Q1

If force (F), length (L) and time (T) be considered fundamental units, then the units of mass will be

(1) $\left[\mathrm{F\ L\ T^{-2}}\right]$

(2) $\left[\mathrm{F\ L^{-2}T^{-1}}\right]$

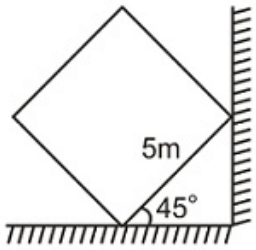
(3) $\left[\mathrm{F\ L^{-1}T^{2}}\right]$

(4) $\left[\mathrm{F^{2}L\ T^{-2}}\right]$

Answer: (3)

Q2

A symmetrical uniform solid cube of side $5\ \mathrm{m}$ is placed on a horizontal surface beside a vertical wall, one side of the cube is making an angle 45° with the floor as shown. If coefficient of friction μ is the same for both wall and floor, the minimum value of μ so that cube does not slip



(1) $\mu = 1$

(2) $\mu = 0$

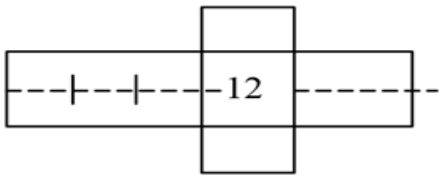
(3) $\mu = \frac{1}{3}$

(4) Impossible to balance for any value of μ

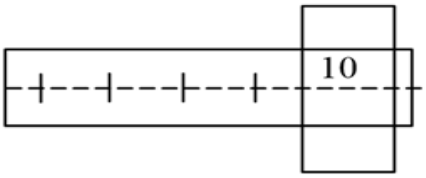
Answer: (2)

Q3

A screw gauge has some zero error, but its value is unknown. We have two identical rods. When the first rod is inserted into the screw, the state of the instrument is shown by the diagram (I). When both the rods are together in series then the state is shown by the diagram (II) what is the zero error of the instrument? $1\ \mathrm{msd} = 100\ \mathrm{csd} = 1\ \mathrm{mm}$



(I)



(II)

(1) -0.16 mm

(2) $+0.16$ mm

(3) $+0.14$ mm

(4) -0.14 mm

Answer: (3)

Q4

A body is projected up with a velocity equal to $\frac{3}{4}^{th}$ of the escape velocity from the surface of the earth. The height it reaches from the center of the earth is

(1) $10R/9$

(2) $16R/7$

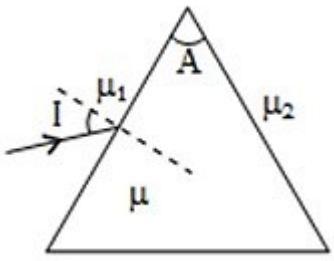
(3) $9R/8$

(4) $10R/3$

Answer: (2)

Q5

A thin prism has different medium on its either side. A light ray is incident almost normally on the first face. What is the angle of deviation if all the angles are very small



(1) $I\left(1-\frac{\mu_1}{\mu_2}\right)-A\left(1-\frac{\mu}{\mu_2}\right)$

(2) $I\left(1-\frac{\mu_1}{\mu_2}\right)+A\left(1-\frac{\mu}{\mu_2}\right)$

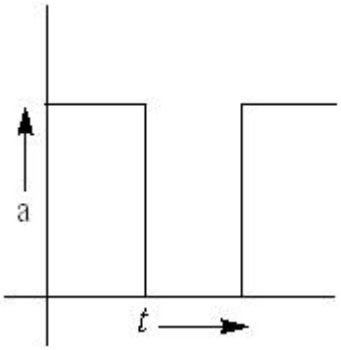
(3) $I\left(1+\frac{\mu_1}{\mu_2}\right)-A\left(1-\frac{\mu}{\mu_2}\right)$

(4) none of these

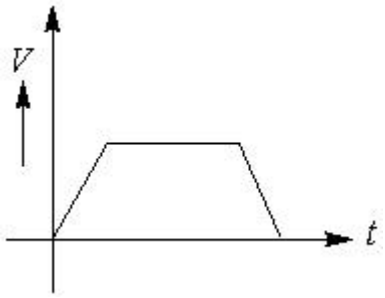
Answer: (1)

Q6

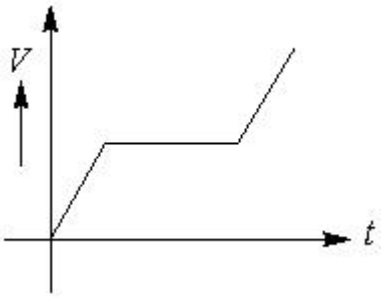
The figure shows the acceleration-time graph of a particle. Which of the following represents the corresponding velocity-time graph? (consider initial velocity zero)



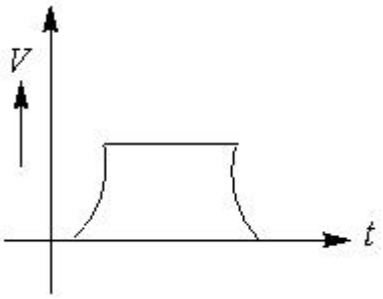
(1)



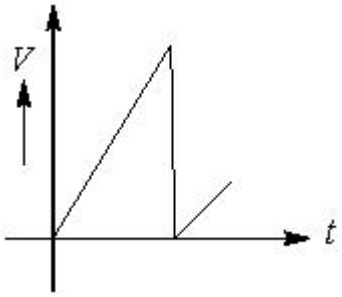
(2)



(3)



(4)



Answer: (2)

Q7

A 100% efficient transformer has 100 turns in the primary and 25 turns in its secondary coil. If the current in the secondary coil is 4 A, then the current in the primary coil is,

