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BEWARE OF NEGATIVE MARKING

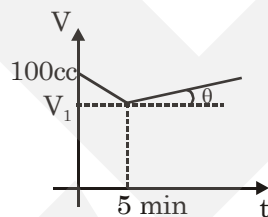
PART-1 : PHYSICS

SECTION-1 : (Maximum Marks: 24)

- This section contains **SIX** questions.
 - Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
 - For each question, choose the correct option(s) to answer the question.
 - Answer to each question will be evaluated according to the following marking scheme:
 - Full Marks* : +4 If only (all) the correct option(s) is (are) chosen.
 - Partial Marks* : +3 If all the four options are correct but **ONLY** three options are chosen.
 - Partial Marks* : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
 - Partial Marks* : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
 - Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered).
 - Negative Marks* : -2 In all other cases.
 - **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.
-
1. Two particles of mass m and $2m$ moving in opposite direction collide head on. They have same de-Broglie wavelength before collision. After the collision :-
- (A) If $e = 1$, de-Broglie wavelength of m is greater than that of $2m$.
 - (B) If $e = 1$, de-Broglie wavelength of $2m$ is greater than that of m .
 - (C) The de-Broglie wavelength of m increases if $e = 1$.
 - (D) The de-Broglie wavelength of $2m$ remains same if $e = 1$.

Space for Rough Work

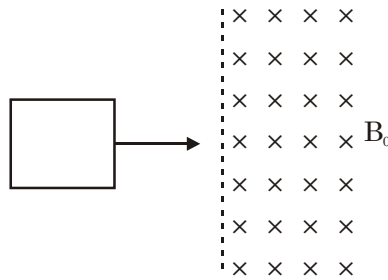
2. A soap bubble of radius 1cm is formed in vacuum. It is filled with a monoatomic gas. Then using a syringe, more gas is pushed inside the soap bubble to double the radius. The surface tension of soap solution is 0.05 N/m. Assume temperature to remain constant :-
- (A) The change in surface energy is $6\pi \times 10^{-5}$ J.
 (B) The number of moles inside the bubble have become 4 times the original.
 (C) If the gas added is also monoatomic, internal energy of gas has become 4 times the original.
 (D) If the gas added is diatomic, internal energy of gas has become 6 times the original.
3. A toy plane has a siren installed on it. The siren has a frequency of 100 Hz. The plane is moving at a velocity of 160 m/s in the horizontal direction. Assume that vertically upward is y direction, direction of motion of plane is x direction and plane is 8m above the ground. The origin is vertically below the plane on the ground at a particular instant. Speed of sound = 320 m/s.
- (A) the frequency recorded by a recorder at (0, 0, 6m) is 100 Hz.
 (B) the frequency recorded by a recorder at (6, 0, 0) is $\frac{500}{3}$ Hz.
 (C) the frequency recorded by recorder at (8, 0, 4) is 150 Hz.
 (D) the frequency recorded by recorder at (8, 0, -4) is 120 Hz.
4. A block of ice at 0°C was being heated at a constant rate. The volume of sample as a function of time is shown in the graph below. Take $\rho_{\text{ice}} = 0.9$ gm/cc, $\rho_{\text{water}} = 1$ gm/cc, $\gamma_{\text{water}} = 10^{-3}$ /°C. Specific heat capacity of water = 1 cal/gm °C, latent heat of fusion of ice = 80 cal/gm :-



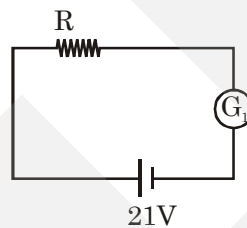
- (A) $V_1 = 90$ cc
 (B) $\frac{dH}{dt} = 24$ cal/sec
 (C) $\tan \theta = 1.44$ cc/min
 (D) Water will start boiling at 8.24 min.

