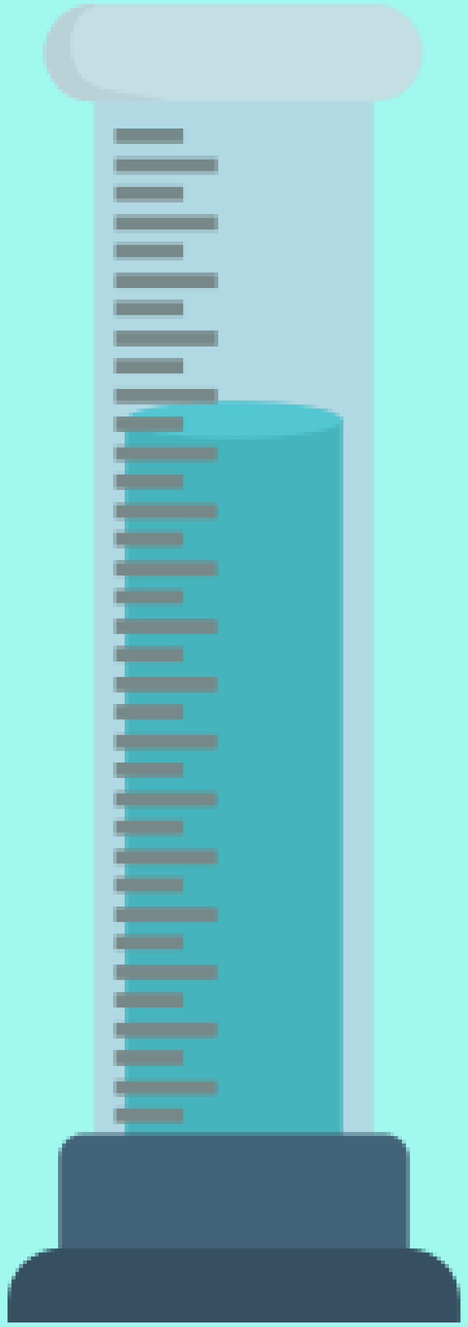
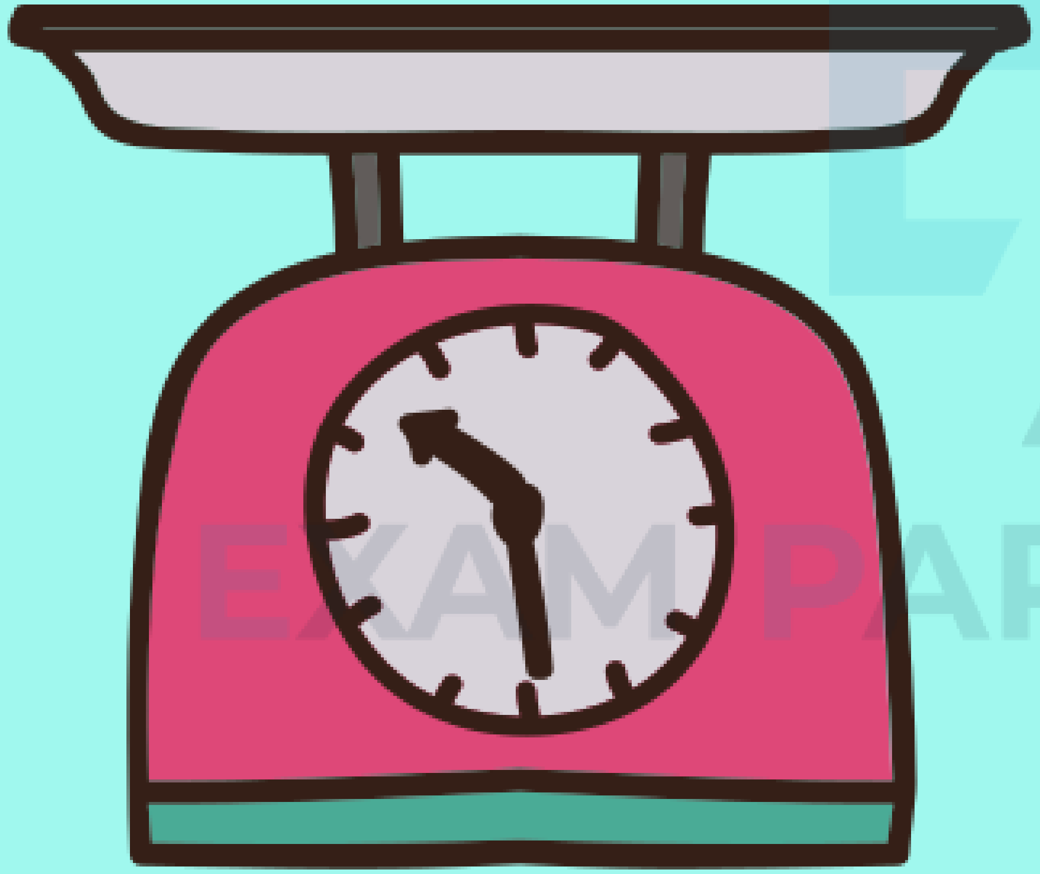
EXAM PAPERS PRACTICE



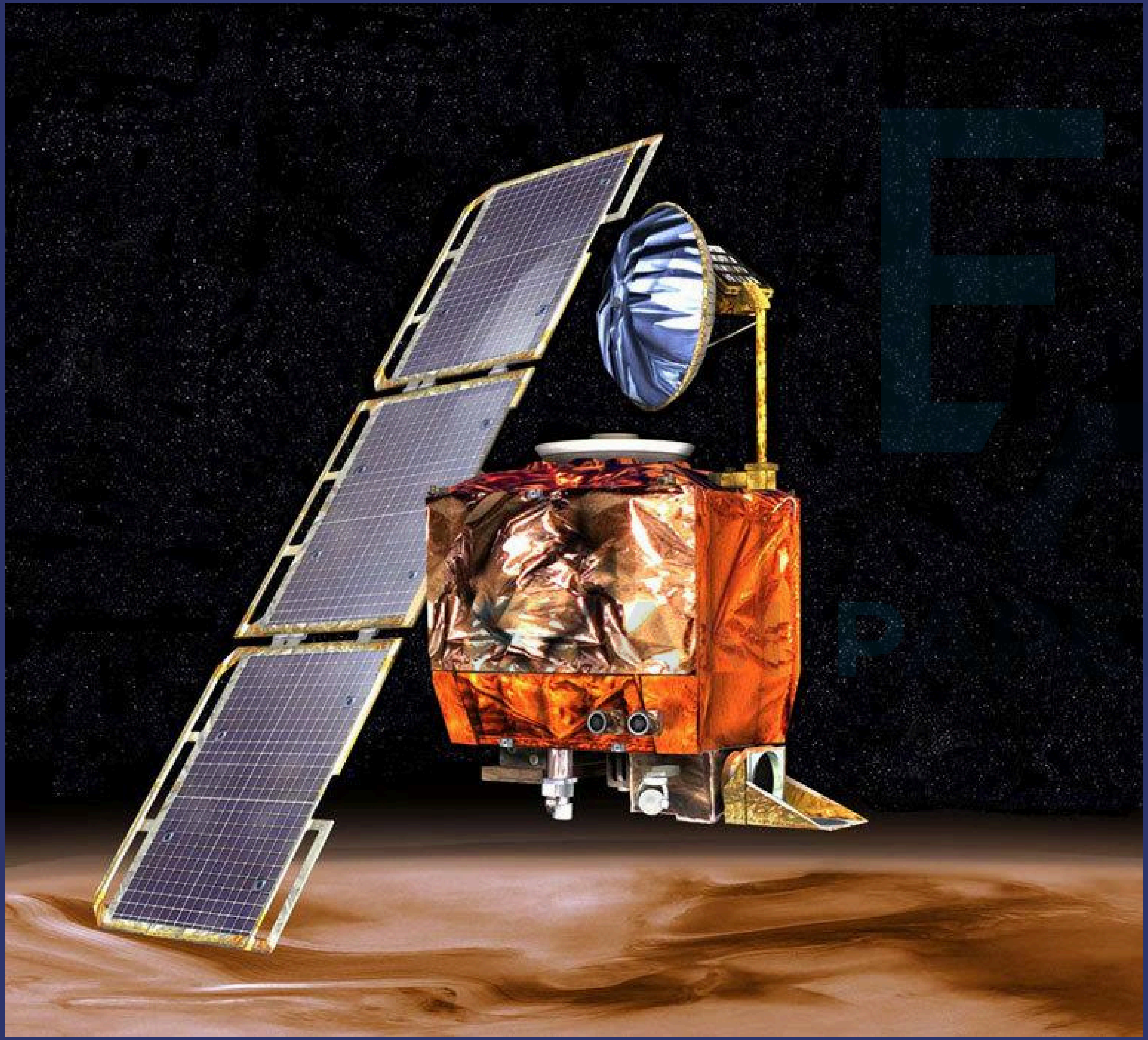


MAKING MEASUREMENTS

CHAPTER 1

CIE IGCSE PHYSICS for board 0625 and 0972
(For exam 2025+)