(1) 2 A

(2) 3 A

(3) 1.3 A

(4) 1 A

Answer: (4)

Q8

An ideal gas expands isothermally from volume V_1 to V_2 and then it is adiabatically compressed back to its original volume V_1. The initial and final pressures of the gas are P_1 and P_3 respectively and the net work done by the gas is W , then

(1) $P_3 > P_1,\ W > 0$

(2) $P_3 < P_1,\ W < 0$

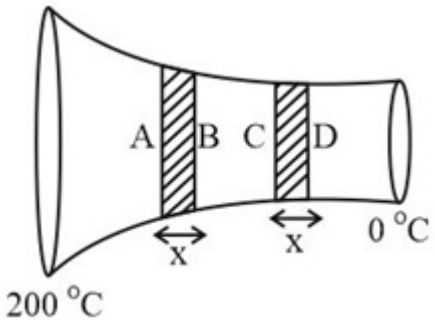
(3) $P_3 > P_1,\ W < 0$

(4) $P_3 = P_1,\ W = 0$

Answer: (3)

Q9

Two ends of a conducting rod of varying cross-sections are maintained at 200°C and 0°C respectively. In steady-state



(1) temperature difference across AB and CD are equal

(2) temperature difference across AB is greater than that of across CD

(3)

temperature difference across AB is less than that of across CD

(4) temperature difference may be equal or different depending on the thermal conductivity of the rod

Answer: (3)

Q10

Assertion: Each bulb in a frill of 20 bulbs in series, when connected to supply voltage, will emit more light than each bulb in a frill of 19 bulbs in series when connected to same supply voltage.
Reason: Each bulb in a frill of 20 bulbs in series will get more voltage than that in a frill of 19 bulbs.

(1) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

(2) If both Assertion and Reason are true but Reason is not explanation of Assertion.

(3) If Assertion is true but Reason is false.

(4) If Assertion is false and Reason is false.

Answer: (4)

Q11

Choose the wrong statement

(1) the radius of path of a charged particle moving in a uniform magnetic field is proportional to the momentum of the particle

(2) an electron beam is moving towards east, on which a perpendicular magnetic field is acting upwards. The beam will be deflected towards the north direction

(3) a positive charge is going straight away from the observer. The magnetic line of force produced due to it are in clockwise direction.

(4) while passing through a given place, the path of electron remains straight line. It can be definitely said that the magnetic field is not present at that place

Answer: (4)

Q12

A magnet is cut in four equal parts by cutting it parallel to its length. The time period of each part, if the time period of the original magnet in the same field is T_0, will be

(1) T_0

(2) $\frac{T_0}{2}$

(3) $\frac{T_0}{4}$

(4) $4T_0$

Answer: (1)

Q13

Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $R^{-\frac{5}{2}}$, then

(1) T^2 is proportional to R^2

(2) T^2 is proportional to $R^{\frac{7}{2}}$

(3) T^2 is proportional to $R^{\frac{3}{2}}$

(4) T^2 is proportional to $R^{\frac{5}{2}}$

Answer: (2)

Q14

Match the **List - I** (Phenomenon associated with electromagnetic radiation) with **List - II** (Part of electromagnetic spectrum) and select the correct code from the choices given below the lists :

	List - I		List-II
I	Doublet of sodium	A	Visible radiation
II	Wavelength corresponding to temperature associated with the isotropic radiation filling all space	B	Microwave
III	Wavelength emitted by atomic hydrogen in interstellar space	C	Short radiowave
IV	Wavelength of radiation arising from two close energy levels in hydrogen	D	X-rays

(1) (I)-(D), (II)-(C), (III)-(A), (IV)-(B)

(2) (I)-(A), (II)-(B), (III)-(C), (IV)-(C)

(3) (I)-(A), (II)-(B), (III)-(B), (IV)-(C)

(4) (I)-(B), (II)-(A), (III)-(D), (IV)-(A)

Answer: (1)

Q15

A clear sheet of Polaroid is placed on top of a similar sheet so that their axes make an angle of $\sin^{-1}\left(\frac{4}{5}\right)$ with each other. The ratio of the intensity of the emergent light to that of polarised light is

(1) 16 : 25

(2) 9 : 25

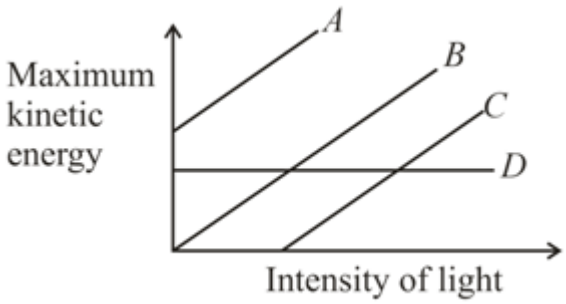
(3) 4 : 5

(4) 8 : 25

Answer: (2)

Q16

The graph between maximum kinetic energy and intensity of light in photoelectric effect is plotted. Out of the four graphs $A,\ B,\ C,\ D$ shown in the figure, the correct graph is



(1) C

(2) B

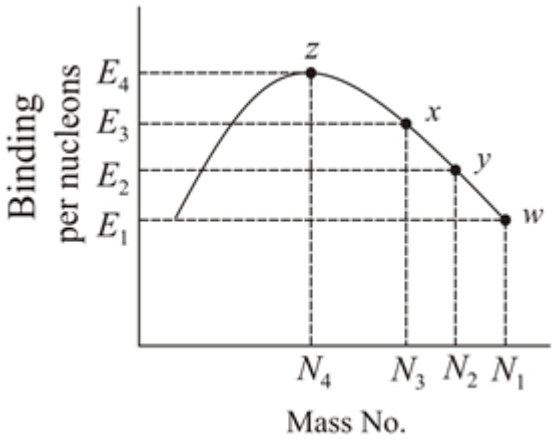
(3) D

(4) A

Answer: (3)

Q17

Consider the nuclear fission reaction $\mathrm{w} \rightarrow \mathrm{x} + \mathrm{y}$, now using the graph given answer the following question.



