

Q:1
Topic Name:Mathematics-Section A

ItemCode:131

Let $x*y = x^2 + y^3$ and $(x*1)*1 = x*(1*1)$.
Then a value of $2\sin^{-1}\left(\frac{x^4+x^2-2}{x^4+x^2+2}\right)$ is

Question:

A

$\frac{\pi}{4}$

B

$\frac{\pi}{3}$

C

$\frac{\pi}{2}$

D

$\frac{\pi}{6}$

Q:2
Topic Name:Mathematics-Section A

ItemCode:132

Question: The sum of all the real roots of the equation $(e^{2x}-4)(6e^{2x}-5e^x+1)=0$ is

A

$\log_e 3$

B

$-\log_e 3$

C

$\log_e 6$

D

$-\log_e 6$

Q:3
Topic Name:Mathematics-Section A

ItemCode:133

Let the system of linear equations
 $x + y + \alpha z = 2$
 $3x + y + z = 4$
 $x + 2z = 1$
have a unique solution (x^*, y^*, z^*) . If (α, x^*) , (y^*, α) and $(x^*, -y^*)$ are collinear
points, then the sum of absolute values of all possible values of α is

Question:

A

4

B

3

C

2

D

1

Q:4
Topic Name:Mathematics-Section A

ItemCode:134

Question: Let $x, y > 0$. If $x^3y^2 = 2^{15}$, then the least value of $3x + 2y$ is

A

30

B

32

C

36

D

40

Q:5
Topic Name:Mathematics-Section A

ItemCode:135

$$\text{Let } f(x) = \begin{cases} \frac{\sin(x - [x])}{x - [x]} & , x \in (-2, -1) \\ \max\{2x, 3[|x|]\} & , |x| < 1 \\ 1 & , \text{otherwise} \end{cases}$$

where $[t]$ denotes greatest integer $\leq t$. If m is the number of points where f is not continuous and n is the number of points where f is not differentiable, then the

ordered pair (m, n) is:

- A (3, 3)
- B (2, 4)
- C (2, 3)
- D (3, 4)

Q:6

Topic Name:Mathematics-Section A

ItemCode:136

The value of the integral

$$\int_{-\pi/2}^{\pi/2} \frac{dx}{(1 + e^x)(\sin^6 x + \cos^6 x)}$$
 is equal to

Question:

- A 2π
- B 0
- C π
- D $\frac{\pi}{2}$

Q:7

Topic Name:Mathematics-Section A

ItemCode:137

$$\lim_{n \rightarrow \infty} \left(\frac{n^2}{(n^2 + 1)(n + 1)} + \frac{n^2}{(n^2 + 4)(n + 2)} + \frac{n^2}{(n^2 + 9)(n + 3)} + \dots + \frac{n^2}{(n^2 + n^2)(n + n)} \right)$$

Question: is equal to

- A $\frac{\pi}{8} + \frac{1}{4} \log_e 2$
- B $\frac{\pi}{4} + \frac{1}{8} \log_e 2$
- C $\frac{\pi}{4} - \frac{1}{8} \log_e 2$
- D $\frac{\pi}{8} + \log_e \sqrt{2}$

Q:8

Topic Name:Mathematics-Section A

ItemCode:138

A particle is moving in the xy -plane along a curve C passing through the point $(3, 3)$. The tangent to the curve C at the point P meets the x -axis at Q . If the y -axis

bisects the segment PQ , then C is a parabola with

- A length of latus rectum 3
- B length of latus rectum 6
- C focus $\left(\frac{4}{3}, 0\right)$

D focus $\left(0, \frac{3}{4}\right)$

Q:9
Topic Name:Mathematics-Section A

ItemCode:139
Let the maximum area of the triangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{4} = 1, a > 2$, having one of its vertices at one end of the major axis of the ellipse and one of its sides parallel to the y -axis, be $6\sqrt{3}$. Then the eccentricity of the ellipse is:

- A $\frac{\sqrt{3}}{2}$
- B $\frac{1}{2}$
- C $\frac{1}{\sqrt{2}}$
- D $\frac{\sqrt{3}}{4}$

Q:10
Topic Name:Mathematics-Section A

ItemCode:1310
Let the area of the triangle with vertices $A(1, \alpha), B(\alpha, 0)$ and $C(0, \alpha)$ be 4 sq. units.
Question: If the points $(\alpha, -\alpha), (-\alpha, \alpha)$ and (α^2, β) are collinear, then β is equal to