Space for Rough Work

5. A square loop of side a , resistance R , mass m is sliding as shown on a smooth horizontal table with speed v_0 . It enters a uniform magnetic field of magnitude B_0 perpendicular to the table. It is seen that the loop comes to rest after entering a distance ℓ inside the magnetic field. The value of v_0 can be :-



- (A) $\frac{2B^2a^3}{mR}$ (B) $\frac{B^2a^3}{2mR}$ (C) $\frac{B^2a^3}{3mR}$ (D) $\frac{B^2a^3}{6mR}$
6. In the circuit shown, the battery is ideal. It has a voltage of 21 V. The galvanometer G_1 shows 0.42 A. When another identical galvanometer G_2 is connected across R , the reading of G_1 increases to 0.50 A :-



- (A) The resistance of galvanometer is 30Ω
 (B) The resistance $R = 40 \Omega$
 (C) The reading of $G_2 = 0.20 \text{ A}$
 (D) If instead of this, G_2 was connected parallel to G_1 , their reading would be same = 0.21A.

Space for Rough Work

SECTION-2 : (Maximum Marks : 12)

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct answer is darkened.
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Paragraph for Questions 1 and 2

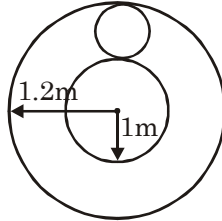
Starting from 2019, scientists have redefined the units of fundamental physical quantities. Thus, definition of metre, second and mole remain essentially the same. But the definition of kilogram, kelvin and ampere have been changed. In the new system, planck's constant h , Boltzmann's constant k and Avogadro's number N_A , velocity of light c , charge on an electron e are given constant fixed values. So the definitions of kilogram, kelvin and ampere are to be given in terms of definition of metre, second, mole and these fundamental constants.

1. In an experiment, we wish to find value of ϵ_0 . This is found by finding force between two electrons kept at a distance r . If the measurement of force has an error of 10^{-3} % and that of distance has an error of 3×10^{-3} %, the relative error in :-
(A) Permittivity of free space ϵ_0 is 7×10^{-3} %.
(B) Permittivity of free space ϵ_0 is 3×10^{-3} %.
(C) Permittivity of free space ϵ_0 is 4×10^{-3} %.
(D) Permittivity of free space ϵ_0 is 5×10^{-3} %.
2. Which of the following constants will have no uncertainty according to the new accepted system ?
(A) Universal gas constant R (B) Stefan constant σ
(C) Permeability of free space μ_0 (D) Universal gravitational constant G .

Space for Rough Work

Paragraph for Questions 3 and 4

Two coaxial pipes of radius 1m and 1.2 m are have a common horizontal axis. A uniform solid spherical ball of radius 0.1m is fitted inside them as shown. The inner surfaces are sufficiently rough so that there is no slipping any where. On slight displacement, the ball starts moving along the gap shown in the downward direction. There are 2 possible cases.



- The inner pipe is held fixed but outer pipe is free to rotate.
- The outer pipe is held fixed but inner pipe is free to rotate.

All the 3 bodies (both pipes & ball) have same mass of 1kg.

3. When ball reaches the bottom, the pipe which is free to rotate is rotating with angular

velocity ω . Let it be ω_1 in 1st case & ω_2 in 2nd case. $\frac{\omega_1}{\omega_2} =$

- (A) $\frac{5}{6}$ (B) $-\frac{5}{6}$ (C) $\frac{2}{3}$ (D) $-\frac{3}{2}$

4. If the angular velocity of ball at the bottom in the 2 cases is ω_0 & ω'_0 respectively, $\frac{\omega_0}{\omega'_0} =$

- (A) 1 (B) -1 (C) $\sqrt{\frac{27}{25}}$ (D) $-\sqrt{\frac{27}{25}}$

Space for Rough Work

SECTION-3 : (Maximum Marks: 24)

- This section contains **EIGHT** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

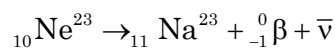
For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

		+		-	
●	●	○	○	○	○
①	①	①	①	①	①
②	②	②	②	●	②
③	③	③	③	③	③
④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	●
⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	●	●	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨

		+		-	
●	●	○	○	○	○
①	①	①	①	①	①
②	②	②	②	●	②
③	③	③	③	③	③
④	④	④	④	④	④
⑤	⑤	⑤	●	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨

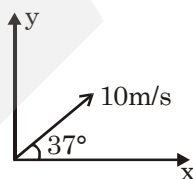
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1. Neon 23 undergoes β decay



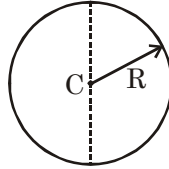
Atomic mass of ${}^{23}\text{Ne}$ and ${}^{23}\text{Na}$ are 22.9945 u and 22.9898u respectively. Mass of electron is $0.51 \frac{\text{MeV}}{c^2}$. The maximum kinetic energy of β^- particle is ___ MeV. (Take $1\text{u} = 931.5 \text{ MeV}/c^2$)

2. A charge $2 \times 10^{-3} \text{ C}$ and mass 1 gm is projected from level ground with a velocity of 10 m/s at an angle of 37° with the horizontal (x direction). The electric potential in space is given by $V = 3x + 4y$. What is the speed of the charge (in m/s) when its y coordinate is maximum ?

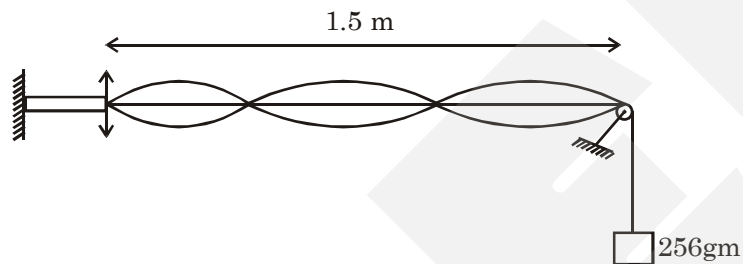


Space for Rough Work

3. Find the magnetic field due to a spinning spherical shell of radius R , charge/area σ rotating about its diameter with an angular velocity ω at its center. $\omega = 3 \text{ rad/s}$, $R = 2\text{m}$, $\sigma = \frac{1.5}{\pi} \text{ C/m}^2$.
Fill $B \times 10^6$ (in tesla) in the OMR sheet.

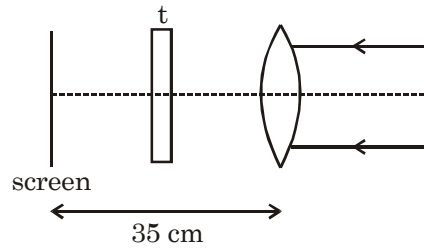


4. A string is stretched between a pulley and a wave generator consisting of a plate vibrating up and down with small amplitude and frequency 120 Hz. The standing wave pattern has 4 nodes as shown. What should be the load (in gm) we want a standing wave with 5 nodes.

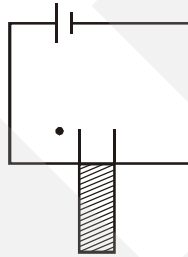


Space for Rough Work

5. Parallel beam is incident on a thin lens ($\mu = 1.4$) and radii 25 cm of each of the surfaces as shown. What should be the thickness of a slab (in cm) ($\mu = 1.5$) between the lens and the screen so that final image is formed on the screen.

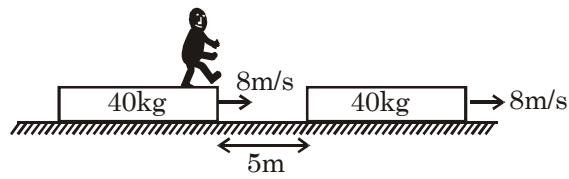


6. A dielectric slab of dielectric constant k , mass m , thickness d and area $L \times L$ is hanging vertically in equilibrium under the influence of gravity and electrostatic pull of a capacitor connected to a battery of voltage V . The capacitor has plates of area $L \times L$ and distance between plates is d . The capacitor is half filled by the dielectric. Suddenly a mass of m is attached to dielectric without any impulse on the system. The slab falls off in time t . Evaluate t (in sec). Take $k = 2$, $V = 4$ volts, $L = 80$ cm, $d = 0.1$ mm.

