

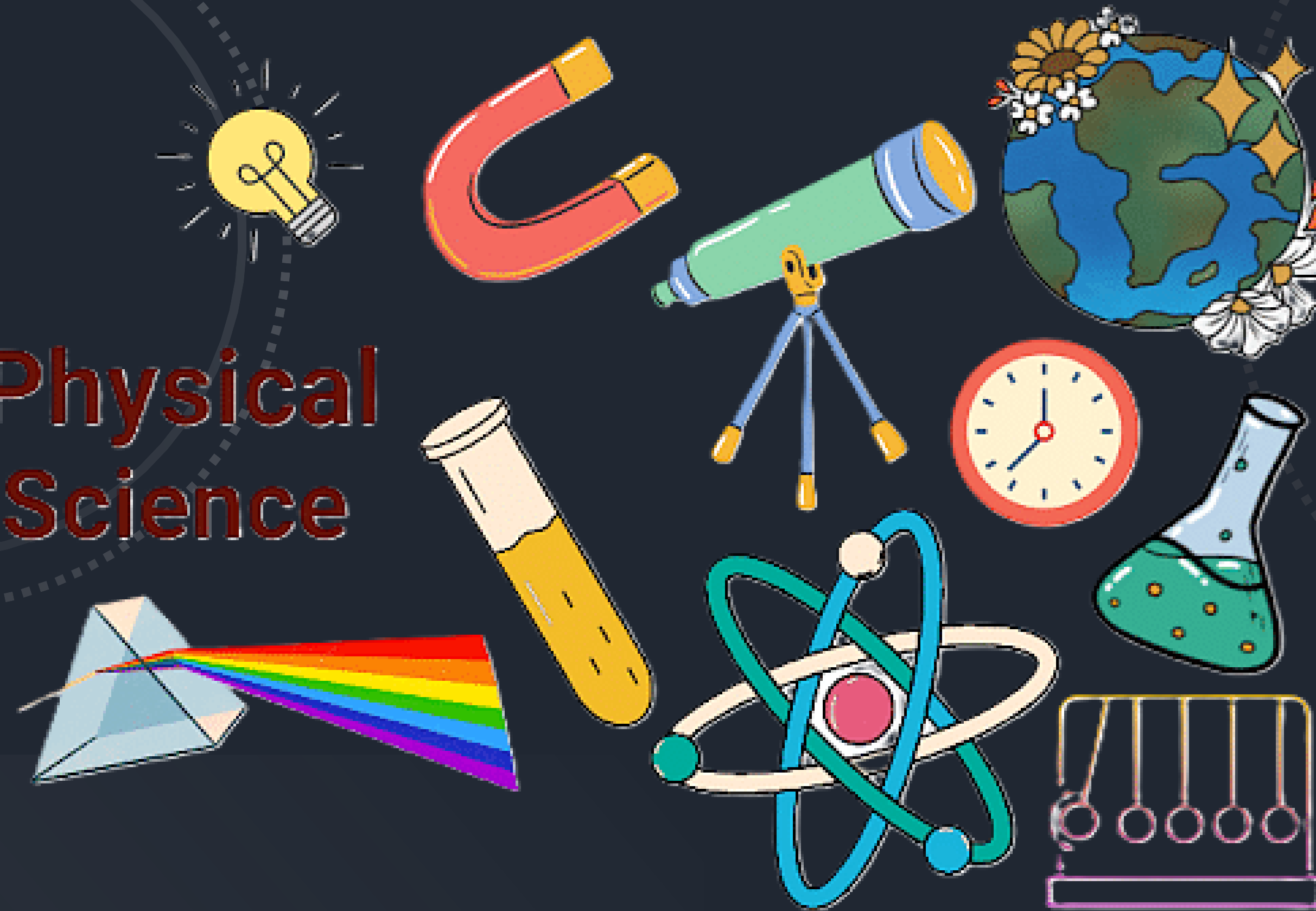
PREPARATORY PHYSICAL SCIENCE (PHSC 001)

