Question Paper

Physics Multiple Correct (Maximum Marks: 32)

Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

A metal spherical shell of mass m is filled completely with nonviscous water of mass $m/2$ and is rolled down an inclined plane of height h. The total kinetic energy of shell plus water and the velocity of the centre of the shell when it reaches the bottom of the plane is K and v respectively. If water in the shell is freezed and then it is rolled down, the corresponding values of kinetic energy and velocity are K' and v' respectively. Then :

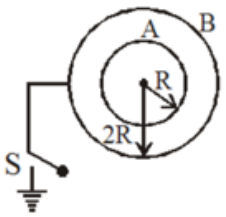
A. $K = \frac{3}{2}mgh$
B. $K' = \frac{3}{2}mgh$
C. $v = v'$
D. $v > v'$

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Two concentric conducting spherical shells of radii R and $2R$ having charges q_A and q_B and potential $2v$ and $3v/2$ respectively. Now shell B is earthed by closing switch S. Let charges on spherical shells A \& B become $q'_A \& q'_B$ respectively, then



A. $q_A/q_B = \frac{1}{2}$ (magnitude)
B. $q'_A/q'_B = 1$ (magnitude).
C. potential of A after earthing becomes $\frac{3v}{2}$.
D. potential difference between A and $B(v_A - v_B)$ after earthing becomes $\frac{v}{2}$.

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Sound waves from different source are interfering and pressure at some point in space is given as $P = P_0 \sin(200\pi t + \pi/2)\cos(3\pi t + \pi/3)$

A. The frequency of one source is above 100 Hz and other source is below 100 Hz.
B. Beat frequency is 3 Hz
C. Beat frequency is 200 Hz
D. Beat frequency can be 3 Hz as well as 200 Hz

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

A parallel beam of light of width t is incident at an angle 45^o on air-water boundary. The refractive index of water is μ. The width of beam in water is

A. t
B. μt
C. $\frac{\sqrt{2\mu^2-1}}{\mu} \times t$
D. $\frac{\sqrt{\mu^2-1}}{\mu} \times t$

Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If electron of hydrogen atom is replaced by another particle of same charge but of double mass then

A. Bohr's radius will increase
B. Ionisation energy of atom will be doubled
C. Speed of new particle in given state will be lesser than electrons speed in same orbit
D. Gap between energy levels will now be doubled

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Assume that the earth changes its shape and turns into an infinite cylinder whose radius and distance of moon from the axis of cylindrical earth remains unchanged and also moon is remain spherical. Assume density of earth remains same and distance of moon from earth is much greater than radius of earth. Which of the following statement(s) is/are correct :

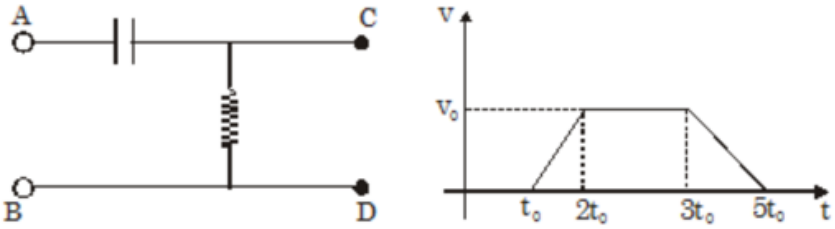
A. Gravitational field at the moon due to earth increases.
B. Gravitational field at the moon due to earth decreases.
C. Speed of the moon in its orbit around the cylindrical earth increases.
D. Speed of the moon in its orbit around the cylindrical earth decreases.

Question No. 7

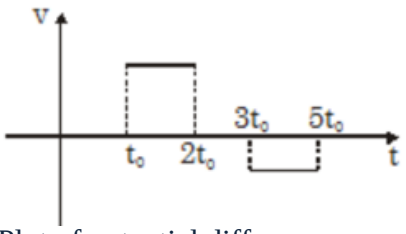
One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

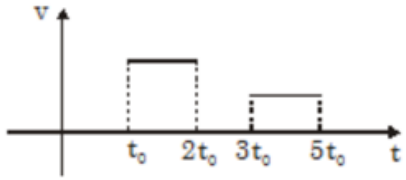
A time varying voltage is applied across AB as shown. Potential difference across the capacitor plate varies as shown. Then which of the following is/are correct.



Plot of potential difference across CD is

A. 

Plot of potential difference across CD is

B. 

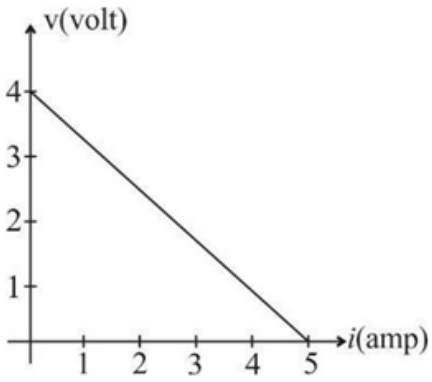
C. Plot of current across resistance does not vary for large value of resistance & capacitor
D. Plot of current across resistance does not vary for small value of resistance & capacitor

Question No. 8

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The graph of terminal voltage V across the cell of emf ε and internal resistance r is given as the function of current i flowing through it. Then :



A. $r = \frac{4}{5}\ \Omega$
B. $\varepsilon = 4$volt
C. Power supplied by the cell is maximum when $i = 2.5$amp
D. maximum power supplied by the cell is 10 W

