

07/04/2025

Evening



# Aakash

Medical | IIT-JEE | Foundations

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## Memory Based Answers & Solutions

Time : 3 hrs.

for

M.M. : 300

## JEE (Main)-2025 (Online) Phase-2

(Physics, Chemistry and Mathematics)

### IMPORTANT INSTRUCTIONS:

- (1) The test is of **3 hours** duration.
- (2) This test paper consists of 75 questions. Each subject (PCM) has 25 questions. The maximum marks are 300.
- (3) This question paper contains **Three Parts**. **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is **Mathematics**. Each part has only two sections: **Section-A** and **Section-B**.
- (4) **Section - A** : Attempt all questions.
- (5) **Section - B** : Attempt all questions.
- (6) **Section - A (01 – 20)** contains 20 multiple choice questions which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.
- (7) **Section - B (21 – 25)** contains 5 **Numerical value** based questions. The answer to each question should be rounded off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.

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4 STATE  
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70+ 100  
PERCENTILERS  
IN PHYSICS, CHEMISTRY & MATHEMATICS

1000+ 99  
PERCENTILERS  
& ABOVE

4000+ 95  
PERCENTILERS  
& ABOVE

100  
Percentile  
in  
Maths



**Shreyas Lohiya**  
PSID: 00003389699

100  
Percentile  
in  
Physics



**Harsh Jha**  
PSID: 00014863322

100  
Percentile  
in  
Chemistry



**Devya Rustagi**  
PSID: 00014768785

99.99  
Percentile



**Amogh Bansal**  
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4 Year Classroom  
**1** AIR  
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2020



**Tanishka Kabra**  
4 Year Classroom  
**1** AIR-16 CRL  
JEE (Adv.)  
2022  
ALL INDIA FEMALE  
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**Sanvi Jain**  
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**PHYSICS**

**SECTION - A**

**Multiple Choice Questions:** This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

**Choose the correct answer:**

1. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

**Assertion (A):** Refractive index of glass is more than air.

**Reason (R):** Optical density of a medium is directly related to its mass density.

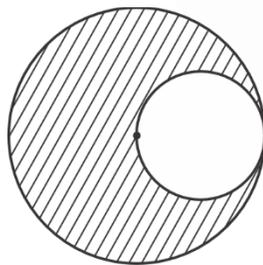
In the light of the above statements, choose the correct answer from the options given below

- (1) (A) is false but (R) is true
- (2) (A) is false but (R) is false
- (3) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (4) Both (A) and (R) are true and (R) is the correct explanation of (A)

**Answer (2)**

**Sol.** Conceptual

2. The figure shows a circular portion of radius  $\frac{R}{2}$  removed from a disc of mass  $m$  and radius  $R$ . The moment of inertia about an axis passing through the centre of the disc and perpendicular to the plane is



- (1)  $\frac{13}{32}mR^2$
- (2)  $\frac{mR^2}{2}$
- (3)  $\frac{mR^2}{4}$
- (4)  $\frac{13}{64}mR^2$

**Answer (1)**

**Sol.** 
$$I = \frac{mR^2}{2} - \frac{3}{2} \left( \frac{m}{4} \right) \left( \frac{R}{2} \right)^2$$

$$= \frac{13}{32}mR^2$$

3. Give below are two statements. One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A) :** A magnetic monopole does not exist.

**Reason (R) :** Magnetic lines are continuous and form closed loops.

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

- (1) (A) is false but (R) is true
- (2) (A) is true but (R) is false
- (3) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
- (4) Both (A) and (R) are true and (R) is the correct explanation of (A)

**Answer (4)**

**Sol.** Conceptual.

4. Potential energy is not defined for which of the force
- (1) Gravitational force
  - (2) Restoring force
  - (3) Friction
  - (4) Electrostatic force

**Answer (3)**

**Sol.** Potential energy is only defined for conservative forces.

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5. Which of the following quantity has same dimensions as

$$\sqrt{\frac{\mu_0}{\epsilon_0}}$$

- (1) Voltage
- (2) Resistance
- (3) Inductance
- (4) Capacitance

**Answer (2)**

**Sol.**  $\mu_0 = MLT^{-2}A^{-2}$

$$\epsilon_0 = M^{-1}L^{-3}T^4A^2$$

$$\sqrt{\frac{\mu_0}{\epsilon_0}} = ML^2T^{-3}A^{-2}$$

6. Equation of a wave is given by  $y = A \sin(20\pi x + 10\pi t)$ , find minimum distance between two particles having same velocity.

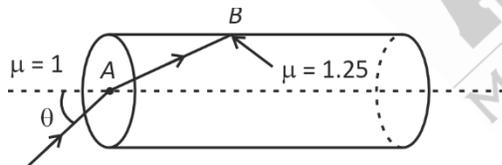
- (1) 2.5 cm
- (2) 5 cm
- (3) 10 cm
- (4) 7.5 cm

**Answer (2)**

**Sol.**  $\frac{2\pi}{\lambda} = 20\pi$                        $\frac{\lambda}{2} = 5\text{cm}$

$$\lambda = 10\text{ cm}$$

7. The maximum value of  $\theta$  (shown in figure) for which total internal reflection can happen at point B is



- (1)  $\tan^{-1}\left(\frac{4}{3}\right)$
- (2)  $\sin^{-1}\left(\frac{3}{4}\right)$
- (3)  $\cot^{-1}\left(\frac{3}{4}\right)$
- (4)  $\cos^{-1}\left(\frac{3}{4}\right)$

