

## HINTS & SOLUTIONS

### ANSWER KEY

<b>Ques.</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Ans.</b>	d	d	c	d	c	c	d	b	a	c	a	d	a	a	d
<b>Ques.</b>	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<b>Ans.</b>	b	Bonus	d	b	b	a	b	c	d	a	a	b	c	b	c

1.  $mgh = \frac{1}{2} kx^2$

$$5 \times 10 \times 1 = \frac{1}{2} k \times 0.125 \times 0.125$$

$$50 = \frac{1}{2} k \cdot 0.125 \times 0.125$$

$$\frac{100}{0.125 \times 0.125} = k$$

$$k = 100 \times 64 \text{ N/m}$$

$$k = \frac{6400 \text{ N}}{1000 \text{ m}}$$

$$k = 6.4 \frac{\text{N}}{\text{mm}}$$

2. (d)

3. (c)

A block dot has mass = 1 femto gram =  $10^{-15}$  gram  
dot is made up of carbon only

So, 12 g carbon contains =  $N_A$  atoms

$$1 \text{ g carbon contain} = \frac{N_A}{12} \text{ atoms}$$

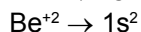
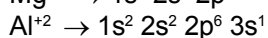
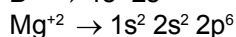
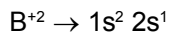
$$10^{-15} \text{ g carbon contain} = \frac{N_A}{12} \times 10^{-15} = \frac{6.023 \times 10^{23} \times 10^{-15}}{12}$$

( $N_A = 6.023 \times 10^{23}$ ) =  $5 \times 10^7$ . Number of carbon atoms.

4. (d)

Beryllium

After removal of two electrons the electronic configuration of the element are



As the configuration of  $Be^{+2}$  is  $1s^2$  which is more stable than others and requires more ionisation energy than others.

So, the third ionisation energy for Beryllium is highest

6.

(c)

$$V_{im} = -V_{om}$$

$$V_i - V_m = -(V_o - V_m)$$

Velocity of image w.r.t. obser along x-axis

$$= -2(10 \cos 60 + 5 \cos 30)$$

$$= -2 \left( 10 \times \frac{1}{2} + 5 \times \frac{\sqrt{3}}{2} \right)$$

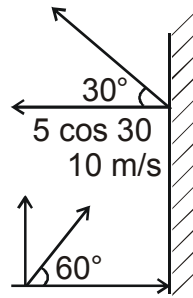
$$= -2 \left( 5 + \frac{5\sqrt{3}}{2} \right)$$

$$= -\frac{2}{2}(10 + 5\sqrt{3})$$

$$= -(10 + 5\sqrt{3})$$

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

Velocity of image w.r.t. obser along y-axis = 0



8.

(b)

$$u = 72 \times \frac{5}{18} = 20 \text{ m/s}$$

$$v = u + at$$

$$v = 0$$

$$0 = 20 - 4t$$

$$a = 4 \text{ m/s}^2$$

$$t = 5$$

$$s = 4t + \frac{1}{2} at^2$$

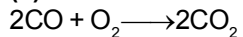
$$s = 20 \times 5 - \frac{1}{2} \times 4^2 \times 25$$

$$s = 50 \text{ m.}$$

Total distance is 52 m.

9.

(a)



60 ml of CO react with 30 ml of O<sub>2</sub>

Volume of CO<sub>2</sub> formed = 60 ml

remaining volume of O<sub>2</sub> = 10 ml

∴ Mixture A contain 60 ml CO<sub>2</sub> and 10 ml of O<sub>2</sub>

Total volume of A = 70 ml

After passing of A in KOH solution as only CO<sub>2</sub> will react with aq. KOH.

Volume remaining = (70-60) ml = 10 ml

Volume of 'B' = 10 ml

10.

(c)

