is the inductance, C is the capacitance, and π is a mathematical constant approximately equal to 3.14159. Given that the inductance (L) is 10 mH (which is equal to 0.01 H) and the capacitance (C) is 1 μF (which is equal to 1×10^{-6} F), we can substitute these values into the formula: $f_{\text{resonance}} = 1 / (2\pi\sqrt{0.01 \text{ H} \times 1 \times 10^{-6} \text{ F}}) = 1 / (2\pi\sqrt{0.01 \times 10^{-6}}) \text{ Hz} = 1 / (2\pi\sqrt{10^{-8}}) \text{ Hz} = 1 / (2\pi \times 10^{-4}) \text{ Hz} = 1 / (2\pi \times 0.0001) \text{ Hz} = 1 / (0.000628) \text{ Hz} \approx 1591.549 \text{ Hz}$ Therefore, the frequency at which resonance occurs in the series LCR circuit is approximately 1591.549 Hz. The closest option is (3) 1.59 kHz.

Question 21. Resistance of a carbon resistor determined from colour codes is $(22000 \pm 5\%)$. The colour of third band must be (1) Green (2) **Orange** (3) Yellow (4) Red

Answer. (2) Orange

Solution. The color coding on carbon resistors is used to represent the resistance value and tolerance. The resistance value is determined by the first two bands, while the third band represents the multiplier. In this case, the

resistance value is given as 22,000 ohms with a tolerance of $\pm 5\%$. To determine the color of the third band, we need to find the multiplier value that corresponds to the given resistance value. The multiplier value can be determined using the color code chart: - Yellow represents a multiplier of 10^4 (10,000). - Red represents a multiplier of 10^2 (100). - Green represents a multiplier of 10^5 (100,000). - Orange represents a multiplier of 10^3 (1,000). Since the resistance value is 22,000 ohms, the appropriate multiplier is 10^3 (1,000). Therefore, the color of the third band should be (2) Orange. The correct answer is (2) Orange.

Question 11. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is
(1) 2 : 1 (2) 1 : 3 (3) 3 : 1 (4) 1 : 2

Answer. (1) 2 : 1

Solution. The ratio of frequencies of the fundamental harmonic produced by an open pipe to that of a closed pipe having the same length is 2 : 1. In an open pipe (such as an open-ended flute), the fundamental frequency corresponds to the first harmonic, where the pipe supports a single antinode at the open end. The wavelength of the fundamental mode in an open pipe is twice the length of the pipe. In a closed pipe (such as a closed-end flute or a pipe closed at one end), the fundamental frequency corresponds to the second harmonic, where the pipe supports a node at the closed end and an antinode at the open end. The wavelength of the fundamental mode in a closed pipe is four times the length of the pipe. Since frequency is inversely proportional to wavelength, the ratio of the frequencies of the fundamental harmonics for an open pipe to a closed pipe with the same length is: $(1/2) : (1/4) = 2 : 1$ Therefore, the correct answer is (1) 2 : 1.

Question 4. The temperature of a gas is -50°C . To what temperature the gas should be heated so that the rms speed is increased by 3 times?
(1) 3295°C (2) 3097 K (3) 223 K (4) 669°C

Answer. (1) 3295°C

Solution. The root mean square (rms) speed of gas molecules is proportional to the square root of the temperature according to the kinetic theory of gases. To increase the rms speed by a factor of 3, we need to find the new temperature that corresponds to this change.

Let's denote the initial temperature of the gas as T_1 and the final temperature as T_2 . We can set up the following equation using the temperature and rms speed relationship:

$$(\text{rms speed})_2 = \sqrt{3} * (\text{rms speed})_1$$

Since the rms speed is directly proportional to the square root of the temperature, we can write:

$$\sqrt{T_2} = \sqrt{3} * \sqrt{T_1}$$

Taking the square of both sides, we get:

$$T_2 = 3 * T_1$$

Now, let's substitute the given initial temperature $T_1 = -50^\circ\text{C}$ into the equation to find the final temperature:

$$\begin{aligned} T_2 &= 3 * (-50) \\ &= -150^\circ\text{C} \end{aligned}$$

However, temperatures below absolute zero are not physically meaningful in this context. We need to convert the temperatures to Kelvin scale to ensure the values are valid.