- A 64
- B -8
- C -64
- D 512

Q:11
Topic Name:Mathematics-Section A

ItemCode:1311
Question: The number of distinct real roots of the equation $x^7 - 7x - 2 = 0$ is

- A 5
- B 7
- C 1
- D 3

Q:12
Topic Name:Mathematics-Section A

ItemCode:1312
A random variable X has the following probability distribution:

X	0	1	2	3	4
$P(X)$	k	$2k$	$4k$	$6k$	$8k$

Question: The value of $P(1 < X < 4 | X \leq 2)$ is equal to :

- A $\frac{4}{7}$

B $\frac{2}{3}$

C $\frac{3}{7}$

D $\frac{4}{5}$

Q:13

Topic Name:Mathematics-Section A

ItemCode:1313

The number of solutions of the equation $\cos\left(x+\frac{\pi}{3}\right)\cos\left(\frac{\pi}{3}-x\right)=\frac{1}{4}\cos^2 2x$,

Question: $x \in [-3\pi, 3\pi]$ is:

A 8

B 5

C 6

D 7

Q:14

Topic Name:Mathematics-Section A

ItemCode:1314

If the shortest distance between the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{\lambda}$ and

Question: $\frac{x-2}{1}=\frac{y-4}{4}=\frac{z-5}{5}$ is $\frac{1}{\sqrt{3}}$, then the sum of all possible values of λ is:

A 16

B 6

C 12

D 15

Q:15

Topic Name:Mathematics-Section A

ItemCode:1315

Let the points on the plane P be equidistant from the points $(-4, 2, 1)$ and $(2, -2, 3)$. Then the acute angle between the plane P and the plane

Question: $2x + y + 3z = 1$ is

A $\frac{\pi}{6}$

B $\frac{\pi}{4}$

C $\frac{\pi}{3}$

D $\frac{5\pi}{12}$

Q:16

Topic Name:Mathematics-Section A

ItemCode:1316

Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that $|(\hat{a} + \hat{b}) + 2(\hat{a} \times \hat{b})| = 2$. If $\theta \in (0, \pi)$ is the angle between $\hat{a}$ and $\hat{b}$, then among the statements:

(S1) : $2|\hat{a} \times \hat{b}| = |\hat{a} - \hat{b}|$

(S2) : The projection of $\hat{a}$ on $(\hat{a} + \hat{b})$ is $\frac{1}{2}$

Question:

A Only (S1) is true.

B Only (S2) is true.

- C Both (S1) and (S2) are true.
- D Both (S1) and (S2) are false.

Q:17

Topic Name:Mathematics-Section A

ItemCode:1317

Question: If $y = \tan^{-1}\left(\sec x^3 - \tan x^3\right), \frac{\pi}{2} < x^3 < \frac{3\pi}{2}$, then

- A $xy'' + 2y' = 0$
- B $x^2y'' - 6y + \frac{3\pi}{2} = 0$
- C $x^2y'' - 6y + 3\pi = 0$
- D $xy'' - 4y' = 0$

Q:18

Topic Name:Mathematics-Section A

ItemCode:1318

Consider the following statements:

A: Rishi is a judge.

B: Rishi is honest.

C: Rishi is not arrogant.

The negation of the statement "if Rishi is a judge and he is not arrogant, then he is

Question: honest" is

- A $B \rightarrow (A \vee C)$
- B $(\sim B) \wedge (A \wedge C)$
- C $B \rightarrow ((\sim A) \vee (\sim C))$
- D $B \rightarrow (A \wedge C)$

Q:19

Topic Name:Mathematics-Section A

ItemCode:1319

The slope of normal at any point (x, y) , $x > 0, y > 0$ on the curve $y = y(x)$ is given

by $\frac{x^2}{xy - x^2y^2 - 1}$. If the curve passes through the point $(1, 1)$, then $e \cdot y(e)$

Question: is equal to

- A $\frac{1 - \tan(1)}{1 + \tan(1)}$
- B $\tan(1)$
- C 1
- D $\frac{1 + \tan(1)}{1 - \tan(1)}$

Q:20

Topic Name:Mathematics-Section A

ItemCode:1320

Let λ^* be the largest value of λ for which the

function $f_\lambda(x) = 4\lambda x^3 - 36\lambda x^2 + 36x + 48$ is increasing for all $x \in \mathbb{R}$. Then

Question: $f_{\lambda^*}(1) + f_{\lambda^*}(-1)$ is equal to :

- A 36
- B 48
- C 64
- D 72

Q:21

Topic Name:Mathematics-Section B

ItemCode:1321

Let $S = \{z \in \mathbb{C} : |z - 3| \leq 1 \text{ and } z(4 + 3i) + \bar{z}(4 - 3i) \leq 24\}$. If $\alpha + i\beta$ is the point in

Question: S which is closest to $4i$, then $25(\alpha + \beta)$ is equal to ____.