$$f = 6 \text{ cm}$$

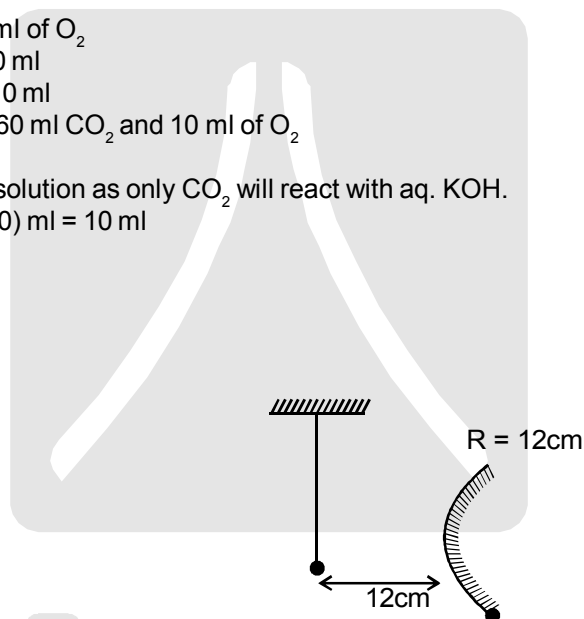
$$u_1 = 9 \text{ cm, } v_1 = ?$$

$$u_2 = 15 \text{ cm, } v_2 = ?$$

$$\frac{1}{f} = \frac{1}{v_1} + \frac{1}{u_1}$$

$$\frac{1}{v_1} = \frac{1}{6} + \frac{1}{9} = \frac{3+2}{18}$$

$$v_1 = \frac{18}{5} \text{ cm}$$



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If  $u = -15$  cm

$$\frac{1}{f} = \frac{1}{v_2} + \frac{1}{u_2}$$

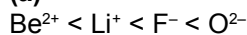
$$\frac{1}{v_2} = \frac{1}{6} + \frac{1}{15} = \frac{5+2}{30} = \frac{7}{30}$$

$$v_2 = \frac{30}{7}$$

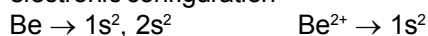
$$v_2 - v_1 = \frac{30}{7} - \frac{18}{5} = \frac{150 - 126}{35} = \frac{24}{35} \text{ cm} \approx 0.7 \text{ cm}$$

11.

(a)



electronic configuration

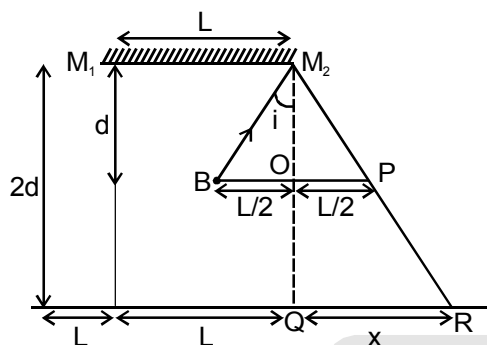


As the charge on anion increases, ionic radii increases.

As the charge on cation increases, ionic radii decreases.

12.

(d)



For  $\triangle OM_2D$  and  $\triangle M_2QR$

$$\frac{d}{2d} = \frac{L/2}{x} \Rightarrow x = L$$

So, total distance =  $x + L + x = L + L + L = 3L$ .

15.

(d)

Molecular wt. of monomer = 48 gm

so molecular wt. of dimer will be 98 gm

In experiment, Mass of compound = 96 gm

Volume of vessel = 33.6 L

Temperature =  $273^\circ \text{C} \rightarrow 273 + 273 = 546 \text{ K}$

If compound exist as a dimer then mass extent of mass by 50% of wt.

so 50% of 96 = 48 gm

Now weight = 96 + 48 = 144 gm

$Pv = nRT$

$$P \times 33.6 = \frac{144}{96} \times 0.082 \times 546 = 1.99 \approx 2 \text{ atm.}$$

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22. (b)
- |    |      |    |     |    |      |    |     |
|----|------|----|-----|----|------|----|-----|
| 1. | (II) | 2. | (I) | 3. | (IV) | 4. | (I) |
|----|------|----|-----|----|------|----|-----|
1. cinnabar – oxidation  
 $\text{HgS} + \text{O}_2 \rightarrow \text{Hg} + \text{SO}_2$
  2. Zinc blend – oxidation and reduction  
 $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$   
 $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$
  3. Hematite - reduction  
 $\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$
  4. Galena-oxidation and reduction  
 $2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$   
 $\text{PbO} + \text{CO} \rightarrow \text{Pb} + \text{CO}_2$

27. Mole of nitrogen gas =  $\frac{22}{28} = 0.78$

Mole of oxygen gas =  $\frac{44}{32} = 1.3$

Mole of  $\text{CO}_2$  gas =  $\frac{38}{44} = 0.86$

at constant V and T

$P \propto n$

n = number of mole

so  $P_{\text{N}_2} < P_{\text{CO}_2} < P_{\text{O}_2}$ .

30.(iii)  $\text{Cu} + \text{dil. HCl} \rightarrow \text{No reaction}$

Copper does not liberate  $\text{H}_2$  from dilute hydro chloric acid because only those metals which are having standard reduction potentials lower than that of hydrogen react with non-oxidising agent like HCl and displaces hydrogen from them.

