ALLEN® CAREER INSTITUTE OVERSEAS

JEE(MAIN) : OVERSEAS COURSE

(Academic Session : 2021 - 2022)

Test Pattern
JEE(Main)
Class-XI

SAMPLE TEST PAPER

ANSWER KEY

PART-1 PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	B	C	B	B	C	B	B	A	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	B	B	C	D	B	D	A	D	A	B
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	20.00	2.00	900.00	0.00	4.00	30.00	40.00	0.06	-6.00	1.25

PART-2 CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	C	B	D	B	A	B	A	D	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	A	A	A	D	B	B	D	D	D	A
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	89.60	85.00	4.00	1.00	8.00	4.00	3.00	8.00	15.00	15.00

PART-3 MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	A	C	C	B	B	C	C	A	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	C	C	A	B	C	B	C	D	C	C
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	2.00	6.00	3.00	10.00	32.00	1.00	9.00	240.00	3.00	2.00

HINT – SHEET

PART-1 : PHYSICS

SECTION-I

1. $K = \frac{1}{2}mv^2$

$\frac{\Delta K}{K} = \frac{\Delta M}{M} + \frac{2\Delta V}{V}$

$\frac{\Delta K}{K} \times 100 = \frac{\Delta M}{M} \times 100 + \frac{2\Delta V}{V} \times 100$

$= 3 + 2\,(2) = 7\%$

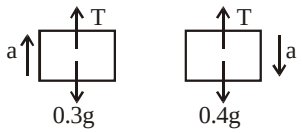
2. $\vec{A}.\vec{B} = 14 - 5 - 9 = 0$

$\therefore$ $\vec{A}$ & $\vec{B}$ are perpendicular to each other.

3. A ⟵ x ⟶ B

$V_{avg} = \frac{2x}{t_1 + t_2} = \frac{2x}{\frac{x}{30} + \frac{x}{20}} = 24$ m/s

4.



$T - 0.3g = 0.3a$ ...(1)

$0.4g - T = 0.4a$ ...(2)

6. NCERT-I, Pg # 185 Topic : Law of gravitation

8. $U = \frac{1}{2}$ (stress) (Strain) (Volume)

$U = \frac{1}{2}\frac{(\text{Stress})^2}{Y}(\text{Volume})$

$\frac{U}{\text{vol.}} = \frac{1}{2}\frac{(\text{Stress})^2}{Y} = \frac{S^2}{2Y}$

9. $F_B = \rho v(g - a)$

$a = g$

$\therefore$ $F_B = 0$

10. $x_{cm} = \frac{m_1(0) + m_2 b}{m_1 + m_2} = \frac{m_2 b}{m_1 + m_2}$

$y_{cm} = \frac{m_1(a) + m_2(c)}{m_1 + m_2} = \frac{m_1 a + m_2 c}{m_1 + m_2}$

$z_{cm} = 0$

SECTION-II

1. $p = \vec{\tau}.\vec{\omega}$

$p = 2 + 6 + 12 = 20$ watt

2. $x = 2, \quad U_f = 2^2 - 3 \times 2 = -2$

$x = 0, \quad U_i = 0$

$x = 0, \quad KE_i = 0$

$U_i + KE_i = U_f + KE_f$

$0 - 0 = -2 + KE_f$

$\boxed{KE_f = 2J}$

PART-2 : CHEMISTRY

SECTION-I

1. $CaCl_2 \rightarrow Ca^{+2} + 2Cl^{\ominus}$

$0.01 \quad 0.01 \quad 2 \times 0.01$

$Ca(OH)_2 \rightleftharpoons Ca^{+2} + 2OH^{\ominus}$

$S \quad 2S$

$(S' + 0.01) \quad 2S'$ (in $CaCl_2$)

$k_{sp} = [Ca^{+2}]\,[OH^-]^2 = (S' + 0.01)\,(2s')^2$

$= (S' + 0.01) \times 4s'^2$

$k_{sp} = 0.01 \times 4.S'^2 \quad S' = \left(\frac{k_{sp}}{4 \times 0.01}\right)^{1/2}$

