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23/01/2026
MORNING

Memory Based
Answers & Solutions

Time : 3 hrs. *for* M.M. : 300

JEE (Main)-2026 (Online) Phase-1

(Mathematics and Physics, Chemistry)

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.

1. If $x^4dy + (4x^3y + 2\sin x)dx = 0$ & $f\left(\frac{\pi}{2}\right)=0$ then the value of $\pi^4 f\left(\frac{\pi}{3}\right)$ (where y = f(x)):

(1) 81 (2) 80

(3) 83 (4) 9

Ans. **(1)**

Sol. $(x^4dy + 4x^3ydx) = -2\sin x\,dx$

$\Rightarrow \int d(x^4y) = \int -2\sin x\,dx$

$\Rightarrow x^4y = 2\cos x + c$

$\Rightarrow x^4f(x) = 2\cos x + c$

As $f\left(\frac{\pi}{2}\right)=0$

So, c = 0

$\left(\frac{\pi}{3}\right)^4 f\left(\frac{\pi}{3}\right)=2\cos\frac{\pi}{3}$

$\pi^4 f\left(\frac{\pi}{3}\right)=81$

2. Let A = {–2, –1, 0, 1, 2, 3, 4} and R be a relation defined on set A such that R {(x, y) : 2x + y ≤ –2, x, y ∈ A}

Let l = numbers of elements in R

m = minimum number of elements to be added in R to make it reflexive relation.

n = minimum number of elements to be added in R to make it symmetric relation then (l + m + n) is:

(1) 17 (2) 18

(3) 19 (4) 20

Ans. **(1)**

Sol. R {(–2, a), (–1, b), (0, – 2)}

a ∈ {–2, – 1, 0, 1, 3} b ∈ {–2, – 1, 0}

No of element in R = 5 + 3 + 1 = 9 = l

R = {(–2, –2), (–1, –1), ……}

minimum number of element to be added to make it reflexive = 5 – m

minimum number of element to be added to make it symmetric 5 = n

R = {(–2, –2), (–2, –1), (–2, 0), (–2, 1), (–2, 2), (–2, –1), (–2, 0), (0, –2)}

l + m + n = 9 +| 5 + 3 = 17

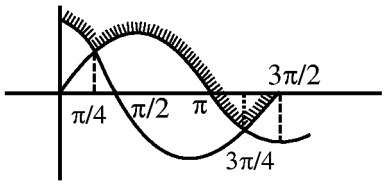
3. Find the area bounded by y = max {sin x, cos x} when $x \in \left[0,\frac{3\pi}{2}\right]$ with x-axis :

(1) 3 (2) 3π

(3) 4 π (4) 4

Ans. **(3)**

Sol.



$$A=\int_0^{\pi/4}\cos x\,dx+\int_{\pi/4}^{\pi}\sin x\,dx+\int_{\pi}^{5\pi/4}-\sin x\,dx+\int_{5\pi/4}^{3\pi/2}-\cos x\,dx$$

$$A=(\sin x)_0^{\pi/4}+(\cos x)_{\pi}^{\pi/4}+(\cos x)_{\pi}^{5\pi/4}+(\sin x)_{3\pi/2}^{5\pi/4}$$

$$A=\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}+1+1-\frac{1}{\sqrt{2}}+1-\frac{1}{\sqrt{2}}=3$$

4. Let $\frac{x^2}{2}+\frac{y^2}{1}=1$ & y = x + 1 intersects each other at A & B then ∠ AOB is (where O is centre of ellipse).

(1) $\frac{\pi}{2}+\tan^{-1}\frac{1}{4}$

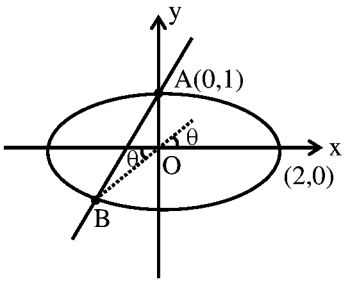
(2) $\frac{\pi}{2}+\tan^{-1}\frac{1}{3}$

(3) $\frac{\pi}{2}+\tan^{-1}\frac{1}{2}$

(4) $\frac{\pi}{4}+\tan^{-1}\frac{1}{2}$

Ans. **(1)**

Sol.



By solving line & equation of ellipse we get x = 0

& $x = -\frac{4}{3}$

$\therefore\ B\left(-\frac{4}{3}, -\frac{1}{3}\right)$

$m_{OB} = \tan\theta = \frac{1}{4}$

$\because\ \angle AOB = \frac{\pi}{2} + \theta = \frac{\pi}{2} + \tan^{-1}\frac{1}{4}$

5. If $\begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix} = \begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix}$

then value of $\cos^2\alpha + \cos^2\beta + \cos^2\gamma$ is :

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

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

Ans. (2)

Sol. Let $\cos\alpha = x$

$\cos\beta = y$

$\cos\gamma = z$

$$\begin{vmatrix} 0 & x & y \\ x & 0 & z \\ y & z & 0 \end{vmatrix} = \begin{vmatrix} 1 & x & y \\ x & 1 & z \\ y & z & 1 \end{vmatrix}$$

Expending both sides, we get

$x^2 + y^2 + z^2 = 1$

i.e. $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

6. The value of $\int_{\pi/24}^{5\pi/24} \frac{1}{(1+\sqrt{\tan 2x})}dx$ is :

(1) $\frac{\pi}{12}$ (2) $\frac{\pi}{6}$

(3) $\frac{\pi}{24}$ (4) $\frac{\pi}{3}$

Ans. (1)

Sol. $I = \int_{\pi/24}^{5\pi/24} \frac{1}{(1+\sqrt{\tan 2x})}dx$ .....(1)

Apply p-5 $I = \int_{\pi/24}^{5\pi/24} \frac{dx}{1+\sqrt{\tan 2\left(\frac{\pi}{4}-x\right)}}$

$I = \int_{\pi/24}^{5\pi/24} \frac{dx}{(1+\sqrt{\cot 2x})}$ .....(2)

Add 1 & 2

$2I = \int_{\pi/24}^{5\pi/24} 1\ dx$

$= \frac{\pi}{12}$

7. Number of 4 letter words with or without meaning formed from the letters of the word PQRSSSTTUVV is :

(1) 2214 (2) 1420

(3) 1422 (4) 1242

Ans. (3)

Sol. Case I 3 alike, 1 different

$^1C_1 \times {}^6C_1 \times \frac{4!}{3!} = 24$

Case II 2 alike, 2 alike

$^3C_2 \times \frac{4!}{2!2!} = 18$

Case III 2 alike, 2 different

$^3C_1 \times {}^6C_2 \times \frac{4!}{2!} = 540$

Case IV All 4 different

$^7C_4 \times 4! = 840$

Total words = 1422

8. The value of $\frac{^{100}C_{50}}{51} + \frac{^{100}C_{51}}{52} + ... + \frac{^{100}C_{100}}{101}$ is :

(1) $\frac{2^{100}}{101}$ (2) $\frac{2^{101}}{100}$

(3) $\frac{2^{99}}{100}$ (4) $\frac{2^{99}}{99}$

Ans. (1)

Sol. $S=\sum_{r=50}^{100}\frac{^{100}C_r}{r+1}=\sum_{r=50}^{100}\frac{1}{r+1}.\frac{r+1}{101}.{}^{101}C_{r+1}$

