TARGET IIT-JEE

HINT & SOLUTIONS

ANSWER KEY WITH SOLUTION

PAPER-II CLASS XI (DATE 22-11-09)

MATHEMATICS

1. B **2.** B **3.** B **4.** C **5.** B,C **6.** A,B,C **7.** C,D

8. B,D **9.** B,C

10. $A \to P$, $B \to S$, $C \to P$, $D \to R$

11. $A \to Q$; $B \to P$; $C \to P,Q,S$; $D \to R$

12. 0 **13.** 0 **14.** 364 **15.** 2009 **16.** 8 **17.** 11 **18.** 6

19. 91

PHYSICS

20. C **21.** B **22.** B **23.** C **24.** B,C,D **25.** A,B,C **26.** C

27. B,C,D **28.** A,D

29. $A \to Q$, ; $B \to R$, ; $C \to Q$, $D \to P$

30. $A \to Q,R$; $B \to R,S$; $C \to P,S$, $D \to S$

31. 2 m/s^2 **32.** 40 **33.** 2 m/s **34.** 0001.75 **35.** 0005.00 **36.** 0020.00 **37.** 0003.60

38. 14.3 s, 0.45 m/s^2

CHEMISTRY

39. D **40.** D **41.** D **42.** B **43.** D **44.** A,C,D **45.** A

46. A,B **47.** A,C,D

48. $A \to S$, $B \to P$, $C \to R$, $D \to Q$

49. $A \to P$; $B \to S$; $C \to P$; $D \to R$

50. 3 **51.** 3 **52.** 79 eV **53.** 58% **54.** 1, 3 **55.** 3 **56.** 5

57. $\frac{9x}{4}$ J / atom

1. **B**

Since A.M. ≥ G.M.

Consider 'n' positive numbers. $a_1, a_2, a_3 \ldots\ldots a_{n-1}, 2a_n$

$$\frac{a_1 + a_2 + \ldots\ldots + a_{n-1} + 2a_n}{n} \geq \sqrt[n]{a_1 a_2 \ldots\ldots a_{n-1}.2a_n}$$

$$a_1 + a_2 + \ldots\ldots\ldots + 2a_n \geq n2^{1/n}$$

equality holds when

$a_1 = a_2 = \ldots\ldots\ldots\ldots\ldots\ldots\ldots = 2a_n = k$ (say)

Then (k.k............... (n – 1)) times). $\frac{k}{2} = 1$

$\Rightarrow k = 2^{1/n}$

$\Rightarrow a_n = 2^{\frac{1-n}{n}}$

2. **B**

Let $\log_x y = t$, then $t + \frac{1}{t} = y \Rightarrow y \geq 2$ or $y \leq -2$

but $y > 0$, so $y \geq 2$, also $y = 6 - x^2 \Rightarrow y \leq 6$ but

only for $y = 2$, $x \in I$ (as $x = \sqrt{6 - y}$ $(x \in N)$)

$x = 2, y = 2 \Rightarrow (2, 2)$

3. **B**

Given : $\cos A + \cos B + \cos C \leq \frac{3}{2}$

$\Rightarrow \cos^2\frac{A}{2} + \cos^2\frac{B}{2} + \cos^2\frac{C}{2} \leq \frac{9}{4}$