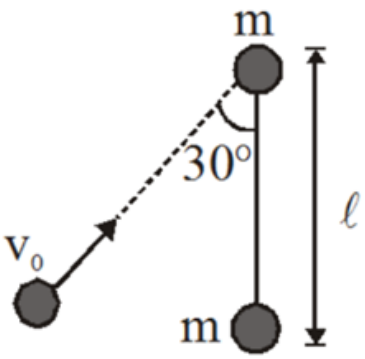
Physics Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

A small putty of mass $m = 1\ kg$ and speed $v_0 = 4\ m/s$, strikes a dumbbell placed on a smooth table as shown in figure. Putty is moving in the plane of the dumbbell. The putty sticks to dumbbell ball which is to be treated as particle. How much thermal energy is produced (in J). Consider rod of dumbbell to be massless.

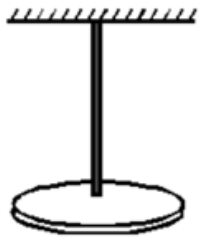


Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

A circular disc suspended from a torsional wire, oscillates with a time period T when twisted by a small angle θ from equilibrium and released.



If another disc of same material but twice the radius and one fourth thickness is made to oscillate (alone) with same wire, its time period is found to be nT . Write the value of n.

Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

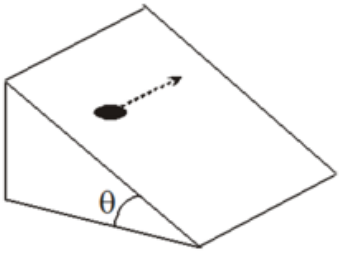
A helicopter flies horizontally with constant velocity in a direction 30° east of north between two points A and B at a distance $3\sqrt{2}\ km$ apart. Wind is blowing from south with a constant speed of $20\ m/s$. The speed of the helicopter is 1.5 times the speed of air, the helicopter flies from A to B and then returns from B to A with same speed relative to air in same wind. Find the total time for the journey in minutes assuming that the helicopter requires negligible time to stop or reverse its direction.

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

An object of mass $m = \sqrt{8}\ \text{kg}$ rests on an inclined plane that makes angle $\theta = 45^\circ$ with the horizontal floor. What minimum force (in N), parallel to the base of the incline must be applied to the object in order to begin to move it along the plane parallel to the floor as shown? The coefficient of static friction between the object and the plane is $\mu_s = 1.25$.



Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

A $3.5\ \text{V}$ mobile phone battery can produce $1\ \text{A}$ of current for 1 hour. This can be charged using a square solar panel $25\ \text{cm}$ on each side. Assuming an efficiency of 10% and an incident solar power of 1kWm^{-2} what time (in minutes) is needed to charge the battery?

Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

A parallel plate condenser, with plate area A and distance between plates d, is filled with a medium whose permittivity varies as ;

$$\in (x) = \epsilon_0 + \beta\epsilon_0 x/d \quad 0 < x < \frac{d}{2}$$

$$\in (x) = \epsilon_0 + \beta\epsilon_0 \frac{(d-x)}{d} \quad \frac{d}{2} < x < d$$

x is the distance from one of the plates. For what value of β would the capacity of the condenser be $\frac{1}{2\ln 2}$ times that when it is completely filled with a uniform dielectric having dielectric constant β ?

Physics Paragraph Type (Maximum Marks: 12)

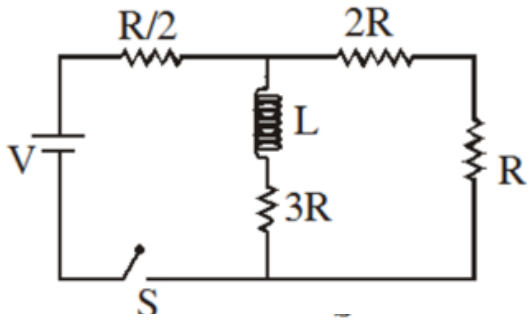
Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

The circuit below has an ideal inductor and a switch as shown in figure. The switch can be closed for a long time and then can be opened at $t = 0$ or it can be closed at $t = 0$. List-I gives the different circuit elements and list-II gives the value.



List-I		List-II	
(I)	Current in inductor	(P)	$\frac{6V}{7}$
(II)	Voltage across inductor	(Q)	$\frac{3V}{2}$
(III)	Current supplied by battery	(R)	$\frac{V}{4R}$
(IV)	Energy stored in the inductor	(S)	$\frac{V}{R}$
		(T)	Zero
		(U)	$\frac{LV^2}{32R^2}$

Question:

If the switch was closed at $t = 0$ then which of the following options are correct match of list I and II for that instant?

A. I → S
B. II → P
C. III → T
D. IV → U

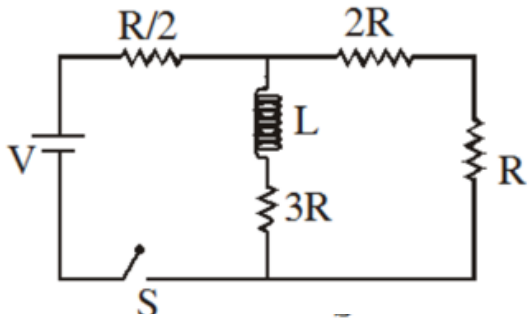
Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

The circuit below has an ideal inductor and a switch as shown in figure. The switch can be closed for a long time and then can be opened at $t = 0$ or it can be closed at $t = 0$. List-I gives the different circuit elements and list-II gives the value.



