JEE(Main + Advanced) : NURTURE TEST SERIES / JOINT PACKAGE COURSE

Test Type : Mock Test

ANSWER KEY PAPER-2

PART-1 : PHYSICS

SECTION-I (i)	Q.	1	2	3	4				
	A.	A	D	B	B				
SECTION-I (ii)	Q.	5	6	7	8				
	A.	A,B,C,D	A,D	A,B	A,C,D				
SECTION-II	Q.	1	2	3	4	5	6	7	8
	A.	15.00	5.00	1.25	6.00	9.00	3.88 to 3.89	2.00	20.20 to 20.23

PART-2 : CHEMISTRY

SECTION-I (i)	Q.	1	2	3	4				
	A.	C	C	C	C				
SECTION-I (ii)	Q.	5	6	7	8				
	A.	A,B,D	B,C,D	A,B	A,B,C,D				
SECTION-II	Q.	1	2	3	4	5	6	7	8
	A.	4.00	6.00	0.00	2.50	3.00	4.00	4.00	0.24

PART-3 : MATHEMATICS

SECTION-I (i)	Q.	1	2	3	4				
	A.	A	A	B	B				
SECTION-I (ii)	Q.	5	6	7	8				
	A.	A,B,C,D	B,D	A,C,D	A,B,C				
SECTION-II	Q.	1	2	3	4	5	6	7	8
	A.	40.00	109.00	0.10	-4.00	3.00	10.10	0.45	2.40

HINT – SHEET

PART-1 : PHYSICS

SECTION-I (i)

1. Ans (A)

$T\sqrt{3} = 6g \Rightarrow T = \dfrac{6g}{\sqrt{3}}$ ... (i)

Also $T = mg$ ... (ii)

from (i) & (ii)

$m = \dfrac{6}{\sqrt{3}} = 2\sqrt{3} = 3.46kg$

2. Ans (D)

If two vectors are perpendicular then $\vec{A}.\vec{B} = 0$

$\left(10\hat{i} - 2t\hat{j}\right)\left(5\hat{i} + 5\hat{j}\right) = 0$

$50 - 10t = 0$

$t = 5sec$

3. Ans (B)

From the given graph

$v^2 = 2t$

$2v\frac{dv}{dt} = 2$

$va = 1$

$a = \frac{1}{v}$

v at t = 1 sec is $v = \sqrt{2}$

$a = \frac{1}{\sqrt{2}}$ m/sec^2

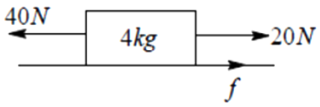
4. Ans (B)

friction will act opposite to the relative velocity.

PART-1 : PHYSICS

SECTION-I (ii)

5. Ans (A,B,C,D)

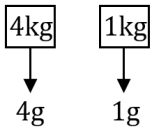


f = 20N (< 24N)