$S=\frac{1}{101}\sum_{r=50}^{100}{}^{101}C_{r+1}$

$=\frac{1}{101}\times\frac{2^{101}}{2}=\frac{2^{100}}{101}$

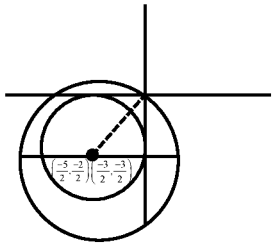
9. If $3\le|2Z+3(1+i)|\le 7$ and if maximum and minimum value of $\left|Z+\frac{1}{2}(5+3i)\right|$ is α and β respectively then $(\alpha+2\beta)$ is :

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

(3) $\frac{9}{2}$ (4) $\frac{11}{2}$

Ans. (4)

Sol. $\frac{3}{2}\le\left|Z+\frac{3}{2}+\frac{3}{2}i\right|\le\frac{7}{2}$



$\left|Z+\frac{5}{2}+\frac{3}{2}i\right|$

Maximum $\alpha=1+\frac{7}{2}=\frac{9}{2}$

Maximum $\beta=\frac{3}{2}-1=\frac{1}{2}$

$\alpha+2\beta=\frac{9}{2}+1=\frac{11}{2}$

10. For given vectors $\vec{a}=-\hat{i}+\hat{j}+2\hat{k}$ and $\vec{b}=2\hat{i}-\hat{j}+\hat{k}$ where $\vec{c}=\vec{a}\times\vec{b}$ and $\vec{d}=\vec{c}\times\vec{b}$ then the value of $(\vec{a}-\vec{b}).\vec{d}$ is :

(1) –35 (2) –36

(3) –38 (4) –37

Ans. (1)

Sol. $\vec{d}=(\vec{a}\times\vec{b})\times\vec{b}$ $\quad\vec{a}.\vec{b}=-1$

$=(\vec{a}.\vec{b})\vec{b}-(\vec{b}.\vec{b})\vec{a}$ $\quad|\vec{a}|^2=6$

$\vec{d}=-\vec{b}-6\vec{a}$ $\quad|\vec{b}|^2=6$

$(\vec{a}-\vec{b}).(-\vec{b}-6\vec{a})$

$=-5+6-36$ $\quad=-35$

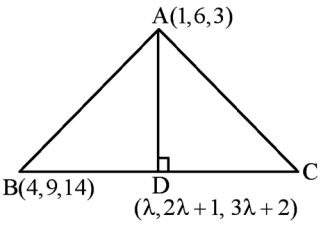
11. Let A(1, 6, 3) and point B and C lies on line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$ where B(4, 9, α) and point C is 10 unit from B. Find area of ΔABC :

(1) $6\sqrt{13}$ (2) $5\sqrt{13}$

(3) $7\sqrt{13}$ (4) $8\sqrt{13}$

Ans. (2)

Sol. $\frac{4}{1}=\frac{9-1}{2}=\frac{\alpha-2}{3}\Rightarrow\alpha=14$



$\overrightarrow{AD}.(\hat{i}+2\hat{j}+3\hat{k})=0$

$(\lambda-1)\hat{i}+(2\lambda-5)\hat{j}+(3\lambda-1)\hat{k}=\overrightarrow{AD}$

$\Rightarrow\lambda-1+4\lambda-10+9\lambda-3=0$

$\Rightarrow 14\lambda=14\Rightarrow\lambda=1$

D = (1, 3, 5)

$AD=\sqrt{3^2+2^2}=\sqrt{13}$

$Ar(\Delta ABC)=\frac{1}{2}\times\sqrt{13}\times 10=5\sqrt{13}$

12. A rectangle is formed by lines x = 0, y = 0, x = 3 and y = 4. A line perpendicular to 3x + 4y + 6 = 0 divides the rectangle into two equal parts then the distance of the line from point $\left(-1,\frac{3}{2}\right)$ is :

(1) $\frac{17}{10}$ (2) $\frac{10}{17}$

(3) $\frac{15}{17}$ (4) $\frac{18}{17}$

Ans. (1)

Sol. $M\left(\frac{3}{2},2\right)$

A line perpendicular to 3x + 4y + 6 = 0 & passing through $\left(\frac{3}{2},2\right)$

$\Rightarrow y-2=\frac{4}{3}\left(x-\frac{3}{2}\right)$

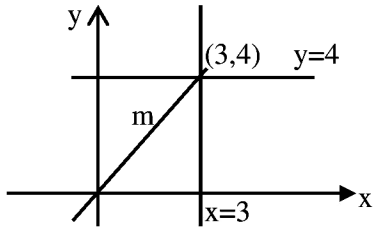
3y – 6 = 4x – 6

$3y = 4x$

$\Rightarrow 4x - 3y = 0$

Distance from $\left(-1, \frac{3}{2}\right)$ is

$$d = \left|\frac{-4-\frac{9}{2}}{\sqrt{4^2+3^2}}\right| = \frac{17}{10}$$



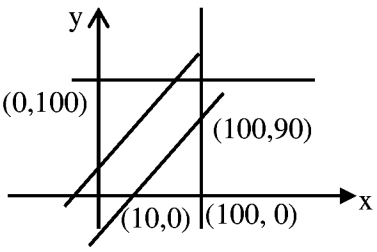
13. If two numbers a & b are selected from S = {1, 2, 3……., 100} then the probability that $|a-b| \geq 10$ is :

(1) $\frac{891}{1000}$ (2) $\frac{119}{1000}$

(3) $\frac{819}{1000}$ (4) None of these

Ans. (3)

Sol. $P = \frac{2(1+2+.....+90)}{100\times100} = \frac{819}{1000}$



14. If $\int e^x\left(\frac{x^2-2}{\sqrt{1+x}(1-x)^{3/2}}\right)dx = f(x)+c$ & $f(0) = 1$

find $f(1/2)$:

(1) $2+\sqrt{3e}$ (2) $2-\sqrt{3e}$

(3) $2+\sqrt{e}$ (4) $2-\sqrt{e}$

Ans. (2)

Sol. $F(x) = \int \frac{e^x(x^2-2)}{\sqrt{1+x}(1-x)^{3/2}}dx = \int e^x\left[\frac{(x^2-1)-1}{\sqrt{x+1}(1-x)^{3/2}}\right]dx$

$$F(x) = -\int e^x\left[\sqrt{\frac{1+x}{1-x}} + \frac{1}{\sqrt{1+x}(1-x)^{3/2}}\right]dx$$

$$= -e^x.\sqrt{\frac{1+x}{1-x}} + \lambda = f(x)+c$$

according to given question

$\because f(0) = 1$

$\Rightarrow f(x) = 2 - e^x\sqrt{\frac{1+x}{1-x}}$

& $f\left(\frac{1}{2}\right) = 2-\sqrt{3e}$

15. Variates are given as

– 10, –7, –1, x, y, 2, 9, 16.