List-I		List-II	
(I)	Current in inductor	(P)	$\frac{6V}{7}$
(II)	Voltage across inductor	(Q)	$\frac{3V}{2}$
(III)	Current supplied by battery	(R)	$\frac{V}{4R}$
(IV)	Energy stored in the inductor	(S)	$\frac{V}{R}$
		(T)	Zero
		(U)	$\frac{LV^2}{32R^2}$

Question:

If the switch remains closed for a long time and then is opened at $t = 0$ then which option in List-I is matched correctly with List-II at that instant ?

A. I → R
B. II → T
C. III → S
D. IV → T

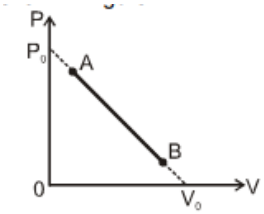
Question No. 3

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

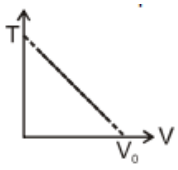
Passage:

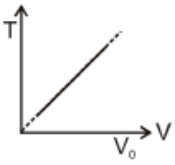
One mole of an ideal monatomic gas undergoes a linear process from A to B, in which its pressure P and its volume V change as shown in figure



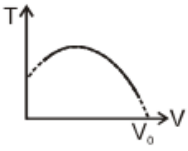
Question:

The absolute temperature T versus volume V for the given process can be represented by :

A.


B.


C.


D.


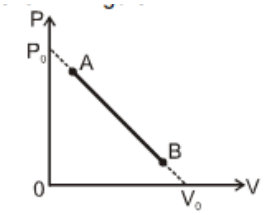
Question No. 4

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Passage:

One mole of an ideal monatomic gas undergoes a linear process from A to B, in which its pressure P and its volume V change as shown in figure



Question:

Choose the correct option(s) :

A. The maximum temperature of the gas during this process is $\frac{P_0 V_0}{4R}$

B. The maximum temperature of the gas during this process is $\frac{3P_0\ V_0}{4R}$

C. As the volume of the gas is increased, then the volume after which if the volume of gas is further increased the given process switches from endothermic to exothermic is $\frac{V_0}{8}$

D. As the volume of the gas is increased, then the volume after which if the volume of gas is further increased the given process switches from endothermic to exothermic is $\frac{3\ V_0}{8}$

Chemistry Multiple Correct (Maximum Marks: 32)

Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

For a dilute solution having molality m for a given solute in a solvent of mol. Wt M,

b.pt. T_b and heat of vaporization per mole ΔH; $[\frac{\Delta T_b}{m}]$ is equal to :

A. Cryoscopic constant of solvent

B. $\frac{RT_b^2 M}{\Delta_{vap} H}$; where M in kg$mol^{-1}$; $\Delta_{vap}\ H$ and R in SI units

C. $\frac{RT_b^2 M}{\Delta_{vap} S}$; where M in kgmol^{-1} $_m\Delta_{vap}\ S$ and R in SI units

D. $\frac{RT_b^2 M}{1000\Delta_{vap} H}$; where M in g$mol^{-1}$; R and $\Delta_{vap}\ H$ in SI units

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Select which square planar complex(es) can show optical isomerism.

A. Bis(en)platinum (II) ion

B. bis (Gly)platinum (II)

C. di(NH_3)(Gly) platinum (II) ion

D. di(NH_3)(N -methyl N-ethylglycinato)platinum (II) ion

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

In which of the following solutions, the solubility of AgCN will be greater than that in pure water?
(Given: $K_{sp}(AgCN) = 4 \times 10^{-16}$, $K_a(HCN) = 5 \times 10^{-10}$)

A. $0.01M AgNO_3$ solution

B. A buffer solution of pH = 12

C. $0.2M NH_3$ solution

D. A buffer solution of pH = 5

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If 100ml of 1M H_2SO_4 is mixed with 100ml of 98%(w/w) H_2SO_4(d = 0.1 g/ml) then

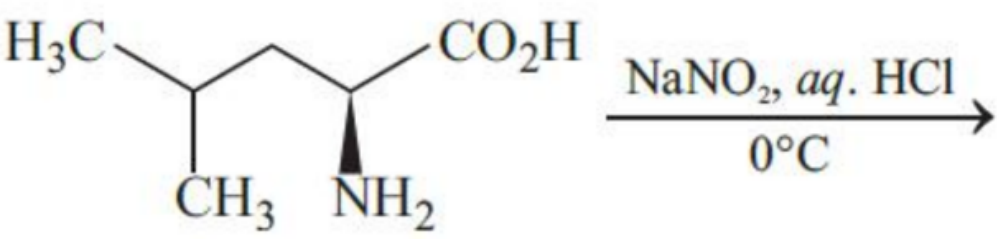
A. concentration of the solution remain same
B. volume of the solution becomes 200ml
C. mass of H_2SO_4 becomes 98 g
D. mass of H_2SO_4 in the solution is 19.6 g

