PACE-IIT & MEDICAL

MUMBAI / DELHI-NCR / PUNE / HYDERABAD / AKOLA / GOA / JALGOAN / BOKARO / AMRAVATI / PATNA / BARAMATI

IIT – JEE: 2026 ADVANCED | **MAJOR TEST - 2 ANSWER KEY** | **DATE: 20/10/24**

PAPER – 2 (Code – 21)

PHYSICS		CHEMISTRY		MATHEMATICS	
1.	C	**18.**	A	**35.**	B
2.	D	**19.**	B	**36.**	B
3.	D	**20.**	B	**37.**	B
4.	A	**21.**	A	**38.**	A
5.	ACD	**22.**	ABCD	**39.**	ABC
6.	ABD	**23.**	ABD or AD	**40.**	ACD
7.	AD	**24.**	ABC	**41.**	ABD
8.	1	**25.**	5	**42.**	9
9.	15	**26.**	4	**43.**	20
10.	4	**27.**	3 or 4	**44.**	6
11.	5	**28.**	5	**45.**	49
12.	2	**29.**	8	**46.**	999
13.	6	**30.**	3	**47.**	5
14.	1	**31.**	700	**48.**	0.50
15.	8.8	**32.**	20	**49.**	0.75
16.	9.8 or 10	**33.**	1200	**50.**	2.25
17.	9.8 or 10	**34.**	240	**51.**	2.50

PART (A) : PHYSICS

1. (C)

For max. speed $\frac{m\upsilon_{max}^2}{R} = \mu mg \Rightarrow \upsilon_{max} = \sqrt{\mu g R}$

$\upsilon_A = \sqrt{0.1\times10\times100}$, $\upsilon_B = \sqrt{0.2\times10\times200}$

= 10 m/sec, = 20 m/sec

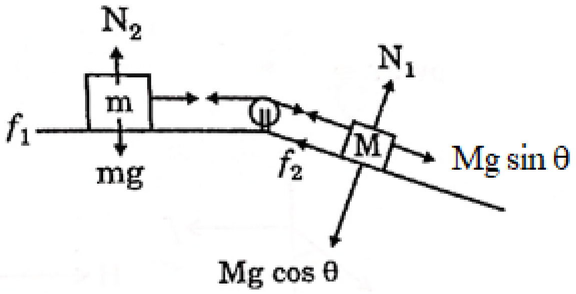
$s_A = 300\ \pi\ m$, $s_B = 400\ \pi m$

So, $t_A = 30\ \pi$ sec. So, $t_B = 20\ \pi$ sec.

2. (D)

The system is at rest $(F_{net} = 0)$

For maximum M/m; Limiting friction will be acting on both blocks (at contact surfaces).



$f_1 + f_2 =$ Net pulling force on the whole system

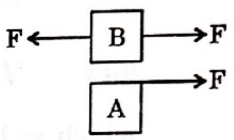
$\mu mg + \mu\ Mg\cos\theta = Mg\sin\theta$

$Mg(\sin\theta - \mu\cos\theta) = \mu mg$

$$\frac{M}{m} = \frac{\mu}{(\sin\theta - \mu\cos\theta)}$$

3. (D)

After some time force on A become constant when relative motion starts but on B goes on increasing, f then becomes limiting and remains constant.



4. (A)

After walking 6 m, he will fall in a pit after travelling 5 steps forward. Till six meter he has to take $8\times3 = 24$ steps and then to reach the pit he takes 5 steps more.

So total number of steps $= 24 + 5 = 29$

Total time $= 29\times1 = 29$ sec.

5. (ACD)

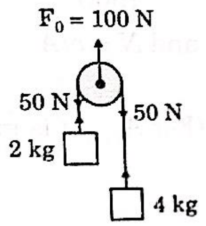
Bob moves on a circular path speed υ in the frame of train which is inertial frame so no pseudo force is required.

$T = \frac{m\upsilon^2}{l}$ ...(i)

Vector sum of velocity of train and velocity of bob w.r.t. train gives net velocity in ground frame. So, option (a) and (d) are correct.