**Answer (2)**

**Sol.** At A

$$1 \sin\theta = 1.25 \sin r$$

At B

$$1.25 \sin(90^\circ - r) = 1 \sin 90^\circ \text{ (for critical angle of incidence at B)}$$

$$\Rightarrow 1 + \sin^2\theta = 1.25^2$$

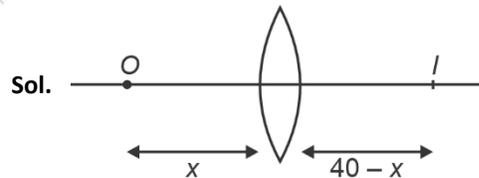
$$\sin^2\theta = 1.25^2 - 1^2$$

$$\sin\theta = \frac{3}{4}$$

8. Distance between object and image for a convex lens is 40 cm and magnification is  $-\frac{1}{4}$ . Find focal length of the lens.

- (1) 14.5 cm
- (2) 15 cm
- (3) 12.5 cm
- (4) 6.4 cm

**Answer (4)**



**Sol.**

$$\frac{40 - x}{x} = \frac{1}{4}$$

$$\frac{1}{f} = \frac{1}{8} + \frac{1}{32}$$

$$x = 32$$

$$f = \frac{32}{5} = 6.4\text{ cm}$$

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**Amogh Bansal**  
PSID: 00014769016

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9. Flux through a plane parallel to x-z plane is 6 SI units. Find area of plane if electric field in the region is  $\vec{E} = (\hat{i} + 4\hat{j} + \hat{k})10^3 \text{ N/C}$ .

- (1)  $2 \times 10^{-3} \text{ m}^2$       (2)  $2.5 \times 10^{-2} \text{ m}^2$   
(3)  $1.5 \times 10^{-3} \text{ m}^2$       (4)  $2.5 \times 10^{-3} \text{ m}^2$

**Answer (3)**

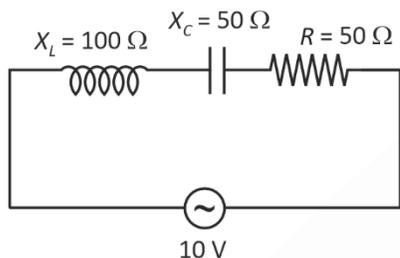
**Sol.**  $\phi = \vec{E} \cdot \vec{A}$

$$6 = (\hat{i} + 4\hat{j} + \hat{k}) \times 10^3 \cdot (A \hat{j})$$

$$6 = 4A \times 10^3$$

$$A = 1.5 \times 10^{-3} \text{ m}^2$$

10. Find the average power for the given AC circuit



- (1) 1 W  
(2) 2 W  
(3) 0.5 W  
(4) 4 W

**Answer (1)**

**Sol.**  $P_{av} = i_{rms} V_{rms} \cos \phi$        $\cos \phi = \frac{R}{Z}$

$$Z = \sqrt{(X_L - X_C)^2 + R^2} = 50\sqrt{2}$$

$$P_{av} = \frac{10}{50\sqrt{2}} \times 10 \times \frac{50}{50\sqrt{2}} = 1 \text{ Watt}$$

11. Match the columns.

- (A) Isothermal process      (P)  $\Delta W = 0$   
(B) Adiabatic process      (Q)  $\Delta U \neq 0$   
(C) Isobaric process      (R)  $\Delta U = 0$   
(D) Isochoric process      (S)  $\Delta Q = 0$

- (1) (A)→(R), (B)→(Q, S), (C)→(Q), (D)→(P, Q)  
(2) (A)→(R), (B)→(S), (C)→(P), (D)→(Q, S)  
(3) (A)→(Q), (B)→(Q, S), (C)→(P), (D)→(P, Q)  
(4) (A)→(Q), (B)→(P), (C)→(P, Q), (D)→(R)

**Answer (1)**

12. Assertion: Airplane is made of metal to prevent from lightning strike.

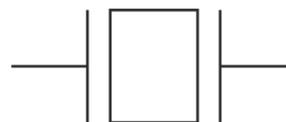
Reason: Electric field in cavity inside conductor at equilibrium remain zero.

- (1) Both Assertion and Reason are correct  
(2) Assertion is correct but Reason is incorrect  
(3) Assertion is incorrect and Reason is correct  
(4) Both are incorrect

**Answer (1)**

**Sol.** Outer skin of most aeroplane widely made of Aluminium which is a good conductor of electricity keeps the charges due to lightning on the surface only.

13. Charge on capacitor plate is  $5 \times 10^{-6} \text{ C}$  and induced charge on dielectric slab is  $4 \times 10^{-6} \text{ C}$ . Find dielectric constant of the slab.



- (1) 2  
(2) 3  
(3) 4  
(4) 5

**Answer (4)**

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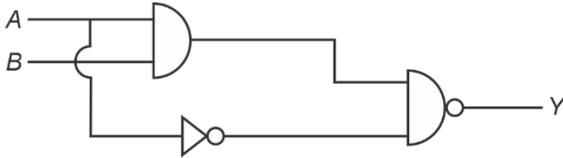


Sol.  $\epsilon_{in} = \epsilon \left( 1 - \frac{1}{k} \right)$

$$\frac{4}{5} = 1 - \frac{1}{k}$$

$$\Rightarrow k = 5$$

14. Find the output (Y) of the Logic Gate shown in diagram.



- (1) 0
- (2) 1
- (3)  $A + \bar{B}$
- (4)  $\bar{A} \cdot B$

Answer (2)