Measurement القياس

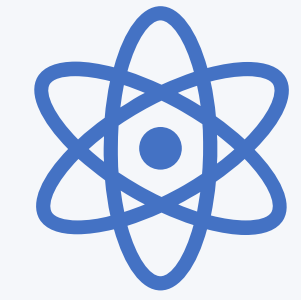
CHAPTER

1

Physical
Science



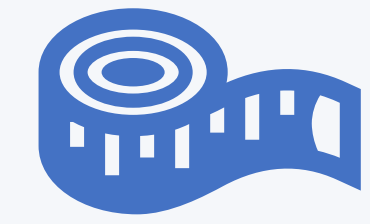
OUTLINES



Physical sciences

1. Definition

2. Measurements



Measuring things,

1. Lengths

2. Time

3. Mass

4. Density

Science is Knowledge

Natural
sciences

Social
sciences

Living Science

Non Living
Science

Biology

Physical
Science

Physics

Geology

Chemistry

Astronomy

Economy

Geography

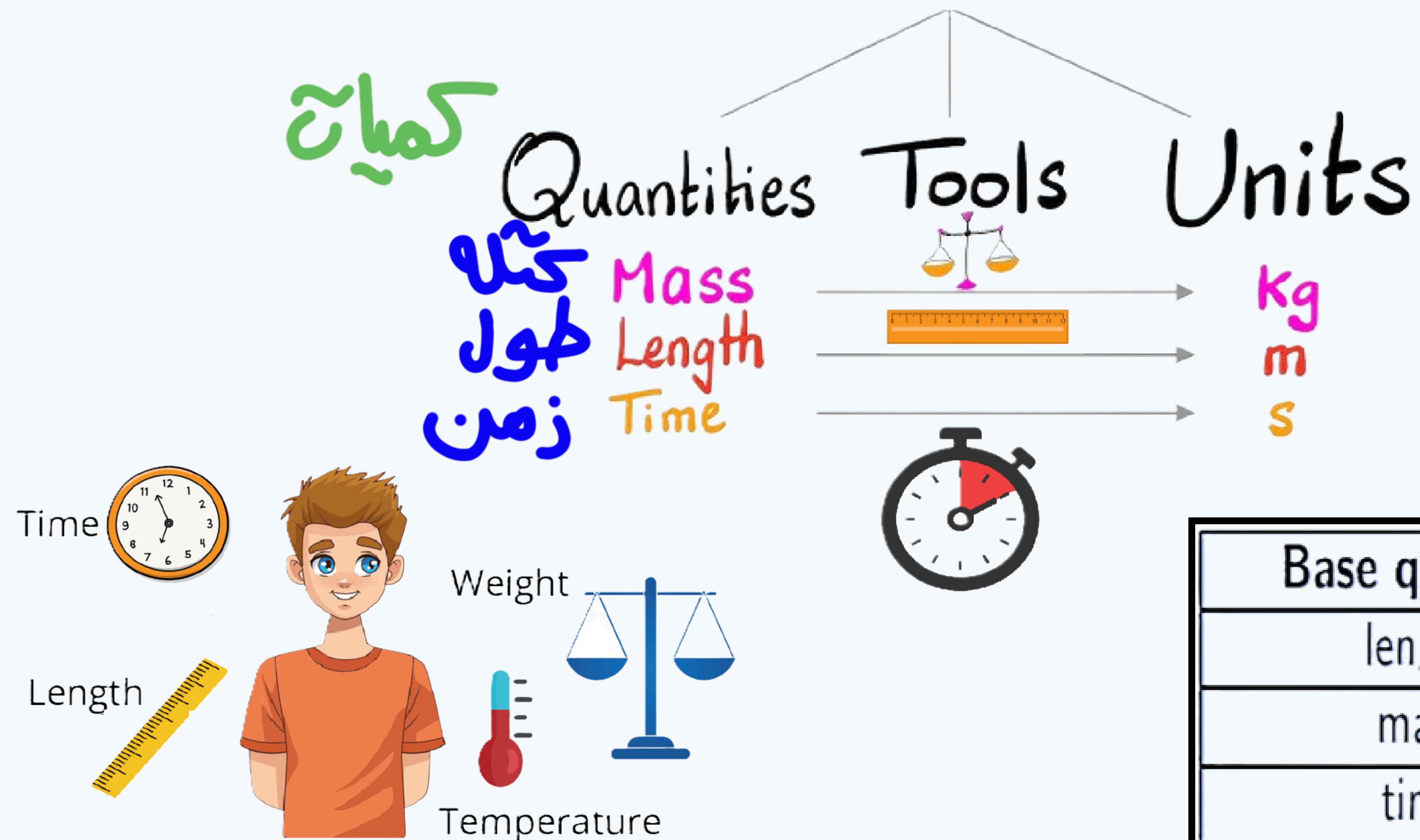
Sociology

Psychology

Political
Science

Physical Measurement

Getting the size of a physical quantity



Base quantity	Name	Symbol
length	metre	m
mass	kilogram	kg
time	second	s

Physical Quantity → Can be measured

الكمية الفيزيائية

Magnitude

مقدار

Unit

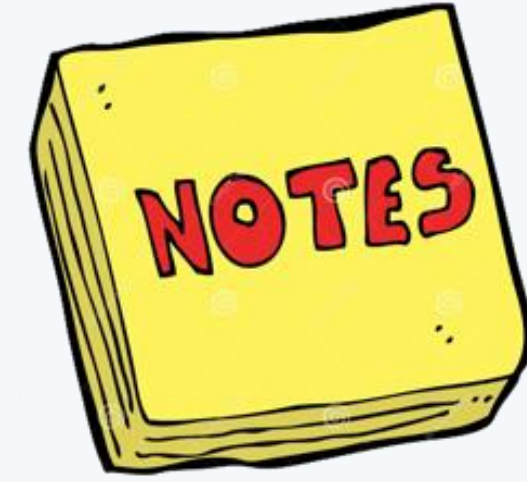
وحدة

كتلة

Mass = 70 kg

وحدة المقدار

Length = 180 cm



By combining these **basic quantities** we can obtain the **derived ones**.

مساحة
الحجم
الكثافة
السرعة
العجلة
القوة

Derived quantity	Symbol	Relationship with base quantities	Derived unit
Area	A	Length $\times$ Length	m^2
Volume	V	Length $\times$ Length $\times$ Length	m^3
Density	ρ	$\frac{\text{Mass}}{\text{Volume}} = \frac{\text{Mass}}{\text{Length} \times \text{Length} \times \text{Length}}$	$\frac{kg}{m^3}$
Velocity	v	$\frac{\text{Displacement}}{\text{Time}}$	$\frac{m}{s}$
Acceleration	a	$\frac{\text{Velocity}}{\text{Time}}$	$\frac{m}{s\ s} = \frac{m}{s^2}$
Force	F	Mass $\times$ Acceleration	$kg \frac{m}{s^2}$

الازاحة

الكميات Quantities



- | | | |
|----------|---------------------|-----------------------------------|
| ① Mass | ④ current التيار | ⑦ amount of substance كمية المادة |
| ② Length | ⑤ Temp درجة الحرارة | |
| ③ Time | ⑥ intensity الشدة | |