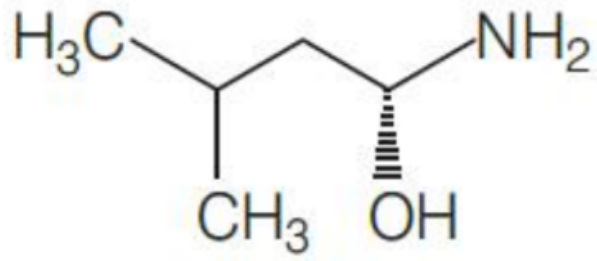
Question No. 5

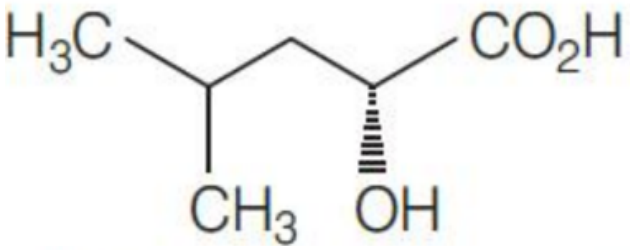
One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The major product of the reaction is



A.


B.


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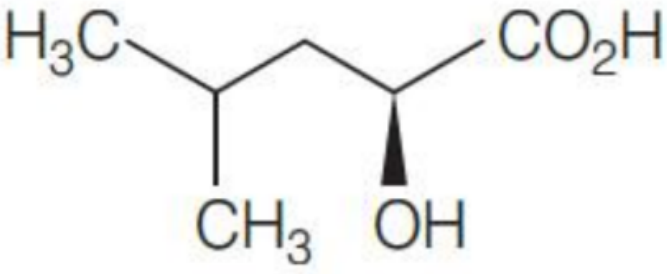
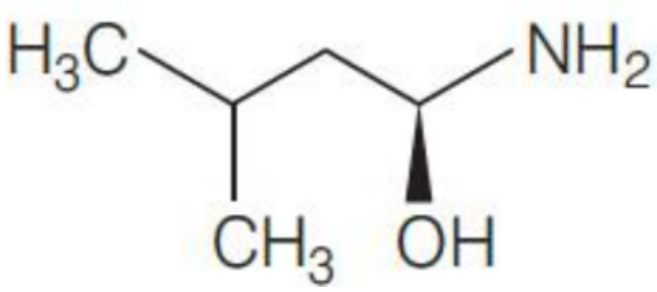


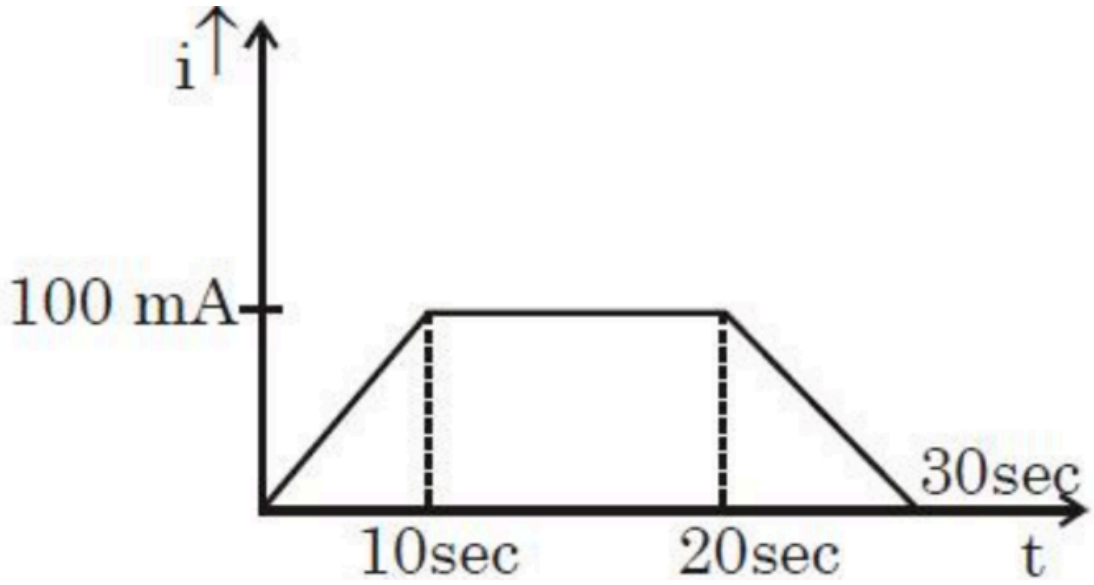
D.


Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

In a voltmeter, mass of a metal deposited in 30 seconds in 200 gms. Analyse the current v/s time graph shown below and identify the correct statement(s):



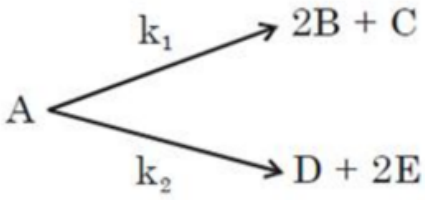
A. Electrochemical equivalent of the metal is 100 g/ coulomb
B. 33.33 grams got discharged in the first 10 seconds.
C. A constant current of 66.66 mA would also discharge approximately the same amount in same time
D. 100 gms of metal got discharged in the first 15 seconds

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If an optically active compound 'A' decompose through given parallel 1^{st} order kinetics



Initial mole of A is $2(k_1 = 0.0693sec^{-1}, k_2 = 0.1386sec^{-1})$. If only A, B&D are optically active compounds and their angle of rotation per mole are $60°, 30°, -90°$ respectively, when which of the following is /are correct.