Sol.  $([A \cdot B] \cdot \bar{A}) = (\bar{A} \cdot B) + A$   
 $= \bar{A} + \bar{B} + A = 1 + \bar{B} = 1$

15. A photon of wavelength  $\lambda_1$  is incident on a photo-sensitive surface of threshold wavelength  $\lambda_0$ . The de-broglie wavelength of fastest photoelectron is

- (1)  $\sqrt{\frac{h}{2mc \left( \frac{1}{\lambda_1} - \frac{1}{\lambda_0} \right)}}$
- (2)  $\sqrt{\frac{h}{2mc \left( \frac{1}{\lambda_1} - \frac{1}{\lambda_0} \right)}}$
- (3)  $\lambda_1 - \lambda_0$
- (4)  $\sqrt{\lambda_1^2 - \lambda_0^2}$

Answer (1)

Sol.  $k = hc \left( \frac{1}{\lambda_1} - \frac{1}{\lambda_0} \right)$

$$P = \sqrt{2mk}$$

$$\lambda_{dB} = \frac{h}{P}$$

$$\lambda_{dB} = \frac{h}{\sqrt{2mhc \left( \frac{1}{\lambda_1} - \frac{1}{\lambda_0} \right)}}$$

$$= \sqrt{\frac{h}{2mc \left( \frac{1}{\lambda_1} - \frac{1}{\lambda_0} \right)}}$$

16. Find ratio of average kinetic energy of equal mass of He and Ar gas at 300 K.

- (1) 10 : 1
- (2) 1 :  $\sqrt{10}$
- (3)  $\sqrt{10} : 1$
- (4) 2 :  $\sqrt{5}$

Answer (1)

Sol.  $U = nC_V T$

$$C_{V1} = C_{V2}$$

$$\frac{U_1}{U_2} = \frac{n_1}{n_2} = \frac{(m/4)}{(m/40)} = \frac{10}{1}$$

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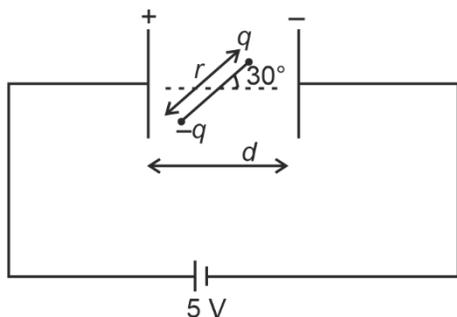
**Amogh Bansal**  
PSID: 00014769016

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17. An electric dipole is kept between plates of a parallel plates capacitor as shown. Find torque on the dipole.

$$(d = 1 \text{ mm}, q = 2 \mu\text{C}, r = 0.5 \mu\text{m})$$



- (1)  $5 \times 10^{-9} \text{ Nm}$
- (2)  $2.5 \times 10^{-9} \text{ Nm}$
- (3)  $5 \times 10^{-12} \text{ Nm}$
- (4)  $2 \times 10^{-8} \text{ Nm}$

**Answer (2)**

**Sol.**  $\tau = PE \sin\theta$

$$= 2 \times 10^{-6} \times \frac{1}{2} \times 10^{-6} \times \left(\frac{5}{10^{-3}}\right) \times \frac{1}{2}$$

18. The SI unit of the quantity  $\frac{2I}{\epsilon_0 c}$  is (here,  $I$  is the moment of inertia,  $\epsilon_0$  is the permittivity of free space and  $c$  is the speed of light).

- (1)  $\frac{\text{kg}^2 \cdot \text{m}^4}{\text{A}^2 \text{s}^3}$
- (2)  $\frac{\text{kg}^2 \text{m}^3}{\text{As}^3}$
- (3)  $\frac{\text{kg}^2 \text{m}^3}{\text{A}^2 \text{s}^3}$
- (4)  $\frac{\text{kgm}^2}{\text{As}^3}$

**Answer (1)**

**Sol.** Unit of  $\frac{2I}{\epsilon_0 c} = \frac{(\text{kg} \cdot \text{m}^2)}{\left(\frac{\text{C}^2}{\text{N} \cdot \text{m}^2}\right) (\text{m/s})} = \frac{\text{kg}^2 \text{m}^4}{\text{A}^2 \text{s}^3}$

19.

20.

**SECTION - B**

**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. The velocity of a particle of mass 500 gm is given by  $v = 4\sqrt{x}$ . Find the force acting on the particle (in Newton).

**Answer (4)**

**Sol.**  $a = v \frac{dv}{dx} = 4\sqrt{x} \cdot \frac{4}{2\sqrt{x}} = 8 \text{ m/s}^2$

$$F = ma = 4 \text{ N}$$

22. An object is released from a plane moving horizontally with a speed 100 m/s at a height 2 km above ground. The horizontal distance travelled (in km) by the object is (take  $g = 10 \text{ m/s}^2$ )

**Answer (2)**

**Sol.**  $d = v_x \sqrt{\frac{2h}{g}} = 100 \sqrt{\frac{2 \times 2000}{10}} = 2000 \text{ m or } 2 \text{ km}$

23.

24.

25.