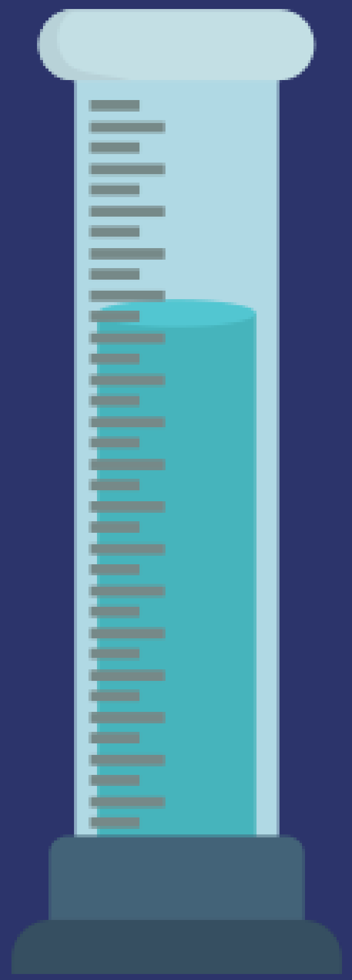
MARS CLIMATE ORBITER



Why did the mission fail?

A software error caused the spacecraft's navigation system to use imperial units (pounds-force-seconds, or lbf·s) instead of metric units (newton-seconds, or N·s) for a critical thruster firing that was supposed to adjust the spacecraft's trajectory as it approached Mars.

As a result of the unit mix-up, the thruster firing was significantly off-target, causing the spacecraft to enter the Martian atmosphere at the wrong angle and at a higher speed than planned. The spacecraft was destroyed as it burned up in the planet's atmosphere, with no scientific data collected.



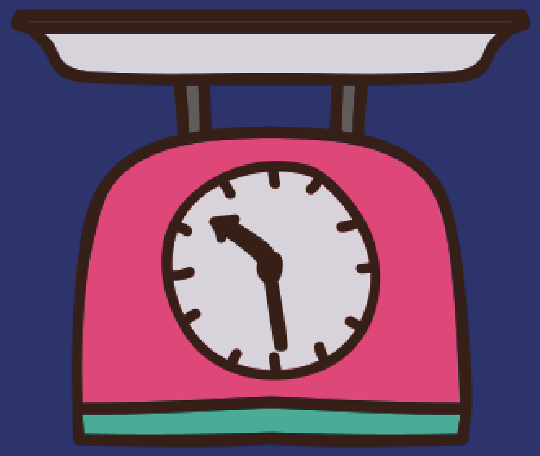
MEASUREMENT

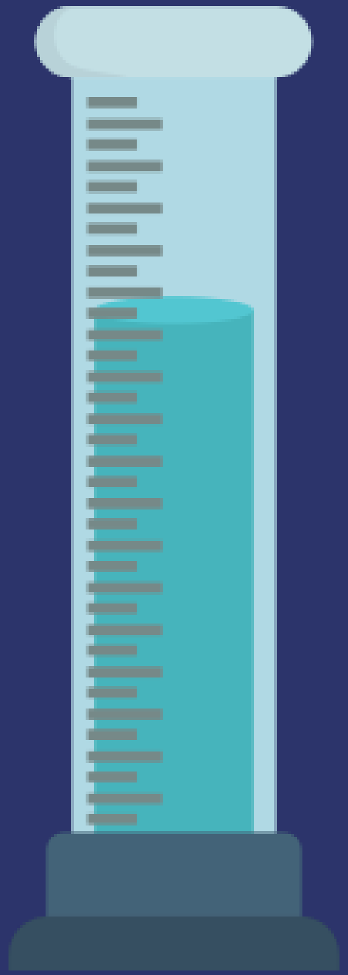
Length

Volume

Time

Density





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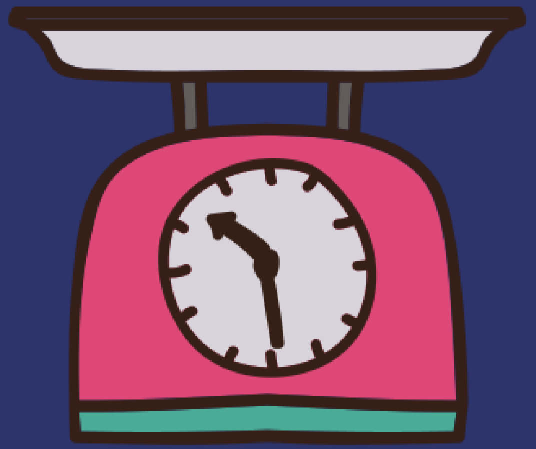
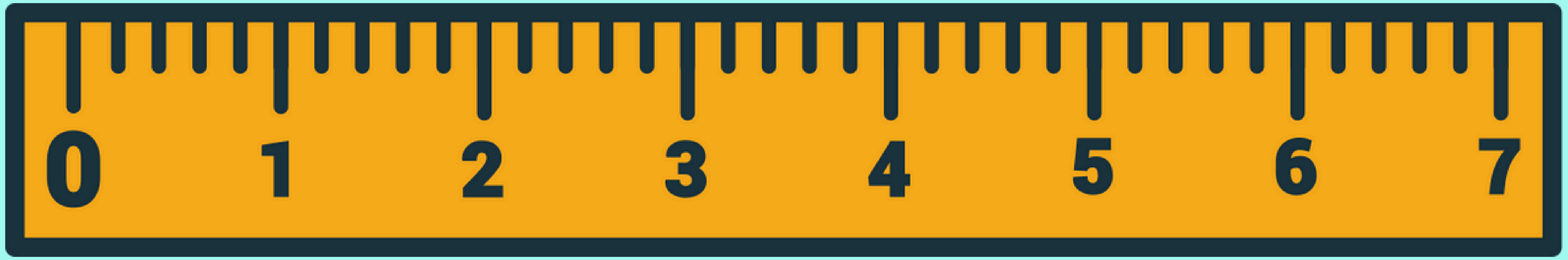


MEASURING LENGTH

EXAM PAPERS PRACTICE

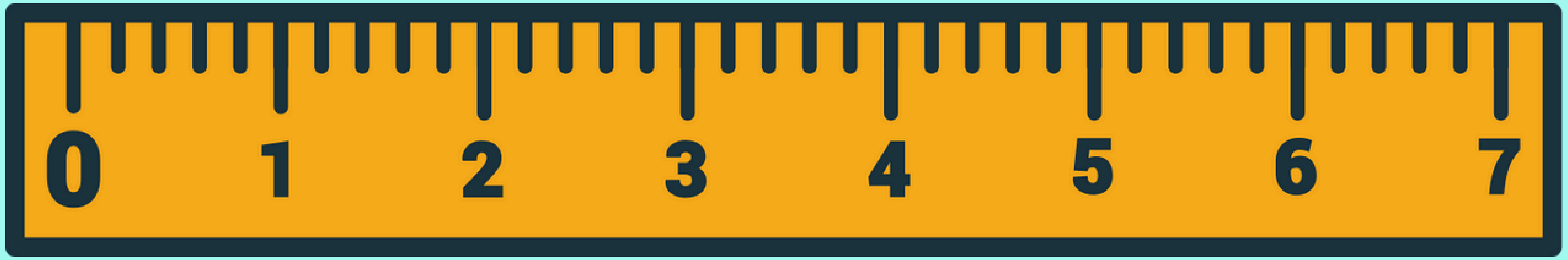
1. In the lab, a ruler is frequently used to measure lengths.
2. It is crucial to critically analyze your measurements, no matter how simple they may appear.