and $x^2 + \frac{1}{x^2} \geq 2 \Rightarrow y_{max} = \frac{9}{8}$

4. **C**

$(x^2 - 5x + 4)(y^2 + y + 1) < 2y, \ \forall y \in R$

$\Rightarrow x^2 - 5x + 4 < \frac{2y}{y^2 + y + 1}$

Now least value of RHS is equal to – 2

$\Rightarrow x^2 - 5x + 4 < -2 \Rightarrow x \in (2, 3)$

5. **B,C**

10 can be sum of two primes as 3 + 7

or 7 + 3 or 5 + 5

$\Rightarrow 3^x = 3$ and $7^{1/x} = 7$ or $3^x = 7$ and $7^{1/x} = 3$

or $3^x = 7^{1/x} = 5$, which is not possible

$\Rightarrow x = 1$ or $x = \log_3 7$

6. **A,B,C**

$ax + by = 1 \Rightarrow y = \frac{1 - ax}{b}$

Putting this value in second equation, we get

$cx^2 + \frac{d}{b^2}(1 - ax)^2 = 1$

$\Rightarrow (b^2c + a^2d)x^2 - 2adx + d - b^2 = 0$

Equation will have equal roots, if

$D = 4a^2d^2 - 4(b^2c + a^2d)(d - b^2) = 0$

$\Rightarrow \quad b^2[b^2c + a^2d - cd] = 0$

$\Rightarrow \quad \frac{b^2}{d} + \frac{a^2}{c} = 1$

Also, in this case

$$x = \frac{2ad}{2(b^2c + a^2d)} = \frac{a}{c}$$

$$y = \frac{1 - ax}{b} = \frac{1}{b}\left(1 - \frac{a^2}{c}\right) = \frac{1}{b}\left(\frac{b^2}{d}\right) = \frac{b}{d}$$

7. **C,D**

$a = \frac{1}{1 + \tan^2 x}$

$\Rightarrow \tan^2 x = \frac{1}{a} - 1$

and $b = \frac{1}{1 + \cot^2 y} \Rightarrow \cot^2 y = \frac{1}{b} - 1$

Then $\sum_{k=0}^{\infty} \tan^{2k} x \cot^{2k} y = \frac{1}{1 - \tan^2 x \cot^2 y}$

$$= \frac{1}{1 - \left(\frac{1}{a} - 1\right)\left(\frac{1}{b} - 1\right)} = \frac{ab}{ab - (1 - a)(1 - b)} = \frac{ab}{a + b - 1}$$

or $\frac{1}{\frac{1}{a} + \frac{1}{b} - \frac{1}{ab}}$

8. **D**

$\because x + 1 = 2\log_2(2^x + 3) - 2\log_{2^2}(1980 - 2^{-x})$

$\Rightarrow x + 1 = \log_2(2^x + 3)^2 - \log_2(1980 - 2^{-x})$

$\Rightarrow x + 1 = \log_2\left\{\frac{(2^x + 3)^2}{1980 - 2^{-x}}\right\}$

$$\Rightarrow 2^x \cdot 2 = \frac{2^{2x} + 6.2^x + 9}{1980 - 2^{-x}}$$

$\Rightarrow 2 \times 1980 \times 2^x - 2 = 2^{2x} + 6.2^x + 9$

$\Rightarrow 2^{2x} - 3954.2^x + 11 = 0$

If roots are α, β, then $2^\alpha . 2^\beta = \frac{11}{1}$

$\Rightarrow 2^{\alpha+\beta} = 11$ or $\alpha + \beta = \log_2 11$

Also, $\log_{0.5}\left(\frac{1}{11}\right) = \log_{1/2}\left(\frac{1}{11}\right) = \log_2 11$

9. **B,C**

Given, $\sec\theta + \tan\theta = 1$

$\Rightarrow \sec\theta - \tan\theta = 1 \quad [\because \sec^2\theta - \tan^2\theta = 1]$

$\therefore \quad 2\sec\theta = 2$

$\Rightarrow \sec\theta = 1 \qquad \therefore \cos\theta = 1$

Since 1 is a root of given quadratic equation.

$\therefore$ $\sec\theta$ or $\cos\theta$ may be one of the root of given quadratic equation.