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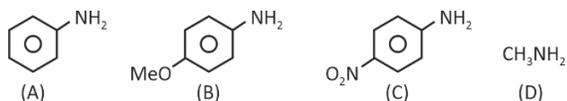
**CHEMISTRY**

**SECTION - A**

**Multiple Choice Questions:** This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

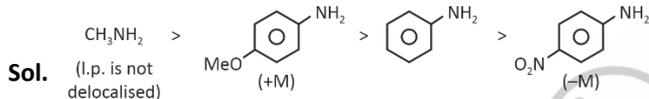
**Choose the correct answer :**

1. The correct order to basic strength of the following molecules is



- (1)  $A > B > C > D$                       (2)  $B > C > D > A$   
 (3)  $D > B > A > C$                       (4)  $B > A > C > D$

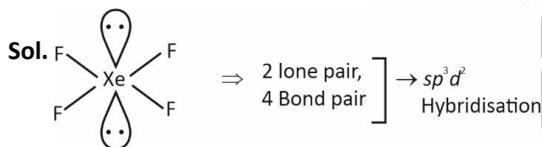
**Answer (3)**



2. Which of the following is the correct Hybridisation of Xe in  $\text{XeF}_4$ ?

- (1)  $sp^3d$     (2)  $sp^3$   
 (3)  $sp^3d^2$                                       (4)  $sp^3d^3$

**Answer (3)**



3. Which of the following is correct order of acidic character of oxides of vanadium?

- (1)  $\text{V}_2\text{O}_5 > \text{VO}_2 > \text{V}_2\text{O}_3$                       (2)  $\text{V}_2\text{O}_3 > \text{VO}_2 > \text{V}_2\text{O}_5$   
 (3)  $\text{V}_2\text{O}_5 > \text{V}_2\text{O}_3 > \text{VO}_2$                       (4)  $\text{VO}_2 > \text{V}_2\text{O}_3 > \text{V}_2\text{O}_5$

**Answer (1)**

**Sol.** Acidic strength of oxides increases with increase in oxidation no. of central atom. Correct order is  $\text{V}_2\text{O}_5 > \text{VO}_2 > \text{V}_2\text{O}_3$

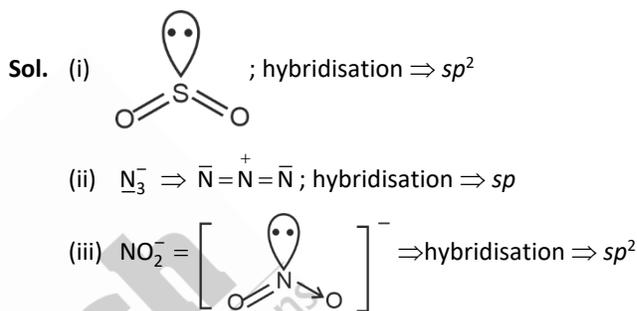
4. Consider the following species

- (i)  $\underline{\text{S}}\text{O}_2$   
 (ii)  $\underline{\text{N}}_3^-$   
 (iii)  $\underline{\text{NO}}_2^-$

Find the hybridisation of underlined atom.

- (1) (i)  $sp^2$  (ii)  $sp^2$  (iii)  $sp^2$                       (2) (i)  $sp^2$  (ii)  $sp$  (iii)  $sp^2$   
 (3) (i)  $sp^3$  (ii)  $sp$  (iii)  $sp^2$                       (4) (i)  $sp$  (ii)  $sp^2$  (iii)  $sp^3$

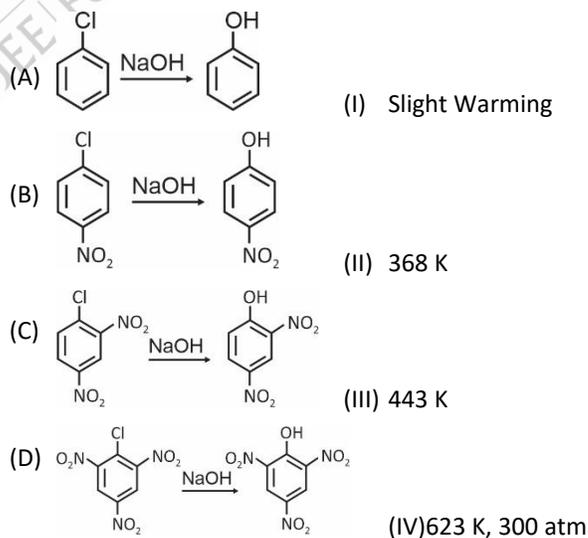
**Answer (2)**



5. Match the following list-I with list-II :

**List-I (Reactions)**

**List-II (Reaction Temperature)**



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Choose the correct answer from the options given below :

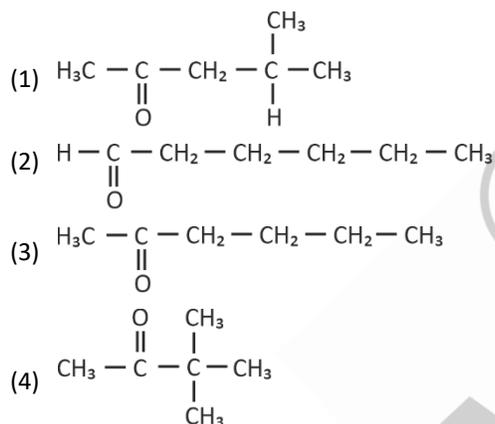
- (1) A-II, B-III, C-I, D-IV
- (2) A-IV, B-III, C-II, D-I
- (3) A-I, B-II, C-III, D-I
- (4) A-II, B-IV, C-III, D-I

**Answer (2)**

**Sol.** A-IV, B-III, C-II, D-I

The presence of electron withdrawing group ( $-\text{NO}_2$ ) at ortho and para position increases the reactivity of haloarenes.

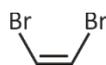
6. Which of the following compounds of molecular formula  $\text{C}_6\text{H}_{12}\text{O}$  give positive 2, 4-DNP test and Tollen's reagent test

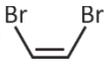


**Answer (2)**

**Sol.**  $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-(\text{CH}_2)_4-\text{CH}_3$  gives positive 2, 4-DNP test and Tollen's reagent test.