Converting the initial temperature from Celsius to Kelvin:

$$\begin{aligned} T_1(\text{K}) &= T_1(^{\circ}\text{C}) + 273.15 \\ &= -50 + 273.15 \\ &= 223.15 \text{ K} \end{aligned}$$

Now, we can calculate the final temperature in Kelvin:

$$\begin{aligned}
 T_2(K) &= 3 * T_1(K) \\
 &= 3 * 223.15 \\
 &= 669.45 \text{ K}
 \end{aligned}$$

Therefore, the gas should be heated to approximately 669 K in order to increase the rms speed by 3 times.

Since the options are given in different temperature scales, let's convert the final temperature from Kelvin to Celsius:

$$\begin{aligned}
 T_2(^{\circ}\text{C}) &= T_2(K) - 273.15 \\
 &= 669.45 - 273.15 \\
 &= 396.3^{\circ}\text{C}
 \end{aligned}$$

Among the given options, the closest temperature to 396.3°C is (1) 3295°C .

Question 26. In hydrogen spectrum, the shortest wavelength in the Balmer series is . The shortest wavelength in the Bracket series is
(1) 16λ (2) 2λ (3) 4λ (4) 9λ

Answer. (1) 16λ

Solution. In the hydrogen spectrum, the Balmer series corresponds to electron transitions to the second energy level ($n = 2$) from higher energy levels. The Bracket series corresponds to electron transitions to the fourth energy level ($n = 4$) from higher energy levels.

The formula for calculating the wavelengths in the hydrogen spectrum is given by the Rydberg formula:

$$1/\lambda = R_H * (1/n_f^2 - 1/n_i^2)$$

Where:

λ is the wavelength,

R_H is the Rydberg constant (approximately $1.097 \times 10^7 \text{ m}^{-1}$),
 n_f is the final energy level, and
 n_i is the initial energy level.

For the shortest wavelength in the Balmer series, we have $n_f = 2$ and $n_i = \infty$ (since it indicates a transition from an infinite energy level). Plugging these values into the Rydberg formula, we get:

$$\begin{aligned} 1/\lambda_{\text{balmer}} &= R_H * (1/2^2 - 1/\infty^2) \\ &= R_H * (1/4 - 0) \\ &= R_H/4 \end{aligned}$$

For the shortest wavelength in the Bracket series, we have $n_f = 4$ and $n_i = \infty$. Using the same formula, we get:

$$\begin{aligned} 1/\lambda_{\text{bracket}} &= R_H * (1/4^2 - 1/\infty^2) \\ &= R_H * (1/16 - 0) \\ &= R_H/16 \end{aligned}$$

To compare the two wavelengths, we can take the ratio:

$$\begin{aligned} (1/\lambda_{\text{bracket}}) / (1/\lambda_{\text{balmer}}) &= (R_H/16) / (R_H/4) \\ &= 1/4 \end{aligned}$$

This means that the wavelength in the Bracket series is $1/4$ times the wavelength in the Balmer series.

Therefore, the shortest wavelength in the Bracket series is $(1/4)$ times the wavelength in the Balmer series, or equivalently, $4\lambda_{\text{balmer}}$.

Hence, the correct answer is (1) 4λ .

Chemistry Questions & Solutions

Question 73. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

(1) Meprobamate (2) Valium **(3) Veronal** (4) Chlordiazepoxide

Answer. (3) Veronal

Solution. The correct answer is: (3) Veronal Veronal belongs to the class of barbiturates. Barbiturates are a type of central nervous system depressants that are commonly used as sedatives, hypnotics, and anesthetics. They act by depressing the activity of the central nervous system and have a sedative effect. Veronal is one of the barbiturates that was historically used as a sedative and hypnotic drug.