What is the Q-Value of the reaction?

(1) $\mathrm{E_1N_1} - [\mathrm{E_2N_2} + \mathrm{E_3N_3}]$

(2) $[E_2N_2 + E_3N_3] - E_1N_1$

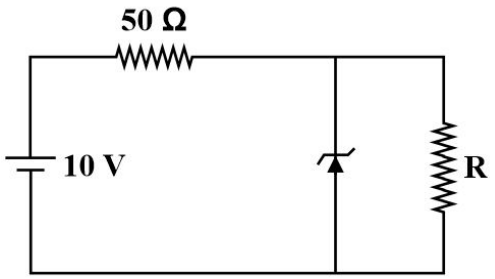
(3) $[E_2N_2 + E_1N_1] - E_3N_3$

(4) $[E_1N_1 + E_3N_3] - E_2N_2$

Answer: (2)

Q18

The 6 V Zener diode shown in the figure has negligible resistance and a knee current of 5 mA. The minimum value of R (in Ω) so that the voltage across it does not fall below 6 V is



(1) 40

(2) 60

(3) 72

(4) 80

Answer: (4)

Q19

Two equally charged small metal balls placed at a fixed distance experience a force F. A similar uncharged metal ball after touching one of them is placed at the middle point between the two balls. The force experienced by this ball is

(1) $\frac{F}{2}$

(2) F

(3) $2F$

(4) $4F$

Answer: (2)

Q20

A closed and an open organ pipe have the same length. When they are vibrating simultaneously in their first overtone, they produce three beats. The length of the open pipe is now made one third the original length and one of its ends is closed. On the other hand, the length of the closed pipe is made three times the original length. The number of beats produced when they vibrate with fundamental frequencies will be

(1) 8

(2) 14

(3) 17

(4) 12

Answer: (1)

Q21

Two wires having the same length and material are stretched by the same force. Their diameters are in the ratio $1:3$. The ratio of strain energy per unit volume for these two wires (smaller to larger diameter), when stretched, is M:1, find M.

Answer: 81

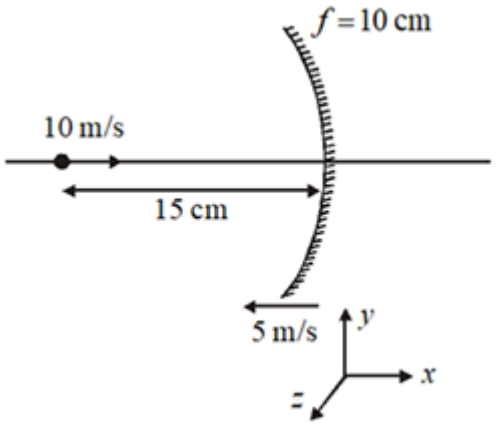
Q22

Water from a tap emerges vertically downwards with an initial speed of $1.0\ \text{m s}^{-1}$. The cross-sectional area of the tap is $10^{-4}\ \text{m}^2$. If we assume that the pressure is constant throughout and that the flow is steady, then the cross-sectional area of the stream, $0.15\ \text{m}$ below the tap, is $n \times 10^{-5}\ \text{m}^2$. What is the value of n?

Answer: 5

Q23

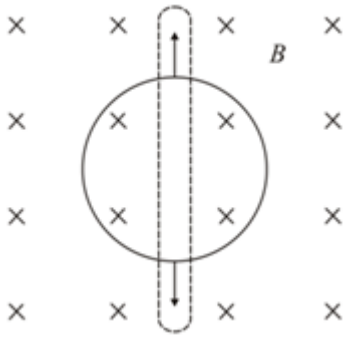
An object and a concave mirror are approaching each other with velocities $10\ \text{m/s}$ and $5\ \text{m/s}$ as shown in figure. The velocity of image of object at the instant shown in figure is V, find absolute value of V.



Answer: 65

Q24

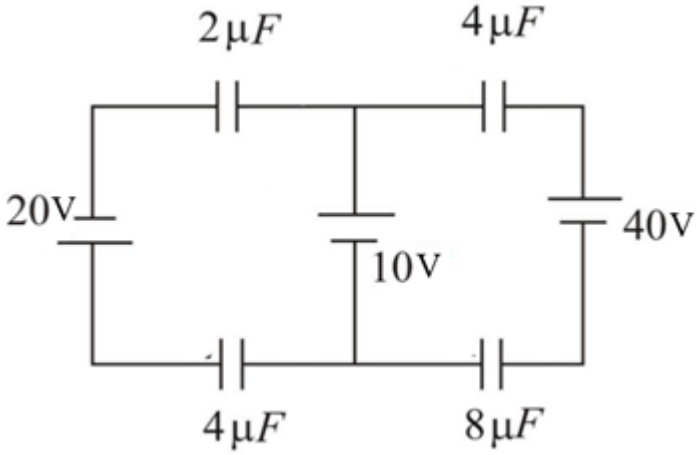
A flexible circular loop 20 cm in diameter lies in a magnetic field of magnitude $B = 1$ T, directed into the plane of page as shown. The loop is pulled at the points indicated by the arrows forming a loop of zero area in 0.314 sec. The average emf induced (in V) in the loop is K, find 10K. ($\pi = 3.14$)



Answer: 1

Q25

In the circuit shown in the figure, calculate the charge on 2 μF capacitor in steady-state (in μC).