7. **Assertion :**  has more dipole moment than



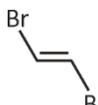
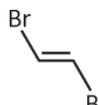
**Reason :**  has more boiling point than 

Choose the correct option.

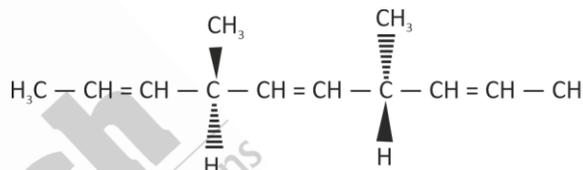
- (1) Both Assertion & Reason are correct, Reason is correct explanation of Assertion
- (2) Both Assertion & Reason are correct, Reason is not correct explanation of Assertion
- (3) Assertion is correct, Reason is incorrect
- (4) Assertion is incorrect, Reason is correct

**Answer (3)**

**Sol.**  has more dipole moment as C - Cl bond is more polar than C - Br bond. So Assertion is correct

 has lesser boiling point as  is non-polar & will have low intermolecular force forces compared to . So Reason is incorrect

8. Consider the following molecule

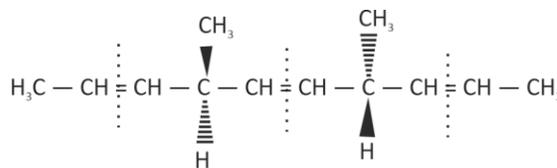


Number of optically active molecule(s) formed after complete reductive ozonolysis of above compound is

- (1) 2
- (2) 1
- (3) 0
- (4) 3

**Answer (3)**

**Sol.**



Product are

$\Rightarrow \text{CH}_3\text{CHO}$  (O. inactive)

$\Rightarrow \text{OHC}-\overset{\text{CH}_3}{\underset{\text{H}}{\text{C}}}-\text{CHO}$  (O. inactive)

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9. If  $P_A^\circ = 350$  torr and  $P_B^\circ = 750$  torr and the two volatile liquids (A) and (B) form an ideal solution.  $X_A$  and  $X_B$  are the respective mole fraction of (A) and (B) in solution and  $Y_A$  and  $Y_B$  are the respective mole fractions of (A) and (B) in the vapour phase. Which one of the following relation is correct?

(1)  $\frac{Y_A}{Y_B} = \frac{X_A}{X_B}$

(2)  $\frac{Y_A}{Y_B} < \frac{X_A}{X_B}$

(3)  $\frac{Y_A}{Y_B} > \frac{X_A}{X_B}$

(4)  $\frac{Y_A}{Y_B} = \frac{X_B}{X_A}$

**Answer (2)**

**Sol.** For an ideal solution of (A) and (B)

$$Y_A = \frac{P_A^\circ X_A}{P} = \frac{350X_A}{P}$$

$$Y_B = \frac{P_B^\circ X_B}{P} = \frac{750X_B}{P}$$

$$\frac{Y_A}{Y_B} = \frac{350 X_A}{750 X_B}$$

$$\Rightarrow \frac{Y_A}{Y_B} < \frac{X_A}{X_B}$$

10. Among the given order, the incorrect order of atomic radii is

(1)  $r_{Rb} < r_{Cs}$

(2)  $r_{Mg} < r_{Al}$

(3)  $r_{Cl} < r_{Br}$

(4)  $r_K < r_{Rb}$

**Answer (2)**

**Sol.**  $r_{Mg} > r_{Al}$

11. Match List-I with List-II and select the correct option.

**List-I (Solution)**

**List-II (Properties)**

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| (A) Benzene + Toluene              | (P) Show +ve deviation              |
| (B) Aniline + CH <sub>3</sub> COOH | (Q) $\Delta V_{mix} = 0$            |
| (C) Water + ethanol                | (R) $\Delta H_{mix} = -ve$          |
| (D) Acetone + CHCl <sub>3</sub>    | (S) Form minimum boiling Azeotrope. |

- (1) A → Q, B → R, C → P, S, D → R  
 (2) A → S, B → Q, R, C → P, S, D → R  
 (3) A → Q, B → P, S, C → R, D → P  
 (4) A → P, S, B → S, C → P, D → R

**Answer (1)**

**Sol.** (A → Q, B → R, C → P, S, D → R)

12. List-I mentions thermodynamic process of list-II mention property

**List-I**

**List-II**

- |                |                     |
|----------------|---------------------|
| (A) Isothermal | I. Q = 0            |
| (B) Adiabatic  | II. $\Delta T = 0$  |
| (C) Isobaric   | III. $\Delta V = 0$ |
| (D) Isochoric  | IV. $\Delta P = 0$  |
- (1) A-II, B-I, C-IV, D-III  
 (2) A-I, B-II, C-III, D-IV  
 (3) A-I, B-IV, C-III, D-II  
 (4) A-II, B-I, C-III, D-IV

**Answer (1)**

**Sol.** For isothermal process, T = constant,  $\Delta T = 0$

For adiabatic process, heat exchange = 0, q = 0

For isobaric process, P = constant,  $\Delta P = 0$

For Isochoric process, V = constant,  $\Delta V = 0$

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13. In electrolysis of aqueous solution of  $\text{AgNO}_3$ ,  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{Hg}(\text{NO}_3)_2$  and  $\text{Au}(\text{NO}_3)_3$  is carried out, then correct order of deposition of metal cathode give