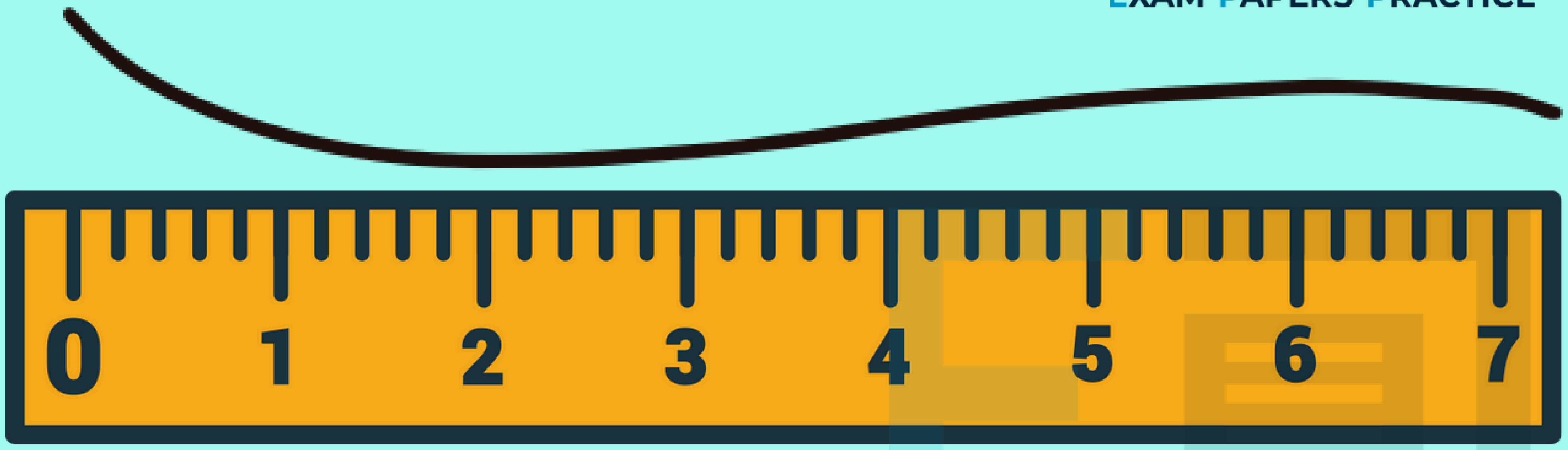
DISCUSSION

a. What are the ideas you have to measure the length of a wire?

b. What about measuring the thickness of one sheet of paper?



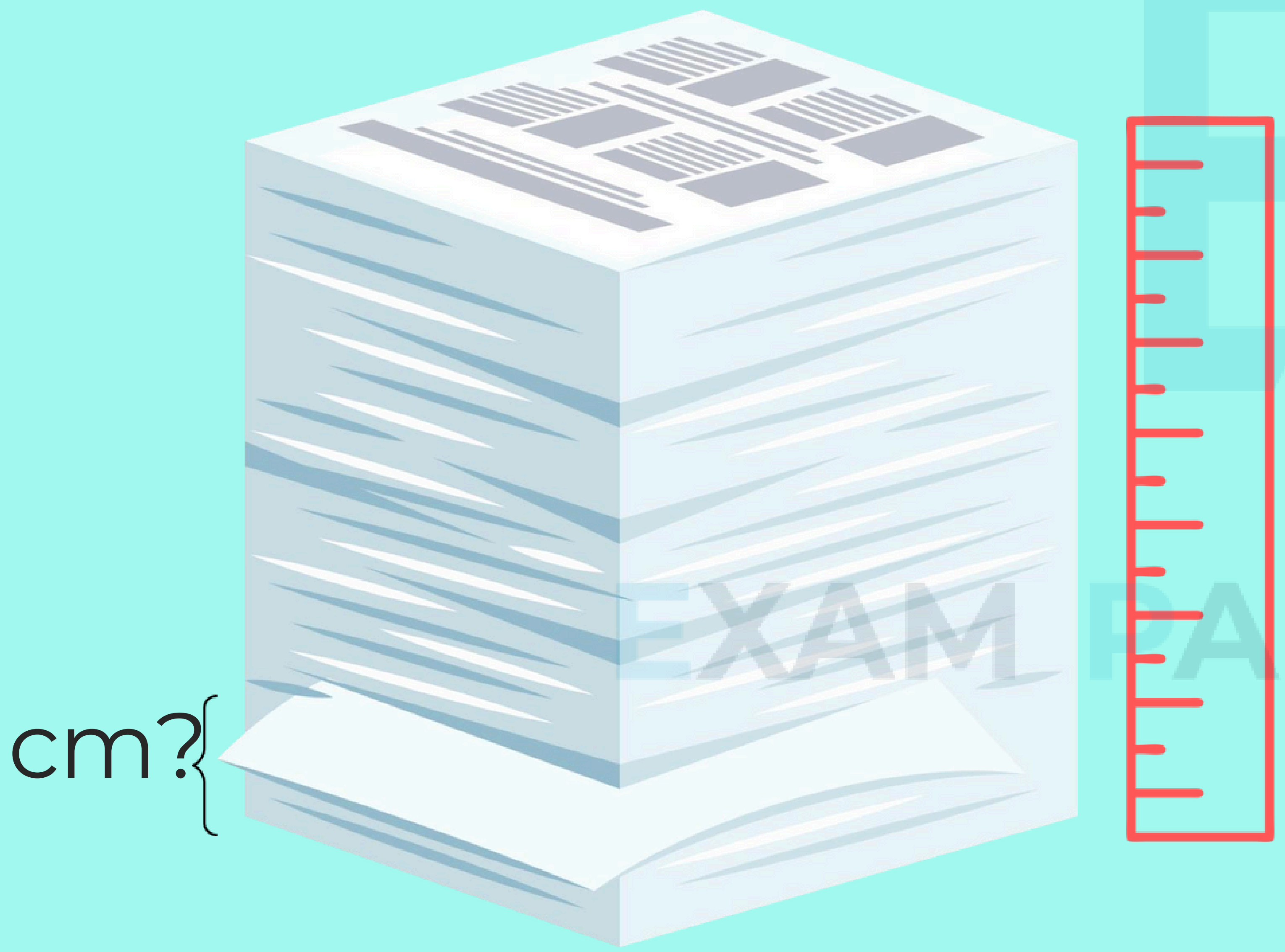
EXAMPLE 1: MEASURING THE LENGTH OF A PIECE OF WIRE



PRECAUTIONS

1. The wire needs to be straight.
2. The wire should align with the 0 mark on the scale.
3. The ruler must be accurately calibrated.

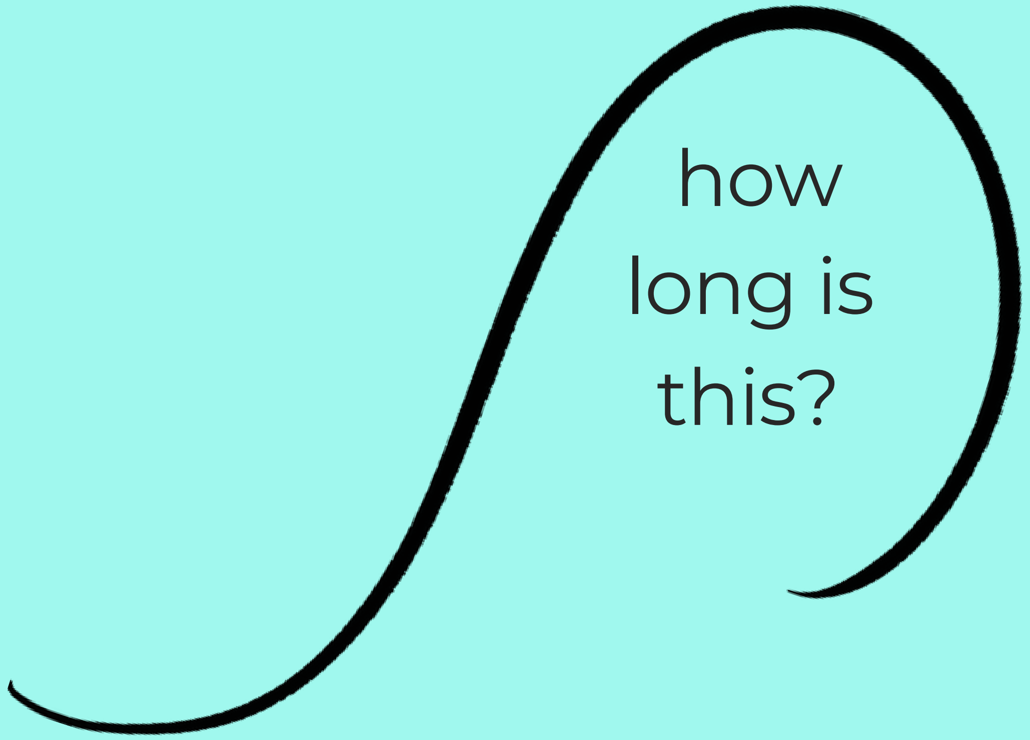
EXAMPLE 2: MEASURING THE THICKNESS OF A SHEET OF PAPER



METHOD

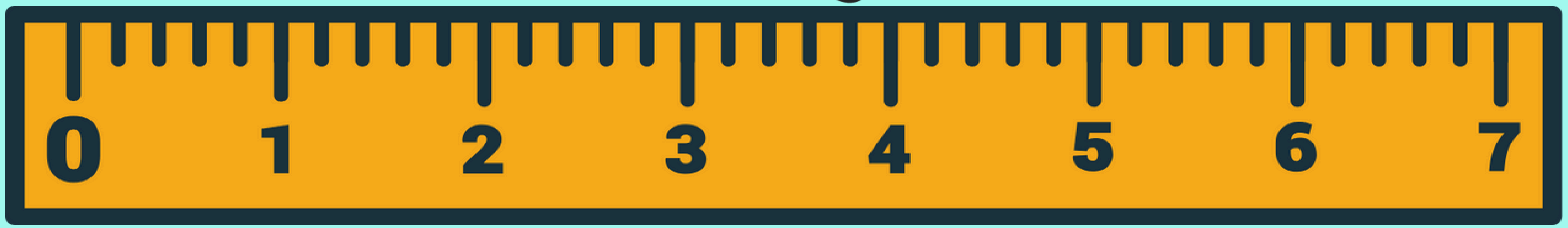
1. Measure the thickness of a stack of 500 sheets using a ruler.
2. Next, dividethe total thickness by 500 to find the thickness of a single sheet.