10. **A → P , B → S , C → P , D → R**

(A) $\sin x + \sin y \geq \cos a . \cos x \ \forall x \in R$

Let $x = -\frac{\pi}{2}$

$\Rightarrow \sin y \geq 1 \Rightarrow (\sin y = 1)$

$\Rightarrow 1 + \sin x \geq \cos\alpha \cos x$

$\Rightarrow \cos\alpha \cos x - \sin x \leq 1$

$\Rightarrow \sqrt{\cos^2\alpha + 1} = 1$

$\Rightarrow \cos\alpha = 0$

$\Rightarrow \sin y + \cos\alpha = 1 + 0 = 1$

(B) A.M. ≥ G.M.

$$\frac{\log_d a + \log_c b + \log_a c + \log_b d}{4} \geq \sqrt[4]{\frac{\log a}{\log d} \times \frac{\log b}{\log c} \times \frac{\log c}{\log a} \times \frac{\log c}{\log b}}$$

$= \log_d a + \log_c b + \log_a c + \log_b d \geq 4$

(C) $x - y = \frac{y-z}{yz}$, $y - z = \frac{z-x}{zx}$, $z - x = \frac{x-y}{xy}$

$\therefore (x - y)(y - z)(z - x) = \frac{(x-y)(y-z)(z-x)}{(xyz)^2}$

$\Rightarrow xyz = 1$

(D) $\frac{\sin(2A+B)}{\sin B} = 5$

Using compondnedo and dividendo

$$\frac{\sin(2A+B)+\sin B}{\sin(2A+B)-\sin B} = \frac{6}{4} \Rightarrow \frac{2\sin(A+B)\cos A}{2\cos(A+B)\sin A} = \frac{3}{2}$$

$$\frac{\tan(A+B)}{\tan A} = \frac{3}{2} = \frac{p}{q} \Rightarrow p = 3$$

11. **(A) → (Q) ; (B) → (P) ; (C) → (P,Q,S) ; (D) → (R)**

(A) Considering the quadratic expression $(2x^2 + 8x + 8)p^2 + (x^2 - 2x + 4)$ is least
$2(x^2 + 4x + 4)p^2 + (x - 1)^2 + 3$
$2(x + 2)^2 p^2 + (x - 1)^2 + 3$ having least value at $p_0 = 0$ & $x_0 = 1$

(B) $(k + 1)a^2 + 4xa + 4(x^2 - k) \geq 0 \ ; \ \forall a \in R$

$\Rightarrow 16x^2 - 16(x^2 - k)(k + 1) \leq 0$

$\Rightarrow kx^2 \geq k(k + 1)$

Case - I $\quad k = 0 \quad 0 \geq 0 \quad$ true $\quad \forall x \in R$

Case - 2 $\quad k \neq 0$

$kx^2 - k(k + 1) \geq 0 \quad \forall x \in R$

(i) $k > 0$

(ii) $D \leq 0$

$4k^2(k + 1) \leq 0$

$k \in (-\infty, -1] \cup \{0\}$

$k \in \phi$

(C) (i) $k - 3 < 0 \Rightarrow k < 3$

(ii) $D \leq 0 \quad \Rightarrow k(k - 1)(k - 3)^2 \leq 0$

$\Rightarrow k \in [0, 1] \cup \{3\}$

Common solution

$k \in [0, 1]$]

for k = 3 also, inequality satisfies.

(D) $$\left(\frac{2\sin\frac{9x}{2}\cos\frac{x}{2}}{3-4\sin^2\frac{3x}{2}}\right)\frac{\sin\frac{3x}{2}}{\sin\frac{3x}{2}} = \frac{2\sin\frac{9x}{2}.\cos\frac{x}{2}.\sin\frac{3x}{2}}{\sin\frac{9x}{2}} = \sin 2x + \sin x$$

a = 1; b = 1]

12. **0**

Since, $\log_{100}|x + y| = 1/2$

$\Rightarrow |x + y| = (100)^{1/2} = 10$

$\therefore \quad |x + y| = 10 \qquad$ ...(i)

and $\log_{10} y - \log_{10}|x| = \log_{100} 4 \qquad (\because y > 0)$

$\Rightarrow \log_{10}\left(\frac{y}{|x|}\right) = \log_{10^2} 2^2 = \frac{2}{2}\log_{10} 2$