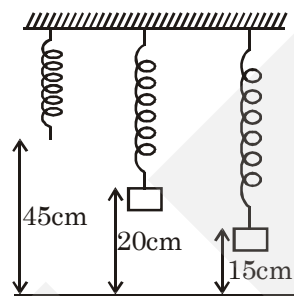


Space for Rough Work

7. A boy of mass 40 kg is on a plank of mass 40 kg moving to right on a smooth floor at 8 m/s. He wants to jump on an identical plank travelling in the front at the same speed. With what minimum speed (in m/s) relative to the plank on which he is standing, should he jump ?



8. A massless spring is suspended from a hook at the top. A small mass of 180 gm is suspended from the bottom of the hook. At the equilibrium it is at 20 cm from ground. It is pulled down to distance 15 cm from ground and released. Find the time (in sec) at which it is first at 25 cm from the ground. Take $\pi^2 = 10$.



Space for Rough Work

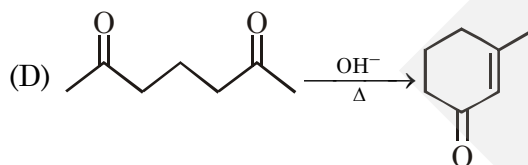
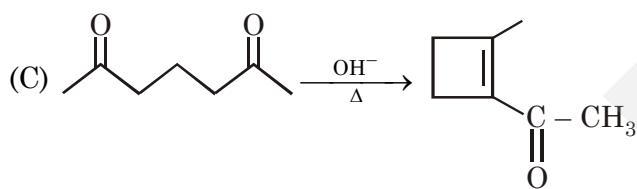
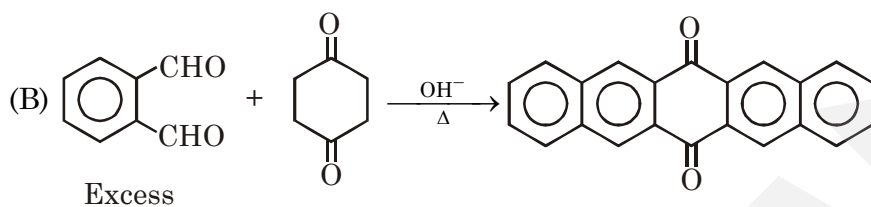
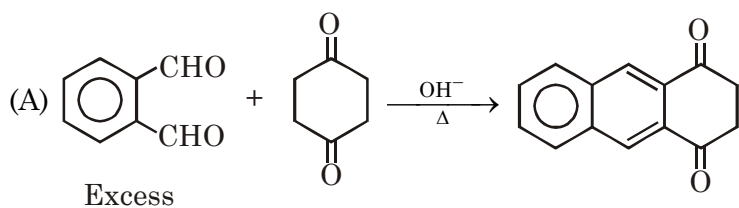
PART-2 : CHEMISTRY**SECTION-1 : (Maximum Marks: 24)**

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-
1. In 1.5 litre, 2M NaOH solution, 320 gm bromine and 0.5 mole acetone are added giving colourless dense bromoform liquid. Excess NaOH was back titrated against 0.5M H_2SO_4 using phenolphthalein as indicator, Volume of H_2SO_4 required to reach end point is - (Br = 80)
(Assume that excess NaOH does not react with Br_2 left and bromoform formed)
- (A) $\frac{1}{4}$ litre (B) $\frac{1}{2}$ litre (C) $\frac{1}{3}$ litre (D) 1 litre
2. Which of the following statements are true about AgI sol prepared by peptization of AgI with $AgNO_3$ (excess).
- (A) In electrophoresis, the dispersed phase will move towards cathode.
(B) $AlCl_3$ is more effective than Na_3PO_4 for bringing about coagulation of sol.
(C) Na_3PO_4 is more effective than $AlCl_3$ for bringing about coagulation of sol.
(D) On persistent dialysis of sol, precipitation of colloidal sol take place (coagulation)