$S' = \left(\frac{4 \times 10^{-6}}{4 \times 10^{-2}}\right)^{1/2} = 10^{-2}$

$[OH^-] = 2 \times 10^{-2} \quad p^{OH} = 2 - \log 2$

$p^{17} = 14 - (2 - \log 2) = 12 + \log 2$

2. In (1) solution will be acidic

(2) solution will be neutral

(3) solution will be alkaline ($p^H > 7$)

(4) Solution will be acidic

3. On increasing the temp. k_w will be increases

$k_w = [H^+][OH^-]$

So conc of $[H^+]$ and $[OH^-]$ increases

So pH and pOH decreases

5. Vander walls equation

$$\left(P+\frac{an^2}{V}\right)(V-nb) = nRT$$

Putt the value of n = 0.5 mol.

6. According to Le-Chatelier principle exothermic reaction is forwarded by low temperature, in forward direction number of moles is less, hence pressure is high.

14. $\Rightarrow BF_3 + F^- \longrightarrow BF_4^-$

$sp^2 \longrightarrow sp^3$

$33\% \longrightarrow 25\%$

$\Rightarrow NH_3 + H^+ \longrightarrow NH_4^+$

$sp^3 \longrightarrow sp^3$

$25\% \longrightarrow 25\%$

$\Rightarrow N_2O_5 \longrightarrow NO_2^+ \cdot NO_3^-$

$sp^2 \longrightarrow sp, sp^2$

$\Rightarrow BeF_2 \longrightarrow [BeF_4]^{-2}$

$sp \longrightarrow sp^3$

$50\% \longrightarrow 25\%$

15. OF_4, OF_6 are not existing because oxygen does not have vacant orbitals in its valency shell.

16. $Na_2B_4O_7 + 7H_2O \longrightarrow 2NaOH + 4H_3BO_3$

Base(strong) Acid(weak)

17. Graphite has free terminal valency

18. $Br^- > Cl^- > Cl > Na^+ > Li^+$

$4p^6\ 3p^6\ 3p^5\ 2p^6\ 1s^2$

19. $Al^{+3} > Al^+ > Al^{+2}$

20. Electron affinity of atom > anion of that atom

$x^+ > x > x^- > x^{-2}$

SECTION-II

1. $N_2 + 3H_2 \longrightarrow 2NH_3$

56 g

$$\text{mole} = \frac{56}{28}$$

= 2 mole N_2

1 mole of $N_2 \longrightarrow$ 2 mole of NH_3

2 mole of $N_2 \longrightarrow 2 \times 2 = 4$ mole of NH_3

Volume at STP = mole × 22.4

= 4 × 22.4

= 89.6 L

2. $\Delta E = q + w = -15 + 100 = 85J.$

4. $n = 3,\ \ell = 2,\ m = -1\ s = +\frac{1}{2}$

3d for 1 = 2, m = +2, +1, 0, –1, –2

–1 has two $e^- \rightarrow +\frac{1}{2}, -\frac{1}{2}$ $1e^-$

5. n = 1 n = 2

$\ell = 0, 1, 2$ $\ell = 0, 1, 2, 3$

s p d s p d f

$1s^2, 1p^6, 2s^2, 1d^{10}$

Total = $8e^-$

8. Number of geometrical isomers = 2^n

n = 3

$\therefore$ Number of G.I. = $2^3 = 8$

9. $Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_4 + 3CH_4$

$Be_2C + 4H_2O \rightarrow 2Be(OH)_2 + CH_4$

10. Acidic oxide = CO_2, SiO_2

x = 2

Neutral oxide = CO

y = 1

2 + 1 = 3

PART-3 : MATHEMATICS

SECTION-I

1. $$\frac{1+\cos y-\sin^2 y}{1+\cos y}+\frac{(1-\cos^2 y)-\sin^2 y}{\sin y(1-\cos y)}$$

$$=\frac{\cos y(1+\cos y)}{1+\cos y}+0=\cos y$$

2. $$\tan\frac{\pi}{3}+2\tan\frac{2\pi}{3}+4\tan\frac{4\pi}{3}+8\tan\frac{8\pi}{3}$$