A. Angle of rotation after time 3.33sec is 20°
B. Mixture is levorotatary after 75% decomposition A
C. Overall $t_{1/2}$ of A is 10/3sec .
D. Percentage of C formed in the product is 11.11%

Question No. 8

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Which of the following options is/are true w.r.t. surface phenomenon?

(Symbols have their usual meaning)

A. At extremely low pressures, graph of $\log(x/m)$ versus $\log P$ for adsorption of gases over a solid will have unit slope.

B. On mixing $100ml$ of $0.1MNaCl$ solution to $200ml$ of $0.02MPb(NO_3)_2$ solution, a negatively charged sol will be obtained.

C. On adding invertase to an aqueous solution of cane sugar, the rate of inversion of the solution increases.

D. Metal sulphide sols are reversible sols.

Chemistry Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

In fusion reaction of chromite ore with sodium carbonate in free access of air, ' a ' number of elements undergo redox change \& ' b ' moles of O_2 are consumed per mole of chromite ore. Report (a + b)

Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

Assume complete reactions of $XeF_2, XeF_4 \& XeF_6$ with water. If number of products which are common in atleast two reactions is ' p ' and, number of gases from $HCl, HBr, HI, H_2S \& NH_3$ which cannot be dried using conc. H_2SO_4 is ' q '.

Report your answer as $p \times q$.

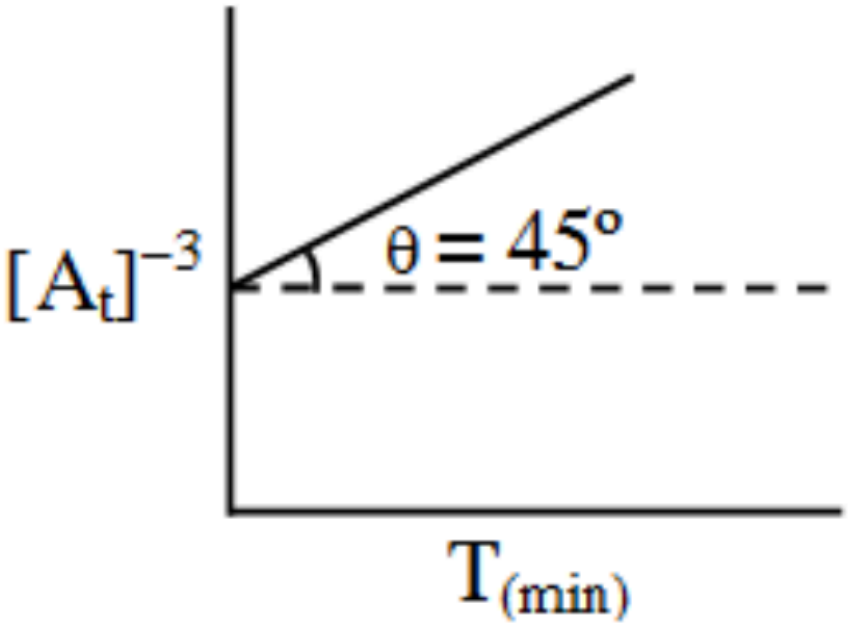
Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

For the reaction:

$3\ A \rightarrow 2\ B$, the rate law is: Rate = $k[A]^n$. The following graph is obtained experimentally:



The rate of reaction when $[A] = 0.1M$ is $P \times 10^{-4}\ Mmin^{-1}$ Determine P.

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

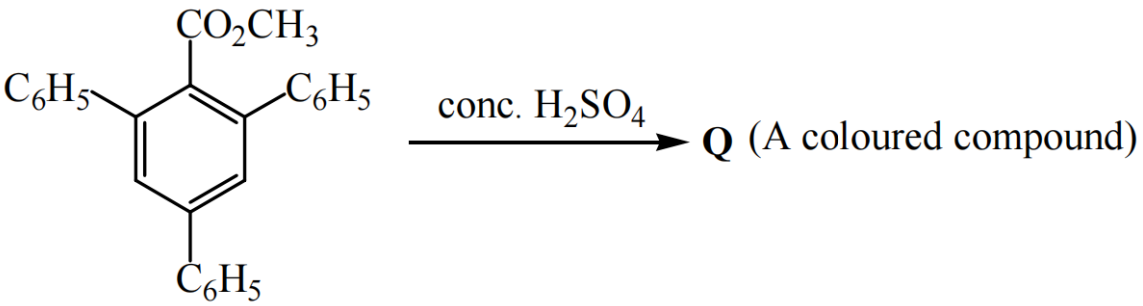
$100ml$ of sample of tap water contain $0.192mg$ of Mg^{+2}, what is the hardness as parts of $CaCO_3$ per million part of water.

Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

In the following reaction, compound **Q** is obtained from compound **P** via an ionic intermediate



P

What is the degree of unsaturation of Q ?

Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

A solution containing 2.54 gram of a salt $K_xH_y(C_2O_4)_z \cdot nH_2O$ per litre. $10ml$ of this salt solution required $30ml$ of 0.01 N$NaOH$

for complete neutralisation. Same quantity of salt solution was also found to require $40ml$ of 0.01 N $KMnO_4$ solution for complete oxidation.