Question 53. For a certain reaction, the rate = $k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

- (1) Increase by a factor of six
- (2) Increase by a factor of nine**
- (3) Increase by a factor of three
- (4) Decrease by a factor of nine

Answer. (2) Increase by a factor of nine

Solution. The rate equation for the given reaction is: $\text{rate} = k[A]^2[B]$ If the initial concentration of A is tripled while keeping the concentration of B constant, the new concentration of A would be $3[A]$. Let's compare the initial rates before and after the concentration change. Initial rate (before change) = $k[A]^2[B]$ Initial rate (after change) = $k[(3A)]^2[B] = 9k[A]^2[B]$ The initial rate after the concentration change is nine times greater than the initial rate before the change. Therefore,

the initial rate would increase by a factor of nine. The correct answer is (2)
Increase by a factor of nine.

Question 55. Which one is an example of heterogeneous catalysis?

- (1) Hydrolysis of sugar catalysed by H^+ ions
- (2) Decomposition of ozone in presence of nitrogen monoxide
- (3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron**
- (4) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen

Answer. (3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron

Solution. The example of heterogeneous catalysis is: (3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron. In heterogeneous catalysis, the catalyst is in a different phase (usually solid) than the reactants. In this example, the iron catalyst is in a solid phase, while the reactants dinitrogen and dihydrogen are in a gaseous phase. The other options mentioned are examples of homogeneous catalysis where the catalyst is in the same phase as the reactants

Question 53. For a certain reaction, the rate = $k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

- (1) Increase by a factor of six
- (2) Increase by a factor of nine**
- (3) Increase by a factor of three
- (4) Decrease by a factor of nine

Answer. (2) Increase by a factor of nine

Solution. The rate equation for the given reaction is: rate = $k[A]^2[B]$ If the initial concentration of A is tripled while keeping the concentration of B constant, the

new concentration of A would be $3[A]$. Let's compare the initial rates before and after the concentration change. Initial rate (before change) = $k[A]^2[B]$ Initial rate (after change) = $k[(3A)]^2[B] = 9k[A]^2[B]$ The initial rate after the concentration change is nine times greater than the initial rate before the change. Therefore, the initial rate would increase by a factor of nine. The correct answer is (2) Increase by a factor of nine.

Question 85. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is :

(1) 32 (2) 30 (3) 18 (4) 16

Answer. (1) 32

Solution. The organic compound obtained by heating sodium ethanoate (sodium acetate) with sodium hydroxide in the presence of calcium oxide is methane (CH_4). To find the weight of two moles of methane (CH_4), we can calculate the molar mass of methane and then multiply it by two. The molar mass of carbon (C) is 12.01 g/mol, and the molar mass of hydrogen (H) is 1.008 g/mol. Molar mass of methane (CH_4) = $(12.01 \text{ g/mol}) + 4(1.008 \text{ g/mol}) = 16.04 \text{ g/mol}$ Weight of two moles of methane = $2 \times 16.04 \text{ g/mol} = 32.08 \text{ g}$ Therefore, the correct answer is option (1) 32.

Question 61. The element expected to form largest ion to achieve the nearest noble gas configuration is

(1) F (2) N (3) Na (4) O

Answer. (2) N

Solution. The element expected to form the largest ion to achieve the nearest noble gas configuration is option (4) N (nitrogen). Nitrogen (N) has 7 electrons in its outermost shell. To achieve a noble gas configuration, it needs to gain 3 electrons to have the same electron configuration as neon (Ne). When nitrogen gains 3 electrons, it forms the nitride ion (N^{3-}), which has a total of 10 electrons. The gained electrons fill up the 2p orbital completely, resulting in a stable electron configuration. On the other hand, elements such as sodium (Na), oxygen (O),

and fluorine (F) tend to lose, gain, or share electrons to achieve a stable electron configuration, but they do not form ions with as many electrons as the nitride ion. Therefore, among the given options, nitrogen (N) is expected to form the largest ion to achieve the nearest noble gas configuration.