6. (ABD)

Acceleration of 2 kg block $(a_2) = \dfrac{50-20}{2} = 15\ \text{m/s}^2 \uparrow$



Acceleration of 4 kg block $(a_4) = \dfrac{50-40}{4} = 2.5\,\text{m/s}^2 \uparrow$

7. (AD)

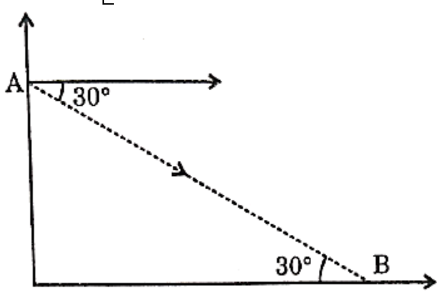
Condition for collision in mid air.

$\alpha_{AB} = 0$ and $\vec{\upsilon}A - \vec{\upsilon}B$ should be directed from A to B.

$\therefore\ \vec{\upsilon}_{AB} = \vec{\upsilon}_A - \vec{\upsilon}_B$

$= \vec{\upsilon}_{AB} = \vec{\upsilon}_A - \vec{\upsilon}_B$

$= 20\hat{i} - \left[-20\cos(\theta+30°)\hat{i} + 20\sin(\theta+30°)\hat{j}\right]$



$\tan 30° = \dfrac{h_y}{h_x} = \dfrac{20\sin(\theta+30°)}{20+20\cos(\theta+30°)}$

$1+\cos(\theta+30°) = \sqrt{3}\sin(\theta+30°)$

$1 = \sqrt{3}\sin(\theta+30°) - \cos(\theta+30°)$

$\dfrac{1}{2} = \dfrac{\sqrt{3}}{2}\sin(\theta+30°) - \dfrac{1}{2}\cos(\theta+30°)$

$\dfrac{1}{2} = \sin(\theta+30°-30°)$

$\sin\left(\dfrac{\pi}{6}\right) = \sin\theta$

$\theta = \dfrac{\pi}{6} = 30°$

$\therefore\ \vec{\upsilon}_{AB} = (20+20\cos 60°)\hat{i} - 20\sin 60°\hat{j}$

$= 30\hat{i} - 10\sqrt{3}\hat{j}$

$$|\vec{\upsilon}_{AB}| = \sqrt{(30)^2 + (10\sqrt{3})^2}$$

$$= 10\sqrt{9+3} = 20\sqrt{3}\ ms^{-1}$$

Time to collide $= \dfrac{\text{relative distance}}{\text{relative speed}}$

Time to collide $= \dfrac{200}{20\sqrt{3}} = \dfrac{10}{\sqrt{3}}$

Hence answers are (A) and (D).

8. (1)

$$T = \sqrt{\frac{2l(1-\cos\theta)}{g}}$$

9. (15)

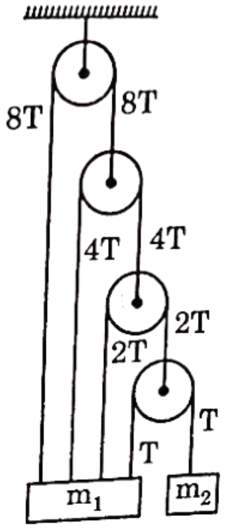
$T = m_1 g$

$8T + 4T + 2T + T = m_2 g$

$\Rightarrow 15T = m_2 g$

$\Rightarrow 15 m_1 g = m_2 g$

$\Rightarrow m_2 = 15\ m_1$



10. (4)

$F_{\text{ext}} = M_1 a_1 + M_2 a_2$

11. (5)

Acceleration $a = \dfrac{\text{Force}}{\text{Total mass}} = \dfrac{6}{1+2} = 2\ \text{m/s}^2$

NLM on half portion of rope $6 - T = \dfrac{1}{2} \times 2$

$\Rightarrow T = 5\ N$

12. (2)

$$\frac{v_f^2-(10)^2}{2}=\frac{1}{2}\times 30\times 10$$

13. (6)

$$a=\frac{\upsilon d\upsilon}{ds}=6[1]=6\ \text{m/s}^2$$

14. (1)

$$10t-5t^2=5t^2 \Rightarrow t=1\text{s}$$

15. (8.8)