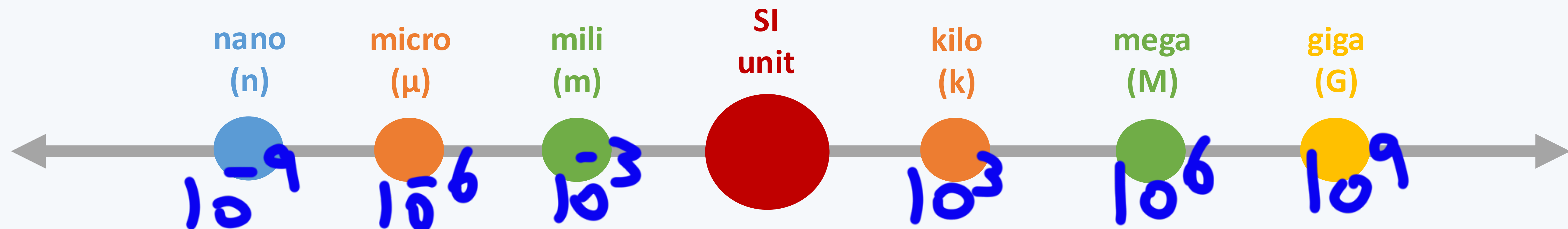
PREFIXES

اللاحقة

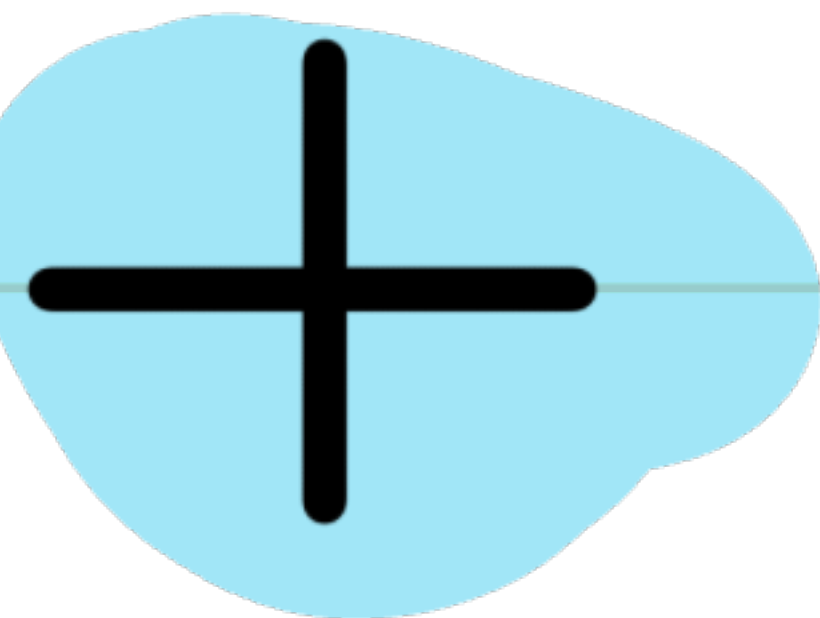
Prefixes are **Latin numbers**

They are multiple of **powers of 10** by (+) or (-)

SI PREFIX (symbol)	MULTIPLIER
giga- (G)	1,000,000,000 = 10^9
mega- (M)	1,000,000 = 10^6
kilo- (k)	1,000 = 10^3
milli- (m)	0.001 = 10^{-3}
micro- (μ)	0.000001 = 10^{-6}
nano- (n)	0.000000001 = 10^{-9}



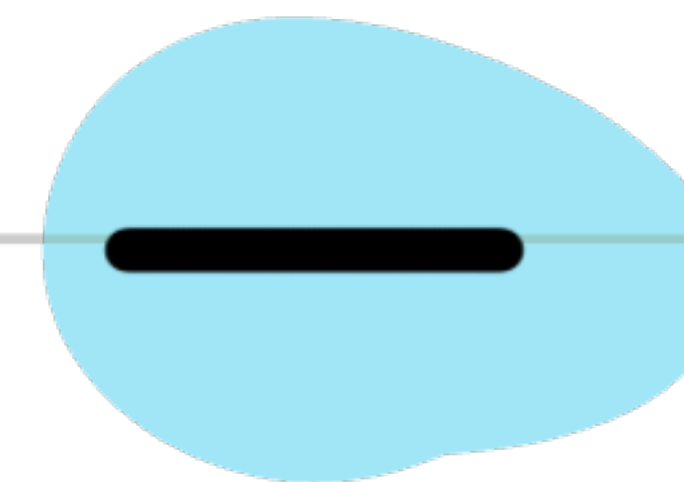
Prefix



K



10^3



m



10^{-3}

M



10^6

μ



10^{-6}

G



10^9

n



10^{-9}

الكثافة
ثابتة للمادة الواحد
وتتغير من مادة لأخرى

DENSITY: the amount of
matter in a volume.

