DATE : 02-02-2019

HINTS & SOLUTIONS

SECTION–A

11. Ans (D)

Argon → $^{40}_{18}Ar$
Atomic No. = 18
Mass No. = 40
No. of n^0 = 40 – 18 = 22
No. of p^+ = 18
If mass of n^0 in Argon made half then, number of n^0 = 11
If mass of electron is doubled
Here mass of electron is negligible.
Now, new mass of Argon = 11 + 18 = 29
Now change in mass = 40–29 = 11

In % = $\frac{11}{40} \times 100$

= $\frac{110}{40}$ = 27.5 %

Mass is reduced by approximately 27%

12. Ans (B)

Common salt (NaCl) = 0.5 g
Sodium = 40%
Iodine = 380 μgm

Mass of Na in common salt = $0.5 \times \frac{40}{100}$ = 0.2 gm

Mass of iodine = 380×10^{-6} gm
∴ Mass of chloride = $0.5 - 0.2 - (380 \times 10^{-6}) = 0.29962$

No. of chloride ions = $\frac{0.29962}{35.5} \times 6.023 \times 10^{23} = 5 \times 10^{21}$

13. Ans (B)

LPG → Butane + Propane
LPG + O_2 → CO_2 + H_2O
5ℓ　　17 ℓ

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
xℓ　　3x ℓ

$C_4H_{10} + O_2 \rightarrow 4CO_2 + 5H_2O$
yℓ　　4y ℓ

For LPG →
x + y = 5
x = 5 – y　　------ (i)
for CO_2 →
3x + 4y = 17
From equation (i)

$3(5 - y) + 4y = 17$
$15 - 3y + 4y = 17$
$y = 2 \rightarrow C_4H_{10}$ (butane)
$x = 3 \rightarrow C_3H_8$ (propane)
ratio (butane to proane) = 2 : 3

14. **Ans. (D)**

Acid $\rightarrow$ 0.42 gm. ($C_6H_{10}O_4$)

Base $\rightarrow$ 0.17 M (NaOH), and 33.8 ml

moles of acid = $\frac{0.42}{72 + 10 + 64}$

$= \frac{0.42}{146}$

$= 2.87 \times 10^{-3}$ mol.

= 2.87 m mol.

Milli moles of Base = 0.17 × 33.8

= 5.746 m mol.

$\because$ 2.87 m mol of Acid Neutralize 5.74 m mol of base.

So. 1 m mol of Acid Neutralise = $\frac{5.74}{2.87}$ =2 m mol.

Means two protons per acid molecule are taking part in reaction.

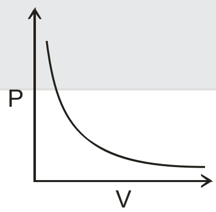
For 1 mol of base Acid is required = $\frac{1}{2}$ mol.

$= \frac{1}{2} \times 146$

= 73 gm

15. **Ans.(D)**

From Ideal gas equation.
PV = nRT.
At constant temperature.
$P \propto \frac{1}{V}$
So correct graph between P vs.V



16. **Ans.(D)**

Given series
Mg > Al > Zn > Cu > Ag
If copper rod is used to stir a solution of aluminium nitrate then there will be no reaction because according to given series copper is less reactive than aluminium.

17. **Ans.(A)**

Compound (P) is NaCl $\rightarrow$

Electrolysis of aqueous NaCl :

NaCl (aq) $\xrightarrow{\text{electricity}}$ NaOH(aq) + H_2 (g) + Cl_2 (g)
"P" "Q"

Gas 'Q' will be Cl_2 because it will form germicide, Bleaching powder ($CaOCl_2$) with $Ca(OH)_2$

$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2$

"R" "Q" Bleaching powder

18. Ans,. (D)

$Fe^{2+} + MnO_4^- + H^+ \longrightarrow Fe^{3+} + Mn^{2+} + H_2O$

Balanced Eq.

