

## विज्ञान तथा प्रौद्योगिकी (Science and Technology)

### A. भौतिक विज्ञान (Physics)

#### 1. बल (Force)

(a) पिण्ड =  $\frac{\text{तौल}}{\text{गुरुत्व प्रवेग}}$  i.e.  $m = \frac{w}{g}$  (Mass =  $\frac{\text{Weight}}{\text{Acceleration due to gravity}}$  i.e.  $m = \frac{w}{g}$ )

(b) गुरुत्व र गुरुत्वाकर्षण बल (Gravity and Gravitational force):

(i) गुरुत्वाकर्षण बल ( $F$ ) =  $\frac{G.m_1.m_2}{d^2}$  जहाँ,  $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

Gravitational force ( $F$ ) =  $\frac{G.m_1.m_2}{d^2}$  where,  $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

(ii) गुरुत्वाकर्षण अचर राशि ( $G$ ) =  $\frac{F \times d^2}{m_1.m_2}$  [Gravitational Constant ( $G$ ) =  $\frac{F \times d^2}{m_1.m_2}$ ]

(iii) सतहमा गुरुत्व प्रवेग ( $g$ ) =  $\frac{GM}{R^2}$  [Acceleration due to gravity in surface ( $g$ ) =  $\frac{GM}{R^2}$ ]

(iv) उचाइमा गुरुत्व प्रवेग ( $g$ ) =  $\frac{GM}{(R+h)^2}$  [Acceleration due to gravity in altitude ( $g$ ) =  $\frac{GM}{(R+h)^2}$ ]

(v) गुरुत्व क्षेत्रको तीव्रता ( $I$ ) =  $\frac{GM}{R^2}$  [Gravitational field intensity ( $I$ ) =  $\frac{GM}{R^2}$ ]

(vi) उचाइमा गुरुत्व क्षेत्रको तीव्रता ( $I$ ) =  $\frac{GM}{(R+h)^2}$  [Gravitational field intensity in altitude ( $I$ ) =  $\frac{GM}{(R+h)^2}$ ]

(vii) तौल ( $W$ ) = पिण्ड ( $m$ ) × गुरुत्व क्षेत्रको तीव्रता ( $I$ ) [Weight ( $W$ ) = Mass ( $m$ ) × Gravitational field intensity ( $I$ )]

(viii)  $g' = g \left( \frac{R}{R+h} \right)^2$  जहाँ,  $g'$  = ग्रहको सतहबाट  $h$  उचाइमा गुरुत्व प्रवेग (value of acceleration due to gravity at 'h' height from surface of a planet)

$g$  = गुरुत्व प्रवेग (acceleration due to gravity),  $R$  = अर्धव्यास (Radius),  $h$  = ग्रहको सतहबाट उचाइ (height from surface of the planet)

#### 2. चाप (Pressure)

(i) चाप =  $\frac{\text{बल}}{\text{क्षेत्रफल}}$  i.e.  $P = \frac{F}{A}$  Pressure =  $\frac{\text{Force}}{\text{Area}}$  i.e.  $P = \frac{F}{A}$

(ii) चाप ( $P$ ) =  $hdg$  जहाँ,  $h$  = गहिराइ,  $d$  = घनत्व,  $g$  = गुरुत्व प्रवेग

Pressure ( $P$ ) =  $hdg$ , where,  $h$  = depth,  $d$  = density,  $g$  = acceleration due to gravity

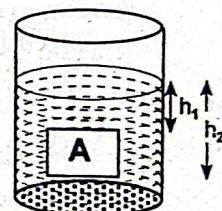
(iii) उच्चवर्चाप ( $U$ ) =  $Adg (h_2 - h_1) = Vdg$  [Up thrust ( $U$ ) =  $Adg (h_2 - h_1) = Vdg$ ]

जहाँ,  $A$  = क्षेत्रफल,  $d$  = घनत्व,  $g$  = गुरुत्व प्रवेग (Where,  $A$  = Area,  $d$  = density,  $g$  = Acceleration due to gravity)

$h_2$  = सतहदेखि तल्लो सतहसम्मको गहिराइ ( $h_2$  = Depth from surface to lower level)

$h_1$  = सतहदेखि माथिल्लो सतह सम्मको गहिराइ ( $h_1$  = depth from surface to upper level)

$V$  = विस्थापित तरल पदार्थको आयतन (volume of the liquid displaced)



(iv) हाईड्रोलिक प्रेसको सिद्धान्त:  $P_1 = P_2$  i.e.  $\frac{F_1}{A_1} = \frac{A_1}{A_2}$  (Principle of hydraulic press:  $P_1 = P_2$  i.e.  $\frac{F_1}{A_1} = \frac{A_1}{A_2}$ )

(v) घनत्व =  $\frac{\text{पिण्ड}}{\text{आयतन}}$  i.e.  $d = \frac{m}{V}$  (Density =  $\frac{\text{mass}}{\text{volume}}$  i.e.  $d = \frac{m}{V}$ )

(vi) सापेक्षित घनत्व (Relative density) =  $\frac{\text{पदार्थको निश्चित आयतनको पिण्ड}}{4^\circ\text{C} \text{ को त्यति नै आयतन पानीको पिण्ड}}$  (mass of any volume of the substance) (mass of an equal volume of water at 4 °C)

#### 3. प्रकाश (Light)

(i) विस्तृति =  $\frac{\text{आकृतिको उचाइ}}{\text{वस्तुको उचाइ}}$  i.e.  $m = \frac{I}{O}$  (Magnification =  $\frac{\text{Height of image}}{\text{Height of object}}$  i.e.  $m = \frac{I}{O}$ )