So block will not move

Contact force = $\sqrt{(20)^2 + (40)^2} = 20\sqrt{5}$N

6. Ans (A,D)



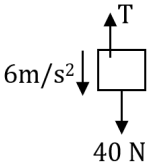
$F_T = 3g$

$F_T = 30$ N

F = ma

30 = 5a

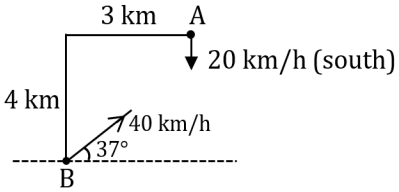
a = 6 m/s^2



40 – T = 4 × 6

T = 16 N

7. Ans (A,B)



$V_A = 20(-\hat{j})$

$V_B = 40\cos 37\hat{i} + 40\sin 37\hat{j}$

$= 40 \times \frac{4}{5}\hat{i} + 40 \times \frac{3}{5}\hat{j}$

$= 32\hat{i} + 24\hat{j}$

$V_{AB} = \vec{V}_A - \vec{V}_B$

$= -20\hat{j} - (32\hat{i} + 24\hat{j})$

$= -32\hat{i} - 44\hat{j}$ k/h

At time = 0

$\vec{r}_{AB} = \vec{r}_A - \vec{r}_B = (3\hat{i} + 4\hat{j})$

at time t

$\vec{r}_{AB} = (\vec{r}_{AB}) + \vec{V}_{AB}t$

$= (3 - 32t)\hat{i} + (4 - 44t)\hat{j}$

8. Ans (A,C,D)

$\vec{V}_{AP} = v$

$\vec{V}_{BP} = -3\vec{V}$

At the plane $V_{AB} = 4V$

$T = \frac{L}{V + 3V} = \frac{L}{4V}$

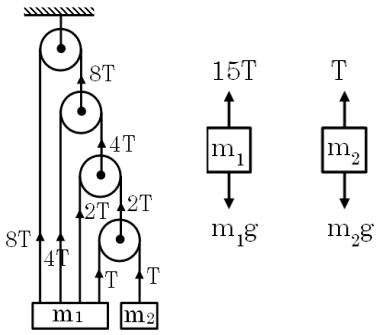
$S_{BP} = 3V\left(\frac{L}{4V}\right) = \frac{3L}{4}$

$S_{AB} = V\left(\frac{L}{4V}\right) = \frac{L}{4}$

PART-1 : PHYSICS

SECTION-II

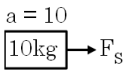
1. Ans (15.00)



$$\frac{15T}{T} = \frac{m_1 g}{m_2 g}$$

$$\frac{m_1}{m_2} = 15$$

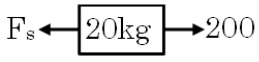
2. Ans (5.00)



$F_S = ma$

$F_S = 10 \times 10$

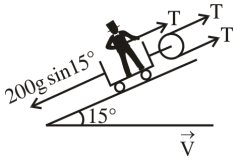
$F_S = 100$



$200 - 100 = 20a$

$a = \frac{100}{20} = 5$

3. Ans (1.25)

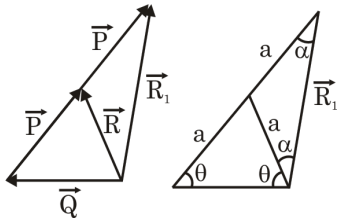


$T = 250$ N

$750 - 200g \sin 15° = 200\, a$

$a = \frac{5}{4} = 1.25$ m/s^2

4. Ans (6.00)



$2\theta + 2\alpha = 180°$

$\therefore\ \theta + \alpha = 90°$

5. Ans (9.00)

Writing position of A and B at time t.

For A, $x = 0$; $y = V_A t - \frac{1}{2} gt^2$

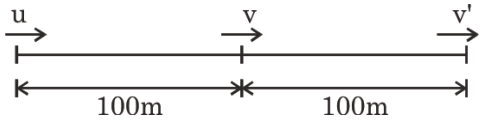
For B : $x = 27 - V_B t$; $y = 45 - \frac{1}{2} gt^2$

For collision both particle must be at a same place in air $\Rightarrow V_A t = 45 \Rightarrow V_B t = 27$

Now, $y_Q > 0 \Rightarrow 45 - 5t^2 > 0 \Rightarrow t < 3$ sec.

$\Rightarrow V_B = \frac{27}{3} = 9$ m/s

6. Ans (3.88 to 3.89)



$100 = S = u(30) + \frac{1}{2}(a)(30)^2$ ...(1)

$200 = u(90) + \frac{1}{2}(a)(90)^2$ ...(2)

7. Ans (2.00)

$\vec{V} \cdot \vec{a} = 0$

$\theta = \frac{\pi}{2}, \frac{3\pi}{2}$

8. Ans (20.20 to 20.23)

$2 = 7t + \frac{1}{2}(-6)t^2 \Rightarrow t = \frac{1}{3}$ sec, 2 sec.