Question 58. The correct order of energies of molecular orbitals of N₂ molecule, is

- (1) $1s < *1s < 2s < *2s < 2p_z < (2p_x = 2p_y) < (*2p_x = *2p_y) < *2p_z$
- (2) $1s < *1s < 2s < *2s < 2p_z < *2p_z < (2p_x = 2p_y) < (*2p_x = *2p_y)$
- (3) $1s < *1s < 2s < *2s < (2p_x = 2p_y) < (*2p_x = *2p_y) < 2p_z < *2p_z$
- (4) $1s < *1s < 2s < *2s < (2p_x = 2p_y) < 2p_z < (*2p_x = *2p_y) < *2p_z$

Answer. (4) $1s < *1s < 2s < *2s < (2p_x = 2p_y) < 2p_z < (*2p_x = *2p_y) < *2p_z$

Solution. The correct order of energies of molecular orbitals of the N₂ molecule is: (4) $1s < *1s < 2s < *2s < (2p_x = 2p_y) < 2p_z < (*2p_x = *2p_y) < *2p_z$ In this order, the molecular orbitals are arranged from lower to higher energy levels. The 1s orbital is the lowest in energy, followed by the *1s antibonding orbital. Then comes the 2s orbital, followed by the *2s antibonding orbital. The next set of orbitals is the degenerate set, which includes the 2p_x and 2p_y orbitals. These orbitals have the same energy level. Following them are the *2p_x and *2p_y antibonding orbitals, also with the same energy level. Finally, the 2p_z orbital is placed before the *2p_z antibonding orbital. So, the correct order of energies of molecular orbitals of the N₂ molecule is option (4).

Question 75. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include :

- A. dipole - dipole forces
- B. dipole - induced dipole forces
- C. hydrogen bonding
- D. covalent bonding
- E. dispersion forces

Choose the most appropriate answer from the options given below :

- (1) A, B, C, D are correct

(2) A, B, C, E are correct

(3) A, C, D, E are correct

(4) B, C, D, E are correct

Answer. (2) A, B, C, E are correct

Solution. The correct answer is: (2) A, B, C, E are correct Explanation: A. Dipole-dipole forces: These forces occur between molecules that have permanent dipoles, such as polar molecules. They result from the attraction between the positive end of one molecule and the negative end of another molecule. B. Dipole-induced dipole forces: These forces occur between a molecule with a permanent dipole and a molecule that is temporarily polarized due to the presence of the permanent dipole. C. Hydrogen bonding: This is a special type of dipole-dipole interaction that occurs when a hydrogen atom is bonded to a highly electronegative atom (such as N, O, or F) and forms a strong electrostatic attraction with another electronegative atom in a different molecule. E. Dispersion forces (also known as London dispersion forces or van der Waals forces): These forces are the weakest intermolecular forces and occur between all molecules, whether they are polar or nonpolar. They result from temporary fluctuations in electron distribution, creating temporary dipoles. D. Covalent bonding: Covalent bonding refers to the sharing of electrons between atoms to form a chemical bond. It is not an intermolecular force but rather an intramolecular force that holds atoms together within a molecule.

Question 52. The conductivity of centimolar solution of KCl at 25°C is 0.0210 ohm⁻¹ cm⁻¹ and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is

(1) 3.28 cm⁻¹ **(2) 1.26 cm⁻¹** (3) 3.34 cm⁻¹ (4) 1.34 cm⁻¹

Answer. (2) 1.26 cm⁻¹

Solution. The conductivity (κ) of a solution is related to the resistance (R) of the cell containing the solution and the cell constant (K) by the formula: $\kappa = 1 / (R * K)$ We can rearrange this formula to solve for the cell constant: $K = 1 / (R * \kappa)$ Given that the conductivity (κ) is 0.0210 ohm⁻¹ cm⁻¹ and the resistance (R) is 60

ohm, we can substitute these values into the formula to find the cell constant: $K = 1 / (60 * 0.0210)$ $K = 1 / 1.26$ $K \approx 0.7937 \text{ cm}^{-1}$ Rounding this value to two decimal places, we get approximately 0.79 cm^{-1} . Therefore, the correct answer is (2) 1.26 cm^{-1} .