كمية المادة
داخل وحدة الحجم

Density Formula

density

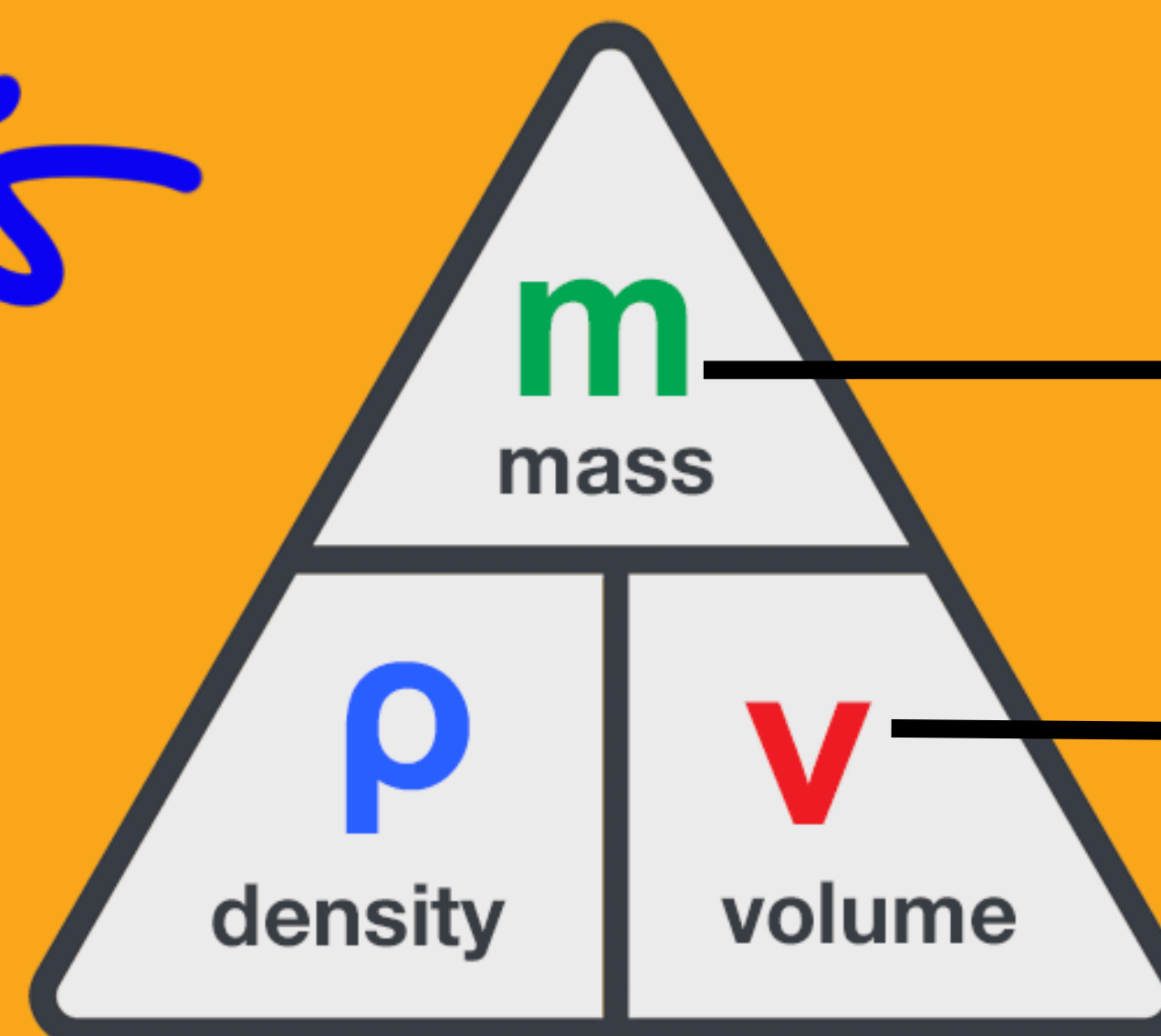
mass

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

volume

thecalculatorsite.com

مثال



density = mass ÷ volume
mass = density × volume
volume = mass ÷ density

kg

m³

kg

m³



Density Virtual Lab



Example 1: Calculating Density

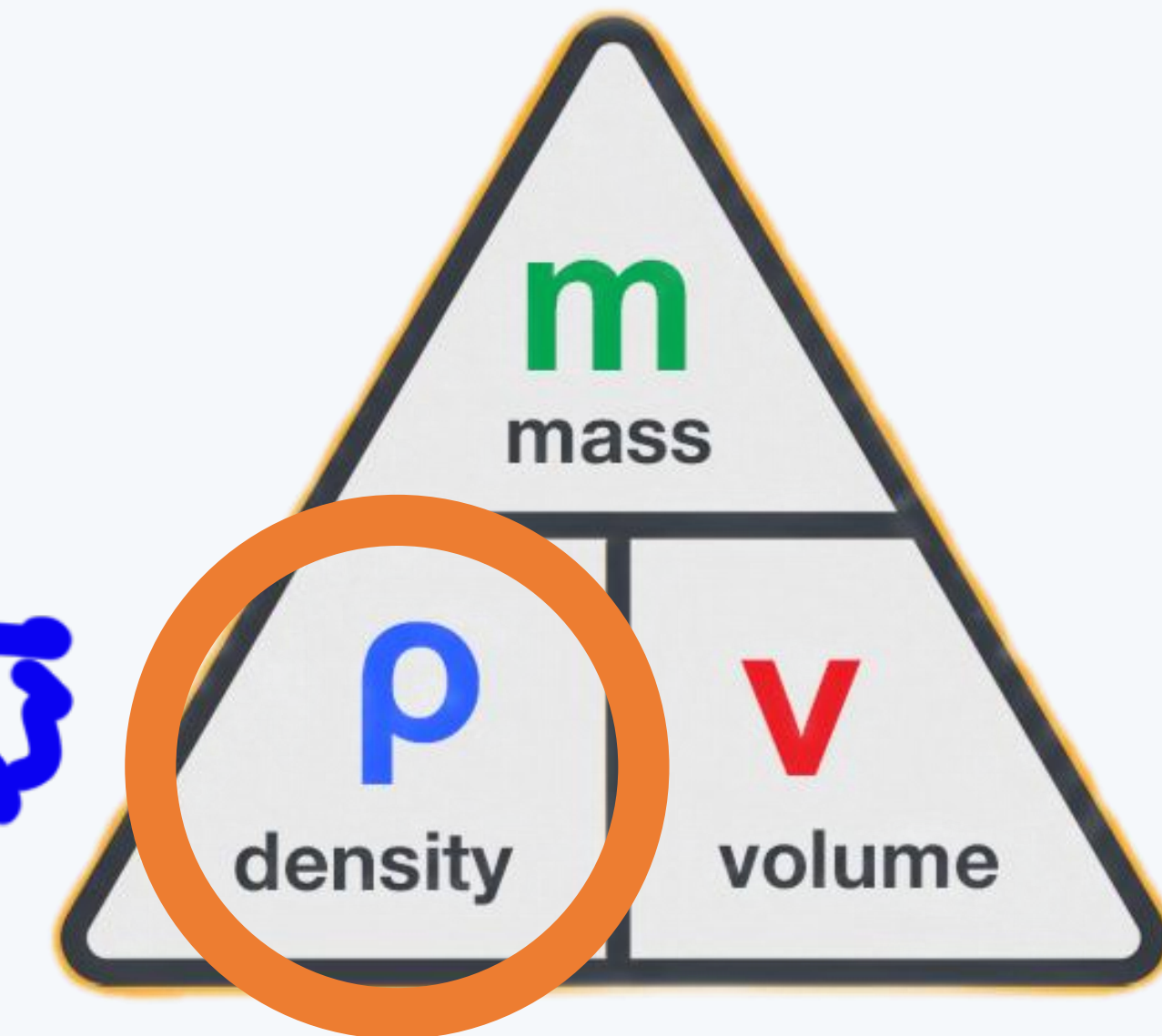
An object has a **mass** of 570 g and a **volume** of 2280 cm³. Calculate its **density**.

$$m = 570 \text{ g}$$

$$V = 2280 \text{ cm}^3$$

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

$$\rho = \frac{570}{2280} = 0.25 \frac{\text{g}}{\text{cm}^3}$$



We're looking for density, so constructing the triangle and covering d , we see we must divide the mass by the volume. So

$$\text{density} = \frac{570}{2280} = 0.25 \text{ g/cm}^3$$

Example 2: Calculating Mass

A cat has **volume** 0.004 m^3 and **density** 980 kg/m^3 . Calculate the **mass** of the cat.