16. (9.8 or 10)

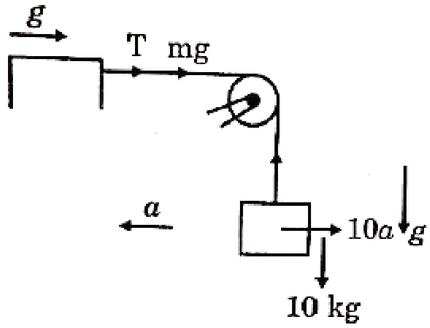
$100-T=10a$ … (i)

$T=5a$ … (ii)

So, $a=\frac{2g}{3}\ m/\text{sec}^2$

17. (9.8 or 10)

Seen from table frame



To fall free $T=0$

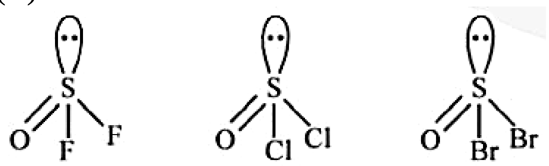
$T+5a=5g$

$a=g$ (left)

PART (B) : CHEMISTRY

18. (A)
$AB \rightarrow$ constant P. T will be increasing with increasing V.
$BC \rightarrow$ constant P. P will be decreasing with increasing V.
$CD \rightarrow$ constant V, decreasing P; hence decreasing T.
$DA \rightarrow$ constant T, decreasing V, increasing P.
Also, BC is at a higher temperature than AD.

19. (B)



In $SOBr_2$, $S-O$ bond has maximum bond length in comparison to S–O bond length in SOF_2 and $SOCl_2$, because in $SOBr_2$, S–O bond has been formed by hybrid orbital containing less s-character. According to Bent's Rule.

20. (B)

21. (A)

$$PV^{\gamma} = C$$

$$\Rightarrow TV^{\gamma-1} = C$$

$$\Rightarrow T_0V_0^{\gamma-1} = T_R\left(\frac{V_0}{2}\right)^{\gamma-1}$$

$$C_V = \frac{R}{\gamma-1}$$

$$\Rightarrow 2R = \frac{R}{\gamma-1}$$

$$\gamma-1 = \frac{1}{2}$$

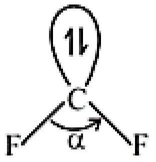
$$\gamma = \frac{3}{2}$$

$$\Rightarrow \frac{T_R}{T_0} = 2^{\gamma-1} = \sqrt{2}$$

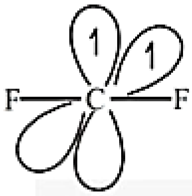
22. (ABCD)

23. (ABD or AD)

(A) $:CF_2$ It may be either singlet or triplet form

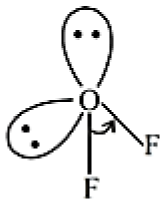


Singlet
Hybridization of C : sp^2
$\alpha \approx 120°$



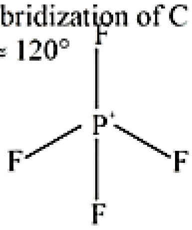
Triplet
Hybridization of C : sp
$\angle FCF = 180°$

OF_2 :

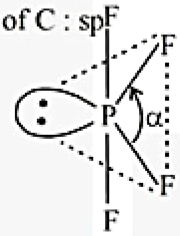


Hybridization of O : sp^3
$\angle FOF = 103°$

(B)



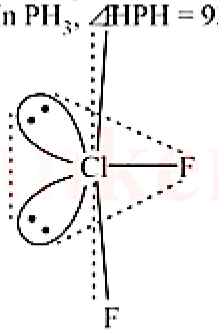
Hybridization of P : sp^3
$\angle = 109°28'$