Metal ion/Metal	SRP(V)
$\text{Ag}^+/\text{Ag}$	0.79
$\text{Cu}^{2+}/\text{Cu}$	0.34
$\text{Hg}^{2+}/\text{Hg}$	0.85
$\text{Au}^{3+}/\text{Au}$	1.4

- (1)  $\text{Au} > \text{Hg} > \text{Ag} > \text{Cu}$   
 (2)  $\text{Au} > \text{Hg} > \text{Cu} > \text{Ag}$   
 (3)  $\text{Au} > \text{Ag} > \text{Hg} > \text{Cu}$   
 (4)  $\text{Cu} > \text{Ag} > \text{Hg} > \text{Au}$

**Answer (1)**

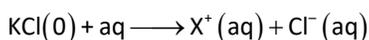
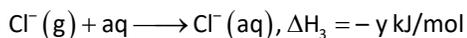
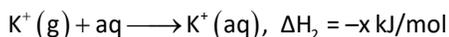
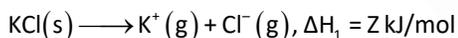
**Sol.** More the standard reduction potential of metal ion more will be tendency to deposit as metal on cathode.

14. Hydration energy of  $\text{K}^+$  is  $-x$  kJ/mol and of  $\text{Cl}^-$  is  $-y$  kJ/mol and lattice energy of  $\text{KCl}$  is  $-Z$  kJ/mol then what is the heat of dissolution of  $\text{KCl}$  ?

- (1)  $z - (x + y)$   
 (2)  $-z - (x + y)$   
 (3)  $z + x + y$   
 (4)  $-z + (x + y)$

**Answer (1)**

**Sol.**

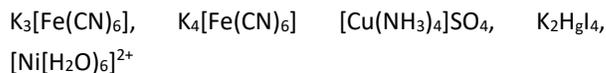


$$\Delta H_{\text{dis}} = \Delta H_1 + \Delta H_2 + \Delta H_3$$

$$= z - x - y$$

$$\Delta H_{\text{dis}} = z - (x + y)$$

15. How many of the following coordination compounds having same coordination number and paramagnetic in nature?



- (1) 2  
 (2) 3  
 (3) 1  
 (4) 4

**Answer (1)**

**Sol.**  $\text{K}_3[\text{Fe}(\text{CN})_6]$  and  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  have same coordination number and paramagnetic in nature due to presence of unpaired electron

16. **Statement-I** : Consider the following statements on hydrolysis of proteins, it give  $\beta$  amino acids.

**Statement-II** : Fibrous proteins after denaturation becomes water soluble

In the light of above statement, choose the correct option.

- (1) Statement-I and Statement-II both are correct  
 (2) Statement-I is correct, Statement-II in incorrect  
 (3) Statement-I is incorrect, Statement-II in correct  
 (4) Statement-I and Statement-II both are incorrect

**Answer (4)**

**Sol.** Only  $\alpha$ -amino acids are obtained on hydrolysis of protein Statement-I is incorrect

17. Choose correct option for Reducing Nature/Stability of oxidation in following.

- (1) Stability  $\text{Ti}^+ < \text{Ti}^{3+}$   
 (2) Reducing nature  $\text{Ti}^+ > \text{Ti}^{3+}$   
 (3) Stability  $\text{Al}^+ > \text{Al}^{3+}$   
 (4) Reducing nature  $\text{Al}^+ > \text{Al}^{3+}$

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**Answer (4)**

**Sol.** Stability of higher oxidation state decreases down the group due to inert pair effect so stability order  $Al^{3+} > Al^{+}$   
 $Tl^{+} > Tl^{3+}$

- 18. ??
- 19. ??
- 20. ??

**SECTION - B**

**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Consider the following oxides of d-block elements  $V_2O_5, Cr_2O_3, Mn_2O_7, V_2O_3, V_2O_4$

Number of oxides which are acidic is x. Consider the following complex compound  $[Co(NH_2CH_2CH_2NH_2)_3]_2(SO_4)_3$ , the primary valency of complex is y

The value of (x + y) is

**Answer (4)**

$V_2O_5$  – Amphoteric

$Cr_2O_3$  → Amphoteric

$Mn_2O_7$  – Acidic

$V_2O_3$  – Basic

$V_2O_4$  – Basic

x = 1

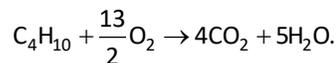
Primary valency = charge on metal ion

= +3

y = 3

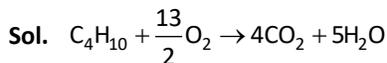
(x + y) = 4

22. Consider the reaction given below:



If 174 g of Butane reacts with 320 g of  $O_2$ . Find the volume of  $H_2O$  formed in ml. (Given density of  $H_2O$  is 1 g/ml)

**Answer (138 ml)**



$$\therefore n_{C_4H_{10}} = \frac{174}{58} = 3 \text{ mol}$$

$$\therefore n_{O_2} = \frac{320}{32} = 10 \text{ mol}$$

$$\therefore 3 \text{ mol } C_4H_{10} \text{ require } \frac{13}{2} \times 3 \text{ mol } O_2$$

$$= \frac{39}{2} = 19.5 \text{ mol } O_2$$

$\therefore O_2$  is limiting reagent.