Answer: 40

Q26

A car is moving in a circular horizontal track of radius $\frac{6\sqrt{3}}{5}$m. A plumb bob is suspended from the roof of the car by a light rigid rod. The angle made by the rod with the vertical is 60°. Then the car moves with a constant speed of _____ $\mathrm{m/s}.\left(\mathrm{g}=10\ \mathrm{m/s^2}\right)$

Answer: 6

Q27

A stationary He^{+}ion emitted a photon corresponding to the first line of the Lyman series. The photon liberates electron from a stationary hydrogen atom in the ground state. The velocity of the liberated electron is 3.1×10^{x} m/s. Find $\mathbf{x}$ (You can make necessary approximations)

Answer: 6

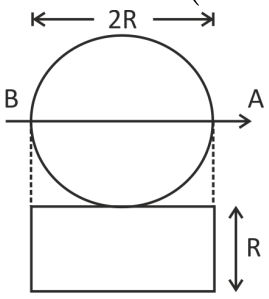
Q28

Two wires A and B of the same material, have radii in the ratio 1 : 2 and carry currents in the ratio 4 : 1. The ratio of drift speed of electrons in A and B is K:1, find K.

Answer: 16

Q29

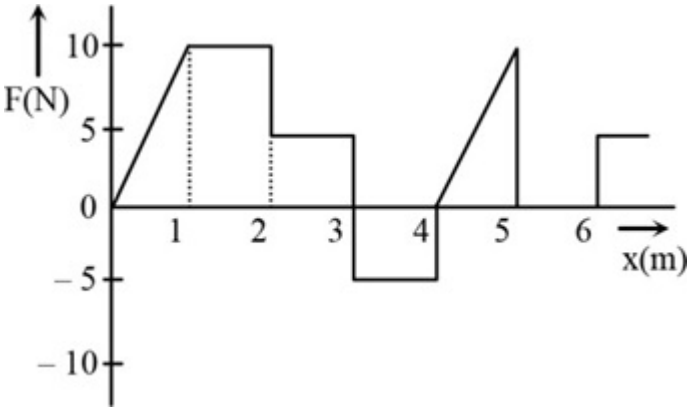
A disc of mass m and radius R is attached to a rectangular plate of the same mass, breadth R and length $2R$ as shown in figure. The moment of inertia of the system about the axis AB passing through the centre of the disc and along the plane is $I=\frac{1}{\alpha}\left(\frac{31}{3}mR^2\right)$, where value of α is



Answer: 4

Q30

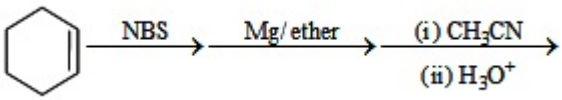
The relationship between the force F and position x of a body is as shown in the figure. The work done in displacing the body from $x = 1$ m to $x = 5$ m will be-



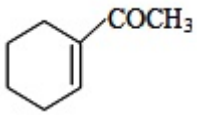
Answer: 15

Q31

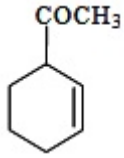
End product of the following sequence of reactions is:



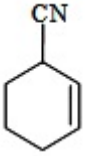
(1)



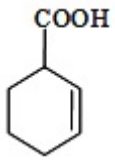
(2)



(3)



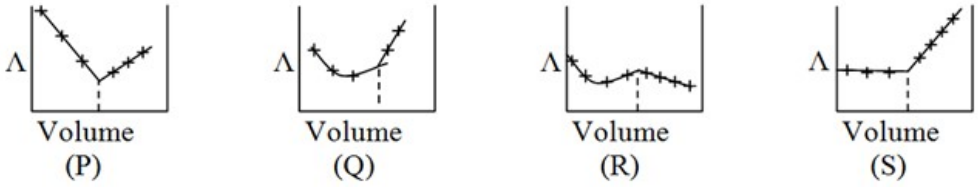
(4)



Answer: (2)

Q32

$AgNO_3(aq)$ was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductivity (Λ) versus the volume of $AgNO_3$ is



(1) (P)

(2) (Q)

(3) (R)

(4) (S)

Answer: (4)

Q33

The chloride of a metal contains 71% chlorine by weight and the vapour density of it is 50. The atomic weigh of the metal will be:

(1) 29

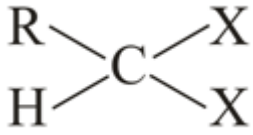
(2) 58

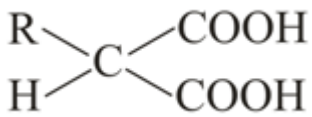
(3) 35.5

(4) 71

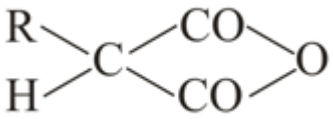
Answer: (1)

Q34

The final product in the following reaction is:  $+KCN \rightarrow A \xrightarrow{H_3O^+} B \xrightarrow{\Delta} C$

(1) 

(2) $R - CH_2 - COOH$

(3) 

(4) A and B both

Answer: (2)

Q35

Match the methods in column I with the respective intermediate in column II.