$\Rightarrow \log_{10}\left(\frac{y}{|x|}\right) = \log_{10} 2$

$\Rightarrow \frac{y}{|x|} = 2 \Rightarrow y = 2|x| \qquad$ ...(ii)

From Eqs. (i) and (ii), $\left|x + 2|x|\right| = 10$

$x < 0, |x - 2x| = 10$

$\Rightarrow |x| = 10 \Rightarrow -x = 10$

$\therefore \quad x = -10$

From Eq. (ii), $y = 2|-10| = 20$

$(a, b) \equiv (-10, 20) \Rightarrow 2a + b = 0$ **Ans.**

13. **0**

Given that $\sin^2\frac{\pi}{7}\ \sin\frac{2\pi}{7}\ \sin\frac{4\pi}{7} = \frac{\left(1-\cos\frac{2\pi}{7}\right)}{4}$

$\left(\cos\frac{2\pi}{7}-\cos\frac{6\pi}{7}\right)$

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

$=\frac{1}{4}\left(\cos\frac{2\pi}{7}+\cos\frac{\pi}{7}-\cos^2\frac{2\pi}{7}-\cos\frac{2\pi}{7}\cos\frac{\pi}{7}\right)$

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

$=\frac{1}{4}\left(\cos\frac{2\pi}{7}-\frac{1}{2}\cos\frac{\pi}{7}-\frac{1}{2}\right) \Rightarrow P + Q + R$

$=\left(-\frac{1}{8}\right)+\left(-\frac{1}{8}\right)+\left(\frac{1}{4}\right) = 0$ **Ans.**

14. **364**

$\because H = 4$

$\Rightarrow 2A + G^2 = 27$

$\Rightarrow 2A + AH = 27\ (\because G^2 = AH)$

$\Rightarrow\quad 6A = 27$

$\Rightarrow A = \frac{9}{2}$ and $G^2 = \frac{9}{2}\times 4 = 18$

$\therefore$ a,b are the roots of $x^2 - 9x + 18 = 0$

$\therefore a = 6, b = 3$ or $a = 3, b = 6$

$\therefore \alpha = a + b = 9,\ \beta = |a - b| = 3$

and $1 + \left(\frac{\alpha}{\beta}\right)+\left(\frac{\alpha}{\beta}\right)^2+\left(\frac{\alpha}{\beta}\right)^3+\left(\frac{\alpha}{\beta}\right)^4+\left(\frac{\alpha}{\beta}\right)^5$

$= 1 + 3 + 3^2 + 3^3 + 3^4 + 3^5 = 364$ **Ans.**

15. **2009**

(A) Case I : $x \ge 4$

Then $|x + 4 - x| - 2x = 4$

$\Rightarrow 4 - 2x = 4$

$\therefore\quad x = 0$

Case II : $x < 4$

Then $|x - (4 - x)| - 2x = 4$

$\Rightarrow\ |2x - 4| = 2x + 4 \Rightarrow |x - 2| = x + 2$

$\Rightarrow \begin{cases} x-2 = x+2, & x \ge 2 \\ 2-x = x+2, & x < 2 \end{cases} \Rightarrow \quad x = 0, x < 2$

is only solution ,

$\therefore\quad S = 0, N = 1 \Rightarrow (100)\,0 + 2009\,(1) = 2009$ **Ans.**

16. **8**

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

$= 1 + \tan^2\theta \Rightarrow \tan^2\theta = \frac{1}{2}$

Now $2\cos^2\alpha - 3\cos\alpha = 32.\ \frac{1}{2^4} = 2$

$\Rightarrow\ 2\cos^2\alpha - 4\cos\alpha + \cos\alpha - 2 = 0$

$\Rightarrow \cos\alpha = -\frac{1}{2}$

$\frac{2\pi}{3}+\frac{4\pi}{3}+\frac{8\pi}{3}+\frac{10\pi}{3} = \frac{24\pi}{3} = 8\pi \Rightarrow K = 8$ **Ans.**

