

# Assignment -1

1. Define the term density of a substance.

Ans) Density of a substance is defined as mass per unit volume.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{m}{V}$$

2. Name the SI unit of density. How is it related to  $\text{g cm}^{-3}$ ?

Ans) SI unit of density is  $\text{kg m}^{-3}$  in C.G.S. System unit of mass is a g and unit of volume is  $\text{cm}^3$ , so C.G.S unit of density is  $\text{g cm}^{-3}$  (gram per cubic centimetre)

Relationship between SI and C.G.S units

$$1 \text{ kg m}^{-3} = \frac{1 \text{ kg}}{1 \text{ m}^3} = \frac{1000 \text{ g}}{(100 \text{ cm})^3} = \frac{1000 \text{ g}}{1000000 \text{ cm}^3} = \frac{1}{1000} \text{ g cm}^{-3}$$

Thus,

$$1 \text{ kg m}^{-3} = 10^{-3} \text{ g cm}^{-3}$$

OR

$$1 \text{ g cm}^{-3} = 1000 \text{ kg m}^{-3}$$



3. The density of brass is  $8.4 \text{ g cm}^{-3}$ .  
What do you mean by this statement?

Ans) This statement means one cubic centimetre volume of brass has mass of  $8.4 \text{ g}$ .

4. Arrange the following substances in order of their ~~an~~ increasing density:

Iron, Cork, Brass, Water, Mercury

Ans) Cork, Water, Iron, Brass, Mercury

5. How does the density of liquid (or gas) vary with temperature?

Ans) As the temperature increases, volume of most of the liquids also increases and the volume increases density decreases.

Similarly, when temperature decreases, the volume of most liquids decreases which increases the density.

However, water shows anomalous behaviour. Water has maximum volume at  $4^\circ \text{C}$  and maximum density at  $4^\circ \text{C}$ .



But when water is cooled down further its volume starts increasing and hence, the density of water ~~is maximum at 4-degree~~ decreases when cooled further below than 4-degree celsius.

Hence, the density of water is maximum at 4-degree celsius at  $1 \text{ g cm}^{-3}$  or  $1000 \text{ kg m}^{-3}$

6) A given quantity of a liquid is heated. Which of the following quantity will vary and how?  
(a) mass, (b) volume or (c) density

Ans) When a given quantity of liquid is heated

- (a) Mass - does not change
  - (b) Volume - changes and increases with a rise in temperature
  - (c) Density - changes and decreases
- $$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{m}{V}$$



7) Describe an experiment to determine the density of the material of a coin.

Ans) 
$$\text{Density} = \frac{\text{mass}}{\text{Volume}} = \frac{m}{V}$$

To find the density of the material of a coin, we need to find its mass by common beam balance and its volume by measuring cylinder.