$\Delta t = \frac{5}{3}$ sec.

width $d = \left(\frac{5}{3}\right) 7\sqrt{3} = \frac{35}{\sqrt{3}}$ m.

PART-2 : CHEMISTRY

SECTION-I (i)

1. Ans (C)

– Ph gr $\longrightarrow 4$

ring $\longrightarrow 5$

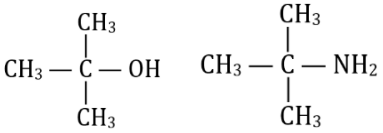
– C ≡ N $\longrightarrow 2$

– COOH $\longrightarrow 1$

Total DEB = 12

2. Ans (C)

Tertiary alcohol is when –OH group is directly connected to a 3° c–atom while tertiary amine is, when nitrogen is directly connected with 3–carbon atoms.



Tertiary alcohol Primary amine

3. Ans (C)

Mass of 0.05 Moles of B_2A_3 = 9 g

Mass of 1 mole of $B_2A_3 = \frac{9}{0.05} = 180$ g

Mass of 0.10 moles of B_2A = 10 g

Mass of 1 mole of $B_2A = \frac{10}{0.10} = 100$ g

2B + 3A = 180 g ....(i)

2B + A = 100 g ....(ii)

A = 40 g

B = 30 g

4. Ans (C)

Al_2O_3 amphoteric

CaO Basic

SO_3, Cl_2O_7 acidic

PART-2 : CHEMISTRY

SECTION-I (ii)

5. Ans (A,B,D)

$SnCl_2$ is Polar (Bent shape)

6. Ans (B,C,D)

(A)$Na_2HPO_3(s)$ (B) $K_2HPO_4(s)$

(C) $KHCO_3(s)$ (D) $NaHCO_3(s)$

Hydrogen bond is formed when hydrogen is covalently bonded to more EN atom like F, O, N.

In (A) OPTION 'H' is covalently bonded to phosphorous so hydrogen bond is not formed.

7. Ans (A,B)

$$\frac{\text{Moles of oxygen atom}}{\text{Moles of hydrogen atom}} = \frac{4}{12} = \frac{1}{3}$$

$3NH_4^+$ cations and 1 PO_4^{3-} anion in one molecule.

Total number of atoms in 1 mole $(NH_4)_3PO_4 = 20\ N_A$.

8. Ans (A,B,C,D)

Based on theory

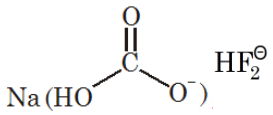
PART-2 : CHEMISTRY

SECTION-II

1. Ans (4.00)

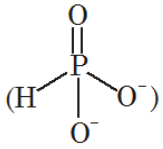
$C\ell F_3$, ICl_2^- , SCl_2 , I_3^+ are planar.

2. Ans (6.00)

HF, H_2O_2, HNO_3, H_3BO_3,  $HF_2^{\ominus}$

($F^{\ominus}$----H – F) shows hydrogen bonding.

So total 6 species shows H bonding.

In H_2S and HPO_3^{-2}  no hydrogen

attached with (F,N,O) so no hydrogen bonding.

3. Ans (0.00)

S_8 Ox. No. $\longrightarrow$ 0

4. Ans (2.50)

x = 8

z = 2

$$\frac{8+2}{4} = \frac{10}{4} = 2.50$$

5. **Ans (3.00)**

Initial moles of Ca = $\frac{0.2 \times 10^3}{40} = 5$

Removed moles of Ca = $\frac{1.2 \times 10^{24}}{6 \times 10^{23}} = 2$

Remaining moles of Ca = 5 – 2 = 3.

6. **Ans (4.00)**

Let the element X_n

where n ⟶ atomicity

PV = nRT (n ⟶ no. of moles)

$1 \times 2.24 = \frac{6.2}{31n} \times 0.0821 \times 546$

$\Rightarrow n = 4$

7. **Ans (4.00)**

Homocyclic hydrocarbon are
1, 3, 7, 8

8. **Ans (0.24)**

$4A + 2B + 3C \longrightarrow A_4B_2C_3$

1 mole 0.6 mole 0.72 mole

In the above reaction, reactant 'C' will be the limiting reactant and it will decide yield product.