Q:22

Topic Name:Mathematics-Section B

ItemCode:1322

Let $S = \left\{ \begin{pmatrix} -1 & a \\ 0 & b \end{pmatrix} ; a, b \in \{1, 2, 3, \dots, 100\} \right\}$ and let $T_n = \{A \in S : A^{n(n+1)} = I\}$. Then

the number of elements in $\bigcap_{n=1}^{100} T_n$ is ____.

Question:

Q:23

Topic Name:Mathematics-Section B

ItemCode:1323

The number of 7-digit numbers which are multiples of 11 and are formed using all

Question: the digits 1, 2, 3, 4, 5, 7 and 9 is ____.

Q:24

Topic Name:Mathematics-Section B

ItemCode:1324

The sum of all the elements of the set $\{a \in \{1, 2, \dots, 100\} : HCF(a, 24) = 1\}$ is

Question: ____.

Q:25

Topic Name:Mathematics-Section B

ItemCode:1325

Question: The remainder on dividing $1 + 3 + 3^2 + 3^3 + \dots + 3^{2021}$ by 50 is ____.

Q:26

Topic Name:Mathematics-Section B

ItemCode:1326

The area (in sq. units) of the region enclosed between the parabola $y^2 = 2x$ and the

Question: line $x + y = 4$ is ____.

Q:27

Topic Name:Mathematics-Section B

ItemCode:1327

Let a circle $C : (x - h)^2 + (y - k)^2 = r^2$, $k > 0$, touch the x -axis at $(1, 0)$. If the line $x + y = 0$ intersects the circle C at P and Q such that the length of the chord PQ is

Question: 2, then the value of $h + k + r$ is equal to ____.

Q:28

Topic Name:Mathematics-Section B

ItemCode:1328

In an examination, there are 10 true-false type questions. Out of 10, a student can guess the answer of 4 questions correctly with probability $\frac{3}{4}$ and the remaining 6

questions correctly with probability $\frac{1}{4}$. If the probability that the student guesses

the answers of exactly 8 questions correctly out of 10 is $\frac{27k}{4^{10}}$, then k is equal to

Question: ____.

Q:29

Topic Name:Mathematics-Section B

ItemCode:1329

Let the hyperbola $H : \frac{x^2}{a^2} - y^2 = 1$ and the ellipse $E : 3x^2 + 4y^2 = 12$ be such that the length of latus rectum of H is equal to the length of latus rectum of E . If e_H and e_E are the eccentricities of H and E respectively, then the value of $12(e_H^2 + e_E^2)$ is

Question: equal to ____.

Q:30

Topic Name:Mathematics-Section B

ItemCode:1330

Let P_1 be a parabola with vertex (3, 2) and focus (4, 4) and P_2 be its mirror image with respect to the line $x + 2y = 6$. Then the directrix of P_2 is $x + 2y =$ ____.

Question:

Q:31

Topic Name:Physics-Section A

ItemCode:1331

Question:Identify the pair of physical quantities that have same dimensions :

- | | |
|---|--|
| A | velocity gradient and decay constant |
| B | wien's constant and Stefan constant |
| C | angular frequency and angular momentum |
| D | wave number and Avogadro number |

Q:32

Topic Name:Physics-Section A

ItemCode:1332

The distance between Sun and Earth is R . The duration of year if the distance between Sun and Earth becomes $3R$ will be :

- | | |
|---|-------------------|
| A | $\sqrt{3}$ years |
| B | 3 years |
| C | 9 years |
| D | $3\sqrt{3}$ years |

Q:33

Topic Name:Physics-Section A

ItemCode:1333

A stone of mass m , tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

- | | |
|---|---|
| A | the same throughout the motion. |
| B | minimum at the highest position of the circular path. |
| C | minimum at the lowest position of the circular path. |
| D | minimum when the rope is in the horizontal position. |