To measure the mass of a coin

Let the mass of a coin shown by a beam balance =  $M$  (gram) = 50 gram

To measure the volume of coin

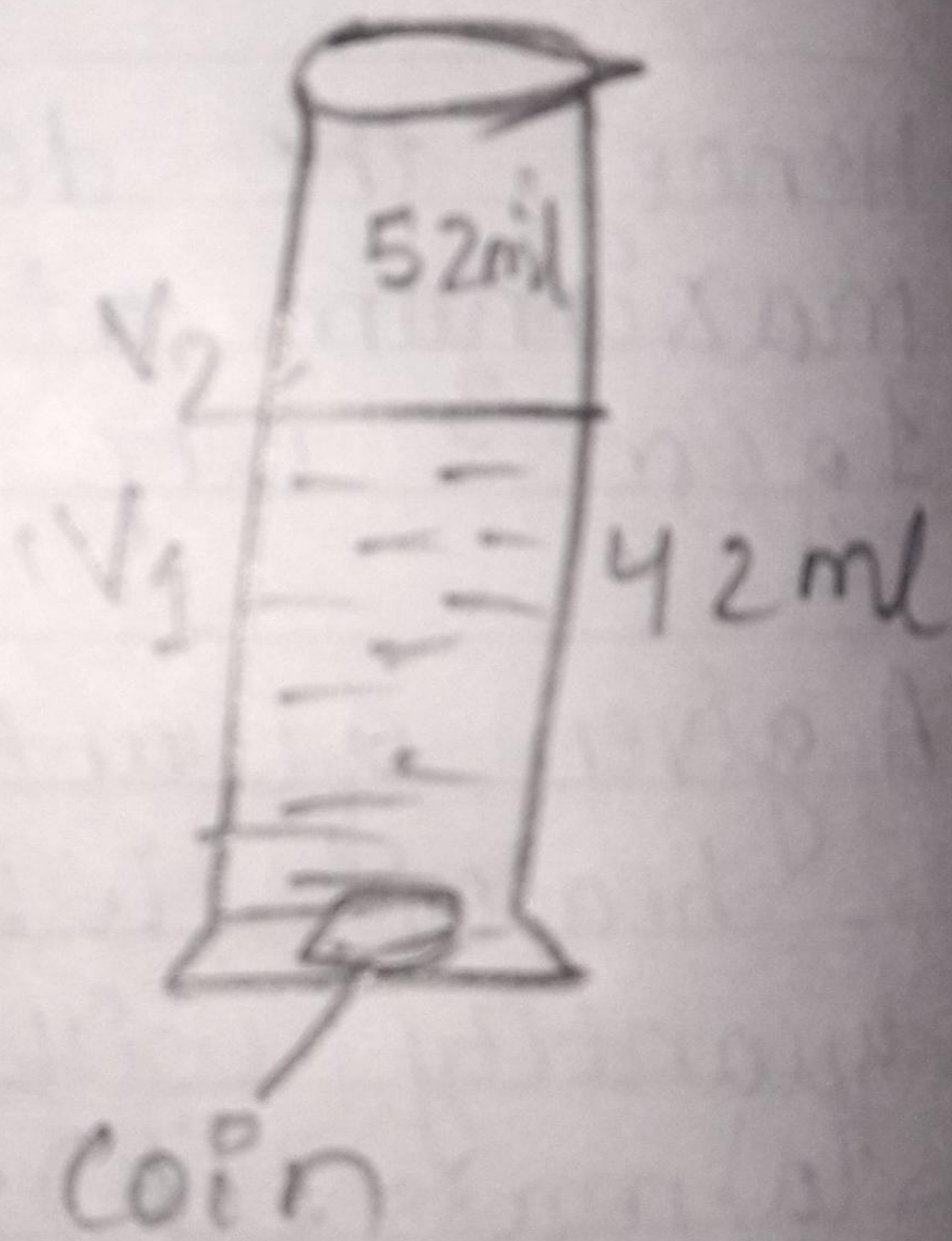
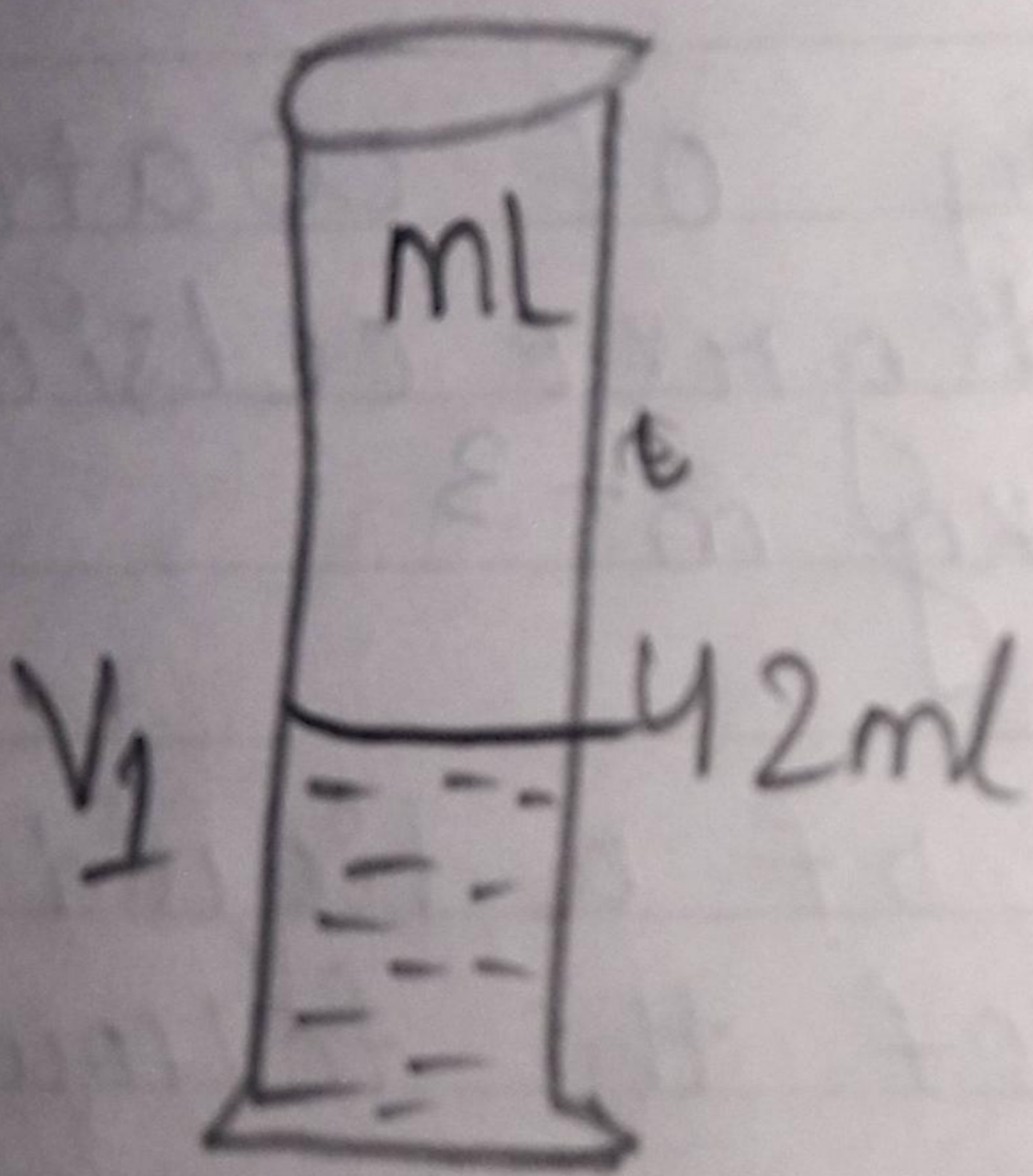
Initial volume of water =  $V_1 = 42 \text{ ml}$