∵ from 3 moles of C; 1 mole product is formed

∴ from 0.72 moles of C = $\frac{1}{3} \times 0.72$

= 0.24 moles of product

PART-3 : MATHEMATICS

SECTION-I (i)

1. **Ans (A)**

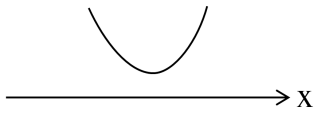
$\tan(\ell n15) = \frac{\tan(\ell n5) + \tan(\ell n3)}{1 - \tan(\ell n5)\tan(\ell n3)}$

$\tan(\ell n15) - \tan(\ell n15)\tan(\ell n5)\tan(\ell n3)$

$= \tan(\ell n5) + \tan(\ell n3)$

$\frac{\tan(\ell n15) - \tan(\ell n3) - \tan(\ell n5)}{\tan(\ell n15)\ \tan(\ell n3)\ \tan(\ell n5)} = 1$

2. **Ans (A)**



$x^2 + 2ax + 10 - 3a > 0$

$D > 0$

$\Rightarrow b^2 - 4ac < 0$

$\Rightarrow 4a^2 - 4(10 - 3a) < 0$

$\Rightarrow a^2 + 3a - 10 < 0$

$\Rightarrow (a + 5)(a - 2) < 0$

$\Rightarrow a \in (-5, 2)$

3. **Ans (B)**

$T_n = 3n^2 + n + 2$

$S_n = n^3 + 2n^2 + 3n$

4. **Ans (B)**

The correct is (B)

Since, $n(X_r) = 5, \bigcup_{r=1}^{20} X_r = S$, we get n(S) = 100

But each element of S belong to exactly 10 of the X_r' is

So, $\frac{100}{10} = 10$ are the number of distinct elements in S.

Also each element of S belong to exactly 4 of the Y_r' and each Y_r contain 2 elements. If S has n number of Y_r in it. Then

$\frac{2n}{4} = 10$

which gives n = 20

PART-3 : MATHEMATICS

SECTION-I (ii)

5. Ans (A,B,C,D)

(A) $4\sin^3x\cos 3x + 4\cos^3x \sin 3x = \frac{3}{2}$

$\Rightarrow (3\sin x - \sin 3x)\cos 3x + (3\cos x + \cos 3x)\sin 3x = \frac{3}{2}$

$\Rightarrow 3[\sin x \cos 3x + \cos x \sin 3x] = \frac{3}{2}$

$\Rightarrow \sin 4x = \frac{1}{2}$

$\Rightarrow 8\sin 4x = 4$

(C) $\cos\alpha + \cos\beta = \frac{1}{2}$

$\Rightarrow 2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) = \frac{1}{2}$ ...(i)

$\sin\alpha + \sin\beta = \frac{1}{3}$

$\Rightarrow 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right) = \frac{1}{3}$ ...(ii)

Dividing Eq. (ii) by Eq.(i). we get

$\tan\left(\frac{\alpha+\beta}{2}\right) = \frac{2}{3}$

(D) $\cos 0° + \cos\frac{\pi}{7} + \cos\frac{2\pi}{7} + \cos\frac{3\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{5\pi}{7} + \cos\frac{6\pi}{7}$

$= 1 + \left(\cos\frac{\pi}{7} + \cos\frac{6\pi}{7}\right) + \left(\cos\frac{2\pi}{7} + \cos\frac{5\pi}{7}\right) + \left(\cos\frac{3\pi}{7} + \cos\frac{4\pi}{7}\right)$

$= 1 + \left(\cos\frac{\pi}{7} + \cos\left(\pi - \frac{\pi}{7}\right)\right) + \left(\cos\frac{2\pi}{7} + \cos\left(\pi - \frac{2\pi}{7}\right)\right) + \left(\cos\frac{3\pi}{7} + \cos\left(\pi - \frac{3\pi}{7}\right)\right)$

$= 1 + 0 + 0 + 0 = 1$

6. Ans (B,D)

A.M. > H.M.

