FIITJEE COMMON TEST

TWO YEAR CRP (CTY - 1820)

BATCH: B - LOT

PCM (PAPER – II) PHASE - I

PAPER CODE: XXXX.X **DATE: DD.MM.YYYY**

HINTS AND SOLUTIONS [SET – A]

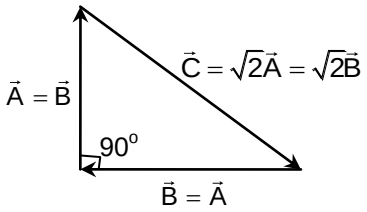
PHYSICS

PART – A

1. **B**

$$\frac{\vec{A}.\vec{B}}{|\vec{B}|}$$

2. **D**



3. **D**

$$PQ = \frac{T.v\sin\theta}{\cos\theta} \qquad (a = 0)$$

4. **D**

$$h = \frac{u_y^2}{2g}$$

$$R = \frac{2u_x u_y}{g}$$

$$R_{max} = \frac{u_x^2 + u_y^2}{g}$$

5. **A**

$$2\left[ut + \frac{1}{2}gt^2\right] = \left[u(t+1) + \frac{1}{2}g(t+1)^2\right]$$

6. **A**

Weight of chain hanging = frictional force on chain above the table

7. **C**

$W = m(g + a)$ w.r.t. earth

8. **D**

$F_{net} = F - \mu N$

For $F_{net} = 0$; $\frac{F}{N} = \mu$

9. **A**

10. **A**

$t = \frac{v_0}{g}$

11. **A**

$v_x = a_0 t,\ v_y = 0$

12. **C**

$x = v_x t$

13. **D**

$\frac{v_{x_1}}{x} = \frac{v_{x_2}}{(30 - x)},\ t = \frac{v_x}{x}$

14. **B**

$x = v_x t,\ y = v_y t$

15. **C**

$a_{rel} = 0$

PART – B

1. **(A) – (q); (B) – (p); (C) – (s); (D) – (r)**

(A) $v = \frac{dx}{dt},\ a = \frac{dv}{dt}$ Either both are positive or negative

(B) $x = 0$

(C) $\frac{d^2x}{dt^2} < 0$ and $\frac{dx}{dt} > 0$ or $\frac{d^2x}{dt^2} > 0$ and $\frac{dx}{dt} < 0$

(D) $\frac{dx}{dt} = 0$

2. **(A) – (q, r); (B) – (p); (C) – (p, q); (D) – (s)**

(A) $mg\sin\theta = F_K < \mu mg\cos\theta$

(B) $F_K = F_{mg}$ along the plane

(C) $a_{net} = 0$, $F_{mg} = F_K$ along the plane

(D) $\tan\theta = 0 \Rightarrow \mu = 0$

$F_K = \mu N = 0$

CHEMISTRY

PART – A

1. **A**

2. **D**

3. **C**

$Fe_3O_4 + 8H^+ + 2I^- \rightarrow 3Fe^{2+} + 4H_2O + I_2$

232 g 254 g

As 232 g of Fe_3O_4 would produce 254 g of I_2

This sample is 90 % pure.

So 10 g of the sample would contain 9 g of Fe_3O_4 which would produce

$\frac{254}{232} \times 9 = 9.853$ g of I_2.

4. **D**

5. **D**

6. **A**

7. **C**

8. **A**

9. **B**

10. **B**

11. **B**

12. **B**

13. **B**

14. **C**

15. **D**

PART – B

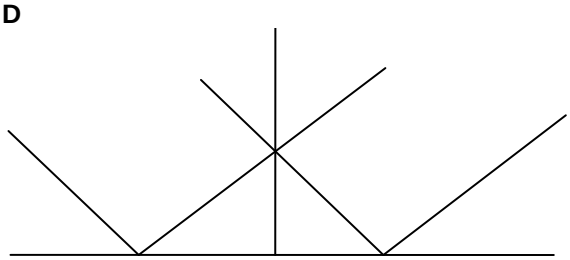
1. **(A) – (q, r, t); (B) – (p, r, t); (C) – (p, r, t); (D) – (r, s, t)**