विस्तृति =  $\frac{\text{आकृतिको दूरी}}{\text{वस्तुको दूरी}}$  i.e.  $m = \frac{v}{u}$  (Magnification =  $\frac{\text{Image distance}}{\text{Object distance}}$  i.e.  $m = \frac{v}{u}$ )

यौगिक (Compound)	अणु सूत्र (Molecular Formulae)	कन्डेन्टड सूत्र (Condensed Formulae)	संरचनात्मक सूत्र (Structural Formulae)
मिथेन (Methane)	CH <sub>4</sub>	CH <sub>4</sub>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}$
इथेन (Ethane)	C <sub>2</sub> H <sub>6</sub>	H <sub>3</sub> CCH <sub>3</sub>	$\begin{array}{cc} \text{H} & \text{H} \\   &   \\ \text{H}-\text{C} & -\text{C}-\text{H} \\   &   \\ \text{H} & \text{H} \end{array}$
प्रोपेन (Propane)	C <sub>3</sub> H <sub>8</sub>	H <sub>3</sub> CCH <sub>2</sub> CH <sub>3</sub>	$\begin{array}{ccc} \text{H} & \text{H} & \text{H} \\   &   &   \\ \text{H}-\text{C} & -\text{C}-\text{C} & -\text{H} \\   &   &   \\ \text{H} & \text{H} & \text{H} \end{array}$
ब्युटेन (Butane)	C <sub>4</sub> H <sub>10</sub>	H <sub>3</sub> C(CH <sub>2</sub> ) <sub>2</sub> CH <sub>3</sub>	$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\   &   &   &   \\ \text{H}-\text{C} & -\text{C}-\text{C} & -\text{C}-\text{H} \\   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$
पेन्टेन (Pentane)	C <sub>5</sub> H <sub>12</sub>	H <sub>3</sub> C(CH <sub>2</sub> ) <sub>3</sub> CH <sub>3</sub>	$\begin{array}{ccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\   &   &   &   &   \\ \text{H}-\text{C} & -\text{C}-\text{C} & -\text{C}-\text{C}-\text{H} \\   &   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$
इथिन (Ethene)	C <sub>2</sub> H <sub>4</sub>	H <sub>2</sub> C = CH <sub>2</sub>	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{C} = \text{C} \\   &   \\ \text{H} & \text{H} \end{array}$
प्रोपिन (Propene)	C <sub>3</sub> H <sub>6</sub>	H <sub>3</sub> C – CH = CH <sub>2</sub>	$\begin{array}{ccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\   &   &   &   &   \\ \text{H} & -\text{C} & -\text{C} = \text{C} \\   & &   & &   \\ \text{H} & & \text{H} & & \text{H} \end{array}$
ब्युटिन (Butene)	C <sub>4</sub> H <sub>8</sub>	H <sub>3</sub> C – CH <sub>2</sub> – CH = CH <sub>2</sub>	$\begin{array}{ccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\   &   &   &   &   \\ \text{H} & -\text{C} & -\text{C} & -\text{C} = \text{C} \\   &   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$
इथाइन (Ethyne)	C <sub>2</sub> H <sub>2</sub>	HC ≡ CH	H – C ≡ C – H
प्रोपाइन (Propyne)	C <sub>3</sub> H <sub>4</sub>	H <sub>3</sub> C – C ≡ CH	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C} & -\text{C} \equiv \text{C}-\text{H} \\   \\ \text{H} \end{array}$
ब्युटाइन (Butyne)	C <sub>4</sub> H <sub>6</sub>	H <sub>3</sub> C – CH <sub>2</sub> – C ≡ CH	$\begin{array}{ccccc} \text{H} & \text{H} & & & \\   &   & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} \equiv \text{C}-\text{H} \\   &   &   & & \\ \text{H} & \text{H} & \text{H} & & \end{array}$

(ii) लेन्सको सामर्थ्य =  $\frac{1}{\text{केन्द्रीकरण दूरी (मिटरमा)}}$  i.e.  $p = \frac{1}{f}$  (Power of lens =  $\frac{1}{\text{Focal length (in meter)}}$ ) i.e.  $p = \frac{1}{f}$

$$(iii) \frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

जहाँ,  $f$  = केन्द्रीकरण दूरी,  $u$  = वस्तुको दूरी,  $v$  = आकृतिको दूरी

Where,  $f$  = focal length,  $u$  = object distance,  $v$  = image distance

#### 4. ताप (Heat)

##### (a) ताप समीकरणहरू (Heat equations)

$$(i) Q = msdt$$

जहाँ,  $dt = (t_2 - t_1)$ ,  $Q$  = लिएको वा छोडेको ताप शक्ति,  $s$  = विशिष्ट ताप धारण शक्ति,  $m$  = पिण्ड र  $dt$  = तापक्रम परिवर्तन  
Where,  $Q$  = Heat lost or gained,  $s$  = Specific heat capacity,  $m$  = mass,  $dt$  = difference in temperature

$$(ii) \text{लिएको ताप} = \text{छोडेको ताप} (\text{Heat gained} = \text{Heat lost}) : m_1 s_1 (x - t_1) = m_2 s_2 (t_2 - x)$$

$$(iii) \text{अन्तिम तापक्रम} (\text{Final temperature}) = \frac{m_1 s_1 t_1 + m_2 s_2 t_2}{m_1 s_1 + m_2 s_2}$$

(यदि दुई ओटा फरक फरक पदार्थहरू जस्तै: पानी र अल्कोहल, फलाम र पानी आदि एकै ठाउँमा मिसाउँदा मिश्रणको तापक्रम पत्ता लगाउन प्रयोग गर्ने)

