INJSO (STAGE-II)-2017

HINTS & SOLUTIONS

ANSWER KEY

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

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

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

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

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

$k = 100 \times 64$ N/m

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

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

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

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

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

4. **(d)**

Beryllium

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

$B^{+2} \rightarrow 1s^2\ 2s^1$

$Mg^{+2} \rightarrow 1s^2\ 2s^2\ 2p^6$

$Al^{+2} \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^1$

$Be^{+2} \rightarrow 1s^2$

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

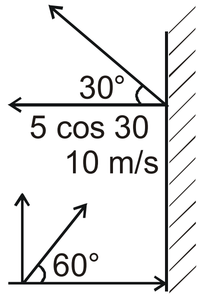
6. **(c)**

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

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

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

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



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

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

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

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

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

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

8. **(b)**

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

$v = 0$

$a = 4\ m/s^2$

$v = u + at$

$o = 20 - 4t$

$t = 5$

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

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

s = 50 m.

Total distance is 52 m.

9. **(a)**

$2CO + O_2 \longrightarrow 2CO_2$

60 ml of CO react with 30 ml of O_2

Volume of CO_2 formed = 60 ml

remaining volume of O_2 = 10 ml

$\therefore$ Mixture A contain 60 ml CO_2 and 10 ml of O_2

Total volume of A = 70 ml

After passing of A in KOH solution as only CO_2 will react with aq. KOH.

Volume remaining = (70–60) ml = 10 ml

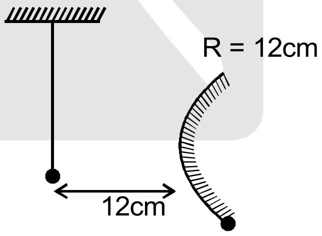
Volume of 'B' = 10 ml

10. **(c)**

f = 6 cm

$u_1 = 9$ cm, $v_1 = ?$

$u_2 = 15$ cm, $v_2 = ?$



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

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

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

If u = – 15 cm

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

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

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

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

11. **(a)**

$Be^{2+} < Li^{+} < F^{-} < O^{2-}$

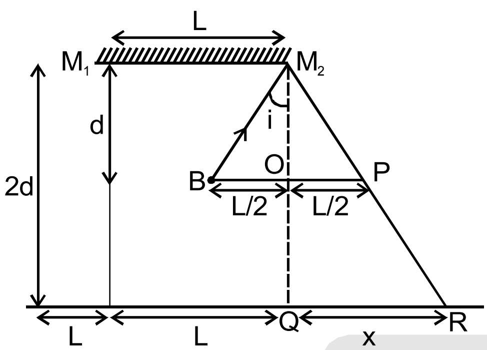
electronic configuration

$Be \to 1s^2, 2s^2$	$Be^{2+} \to 1s^2$
$Li \to 1s^2, 2s^1$	$Li^{+} \to 1s^2$
$F \to 1s^2, 2s^2, 2p^5$	$F^{-} \to 1s^2, 2s^2, 2p^6$
$O \to 1s^2, 2s^3, 2p^4$	$O^{2-} \to 1s^2, 2s^2, 2p^6$

As the charge on anion increases, ionic radii increases.

As the charge on cation increases, ionic radii decreases.

12. **(d)**



For ΔOM_2D and ΔM_2QR

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

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

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° C → 273 + 273 = 546 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

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

16. **(b)**

$y = a\sin(wt-kx)$ when wave is moving towards + x axes

$\frac{dy}{dt} = v = aw\cos(wt-kx)$

of y = max then $\sin(wt-kx) = 1 \Rightarrow (wt-kx) = 90°$

so when y = max then velocity will be zero

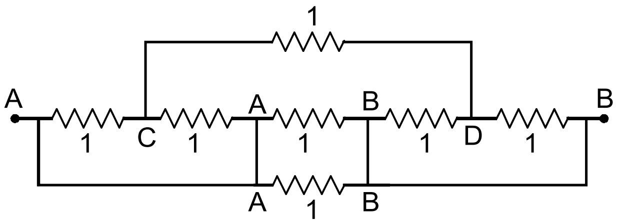
At, F, L and R K.E. will be max

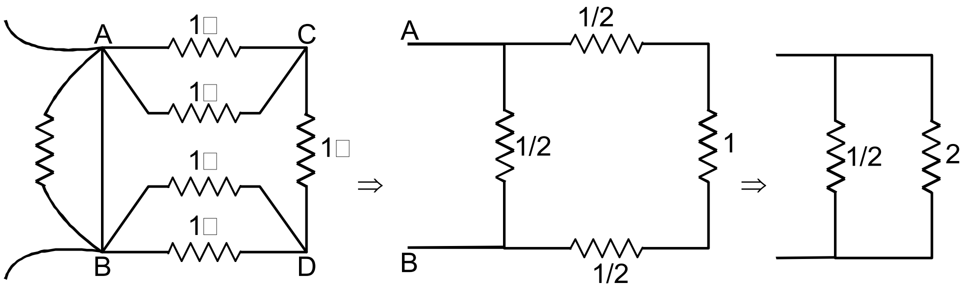
At G, velocity s negative

$V = aw\cos(\pi + wt. - kx) = -aw\cos wt$

so wave is moving towards + x axis

17.