2. **(A) – (p, q, r, t); (B) – (q, r); (C) – (s); (D) – (p, q, r, t)**

MATHEMATICS

PART – A

1. **D**



The image of $y = |x-1|$ w.r.t. y-axis is $y = |x+1| \Rightarrow y = \pm(x+1)$

Required solution is $(y-(x+1))(y+(x+1)) = 0$

$y^2 - (x+1)^2 = 0$ $\quad y^2 - x^2 - 2x - 1 = 0$

$x^2 - y^2 + 2x + 1 = 0$

2. **C**

$\log_k x \log_5 k = \log_x 5$

$\frac{\log x}{\log k}\frac{\log k}{\log 5} = \log_x 5 \Rightarrow \frac{1}{\log_x 5} = \log_x 5$

$(\log_x 5)^2 = 1 \Rightarrow \log_x 5 = \pm 1$

$x = 5,\ 5^{-1}$

$\text{Sum} = 5 + \frac{1}{5} = \frac{26}{5}$

3. **A**

Equation of circle

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

$x^2 + y^2 + 2(\lambda - 2)x - (10 + \lambda)y + 29 + \lambda = 0$

Centre $\left(2 - \lambda,\ \frac{10+\lambda}{2}\right)$

Centre lies on $x - 2y = 4 \Rightarrow 2 - \lambda - 10 - \lambda = 4$

$2\lambda = -12$

$\lambda = -6$

$\therefore$ Radius $= \sqrt{g^2 + f^2 - c} = \sqrt{64 + 4 - 29 + 6}$

$= \sqrt{64 - 19} = \sqrt{45} = 3\sqrt{5}$

4. **C**

$y = \sqrt{\frac{1-x}{1+x}}$ ..... (i)

$y^2(1+x) = 1 - x$ ..... (ii)

$2yy'(1+x) + y^2 = -1$

$y' = \frac{-(1+y^2)}{2y(1+x)} \Rightarrow (1-x^2)\frac{dy}{dx} = -\frac{(1-x^2)(1+y^2)}{2y(1+x)}$

$(1-x^2)\frac{dy}{dx} = \frac{-(1-x)\left(1+\frac{1-x}{1+x}\right)}{2y}$

$(1-x^2)\frac{dy}{dx} = -\frac{2(1-x)}{2y(1+x)}$

$(1-x^2)\frac{dy}{dx} = -\frac{y^2}{y} = -y$

5. **C**

$I = \int \frac{\ln(\tan x)}{\sin x \cos x} dx$

Let $\ln(\tan x) = t$

$\frac{1}{\tan x}\sec^2 x dx = dt$

$\frac{dx}{\sin x \cos x} = dt$

$\therefore I = \int t dt = \frac{t^2}{2} + c = \frac{(\ln \tan x)^2}{2} + c$

6. **A**

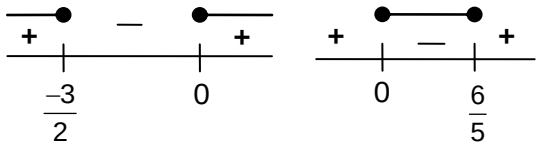
$$\int_{\pi/4}^{3\pi/4}(1+\cos x)\,dx=\left[x+\sin x\right]_{\pi/4}^{3\pi/4}=\frac{\pi}{2}$$

7. **C**

$$\log_{\frac{1}{5}}\frac{4x+6}{x}\geq 0\Rightarrow 0<\frac{4x+6}{x}<1$$

$$\frac{4x+6}{x}>0 \;\&\; \frac{4x+6}{x}-1<0$$

$$\frac{5x-6}{x}<0$$



Clearly $x\in\left(-\frac{3}{2},\,0\right)$ has no solution

$2^{y-x}(x+y)=1$ and $(x+y)^{x-y}=2$ have two pair of solutions.

$\therefore$ Option (C) is true.