$\frac{x+y+z}{3} > \frac{3}{\frac{1}{x}+\frac{1}{y}+\frac{1}{z}}$

$\Rightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} > \frac{9}{a}$

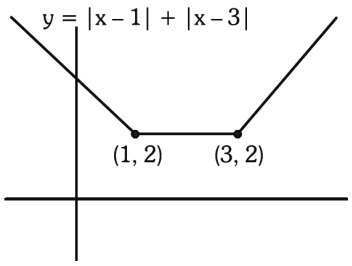
A.M. > G.M.

$\frac{(a-x)+(a-y)+(a-z)}{3} > ((a-x)(a-y)(a-z))^{1/3}$

$\Rightarrow (a-x)(a-y)(a-z) < \frac{8a^3}{27}$

7. Ans (A,C,D)

Graph $\longrightarrow$ for more than solution $\Rightarrow r \geqslant 2$



8. Ans (A,B,C)

$abc = \sin 10° \cdot \sin 50° \cdot \sin 70°$

$= \sin 10° \cdot \sin(60° - 10°) \cdot \sin(60° + 10°)$

$= \frac{1}{4}\sin(3 \times 10°) = \frac{1}{8}$

$\frac{a+b}{c} = \frac{\sin 10° + \sin 50°}{\sin 70°} = \frac{2\sin 30° \cdot \cos 20°}{\sin 70°} = 1$

$\frac{1}{a} + \frac{1}{b} - \frac{1}{c} = \frac{1}{\sin 10°} + \frac{\sin 70° - \sin 50°}{\sin 70° \sin 50°}$

$= \frac{1}{\sin 10°} + \frac{2\cos 60° \sin 10°}{\sin 70° \sin 50°}$

$= \frac{\sin(60° + 10°)\sin(60° - 10°) + \sin^2 10°}{1/8}$

$= 8\left(\sin^2 60°\right) = 8 \times \frac{3}{4} = 6$

PART-3 : MATHEMATICS

SECTION-II

1. Ans (40.00)

Using AM ≥ GM

$$\frac{x+x+x+y+y}{5} \geqslant \left(x^3.y^2\right)^{\frac{1}{5}}$$

$$\frac{3x+2y}{5} \geqslant \left(2^{15}\right)^{\frac{1}{5}}$$

$$(3x+2y)_{min} = 40$$

2. Ans (109.00)

$$\sin x = -\frac{3}{5}\ ,\ \pi < x < \frac{3\pi}{2}$$

$$\tan x = \frac{3}{4}\quad \cos x = -\frac{4}{5}$$

$$80(\tan^2 x - \cos x)$$

$$= 80\left(\frac{9}{16} + \frac{4}{5}\right)$$

$$= 45 + 64 = 109$$

3. Ans (0.10)

$$\frac{1}{1.(1+d)} + \frac{1}{(1+d)(1+2d)} + \ldots$$

$$\frac{1}{(1+9d)(1+10d)} = 5$$

$$\frac{1}{d}\left[\frac{(1+d)-1}{1.(1+d)} + \frac{(1+2d)-(1-d)}{(1+d)(1+2d)}\right] + \ldots$$

$$\frac{(1+10d)-(1+9d)}{(1+9d)(1+10d)} = 5$$

$$\frac{1}{d}\left[\left(1-\frac{1}{1+d}\right) + \left(\frac{1}{1+d} - \frac{1}{1+2d}\right) + \ldots\right.$$