If mean $(\mu) = \frac{7}{2}$ and variance = $\frac{293}{4}$

Find mean of (1+x+y), x, y, |y–x| :

(1) 16 (2) 19

(3) 11 (4) 13

Ans. (3)

Sol. $\text{Mean} = \frac{-18+x+y+2+9+16}{8} = \frac{7}{3}$

$= \frac{x+y+9}{8} = \frac{7}{2} \Rightarrow x+y+9 = 28$ .....(1)

$\text{Variance} = \frac{\sum z_i^2}{8} - (\mu)^2 = \frac{293}{4}$

$\Rightarrow \frac{10^2+7^2+1^2+x^2+y^2+2^2+9^2+16^2}{8} - \left(\frac{7}{2}\right)^2 = \frac{293}{4}$

.... (2)

Solving (1) & (2) $\Rightarrow$ x = 12, y = 7

Mean of (1 +x + y), x, y, |y –x| is

$\Rightarrow \frac{20+12+7+5}{4} = \frac{44}{4} = 11$

Sol. $\text{adj } 2A = 2^2 \text{ adj } A \quad \because \text{ adj } kA = k^{n-1} (\text{adj } A)$

$= 4 \text{ adj } A$

Now $A^2 (\text{adj } 2A) = 4A (\text{adj } A)$

$= 4 A |A| I_3$

$= 24A$

Now $3 \text{ adj } (A^2(\text{adj } 2A)) = 3 \text{ adj } (2u A)$

$= 3.(2u)^2 \text{ adj } A$

Now $\left|\text{adj}\left(3\text{adj } (A^2(\text{adj}2A))\right)\right|$

$= \left|\text{adj}\left(3.(2u)^2 \text{adj}A\right)\right|$

$= \left|\left(3.(2u)^2\right)^2(\text{adj adj}A)\right|$

$= \left|3^6.2^{12} \text{ adj adj } A\right|$

$= (3^6.2^{12})^3 \ |\text{adj adj } A|$

$= 3^{18}.2^{36}.(A)^4$

$3^{22}.2^{40}$

$\therefore m + n = 62$

19. $y = \log_5 \log_3 \log_7 (9x - x^2 - 13)$, If its domain is (m, n) and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is a hyperbola having eccentricity $\frac{n}{3}$ & length of lotus rectum is $\frac{8m}{3}$. Find $b^2 - a^2$:

Ans. **(7)**

Sol. $\log_3\left(\log_7\left(9x - x^2 - 13\right)\right) > 0$

$\Rightarrow \quad 9x - x^2 - 13 > 7$

$x^2 - 9x + 20 < 0 \Rightarrow 4 < x < 5$

$m = 4, n = 5$

$\Rightarrow \quad e = \sqrt{1 + \frac{b^2}{a^2}} = \frac{5}{3} \Rightarrow \frac{b^2}{a^2} = \frac{25}{9} - 1 = \frac{16}{9}$

$\frac{b}{a} = \frac{4}{3}$

$\Rightarrow \quad \frac{2b^2}{a} = \frac{8m}{3} \Rightarrow \frac{2b^2}{a} = \frac{32}{3}$

$\Rightarrow \quad 2b^2 = \frac{32}{3} \times \frac{3b}{4} \Rightarrow b = 4, \ a = 3$

$b^2 - a^2 = 16 - 9 = 7$

20. If in the expansion of $(1+x^2)^2(1+x)^n$, the coefficient of x, x^2 & x^3 are in arithmetic progression, then sum of all possible values of n is (where $n \geq 3$) :

Ans. **(7)**

Sol. $(x^4 + 2x^2 + 1)\ ({}^nC_0x^0 + {}^nC_1x^1 + {}^nC_2x^2 + {}^nC_3)$

Coefficient $x \Rightarrow {}^nC_1$, coeff. of $x^2 \Rightarrow 2 + {}^nC_2$

$$2 + \frac{n(n-1)}{2}$$

Coeff. of $x^3 = 2.{}^nC_1 + {}^nC_3 = \ 2n + \frac{n(n-1)(n-2)}{6}$

Now according to question

$$n + 2n + \frac{n(n-1)(n-2)}{6} = 2\left[2 + \frac{n(n-1)}{2}\right]$$

$$3n + \frac{n(n-1)(n-2)}{6} = 4 + n(n-1)$$

$\Rightarrow n^3 - 9n^2 + 26n - 24 = 0$

$\Rightarrow n = 2, 3, 4 \qquad (n = 2 \text{ rejected})$

$\Rightarrow$ sum of values of $n = 3 + 4 = 7$

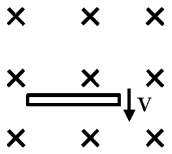
1. A rod of mass 'm' and length 'ℓ' falls from rest in a region of uniform horizontal magnetic field B. Find emf induced in the rod after falling through a distance 'x' :

(1) $B\ell\sqrt{gx}$ (2) $B\ell\sqrt{5gx}$

(3) $B\ell\sqrt{2gx}$ (4) $B\ell\sqrt{3gx}$

Ans. (3)

Sol. Free fall distance 'x'



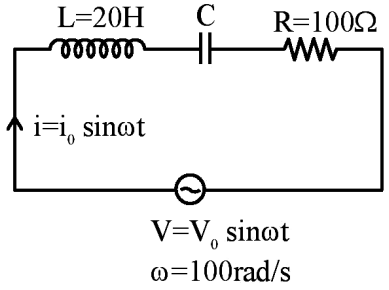
$v = \sqrt{2gx}$

induced emf

$e = Bv\ell$

$= B\ell\sqrt{2gx}$

2. Find capacitance 'C' for the given circuit.



(1) 5×10^{-6} farad

(2) 8×10^{-6} farad

(3) 7×10^{-6} farad

(4) 4×10^{-6} farad

Ans. (1)

Sol. Condition of resonance

$$\omega = \omega_0 = \frac{1}{\sqrt{LC}}$$

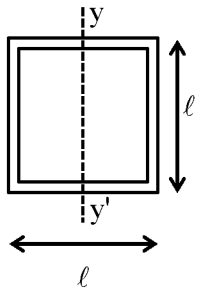
$$LC = \frac{1}{\omega_0^2}$$

$$C = \frac{1}{L\omega_0^2} = \frac{1}{20 \times (100)^2}$$

$$C = \frac{1}{2} \times 10^{-5}$$

$$C = 5 \times 10^{-6} \text{ farad}$$

3. All are cylindrical rods having radius of cross-section 'R' and mass of each rod is $\frac{M}{4}$. Find moment of inertia about yy' axis. :



(1) $I = \frac{1}{16}MR^2 + \frac{1}{6}M\ell^2$

(2) $I = \frac{5}{16}MR^2 + M\ell^2$

(3) $I = \frac{16}{5}MR^2 + \frac{1}{6}M\ell^2$

(4) $I = \frac{3}{8}MR^2 + \frac{M\ell^2}{6}$

Ans. (4)

Sol. $I = I_1 + I_2 + I_3 + I_4$

$$= 2\left(\frac{M'R^2}{4} + \frac{M'\ell^2}{12}\right) + 2\left(\frac{M'R^2}{2} + M'\left(\frac{\ell}{2}\right)^2\right)$$

$$= \frac{M'R^2}{2} + \frac{M'R^2}{6} + M'R^2 + \frac{M'\ell^2}{2}$$

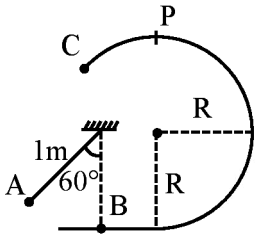
$$= \frac{3M'R^2}{2} + \frac{2M'\ell^2}{3}$$

Given masses $M' = \frac{M}{4}$

So, $I = \frac{3(M/4)R^2}{2} + 2\frac{(M/4)\ell^2}{3}$

$$I = \frac{3}{8}MR^2 + \frac{M\ell^2}{6}$$

4. A and B are identical point masses. A is released as shown in diagram at angle 60° from vertical. Find 'R' if B is able to reach point 'C' after elastic impact.

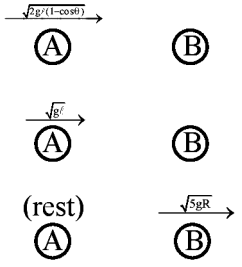


(1) $\frac{1}{5}$ (2) $\frac{1}{2}$

(3) $\frac{1}{3}$ (4) $\frac{1}{6}$

Ans. (1)

Sol. If ball reach at point 'p' then it will pass through C surely.