$5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

$5 + 1 + 8 + 5 + 1 + 4 \Rightarrow 24$

19. Ans. (C)

(a) $2\overset{+4}{N}O_2 + H_2O \longrightarrow H\overset{+5}{N}O_3 + H\overset{+3}{N}O_2$

Oxidation No. of Nitrogen (+4) in NO_2 changed to + 5 and + 3. In a disproportionation reaction an element in one oxidation state is simultaneously oxidised and reduced". So it is disproportionation reaction.

(b) $3\overset{0}{S} + 2H_2O \longrightarrow \overset{+4}{S}O_2 + 2H_2\overset{-2}{S}$

O.S. of sulphur changed from 0 to + 4 and – 2

So it is disproportionation Reaction

(c) $\overset{-3}{N}H_4\overset{+5}{N}O_3 \longrightarrow \overset{+1}{N_2}O + 2H_2O$

O.N. of Nitrogen changed from – 3 & +5 to +1.

In comproportionation reaction, two different oxidation state of an element in reactant state is simultaneously oxidised and reduced to a single oxidation state in product.

So it is comproportionation Reaction.

(d) $3\overset{0}{Cl_2} + 6OH^- \longrightarrow 5\overset{-1}{Cl^-} + \overset{+5}{Cl}O_3^- + 3H_2O$

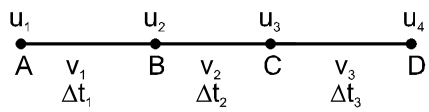
O.N. of Cl changed from 0 to – 1 & + 5

So it is disproporationation Reaction.

20. Ans. (C)

$(n-1)s^2\,p^6$, ns^1

21. (B)



$v_1 = \frac{u_1 + u_2}{2}$ $v_2 = \frac{u_2 + u_3}{2}$ $v_3 = \frac{u_3 + u_4}{2}$

$u_2 = u_1 + a\Delta t_1$

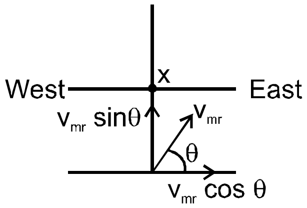
$u_3 = u_2 + a\,\Delta t_2 = u_1 + a\,(\Delta t_1 + \Delta t_2)$

$u_4 = u_3 + a\Delta t_3 = u_1 + a\,(\Delta t_1 + \Delta t_2 + \Delta t_3)$

$$\frac{v_2 - v_1}{v_3 - v_2} = \frac{u_2 + u_3 - u_1 - u_2}{u_3 + u_4 - u_2 - u_3} = \frac{u_3 - u_1}{u_4 - u_2} = \frac{a(\Delta t_1 + \Delta t_2)}{a(\Delta t_2 + \Delta t_3)}$$

$$\frac{v_2 - v_1}{\Delta t_1 + \Delta t_2} = \frac{v_3 - v_2}{\Delta t_3 + \Delta t_2}$$

22. **(D)**

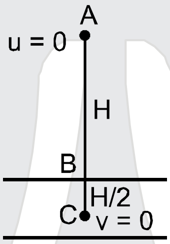


$$t = \frac{d}{v_{mr}\sin\theta}$$

If $\sin\theta = 1$ them t will be minimum and for Q., $\theta = 90^\circ$

so Q will reach in minimum time towards east of x.

23. **(C)**



By work energy theorem between A & C

$W = \Delta K$

$W_f + W_g = K_f - K_i$

$$-f\left(\frac{H}{2}\right) + m\left(H + \frac{H}{2}\right)g = 0 - 0$$

$$m\left(\frac{3H}{2}\right)g = \frac{fH}{2}$$

f = 3 mg

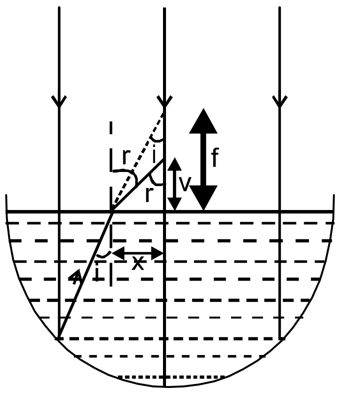
24. **(B)**

Potential difference across unit length (x) = $\frac{10}{L}$

In balanced condition no current will flow through galvanometer (G) so there will not be any effect of resistance r.