$$\left.\left(\frac{1}{1+9d} - \frac{1}{1+10d}\right)\right] = 5$$

$$\frac{1}{d}\left[1 - \frac{1}{(1+10d)}\right] = 5$$

$$\frac{10d}{1+10d} = 5d$$

$$50d = 5$$

4. Ans (-4.00)

$$R = \log_2 \sin\left(\frac{\pi}{5}\right) + \log_2 \sin\left(\frac{2\pi}{5}\right) + \log_2$$

$$\sin\left(\frac{3\pi}{5}\right) + \log_2 \sin\left(\frac{4\pi}{5}\right) - \log_2 5$$

$$R = \log_2\left(\sin\frac{\pi}{5}.\sin\frac{2\pi}{5}.\sin\frac{3\pi}{5}.\sin\frac{4\pi}{5}\right) - \log_2 5$$

$$= \log_2\left(\sin^2\frac{\pi}{5}.\sin^2\frac{2\pi}{5}\right) - \log_2 5$$

$$= \log_2\frac{1}{4}\left(2\sin^2\frac{\pi}{5}.2\sin^2\frac{2\pi}{5}\right) - \log_2 5$$

$$= \log_2\frac{1}{4}\{(1-\cos 72°)(1-\cos 144°)\} - \log_2 5$$

$$= \log_2\frac{1}{4}\{(1-\sin 18°)(1+\cos 36°)\} - \log_2 5$$

$$= \log_2\left\{\left(1-\frac{\sqrt{5}-1}{4}\right)\left(1+\frac{\sqrt{5}+1}{4}\right)\right\} - \log_2 5$$

$$= \log_2\frac{1}{4}\left(\frac{5-\sqrt{5}}{4}\right)\left(\frac{5+\sqrt{5}}{4}\right) - \log_2 5$$

$$= \log_2\frac{1}{4}\left(\frac{20}{4\times 4}\right) - \log_2 5 = \log_2\left(\frac{5}{16}\right) - \log_2 5$$

$$= \log_2 5 - \log_2 16 - \log_2 5 = -4$$

5. Ans (3.00)

$$\sqrt{3x-5} + \sqrt{x-2} = 3$$

$$\sqrt{3x-5} = 3 - \sqrt{x-2}$$

$$3x - 5 = 9 + (x-2) - 6\sqrt{x-2}$$

$$2x = 12 - 6\sqrt{x-2}$$

$$x = 6 - 3\sqrt{x-2}$$

$$x - 6 = -3\sqrt{x-2}$$

$$x^2 + 36 - 12x = 9(x-2)$$

$$x^2 - 21x + 54 = 0$$

sum = 3

6. **Ans (10.10)**

$a_1 + a_2 + \ldots + a_n - 2\sqrt{a_1} - 2\sqrt{a_2 - 1} \ldots - 2\sqrt{a_n - (n-1)} - \frac{n(n-3)}{2} = 0$

$(\sqrt{a_1} - 1)^2 + (\sqrt{a_2 - 1} - 1)^2 + \ldots + \left(\sqrt{a_n - (n-1)} - 1\right)^2 = 0$

$a_1 = 1, a_2 = 2, \ldots a_n = n$

$\sum_{i=1}^{100} a_i = \frac{100 \times 101}{2} = 5050$

7. **Ans (0.45)**

Let roots are a − d, a, a + d with common diff. = d

$\Rightarrow a + d + a + a - d = 21 \Rightarrow a = 7$

also $a(a^2 - d^2) = 28$

$\Rightarrow 49 - d^2 = 4 \Rightarrow d^2 = 45$

8. **Ans (2.40)**

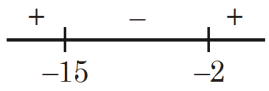
$f(x) = 16x^2 + 8(a + 5)x - (7a + 5) > 0$

for $\forall\ x \in R$

$\therefore D < 0 \Rightarrow D = 64\{(a + 5)^2 + 7a + 5\} < 0$

$\Rightarrow (a^2 + 17a + 30) < 0$

$\Rightarrow (a + 15)(a + 2) < 0$



$\Rightarrow a \in (-15, -2)$