$$R_{eq} = \frac{2\times\frac{1}{2}}{2+\frac{1}{2}} = \frac{1}{5} = \frac{2}{5}.$$

19. **(b)**

$$Fe_2(SO_4)_{3(aq.)} + 3Ba(OH)_{2(aq.)} \rightarrow \underset{ppt}{2Fe(OH)_{3(S)}} + \underset{ppt}{3BaSO_{4(S)}}$$

Given Ferric ions = 0.140 gm = $\frac{0.140}{56}$ = 0.0025 moles Fe^{3+} ions

$\because$ moles of pure ferric sulphate taken = 0.00125 moles

As per the reaction $Fe(OH)_3$ and $BaSO_4$ both will precipitate out.

So, total amount of precipitate = amount of $Fe(OH)_3$ + amount of $BaSO_4$

Amount of $Fe(OH_3)$ = 2 × 0.00125 × 107 = 0.2675 gm

Amount of $BaSO_4$ = 3 × 0.00125 × 233 = 0.87375 gm

Total weight of precipitate = $Fe(OH)_3 + BaSO_4$ = 0.2675 + 0.8737 = 1.14 gm.

20. **(b)**

(i) Phenolphthalein + NaCl $\rightarrow$ No reaction.
P **Q**

(ii) Phenolphthalein + $CaCO_3$ $\rightarrow$ Alkaline medium
P R (Dark Pink Colour)

(iii) $CaCO_3 + 2CH_3COOH \rightarrow (CH_3COO)_2Ca + CO_2\uparrow + 2H_2O$
R **S** effervescence

P = Phenolphthalein

Q = NaCl

R = $CaCO_3$

S = CH_3COOH.

22. **(b)**

1. (II) **2.** (I) **3.** (IV) **4.** (I)

1. cinnabar – oxidation
   $HgS + O_2 \rightarrow Hg + SO_2$
2. Zinc blend – oxidation and reduction
   $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
   $ZnO + C \rightarrow Zn + CO$
3. Hematite - reduction
   $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$
4. Galena-oxidation and reduction
   $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$
   $PbO + CO \rightarrow Pb + CO_2$

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

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

Mole of CO_2 gas = $\frac{38}{44}$ = 0.86

at constant V and T

$P \propto n$

n = number of mole

so $P_{N_2} < P_{CO_2} < P_{O_2}$.

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

Copper does not liberate 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 × $\frac{70}{100}$ = 49 kg

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

Density of blood=1060g/l = In 1.06 kg

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

Ans = 3.69 ℓ = 3.7 ℓ

(II) Volume of Blood $\rightarrow$ 3.7 ℓ =3.7 ×10^6 mm^3

Number of WBC =7000 / mm^3,

Number of WBc in 3.7 ×10^6 × 7000 = 2.59 × 10^{10}

Number of DNA in single WBC =46

Number of DNA molecule in 2.59 × 10^{10} WBC

= 2.59 × 10^{10} × 46=1.19 × 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 × 10^{-3} moles

31. **(b)**

Label	Composition of Blood	Direction of Flow
1.	oxygenated	Away
2.	Deoxygenated	Away
3.	oxygenated	towards
4.	Deoxygenated	towards

32. **(a)**

(i) $Al_2O_3 + 3Cl_2 + 3C \rightarrow 2AlCl_3 + 3CO$

(ii) $2[Al_2O_3 \, . \, xSiO_2] + 6\,FeS_2 + 21O_2 \rightarrow 2Al_2(SO_4)_3 + 6FeSO_4 + 2x\,SiO_2$

(b)

Given mix of $NaHCO_3 + Na_2CO_3 + NaCl = 3gm$

On heating $NaHCO_3$ undergoes decomposition & gives CO_2

$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

22400 ml O_2 produced by = 2 moles of $NaHCO_3$

56 ml CO_2 produced by = $\frac{2 \times 56}{22400} = 5 \times 10^{-3}$ moles

Amount of $NaHCO_3$ in mix = $5 \times 10^{-3} \times 84$

= 0.42 gm $NaHCO_3$

During neutralisation Na_2CO_3 and $NaHCO_3$ will react with HCl

$Na_2CO_3 + NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

On neutralisation

equivalents of Na_2CO_3 + equivalent of $NaHCO_3$ = eq. of HCl

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

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

$x = 12.75 \times 10^{-3}$ moles of Na_2CO_3

Amount of $Na_2CO_3 = 12.75 \times 10^{-3} \times 106$

= 1.351 gm Na_2CO_3

Amount of NaCl = Total amount of mixture – (amount of Na_2CO_3 + amount of $NaHCO_3$)