Before :

$$\sqrt{g\ell} = \sqrt{5gR}$$

$$\ell = 5R$$

$$R = \frac{\ell}{5} = \frac{1}{5}m$$

5. Among the given options choose the correct energy of transition :

(1) $H_{2\to1}(6.8ev)$ (2) $Li^{2+}_{2\to1}(13.6ev)$

(3) $He^{+}_{2\to1}(40.8ev)$ (4) $Be^{3+}_{2\to1}(13.6ev)$

Ans. (C)

Sol. $Ex = -13.6\frac{z^2}{n^2}$

H-atom :

$E_1 = -13.6$ eV $E_2 = -3.4$ eV $\Delta E = 10.2$ eV

He^+-ion :

$E_1 = -54.4$ eV $E_2 = -13.6$ eV $\Delta E = 40.8$ eV

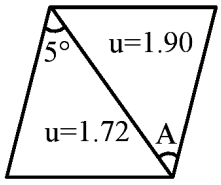
Li^{2+}-ion :

$E_1 = -122.4$ eV $E_2 = -30.6$ eV $\Delta E = 91.8$ eV

Be^{3+} ion :

$E_1 = -217.6$ eV $E_2 = -54.4$ eV $\Delta E = 163.2$ eV

6. Find the angle A of second prism so that light ray suffers dispersion without deviation :



(1) 6° (2) 4°

(3) 7° (4) 2°

Ans. (2)

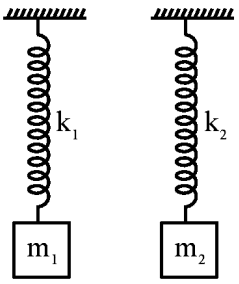
Sol. For no deviation,

$$(\mu_{y_1} - 1)A_1 - (\mu_{y_2} - 1)A_2 = 0$$

$$\Rightarrow (1.72-1)5 - (1.90-1)A = 0$$

$$\therefore A = 4°$$

7. There are two spring-block system as shown. They are in equilibrium. If $\frac{m_1}{m_2} = \alpha$ and $\frac{k_1}{k_2} = \beta$. Then the ratio of the energies of springs $\left(\frac{E_1}{E_2}\right)$ is :-



(1) $\frac{E_1}{E_2} = \frac{\alpha^2}{\beta}$ (2) $\frac{E_1}{E_2} = \frac{\alpha}{\beta}$

(3) $\frac{E_1}{E_2} = \frac{\alpha}{\beta^2}$ (4) $\frac{E_1}{E_2} = \frac{\alpha^2}{\beta^2}$

Ans. (1)

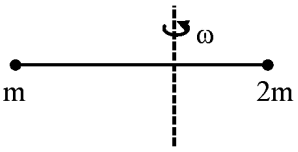
Sol. $x_1 = \frac{m_1 g}{k_1}$ and $x_2 = \frac{m_2 g}{k_2}$

$$\frac{E_1}{E_2} = \frac{\frac{1}{2}k_1 x_1^2}{\frac{1}{2}k_2 x_2^2} = \frac{\frac{1}{2}k_1\left(\frac{m_1 g}{k_1}\right)^2}{\frac{1}{2}k_2\left(\frac{m_2 g}{k_2}\right)^2} = \frac{\frac{m_1^2}{k_1}}{\frac{m_2^2}{k_2}}$$

$$\frac{E_1}{E_2} = \left(\frac{m_1}{m_2}\right)^2 \times \frac{k_2}{k_1} = \frac{\alpha^2}{\beta}$$

$$\frac{E_1}{E_2} = \frac{\alpha^2}{\beta}$$

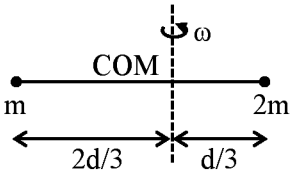
8. Masses 'm' and '2m' are connected by a massless rod of length 'd'. If angular momentum about axis passing through centre of mass and perpendicular to length is 'L'. Then angular speed (ω) of the system is :



(1) $\frac{3L}{2md^2}$ (2) $\frac{L}{2md^2}$ (3) $\frac{5L}{3md^2}$ (4) $\frac{3L}{md^2}$

Ans. (1)

Sol.



$L = I\omega$ and $\omega = \frac{L}{I}$

$$\omega = \frac{L}{m\left(\frac{2d}{3}\right)^2 + 2m\left(\frac{d}{3}\right)^2} = \frac{L}{\frac{4}{9}md^2 + \frac{2}{9}md^2} = \frac{L}{\frac{6md^2}{9}}$$

$$\omega = \frac{3L}{2md^2}$$

9. In young's double slit experiment with two different set-up fringe widths are equal. If ratio of slits-separation is 2 and wavelengths ratio is $\frac{1}{2}$. Find ratio of screen distances in both setup :

(1) $\frac{D_1}{D_2} = 3$

(2) $\frac{D_1}{D_2} = 2$

(3) $\frac{D_1}{D_2} = 8$

(4) $\frac{D_1}{D_2} = 4$

Ans. (4)

Sol. $\beta_1 = \beta_2$

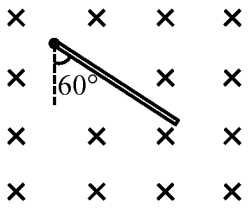
$$\frac{D_1\lambda_1}{d_1} = \frac{D_2\lambda_2}{d_2}$$

$$\frac{D_1}{D_2} = \frac{\lambda_2}{\lambda_1}\left(\frac{d_1}{d_2}\right)$$

$= 2 \times 2$

$$\frac{D_1}{D_2} = 4$$

10. A rod of mass m and length ℓ is released from the position shown with upper end hinged in uniform horizontal magnetic field 'B'. Find maximum induced emf in the rod:



(1) $B\ell\sqrt{\frac{3}{8}g\ell}$ (2) $B\ell\sqrt{\frac{1}{8}g\ell}$

(3) $B\ell\sqrt{\frac{7}{8}g\ell}$ (4) $B\ell\sqrt{\frac{5}{8}g\ell}$

Ans. (1)

Sol. Maximum emf of maximum 'ω'

$$e_{max} = \frac{B\omega\ell^2}{2}$$

W.E.T.

$$mg\frac{\ell}{2}(1-\cos 60) = \frac{1}{2}\frac{m\ell^2}{3}\omega^2$$

$$\frac{mg\ell}{4} = \frac{m\ell^2}{6}\omega^2$$

$$\omega^2 = \frac{3}{2}\frac{g}{\ell}$$

$$e_{max} = \frac{B\ell^2}{2}\sqrt{\frac{3}{2}\frac{g}{\ell}} = B\ell\sqrt{\frac{3}{8}g\ell}$$

11. Two media of refractive indices n_1 and n_2 have a plane interface. In the first medium, speed of light is 2.4×10^8 m/s and in the second medium, it is 2.8×10^8 m/s. Find the critical angle when light travels from 1st medium to 2nd medium :

(1) $\sin^{-1}\left(\frac{5}{7}\right)$ (2) $\sin^{-1}\left(\frac{1}{3}\right)$

(3) $\sin^{-1}\left(\frac{6}{7}\right)$ (4) $\sin^{-1}\left(\frac{1}{4}\right)$

Ans. (3)

Sol. $\mu_1 = \frac{C}{v_1} = \frac{3}{2.4} = \frac{5}{4}$

$\mu_2 = \frac{C}{v_2} = \frac{3}{2.8} = \frac{15}{14}$

11. Two media of refractive indices n_1 and n_2 have a plane interface. In the first medium, speed of light is 2.4×10^8 m/s and in the second medium, it is 2.8×10^8 m/s. Find the critical angle when light travels from 1st medium to 2nd medium :