EXAMPLE 3: MEASURING THE LENGTH OF A CURVE LINE



1.Place a thread along the line.

2. Mark the thread at both ends of the line, then lay it on a ruler to measure the length.



SI UNIT FOR LENGTH

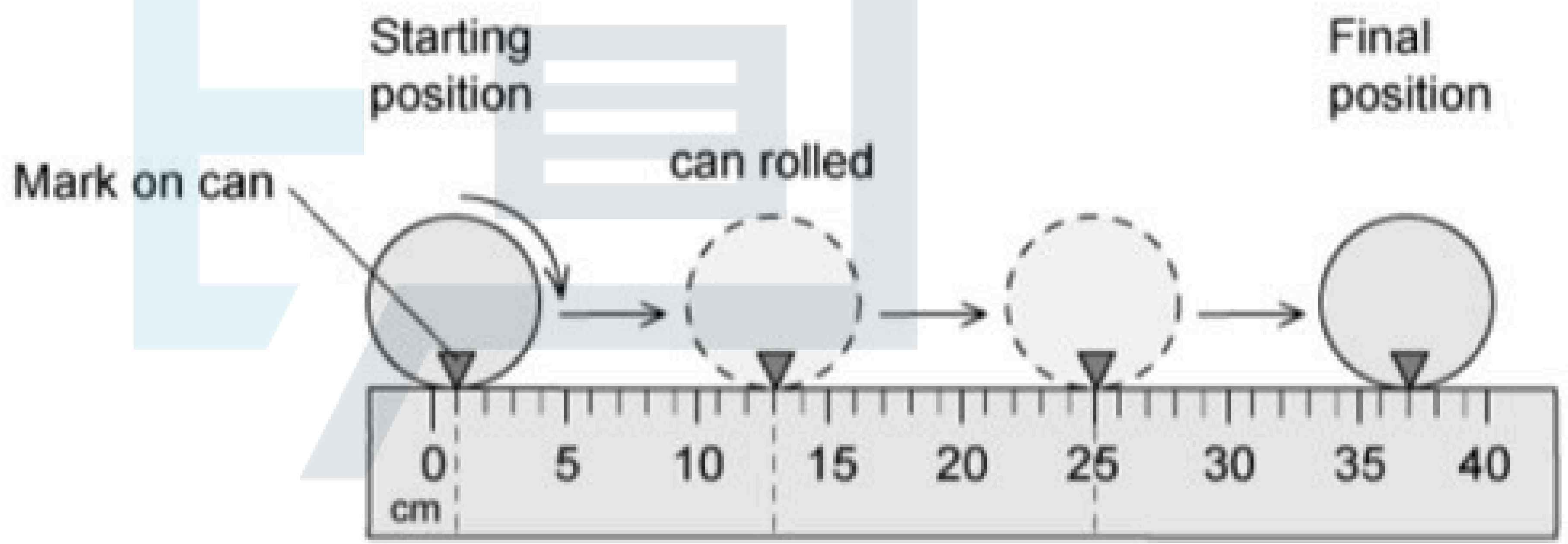
EXAM PAPERS PRACTICE

International System of Units

1 decimetre (dm)	= 0.1m
1 centimetre (cm)	= 0.01m
1 millimetre (mm)	= 0.001m
1 micrometre (μm)	= 0.000001m
1 kilometre (km)	= 1000m

A student uses a ruler to determine the circumference of a wooden dowel.

She puts a mark onto the dowel, then rolls it along the ruler three times, before reading the position on the ruler at which it stopped.



What is the circumference of the dowel?

A 12 cm

B 12.3 cm

C 37 cm

D 36 cm

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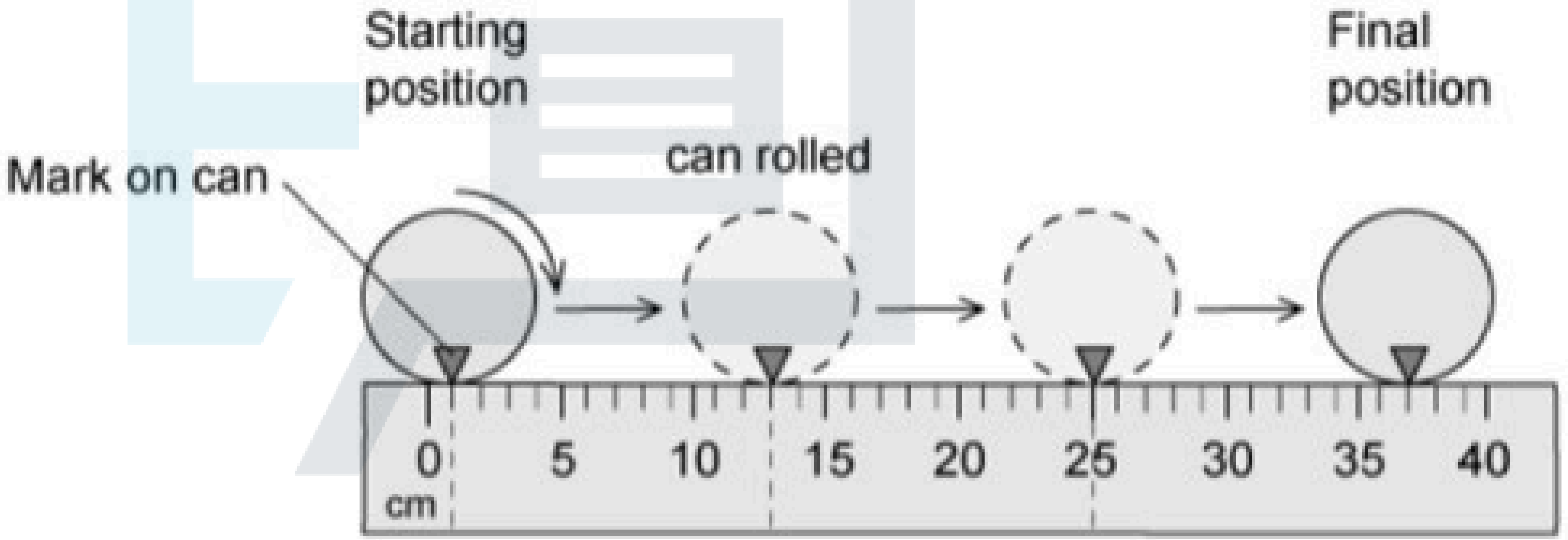

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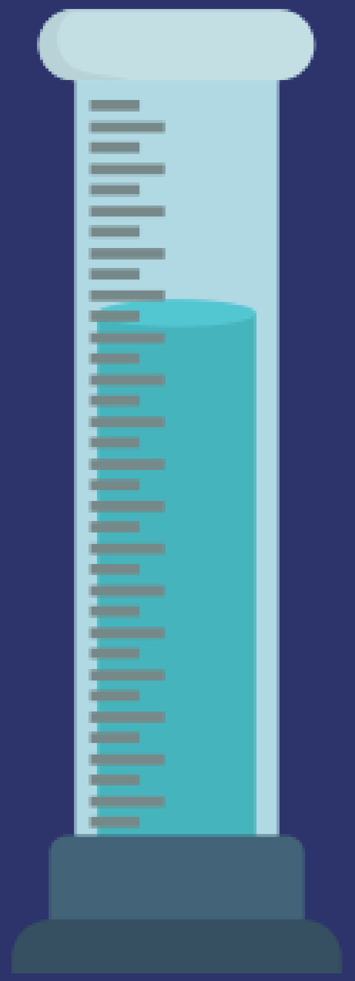


MEASUREMENT

Length

Volume

Time

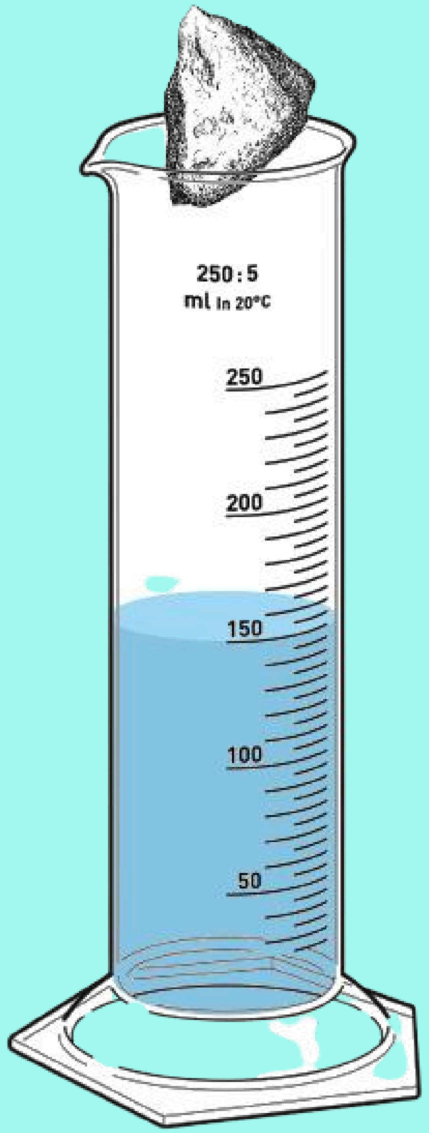
Density

Measuring the volume of regular shapes

Often, we only need to measure one or two dimensions (such as radius and height) and then use the volume formula.