(If two different substances are mixed together, final temperature of the mixture can be found by this formula)

$$(b) \text{तापक्रमको मान एक स्केलबाट अर्को स्केलमा बदलन: } \frac{C - 0}{100} = \frac{F - 32}{180} = \frac{K - 273}{100}$$

$$\text{To convert the value of temperature from one scale to another: } \frac{C - 0}{100} = \frac{F - 32}{180} = \frac{K - 273}{100}$$

#### 5. धारा विद्युत र चुम्बकत्व (Current Electricity and Magnetism)

$$(a) \text{विद्युत खपत} = \text{सामर्थ्य (P)} \times \text{समय (t)} (\text{Electricity consumption} = \text{power (P)} \times \text{time (t)})$$

$$(b) \text{इलेक्ट्रोमोटिभ फोर्स (e.m.f.)} = I(R + r); \quad \text{जहाँ, } r \rightarrow \text{आन्तरिक अवरोध}$$

Electromotive force (E.m.f.) =  $I (R + r)$ ; Where  $r \rightarrow$  Internal resistance of cell

$$(c) V = IR \text{ जहाँ, } V = \text{पोटेन्शियल फरक (Potential difference)}, I = \text{विद्युतधारा (Current)} \text{ र } R = \text{अवरोध (Resistance)}$$

$$(d) \text{ट्रान्सफर्मर (Transformer)} : \frac{n_1}{n_2} = \frac{V_1}{V_2}$$

जहाँ,  $n_1$  = प्राइमरी फन्का (no. of turns in primary coil)

$V_1$  = प्राइमरी भोल्टेज (Primary voltage)

$n_2$  = सेकेन्डरी फन्का (no. of turns in secondary coil)

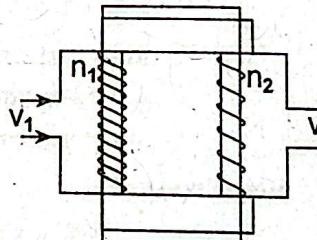
$V_2$  = सेकेन्डरी भोल्टेज (Secondary voltage)

$$(e) Q = I \times t$$

$$(f) P = I^2 R$$

$$(g) P = \frac{V^2}{R}$$

$$(h) P = I \times V$$



#### B. रसायन विज्ञान (Chemistry)

##### कार्बन र यसका यौगिकहरू (Carbon and its compounds)

###### (a) संतृप्त हाईड्रोकार्बन (Saturated hydrocarbon):

$$(i) \text{अल्केन (अन्तमा 'एन' आउने र एउटा मात्र बन्ड हुने यौगिकहरू)} : C_n H_{2n+2}$$

Alkane (ane' at last and single bond):  $C_n H_{2n+2}$

जहाँ,  $C$  = कार्बन,  $H$  = हाईड्रोजन,  $n$  = संख्या (Where, C = Carbon, H = Hydrogen, n = number)

###### (b) असंतृप्त हाईड्रोकार्बन (Unsaturated hydrocarbon):

$$(i) \text{अल्कीन (अन्तमा 'इन' आउने र दुईवटा बन्ड हुने यौगिकहरू (Alkene ('ene' at last and double bond)) : } C_n H_{2n}$$

$$(ii) \text{अल्काईन (अन्तमा 'आईन' आउने र तीनओटा बन्ड हुने यौगिकहरू) (Alkyne ('yne' at last and triple bond)) : } C_n H_{2n-2}$$

$$(c) \text{अल्कोहल (Alcohol): } C_n H_{2n+1} OH$$

$$(d) \text{अल्काईल इथर (Alkyl ether): } C_n H_{2n+1} O C_n H_{2n+1}$$

यौगिक (Compound)	अणु सूत्र (Molecular Formulae)	संरचनात्मक सूत्र (Structural Formulae)
मिथाइल अल्कोहल (Methyl Alcohol)	$\text{CH}_3\text{OH}$	$  \begin{array}{c}  \text{H} \\    \\  \text{H} - \text{C} - \text{OH} \\    \\  \text{H}  \end{array}  $
इथाइल अल्कोहल (Ethyl alcohol)	$\text{C}_2\text{H}_5\text{OH}$	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H} - \text{C} - \text{C} - \text{OH} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $
ग्लिसरोल (Glycerol)	$\text{C}_2\text{H}_5(\text{OH})_3$	$  \begin{array}{c}  \text{OH} \quad \text{OH} \quad \text{OH} \\    \quad   \quad   \\  \text{H} - \text{C} - \text{C} - \text{C} - \text{H} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $
ग्लूकोज (Glucose)	$\text{C}_6\text{H}_{12}\text{O}_6$	$  \begin{array}{c}  \text{H} - \text{C} = \text{O} \\    \\  \text{H} - \text{C} - \text{OH} \\    \\  \text{OH} - \text{C} - \text{H} \\    \\  \text{H} - \text{C} - \text{OH} \\    \\  \text{H} - \text{C} - \text{OH} \\    \\  \text{CH}_2\text{OH}  \end{array}  $