(1) $\sin^{-1}\left(\frac{5}{7}\right)$ (2) $\sin^{-1}\left(\frac{1}{3}\right)$

(3) $\sin^{-1}\left(\frac{6}{7}\right)$ (4) $\sin^{-1}\left(\frac{1}{4}\right)$

Ans. (3)

12. A screw gauge has a least count of 0.01 mm. Using this screw gauge a measurement was done. When nothing was present in the jaw, zero of circular scale was above reference line by 3 units. When a sphere was kept between the jaws, main scale reads 1 mm and 51st division of circular scale coincides with reference line. The actual diameter of the ball is :

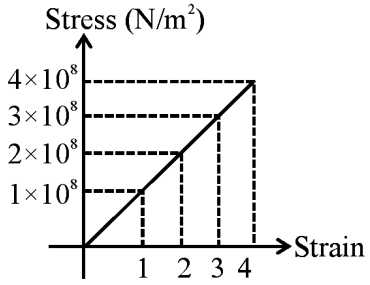
(1) 1.54 mm (2) 1.48 mm

(3) 1.51 mm (4) 1.53 mm

Ans. (1)

Sol. Screw gauge has negative zero error.

13. The stress v/s strain graph of a material is as shown. Find the Young's modulus of the material.



(1) 10^8 N/m² (2) 2×10^8 N/m²

(3) 4×10^8 N/m² (4) 3×10^8 N/m²

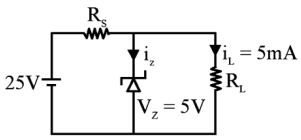
Ans. (1)

Sol. $Y = \frac{\text{Stress}}{\text{Strain}}$

$= \frac{4\times10^8}{4}$

$= 10^8$ N/m²

14.



In the given diagram if $i_z = 4i_L$. Find R_s(in Ω)

Ans. (800)

Sol. Zener diode is conducting

means $V_Z = V_{R_L} = 5V$

$i_L = 5mA$

$\therefore V_{RS} = 20V$

$i_{RS} = i_Z + i_L = 5i_L = 25mA$

$$R_S = \frac{V_{RS}}{i_{RS}} = \frac{20}{25\times10^{-3}} = \frac{20\times1000}{25} = 800\Omega$$

15. A set of measurements of a certain parameter is :

20.00, 19.75, 18.25, 17.01. Find relative error for the set of measurements.

(1) 0.12 (2) 0.06

(3) 0.09 (4) 0.17

Ans. (2)

Sol. Average value = $\frac{75.01}{4} = 18.75$

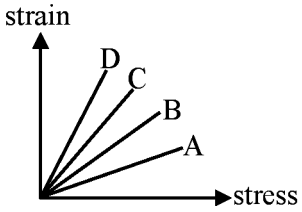
Absolute error of each measurement :

1.25, 1.00, 0.5, 1.74

Mean absolute error = 1.12

Relative error = $\frac{1.12}{18.75} = 0.06$

16. Figure beside represent strain versus stress graph for four materials A,B,C and D. Which material has maximum Young's modulus.



(1) A (2) B

(3) C (4) D

Ans. (1)

Sol. Young's modulus

$= \frac{\text{stress}}{\text{strain}}$

= inverse of slope given in graph.

Hence, A should have maximum Young's modulus.

17. A simple pendulum of length 30cm makes 20 oscillations in 10 sec on a certain planet. Another pendulum makes 40 oscillations in 10 sec on same planet. Find length of second pendulum:

(1) 10 cm (2) 14 cm

(3) 7.5 cm (4) 25 cm

Ans. (3)

Sol. $T = 2\pi\sqrt{\frac{\ell}{g}} = \frac{\Delta t}{N}$

1st pendulum

$2\pi\sqrt{\frac{0.3}{g}} = \frac{10}{20}$ …(i)

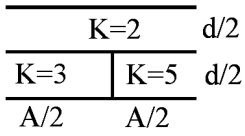
2nd pendulum

$2\pi\sqrt{\frac{\ell}{g}} = \frac{10}{40}$ …(ii)

(ii)/(i) $\sqrt{\frac{\ell}{0.3}} = \frac{1}{2}$

$\ell = \frac{0.3}{4}\text{m} = 7.5$ cm

18. When there is no dielectric then value of capacitance of a capacitor is C. Now some dielectrics inserted in this capacitor as shown in the diagram if capacitance become $\frac{nC}{3}$ then find value of 'n' to the nearest integer.



Ans. (8)

Sol. $C_1 = \frac{5\epsilon_0 A/2}{d/2} = \frac{5\epsilon_0 A}{d} = 5C$

$C_2 = \frac{2\epsilon_0 A/2}{d/2} = \frac{2\epsilon_0 A}{d} = 2C$

C_1 & C_2 in series.

$$C' = \frac{C_1C_2}{C_1 + C_2} = \frac{(5C)(2C)}{7C} = \frac{10}{7}C$$

$$C_3 = \frac{3\epsilon_0 A/2}{d/2} = 3C$$

$$C_4 = \frac{2\epsilon_0 A/2}{d/2} = 2C$$

C_4 & C_3 in series; $C'' = \frac{(2C)(3C)}{5C} = \frac{6}{5}C$

C' & C'' in parallel;

So, $C_{eq} = C\left(\frac{6}{5} + \frac{10}{7}\right) = C\left(\frac{42+50}{35}\right) = \left(\frac{92}{35}\right)C$

$$\frac{92}{35}C = \frac{nC}{3}$$

$$n = \frac{92 \times 3}{35} = 7.9$$

$n \simeq 8$

19. Find de-Broglie wavelength of oxygen molecule at 27°C. Molar mass of oxygen molecule is 32 gm/mole.

(1) 0.257 Å (2) 2.57 Å

(3) 25.7 Å (4) 257 Å

Ans. (1)

Sol. KE of O_2 molecule at 27°C

$$K = \frac{3}{2}kT$$

$$= \frac{3}{2} \times 1.38 \times 10^{-23} \times 300$$

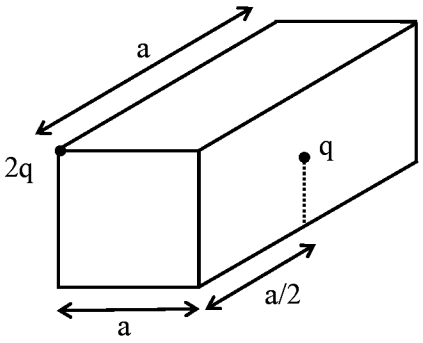
$$= 6.21 \times 10^{-21} \text{ J}$$

de-Broglie wavelength $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mk}}$

$$= \frac{6.63 \times 10^{-34}}{\sqrt{2 \times \frac{32 \times 10^{-3}}{6 \times 10^{23}} \times 6.21 \times 10^{-21}}} = 2.57 \times 10^{-11}$$

$$= 0.257 \text{ Å}$$

20. There are two point charges, one at vertex and other at face centre as shown on the cube. Find electric flux through the cube :



(1) $3q/\varepsilon_0$ (2) q/ε_0

(3) $3q/4\varepsilon_0$ (4) $5q/\varepsilon_0$

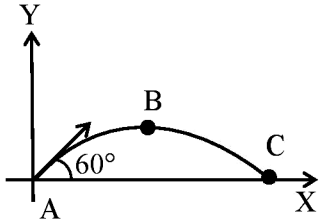
Ans. (3)