Q:34

Topic Name:Physics-Section A

ItemCode:1334

Two identical charged particles each having a mass 10 g and charge $2.0 \times 10^{-7} C$ are placed on a horizontal table with a separation of L between them such that they stay in limited equilibrium. If the coefficient of friction between

Question:each particle and the table is 0.25, find the value of L . [Use $g = 10\text{ms}^{-2}$]

- | | |
|---|-------|
| A | 12 cm |
| B | 10 cm |
| C | 8 cm |

D	5 cm
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Q:35

Topic Name:Physics-Section A

ItemCode:1335	
A Carnot engine takes 5000 kcal of heat from a reservoir at $727^{\circ}C$ and gives heat	
Question: to a sink at $127^{\circ}C$. The work done by the engine is	
A	$3 \times 10^6 J$
B	Zero
C	$12.6 \times 10^6 J$
D	$8.4 \times 10^6 J$

Q:36

Topic Name:Physics-Section A

ItemCode:1336	
Two massless springs with spring constants 2 k and 9 k, carry 50 g and 100 g	
masses at their free ends. These two masses oscillate vertically such that their	
maximum velocities are equal. Then, the ratio of their respective amplitudes will	
Question: be :	
A	1:2
B	3:2
C	3:1
D	2:3

Q:37

Topic Name:Physics-Section A

ItemCode:1337	
What will be the most suitable combination of three resistors	
A= 2Ω , B= 4Ω , C= 6Ω so that $\left(\frac{22}{3}\right)\Omega$ is equivalent resistance of combination?	
Question:	
A	Parallel combination of A and C connected in series with B.
B	Parallel combination of A and B connected in series with C.
C	Series combination of A and C connected in parallel with B.
D	Series combination of B and C connected in parallel with A.

Q:38

Topic Name:Physics-Section A

ItemCode:1338	
The soft-iron is a suitable material for making an electromagnet. This is because	
Question: soft-iron has	
A	low coercivity and high retentivity.
B	low coercivity and low permeability.
C	high permeability and low retentivity.
D	high permeability and high retentivity.

Q:39

Topic Name:Physics-Section A

ItemCode:1339	
A proton, a deuteron and an α -particle with same kinetic energy enter into a	
uniform magnetic field at right angle to magnetic field. The ratio of the radii of	
Question: their respective circular paths is :	
A	$1:\sqrt{2}:\sqrt{2}$
B	$1:1:\sqrt{2}$

C	$\sqrt{2}:1:1$
D	$1:\sqrt{2}:1$

Q:40

Topic Name:Physics-Section A

ItemCode:1340 Given below are two statements : Statement-I: The reactance of an ac circuit is zero. It is possible that the circuit contains a capacitor and an inductor. Statement-II: In ac circuit, the average power delivered by the source never becomes zero. In the light of the above statements, choose the correct answer from the options Question: given below	
A	Both Statement I and Statement II are true.
B	Both Statement I and Statement II are false.
C	Statement I is true but Statement II is false.
D	Statement I is false but Statement II is true.

Q:41

Topic Name:Physics-Section A

ItemCode:1341 Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance, A and B are positive constants. The equilibrium distance Question: between the two atoms will be :	
A	$\left(\frac{A}{B}\right)^{\frac{1}{5}}$
B	$\left(\frac{B}{A}\right)^{\frac{1}{5}}$
C	$\left(\frac{2A}{B}\right)^{\frac{1}{5}}$
D	$\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

Q:42

Topic Name:Physics-Section A

ItemCode:1342 An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The Question: ratio of time of ascent to the time of descent will be equal to : [Use $g = 10\text{ms}^{-2}$].	
A	1:1
B	$\sqrt{2}:\sqrt{3}$
C	$\sqrt{3}:\sqrt{2}$
D	2:3

Q:43

Topic Name:Physics-Section A

ItemCode:1343 A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first Question: second. The angle rotated by the fly wheel in the next second, will be :	
A	7.5 rad
B	15 rad
C	20 rad

D	30 rad
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Q:44

Topic Name:Physics-Section A

ItemCode:1344	
A 100 g of iron nail is hit by a 1.5 kg hammer striking at a velocity of 60 ms^{-1} . What will be the rise in the temperature of the nail if one fourth of energy of the hammer goes into heating the nail ?	
Question: [Specific heat capacity of iron = $0.42 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$]	
A	675°C
B	1600°C
C	16.07°C
D	6.75°C