$$V = 0.004 \text{ m}^3$$

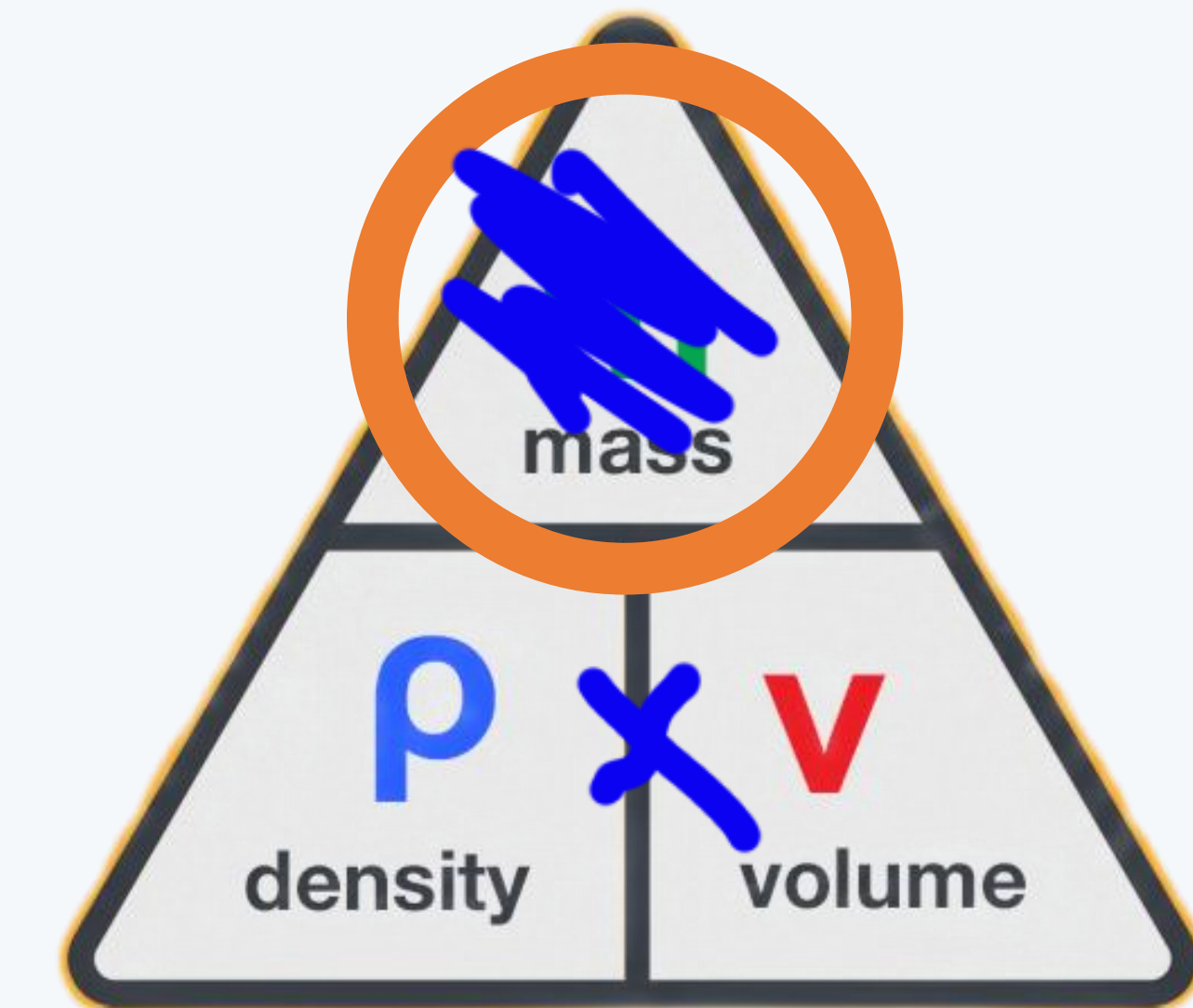
$$\rho = 980 \frac{\text{kg}}{\text{m}^3}$$

$$m = ??$$

$$m = \rho \times V$$

$$= 980 \times 0.004$$

$$= 3.92 \text{ kg}$$



We're looking for mass, so constructing the triangle and covering m , we see that to calculate the mass we must multiply the density by the volume. So

$$\text{Mass} = 980 \times 0.004 = 3.92 \text{ kg}$$

Example 3: Calculating Volume

A bottle of water has a **density** of 1000 kg/m^3 and **mass** of 0.5 kg . Calculate the **volume** of the water bottle giving your answer in litres.