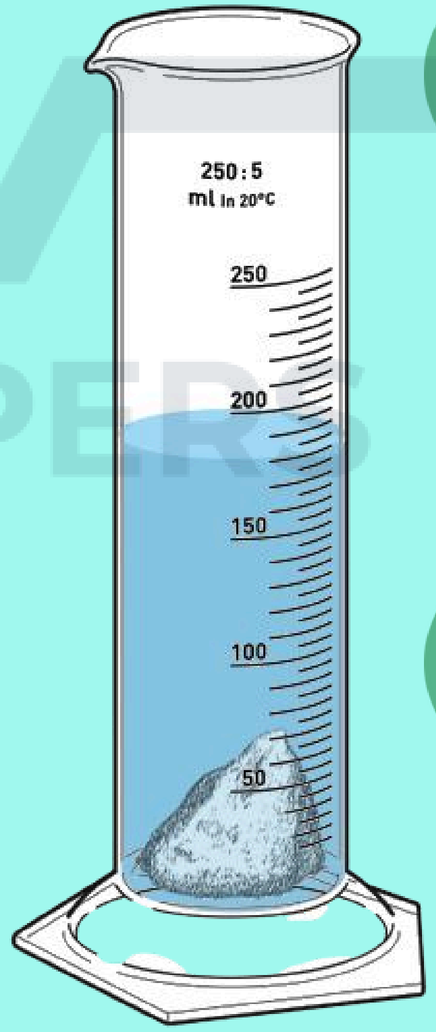
Measuring the volume of Irregular shapes

The technique used to measure irregular shapes is called displacement.



1. Choose a measuring cylinder that is biggerthan the object.

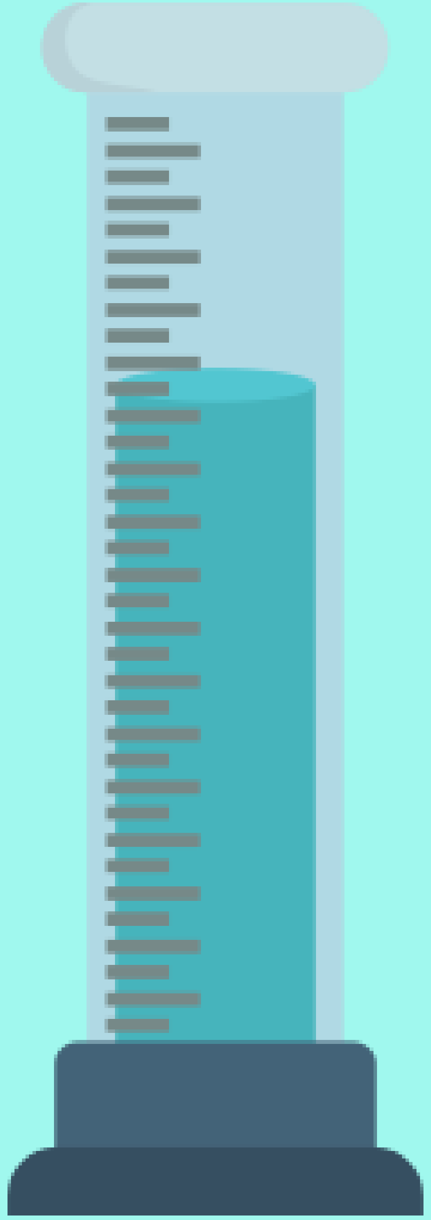
2. Fill the cylinder partially with water and record the water **volume**.



3. **Submerge** the object in the water.

4. The volume increase corresponds to the volume of the object.

Measuring the volume of liquid



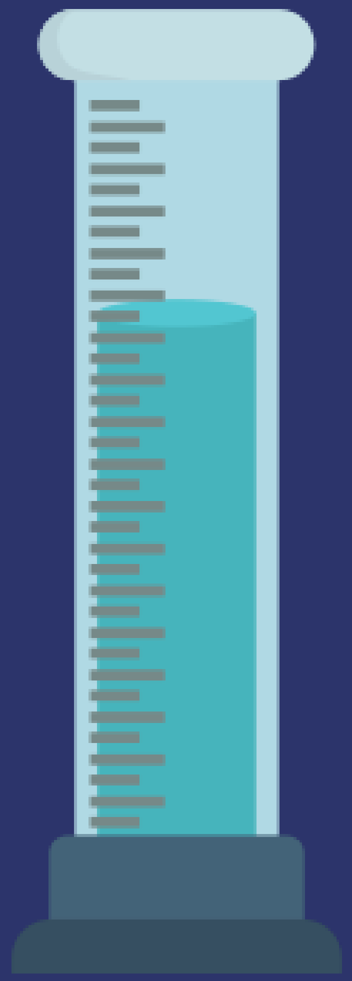
Measuring cylinderis used.

Note: Use a small size measuring cylinder to measure small volume.

SI UNIT FOR VOLUME

International System of Units

1 cubic centimetre (cm^3)	= 0.000001 m^3
1 cubic decimetre (dm^3)	= 0.001 m^3



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Length

Volume

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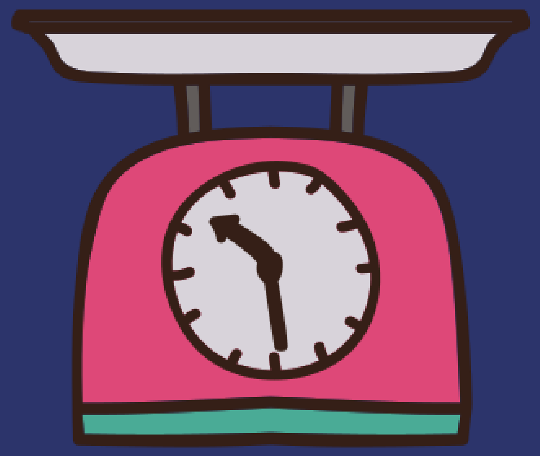


Measuring time

In the laboratory, you may need to measure the temperature of a container of water every minute or determine the duration an electric current is flowing.

There are 2 types of timing device:

Analogue clock

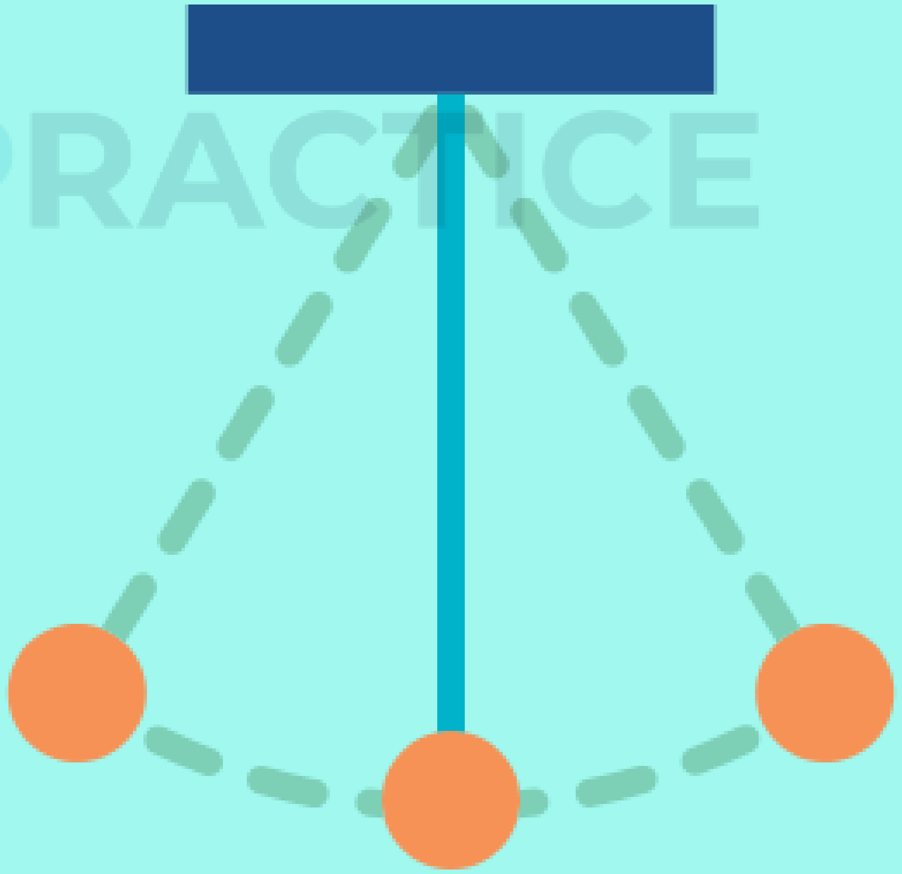
- It can measure time intervals only to the nearest second.