Q:45

Topic Name:Physics-Section A

ItemCode:1345	
If the charge on a capacitor is increased by 2 C, the energy stored in it increases by 44%. The original charge on the capacitor is (in C)	
Question:	
A	10
B	20
C	30
D	40

Q:46

Topic Name:Physics-Section A

ItemCode:1346	
A long cylindrical volume contains a uniformly distributed charge of density ρ . The radius of cylindrical volume is R . A charge particle (q) revolves around the cylinder in a circular path. The kinetic energy of the particle is :	
Question:	
A	$\frac{\rho q R^2}{4\epsilon_o}$
B	$\frac{\rho q R^2}{2\epsilon_o}$
C	$\frac{q\rho}{4\epsilon_o R^2}$
D	$\frac{4\epsilon_o R^2}{q\rho}$

Q:47

Topic Name:Physics-Section A

ItemCode:1347	
An electric bulb is rated as 200 W. What will be the peak magnetic field at 4 m distance produced by the radiations coming from this bulb? Consider this bulb as a point source with 3.5% efficiency.	
Question:	
A	$1.19 \times 10^{-8} \text{ T}$
B	$1.71 \times 10^{-8} \text{ T}$
C	$0.84 \times 10^{-8} \text{ T}$
D	$3.36 \times 10^{-8} \text{ T}$

Q:48

Topic Name:Physics-Section A

ItemCode:1348

The light of two different frequencies whose photons have energies 3.8 eV and 1.4 eV respectively, illuminate a metallic surface whose work function is 0.6 eV successively. The ratio of maximum speeds of emitted electrons for the two frequencies respectively will be :

Question:

- A 1 : 1
- B 2 : 1
- C 4 : 1
- D 1 : 4

Q:49

Topic Name:Physics-Section A

ItemCode:1349

Two light beams of intensities in the ratio of 9 : 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be :

Question:

- A 2 : 3
- B 16 : 81
- C 25 : 169
- D 25 : 1

Q:50

Topic Name:Physics-Section A

ItemCode:1350

In Bohr's atomic model of hydrogen, let K, P and E are the kinetic energy, potential energy and total energy of the electron respectively. Choose the correct option when the electron undergoes transitions to a higher level :

Question:

- A All K, P and E increase.
- B K decreases, P and E increase.
- C P decreases, K and E increase.
- D K increases, P and E decrease.

Q:51

Topic Name:Physics-Section B

ItemCode:1351

A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after 2 s is 20 ms^{-1} . The maximum height reached by the body during its

Question: motion is _____ m. (use $g = 10\text{ms}^{-2}$)

Q:52

Topic Name:Physics-Section B

ItemCode:1352

An antenna is placed in a dielectric medium of dielectric constant 6.25. If the maximum size of that antenna is 5.0 mm , it can radiate a signal of minimum frequency of _____ GHz.

Question: (Given $\mu_r = 1$ for dielectric medium)

Q:53

Topic Name:Physics-Section B

ItemCode:1353

A potentiometer wire of length 10 m and resistance $20\ \Omega$ is connected in series with a 25 V battery and an external resistance $30\ \Omega$. A cell of emf E in secondary circuit is balanced by 250 cm long potentiometer wire. The value of E (in volt) is

Question: $\frac{x}{10}$. The value of x is _____.

Q:54

Topic Name:Physics-Section B

ItemCode:1354

Two travelling waves of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a stationary wave whose equation is given by

$$y = (10 \cos \pi x \sin \frac{2\pi t}{T}) \text{ cm}$$

Question: The amplitude of the particle at $x = \frac{4}{3}$ cm will be _____ cm.

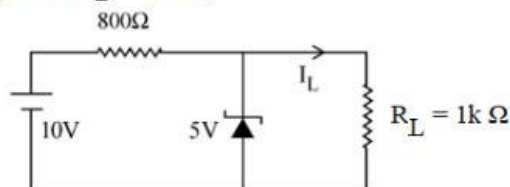
Q:55

Topic Name:Physics-Section B

ItemCode:1355

In the given circuit, the value of current I_L will be _____ mA.

(When $R_L = 1 \text{ k } \Omega$)



Question:

Q:56

Topic Name:Physics-Section B

ItemCode:1356

A sample contains 10^{-2} kg each of two substances A and B with half lives 4 s and 8 s respectively. The ratio of their atomic weights is 1 : 2. The ratio of the amounts

of A and B after 16 s is $\frac{x}{100}$. The value of x is _____.