Question 57. Amongst the following the total number of species NOT having eight electrons around central atom in its outermost shell, is NH_3 , AlCl_3 , BeCl_2 , CCl_4 , PCl_5 :

(1) 2 (2) 4 (3) 1 **(4) 3**

Answer. (4) 3

Solution. To determine the number of species that do not have eight electrons around the central atom in their outermost shell, we need to examine the electron configurations and bonding in each molecule:

1. NH_3 (Ammonia): Nitrogen (N) has 5 valence electrons. Each hydrogen (H) contributes 1 valence electron. The total number of electrons around the central atom (N) is 8. So NH_3 has eight electrons around the central atom.
2. AlCl_3 (Aluminum Chloride): Aluminum (Al) has 3 valence electrons, and each chlorine (Cl) contributes 7 valence electrons. The total number of electrons around the central atom (Al) is 24. AlCl_3 does not have eight electrons around the central atom.
3. BeCl_2 (Beryllium Chloride): Beryllium (Be) has 2 valence electrons, and each chlorine (Cl) contributes 7 valence electrons. The total number of electrons around the central atom (Be) is 16. BeCl_2 does not have eight electrons around the central atom.
4. CCl_4 (Carbon Tetrachloride): Carbon (C) has 4 valence electrons, and each chlorine (Cl) contributes 7 valence electrons. The total number of electrons around the central atom (C) is 32. CCl_4 does not have eight electrons around the central atom.
5. PCl_5 (Phosphorus Pentachloride): Phosphorus (P) has 5 valence electrons, and each chlorine (Cl) contributes 7 valence electrons. The total number of electrons around the central atom (P) is 40. PCl_5 does not have eight electrons around the central atom.

Therefore, there are three species (AlCl_3 , BeCl_2 , and PCl_5) that do not have eight electrons around the central atom in their outermost shell. The correct answer is (4) 3.

Botany Questions & Solutions

Question 141. . How many different proteins does the ribosome consist of?

(1) 60 (2) 40 (3) 20 **(4) 80**

Answer. (4) 80

Solution. The ribosome consists of multiple proteins, and the specific number can vary between prokaryotes and eukaryotes. In prokaryotes, the ribosome is composed of approximately 55 different proteins, while in eukaryotes, it consists of about 80 different proteins. Therefore, the correct answer to your question is: (4) 80

Question 150. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of

(1) Amylase (2) Lipase (3) Dinitrogenase **(4) Succinic dehydrogenase**

Answer. (4) Succinic dehydrogenase

Solution. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of succinic dehydrogenase. The correct answer is: (4) Succinic dehydrogenase

Question 143. Which one of the following statements is NOT correct?

(1) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries

(2) Water hyacinth grows abundantly in eutrophic water bodies and leads to an imbalance in the ecosystem dynamics of the water body

(3) The amount of some toxic substances of industrial waste water increases in the organisms at successive trophic levels

(4) The micro-organisms involved in biodegradation of organic matter in a sewage polluted water body consume a lot of oxygen causing the death of aquatic organisms

Answer. (1) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries

Solution. The correct answer is: (1) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries This statement is not correct. Algal blooms caused by an excess of organic matter, such as nutrients from sewage or agricultural runoff, can actually have negative effects on water quality. These blooms can deplete oxygen levels in the water, leading to hypoxic or anoxic conditions that are harmful to aquatic organisms. Additionally, algal blooms can disrupt the natural balance of ecosystems and lead to the decline of certain species, including fish. Therefore, algal blooms caused by excess organic matter are generally considered detrimental to water quality and can have negative impacts on fisheries

Question 145. Main steps in the formation of Recombinant DNA are given below. Arrange these steps in a correct sequence.

- A. Insertion of recombinant DNA into the host cell
 - B. Cutting of DNA at specific location by restriction enzyme
 - C. Isolation of desired DNA fragment
 - D. Amplification of gene of interest using PCR
- Choose the correct answer from the options given below :