final volume of water

When a coin is added in the cylinder =  $V_2 = 52 \text{ ml}$

Then volume of coin =  $V_2 - V_1$   
 $= 52 - 42$   
 $= 10 \text{ ml}$







8) Describe an experiment to determine the density of a liquid.

Ans) 
$$\text{Density} = \frac{\text{mass}}{\text{Volume}} = \frac{M}{V}$$

We need to find the volume of liquid i.e milk and mass of liquid

Experiment -

To find the mass of milk -  
weight of empty 100 c.c  
beaker =  $M_1 \text{ g} = 70 \text{ g}$

Fill the beaker with milk and  
weigh again =  $M_2 \text{ g} = 116 \text{ g}$

To find the volume of milk -  
Transfer this milk into  
measuring cylinder and note the  
volume  $V = 40 \text{ c.c}$

$$\therefore \text{Density of milk} = D = \frac{m}{V} = \frac{M_2 - M_1}{40 \text{ c.c}}$$

$$= \frac{116 - 70}{40} = \frac{46}{40} = \frac{4.6}{4} \quad \text{1.15 gm}$$

$$= 1.15 \text{ g cm}^3$$

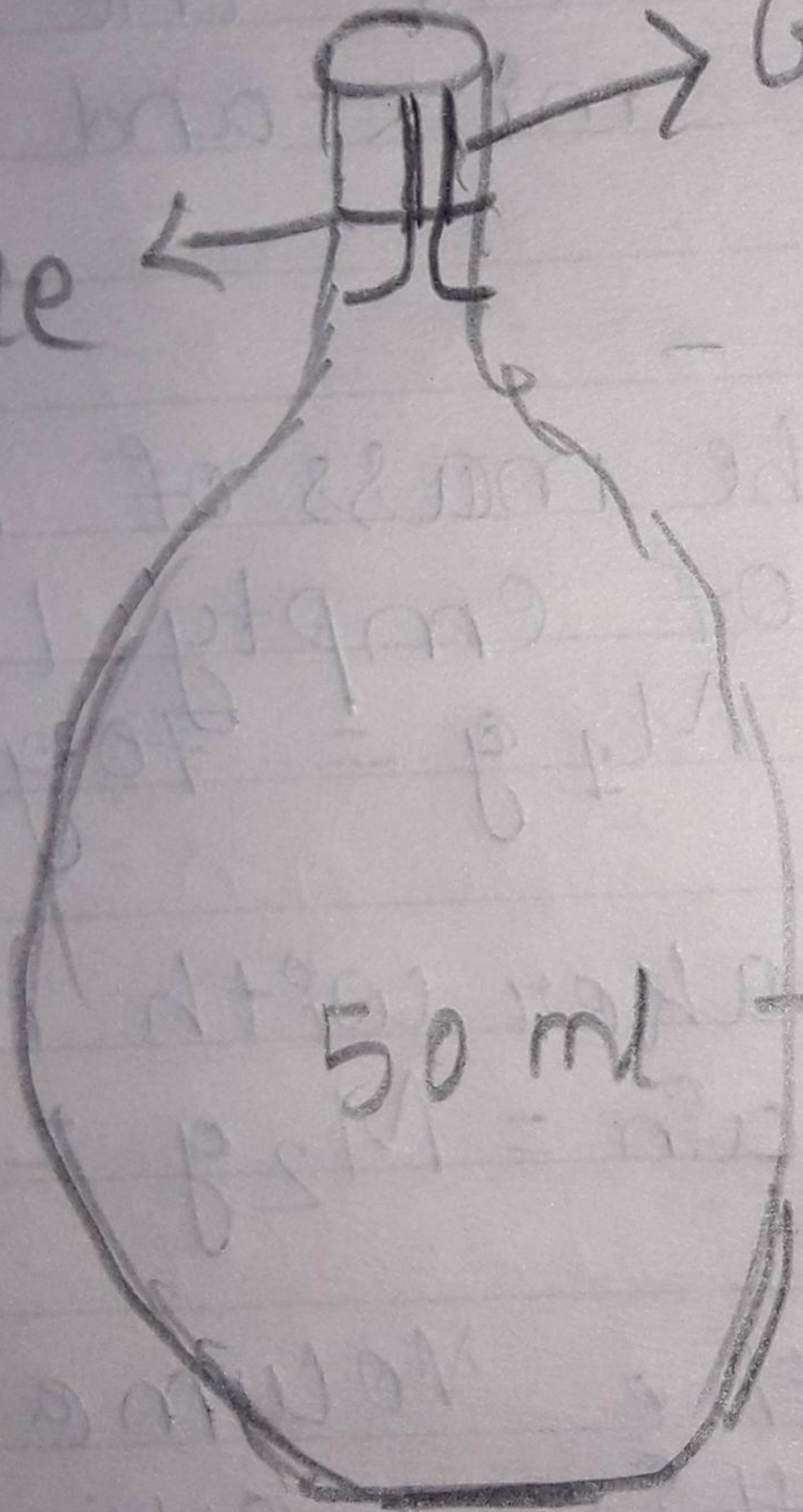


9) What is density bottle? How is it used to find the density of a liquid?

Ans) ~~A~~ Density bottle is a small glass bottle which has a glass stopper at its neck. The bottle can store a fixed volume of a liquid. Generally, the density bottle comes in two sizes, 25 ml or 50 ml. The glass stopper has a narrow hole in it. When the bottle is filled with liquid and a stopper is inserted, the excess liquid rises through the hole and drains out. Thus the bottle will contain the same volume of liquid each time when it is filled. It is used to determine the density of a liquid.



Hole → Glass stopper



Glass bottle

Density bottle