Digital clock

- More accurate than analogue clock

Measuring time using a lab pendulum

1.The duration of one pendulum swing is known as its period.
2.Since a pendulum swings consistently, you can use a stopwatch to time many oscillations and then find the average time per swing.
3.Measuring the total time for many oscillations reducesthe impact of any inaccuracies in starting and stopping the stopwatch.

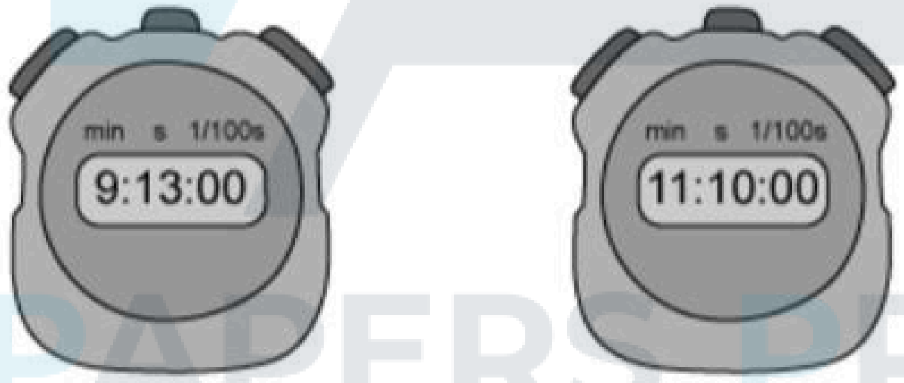


A student is trying to see how quickly they can run 5.0 km on a standard 400 m running track.

They reason that, if they know how fast they can run one lap, they can assume they will run at the same speed for 5.0 km, and can calculate their predicted time.

They, correctly, reason that they will not be able to maintain their initial pace throughout the whole 5.0 km, so they decide to time lap 5.

The diagram shows the reading on the stopwatch at the beginning and the end of lap 5.



Start of lap   End of lap

Calculate how long it should take the student to run 5.0 km.

A 36 minutes 52.5 seconds

B 24 minutes 22.5 seconds

C 13 minutes 0 seconds

D 9 minutes 45 seconds.

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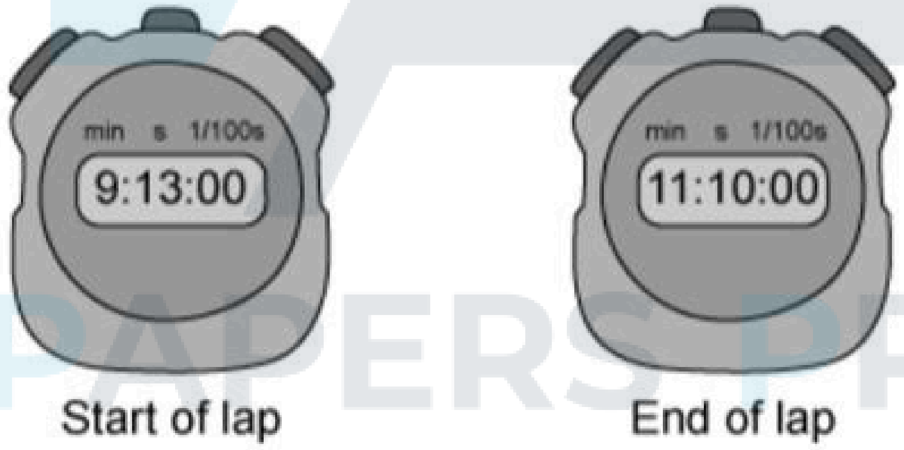

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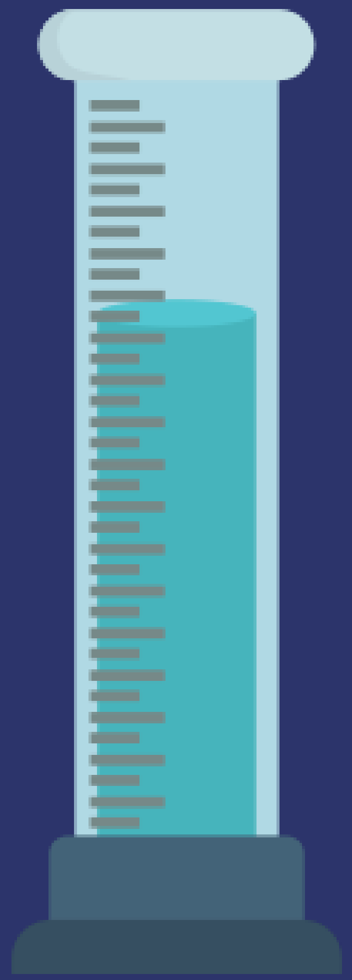
MEASUREMENT



Length	Volume
Time	Density

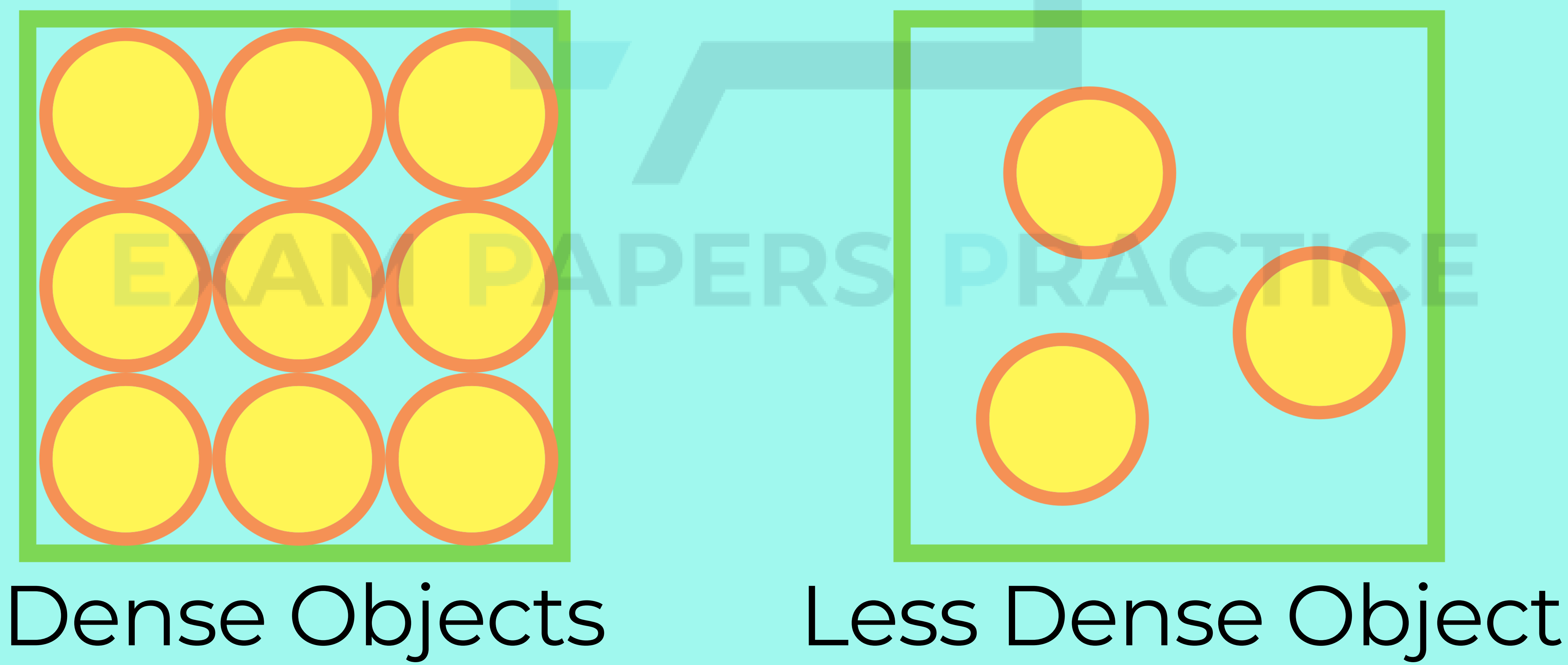
THINK PAIR SHARE

How is layered tea formed?

Measuring Density

The mass of an object is the quantity of matter it is made of.

The density tells us how concentrated an object's mass is.