$$=\tan\frac{\pi}{3}+2\tan\left(\pi-\frac{\pi}{3}\right)+4\tan\left(\pi+\frac{\pi}{3}\right)+8\tan\left(3\pi-\frac{\pi}{3}\right)$$

$$=\tan\frac{\pi}{3}-2\tan\frac{\pi}{3}+4\tan\frac{\pi}{3}-8\tan\frac{\pi}{3}$$

$$=-5\tan\frac{\pi}{3}=-5\sqrt{3}$$

4. $4\sin\theta \sin2\theta \sin4\theta = 3\sin\theta - 4\sin^3\theta$

$\Rightarrow \sin\theta\,[4\sin2\theta \sin4\theta - 3 + 4\sin^2\theta] = 0$

$\Rightarrow \sin\theta\,[2(\cos2\theta - \cos6\theta) - 3 + 2(1 - \cos2\theta)] = 0$

$\Rightarrow \sin\theta(-2\cos6\theta - 1) = 0$

$\Rightarrow \sin\theta = 0$ or $\cos6\theta = -1/2$

$\Rightarrow \theta = n\pi$ or $6\theta = 2n\pi + 2\pi/3\ \forall\ n \in Z$

$\Rightarrow \theta = n\pi$ or $\theta = (3\pi \pm 1)\,\pi/9\ \forall\ n \in Z$

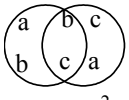
5. $$\cos C = \frac{8^2+10^2-12^2}{2.8.10} = \frac{1}{8}$$

$$\cos A = \frac{10^2+12^2-8^2}{2.10.12} = \frac{3}{4}$$

$$\cos2A = 2\cos^2A - 1 = 2\times\frac{9}{16} - 1 = \frac{1}{8}$$

So cos C = cos2A

C = 2A

6. 

By cross multiplication

$\Rightarrow (ac-b^2)(ab-c^2) = (a^2 - bc)^2$

$\Rightarrow a^2bc - ac^3 - ab^3 + b^2c^2 = a^4 + b^2c^2 - 2a^2bc$

$\Rightarrow a^4 + ac^3 + ab^3 = 3a^2bc$

7. $a = p^2 + 1, d = 2$

$\text{sum} = \frac{2p+1}{2}[2(p^2+1)+(2p)2]$

$= (2p + 1)[p^2 + 1 + 2p] = (2p + 1)(p + 1)^2$

8.

x^4	x^1
4	4
8	0

So coeff. of x^8 is

$= -{}^4C_1 \times {}^5C_4 + {}^4C_2 \times {}^5C_0$

$= -20 + 6 = -14$

9. $\square\square\square\square\square\square$

${}^3C_1 \cdot {}^3C_1 \cdot \underline{|2} \cdot \underline{|4} = 432$

10. Total cases $= 2^3 = 1$

P(At least one Head) = 1 – P(No Head)

$= 1 - \frac{1}{8} = \frac{7}{8}$

11. $\left|\frac{1}{1+i}\right| = \frac{1}{|1+i|} = \frac{1}{\sqrt{2}}$

12. $\log_{0.5} \log_{0.25} x > 0 \ \& \ \log_{0.25} x > 0 \ \& \ x > 0$

$\Rightarrow \log_{0.25} x < 1 \ \& \ x < 1 \ \& \ x > 0$

$x > 0.25 \ \& \ x < 1 \ \& \ x > 0$

$\Rightarrow x \in \left(\frac{1}{4}, 1\right)$

13. $\lim_{x\to 0}\left(\frac{3^x - 1}{\sqrt{x+1}-1}\right) \times \left(\frac{\sqrt{x+1}+1}{\sqrt{x+1}+1}\right)$

$= \lim_{x\to 0}\left(\frac{3^x - 1}{x}\right) x \times \left(\frac{\sqrt{x+1}+1}{x+1-1}\right)$

$= (\log_e 3)^2 = \log_e 9$

14. $y = x^{1/2} + x^{-1/2}$ .....(1)