17. **11**

Let $x^2 - x - 21 = y$

$E = y\,(y - 18y)$

$= y^2 - 18y = (y - 9)^2 - 81$

$= (x^2 - x - 30)^2 - 81$

$= [(x - 6)\,(x + 5)]^2 - 81$ will be minimum for

$x = 6, -5$

difference $= |6 - (-5)| = 11$ **Ans.**

18. **6**

$\pm\sqrt{(ab)^2+(b\sqrt{1-a^2})^2} + c = \pm b + c$

Minimum $= c - b$

Maximum $= c + b$

sum $= 2c = 2.3 = 6$ **Ans.**

19. **91**

Let $f(x) = x^2 + ax + a^2 + 6a$

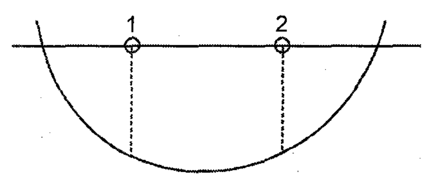
$f(1) < 0$

$\Rightarrow a^2 + 7a + 1 < 0$

or $\frac{-7-3\sqrt{5}}{2} < a < \frac{-7+3\sqrt{5}}{2}$ ...(i)

$f(2) < 0$

$\Rightarrow a^2 + 8a + 4 < 0$



or $-4 - 2\sqrt{3} < a < -4 + 2\sqrt{3}$ ...(ii)

From inequations (i) and (ii) we get

$\frac{-7-3\sqrt{5}}{2} < a < -4 + 2\sqrt{3}$

Integral values of a are $-6, -5, -4, -3, -2, -1$

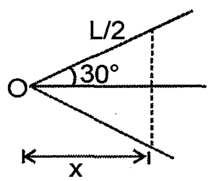
Required sum

$= (-6)^2 + (-5)^2 + (-4)^2 + (-3)^2 + (-2)^2 + (-1)^2 = 91$ **Ans.**

20. **C**

$$\frac{1}{2}\left(\frac{u}{\cos\theta}+\frac{v}{\cos\theta}\right)=\frac{u+v}{2\cos\theta}$$

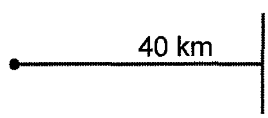
21. **B**



$$x = \frac{L}{2}\cos 30° = \frac{L\sqrt{3}}{4}$$

22. **B**

23. **C**



$v_C = 8$ km/h $S_C = v_C \times t$

$t = \frac{40}{8} = 5$ h $S_B = 10 \times 5 = 50$ km

24. **B,C,D**

B) Acceleration is upward with horizontal initial velocity so trajectory is parabolic.

(C) Acceleration is zero so velocity is constant.

(D) Due to acceleration speed increase

25. **A,B,C**

$$a_n = \frac{v^2}{R} = \omega^2 R$$

26. **C**

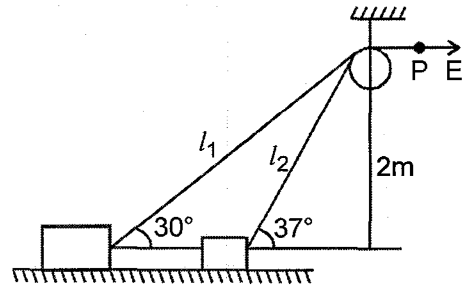
Centre of Mass is affected only by external forces.