Formula of density

$$\text{density} = \frac{\text{mass (m)}}{\text{volume (v)}}$$

Density unit

Unit of mass	Unit of volume	Unit of density	Density of water
g	cm^3	g cm3	1g cm3
kg	cm^3	kg cm3	0.001kg cm3
kg	m3	kg m3	1000kg m3

Density Implication

1. If an object is denser than water, then it will sink.
2. If an object is less dense than water, then it will float.

Worked Example (1)

A sample of metal has a volume of 180 cm^3. Its mass is measured to be 270.0 grams. What is the density of the metal?

solution:

$$\text{density} = \frac{\text{mass (m)}}{\text{volume (v)}}$$

$$= \frac{270g}{180cm3}$$

$$= \quad 1.5\ g\ /m3$$

Worked Example (2)

In a workshop, a container holds 50 bolts with a total mass of 450 grams. The container itself weighs 50 grams.

a. What is the mass of one bolt in grams?

mass of 50 bolts =
450g -50g = 400g

mass of 1 bolt =
400g / 50 = 8g

Worked Example (2)

In a workshop, a container holds 50 bolts with a total mass of 450 grams. The container itself weighs 50 grams.

b. Calculate the volume (in cm^3) of each bolt. Each bolt has dimensions of 3.5 cm x 0.5 cm x 0.5 cm.

$$3.5 \times 0.5 \times 0.5$$

$$= 0.875 \text{ cm}^3$$

Worked Example (2)

In a workshop, a container holds 50 bolts with a total mass of 450 grams. The container itself weighs 50 grams.

c. Determine the density of the bolts.

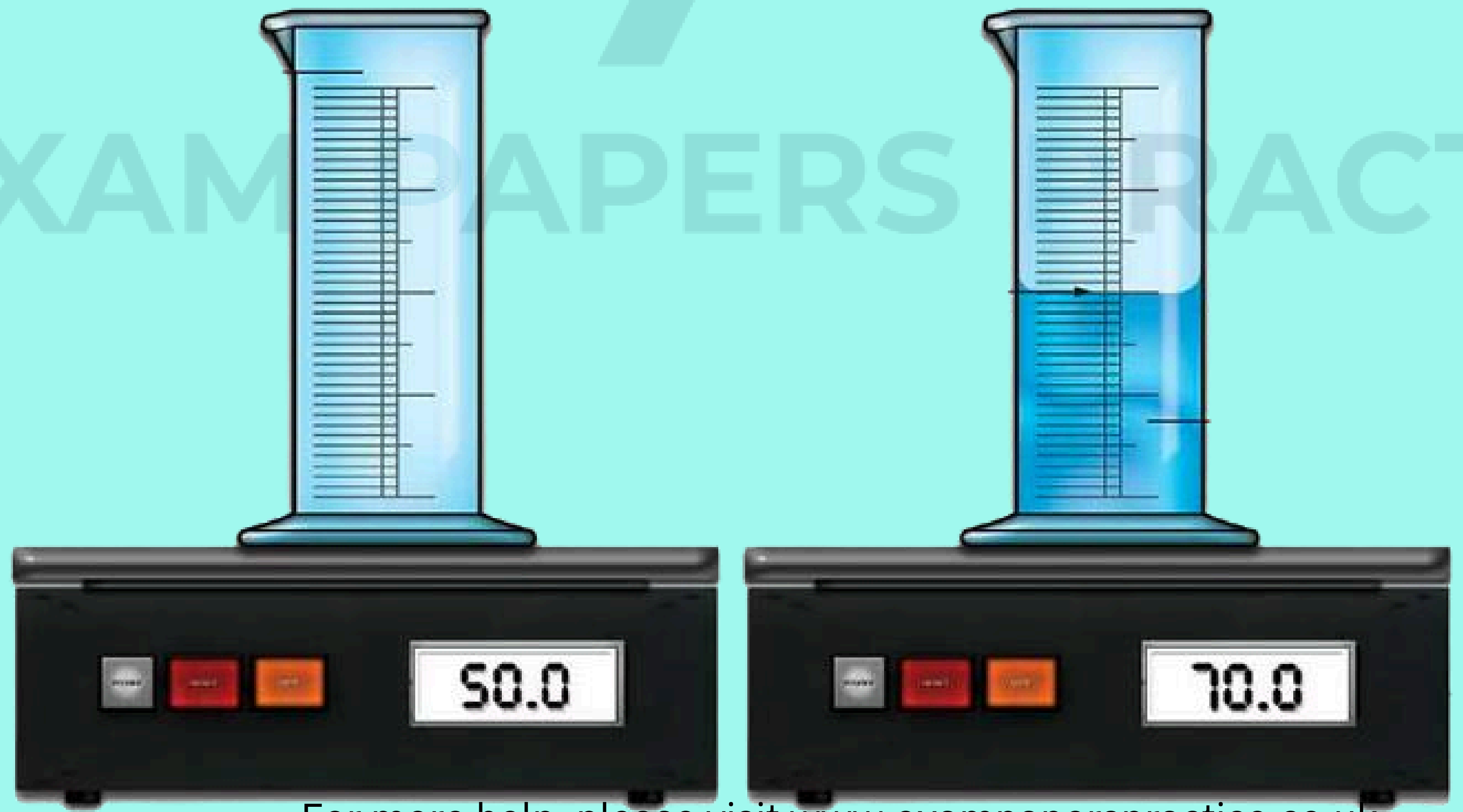
$$\text{density} = \frac{\text{mass (m)}}{\text{volume (v)}}$$

$$= \frac{8\text{g}}{0.8375\text{cm}^3}$$

$$= 9.14 \text{ g/cm}^3$$

Finding the density of liquid

1. Position a measuring cylinder on a balance.
2. Reset the balance to its initial state.
3. Pour the liquid into the cylinder.
4. Record the volumeindicated by the cylinder's scale and the massshown on the balance.
5. Compute the liquid's density using the appropriate formula.



Plenary

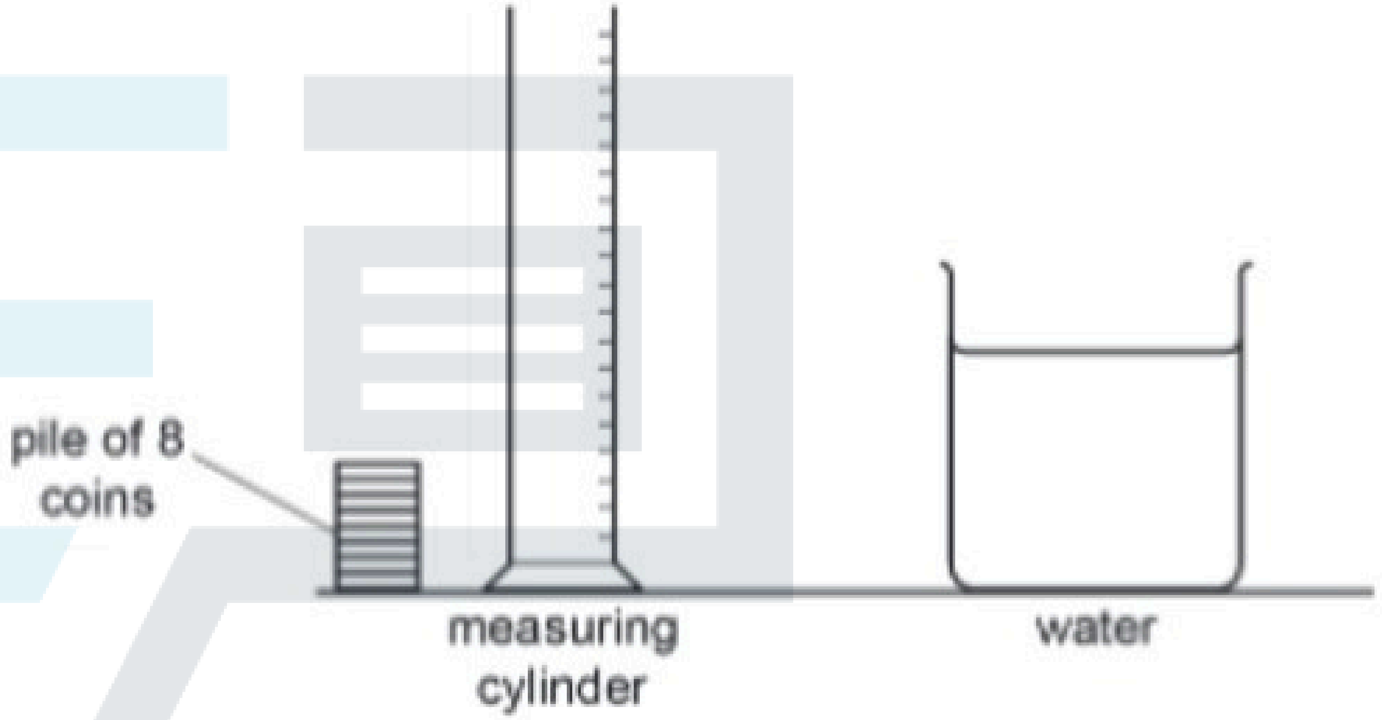
You have a rectangular object with a length of 10 cm, a width of 5 cm, and a height of 2 cm. The mass of the object is measured to be 50 grams. Calculate the density of the object in grams per cubic centimeter (g/cm^3).