$E = x\,\ell = \frac{10}{L}\ell \Rightarrow \ell = \frac{E \times L}{10}$

25. **(D)**



$\mu_1 \sin i = \mu_2 \sin r$

$\frac{4}{3}\sin i = \sin r$

$\frac{4}{3} i = r$ [$\because \sin i = i = \tan i = \frac{x}{f}$ & $\sin r = r = \tan r = \frac{x}{v}$]

$\frac{4}{3}\frac{x}{f} = \frac{x}{v}$

$v = \frac{3}{4}f = 0.75f$

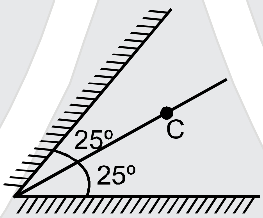
26. **(D)**

Image by M_1	Image by M_2
25º	25º
75º	75º
125º	125º
175º	175º

4 + 4 = 8

175 + 175 ≠ 360º

So no image coincide



27. **(B)**

Efficiency of heating element is 50%

So power = 210 J/S

That means in 1 sec supplied heat is 210 J

So in 60 sec in supplied heat is = 210 × 60 J

Now $Q = mS\Delta t$

$210 \times 60 = m \times 4.2 \times 10^3 \times 5$

$m = \frac{210 \times 60}{4.2 \times 10^3 \times 5} = \frac{210 \times 60}{21 \times 10^3} = \frac{600}{1000} = 0.6 \text{ kg/min}$

Now

$\rho = \frac{m}{V}$

So $V = \frac{m}{\rho} = \frac{0.6}{10^3} \times 10^3 \frac{L}{\min} = 0.6 \frac{L}{\min}$

28. **(C)**

Total resistance in || combination = $\frac{r}{N}$ (Assuming each resistance is of value r)

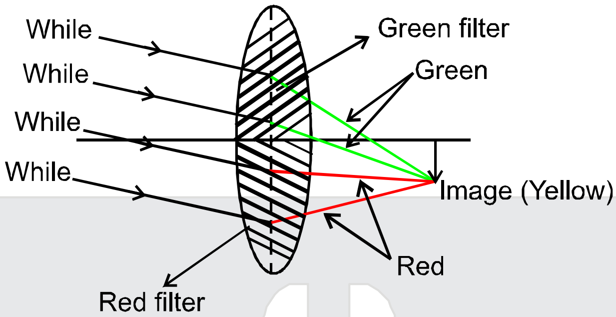
Total resistance in series combination = r N

$\therefore$ Power displacement in || $= \dfrac{E^2}{r/N}$

Power dissipated in series = $\dfrac{E^2}{rN}$

$\therefore$ Ratio = N^2

29. **(D)**

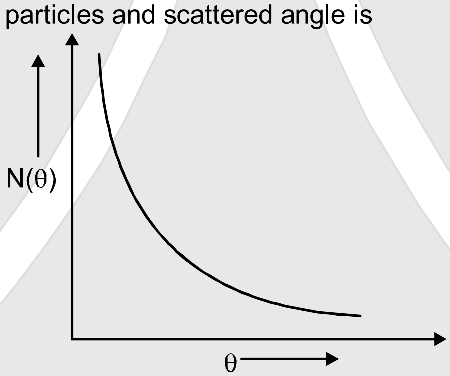


Since R + G = Yellow colour .
So image will be yellow.