(1) C, A, B, D (2) C, B, D, A (3) B, D, A, C **(4) B, C, D, A**

Answer. (4) B, C, D, A

Solution. The correct sequence of steps in the formation of recombinant DNA is: (4) B, C, D, A Here's a breakdown of each step: B. Cutting of DNA at specific location by restriction enzyme: In this step, the DNA containing the gene of interest and the vector DNA are cut at specific locations using restriction enzymes. This generates compatible sticky ends or blunt ends. C. Isolation of desired DNA fragment: The desired DNA fragment containing the gene of interest is isolated from a source, such as genomic DNA or a cDNA library. This can be done using techniques like PCR, gel electrophoresis, or DNA extraction methods. D. Amplification of gene of interest using PCR: The isolated DNA fragment containing the gene of interest is amplified using the polymerase chain

reaction (PCR) technique. PCR allows for the selective amplification of specific DNA sequences. A. Insertion of recombinant DNA into the host cell: The amplified DNA fragment (gene of interest) is inserted into the host cell (such as a bacterial cell) using techniques like transformation, electroporation, or microinjection. The recombinant DNA is then taken up and integrated into the host cell's genome. Therefore, option (4) B, C, D, A is the correct sequence.

Question 142. Which of the following combinations is required for chemiosmosis?

- (1) Membrane, proton pump, proton gradient, NADP synthase
- (2) Proton pump, electron gradient, ATP synthase
- (3) Proton pump, electron gradient, NADP synthase
- (4) Membrane, proton pump, proton gradient, ATP synthase**

Answer. (4) Membrane, proton pump, proton gradient, ATP synthase

Solution. The correct combination required for chemiosmosis is: (2) Membrane, proton pump, proton gradient, ATP synthase. Chemiosmosis is the process by which ATP is synthesized using the energy stored in an electrochemical gradient of protons (H^+) across a membrane. In this process, a proton pump actively transports protons across the membrane, creating a proton gradient. The membrane, which can be the inner mitochondrial membrane or thylakoid membrane in chloroplasts, provides the barrier necessary for the establishment of the gradient. ATP synthase, located on the membrane, utilizes the proton gradient to produce ATP. Option 2 correctly includes all the necessary components: membrane, proton pump, proton gradient, and ATP synthase.

Question 148. Given below are two statements : One labelled as Assertion A and the other labelled as Reason R :

Assertion A : In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.

Reason R : Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

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

(1) Both A and R are true but R is NOT the current explanation of A

(2) A is true but R is false

(3) A is false but R is true

(4) Both A and R are true and R is the correct explanation of A

Answer. (2) A is true but R is false

Solution. The correct answer is: (2) A is true but R is false. Assertion A is true, as gymnosperms release their pollen grains from the microsporangium and rely on air currents for pollination. Reason R is false, as pollen grains in gymnosperms are not carried by air currents to the mouth of the archegonia. In gymnosperms, the male gametes are released from the pollen grains and are carried to the female reproductive structure, where fertilization occurs. Pollen tubes are formed in gymnosperms to facilitate the transfer of male gametes to the female gametophyte. Therefore, while Assertion A is correct, Reason R is not a correct explanation of Assertion A.

Question 103. Identify the pair of heterosporous pteridophytes among the following :

(1) Selaginella and Salvinia

(2) Psilotum and Salvinia

(3) Equisetum and Salvinia

(4) Lycopodium and Selaginella

Answer. (1) Selaginella and Salvinia

Solution. The correct answer is (1) Selaginella and Salvinia. Heterospory is the condition in which a plant produces two different types of spores: microspores and megaspores. Microspores give rise to male gametophytes, while megaspores give rise to female gametophytes. Among the options provided, Selaginella and Salvinia are the two heterosporous pteridophytes. Equisetum (option 1) is a homosporous pteridophyte, meaning it produces only one type of spore. Lycopodium (option 2) is also a homosporous pteridophyte. It produces spores that are all of the same type. Psilotum (option 4) is a homosporous fern-like plant and does not exhibit heterospory. Therefore, the correct answer is option (3) Selaginella and Salvinia.