Copper has higher reduction potential than hydrogen.

31. (a) (I)

Weight of individual = 70 kg

total fluid =  $70 \times \frac{70}{100} = 49 \text{ kg}$

blood 8% =  $\frac{49 \times 8}{100} = 3.92 \text{ kg}$

Density of blood =  $1060 \text{ g/l} = 1.06 \text{ kg}$

volume of blood =  $\frac{3.92}{1.06} = 3.69$

Ans =  $3.69 \text{ l} = 3.7 \text{ l}$

(II) Volume of Blood  $\rightarrow 3.7 \text{ l} = 3.7 \times 10^6 \text{ mm}^3$

Number of WBC =  $7000 / \text{mm}^3$ ,

Number of WBC in  $3.7 \times 10^6 \times 7000 = 2.59 \times 10^{10}$

Number of DNA in single WBC = 46

Number of DNA molecule in  $2.59 \times 10^{10} \text{ WBC}$

=  $2.59 \times 10^{10} \times 46 = 1.19 \times 10^{12}$

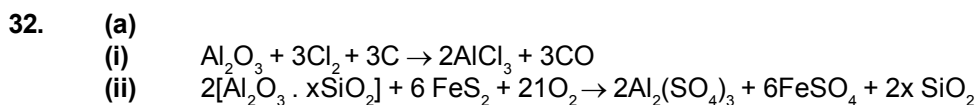
(III) Blood – 3.92

plasma =  $\frac{3.92 \times 55}{100} \times \frac{7}{100} \times \frac{58}{100}$

= 0.0875 kg Albumin

moles =  $\frac{0.0875}{66} = 1.3 \times 10^{-3} \text{ moles}$

31.	(b)	Label	Composition of Blood	Direction of Flow
		1.	oxygenated	Away
		2.	Deoxygenated	Away
		3.	oxygenated	towards
		4.	Deoxygenated	towards



(b)

Given mix of  $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3 + \text{NaCl} = 3\text{gm}$   
 On heating  $\text{NaHCO}_3$  undergoes decomposition & gives  $\text{CO}_2$

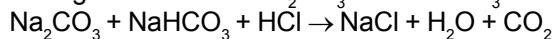


22400 ml  $\text{O}_2$  produced by = 2 moles of  $\text{NaHCO}_3$

$$56 \text{ ml } \text{CO}_2 \text{ produced by} = \frac{2 \times 56}{22400} = 5 \times 10^{-3} \text{ moles}$$

Amount of  $\text{NaHCO}_3$  in mix =  $5 \times 10^{-3} \times 84$   
 = 0.42 gm  $\text{NaHCO}_3$

During neutralisation  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$  will react with HCl



On neutralisation

equivalents of  $\text{Na}_2\text{CO}_3$  + equivalent of  $\text{NaHCO}_3$  = eq. of HCl

$$(x \times 2) + (5 \times 10^{-3}) = \frac{30.5 \times 1}{1000}$$

$$x \times 2 = 30.5 \times 10^{-3} - 5 \times 10^{-3}$$

$$x = 12.75 \times 10^{-3} \text{ moles of } \text{Na}_2\text{CO}_3$$

$$\text{Amount of } \text{Na}_2\text{CO}_3 = 12.75 \times 10^{-3} \times 106$$

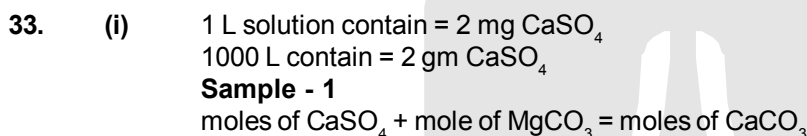
$$= 1.351 \text{ gm } \text{Na}_2\text{CO}_3$$

$$\text{Amount of NaCl} = \text{Total amount of mixture} - (\text{amount of } \text{Na}_2\text{CO}_3 + \text{amount of } \text{NaHCO}_3)$$

$$= 3 - (1.351 + 0.42 \text{ gm})$$

$$= 1.228 \text{ gm NaCl}$$

$$\% \text{ of NaCl in mixture} = \frac{1.228}{3} \times 100 = 40.9\%$$



$$\frac{2}{136} + \frac{0.5}{95} = \frac{1}{100}$$

$$\left( \frac{2}{136} + \frac{0.5}{95} \right) \times 100 = 1.9 \approx 2 \text{ ppm.}$$

**Sample - 2**

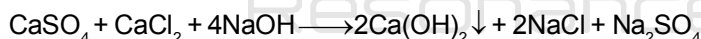
1 L solution contain = 3 mg  $\text{MgSO}_4$

1000 L solution contain = 3 gm  $\text{MgSO}_4$

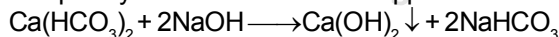
moles of  $\text{MgSO}_4$  = moles of  $\text{CaCO}_3$

$$\frac{3}{120} \times 100 = 2.5 \text{ ppm.}$$

(ii) Removal of Permanent Hardness



Temporary Hardness ppt



ppt.