30. **(A)**

$N(\theta)\alpha\dfrac{1}{\sin^4\dfrac{\theta}{2}}$

So, graph between number of particles and scattered angle is



SECTION–B

31. A. (C) $\frac{\text{Leaf weight + Stem Weight}}{\text{Root weight}}$

B. (i) $\frac{\text{Leaf weight + Stem Weight}}{\text{Root weight}}$

$\frac{0.126 + 0.283}{0.239} = 1.711$

(ii) $\frac{0.061 + 0.138}{0.089} = 2.2359$

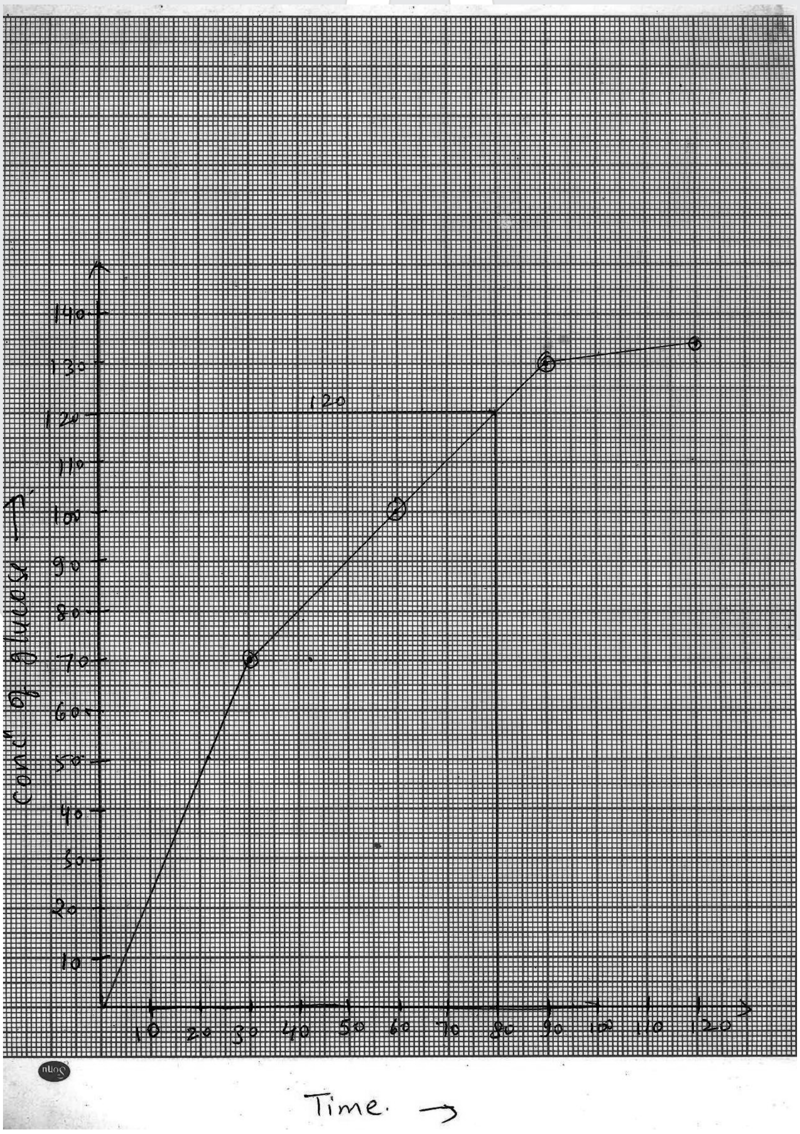
C. (i) X = Yes

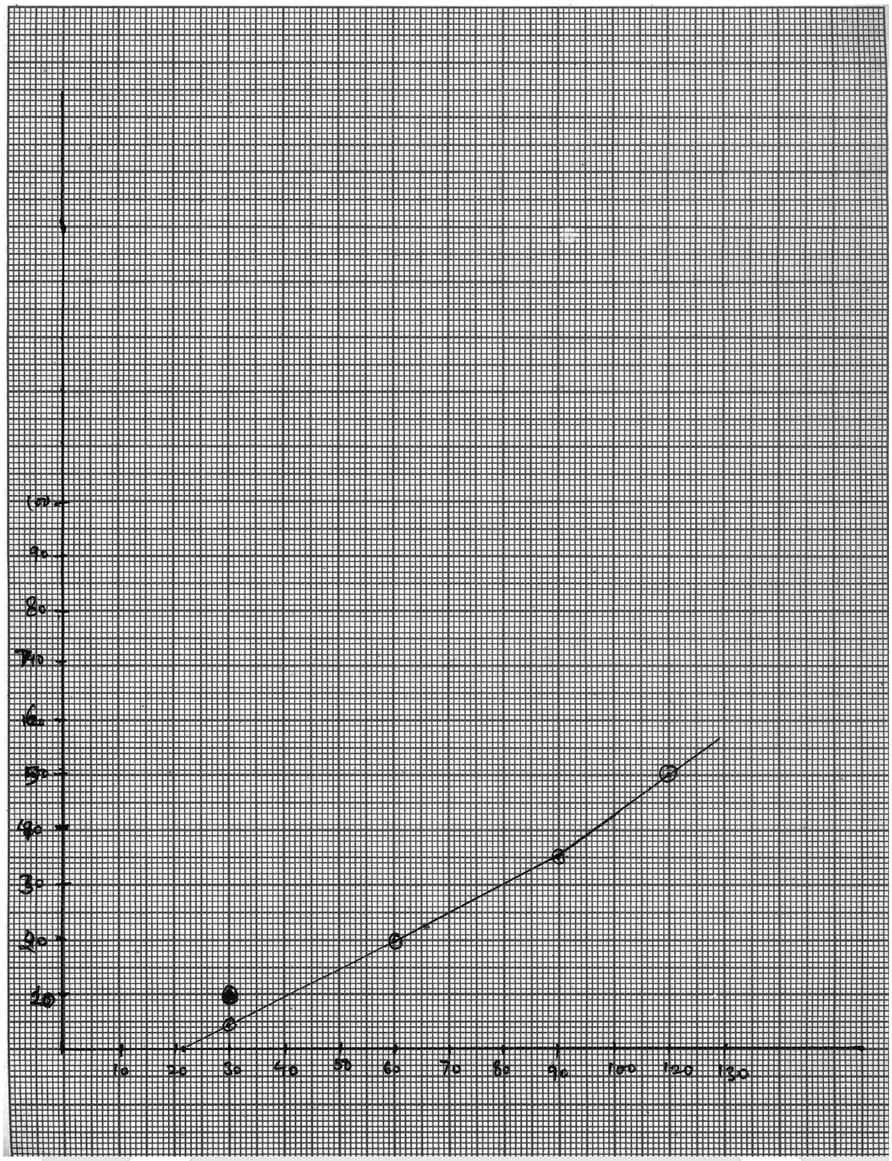
(ii) No

D. (a) $\frac{\text{Leaf weight}}{\text{Leaf area}}$

32. **A.** 0.0055 M

B.





C. 120 mg%

D. 50 mg%

33. (A)

(i) Z (More in number so producers).

(ii) Y (Herbivores)

(iii) X (Carnivores)

(B) Average weight of Z = 0.0060 gm.