Question:

Q:57

Topic Name:Physics-Section B

ItemCode:1357

A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}$ cm. The thickness of the

Question: glass slab is _____ cm.

Q:58

Topic Name:Physics-Section B

ItemCode:1358

A circular coil of 1000 turns each with area 1 m^2 is rotated about its vertical diameter at the rate of one revolution per second in a uniform horizontal magnetic

Question: field of 0.07T. The maximum voltage generation will be _____ V.

Q:59

Topic Name:Physics-Section B

ItemCode:1359

A monoatomic gas performs a work of $\frac{Q}{4}$ where Q is the heat supplied to it. The molar heat capacity of the gas will be _____ R during this transformation.

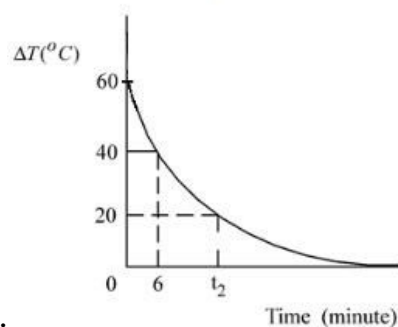
Question: Where R is the gas constant.

Q:60

Topic Name:Physics-Section B

ItemCode:1360

In an experiment to verify Newton's law of cooling, a graph is plotted between, the temperature difference (ΔT) of the water and surroundings and time as shown in figure. The initial temperature of water is taken as 80°C . The value of t_2 as mentioned in the graph will be _____.



Question:

Q:61

Topic Name:Chemistry-Section A

ItemCode:1361

120 g of an organic compound that contains only carbon and hydrogen gives 330 g of CO_2 and 270 g of water on complete combustion. The percentage of carbon and

Question:hydrogen, respectively are

- A 25 and 75
- B 40 and 60
- C 60 and 40
- D 75 and 25

Q:62

Topic Name:Chemistry-Section A

ItemCode:1362

The energy of one mole of photons of radiation of wavelength 300 nm is

Question:(Given : $h = 6.63 \times 10^{-34} \text{ J s}$, $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, $c = 3 \times 10^8 \text{ m s}^{-1}$)

- A 235 kJ mol^{-1}
- B 325 kJ mol^{-1}
- C 399 kJ mol^{-1}
- D 435 kJ mol^{-1}

Q:63

Topic Name:Chemistry-Section A

ItemCode:1363

Question:The correct order of bond orders of C_2^{2-} , N_2^{2-} and O_2^{2-} is, respectively

- A $\text{C}_2^{2-} < \text{N}_2^{2-} < \text{O}_2^{2-}$
- B $\text{O}_2^{2-} < \text{N}_2^{2-} < \text{C}_2^{2-}$
- C $\text{C}_2^{2-} < \text{O}_2^{2-} < \text{N}_2^{2-}$
- D $\text{N}_2^{2-} < \text{C}_2^{2-} < \text{O}_2^{2-}$

Q:64

Topic Name:Chemistry-Section A

ItemCode:1364

At 25°C and 1 atm pressure, the enthalpies of combustion are as given below:

Substance	H ₂	C (graphite)	C ₂ H ₆ (g)
$\Delta_c H^\ominus$ kJ mol ⁻¹	-286.0	-394.0	-1560.0

Question: The enthalpy of formation of ethane is

- A +54.0 kJ mol⁻¹
- B -68.0 kJ mol⁻¹
- C -86.0 kJ mol⁻¹
- D +97.0 kJ mol⁻¹

Q:65

Topic Name: Chemistry-Section A

ItemCode:1365

For a first order reaction, the time required for completion of 90% reaction is 'x' times the half life of the reaction. The value of 'x' is

Question: (Given: $\ln 10 = 2.303$ and $\log 2 = 0.3010$)

- A 1.12
- B 2.43
- C 3.32
- D 33.31

Q:66

Topic Name: Chemistry-Section A

ItemCode:1366

Metals generally melt at very high temperature. Amongst the following, the metal

Question: with the highest melting point will be

- A Hg
- B Ag
- C Ga
- D Cs

Q:67

Topic Name: Chemistry-Section A

ItemCode:1367

Question: Which of the following chemical reactions represents Hall-Heroult Process?