S. No.

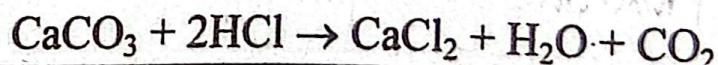
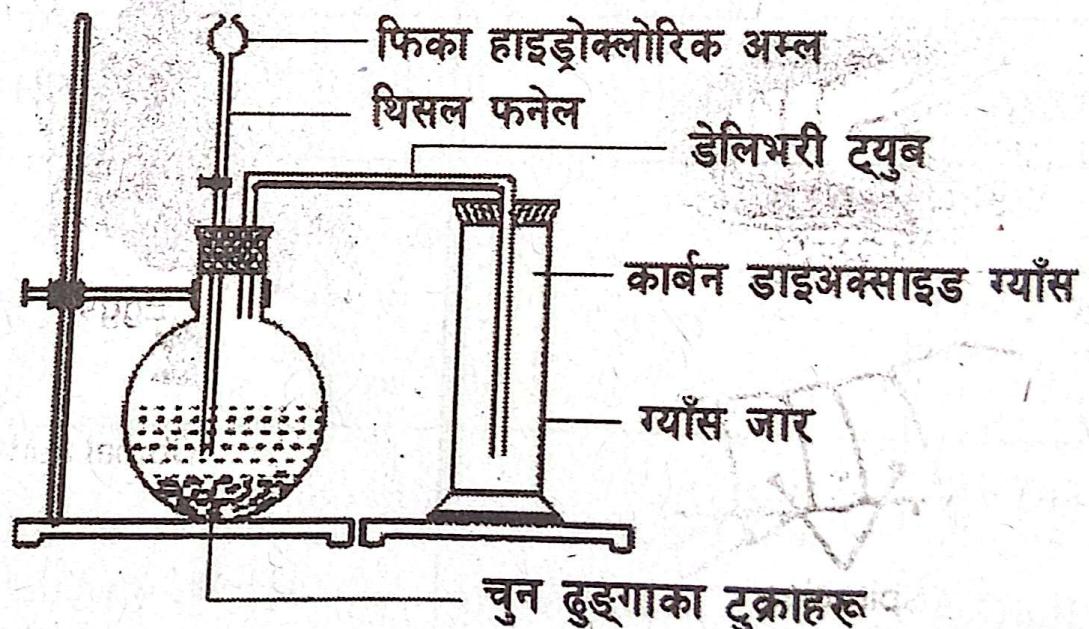
ग्यांस (Gas)

1.

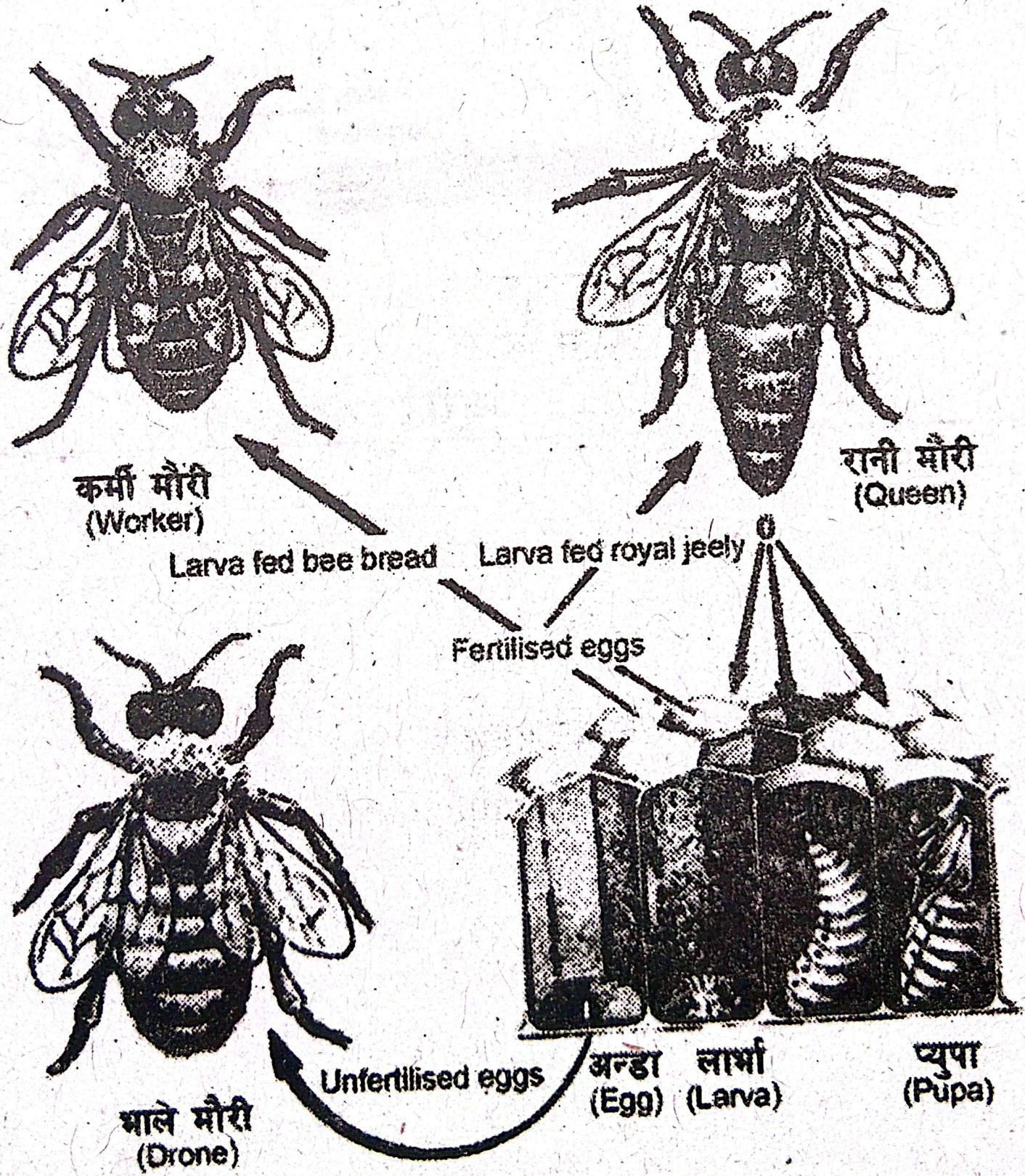
कार्बन डाइऑक्साइड  
(Carbon dioxide)