Sol. $\phi = \frac{(2q)}{8\varepsilon_0} + \frac{q}{2\varepsilon_0}$

$$= \frac{q}{4\varepsilon_0} + \frac{2}{2\varepsilon_0}$$

$$= \frac{3}{4}\frac{q}{\varepsilon_0}$$

21. A projectile is projected with speed v at an angle 60° with ground (horizontal). Find the ratio of difference of kinetic energies at point C (at ground) and point B (at highest point) with kinetic energy at point C as shown in the diagram:



(1) 3 : 4

(2) 1 : 3

(3) 1 : 2

(4) 1 : 12

Ans. (1)

Sol. $K_A = K_C = K = \frac{1}{2}mu^2$

$K_B = \frac{1}{2}m(u\cos 60°)^2$

$\left(\frac{1}{2}mu^2\right)\frac{1}{4} = \frac{k}{4}$

$\frac{K_C - K_B}{K_C} = 1 - \frac{K_B}{K_C} = 1 - \frac{1}{4} = \frac{3}{4}$

22. If electric field component is E = 377 sin(ωt + kx)V/m of a electromagnetic wave and $\sqrt{\frac{\mu_0}{\varepsilon_0}} = 377$. Then find average intensity of the wave. (in W/m^2)

(1) 188.5 (2) 200
(3) 100 (4) 300

Ans. (1)

Sol. $I_{avg} = \left(\frac{1}{2}\varepsilon_0 E^2\right).C$

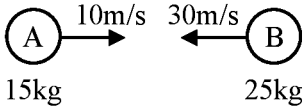
$= \frac{1}{2}\varepsilon_0 E^2 \frac{1}{\sqrt{\mu_0\varepsilon_0}}$

$= \frac{1}{2}\sqrt{\frac{\varepsilon_0}{\mu_0}}.E_0^2$

$= \frac{1}{2} \times \frac{1}{377} \times (377)^2$

$= \frac{377}{2} = 188.5\,W/m^2$

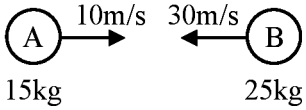
23.



Two ball made of same material collides perfectly inelastically. Energy lost in the collision is completely utilized for raising temperature of each ball. Find rise in temperature of balls. [specific heat: 31 cal/kg-°C] :

(1) 1.24°C (2) 2.44°C
(3) 2.24°C (4) 1.44°C

23.



Two ball made of same material collides perfectly inelastically. Energy lost in the collision is completely utilized for raising temperature of each ball. Find rise in temperature of balls. [specific heat: 31 cal/kg-°C] :

(1) 1.24°C
(2) 2.44°C
(3) 2.24°C
(4) 1.44°C

Ans. (4)

1. 25 ml, 0.1 M $Ba(OH)_2$ react completely with HCl. Find weight of HCl (in milligram) required?

Ans. **(182)**

Sol. $Ba(OH)_{2(aq)} + 2HCl_{(aq)} \rightarrow BaCl_{2(aq)} + 2H_2O_{(\ell)}$

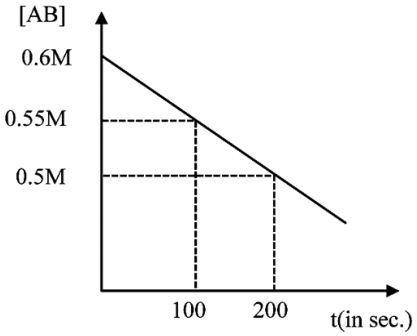
2.5 mmole 5mmole

wt of HCl = 5 × 36.5 (milligram)

= 182.5 (milligram)

= 182

2. For given zero order reaction $AB_g \rightleftharpoons A_g + B_g$, the graph is given for decomposition of [AB]. Find half life ($t_{1/2}$) in minutes?



Ans. **(10)**

Sol. $[AB]_0 - [AB]_t = kt$

$0.60 - 0.55 = k(100)$

$k = 5 \times 10^{-4}$

$$\text{Half life } (t_{1/2}) = \frac{[AB]_0}{2k}$$

$$= \frac{0.60}{2\times5\times10^{-4}}$$

= 600 sec

= 10 min

3. For the following change

$H_2O(\ell) \rightarrow H_2O\ (g)$

5°C 100°C

Select the correct answer

(1) q = +ve, w = +ve, ΔU = +ve

(2) q = -ve, w = -ve, ΔU = +ve

(3) q = +ve, w = -ve, ΔU= +ve

(4) q = -ve, w = -ve, ΔU= -ve

Ans. **(3)**

Sol. $\underset{5°C}{H_2O(\ell)} \longrightarrow \underset{100°C}{H_2O(\ell)} \rightleftharpoons \underset{100°C}{H_2O(g)}$

due to expansion

w = -ve

as heat is given to system so q = +ve and

internal energy of gas will be more than internal energy of liquid so ΔU = +ve

4. For a given reaction, $K_P = 9$ atm

$$NH_{3(g)} \rightleftharpoons \frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)}$$

Total pressure at equilibrium is $\sqrt{3}$ atm.

Find the value of $7\ \alpha^2$, where α is degree of dissociation of $NH_{3(g)}$?

Ans. **(6)**

Sol.

$$NH_{3(g)} \rightleftharpoons \frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)}$$

t = 0	1mole	–	–
$t = t_{eq}$	1-α	α/2	3α/2

$$k_P = \frac{\left(\frac{\alpha}{2}\right)^{1/2}\left(\frac{3\alpha}{2}\right)^{3/2}}{(1-\alpha)}\left[\frac{P_T}{1+\alpha}\right]^1 \qquad \left[\because P_T = \sqrt{3}\ \text{atm}\right]$$

$$9 = \frac{\left(\frac{\alpha}{2}\right)^{1/2}\left(\frac{3\alpha}{2}\right)^{3/2}}{(1-\alpha)} \times \frac{(3)^{1/2}}{1+\alpha}$$

$$9 = \frac{9\left(\frac{\alpha}{2}\right)^2}{1-\alpha^2}$$

$$1-\alpha^2 = \frac{\alpha^2}{4}$$

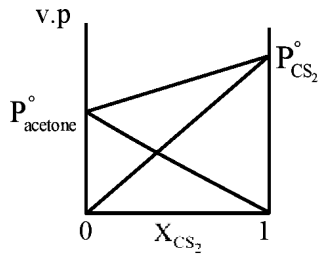
$$\frac{5\alpha^2}{4} = 1$$

$$\alpha^2 = 0.8$$

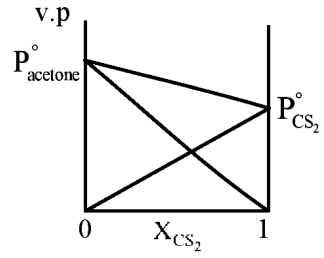
$$7\alpha^2 = 5.6$$

5. Choose the correct graph for the mixture of the volatile liquid CS_2 and acetone

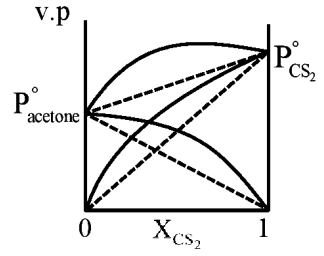
(1)



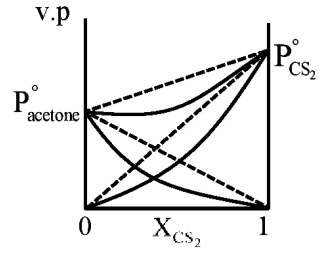
(2)



(3)



(4)



Ans. (3)

Sol. Mixture of CS_2 and $CH_3-\underset{\underset{O}{\|}}{C}-CH_3$ show positive deviation

$P^\circ_{CS_2} > P^\circ_{Acetone}$

6. A cell representation is given

$Ag/AgCl \,||\, FeCl_2, FeCl_3/Pt$

Which of the following can increase the EMF of cell ?