$$\therefore \frac{13}{2} \text{ mol of } O_2 \rightarrow 5 \text{ mol } H_2O$$

$$\therefore 10 \text{ mol of } O_2 \rightarrow \frac{5 \times 2}{13} \times 10 = \frac{100}{13} = 7.69 \text{ mol}$$

$$\therefore \text{mass of } H_2O = 7.69 \times 18 \text{ g}$$

$$= 138.4 \text{ g}$$

$$\therefore \text{Volume of } H_2O = \frac{\text{Mass}}{\text{Density}}$$

$$= \frac{138.4}{1} \text{ ml}$$

$$= 138.4 \text{ ml}$$

$$\approx 138 \text{ ml}$$

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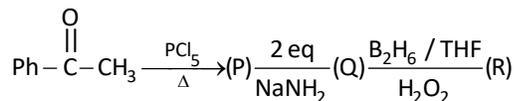


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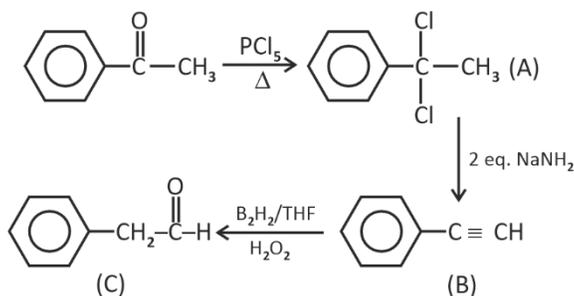
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23. Find no. of  $sp^2$  hybridised C-atoms in major (R) in the following sequence of reactions :



**Answer (7)**

**Sol.**



No. of  $sp^2$  hybridised C in (C) = 7

24. In Dumas method, 292 mg of organic compound yields 50 mL  $\text{N}_2(\text{g})$  at 300 K and 715 mm Hg pressure. Find % of 'N' in organic compound.

Aqueous tension  $i = 15$  mm Hg

**Answer (18)**

**Sol.**  $V_{\text{N}_2}$  at STP =  $\frac{273 \times (715 - 15) \times 50}{300 \times 760}$

= 41.9 mL

$$m_{\text{N}_2} = \frac{41.9}{22400} \times 28 = 0.052 \text{ g}$$

$$\% \text{ of N} = \frac{0.052 \text{ g}}{0.292} \times 100 = 17.94\%$$

≈ 18%

25. A buffer solution have 0.1M  $\text{NH}_4\text{Cl}$  & 0.1M  $\text{NH}_4\text{OH}$ . If 0.05 mole HCl is added in the solution. The change in pH is  $x \times 10^{-1}$  ( $\log 3 = 0.48$ )

**Answer (5)**

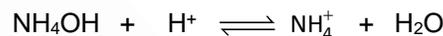
**Sol.** Initially

$$\text{pOH} = \text{pK}_b + \log \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_4\text{OH}]} = \text{pK}_b + \log \frac{0.1}{0.1}$$

$$\text{pOH} = \text{pK}_b$$

$$\text{pH} = 14 - \text{pOH} = 14 - \text{pK}_b \quad \dots(i)$$

When 0.05 mole HCl is added



0.1	0.05	0.1	
-----	------	-----	--

0.1-0.05	0	0.15	
----------	---	------	--

= 0.05

$$\text{pOH} = \text{pK}_b + \log \frac{[\text{NH}_4^+]}{[\text{NH}_4\text{OH}]} = \text{pK}_b + \log \frac{0.15}{0.05}$$

$$\text{pH} = 14 - \text{pK}_b - \log \frac{0.15}{0.05}$$

$$\text{Change in pH} = 14 - \text{pK}_b - \log \frac{0.15}{0.05} - 14 + \text{pK}_b$$

$$= -\log 3 = -0.48$$

$$\text{Change in pH} = 0.48 \text{ or } 4.8 \times 10^{-1}$$

$$= x = 4.8 \approx 5$$

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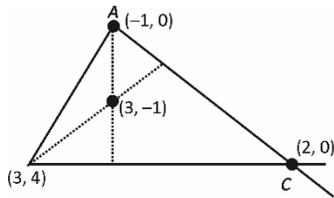


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$$\frac{K+8}{4} + K - 2 = 0 \Rightarrow K = 0$$



Line AC :  $y = 0$

7. Let the foot of perpendicular from  $P(5, 1, -3)$  on the line  $L_1 : x - 1 = y - 2 = z$  and  $L_2 : x - 2 = y = z - 1$  is  $Q$  and  $R$ , respectively. The area of triangle  $PQR$  is equal to

- (1)  $\frac{7}{2}$  (2)  $\frac{7}{\sqrt{2}}$   
 (3)  $\frac{7\sqrt{3}}{2}$  (4) 7

**Answer (3)**

**Sol.**  $P(5, 1, -3)$

$$L_1 : x - 1 = y - 2 = z = \lambda$$

$$L_2 : x - 2 = y = z - 1 = \mu$$

Any point of  $L_1$  is  $Q(\lambda + 1, \lambda + 2, \lambda)$

Any point of  $L_2$  is  $R(\mu + 2, \mu, \mu + 1)$

$$\text{Now } PQ < \lambda - 4, \lambda + 1, \lambda + 3 > \cdot < 1, 1, 1 > = 0$$

$$\lambda - 4 + \lambda + 1 + \lambda + 3 = 0$$

$$3\lambda = 0$$

$$\Rightarrow \lambda = 0$$

$$\therefore Q(1, 2, 0)$$

$$\text{Also, } PR < \mu - 3, \mu - 1, \mu + 4 > \cdot < 1, 1, 1 > = 0$$

$$\mu - 3 + \mu - 1 + \mu + 4 = 0$$

$$\Rightarrow \mu = 0$$

$$R(2, 0, 1)$$

$$\text{Area} = \frac{1}{2} |\overrightarrow{PQ} \times \overrightarrow{PR}| = \frac{1}{2} \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & -1 & -3 \\ 3 & 1 & -4 \end{vmatrix}$$

$$= \frac{1}{2} |7\hat{i} + 7\hat{j} + 7\hat{k}| = \frac{1}{2} \times 7 \times \sqrt{3} = \frac{7\sqrt{3}}{2}$$