Column I	Column II
(i) Dumas method	(a) Ammonium sulphate
(ii) Kjeldahl's method	(b) Silica gel
(iii) Carius method	(c) $AgNO_3$
(iv) Chromatography	(d) Nitrogen gas

(1) $i - b,\ ii - c,\ iii - a,\ iv - d$

(2) $i - a,\ ii - b,\ iii - c,\ iv - d$

(3) $i - b,\ ii - a,\ iii - c,\ iv - d$

(4) $i - d,\ ii - a,\ iii - c,\ iv - b$

Answer: (4)

Q36

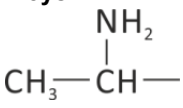
In the given reaction

$R - CH_2 - COOH \xrightarrow{\text{Red P}+Br_2} A \xrightarrow{NH_3}$ Alanine

The name of I^{st} reaction and group R is -

(1) Hell Vohlard Zelinsky reaction, - C_6H_5

(2) Hell Vohlard Zelinsky reaction, - CH_3

(3) Schimdt Reaction, 

(4) Claisen Schimdt reaction, - CH_3

Answer: (2)

Q37

Find the correct match for the column I , from the column II and choose the correct option:

	Column - I		**Column - II**
(a)	C_2H_2	(i)	sp^3d^2 hybridisation
(b)	SF_6	(ii)	sp^3d^3 hybridisation
(c)	SO_2	(iii)	sp hybridisation
(d)	IF_7	(iv)	sp^2 hybridisation

(1) (a)$\longrightarrow$(i), (b)$\longrightarrow$(iii), (c)$\longrightarrow$(ii), (d)$\longrightarrow$ (iv)

(2) (a)$\longrightarrow$(iii), (b)$\longrightarrow$(i), (c)$\longrightarrow$(iv), (d)$\longrightarrow$(ii)

(3) (a)$\longrightarrow$(ii), (b)$\longrightarrow$(iii), (c)$\longrightarrow$(i), (d) $\longrightarrow$(iv)

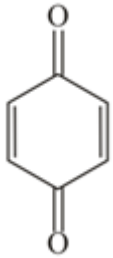
(4) (a)$\longrightarrow$(iv), (b)$\longrightarrow$(i), (c)$\longrightarrow$(iii), (d)$\longrightarrow$(ii)

Answer: (2)

Q38

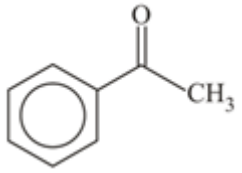
Which of the following compound will undergo tautomerism?

(1)

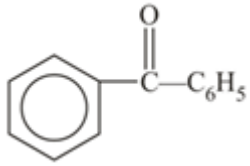


(2)

(3)



(4)



Answer: (3)

Q39

Amongst the halides, what is the correct order of decreasing Lewis acid character?

(1) BCl_3

(2) $AlCl_3$

(3) $GaCl_3$

(4) $InCl_3$

(1) $1 > 2 > 3 > 4$

(2) $4 > 3 > 2 > 1$

(3) $3 > 4 > 2 > 1$

(4) $2 > 3 > 4 > 1$

Answer: (1)

Q40

A heating coil is immersed in a 100g sample of $H_2O(l)$ at 1 atm and 100°C in a closed vessel.In this heating process, 60% of the liquid is converted to the gaseous form at constant pressure of 1 atm. The densities of liquid and gaseous water under these conditions are 1000 kg/m^3 and 0.60 kg/m^3 respectively. Magnitude of the work done for the process is: $\left(\text{take 1 atm} = 10^5\ {}^{N}/_{m^2}\right)$

(1) 4997 J

(2) 4970 J

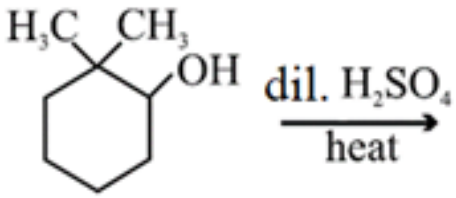
(3) 9994 J

(4) 1060 J

Answer: (3)

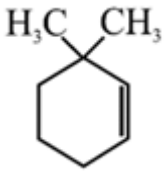
Q41

Consider the reaction



The alkene formed in major amount is

(1)



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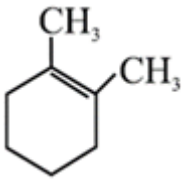

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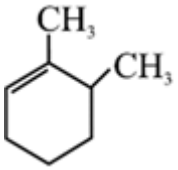

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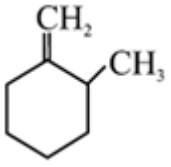


Answer: (2)

Q42

Which of the following orders of ionic radii is correctly represented?

(1) $H^- > H > H^+$

(2) $Al^{3+} > Mg^{2+} > N^{3-}$

(3) $F^- > O^{2-} > Na^+$

(4) $Na^+ > F^- > O^{2-}$

Answer: (1)

Q43

Solid Na_2SO_4 is slowly added to a solution which is 0.020 M in $Ba(NO_3)_2$ and 0.020 M in $Pb(NO_3)_2$. Assume that there is no increase in volume on adding Na_2SO_4 . There preferential precipitation takes place. What is the concentration of Ba^{2+} when $PbSO_4$ starts to precipitate?
$[K_{sp}(BaSO_4) = 1.0 \times 10^{-10}$ and $K_{sp}(PbSO_4) = 1.6 \times 10^{-8}]$

(1) 5.0×10^{-9} M

(2) 8.0×10^{-7} M

(3) 1.25×10^{-4}M

(4) 1.95×10^{-8}M

Answer: (3)

Q44

At 35^oC the vapour pressure of CS_2 is 512 mm Hg, and of acetone, CH_3COCH_3 , is 344 mm Hg. A solution of CS_2 and acetone in which the mole fraction of CS_2 is 0.25 has a total vapour pressure of 600 mm Hg. Which of the following statements about solution of acetone - CS_2 is true ?

(1) A mixture of 100 ml of acetone and 100 ml of CS_2 has a total volume of 200 ml.