27. **B,C,D**

28. **A,D**

$$l_1 = \frac{2}{\sin 30°} = 4\text{m},\quad l_2 = \frac{2}{\sin 37°} = \frac{10}{3}\text{m}$$

Displacement. of point P : $l_1 - l_2 = 4 - \frac{10}{3} = \frac{2}{3}$m



Work done, $W = F(l_1 - l_2) = 50 \times \frac{2}{3} = \frac{100}{3}$J

$$W = \frac{1}{2}m(v^2 - u^2),\ u = 0$$

$$\Rightarrow \quad \frac{100}{3} = \frac{1}{2}10v^2 \Rightarrow v^2 = \frac{20}{3}$$

$$\Rightarrow \quad v = \sqrt{\frac{20}{3}}\text{m/s}$$

Initial acceleration $= \frac{F\cos 30°}{m}$

Final acceleration $= \frac{F\cos 37°}{m}$

Ratio $= \frac{\cos 30°}{\cos 37°} = \frac{\sqrt{3}\times 5}{2\times 4} = \frac{5\sqrt{3}}{8}$

29. **A → Q, ; B → R, ; C → Q, D → P**

30. **A → Q,R ; B → R,S ; C → P,S, D → S**

31. **2 m/s²**

Acceleration of block A in lift frame,

$$a_{AL} = \frac{m(g-a)}{2m}\text{, rightward}$$

Net acceleration of block A w.r.t. earth

$$a_N = \sqrt{(a_{AL})^2 + a^2} = \sqrt{\frac{(g-a)^2}{4} + a^2}$$

$$a_N^2 = \frac{(g-a)^2}{4} + a^2$$

to find out the minimum value of a_N

$$2a_N\frac{da_N}{da} = -\frac{(g-a)}{2} + 2a = 0 \quad \Rightarrow -\frac{g}{2} + \frac{5a}{2} = 0$$

$$a = \frac{g}{5}$$

32. **40**

According to work energy theorem

$W_g + W_F + W_f = \Delta KE = 0$

$W_F = 400$ J

$W_g = -72 \times 5 = -360$

$\therefore \; W_f = 40$

33. **2 m/s**

$(600g - 300g)\, v = 10 \times 10^3\, (0.6)$

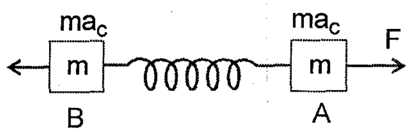
$3000\, v = 6 \times 10^3$

$v = 2$ m/s

34. **0001.75**

$$a_{cm} = \frac{F}{m+m} = \frac{F}{2m} \Rightarrow \frac{1}{2} \times 2.5 \times (0.1)^2 = s_c$$

$$\frac{5}{400} m = s_c$$



In C-frame

Displacement of A in C-frame

$$s_{ac} - s_{bc} = s_{ab} = \frac{1}{100} \Rightarrow 2s_{ac} + 2s_{bc} = 0$$

$$s_{ac} = -s_{bc} \qquad \Rightarrow 2s_{ac} = \frac{1}{100}$$

$$s_{ac} - s_c = s_{ac} = \frac{1}{200} \Rightarrow s_a = \frac{5}{400} + \frac{1}{400} = \frac{7}{400}$$

Total displacement A = $s_c + s_{ac}$

35. **0005.00**

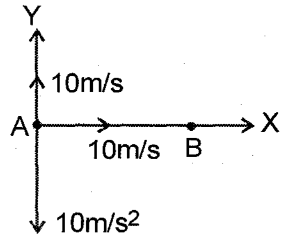
For minimum V

$$\frac{dV}{dx} = 0 \Rightarrow x - 1 = 0 \Rightarrow x = 1 \Rightarrow V(x) = -\frac{1}{2}$$

V(x) + KE = 2

$$KE = \frac{5}{2} \Rightarrow \frac{1}{2}mv^2 = \frac{5}{2} \Rightarrow v = 5\text{m/s}$$