8. **A**

$$y=\sqrt{\log_2\sin x}\Rightarrow \log_2\sin x\geq 0$$

$$\sin x\geq 1\Rightarrow \sin x=1$$

$$x=(4n+1)\frac{\pi}{2},\; n\in I$$

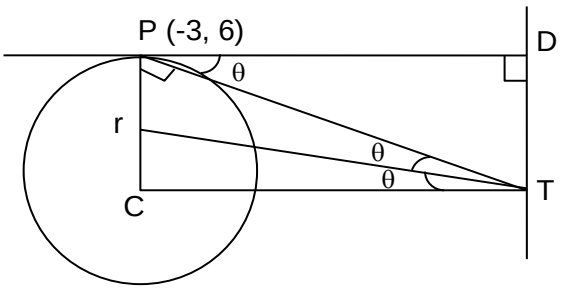
9. **A**

For n = 3, $\theta=\frac{\pi}{2^3-1}=\frac{\pi}{7}$

$$\cos\theta\cos 2\theta\cos 2^2\theta=\frac{-1}{2^3}$$

$$\therefore \cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{4\pi}{7}=-\frac{1}{8}$$

10. **B**



Equation of tangent at P

$$14x(-3)+14.y.6+108(x-3)-\frac{69}{2}(y+6)+432=0$$

$$4x+3y-6=0$$

11. **C**

$$\text{Radius}=\sqrt{g^2+f^2-c}=\frac{165}{28}$$

12. **B**

$\angle DPT = \theta$, slope of PT $= \dfrac{-4}{3}$

Let PT = ℓ, $\tan 2\theta = \dfrac{165}{8\ell}$

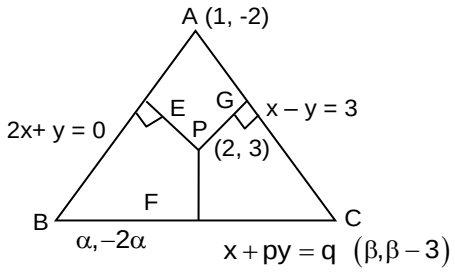
$\cos\theta = \dfrac{11\sqrt{30}}{13\ell}$

$\dfrac{\tan 2\theta}{\cos\theta} = \dfrac{15\times 13}{28\sqrt{13}\times\sqrt{110}}$

$\sin\theta = \dfrac{-56\sqrt{10}+74\sqrt{10}}{60\sqrt{13}}$

$\therefore \tan\theta = \dfrac{3}{11}$

13. **D**



$1+\alpha+\beta = 6,\ -2-2\alpha+\beta-3 = 9$

$\alpha = -3,\ \beta = 8$

$B \equiv (-3,\ 6),\ C \equiv (8,\ 5)$

Equation of BC is $x + 11y = 63$

$\therefore p + q = 63 + 11 = 74$

14. **B**

Slope of BP $= -1 \Rightarrow \dfrac{3+2\alpha}{2-\alpha} = -1 \Rightarrow \alpha = -5$

Slope of CP $= \dfrac{1}{2} \Rightarrow \dfrac{\beta-6}{\beta-2} = \dfrac{1}{2} \Rightarrow \beta = 10$

$B \equiv (-5,\ 10)$, $C \equiv (10,\ 7)$, Equation of BC is $r + 5y = 45$

$\therefore p + q = 50$

15. **A**

$PA^2 = 26 = PB^2 = PC^2$

$(\alpha-2)^2 + (3+2\alpha)^2 = (\beta-2)^2 + (\beta-6)^2 = 26$

$\beta = 7$

$\alpha = -\dfrac{13}{5}$ or 1 (rejected because vertices A and B coincide)

$\therefore B \equiv \left(-\dfrac{13}{5},\ \dfrac{26}{5}\right)$ and $C \equiv (7,\ 4)$

$\therefore$ Equation of BC is $x + 8y = 39 \Rightarrow p + q = 47$

PART – B

1. **(A) – (p, q, r, s); (B) – (q, s); (C) – (r); (D) – (q)**

2. **(A) – (t); (B) – (p); (C) – (r); (D) – (q)**