Total weight = 0.0060 × 200 = 1.2

Average weight of Y = 0.0025

Total weight = 0.0025 × 40 = 0%

$= \frac{.1 \times 100}{1.2} = 8.3$

(C) 17

(D) a

34. (A) $\{ 16H^+ + 10e^- + 2MnO^-_4 \rightarrow 2Mn^{+2} + 8H_2O$ .... (i) } × 2

$\{ 5C_2O_4^{2-} \rightarrow 10CO_2 + 10e^-$ .... (ii) } × 5

Solving equation (i) and (ii)

$2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$

(B) (i) $KMnO_4$

(ii) $H_2C_2O_4$

(C) Mole of $KMnO_4$ participated = M × V = $0.1 \times 17.8 \times 10^{-3}$

$= 1.78 \times 10^{-3}$

according to above equation –

for 2 mole of $KMnO_4$ 5 moles of oxalic acid required

$\therefore$ for 1.78×10^{-3} mol of $KMnO_4$, moles of oxalic acid required = $\frac{5 \times 1.78 \times 10^{-3}}{2}$ = 4.45 m mol

(D) $CaCO_3 + H_2C_2O_4 \rightarrow CaC_2O_4 + H_2O + CO_2$

$CaC_2O_4 + H_2SO_4 \rightarrow H_2C_2O_4 + CaSO_4$

According to above equation for 4.45 m mol of $H_2C_2O_4$, $CaCO_3$ required = $4.45 \times 100 \times 10^{-3}$ g = 0.445 g

(E) Given mass of sample = 0.626 g

So, mass of Na_2SO_4 in sample = 0.626 – 0.445 = 0.181 g

% of Na_2SO_4 = $\frac{0.181}{0.626} \times 100$ = 28.91%

35. $H^+(aq) + OH^-(aq) \rightarrow H_2O\ (\ell) + (E)$

Mass of water (M) = 90 g

S = 4.18 J/gm°C

$\Delta T = 30.5 - 29 = 1.5$

(A) Heat absorbed by water

$Q_{water} = M\ S\ \Delta\ T$

= 90 × 4.18 × 1.5

Q_{water} = 564.3 J

(B) For 0.01 mole of water formation heat absorbed by water is = 564.3 J

$OH^-(aq) + H^+(aq) \rightarrow H_2O\ (\ell)$

17 gm	1 gm	18 gm
1 mole	1mol	1 mol

$\because$ From 0.01 mole heat released = 564.3 J

$\therefore$ Now for 1 mole heat evolved = $\frac{564.3J \times 1}{0.01}$

= 56430 J = 56.430 kJ

36.

	% by mass	Atomic mass	Relative mole	
C	85.7	12	85.7/12	7.14
H	14.30	1	14.30/1	14.3

	Simplest ratio
C	1
H	2

Empirical formula = CH_2

Empirical formula mass = 14 gm

Molecular formula = (Empirical formula) × n

Molecular mass (M) = $\frac{density \times R \times T}{P} = \frac{2.28 \times 0.0821 \times 300}{1}$

Molecular mass (M) = 56.15 g

(A) No. of moles of carbon in 100 g of compound

% of C = 85.7%

Number of Moles = $\frac{85.7}{12}$ = 7.14

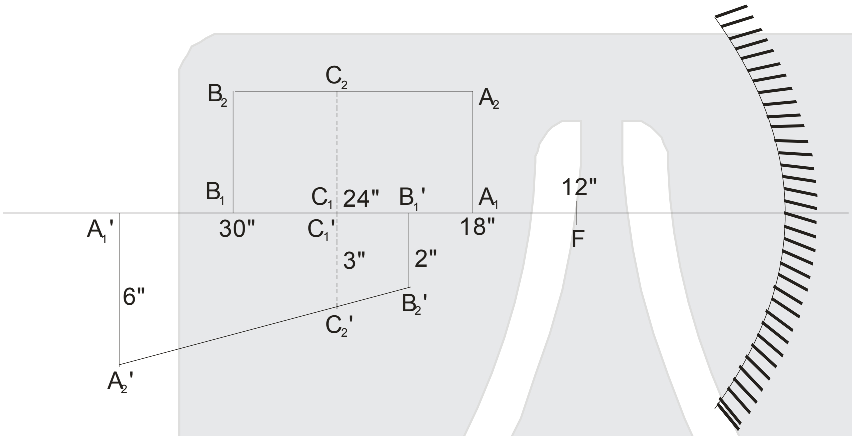
(B) No. of moles of H = 14.3 mole
(C) Empirical formula of the compound = CH_2
(D) Moles / Litre of compound = $\frac{\text{density(g/L)}}{M}$ = 0.0406
(E) Empirical formula unit (n) = 4
(F) Molecular formula = C_4H_8

$$n = \frac{\text{Molecular mass}}{\text{empirical formula mass}}$$

$$n = \frac{56.14}{14} = 4$$

Molecular formula = C_4H_8

37.