(i) By increasing concentration of Fe^{2+}

(ii) By increasing concentration of Fe^{3+}

(iii) By decreasing concentration of Fe^{2+}

(iv) By decreasing concentration of Fe^{3+}

(v) By increasing concentration of Cl^-

(1) i, iv, v (2) ii, iii, v

(3) iii, iv, v (4) i, iii, v

Ans. (2)

Sol. $Cl^-_{aq} + Ag_{(S)} + Fe^{+3}_{aq} \rightarrow Fe^{+2}_{aq} + AgCl_{(S)}$

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{1}\log\frac{[Fe^{2+}]}{[Cl^-][Fe^{3+}]}$$

7. For a given reaction at 400 K

(R=0.082 atm-L/mol-K)

$xA \rightleftharpoons yB$

Given (i) $K_P = 0.82$, $K_C = 25.7$

(ii) $K_P = 8.2$, $K_C = 0.25$

Then which will be correct combination of x & y for above set (i) & set (ii) data

	set (i) (x,y)	set (ii) (x,y)
(A)	(1, 2)	(2, 1)
(B)	(2, 1)	(1, 2)
(C)	(1, 1)	(2, 1)
(D)	(1,2)	(1, 1)

Ans. (2)

Sol. $\frac{K_P}{K_C} = (RT)^{\Delta n_g}$

for $\Delta n_g = 1$ $(RT)^{\Delta n_g} = 32.8$

for $\Delta n_g = -1$ $(RT)^{\Delta n_g} = 0.03$

set (i) $\frac{K_P}{K_C} = \frac{0.82}{25.7} = 0.03 \Rightarrow \Delta n_g = -1$

set (ii) $\frac{K_P}{K_C} = \frac{8.2}{0.25} = 32.8 \Rightarrow \Delta n_g = +1$

8. Which of the following is correct match for hydrogen like species for the total energy of e^-

	Energy (J/atom)
(1) 3rd orbit of Li^{2+} ion	-21.6×10^{-19}
(2) 2nd orbit of He^{+} ion	-10.8×10^{-19}
(3) 2nd orbit of Li^{2+} ion	-9.6×10^{-19}
(4) 2nd orbit of H-atom	-86.4×10^{-19}

Ans. **(1)**

Sol. $E = -21.6 \times 10^{-19} \times \frac{Z^2}{n^2}$ J/atom

9. The correct order of ionization energy of Cl, S, P, Al, Si is. :

(1) Cl > P > S > Si > Al

(2) Cl < P < S < Si < Al

(3) P > Cl > S > Si > Al

(4) S > P > Cl > Si > Al

Ans. **(1)**

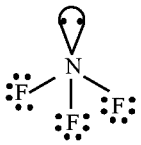
Sol. In general on moving from left to right in a period ionization energy increases.

10. The correct bond angle in the compound which has maximum number of lone pair of electrons among the following compounds H_2SO_4, HNO_3, O_3, NF_3 is :

(1) 102° (2) 107°

(3) 112° (4) 126°

Ans. **(1)**

Sol.  sp^3, Higher the electronegativity of surrounding atoms smaller is the bond angle

11. Consider the following statements about group 13 elements of the periodic table.

(A) Electronegativity decreases down the group.

(B) Size increases down the group.

(C) Ionization energy decreases down the group.

(D) Boiling point of Boron is maximum.

(E) Melting point of Boron is maximum.

(1) A, B, C are correct

(2) A, D, E are correct

(3) D and E are correct

(4) A, B, C, D and E are correct

Ans. **(3)**

Sol. Atomic radii order → B < Ga < Al < In < Tℓ

Ionization enthalpies order → B > Tℓ > Ga > Al > In.

Electronegativity order → B > Tℓ > In > Ga > Al

M.P. → B > Al > Tl > In > Ga

B.P. → B > Al > Ga > In > Tl

12. Find the ratio of CFSE of $[Co(C_2O_4)_3]^{3-}$ and $[Cr(C_2O_4)_3]^{3-}$, for each complex assume $\Delta_0 > P$:

Ans. **(2)**

Sol. $Co^{3+} \rightarrow 3d^6 \rightarrow t_{2g}^{2,2,2}\, eg^{0,0} \rightarrow CFSE = 6 \times \left(\frac{-2}{5}\right)\Delta_0$

$Cr^{3+} \rightarrow 3d^3 \rightarrow t_{2g}^{1,1,1}\, eg^{0,0} \rightarrow CFSE = 3 \times \left(\frac{-2}{5}\right)\Delta_0$

Required ratio $= \frac{6}{3} = 2$

13. Given below are two statements:

Statement-I : $[CoBr_4]^{2-}$ absorbs lesser energy than $[CoCl_4]^{2-}$

Statement-II : $[CoCl_4]^{2-}$ has higher crystal field splitting energy than $[CoBr_4]^{2-}$

(1) Both statements-I and II are correct

(2) Both statements-I and II are incorrect

(3) Statement-I is correct and statement-II is incorrect

(4) Statement-I is incorrect and statement-II is correct.

Ans. **(1)**

Sol. Cl^- is a stronger ligand than Br^-.

14. Consider the following statements for $[Ni(dmg)_2]$

(A) It is a red colour compound.

(B) It is readily soluble in water at pH = 9.

(C) Central metal ion has two unpaired electrons.

(D) It has four, 5 membered metal containing rings.

(1) A and D are correct

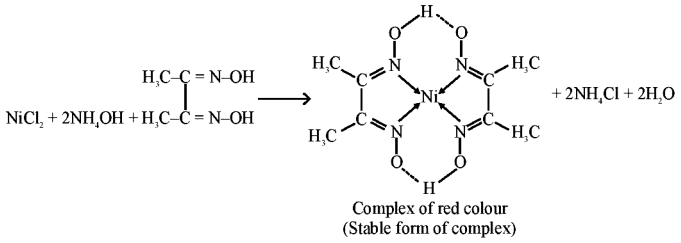
(2) B, C and D are incorrect

(3) A,C and D are correct

(4) A, B, C, D are incorrect

Ans. **(2)**

Sol.



15. The maximum number of electrons in the following two given set of quantum numbers
(i) n=5, $m_\ell = -1$ and

(ii) n = 4, $\ell = 2$, $m_\ell = 1$, $m_s = \frac{1}{2}$

respectively is :-

(1) 8, 1 (2) 4, 1
(3) 26, 2 (4) 10, 2

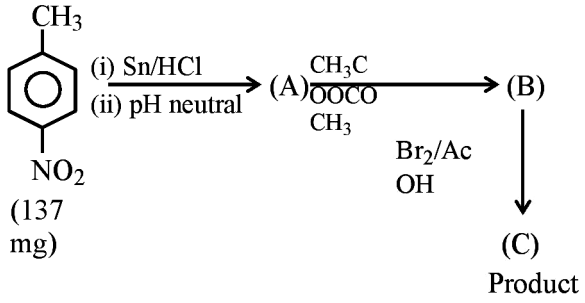
Ans. (1)

Sol. n = 5, $\ell = 0, 1, 2, 3$ and 4.

Only p, d, f and g subshells have one orbital each of $m_\ell = -1$ so total 4 orbitals and & 8 electrons.

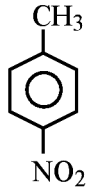
n = 4, $\ell = 2$, $m_\ell = 1$, $m_s = \frac{1}{2}$ $\Rightarrow$ All the four quantum members $\Rightarrow$ only one electron.