Space for Rough Work

3. Which of following reaction sequence is/are given correct set of reaction as major final product?



Space for Rough Work

4. Which of following correct regarding formation of osazone by hexose sugar?
- (A) 2 mole of phenyl hydrazine consumed in osazone formation.
(B) 3 mole of phenyl hydrazine consumed in osazone formation.
(C) Only C_1 and C_2 carbon are involved in osazone formation due to formation of six membered transition state .
(D) C_2 epimer of reducing hexose sugar gives similar osazone.
5. Which of the following species have integral bond order, gerade type HOMO and paramagnetic nature.
- (A) O_2^{2-} (B) N_2^{2-} (C) O_2 (D) O_2^+
6. Which of the following properties is/are common amongst the oxy acids $H_2S_2O_7$, $H_4P_2O_5$ and $H_3P_3O_9$
- (A) All have chain type open structure
(B) All have X–O–X type linkage (X = central atom)
(C) Central atom have it's highest oxidation state
(D) Atleast one X=O bond is present (X = central atom)

Space for Rough Work

SECTION-2 : (Maximum Marks : 12)

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Paragraph for Questions 1 and 2

Complex having same molecular formula but different orientation in space are known as stereoisomers.

Answer the following questions :-

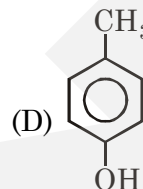
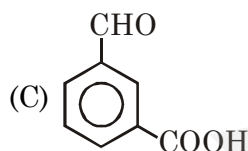
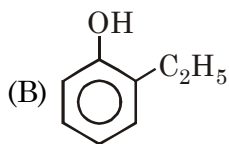
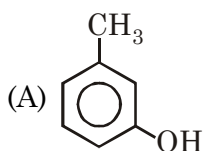
1. For the octahedral complex $Ma_xb_xc_x$ total number of geometrical isomers is :-
(where a, b, c are monodentate ligands having achiral center.)
(A) 6 (B) 5 (C) 4 (D) 3
2. For the octahedral complex $M(AB)_2(CD)$ (where (AB) and (CD) are two different bidentate ligands) $C-\widehat{M}-D$ angle will be in general :-
(A) approx 90° (B) approx 180°
(C) either 90° or 180° (D) approx 120°

Space for Rough Work

Paragraph for Questions 3 and 4

Electrophilic aromatic substitution is characteristic reaction of aromatic compounds where substitution of electrophile of reactant takes place under influence of +M / -M group +M group substitute electrophile on O/P position, while -M on -M position if both group present in same aromatic compound substitution takes place according to more activating group.

3. Which of following produce only mono substituted product on nitration?



4. Why acylation followed by reduction with (Zn -Hg / HCl) is more suitable to get alkyl benzene in place of direct alkylation in presence of Lewis acid.
- (A) Direct alkylation not possible.
- (B) Direct alkylation produce alkyl benzene which activates the ring for further alkylation and gives polyalkylated product.
- (C) Alkylation follows free radical substitutions.
- (D) Acylation followed by reduction give alcohol in place of alkyl benzene

Space for Rough Work

SECTION-3 : (Maximum Marks: 24)

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- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

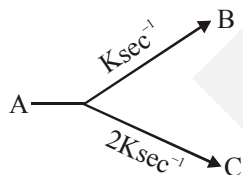
For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

+									
●	●	○	○	○	○	○	○	○	○
①	①	①	①	①	①	①	①	①	①
②	②	②	②	●	②	②	②	②	②
③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	●	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	●	●	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

-									
●	●	●	○	○	○	○	○	○	○
①	①	①	①	①	①	①	①	①	①
②	②	②	②	●	②	②	②	②	②
③	③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④	④
⑤	⑤	⑤	●	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

- Answer to each question will be evaluated according to the following marking scheme:
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Zero Marks : 0 In all other cases.