- A $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$
- B $2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$
- C $\text{FeO} + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$
- D $2[\text{Au}(\text{CN})_2]^-_{(\text{aq})} + \text{Zn}(\text{s}) \rightarrow 2\text{Au}(\text{s}) + [\text{Zn}(\text{CN}_4)]^{2-}$

Q:68

Topic Name: Chemistry-Section A

ItemCode:1368

In the industrial production of which of the following, molecular hydrogen is

Question: obtained as a byproduct ?

- A NaOH
- B NaCl
- C Na metal
- D Na₂CO₃

Q:69
Topic Name:Chemistry-Section A

ItemCode:1369

Which one of the following compounds is used as a chemical in certain type of fire

Question:extinguishers?

- A Baking soda
- B Soda ash
- C Washing soda
- D Caustic Soda

Q:70
Topic Name:Chemistry-Section A

ItemCode:1370

Question: PCl_5 is well known, but NCl_5 is not. Because,

- A nitrogen is less reactive than phosphorous.
- B nitrogen doesn't have d-orbitals in its valence shell.
- C catenation tendency is weaker in nitrogen than phosphorous.
- D size of phosphorous is larger than nitrogen.

Q:71
Topic Name:Chemistry-Section A

ItemCode:1371

Question:Transition metal complex with highest value of crystal field splitting (Δ_0) will be

- A $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
- B $[\text{Mo}(\text{H}_2\text{O})_6]^{3+}$
- C $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
- D $[\text{Os}(\text{H}_2\text{O})_6]^{3+}$

Q:72
Topic Name:Chemistry-Section A

ItemCode:1372

Some gases are responsible for heating of atmosphere (green house effect).

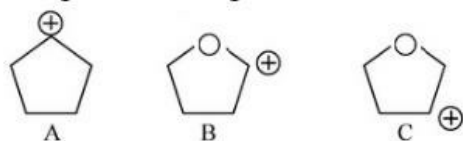
Question:Identify from the following the gaseous species which does not cause it.

- A CH_4
- B O_3
- C H_2O
- D N_2

Q:73
Topic Name:Chemistry-Section A

ItemCode:1373

Arrange the following carbocations in decreasing order of stability.



- A $A > C > B$
- B $A > B > C$
- C $C > B > A$
- D $C > A > B$

Q:74

ItemCode:1374

Given below are two statements.

Statement I: The presence of weaker π -bonds make alkenes less stable than alkanes.

Statement II: The strength of the double bond is greater than that of carbon-carbon single bond.

In the light of the above statements, choose the *correct* answer from the options

Question: given below.

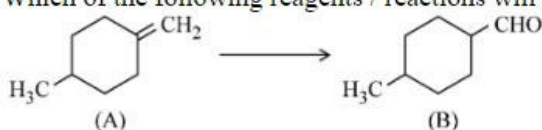
- A Both Statement I and Statement II are correct.
- B Both Statement I and Statement II are incorrect.
- C Statement I is correct but Statement II is incorrect.
- D Statement I is incorrect but Statement II is correct.

Q:75

Topic Name: Chemistry-Section A

ItemCode:1375

Which of the following reagents / reactions will convert 'A' to 'B'?



Question:

- A PCC oxidation
- B Ozonolysis
- C BH_3 , H_2O_2 / OH^- followed by PCC oxidation
- D HBr , hydrolysis followed by oxidation by $\text{K}_2\text{Cr}_2\text{O}_7$.

Q:76

Topic Name: Chemistry-Section A

ItemCode:1376

Hex-4-ene-2-ol on treatment with PCC gives 'A'. 'A' on reaction with sodium hypoiodite gives 'B', which on further heating with soda lime gives 'C'. The

Question: compound 'C' is

- A 2-pentene
- B propanaldehyde
- C 2-butene
- D 4-methylpent-2-ene

Q:77

Topic Name: Chemistry-Section A

ItemCode:1377

The conversion of propan-1-ol to n-butylamine involves the sequential addition of reagents. The correct sequential order of reagents is

- A (i) SOCl_2 (ii) KCN (iii) H_2/Ni , $\text{Na}(\text{Hg})/\text{C}_2\text{H}_5\text{OH}$
- B (i) HCl (ii) H_2/Ni , $\text{Na}(\text{Hg})/\text{C}_2\text{H}_5\text{OH}$
- C (i) SOCl_2 (ii) KCN (iii) CH_3NH_2
- D (i) HCl (ii) CH_3NH_2

Q:78

Topic Name: Chemistry-Section A

ItemCode:1378

Question: Which of the following is **not** an example of a condensation polymer?