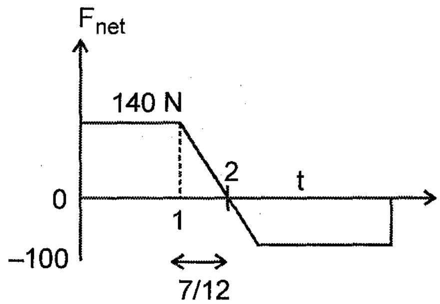
36. **0020.00**



Path of particle A, w.r.t B will projectile, they collide if AB in equal to range

$$AB = \frac{2 \times 10 \times 10}{10} = 20\text{m}$$

37. **0003.60**



Positive area = negative area at t = 1.6

Total time 2 + 1.6 = 3.6

38. 14.3 s, 0.45 m/s²

$1.5t + 0.7t = 2\pi R = 10\,\pi$

$$\therefore \quad t = \frac{10\pi}{2.2} = 14.3\,\text{s}$$

$$a = \frac{v_B^{\,2}}{R} = 0.45\,\text{m/s}^2$$

39. **D**

$N = \frac{V}{5.6} = \frac{33.6}{5.6} = 6$ Let v = 1 lt.

$M = \frac{6}{2} = 3$

Wt of H_2O_2/lit = 3 × 34 = 102 gm
Wt of H_2O = 264 – 102 = 162 gm

Moles of $H_2O = \frac{162}{18} = 9$

Mole fraction of $H_2O_2 = \frac{3}{9+3} = 0.25$

% wt/v $= \frac{102}{1000} \times 100 = 10.2\%$

Molality 162 gm water contain 3 moles of H_2O_2

$1000 \rightarrow \frac{3}{162} \times 1000 = \frac{1000}{54} =$ Molality

40. **D**

K.E. $= \frac{3}{2}RT$ per mole

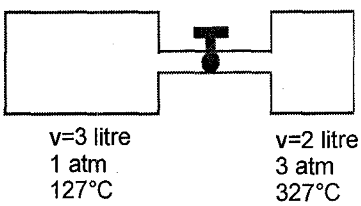
K.E. $= \frac{3}{2}nRT$ for n mole

$E_1 = \frac{3}{2}\frac{w}{16}RT_1$; $E_2 = \frac{3}{2}\frac{w}{30}RT_2$

$\frac{E_1}{E_2} = \frac{36}{16} \times \frac{T_1}{T_2} = \frac{3}{1}$

$\frac{T_1}{T_2} = \frac{16}{30} \times 3 = \frac{8}{5} \Rightarrow$ **$T_1 : T_2 = 8 : 5$**

41. **D**



$n_1 = \frac{1 \times 3}{R \times 400}$, $n_2 = \frac{3 \times 2}{600R}$

Now, when stop cock is opened.

$\frac{P \times 3}{R \times 500} + \frac{P \times 2}{R \times 500} = n_1 + n_2$

$\frac{3P}{500R} + \frac{2P}{500R} = \frac{3}{400R} + \frac{6}{600R}$

$\frac{3P}{5} + \frac{2P}{5} = \frac{3}{4} + \frac{6}{6}$

$\frac{5P}{5} = \frac{7}{4} \Rightarrow P = \frac{7}{4}$atm

42. **B**

$PV = nRT$; $P = \frac{nRT}{V}$

For I_{st} $V_1 = (10)^3$
IInd $V_2 = \pi(10)^2 \times 10$

IIIrd $V_3 = \frac{4}{3}\pi(10)^3$

$V_3 > V_2 > V_1$
Therefore, $P_3 < P_2 < P_1$

$\frac{P_2}{P_3} = \frac{V_3}{V_2} = \frac{4/3\pi(10)^3}{\pi \times (10)^3} = \frac{4}{3}$

43. **D**

44. **A,D**

45. **A,B,C**

46. **A,B**

47. **A,C,D**

48. **($A \rightarrow S$, $B \rightarrow P$, $C \rightarrow R$, $D \rightarrow Q$)**

total values of l = n
Actual value of l = 0 to n – 1
Total m value = $2l + 1$
Actual m values = + l to – l including zero.