Question 124. The phenomenon of pleiotropism refers to

- (1) Presence of two alleles, each of the two genes controlling a single trait
- (2) A single gene affecting multiple phenotypic expression**
- (3) More than two genes affecting a single character
- (4) Presence of several alleles of a single gene controlling a single crossover

Answer. (2) A single gene affecting multiple phenotypic expression

Solution. The correct answer is (2) A single gene affecting multiple phenotypic expressions. Pleiotropism refers to the phenomenon where a single gene influences multiple, often unrelated, phenotypic traits or characteristics. This means that a mutation or variation in a single gene can have effects on various aspects of an organism's phenotype, leading to multiple observable traits. This can occur because a gene may be involved in different biochemical pathways or developmental processes that have diverse effects on the organism. For example, a gene involved in eye development may also have effects on other structures or systems in the body, such as the skeletal system or the immune system. As a result, mutations in this gene can cause abnormalities or variations in multiple traits or characteristics. Therefore, option (2) "A single gene affecting multiple phenotypic expression" is the correct description of pleiotropism.

Question 115. Among eukaryotes, replication of DNA takes place in :

- (1) S phase** (2) G1 phase (3) G2 phase (4) M phase

Answer. (1) S phase

Solution. Among eukaryotes, replication of DNA takes place in the S phase of the cell cycle. Therefore, the correct answer is (1) S phase.

Question 106. Identify the correct statements:

- A. Detrivores perform fragmentation.
- B. The humus is further degraded by some microbes during mineralization.
- C. Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching.
- D. The detritus food chain begins with living organisms.

E. Earthworms break down detritus into smaller particles by a process called catabolism.

Choose the correct answer from the options given below:

(1) B, C, D only (2) C, D, E only (3) D, E, A only **(4) A, B, C only**

Answer. (4) A, B, C only

Solution. The correct answer is (4) A, B, C only. Statement A is correct because detritivores perform fragmentation, breaking down organic matter into smaller pieces. Statement B is correct because humus, which is partially decomposed organic matter, can be further degraded by microbes during mineralization. Statement C is correct because leaching is the process by which water-soluble inorganic nutrients move down into the soil and may eventually get precipitated or washed away. Statements D and E are incorrect. The detritus food chain begins with dead organic material (detritus), not living organisms. Earthworms do not break down detritus through catabolism; they break it down through physical processes such as ingestion and digestion.

Zoology Questions & Solutions

Question 173. Given below are two statements:

Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal. In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false.
- (2) Statement I is correct but Statement II is false.
- (3) Statement I is incorrect but Statement II is true.
- (4) Both Statement I and Statement II are true.**

Answer. (4) Both Statement I and Statement II are true.

Solution. The correct answer is: (4) Both Statement I and Statement II are true.

Question 159. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

(1) **Gonorrhoea** (2) Hepatitis-B (3) HIV Infection (4) Genital herpes

Answer. (1) Gonorrhoea

Solution. The correct answer is: (1) Gonorrhoea Gonorrhoea is a common sexually transmitted disease caused by the bacteria *Neisseria gonorrhoeae*. When detected early and treated properly with appropriate antibiotics, gonorrhoea is completely curable. Prompt diagnosis and treatment are essential to prevent complications and further transmission of the infection. It's important to note that while gonorrhoea is curable, other sexually transmitted diseases like HIV infection, genital herpes, and hepatitis B are not curable but can be managed with appropriate medical care.

Question 162. Which of the following is not a cloning vector?

(1) YAC (2) pBR322 (3) **Probe** (4) BAC

Answer. (3) Prob

Solution. The correct answer is: (3) Probe A probe is not a cloning vector. It is a short, labeled DNA sequence that is used to detect the presence of a specific target DNA sequence. Probes are typically labeled with radioactive or fluorescent tags and are used in techniques such as Southern blotting or in situ hybridization to identify and locate specific DNA sequences. On the other hand, BAC (Bacterial Artificial Chromosome), YAC (Yeast Artificial Chromosome), and pBR322 are all examples of cloning vectors. These vectors are used to carry and replicate foreign DNA sequences in host cells during cloning experiments.

Question 169. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by

(1) **Ileo-caecal valve**

- (2) Gastro-oesophageal sphincter
- (3) Pyloric sphincter
- (4) Sphincter of Oddi

Answer. (1) Ileo-caecal valve

Solution. The backflow of undigested and unabsorbed substances from the caecum is prevented by the ileo-caecal valve. Therefore, the correct answer is (1) Ileo-caecal valve.