$\text{CO}_2$

प्रयोगशालामा बनाउने चित्र र समीकरण  
Lab. Preparation figure with equation)



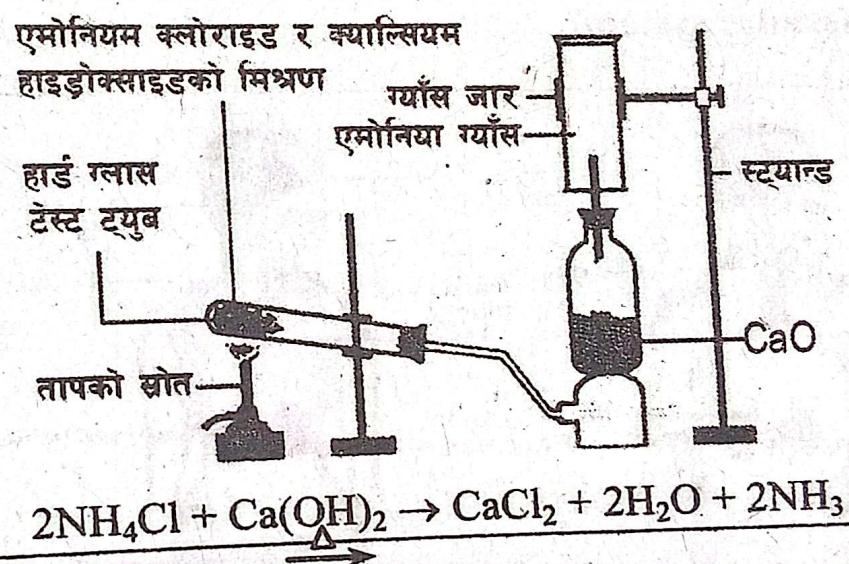
## मौरीका जीवन चक्र (Life cycle of bee)

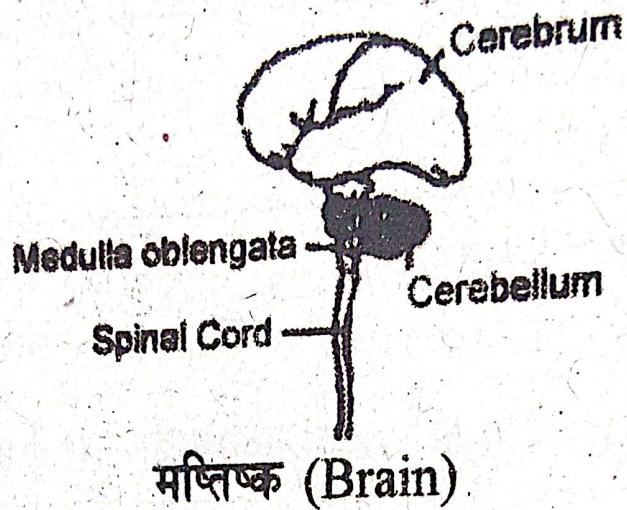


मौरीको जीवन चक्र (Life cycle of bee)

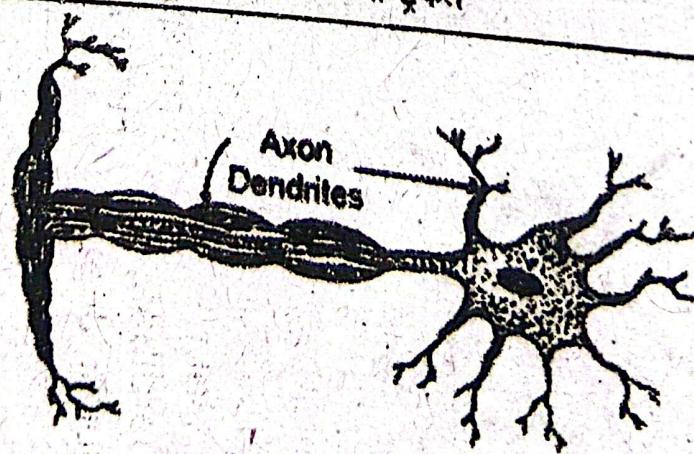
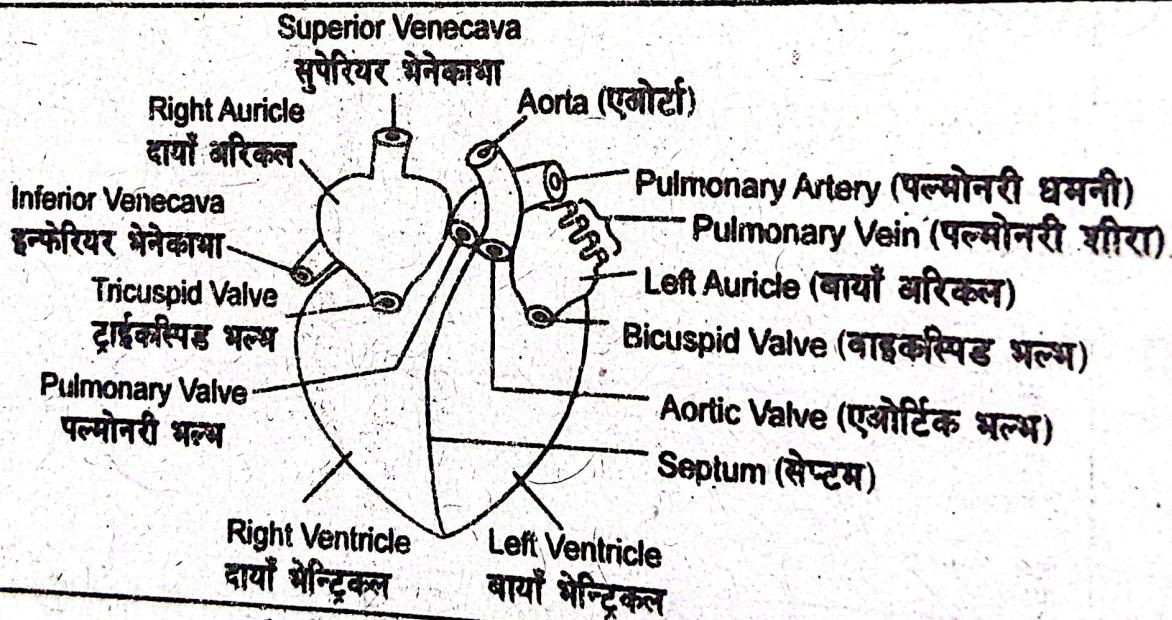
2.