49. **$A \rightarrow S$; $B \rightarrow Q$; $C \rightarrow P$; $D \rightarrow Q$**

50. **3**

$\frac{r_A}{r_B} = \frac{2}{1}$

$\frac{r_A}{r_B} = \sqrt{\frac{M_B}{M_A}} = \frac{2}{1} \Rightarrow \frac{M_B}{M_A} = \frac{4}{1}$

$V_{rms} = \sqrt{\frac{3RT}{M}}$

$\frac{V_{rms}(A)}{V_{rms}(B)} = \sqrt{\frac{T_A \cdot M_B}{M_A \; T_B}} = \sqrt{\frac{2}{1} \times \frac{4}{1}} = 2\sqrt{2} = 2.83 \simeq$ **3**

51. **3**

number of waves = orbit no. = 3

52. **79 eV**

$H \to H^+ + e^-$ $IE_1 = 13.6$ eV

$He \to He^+ + e^-$ $IE_1 = 24.6$ eV

We have to determine the value of

$He^{+2} + e^- \to He^+$ $\Delta H = a$

$He^+ + e^- \to He$ $\Delta H = b$

$He^{+2} + 2e^- \to He$ $\Delta H = (a + b)$

IE_1 of $He^+ = IE_{1\,H} \times 2^2 = 13.6 \times 4 = 54.4$

$a = -54.4$ ev

$He^+ + e^- \to He$

IE = 24.6 eV

$b = -24.6$ eV

total energy given

$= -54.4 - 24.6$

$= -79$ eV = 79 ev

53. **58%**

$H_2 = 1.12$ at = 0.05 mole = 0.1 gm

$D_2 = 1.12$ at = 0.05 mole = 0.2 gm

After deffusion H_2 left = 0.05 gm

H_2 diffusel in given time

$= 0.1 - 0.05$

$= 0.05$ gm

$$\frac{w_{H_2}}{t_{H_2}} \cdot \frac{t_{D_2}}{w_{D_2}} = \sqrt{\frac{M_{H_2}}{M_{D_2}}} = \sqrt{\frac{2}{4}}$$

$$\Rightarrow \frac{0.05}{w_{D_2}} = \sqrt{\frac{1}{2}} \Rightarrow w_{D_2} = 1.4 \times 0.05 = 0.07 \text{ gm}$$

% of D_2 in II^nd bulb

$$= \frac{0.07}{0.07 + 0.05} \times 100 = 58\%$$

54. **1, 3**

Balance the given reaction in terms of x and y.
Compare the moles of compounds at different stages.
The balanced chemical reactions are

$$(C_2H_5)_x TiCl_y \longrightarrow xC_2H_6 + Ti^{4+} + yCl^-$$

$$Cl^- + Ag^+ \longrightarrow AgCl$$

$$\text{Moles of } (C_2H_5)_x TiCl_y = \frac{0.612}{48 + 29x + 35.5y} = \frac{0.1}{30}$$

$$\Rightarrow \text{moles of } C_2H_6 = \frac{0.612x}{48 + 29x + 35.5y} = \frac{0.1}{30} \quad ...(i)$$

$$\Rightarrow \text{Moles of } Cl^- = \frac{0.612y}{48 + 29x + 35.5y}$$

$$= \text{moles of AgCl} = \frac{1.435}{143.5} \quad ...(ii)$$

From Eqs. (i) and (ii) : $\frac{x}{y} = \frac{1}{3}$ or $y = 3x$

Substituting in Eq. (i) gives :

$$\frac{0.612x}{48 + 29x + 106.5x} = \frac{1}{300}$$

$\Rightarrow 48 + 135.5x = 183.6x$

$\Rightarrow x = 1$ and $y = 3$

$\Rightarrow$ [1, 3]

55. **3**

From the mass of precipitate, moles of AgI formed by moles of ethyl iodide can be known. Comparing the moles of ethyl iodide to the moles of organic compound, x can be determined.

Moles of AgI $= \frac{148}{235} = 0.63$ = Moles of ethyl iodide

Also moles of theyl iodide = x × Moles of organic compound

$$\Rightarrow \quad 0.63 = \frac{37}{176}x$$

$\Rightarrow \quad x = 3$

56. **5**

57. $\frac{4}{9}$ **xJ / atom**