(2) When acetone and CS_2 are mixed at 35^oC , heat must be absorbed in order to produce a solution at 35^oC .

(3) When acetone and CS_2 are mixed at 35^oC , heat is released.

(4) Raoult's law is obeyed by both CS_2 and acetone for the solution in which the mole fraction of CS_2 is 0.25.

Answer: (2)

Q45

STATEMENT-1: The rate of a chemical reaction increases with increase in temperature.
STATEMENT-2: Increase in temperature increases the number of effective collision.

(1) STATEMENT-1 is True, STATEMENT-2 is True, STATEMENT-2 is correct explanation of STATEMENT-1

(2) STATEMENT-1 is True, STATEMENT-2 is True, STATEMENT-2 is NOT correct explanation of STATEMENT-1

(3) STATEMENT-1 is True, STATEMENT-2 is False

(4) STATEMENT-1 is False, STATEMENT-2 is True

Answer: (1)

Q46

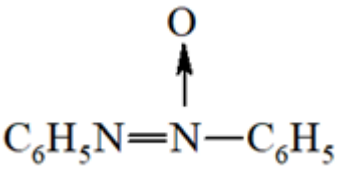
Which of the following is the intermediate in the reduction of nitrobenzene

(1) $C_6H_5N = O$

(2) $C_6H_5NH - NH - C_6H_5$

(3) $C_6H_5 - N = N - C_6H_5$

(4)



Answer: (1)

Q47

Which of the following can give iodoform test ?

(I) $CH_3 - \overset{\overset{O}{\|}}{C} - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$

(II) $C_6H_5 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$

(III) $CH_3 - CHO$

(IV) $C_6H_5 - \overset{\overset{O}{\|}}{C} - CH_3$

(1) Only IV

(2) II and IV

(3) III and IV

(4) All of these

Answer: (4)

Q48

It is said that coordination compounds have great importance in biological systems. In this context, which of the following statements is incorrect?

(1) Chlorophylls are green pigments in plants and contain calcium.

(2) Cyanocobalamine is $B_{12}$and contains cobalt.

(3) Carboxypeptidase-A is an enzyme and contains zinc.

(4) Haemoglobin is the red pigment of blood and contains iron.

Answer: (1)

Q49

When MnO_2 is fused with KOH and KNO_3, a coloured compound is formed. Choose the right compound with the appropriate colour.

(1) K_2MnO_4, green

(2) $KMnO_4$, purple

(3) Mn_2O_3, brown

(4) Mn_3O_4, black

Answer: (1)

Q50

If one strand of DNA has a nucleotide sequence 3' ATTCGCTAT 5', the nucleotide sequence of other DNA strand will be

(1) 3’ TAAGCGATA 5’

(2) 5’ TAGCACGTA 5’

(3) 5’ TAGCACGTA 3’

(4) 5’ TAAGCGATA 3’

Answer: (4)

Q51

Consider the following cell reaction

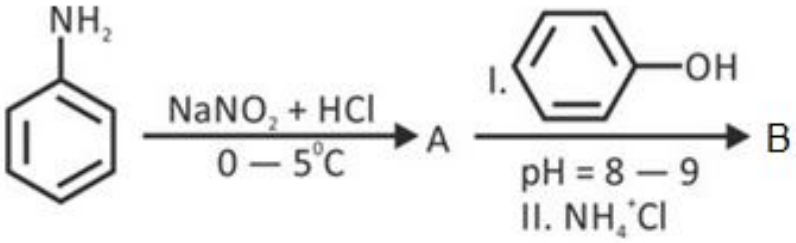
$2Fe(s)+O_2(g)+4H^+(aq)\rightarrow 2Fe^{2+}(aq)+2H_2O(l)$

If $E_{cell} = E^{o}_{cell}$ at $25^{o}C$ and $\left[Fe^{2+}\right]= 10^{-3}M$, $P_{O_2}= 0.01$ atm and $pH = x$

Value of x is

Answer: 1

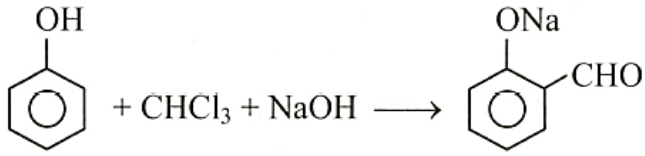
Q52



If molar mass of compound B is x then find $\frac{x}{2}$

Answer: 99

Q53

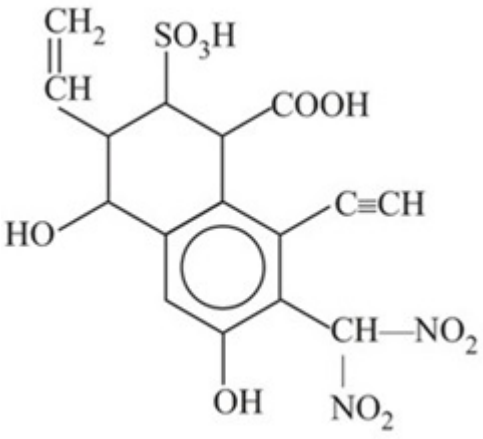


The electrophile involved in above reaction has _____ lone pair of electrons on central carbon atom.

Answer: 1

Q54

How many acidic H-atoms are present in this compound that can react with $\overset{\ominus}{R}$ for R-MgX to give alkane



Answer: 6

Q55

At $37^{\circ}C$, the osmotic pressure of blood is 8.21 atm. The amount of glucose that should be used per litre for an intravenous injection so that it becomes isotonic with blood is (mark answer to nearest integer in grams)

Answer: 58

Q56

How many of these elements have more first ionization energy then boron
Li, Be, C, N, O, F, Ne .