एमोनिया  
(Ammonia)  
 $\text{NH}_3$

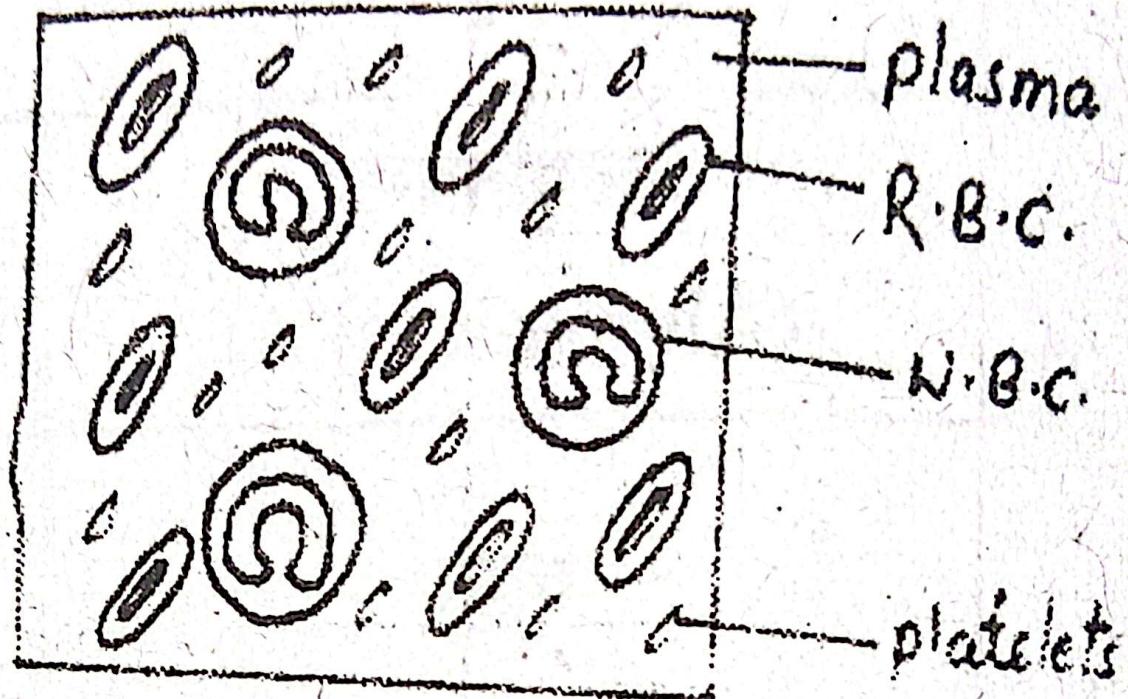




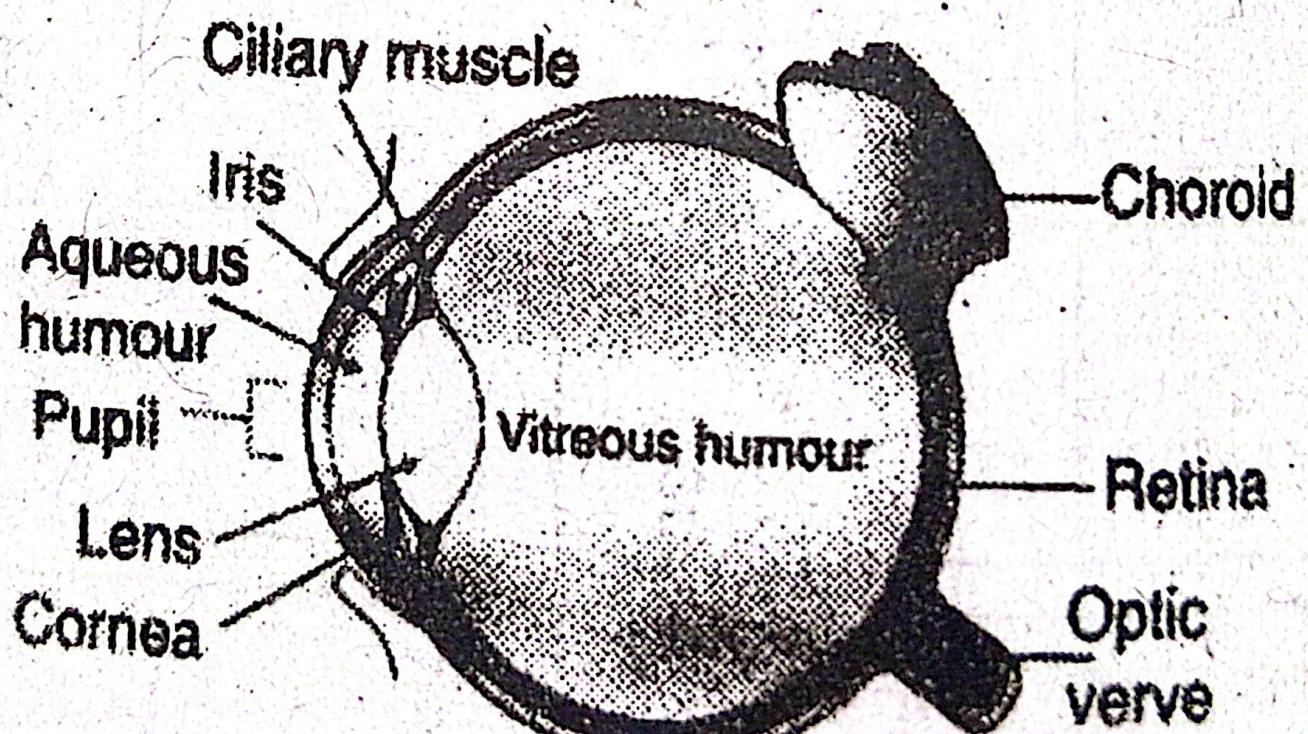
मस्तिष्क (Brain)