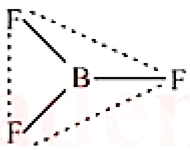
Hybridization of P : sp^3d
$\angle FPF$ (eq.) < 120°
$\angle F_{eq}PF_{(axial)} < 90°$

(D) In NH_3, $\angle HNH = 107°$
In PH_3, $\angle HPH = 93.8°$

(C)



Hybridization of Cl : sp^3d
$\angle FClF = 89°$

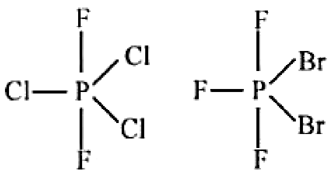


Hybridization of B : sp^2
$\angle FBF = 120°$

24. (ABC)

(B) Both PH_5 and NH_5 do not exist

(C)



$\angle ClPCl$ and $\angle BrPBr$ are not equal

(D) $C_2 = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \begin{cases} \pi 2p_\pi^2 \\ \pi 2p_\pi^2 \end{cases}$

B.O. = 2, all stabilized electron present in π bonding M.O. so there are two covalent bonds between two C atoms in which both are π bonds.

25. (5)

26. (4)

In vapour state of HF be $(HF)_n$

$P \times \text{mol. wt.} = dRT$

$1 \times \text{mol. wt.} = 3.248 \times 0.0821 \times 300$

$n(20) = \text{mol. wt.} = 79.9 \simeq 80$

$n = 4$

Hence vapour state is represented as $(HF)_4$

27. (3 or 4)

28. (5)

(i) $n \to 2, \ell \to 0, m_\ell \to 0, m_s \to +\frac{1}{2}$

(ii) $n \to 2, \ell \to 0, m_\ell \to 1, m_s \to -\frac{1}{2}$

(iii) $n \to 1, \ell \to 1, m_\ell \to 1, m_s \to +\frac{1}{2}$

(vi) $n \to 2, \ell \to 2, m_\ell \to 1, m_s \to -\frac{1}{2}$

(viii) $n \to 2, \ell \to 1, m_\ell \to -2, m_s \to +\frac{1}{2}$

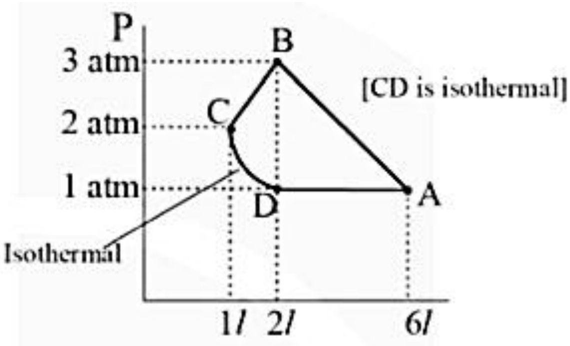
are incorrect set of quantum numbers for incoming electron in given process.

29. (8)

$CD \to$ is isothermal

$DA \to$ is isobaric

$T_A > T_D$



For BC

PV both decrease

T also decrease

For AB

$P - 1 = \frac{3-1}{2-6}(V - 6)$ $\quad PV = RT$

$P - 1 = -\frac{V}{2} + 3$ $\quad T = \frac{RT}{V}$

$P = -\frac{V}{2} + 4$

$RT = -\frac{V^2}{2} + 4V$

$R\frac{dT}{dV} - V + 4 = 0$

V = 4L

PV = RT

$$T_{max} = -\frac{16}{2} + 16 = +\frac{8}{R}$$

30. (3)

$A \longrightarrow 30\ W$ $\qquad E_A\ (\text{photon}) = 13.6\ eV$

$B \longrightarrow 40\ W$ $\qquad E_B\ (\text{photon}) = 13.6 \times 2^2 = 4 \times 13.6\ eV$

For A $\left(13.6 \times 1.6 \times 10^{-19}\right) \times n_A = 30$

For B $\left(4 \times 13.6 \times 1.6 \times 10^{-19}\right) \times n_B = 40$

$$\frac{n_A}{4n_B} = \frac{3}{4}$$

$$\Rightarrow \frac{n_A}{n_b} = \frac{3}{1}$$

31. (700)
32. (20)