= 3 – (1.351 + 0.42 gm)

= 1.228 gm NaCl

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

33. **(i)** 1 L solution contain = 2 mg $CaSO_4$

1000 L contain = 2 gm $CaSO_4$

Sample - 1

moles of $CaSO_4$ + mole of $MgCO_3$ = moles of $CaCO_3$

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

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

Sample - 2

1 L solution contain = 3 mg $MgSO_4$

1000 L solution contain = 3 gm $MgSO_4$

moles of $MgSO_4$ = moles of $CaCO_3$

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

(ii) Removal of Permanent Hardness

$CaSO_4 + CaCl_2 + 4NaOH \longrightarrow 2Ca(OH)_2\downarrow + 2NaCl + Na_2SO_4$
ppt

Temporary Hardness

$Ca(HCO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2\downarrow + 2NaHCO_3$
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 gm

(b) Voltage range required

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

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

T.D. left = 5 – 2.8 = 2.2 v

2.2 v $\rightarrow$ 20 mA.

R = 110 Ω

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

P.D. left = 5 – 3.3 = 1.7 v

1.7 v $\rightarrow$ 20 mA

R= 85 Ω

Range will be 85 Ω to 110 Ω.

35. (i)-c

(ii)-b

(iii)-c

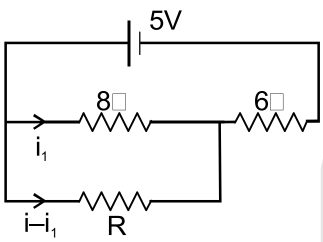
(iv)-a

(v) Red round eyes

b- yes

c- 9 : 3 : 3 : 1

36. **(a)**



Case - I

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

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

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

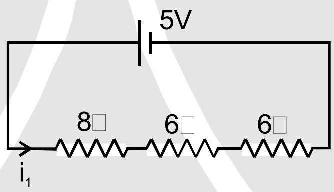
$(8 + R)\, i_1 = Ri$

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

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

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

Case - II



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

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 $R_{eff} = \frac{5}{4}R$

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)**

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

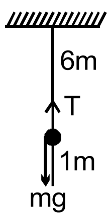
λ = linear density as mass per unit length

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

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

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

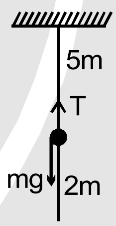
<u>**At 6 m from celing**</u>



$T_1 = mg = \lambda g$

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

<u>**At 5 m :**</u>



$T_2 = m_2 g = 2\lambda g$

$$V_2 = \sqrt{\frac{T_2}{\lambda}} = \sqrt{\frac{2\lambda g}{\lambda}} = \sqrt{2g}.$$

39. **(a)**
P = 1 atm
v = 1 lit.
w = 2.8 gm
PV = nRT

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

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

$M_w = 92$ gm

Given 10.5 gm of C at 1 gm of H

C	H
10.5	1

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

↓

Multiply by factor (8) to make whole number

↓	↓
0.875 × 8	1 × 8
= 7	= 8

so m.w. for = C_7H_8.

39. **(b)**

$2H_2(g) + O_2(l) \longrightarrow 2H_2O(l)$

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 .

so, mole % of H_2 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. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy

Person inhales 8 litre air per minute

So vol. of air inhales in 3.5 hr

= 3.5 × 60 × 8 litre

= 1680 litre

Total amount of air inhaled by person = 1680 litre

air contain only 20% oxygen

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

only 5% of oxygen is consumed by body

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

Acc to equation

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

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

Amount of CO_2

6 moles of oxygen gives = 6 mole of CO_2

∵ 6 × 22.4 litre O_2 = 6 × 22.4 litre CO_2

16.8 L O_2 = 16.8 L CO_2

Vol of CO_2 produced is 16.8 L

Amount of $CO_2 = \frac{16.8}{22.4} \times 44 = 33$ gm CO_2.

42. Mix of $H_2O + D_2O = 1000$ L

amount of $H_2O = 600$ L $= 600$ kg

amount of $D_2O = 400$ L $= 440$ kg

$$D_2O_{(0°C,\ solid)} \xrightarrow{q_1} D_2O_{(4°C\ solid)} \xrightarrow{q_2} D_2O_{(4°C,\ \ell)} \xrightarrow{q_3} D_2O_{(10°C,\ \ell)}$$

heat required for $D_2O = q_1 + q_2 + q_3$

$$H_2O_{(0°C,\ solid)} \xrightarrow{q_4} H_2O_{(0°C,\ \ell)} \xrightarrow{q_5} H_2O_{(10°C,\ \ell)}$$

Heat required for $H_2O = q_4 + q_5$

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

$q_2 = m \times L = 440 \times 340 = 149600$ KJ

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

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

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

Total amount of heat required for the mixture $= q_1 + q_2 + q_3 + q_4 + q_5$

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

$x = 1.95$ KJ/Kg K.