Answer: 6

Q57

The standard enthalpy of formation of NH_3 is - 46.0 kJ/mol. If bond enthalpy of H_2 is - 436 kJ/mol and that of N_2 is - 712 kJ/mol , the average bond enthalpy of N - H bond in NH_3 is : (mark answer to nearest integer in KJ/mol)

Answer: 352

Q58

How many of the following statements is/are correct?
(A) The order of splitting energy is $PtCl_4^{2-} > PdCl_4^{2-} > NiCl_4^{2-}$ (consider only magnitude)
(B) $[Ni(CO)_4]$ is diamagnatic whereas $\left[Ni\left(H_2O\right)_6\right]^{2+}$ is paramagnetic.
$(C)\left[Ni\left(CN\right)_4\right]^{2-} \rightarrow dsp^2$ hybridized and paramagnetic.
(D) The magnetic moment of $K_3\left[Fe(CN)_6\right]$ is $\sqrt{3}$ B.M

Answer: 3

Q59

The degree of dissociation of I_2 molecule at $1000^{\circ}\mathrm{C}$ and under 1.0 atmospheric pressure is 40% by volume. If the dissociation is reduced to 20% at the same temperature, then if the total equilibrium pressure on the gas is 4.57×10^{x} atm. Find x?

Answer: 0

Q60

Number of electrons having $l + m = 0$ in $\mathrm{Mn(z = 25)}$ is (l represent angular quantum number and m represent magnetic quantum number)

Answer: 13

Q61

If the mean deviation about the median of the numbers $a,\ 2a, \ldots, 50a$ is 50, then $|a|$ equals

(1) 4

(2) 5

(3) 2

(4) 3

Answer: (1)

Q62

Number of points where the function $\mathrm{f(x) = max(|\tan x|, \cos|x|)}$ is non differentiable in the interval $(-\pi, \pi)$ is

(1) 4

(2) 6

(3) 3

(4) 2

Answer: (1)

Q63

The number of ways of arranging the letters of the word NALGONDA, such that the letters of the word GOD occur in that order (G before O and O before D), is

(1) 1250

(2) 1440

(3) 1560

(4) 1680

Answer: (4)

Q64

Let $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ be three non-zero vectors satisfying $\vec{\mathbf{a}} = \vec{\mathbf{b}} \times \vec{\mathbf{c}} + 2\vec{\mathbf{b}}$ where $|\vec{\mathbf{b}}| = |\vec{\mathbf{c}}| = 2$ and $|\vec{\mathbf{a}}| \leq 4$. The sum of possible value(s) of $|2\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}}|$ is:

(1) 8

(2) 12

(3) 20

(4) 32

Answer: (3)

Q65

Let $f : [0, 2] \to R$ be a function which is continuous on $[0, 2]$ and is differentiable on $(0, 2)$ with $f(0) = 1$. Let $F(x) = \int_0^{x^2} f(\sqrt{t})dt$ for $x \in [0, 2]$. If $F'(x) = f'(x)$ for all $x \in (0, 2)$, then $F(2)$ equals

(1) $e^2 - 1$

(2) $e^4 - 1$

(3) $e - 1$

(4) e^4

Answer: (2)

Q66

$\int e^{x^4}\left(1+x^2+2x^4\right) d\left(e^{x^2}\right)=f(x)+C$

where C is constant of integration and $f(0)=0$. Then the value of $f(1)+f'(0)$ is equal to

(1) e

(2) e^2

(3) 0

(4) e^3

Answer: (2)

Q67

Let PM be the perpendicular from the point $P(1,2,3)$ to $x-y$ plane. If OP makes an angle θ with the positive direction of z-axis and OM makes an angle ϕ with the positive direction of x-axis, where O is the origin and θ and ϕ are acute angles, then select incorrect option.

(1) $\tan\theta=\frac{\sqrt{5}}{3}$

(2) $\sin\theta\sin\phi=\frac{2}{\sqrt{14}}$

(3) $\tan\phi=2$

(4) $\cos\theta\cos\phi=\frac{1}{\sqrt{14}}$

Answer: (4)

Q68

Consider the ellipse $\frac{x^2}{f(k^2-4k+6)}+\frac{y^2}{f(k+12)}=1$ where $f(x)$ is a positive decreasing function. The number of integral non-negative values of k for which major axis lies on the line $y=0$ is

(1) 2

(2) 3

(3) 6

(4) 4

Answer: (3)

Q69

If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then $(x+y+z)^2$

(1) 0

(2) 1

(3) 4

(4) 9

Answer: (4)

Q70

The number of irrational roots of $x^4 - 6x^3 + 10x^2 - 6x + 1 = 0$ is

(1) 0

(2) 1

(3) 2

(4) 4

Answer: (3)

Q71

If $f(x)$ is the least degree polynomial such that $f(n) = \frac{1}{n}, n = 1, 2, 3, 4, 5$, then $f(0) =$

(1) $\frac{137}{60}$

(2) $\frac{97}{60}$

(3) $\frac{119}{60}$

(4) $\frac{5}{2}$

Answer: (1)

Q72

A fair coin is tossed until one of the two sides occurs twice in a row. Then the Probability that number of tosses required is even is

(1) $\frac{1}{3}$

(2) $\frac{1}{2}$

(3) $\frac{2}{3}$

(4) $\frac{1}{4}$

Answer: (3)

Q73

Let a be a complex number such that $|a| = 1$. If the equation $az^2 + z + 1 = 0$ has a pure imaginary root, then $\tan(\arg a) =$

(1) $\frac{\sqrt{5}-1}{2}$

(2) $\frac{\sqrt{5}+1}{2}$

(3) $\sqrt{\frac{\sqrt{5}-1}{2}}$

(4) $\sqrt{\frac{\sqrt{5}+1}{2}}$

Answer: (4)

Q74

Let I be the set of positive integers. R is a relation on the set I given by $R = \left\{(a, b) \in I \times I \mid \log_2\left(\frac{a}{b}\right)\right.$ is a non-negative integer$\}$, then R is

(1) neither symmetric nor transitive but reflexive.