1. Equivalent conductivity of AgNO_3 , CaCl_2 and $\text{Ca}(\text{NO}_3)_2$ at infinite dilution are 110, 230 and $196.5 \Omega^{-1} \text{cm}^2 \text{eqv}^{-1}$ respectively. Conductivity of $\text{AgCl}(\text{aq.})$ & H_2O is $2.4 \times 10^{-6} \Omega \text{cm}^{-1}$ and $1.4 \times 10^{-6} \Omega^{-1} \text{cm}^{-1}$ respectively. Find solubility of AgCl in **mg/litre**.
 [Atomic mass : Ag = 108, Cl = 35.5]
2. In a parallel first order reaction starting with 1 mol 'A' as :



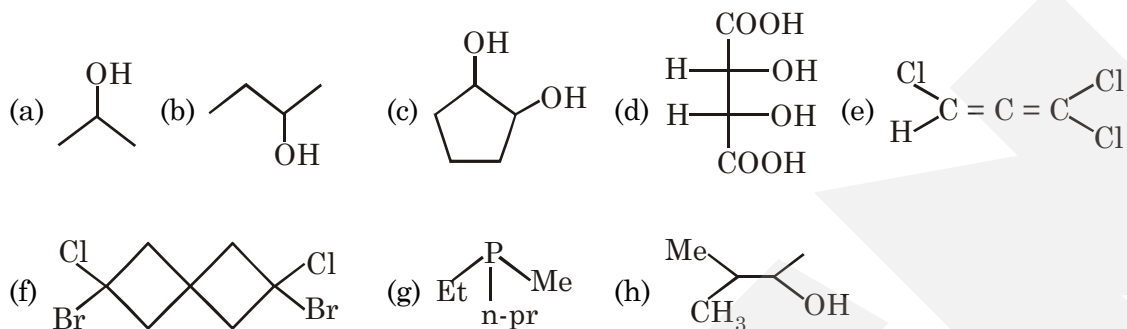
If A, B & C are optically active with standard optical rotation 15° , 10° & -20° degree per mole respectively then give time in sec when solution will be optically inactive.

Given : $k = 0.024 \text{ sec}^{-1}$, $\ln 2 = 0.7$, $\ln 5 = 1.60$.

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3. A point source of light of power 3.2 milli watts emit energy 5eV. If the source is located at a distance of 0.8m from the centre of metallic sphere of work function 3 eV and radius 8mm. Number of photoelectrons emitted in 1 sec if efficiency is 1% is $x \times 10^y$ in significant number, then find value of 'y' ($1\text{eV} = 1.6 \times 10^{-19}\text{J}$)

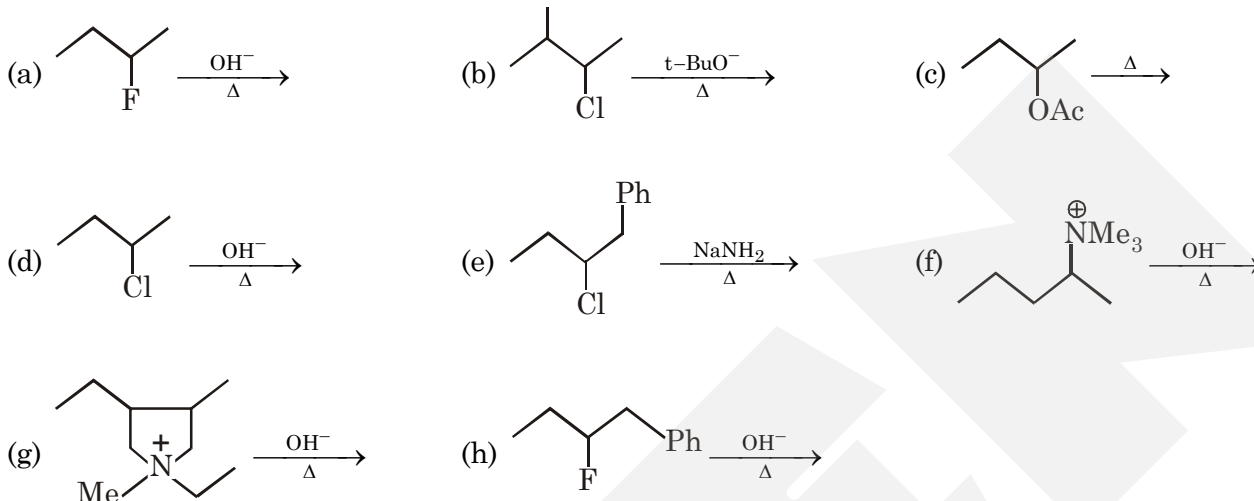
4. Which of following molecule shows optical isomerism