Find out x, y, z and $n(x, y, z$ are simplest possible integers $)(K = 39)$

Report your answer as $\{\frac{x+y-z}{n}\}$

Chemistry Paragraph Type (Maximum Marks: 12)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

VSEPR theory proposes that the stereochemistry of an atom in a molecule is determined primarily by the repulsive interactions amongst all the electron pairs in the valence shell.

The shape of a molecule is determined by the arrangement and the repulsion between all the electron pairs present in the valence shell of the central atom. The magnitude of the repulsion between the bonding pairs of electrons depends on the electro negativity difference between the central atom and the other atoms bonded with it. When an atom with filled valence shell and one or more lone pairs is bonded to an atom with an incomplete valence shell, or a valence shell that can become complete by electron shifts, there is a tendency for the lone pairs to be partially transferred from the filled to the unfilled shell.**Question:**

Which of the following statement is incorrect?

A. Dimethyl ether is a weaker base than disilyl ether
B. Methyl isocyanate $(CH_3 - N = C = O)$ is bent, but silyl isocyanate $(SiH_3 - N = C = O)$ is linear (neglecting hydrogens)
C. In trisilyl amine $(SiH_3)_3 N$, all $N - Si$ bond lengths are identical but shorter than the expected N - Si bond length
D. NMe_3 and $N(SiMe_3)_3$ are not isostructural

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

VSEPR theory proposes that the stereochemistry of an atom in a molecule is determined primarily by the repulsive interactions amongst all the electron pairs in the valence shell.

The shape of a molecule is determined by the arrangement and the repulsion between all the electron pairs present in the valence shell of the central atom. The magnitude of the repulsion between the bonding pairs of electrons depends on the electro negativity difference between the central atom and the other atoms bonded with it. When an atom with filled valence shell and one or more lone pairs is bonded to an atom with an incomplete valence shell, or a valence shell that can become complete by electron shifts, there is a tendency for the lone pairs to be partially transferred from the filled to the unfilled shell.**Question:**

Trialkyl amine and trialkyl phosphine forms corresponding amine oxides and phosphine oxides respectively. Regarding $N-O$ and $P-O$ bonds in these compounds, the wrong statement is/are

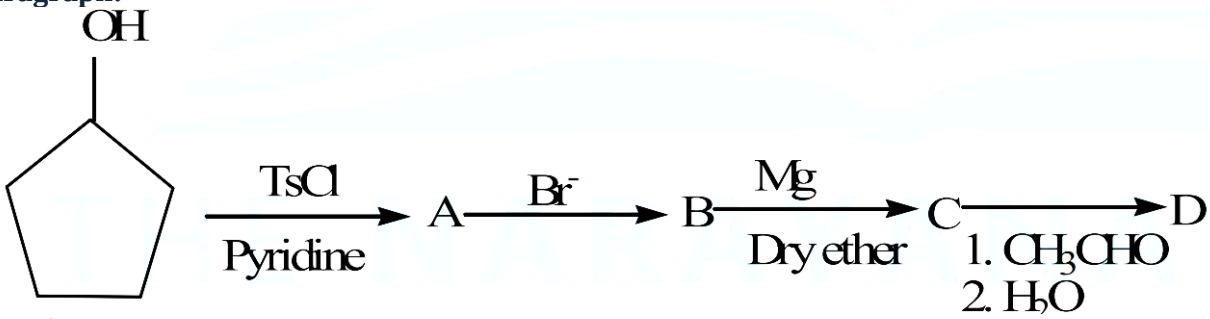
A. $P-O$ bond is stronger than $N-O$ bond
B. $P-O$ bond is more polar than $N-O$ bond
C. $P-O$ bond has double bond character while $N-O$ bond is not
D. Phosphine oxides have less dipole moment than amine oxides

Question No. 3

Only One Option Correct Type

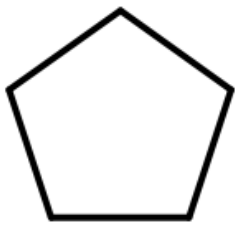
Each question has multiple options out of which ONLY ONE is correct.

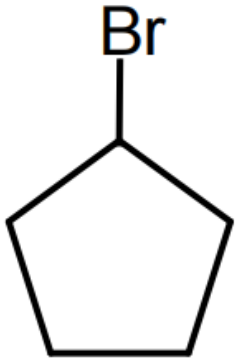
Paragraph:

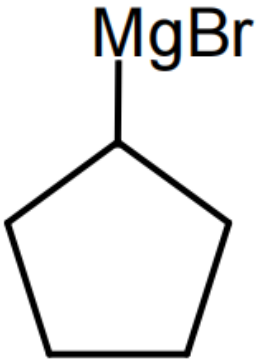


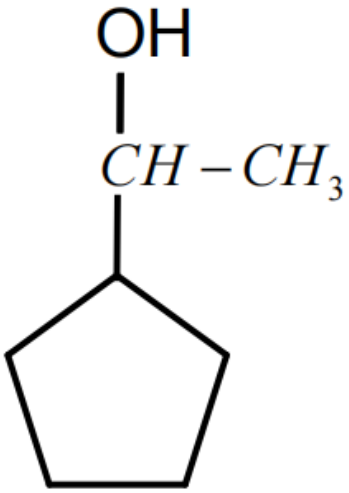
Question:

Compound ' C ' is:

A. 