(2) reflexive, transitive but not symmetric

(3) neither reflexive nor transitive but symmetric

(4) equivalence relation.

Answer: (2)

Q75

Let a, b, c, d be four positive integers in arithemetic progression such that $a < b < c < d$ and $ab = c + d - 1$. The sum of all possible value(s) of ' a ' is

(1) 6.5

(2) 7

(3) 13

(4) 6

Answer: (2)

Q76

A line cuts the x-axis at $A(7,0)$ and the y-axis at $B(0,-5)$, a variable line PQ is drawn perpendicular to AB cutting the x-axis at P and y-axis at Q. If AQ and BP intersect at R then locus of R is

(1) $x^2+y^2-7x+5y=0$

(2) $x^2+y^2+7x-5y=0$

(3) $x^2-y^2-7x+5y=0$

(4) $x^2-y^2+7x-5y=0$

Answer: (1)

Q77

The radius of the circle whose centre is $(-8,0)$ and which cuts the parabola $y^2=8x$ at A & B such that the common chord $\overline{AB}$ subtends a right angle at the vertex of the parabola, is

(1) 20

(2) $20\sqrt{5}$

(3) $8\sqrt{5}$

(4) $40\sqrt{2}$

Answer: (3)

Q78

Let M be a square matrix of order 3 such that $\mathrm{MM}^{\mathrm{T}}=\mathrm{I}$ and $\mathrm{M}^2=\mathrm{I}$. Also $\mathrm{M}^{-1}+\mathrm{adj}(\mathrm{M})=0$, if P is another matrix such that $P+2M=0$ then value of $\det\left(\mathrm{PP}^{\mathrm{T}}\mathrm{P}^{-1}\right)$

(1) 4

(2) 16

(3) 24

(4) 8

Answer: (4)

Q79

Area bounded between the curves $y = \sqrt{4 - x^2}$ and $y^2 = 3|x|$ is :

(1) $\frac{\pi - 1}{\sqrt{3}}$

(2) $\frac{2\pi - 1}{3\sqrt{3}}$

(3) $\frac{2\pi - \sqrt{3}}{3}$

(4) none of these

Answer: (3)

Q80

$\int_{-1}^{2} \left[\frac{[x]}{1+x^2}\right] dx$, (where [.] denotes the greatest integer function) is equal to

(1) -2

(2) -1

(3) zero

(4) $\frac{1}{2}$

Answer: (2)

Q81

Let a, b are two integers such that $0 < a < b < 10^6$ and arithmetic mean of a and b is exactly 8 more than its geometric mean. If number of such ordered pairs is N, then N is equal to

Answer: 995

Q82

Let $f(x) = 2x^3 - 3(2 + p)x^2 + 12px + \ln\left(16 - p^2\right)$. If $f(x)$ has exactly one local maxima and one local minima, then the number of integral values of p is .....

Answer: 6

Q83

Number of integral points (points whose abscissa & ordinate both are integer) in the common region bounded by $\left|\frac{z+1}{z-1}\right| \geqslant 1$ and $\operatorname{Re}\left(\frac{1}{z}\right) \geqslant \frac{1}{2}$, is

Answer: 3

Q84

The solution of $x^2\frac{dy}{dx} - xy = 1 + \cos\frac{y}{x}$ is $\tan\left(\frac{y}{px}\right) = c - \frac{1}{qx^2}$ where c is constant then, find the value of $p + q$?

Answer: 4

Q85

If a line passing through $(2, 1, 4)$ cuts off an intercept of minimum length between two non coplanar lines $\mathrm{x} - 6 = \frac{\mathrm{y}}{\alpha} = -\mathrm{z}$ and $\mathrm{x} = \frac{\mathrm{y}}{0} = \mathrm{z}$, then α is equal to

Answer: 2

Q86

In how many ways Ram can distribute 40 apples in his six children named A, B, C, D, E and F such that A gets two more than B, C gets 3 more than F and D gets five less than E and every one must have atleast one fruit

Answer: 91

Q87

Let $P = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 8 & 4 & 1 \end{bmatrix}$ and I be the identity matrix of order 3. If $Q = \left[\mathrm{q}_{\mathrm{ij}}\right]$ is a matrix such that $\mathrm{P}^{500} - \mathrm{Q} = \mathrm{I}$, then $\frac{\mathrm{q}_{31} + \mathrm{q}_{32}}{\mathrm{q}_{21}}$ equals

Answer: 1001

Q88

The remainder when $16^{32^{128}}$ is divided by 7 is

Answer: 2

Q89

Let $A = \{1, 2, 3, 4\}$ and $B = \{0, 1, 2, 3, 4, 5\}$. The number of one-one functions from A to B which are not increasing is

Answer: 345

Q90

If $\mathrm{P}_1, \mathrm{P}_2, \mathrm{P}_3$ are the points on ellipse $3x^2 + y^2 - 12 = 0$ and $\mathrm{P}_1'\mathrm{P}_2'\mathrm{P}_3'$ are their corresponding points on the auxillary circle, then the area of triangle $\mathrm{P}_1'\mathrm{P}_2'\mathrm{P}_3'$ is λ times the area of triangle $\mathrm{P}_1\mathrm{P}_2\mathrm{P}_3$, then λ^2 is

Answer: 3