न्यूरोन (Neuron)



रगत (Blood)



आँखा (Eye)

S.N.	Derived quantity	Related formulae	Symbol of unit name	Derived units	Fundamental unit involved
1.	Area (A)	length×breath ( $l \times b$ )	square metre	$m^2$	$m \times m$
2.	Volume (V)	length × breadth × height ( $l \times b \times h$ )	cubic metre	$m^3$	$m \times m \times m$
3.	Velocity (v)	displacement/time ( $\frac{s}{t}$ )	metre per second	$ms^{-1}$	$m/s$
4.	Acceleration (a)	change in velocity/time ( $\frac{v-u}{t}$ )	metre per square second	$ms^{-2}$	$m/(s \times s)$
5.	Force (F)	mass × acceleration ( $m \times a$ )	kilogram × metre per square second or newton	N	$kg \times m/(s \times s)$
6.	Density ( $\rho$ or d)	mass/volume ( $\frac{m}{v}$ )	kilogram per cubic metre	$kg/m^3$ or $kgm^{-3}$	$kg/(m \times m \times m)$
7.	Pressure (P)	force/area ( $\frac{F}{A}$ )	Newton per square metre or pascal	Pa or $Nm^{-2}$	$kg/(m \times s \times s)$
8.	Momentum (p)	mass × velocity ( $m \times v$ )	kilogram × metre per second	$kg \ ms^{-1}$	$kg \times m/s$
9.	Work and Energy (W/E)	force × displacement ( $F \times s$ )	newton × metre or joule	Nm or J	$(kg \times m \times m)/(s \times s)$
10.	Power (P)	work done/time ( $\frac{w}{t}$ )	Joile per second or watt	$ms^{-1}$ or W	$(kg \times m \times m)/(s \times s \times s)$
11.	Frequency (f)	velocity/wavelength ( $\frac{v}{\lambda}$ )	1 / second or hertz	Hz	cycle/s or $s^{-1}$
12.	Potential difference (V)	work done/charge ( $\frac{w}{q}$ )	newton × metre / Columb (second × Ampere) or volt (J/C)	V	$(kg \times m \times m)/(s \times s \times s \times A)$
13.	Resistance (R)	potential difference/ current ( $\frac{V}{I}$ )	Newton × metre / columb × second × Ampere or ohm	$\Omega$	$(kg \times m \times m)/(s \times s \times s \times A \times A)$