B. 

C. 

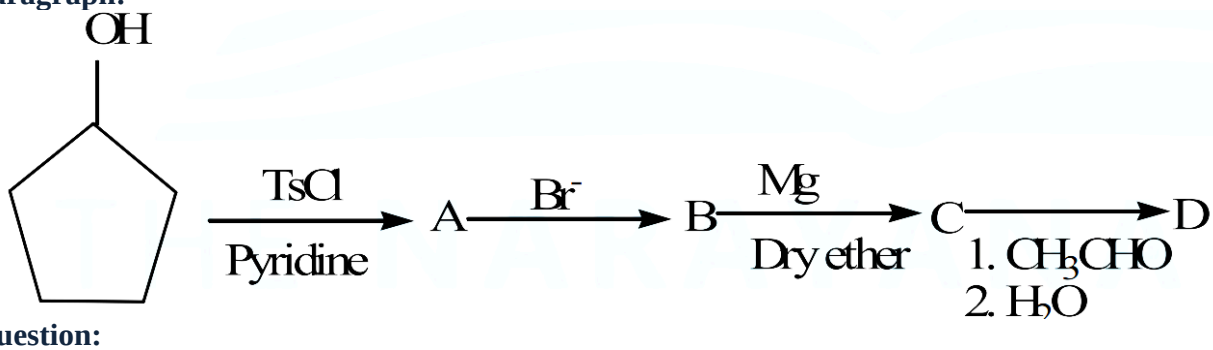
D. 

Question No. 4

Only One Option Correct Type

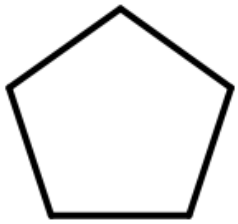
Each question has multiple options out of which ONLY ONE is correct.

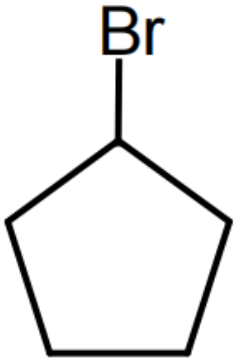
Paragraph:

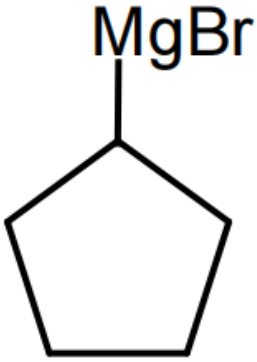


Question:

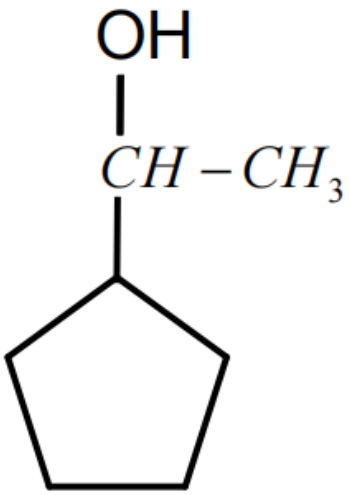
Compound ' D ' is:

A. 

B. 

C. 

D.



Mathematics Multiple Correct (Maximum Marks: 32)

Question No. 1

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let the conics $x^2 = xy + 1$ and $xy = x^2 + 1$ have eccentricities e_1 and e_2 respectively then

A. $e_1 > e_2$
B. $e_1 < e_2$
C. $e_1 \cdot e_2 = 2$
D. $e_1^{-2} + e_2^{-2} = 1$

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let for $n \in N; (2x^2 - 2x + 1)^n = \sum_{r=0}^{2n} (-1)^r a_r x^r$ then

A. $\sum_{r=0}^{2n} a_r = 1$
B. $\sum_{r=1}^{2n} (-1)^r a_r = 0$
C. $\sum_{k \geqslant 0} {}^nC_k \, {}^{2n-2k}C_r = 2^{n-r} a_r$
D. $\sum_{r=0}^{2n} ((-1)^r a_r a_{2n-r}) = 0$ if n = odd

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let $f : [0, 1] \to [0, \infty)$ be a differentiable function so that $f'(x)$ is decreasing function ; $f(0) = 0$, $f'(1) > 0, f'(0) > 0$ and $I = \int_0^1 \frac{dx}{1+f^2(x)} dx$ then which of the following is INCORRECT ?

A. $I \leqslant \frac{f(1)}{f'(1)}$
B. $I < \frac{f(1)}{f'(1)}$
C. $I \geqslant \frac{f(1)}{f'(1)}$

D. $I > \frac{f(1)}{f'(1)}$

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The coordinates of four angular points of a tetrahedron OABC are $(0,0,0),(0,0,2),(0,4,0)$ and $(6,0,0)$ respectively. A point P inside the tetrahedron is at the same distance r from the four plane faces of tetrahedron. Which of following cannot be the value of r ?