34. (a) As per given data 42000 J/mol

$$= \frac{42000}{4.2 \times 18} \times \frac{\text{cal}}{\text{gm}} = 555.55.$$

$$\frac{1000}{555.55} = m = 18.51 \text{ g of water bond}$$

Man of work left  
 $= 2000 - 18 = 19982 \text{ gm}$

(b) Voltage range required

$$= \frac{1250}{625} = 2\text{V} \ \& \ \frac{1250}{500} = 2.5 \text{ V}$$

For voltage across led = 2v and across R = 0.8 v

$$\text{T.D. left} = 5 - 2.8 = 2.2 \text{ v}$$

$$2.2 \text{ v} \rightarrow 20 \text{ mA.}$$

$$R = 110 \ \Omega$$

For voltage across LED = 2.5 v and across R = 0.8 v

$$\text{P.D. left} = 5 - 3.3 = 1.7 \text{ v}$$

$$1.7 \text{ v} \rightarrow 20 \text{ mA}$$

$$R = 85 \ \Omega$$

Range will be  $85 \ \Omega$  to  $110 \ \Omega$ .

35.

(i)-c

(ii)-b

(iii)-c

(iv)-a

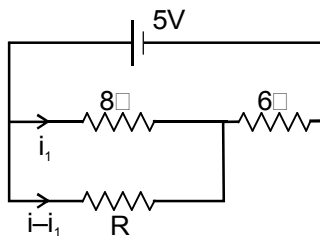
(v) Red round eyes

b- yes

c- 9 : 3 : 3 : 1

36.

(a)



Case - I

$$i \left( \frac{8R}{8+R} + 6 \right) = 5$$

$$i \left( \frac{8R + 48 + 6R}{8+R} \right) = 5$$

$$8 i_1 = R (i - i_1)$$

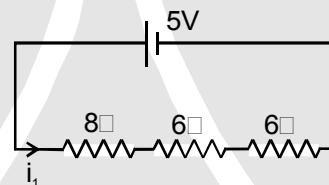
$$(8 + R) i_1 = Ri$$

$$i_1 = \frac{Ri}{8+R}$$

$$\frac{1}{4} = \frac{R}{8+R}, \frac{5(8+R)}{14R+48}$$

$$14R + 48 = 20R \Rightarrow R = 8 \ \Omega$$

Case - II



$$i_1 = \frac{5}{20} = \frac{1}{4}$$

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36. (b)

Between A and C effective resistance =  $\frac{3}{2} R$

Now  $V = iR$

$$3.6 = \frac{3600 \times 10^{-3}}{24} R$$

$$\therefore R = 24.$$

Now  $\frac{3}{2} R = 24.$

$$\therefore R = 16$$

Now between A and B  $R_{\text{eff}} = \frac{5}{4} R$

i.e., = 202

$\therefore$  Time required

$$3.6 = \frac{3600 \times 10^{-3}}{4t} \times 20 \text{ hr.}$$

37.A (i) - c  
(ii) - a  
(iii) - a  
(iv) - b

37.B (i) - c  
(ii) - F T T F F

38. (b)

$$V = \sqrt{\frac{T}{\lambda}}$$

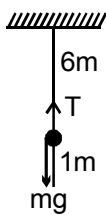
$\lambda$  = linear density as mass per unit length

$\therefore$  mass A 7 m wire = 140 g

$$\text{mass A 1 m wire} = \frac{140}{7} \text{ g} = 20 \text{ g}$$

$$\therefore \lambda = 20 \text{ g/m} = \frac{20}{1000} \text{ kg/m}$$

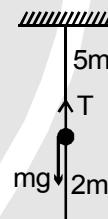
**At 6 m from ceiling**



$$T_1 = mg = \lambda g$$

$$v_1 = \sqrt{\frac{T_1}{\lambda}} = \sqrt{\frac{\lambda g}{\lambda}} = \sqrt{g}$$

**At 5 m :**



$$T_2 = m_2 g = 2\lambda g$$

$$v_2 = \sqrt{\frac{T_2}{\lambda}} = \sqrt{\frac{2\lambda g}{\lambda}} = \sqrt{2g}.$$