16. What is the mass (in mg) of final product (C) ?



Ans. (228)

Sol.



(137 mg)

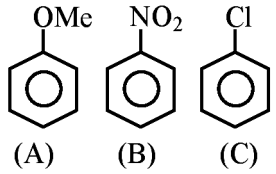
$$\text{Mole} = \frac{137 \times 10^{-3}}{137} = 0.001 \text{ mole}$$

Mole of product = 0.001 mole

Mass of product = 0.001 × 228 gm

= 0.228 gm = 228 mg

17. Compare rate of nitration is decreasing order :



(1) A > B > C (2) A > C > B
(3) B > A > C (4) C > A > B

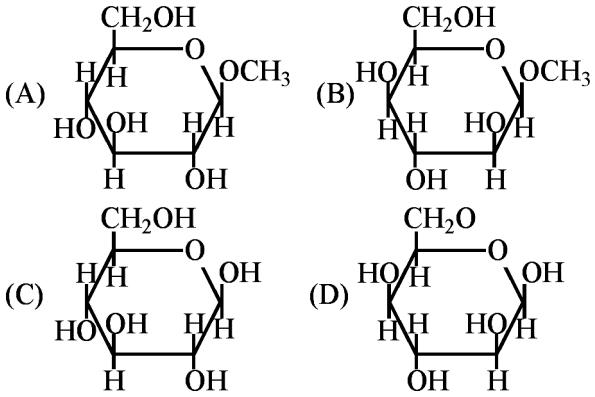
Ans. (2)

Sol. In Ph–OMe , –OMe is a electron donor group (+M).

$Ph–NO_2$, $–NO_2$ is a strong withdrawing group (–M).

Ph–Cl, –Cl is a electron withdrawing group.

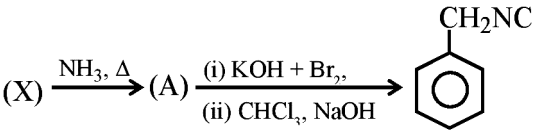
18. Which of the following are the compound(s) do not give Tollen's test ?



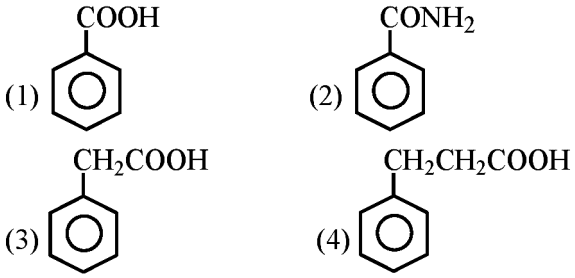
(1) A, B (2) A, C
(3) C, D (4) B, D

Ans. (1)

Sol. Compound in option (A) and (B) are acetals (i.e. not having anomeric –OH). Hence they do not give Tollen's test.

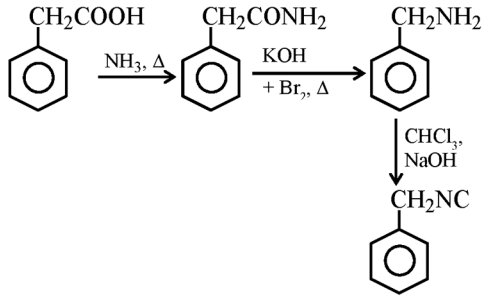
19. 

X will be :



Ans. (3)

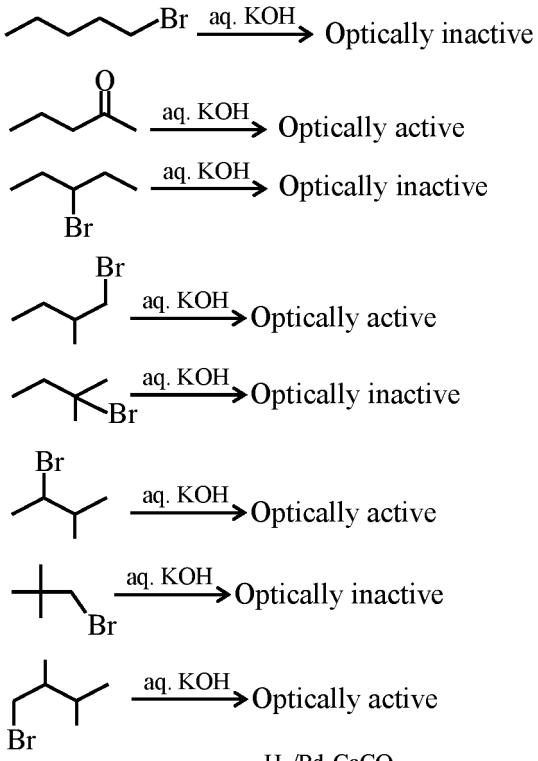
Sol.



20. All possible isomers of $C_5H_{11}Br$ when reacted with aq. KOH. Find out total number of optically active product (without rearrangement).

Ans. (6)

Sol.



21. $CH_3–C\equiv C–CH_3$ → $H_2/Pd\text{-}CaCO_3$ → (X); → $Na/Liq.\ NH_3$ → (Y)

Select correct statement.

(1) Boiling point of X < Y

(2) Dipole moment Y > X

(3) X and Y are stereoisomer of each other

(4) Melting point of X > Y

Ans. **(3)**

Sol. X is cis-2-butene

Y is trans-2-butene

and both are geometrical isomers (i.e. stereoisomers).

22. **Statement-1 :** Sublimation is a purification technique that is used to separate those solid substance which changes from solid to vapour state without passing through liquid state.

Statement-2 : If external atmospheric pressure is reduced, then boiling point of substance decreased.

(1) Statement-1 and Statement-1 both are correct.

(2) Statement-1 and Statement-1 both are incorrect.

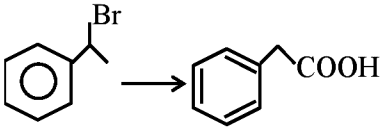
(3) Statement-1 is correct but Statement-2 is incorrect.

(4) Statement-1 is incorrect but Statement-2 is correct.

Ans. **(1)**

Sol. Statement-1 and Statement-1 both are correct.

23. Correct sequence of reagent for the given the reaction



(1) NaOEt, B_2H_6/H_2O_2/Jone's reg

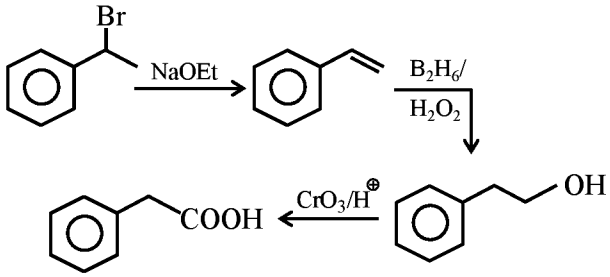
(2) B_2H_6/H_2O_2/Jone's reagent, NaOEt

(3) aq. KOH, B_2H_6/H_2O_2/Jone's reagent

(4) NaOEt, $Hg(OAc)_2/H_2O$/Jone's reagent.

Ans. **(1)**

Sol.



24. Match the list-I and list-II name of reagent.

(1) Baeyer's reagent	(P) Violet colour
(2) Cerric Ammonium nitrate	(Q) Red
(3) Tollen's reagent	(R) Silver mirror
(4) Neutral $FeCl_3$	(S) Pink colour disappears

(1) 1-S, 2-Q, 3-R, 4-P

(2) 1-Q, 2-S, 3-R, 4-P

(3) 1-R, 2-P, 3-Q, 4-S

(4) 1-P, 2-R, 3-Q, 4-S

Ans. **(1)**