- A Nylon 6,6

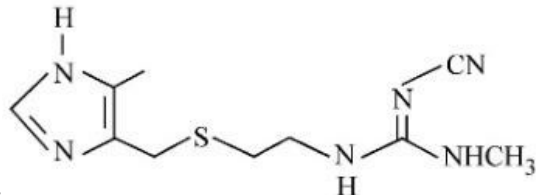
B	Decron
C	Buna-N
D	Silicone

Q:79

Topic Name:Chemistry-Section A

ItemCode:1379

The structure shown below is of which well-known drug molecule ?



Question:

- A Ranitidine
- B Seldane
- C Cimetidine
- D Codeine

Q:80

Topic Name:Chemistry-Section A

ItemCode:1380

In the flame test of a mixture of salts, a green flame with blue centre was observed.

Question: Which one of the following cations may be present?

- A Cu^{2+}
- B Sr^{2+}
- C Ba^{2+}
- D Ca^{2+}

Q:81

Topic Name:Chemistry-Section B

ItemCode:1381

At 300 K, a sample of 3.0 g of gas A occupies the same volume as 0.2 g of hydrogen at 200 K at the same pressure. The molar mass of gas A is _____ g mol^{-1} . (nearest integer) Assume that the behaviour of gases as ideal.

Question: (Given: The molar mass of hydrogen (H_2) gas is 2.0 g mol^{-1} .)

Q:82

Topic Name:Chemistry-Section B

ItemCode:1382

A company dissolves 'x' amount of CO_2 at 298 K in 1 litre of water to prepare soda water. $X = \text{_____} \times 10^{-3}$ g. (nearest integer)
(Given: partial pressure of CO_2 at 298 K = 0.835 bar.
Henry's law constant for CO_2 at 298K = 1.67 kbar.

Question: Atomic mass of H, C and O is 1, 12, and 6 g mol^{-1} , respectively)

Q:83

Topic Name:Chemistry-Section B

ItemCode:1383

PCl_5 dissociates as
 $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K. The equilibrium pressure is 2.46 atm. The equilibrium constant K_p for the dissociation of PCl_5 is _____ $\times 10^{-3}$. (nearest integer)

Question: (Given: $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$; Assume ideal gas behaviour)

Q:84

Topic Name: Chemistry-Section B

ItemCode:1384

The resistance of a conductivity cell containing 0.01 M KCl solution at 298 K is $1750\ \Omega$. If the conductivity of 0.01M KCl solution at 298 K is $0.152 \times 10^{-3}\ \text{S cm}^{-1}$, then the cell constant of the conductivity cell is

Question: _____ $\times 10^{-3}\text{cm}^{-1}$.

Q:85

Topic Name: Chemistry-Section B

ItemCode:1385

When 200 mL of 0.2 M acetic acid is shaken with 0.6 g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1 M. The mass of acetic acid

Question: adsorbed per gram of carbon is _____ g.

Q:86

Topic Name: Chemistry-Section B

ItemCode:1386

(a) Baryte, (b) Galena, (c) Zinc blende and (d) Copper pyrites. How many of these

Question: minerals are sulphide based?

Q:87

Topic Name: Chemistry-Section B

ItemCode:1387

Manganese (VI) has ability to disproportionate in acidic solution. The difference in

Question: oxidation states of two ions it forms in acidic solution is _____.

Q:88

Topic Name: Chemistry-Section B

ItemCode:1388

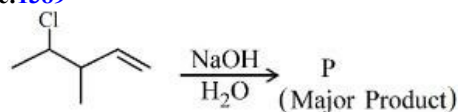
0.2 g of an organic compound was subjected to estimation of nitrogen by Dumas method in which volume of N_2 evolved (at STP) was found to be 22.400 mL. The percentage of nitrogen in the compound is _____. [nearest integer]

Question: (Given: Molar mass of N_2 is $28\ \text{g mol}^{-1}$, Molar volume of N_2 at STP : 22.4L)

Q:89

Topic Name: Chemistry-Section B

ItemCode:1389



Consider the above reaction. The number of π electrons present in the product 'P'

Question: is _____.

Q:90

Topic Name: Chemistry-Section B

ItemCode:1390

Question: In alanylglycylleucylalanylvaline, the number of peptide linkages is _____.