A. $\frac{2}{3}$
B. $\frac{2}{5}$
C. 2
D. 3

Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Consider the planes $P_1 : 2x + y + z + 4 = 0, P_2 : y - z + 4 = 0$ and $P_3 : 3x + 2y + z + 8 = 0$. Let L_1, L_2, L_3 be the lines of intersection of the planes P_2 and P_3, P_3 and P_1, and P_1 and P_2 respectively. Then,

A. Atleast two of the lines L_1, L_2 and L_3 are non-parallel
B. Atleast two of the lines L_1, L_2 and L_3 are parallel
C. The three planes intersect in a line
D. The three planes form a triangular prism

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If $t = \sum_{n=1}^{\infty} \cot^{-1}(2\sum_{i=1}^{n}(2i-1))$, then $\sin t + \cos t =$

A. $\sqrt{2}$
B. $-\sqrt{2}$
C. 0
D. 1

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let $\int_0^{\pi/2^n} \ln(\sin x)dx = a_n, \int_0^{\pi/2^n} \ln(\cos x)dx = b_n$, then

A. $a_1 + b_1 = -\pi \ln 2$
B. $a_2 + b_2 = -\frac{\pi}{2}\ln 2$
C. $a_2 + b_2 = \frac{\pi}{2}\ln 2$
D. $a_1 + b_1 = -\frac{\pi}{4}\ln 2$

Question No. 8

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let $\int_0^{\infty} e^{-x^2}\,dx = a$ and $I_n = \int_0^{\infty} x^n e^{-x^2}\,dx, n \in N$, then

A. $I_n = (\frac{n-1}{2})I_{n-2}$

B. $I_n = \frac{(n-1)!}{2^{n-1}(\frac{n-2}{2})!}a$, if n is even

C. $I_n = \frac{1}{2}(\frac{n-2}{2})!a$, if n is even

D. $I_n = \frac{(n-1)!}{2^{n-1}(\frac{n-2}{2})!}$, if n is even

Mathematics Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

In a triangle ABC (with usual notations), $a = 5,\ b = 4$ and $A - B = \cos^{-1}(\frac{31}{32})$ then the value of $\frac{c}{5}$ is

Question No. 2

Numerical Type

The answer has to be filled into the input box provided below.

In the equation $x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$ if p is the sum of real roots and q is the product of real roots then the value of $\frac{q}{p}$ is

Question No. 3

Numerical Type

The answer has to be filled into the input box provided below.

Let $\tan\alpha, \tan\beta$ and $\tan\gamma; \alpha, \beta, \gamma \neq \frac{(2n-1)\pi}{2}$ $n \in N$ be the slopes of three line segments OA, OB and OC, respectively, where O is origin.If circumcentre of ΔABC coincides with origin and its orthocentre lies on y-axis, then the value of $(\frac{\cos3\alpha+\cos3\beta+\cos3\gamma}{\cos\alpha\cos\beta\cos\gamma})^2$ is equal to :

Question No. 4

Numerical Type

The answer has to be filled into the input box provided below.

If the co-efficient of x^4 in the expansion of $(1 - x + 2x^2)^{12}$ is ${}^{n+2}C_{r+1} + r \cdot {}^{n+1}C_r + {}^nC_r$, then the coefficient of x^r in the expansion of $(1 + x)^{n/2}$ is

Question No. 5

Numerical Type

The answer has to be filled into the input box provided below.

Let $2(f(x))^2 - \frac{d^2 f(x)}{dx^2} f(x) + \left(\frac{df(x)}{dx}\right)^2 = 0 \& f(0) = f(1) = -1$. Area of region bounded by $y = 0, x = 0, x = 1$ and $y = (2x - 1)f(x)$ is $2\left(\frac{e^{1/a} - 1}{e^{1/a}}\right)$, then ' a ' is ?

Question No. 6

Numerical Type

The answer has to be filled into the input box provided below.

A trapezium is inscribed in the parabola $y^2 = 4x$ such that its digonals pass through the focus and are of length $\frac{25}{4}$ units. If area of this trapezium is A, then 4 A is?

Mathematics Paragraph Type (Maximum Marks: 12)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

Let $f(x)$ be a polynomial with positive leading coefficient satisfying
$f(0) = 0 \& f(f(x)) = x\int_0^x f(t)dt \quad \forall x \in R$

Question:

Two perpendicular tangents to the curve $y = f(x)$ will intersect on the curve/line

A. $x^2 + y^2 = 3$
B. $y = \frac{1}{4\sqrt{3}}$
C. $y = -\frac{\sqrt{3}}{4}$
D. $y^2 = \frac{3x}{-16}$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

Let $f(x)$ be a polynomial with positive leading coefficient satisfying
$f(0) = 0 \& f(f(x)) = x\int_0^x f(t)dt \quad \forall x \in R$

Question:

If a line having slope 1 and passing through $(\alpha, 0)$ neither cuts nor touches the curve $y = f(x)$, then the value of α must lie in the interval.

A. $(0, \infty)$
B. $\left(\frac{\sqrt{3}}{4}, \infty\right)$
C. $\left(\frac{3-\sqrt{3}}{4}, \infty\right)$
D. $\left(-\frac{3}{4}, \infty\right)$

Question No. 3

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

Let A and B are two square matrix of order 2×2, where $\det(A) = 1, \det(B) = 2$, then

Question:

Find $\det(A + \alpha B) - \det(\alpha A + B), \alpha \in R$:

A. α^2
B. 0
C. $\alpha^2 - 1$
D. None of these

Question No. 4

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

Paragraph:

Let A and B are two square matrix of order 2×2, where $\det(A) = 1, \det(B) = 2$, then

Question:

Find $\det(A - \alpha B) - \det(-\alpha A + B), \alpha \in R$:

A. α^2
B. 0
C. $\alpha^2 - 1$
D. None of these