For point A_1A_2
$u = -18''$ and $f = -12''$
so from mirror formula $\frac{1}{f} = \frac{1}{v_1} + \frac{1}{u}$

$$\frac{1}{v_1} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{12} - \left(-\frac{1}{18}\right)$$

$$= -\frac{1}{12} + \frac{1}{18} = \frac{-3+2}{36}$$

$v_1 = -36''$
Now for point B_1B_2
$u = -30''$ and $f = -12''$
So from mirror formula

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

$$\frac{1}{v_2} = \frac{1}{f} - \frac{1}{u}$$

$$= \frac{-1}{12} - \left(-\frac{1}{30}\right) = \frac{-30+12}{360}$$

$$\frac{1}{v_2} = \frac{-18}{360} \quad \Rightarrow \quad v_2 = -20''.$$

Image of C_1C_2 will be at $-24''$
for point A_1A_2

$$h_2 = -\frac{v}{u}h_1 = -\frac{-36}{-18}\times 3 = -6''.$$

And for point B_1B_2

$$h_2 = \frac{v}{u}h_1 = \frac{-20}{-30}\times 3 = -2''.$$

So for point C_1C_2

$$h_2 = \left(\frac{6-2}{36-20}\right)(24-20)+2 = \frac{4\times 4}{16}+2$$

$h_2 = 3''$.

38

(A) $\frac{\lambda}{4} = L + e$

$\frac{\lambda}{4} = L + 0.3 \times D$

$\therefore \frac{\lambda}{4} = L + 0.015$ D = 0.05 m

$\frac{v}{4f} = L + 0.015$

$\frac{1}{f} = \frac{4}{v}[L + 0.015]$

$T = \frac{4}{v}[L + 0.015]$

(i) X-axis $\rightarrow$ L

(ii) Y-axis $\rightarrow$ T

$y = \frac{4}{v}[x + 0.015]$

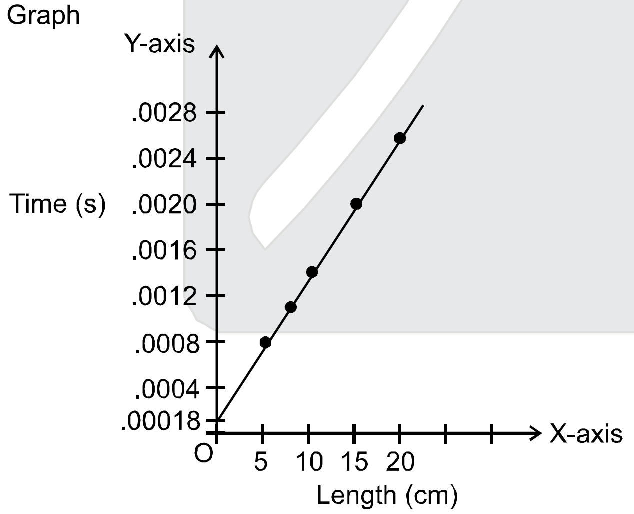
or y = mx + c

where $m = \frac{4}{v}$ & $c = \frac{0.06}{v}$

(B)

L(cm) X – axis	19.9	16	10	7.5	5.1
T(s)	0.0025	.002	.00133	.001	0.0008

(C) Graph



(D) From graph C = 0.00018

$\therefore$ $0.00018 = \frac{0.06}{v} \Rightarrow v = 333$ m/s