Plenary

A metal sphere has a mass of 100 grams and a volume of 20 cm^3.

Determine the density of the sphere in grams per cubic centimeter (g/cm^3).

The diagram shows a pile of coins, a measuring cylinder and a beaker containing some water.



Describe how the student can measure the volume of **one** of the coins using the set-up shown in the diagram.

....

....

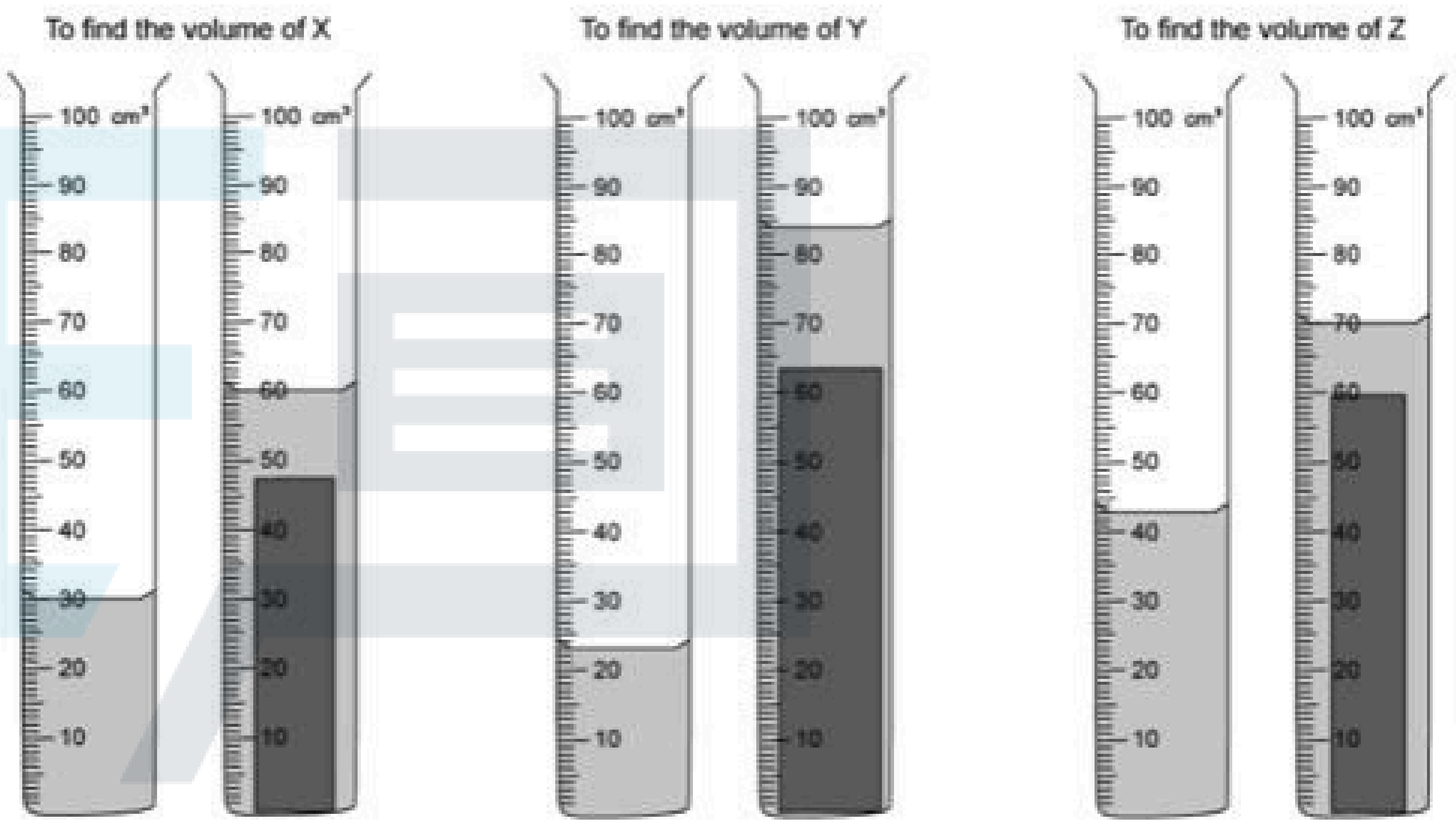
....

.... [4]

[Total: 4]

Question	Answer	Marks
1	any **four** from: measuring cylinder partially filled with water / displacement can filled with water volume of water recorded / empty measuring cylinder under spout coin(s) in water / water covers all coin(s) new volume noted / displaced water collected in measuring cylinder (average) volume of a coin = increase in volume **OR** increase in volume ÷ number of coins	4

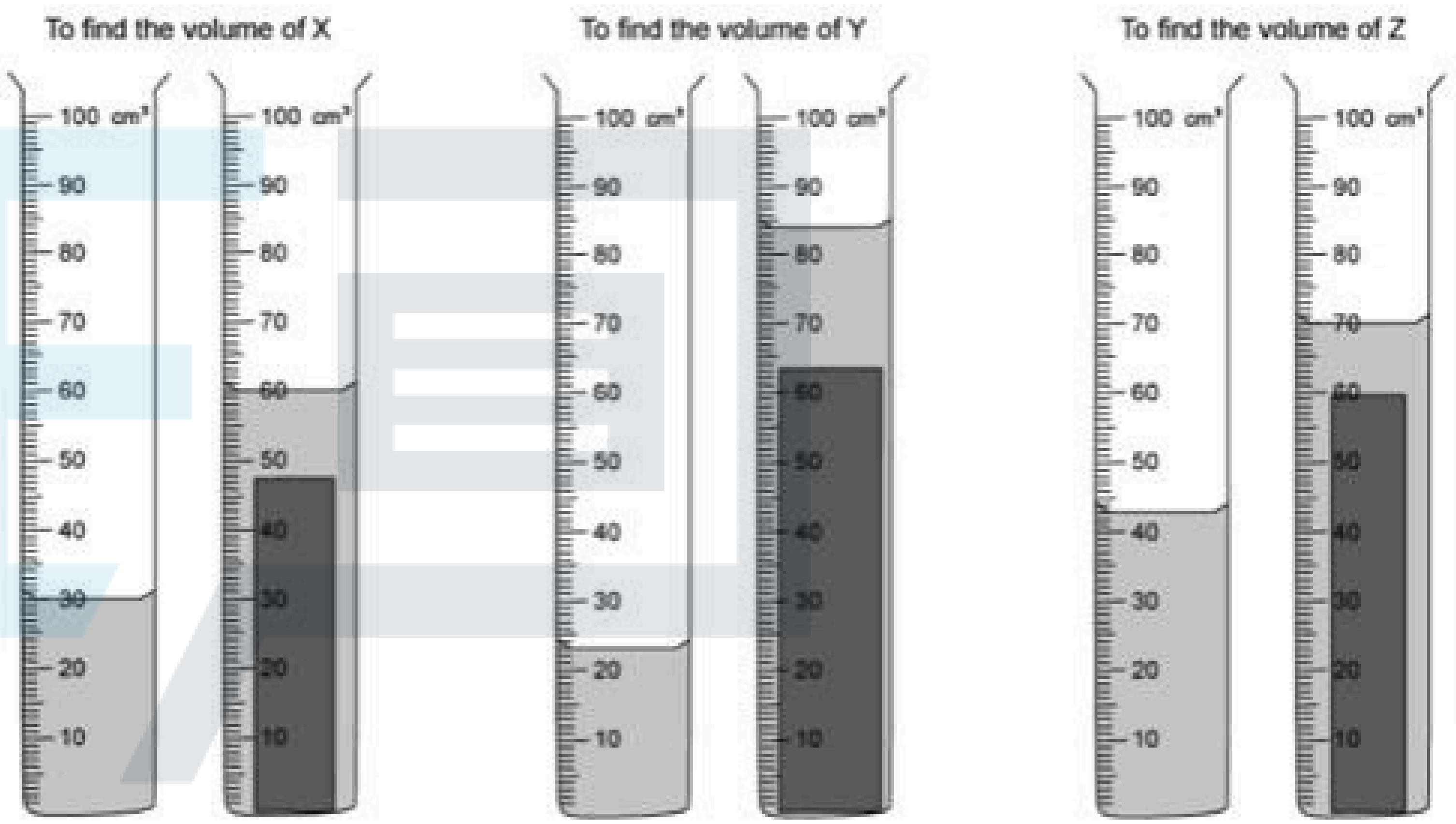
Three blocks are placed into three measuring cylinders. These are shown below.



Which row in the table shows the blocks in order of increasing volume?

	Smallest volume	→	Largest volume
A	X	Y	Z
B	Y	X	Z
C	Z	Y	X
D	Z	X	Y

Three blocks are placed into three measuring cylinders. These are shown below.



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