(i)
$$\underbrace{\overset{a\ ml}{C_xH_yN_z} + \overset{(90-a)\ ml}{O_2}}_{90\ ml} \rightarrow \underset{40\ ml}{CO_2} + \underset{60\ ml}{H_2O} + \underset{20\ ml}{N_2}$$

Applying POAC for C

$a \times x = 40$ ...(i)

For H $\quad y \times a = 120$ ...(ii)

For N $\quad z \times a = 2 \times 20$ ...(iii)

For O $\quad 2 \times (90 - a) = 2 \times 40 + 60$

$90 - a = 70$

$a = 20\ ml$

(ii) Volume of $O_2 = 70\ ml$

Mole % of $O_2 = \frac{70}{90} \times 100 = \frac{700}{9}\%$

33. (1200)

$V_1 = 320\ mL$

$V_2 = 10\ mL$

$P_1 = 1\ atm$

$T_1 = 300\ K$

$T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1}$

$$T_2 = 300 \times \left(\frac{320}{10}\right)^{7/5-1} = 1200k$$

34. (240)

$$P_2 = P_1\left(\frac{320}{10}\right)^{7/5}$$

$$P_2 = 128\ \text{atm}$$

$$|W| = \frac{P_2V_2 - P_1V_1}{\gamma - 1}$$

$$|W| = \left(\frac{128\times10\times10^{-3} - 1\times320\times10^{-3}}{7/5-1}\right) = 2.4\ \text{L atm} = 240\ \text{J}$$

PART (C) : MATHEMATICS

35. (B)

$$S=\sum_{K=1}^{2006}\frac{K+2}{K!+(K+1)!+(K+2)!}=\sum_{K=1}^{2006}\frac{K+2}{k!(K+2)^2}=\sum_{K=1}^{2006}\frac{1}{K!(K+2)}$$

$$=\sum_{K=1}^{2006}\frac{K+1}{(K+2)!}=\sum_{K=1}^{2006}\frac{K+2-1}{(K+2)!}=\sum_{K=1}^{2006}\left[\frac{1}{(K+1)!}-\frac{1}{(K+2)!}\right]=\frac{1}{2}-\frac{1}{2008!}$$

36. (B)

$$\sum_{r=1}^{99}r!\left((r+1)^2-r\right)=\sum_{r=1}^{99}\left((r+1)(r+1)!-rr!\right)=100(100!)-1$$

37. (B)

We have, $(1+x)^n=C_0+C_1x+C_2x^2+...+C_nx^n$ ...(i)

And $\left(1+\frac{1}{x}\right)^n=C_0+C_1\frac{1}{x}+C_2\left(\frac{1}{x}\right)^2+...+C_n\left(\frac{1}{x}\right)^n$ ...(ii)

On multiplying Eqs. (i) and (ii) and taking the coefficient of constant terms in right hand side

$$=C_0^2+C_1^2+C_2^2+..+C_n^2$$

In right hand side $(1+x)^n\left(1+\frac{1}{x}\right)^n$ or in $\frac{1}{x^n}(1+x)^{2n}$ or term containing x^n in $(1+x)^{2n}$.

Clearly, the coefficient of x^n in $(1+x)^{2n}$ is equal to ${}^{2n}C_n=\frac{(2n)!}{n!n!}$.

38. (A)

$$\sin x+\cos(k+x)+\cos(k-x)=2 \Rightarrow \sin x+2\cos k\cdot\cos x=2$$

$$\therefore\ 2\le\sqrt{1+4\cos^2 k}\ \Rightarrow\ \cos^2 k\ge\frac{3}{4}\Rightarrow\ k\in\left[n\pi-\frac{\pi}{6},n\pi+\frac{\pi}{6}\right]$$