$\frac{dy}{dx} = \frac{1}{2\sqrt{x}} - \frac{1}{2x^{3/2}}$

Multiplying both sides by 2x

$2x\frac{dy}{dx} = \sqrt{x} - \frac{1}{\sqrt{x}}$ .....(2)

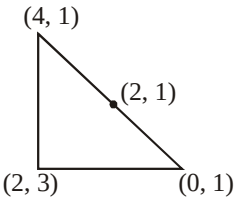
(1) + (2) ; we get

$2x\frac{dy}{dx} + y = 2\sqrt{x}$

15. Required ratio $= -\left(\frac{2-3+2}{-5+6+2}\right) = -\left(\frac{1}{3}\right) \Rightarrow 1:3$

(External div.)

16. Solving all three sides gives vertices (4, 1), (0, 1), (2, 3)



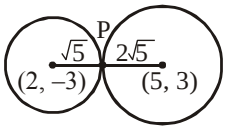
Here ortho centre = (2, 3) and circum centre is (2, 1)

Hence distance = 2

17. Intersection point of first two lines (–q, 2) must be on third line.

$\Rightarrow -3q + 4 + 5 = 0 \Rightarrow q = 3$

18. Here $c_1c_2 = r_1 + r_2$



Hence required point divides the line segment joining (2, –3) and (5, 3) in 1 : 2

Hence, $P = \left(\frac{5+4}{3}, \frac{3-6}{3}\right) = (3, -1)$

19. Here $a = \left|\frac{3\times 2 + 4\times 3 + 7}{\sqrt{3^2+4^2}}\right| = 5 \Rightarrow 4a = 20$

20. Given ellipse is $\frac{(x-1)^2}{1} + \frac{(y+1)^2}{4} = 1$

Hence $e = \sqrt{1 - \frac{1}{4}} = \frac{\sqrt{3}}{2}$

SECTION-II

1. Let $\tan^2\theta = t$

$1 - t^2 + 2^t = 0$

It is clearly satisfied by t = 3 by inspection

$\Rightarrow \tan^2\theta = 3$

$\theta = \pm\frac{\pi}{3}$ in the given interval

2. Mean deviation is minimum when it taken about medium

3. $T_5 = 7! = ar^4$

$T_8 = 8! = ar^7$

$r^3 = 8 \Rightarrow r = 2$

$7! = a.2^4 \Rightarrow a = 315$

$S_n = 2205 = 315(2^n - 1)$

$7 = 2^n - 1$

$n = 3$

4. Using distance formula

5. Here $e=\sqrt{2}$, $2ae=16 \Rightarrow a=4\sqrt{2}$

$2a=2b \Rightarrow$ eq^n of hyperbola

$= x^2-y^2=\left(4\sqrt{2}\right)^2$

$\Rightarrow k=32$

6. $\alpha+\beta=90°$ and $\alpha-\beta=30°$

$\Rightarrow \quad \alpha=60°, \beta=30°$

$\Rightarrow \quad \tan 120° \times \tan 150° = \left(-\sqrt{3}\right)\left(-\frac{1}{\sqrt{3}}\right)=1$

7. Equation can be written as

$3\tan^2\theta + 2\sqrt{3}\tan\theta - 3 = 0$

$\Rightarrow \quad \tan\theta = \frac{1}{\sqrt{3}}$ and $\tan\theta = -\sqrt{3}$

$\Rightarrow \quad \theta = n\pi + \frac{\pi}{6}$ or $\theta = n\pi - \frac{\pi}{3}$

$\Rightarrow \quad |r-s| = |6+3| = 9$

8. A or O

$\square\ \square\ \square\ \square\ \square$ = 240 words

2 5 4 3 2

9. $\lim\limits_{x\to 2}\frac{(x-2)(x+1)}{x(x-2)-\sin(x-2)}$

$= \lim\limits_{x\to 2}\frac{x+1}{x-\frac{\sin(x-2)}{x-2}}=3$

10. $(x^2+y^2+5x-8y+1)$

$-(x^2+y^2-3x+7y-25)=0$

$8x-15y+26=0$

C(1,0)

$\therefore$ distance $=\left|\frac{8+26}{\sqrt{64+225}}\right|=\frac{34}{17}=2$