5. Total number of ore which concentrated by magnetic separation method.
 Tin stone consisting of Wolframite, Ilmenite, Chromite, Silver glance, Dolomite

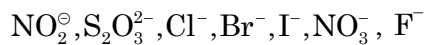
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6. Any metal 'A' (sp.gr = 0.8) crystallises in ccp arrangement with atomic radius $2\sqrt{2}\text{\AA}$ then give no. of moles of unit cell in 307.2 gm metal. [Use : $N_A = 6 \times 10^{23}$]
7. How many of following reaction gives Hoffmann product as a major product?



8. Salt 'X' $\xrightarrow{\text{dil. H}_2\text{SO}_4}$ NO observation
 $\xrightarrow[\Delta]{\text{MnO}_2 + \text{conc. H}_2\text{SO}_4}$ Coloured gas/vapours

Total number of anions which will give coloured gas will be :-



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PART-3 : MATHEMATICS
SECTION-1 : (Maximum Marks: 24)

- This section contains **SIX** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If only (all) the correct option(s) is (are) chosen.
Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.
Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).
Negative Marks : -2 In all other cases.
- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

1. Let $f(x) = \begin{cases} \frac{B(e^x - e^{-x} - 2\sin x)}{x^3} & ; x \neq 0 \\ A & ; x = 0 \end{cases}$, where A and B are chosen from the set of first ten natural numbers, with $B > A$. If the probability that $f(x)$ is continuous is $\frac{p}{q}$ (Where p and q are relatively prime) then
 (A) $p + q = 16$ (B) $p^2 + q^2 = 13$ (C) $pq = 15$ (D) $pq = 12$
2. Let z be a root of $x^5 - 1 = 0$ with $z \neq 1$. The value of $z^{15} + z^{16} + z^{17} + \dots + z^{50}$ is less than or equals to
 (A) 1 (B) -1 (C) 0 (D) 5

Space for Rough Work

3. If ABCD is a regular tetrahedron with length of any edge as ℓ , then
- (A) volume of tetrahedron is $\frac{\ell^3}{6\sqrt{2}}$
- (B) volume of tetrahedron is $\frac{\ell^3}{6\sqrt{3}}$
- (C) minimum distance of any vertex from the opposite face is $\sqrt{\frac{2}{3}}\ell$
- (D) minimum distance of any vertex from the opposite face is $\sqrt{\frac{3}{2}}\ell$
4. For the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$, which of the following is true
- (A) Radius of auxilliary circle is 4 (B) Radius of director circle is 5
- (C) Length of major axis is 8 (D) Length of minor axis is 6
5. Suppose $f(1) = 2$, $f(4) = 7$, $f'(1) = 5$, $f'(4) = 4$ and $f''(x)$ is continuous. Then the value of $\int_1^4 x f''(x) dx$ is/are
- (A) an even integer (B) an odd integer
- (C) a positive value (D) a non integral value
6. If α, β are roots of equation $2x^2 - 7x + \frac{3}{2} = 0$ then $\tan^{-1}\alpha + \tan^{-1}\beta$ is
- (A) $\tan^{-1}(14)$ (B) $\cot^{-1}\left(\frac{1}{14}\right)$ (C) $\tan^{-1}(6)$ (D) $\cot^{-1}\left(\frac{1}{6}\right)$

Space for Rough Work

SECTION-2 : (Maximum Marks : 12)

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct answer is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases

Paragraph for Questions 1 and 2

Consider the curve $y = f(x)$ which is defined parametrically as $x = \frac{2t^2}{(1+t^2)}$; $y = \frac{2t}{(1+t^2)}$ then

1. The value of t for which the tangent to the curve is parallel to x axis is
 (A) 0 (B) 1 (C) 2 (D) 3
2. The normal at $\left(\frac{2}{5}, \frac{4}{5}\right)$ to the curve $y = f(x)$ intersects the curve again at the point
 (A) $\left(\frac{8}{5}, \frac{4}{5}\right)$ (B) $\left(\frac{8}{5}, -\frac{4}{5}\right)$ (C) $\left(\frac{2}{5}, -\frac{4}{5}\right)$ (D) $\left(\frac{4}{5}, \frac{8}{5}\right)$

Paragraph for Questions 3 and 4

Consider the curve $C_1 : x^2 - y^2 = 1$ and $C_2 : y^2 = 4x$ then

3. The point of intersection of directrix of the curve C_2 with C_1 is
 (A) (-1, 0) (B) (1, 0) (C) (2, 0) (D) (-3, 0)
4. The number of lines which are normal to C_2 and tangent to C_1 is
 (A) 0 (B) 1 (C) 2 (D) 4

Space for Rough Work

SECTION-3 : (Maximum Marks: 24)

- This section contains **EIGHT** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

		+		-	
●	●	○	○	○	○
①	①	①	①	①	①
②	②	②	②	●	②
③	③	③	③	③	③
④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	●
⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	●	●	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨

		+		-	
●	●	○	○	○	○
①	①	①	①	①	①
②	②	②	②	●	②
③	③	③	③	③	③
④	④	④	④	④	④
⑤	⑤	⑤	●	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨

- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +3 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

1. If $\int_{-5}^{-2} \left(\frac{x^2 - x}{x^3 - 3x + 1} \right)^2 dx + \int_{\frac{1}{6}}^{\frac{1}{3}} \left(\frac{x^2 - x}{x^3 - 3x + 1} \right)^2 dx + \int_{\frac{6}{5}}^{\frac{3}{2}} \left(\frac{x^2 - x}{x^3 - 3x + 1} \right)^2 dx = \frac{p}{q}$, where p and q are co-primes, then $\frac{(6q - p)}{12}$ is
2. Let B is adjoint of matrix A, having order 3 and $B^T B^{-1} = A$ (where B is non singular), then $\frac{\text{tr}(A + B)}{4}$ is (where $\text{tr}(A)$ is sum of diagonal elements of matrix A)

Space for Rough Work

3. The complete range of k for which the equation $x^4 - 2kx^2 + x + k^2 - k = 0$ has all real solutions is $\left[\frac{m}{n}, \infty\right)$, where m and n are relatively prime, then $\frac{(m+n)}{5}$ is
4. Let the curve $y = f(x)$ is having the property that slope of tangent at any point is equal to twice its abscissa. If the curve passes through the points $(1, 2)$ and $(2, y_0)$ then $\frac{y_0}{4}$ is

Space for Rough Work

5. Let λ is number of all possible 8 digit odd numbers formed by using only digits 0, 0, 2, 2, 3, 3, 4, 5, then $\frac{\lambda}{900}$ is
6. If the sum of all solutions of equations $\sin x + 2\cos x = 1 + \sqrt{3} \cos x$ in $[0, 2\pi]$ is $\frac{k\pi}{6}$ then $\frac{k}{2}$ is

Space for Rough Work

7. If $[\vec{a} + \vec{b} \quad \vec{b} + \vec{c} \quad \vec{c} + \vec{a}] = \lambda_1 [\vec{a} \quad \vec{b} \quad \vec{c}]$ and $[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}] = [\vec{a} \quad \vec{b} \quad \vec{c}]^{\lambda_2}$ then $\frac{(\lambda_1 + \lambda_2)}{3}$ is
(where $\vec{a}, \vec{b}, \vec{c}$ are non zero and non coplanar vectors)

8. $\sum_{r=1}^{\infty} \frac{1}{r(r+1)}$ is

Space for Rough Work