39. (a)

$P = 1 \text{ atm}$

$v = 1 \text{ lit.}$

$w = 2.8 \text{ gm}$

$PV = nRT$

$$1 \times 1 = \frac{w}{M_w} \times 0.0821 \times 400$$

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$$1 = \frac{2.8}{M_w} \times 0.0821 \times 400$$

$$M_w = 92 \text{ gm}$$

Given 10.5 gm of C at 1 gm of H

C	H
10.5	1

$$\text{so ratio of a.w.} = \frac{10.5}{12} \quad \frac{1}{1}$$

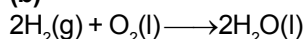
Multiply by factor (8) to make whole number

$$\begin{array}{cc} \downarrow & \downarrow \\ 0.875 \times 8 & 1 \times 8 \\ = 7 & = 8 \end{array}$$

so m.w. for =  $C_7H_8$ .

39.

(b)



Total initial vol. of  $H_2$  and  $O_2$  = 40 ml.

At const pressure and temperature conditions.

volume of remaining  $H_2$  = 10 ml.

$H_2$  &  $O_2$  react in 2 : 1 molar ratio

there for volume of  $H_2$  reacted = 20 ml.

& vol. of  $O_2$  reacted = 10 ml .

$$\text{so, mole \% of } H_2 \text{ initially} = \frac{30}{40} \times 100 = 75\%$$

40.

(i)-F T T

(ii)- (i) Chloroplast, (ii) photosynthesis, (iii) decreases, (iv) endosmosis, (v) Higher, (vi) Lower, (vii) increases

(iii)-c

(iv)-a

(v)-c

(vi)-a

41.



Person inhales 8 litre air per minute

So vol. of air inhales in 3.5 hr

$$= 3.5 \times 60 \times 8 \text{ litre}$$

$$= 1680 \text{ litre}$$

Total amount of air inhaled by person = 1680 litre

air contain only 20% oxygen

$$\text{So amount of oxygen present} = 1680 \times \frac{20}{100} = 336 \text{ litre oxygen}$$

only 5% of oxygen is consumed by body

$$\text{So vol. of oxygen consumed} = 336 \times \frac{5}{100} = 16.80 \text{ litre}$$

Acc to equation

6 × 22.4 litre oxygen is consumed by 180 gm of  $C_6H_{12}O_6$

$$\therefore 16.80 \text{ litre oxygen is consumed by} = \frac{180 \times 16.80}{6 \times 22.4} = 22.5 \text{ gm glucose}$$

Amount of  $CO_2$

6 moles of oxygen gives = 6 mole of  $CO_2$

$$\therefore 6 \times 22.4 \text{ litre } O_2 = 6 \times 22.4 \text{ litre } CO_2$$

$$16.8 \text{ L } O_2 = 16.8 \text{ L } CO_2$$

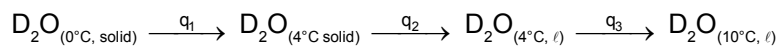
Vol of  $CO_2$  produced is 16.8 L

$$\text{Amount of CO}_2 = \frac{16.8}{22.4} \times 44 = 33 \text{ gm CO}_2.$$

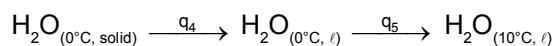
42. Mix of H<sub>2</sub>O + D<sub>2</sub>O = 1000 L

amount of H<sub>2</sub>O = 600 L = 600 kg

amount of D<sub>2</sub>O = 400 L = 440 kg



heat required for D<sub>2</sub>O = q<sub>1</sub> + q<sub>2</sub> + q<sub>3</sub>



Heat required for H<sub>2</sub>O = q<sub>4</sub> + q<sub>5</sub>

$$q_1 = ms\Delta T = 440 \times x \times 4 = 1760x$$

$$q_2 = m \times L = 440 \times 340 = 149600 \text{ KJ}$$

$$q_3 = ms\Delta T = 440 \times 4.25 \times 6 = 11220 \text{ KJ}$$

$$q_4 = M \times L = 600 \times 330 = 198000 \text{ KJ.}$$

$$q_5 = MS\Delta T = 600 \times 4.15 \times 10 = 24900 \text{ KJ}$$

Total amount of heat required for the mixture = q<sub>1</sub> + q<sub>2</sub> + q<sub>3</sub> + q<sub>4</sub> + q<sub>5</sub>

$$387160 = 1760x + 149600 + 11220 + 198000 + 24900$$

$$x = 1.95 \text{ KJ/Kg K.}$$



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