39. (ABC)

$$A_1=a+\frac{1}{3}(b-a),\ A_2=a+\frac{2}{3}(b-a)$$

$$\Rightarrow\ A_1=A_2=a+b$$

Similarly, $G_1=a\left(\frac{b}{a}\right)^{1/3}, G_2=a\left(\frac{b}{a}\right)^{2/3}$

$$\Rightarrow\ G_1G_2=ab$$

And $\frac{1}{H_1}=\frac{1}{a}+\frac{1}{3}\left(\frac{1}{b}-\frac{1}{a}\right),\ \frac{1}{H_2}=\frac{1}{a}+\frac{2}{3}\left(\frac{1}{b}-\frac{1}{a}\right)$

Now, $\frac{1}{H_1}+\frac{1}{H_2}=\frac{1}{a}+\frac{1}{b}$

$\Rightarrow \dfrac{H_1+H_2}{H_1H_2}=\dfrac{a+b}{ab}=\dfrac{A_1+A_2}{G_1G_2}$

$\Rightarrow \dfrac{G_1G_2}{H_1H_2}=\dfrac{A_1+A_2}{H_1+H_2}$

Now, $H_1+H_2=\dfrac{3ab}{a+2b}+\dfrac{3ab}{2a+b}$

$=\dfrac{9ab(a+b)}{(a+2b)(2a+b)}$

$\Rightarrow \dfrac{A_1+A_2}{H_1+H_2}=\dfrac{2(a^2+b^2)+5ab}{9ab}$

Thus, $\dfrac{G_1G_2}{A_1A_2}-\dfrac{5}{9}=\dfrac{2}{9}\left(\dfrac{a}{b}+\dfrac{b}{a}\right)$

40. (ACD)

$^{15}C_1+{}^{16}C_2+{}^{17}C_3+.....+{}^{39}C_{25}={}^{15}C_0+{}^{15}C_1+{}^{16}C_2+{}^{17}C_3+....+{}^{39}C_{25}-{}^{15}C_0={}^{40}C_{25}-1$

41. (ABD)

Put $x=1$ & -1 and add $4^{20}+4^{20}=2(a_0+a_2+....+a_{60})$

Now subtract $\Rightarrow 0=2(a_1+a_3+...+a_{59})$

$a_0=2^{20}$ and $a_{59}=$ coeff. of x^{59} in $(2-3x+2x^2+3x^3)^{20}={}^{20}C_1\cdot 2\cdot 3^{19}$

42. (9)

$a_0+a_1x+a_2x^2+.........=(1+2x^2+x^4)(1+{}^nC_1x+{}^nC_2x^2+.....)$

$=1+{}^nC_1x+(2+{}^nC_2)x^2+(2\,{}^nC_1+{}^nC_3)x^3+........$

Now $2a_2=a_1+a_3$

For $n=2$ we have $a_1=2, a_2=3, a_3=4$ which are in A.P.

For $n\geq 3$ we have

$2({}^nC_2+2)={}^nC_1+({}^nC_3+2\,{}^nC_1)\Rightarrow n^3-9n^2+26n-24=0\Rightarrow n=2,3,4\Rightarrow n=3,4$

43. (20)

$x=\sec\theta$

$y=\operatorname{cosec}\theta$

44. (6)

$x=\sqrt{2}-1$

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

45. (49)

$$\sum_{r=1}^{\infty}\frac{1}{(r+1)(r+4)}$$

46. (999)

$\sqrt{r+1}=a \qquad \sqrt{r}=b$

$$\sum\frac{a^2+b^2+ab}{a+b}=\sum a^3-b^3$$
$$=\sum_{r=1}^{99}(r+1)^{3/2}-r^{3/2}$$

47. (5)

$$y=\frac{ax^2+3x-4}{3x-4x^2+a}$$
$$(a+4y)x^2+(3-3y)x-(ay+4)=0$$
$D\geq 0 \qquad a\in(1,7)$

48. (0.50)

49. (0.75)

Solution for Q. 48 & 49

$f(-3)>0$

$f(-4)\leq 0$

50. (2.25)

51. (2.50)

Solution for Q. 50 & 51

$$\log_{3x}45=\log_{4x}40\sqrt{3}=k$$
$$\frac{45}{40\sqrt{3}}=\left(\frac{3}{4}\right)^k$$
$$k=\frac{3}{2}$$