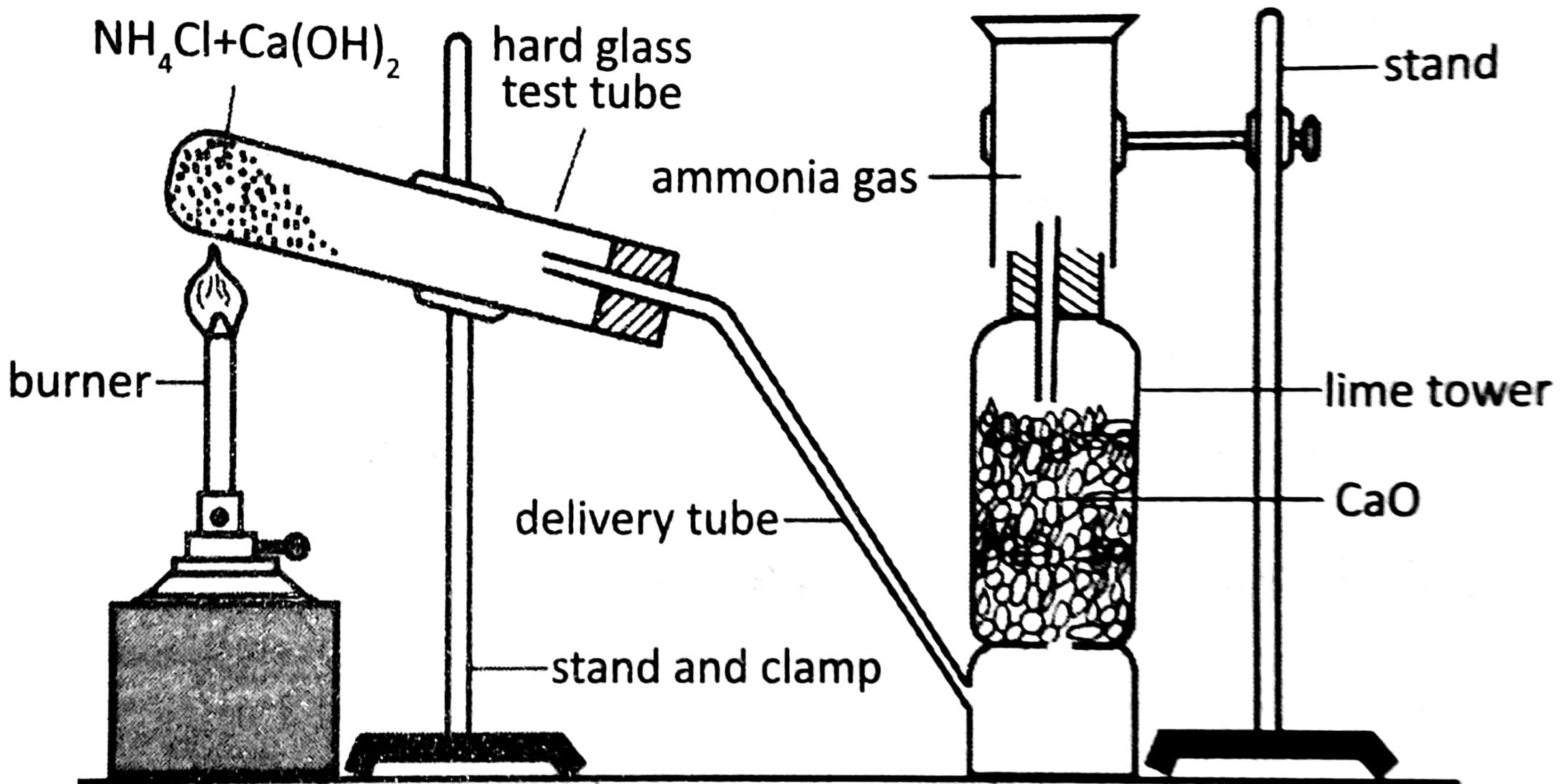


Fig: 16.6 laboratory preparation of ammonia gas

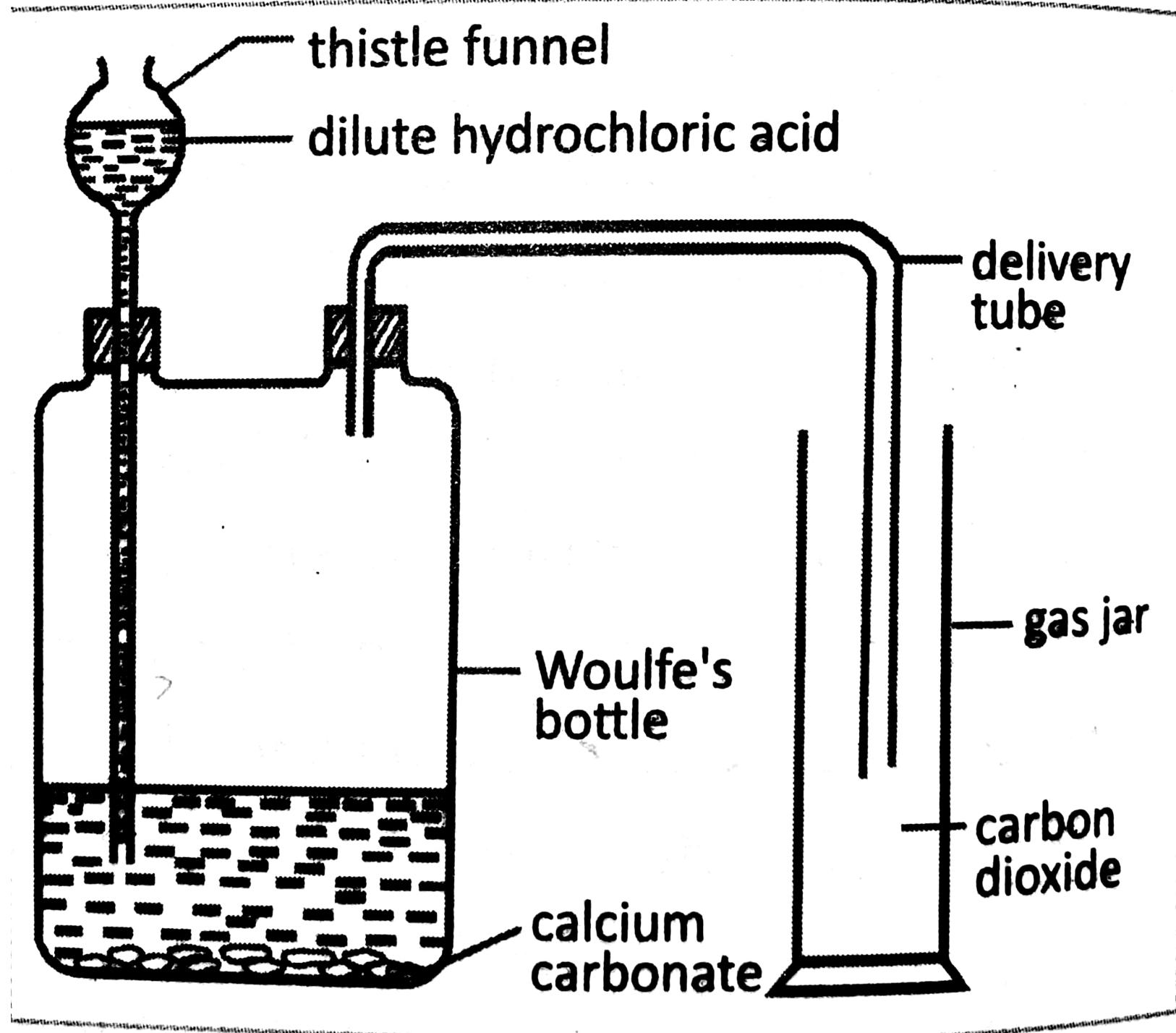


Fig. 16.2 laboratory preparation of CO<sub>2</sub> gas