8. Let  $\alpha$  and  $\beta$  be roots of the equation

$$\left[ (t+2)^{\frac{1}{7}} - 1 \right] x^2 + \left[ (t+2^{\frac{1}{6}} - 1) \right] x + \left( (t+2)^{\frac{1}{21}} - 1 \right) = 0$$

If  $\lim_{t \rightarrow -1} \alpha = a$  and  $\lim_{t \rightarrow -1} \beta = b$  then  $72(a+b)^2$  is equal to

- (1) 49 (2) 98  
 (3) 36 (4) 75

**Answer (2)**

**Sol.** Notice that

$$\alpha + \beta = - \frac{(t+2)^{\frac{1}{6}} - 1}{(t+2)^{\frac{1}{7}} - 1}$$

$$\alpha\beta = \frac{(t+2)^{\frac{1}{21}} - 1}{(t+2)^{\frac{1}{7}} - 1}$$

$$\lim_{t \rightarrow -1} (\alpha + \beta) = \frac{-\frac{1}{6}}{\frac{1}{7}} = \frac{-7}{6} = a + b$$

$$\lim_{t \rightarrow -1} (\alpha\beta) = \frac{\frac{1}{21}}{\frac{1}{7}} = \frac{7}{21} = \frac{1}{3} = ab$$

$$\Rightarrow (a+b)^2 = \frac{49}{36} \Rightarrow 72(a+b)^2 = 98$$

9. In an experiment, a random variable  $X$  can take values 0, 1, 2, 3. If  $P(X=0) = P(X=1)$ ,  $P(X=2) = P(X=3)$  and  $E(X^2) = 2E(X)$ , then the value of  $P(X=0)$  is

- (1)  $\frac{1}{8}$  (2)  $\frac{1}{4}$   
 (3)  $\frac{1}{2}$  (4)  $\frac{3}{8}$

**Answer (4)**

**Sol.**  $P(X=0) = P(X=1) = a$  and  $P(X=2) = P(X=3) = b$

$$2a + 2b = 1$$

$$\Rightarrow a + b = \frac{1}{2}$$

$$E(X^2) = 2E(X)$$

$$= a \times 0^2 + a \times 1^2 + b \times 2^2 + b \times 3^2$$

$$= 2(a \times 0 + a \times 1 + b \times 2 + b \times 3)$$

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23. If  $f(\theta) = \frac{\tan(\tan\theta) - \tan(\sin\theta)}{\tan\theta - \sin\theta}$  is continuous at  $\theta = 0$ , then the value of  $f(\theta)$  at  $\theta = 0$  is equal to

**Answer (1)**

**Sol.**  $\lim_{\theta \rightarrow 0} = \frac{\tan(\tan\theta) - \tan(\sin\theta)}{\tan\theta - \sin\theta}$

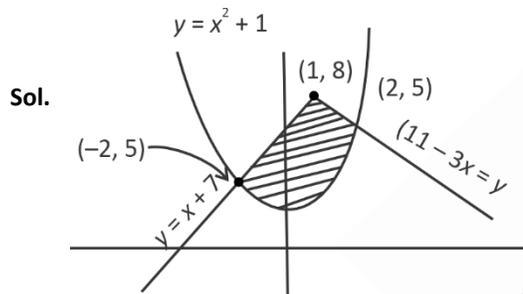
$$= \frac{\left( \tan\theta + \frac{\tan^3\theta}{3} + \frac{2}{15}(\tan\theta)^5 + \dots \right) - \left( \sin\theta + \frac{(\sin\theta)^3}{3} + \dots \right)}{\tan\theta - \sin\theta}$$

$$= \frac{(\tan\theta - \sin\theta) + \frac{1}{3}(\tan\theta - \sin\theta)(\tan^2\theta + \tan\theta \cdot \sin\theta + \sin^2\theta) + \dots}{\tan\theta - \sin\theta}$$

= 1

24. If  $A$  is the area of the region given by  $x^2 + 1 \leq y \leq \min(11 - 3x, x + 7)$ , then the value of  $\frac{A}{3}$  is equal to (in square units)

**Answer (50)**



$$A = \int_{-2}^1 ((x+7) - (x^2+1))dx + \int_1^2 ((1-3x) - (x^2+1))dx$$

$$= \frac{50}{3}$$

$\therefore 3A = 50$

25. If  $a_1, a_2, a_3, \dots, a_n$  are in AP, then find the value of  $a_n$  if it is given that  $a_1 + a_2 + a_3 + \dots + a_n = 700$ , and  $a_6 = 7, S_7 = 7$ .

**Answer (64)**

**Sol.**  $a + 5d = 7$

$$\frac{7}{2}[2a + 6d] = 7$$

$a + 3d = 1$

$a + 5d = 7$

$d = 3, a = -8$

$$\frac{n}{2}[-16 + (n-1)3] = 700$$

$$\frac{n}{2}[(3n-19)] = 700$$

$3n^2 - 19n - 1400 = 0$

$\Rightarrow n = 25$

$\therefore a_n = a_{25} = -8 + 24 \times 3 = 64$

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