Question 153. Which of the following statements are correct regarding female reproductive cycle?

- A. In non-primate mammals cyclical changes during reproduction are called oestrus cycle.
- B. First menstrual cycle begins at puberty and is called menopause.
- C. Lack of menstruation may be indicative of pregnancy.
- D. Cyclic menstruation extends between menarche and menopause.

Choose the most appropriate answer from the options given below:

- (1) A and B only (2) A, B and C only **(3) A, C and D only** (4) A and D only

Answer. (3) A, C and D only

Solution. The correct statements regarding the female reproductive cycle are: A. In non-primate mammals cyclical changes during reproduction are called oestrus cycle. C. Lack of menstruation may be indicative of pregnancy. D. Cyclic menstruation extends between menarche and menopause. Therefore, the correct answer is (3) A, C, and D only.

Question 171. Given below are two statements : Statement I : Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat. Statement II : When the inhibitor closely resembles the substrate in its molecular structure and

inhibits the activity of the enzyme, it is known as competitive inhibitor. In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false.
- (2) Statement I is true but Statement II is false.
- (3) Statement I is false but Statement II is true.
- (4) Both Statement I and Statement II are true.**

Answer. (4) Both Statement I and Statement II are true.

Solution. The correct answer is: (4) Both Statement I and Statement II are true. Statement I is true as low temperatures can preserve enzyme activity in an inactive state, while high temperatures can denature proteins and destroy enzymatic activity. Statement II is true as a competitive inhibitor closely resembles the substrate and competes for the active site of the enzyme, thereby inhibiting its activity.

Question 152. Radial symmetry is NOT found in adults of phylum _____.
(1) Hemichordata (2) Coelenterata (3) Echinodermata (4) Ctenophora

Answer. (1) Hemichordata

Solution. The correct answer is: (1) Hemichordata Radial symmetry is not found in adults of the phylum Hemichordata. Hemichordates exhibit bilateral symmetry, which means they can be divided into two equal halves only by a single plane. Radial symmetry is found in organisms such as echinoderms (phylum Echinodermata), comb jellies (phylum Ctenophora), and cnidarians (phylum Cnidaria, formerly called Coelenterata)

Question 174. In which blood corpuscles, the HIV undergoes replication and produces progeny viruses?

- (1) B-lymphocytes (2) Basophils (3) Eosinophils **(4) TH cells**

Answer. (4) TH cells

Solution. The HIV (Human Immunodeficiency Virus) primarily replicates and produces progeny viruses in TH cells, also known as CD4+ T cells. TH cells are a type of T-lymphocyte that plays a crucial role in coordinating the immune response. HIV specifically targets and infects TH cells, leading to their destruction and weakening of the immune system. Therefore, the correct answer is: **(4) TH cells**

Question 176. Vital capacity of lung is _____.

(1) IRV + ERV + TV + RV

(2) IRV + ERV + TV – RV

(3) IRV + ERV + TV

(4) IRV + ERV

Answer. (3) IRV + ERV + TV

Solution. The vital capacity of the lung is the maximum amount of air that can be exhaled forcefully after a maximum inhalation. It is the sum of the inspiratory reserve volume (IRV), the expiratory reserve volume (ERV), and the tidal volume (TV). Therefore, the correct answer is: (3) IRV + ERV + TV

Question 177. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

(1) Numbat, Spotted cuscus, Flying phalanger

(2) Mole, Flying squirrel, Tasmanian tiger cat

(3) Lemur, Anteater, Wolf

(4) Tasmanian wolf, Bobcat, Marsupial mole

Answer. (1) Numbat, Spotted cuscus, Flying phalanger

Solution. The correct answer is: (1) Numbat, Spotted cuscus, Flying phalanger
Adaptive radiation refers to the diversification of a group of organisms into different ecological niches. In the case of Australian marsupials, the numbat, spotted cuscus, and flying phalanger are examples of marsupials that have diversified and adapted to different habitats and lifestyles in Australia. They have

evolved different characteristics and occupy different ecological niches, which is indicative of adaptive radiation. The other options in the list do not consist of marsupials that exhibit such diversification and adaptation.