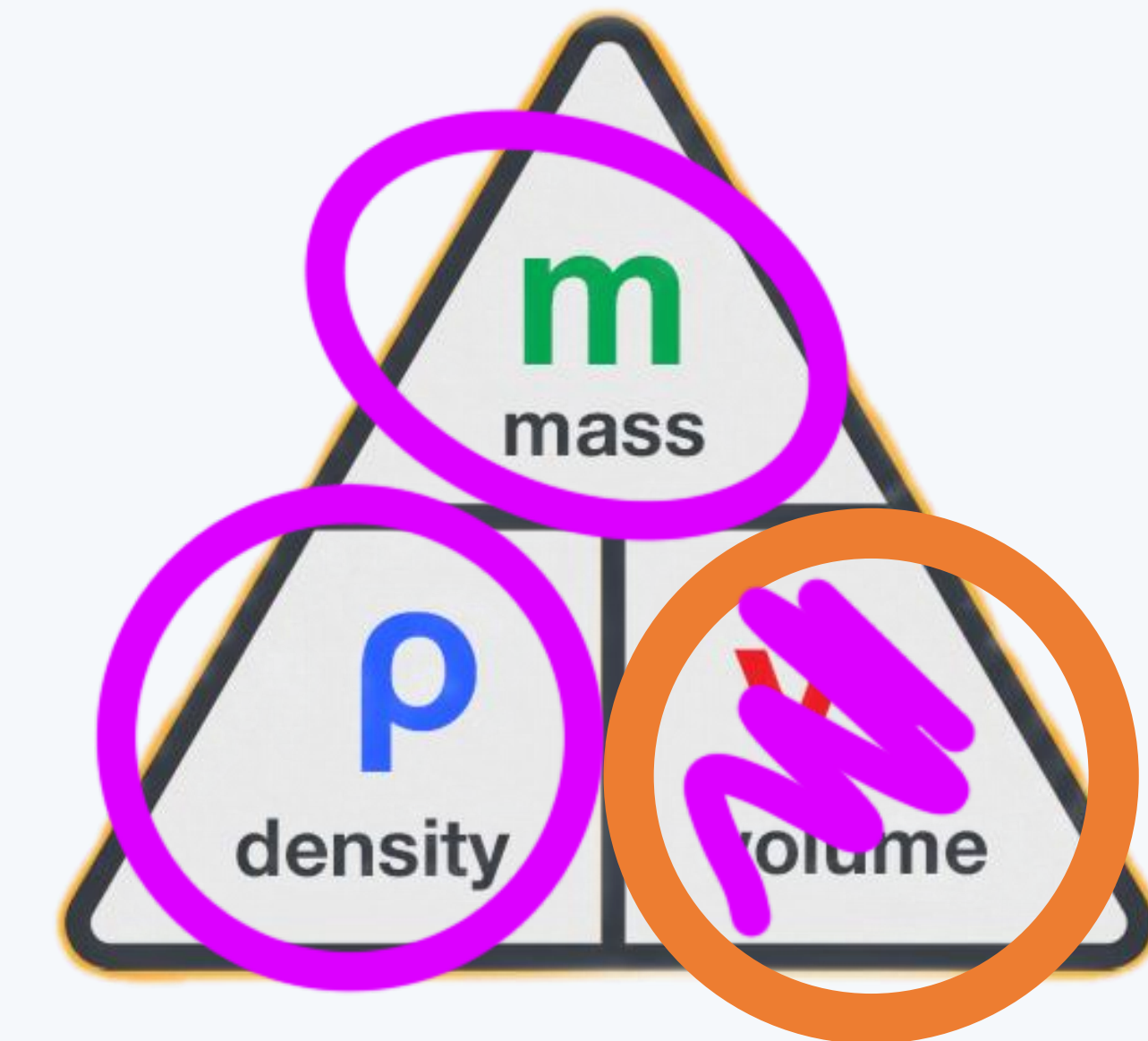
$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$m = 0.5 \text{ kg}$$

$$V = ??$$

$$V = \frac{m}{\rho} = \frac{0.5}{1000}$$

$$V = 0.0005 \text{ m}^3$$



We're looking for volume, so covering V , we must divide the mass by the density.

So

$$\text{Volume} = \frac{0.5}{1000} = 0.0005 \text{ m}^3$$

Multiplying this by 1000 to convert into litres, gives us the final answer,

$$\text{Volume} = 0.5 \text{ L}$$

Write down the **unit/s** of each of the following **quantities**:

فوتون
رسم
عالم
طابق
زمن
سرعة
مركب
ان

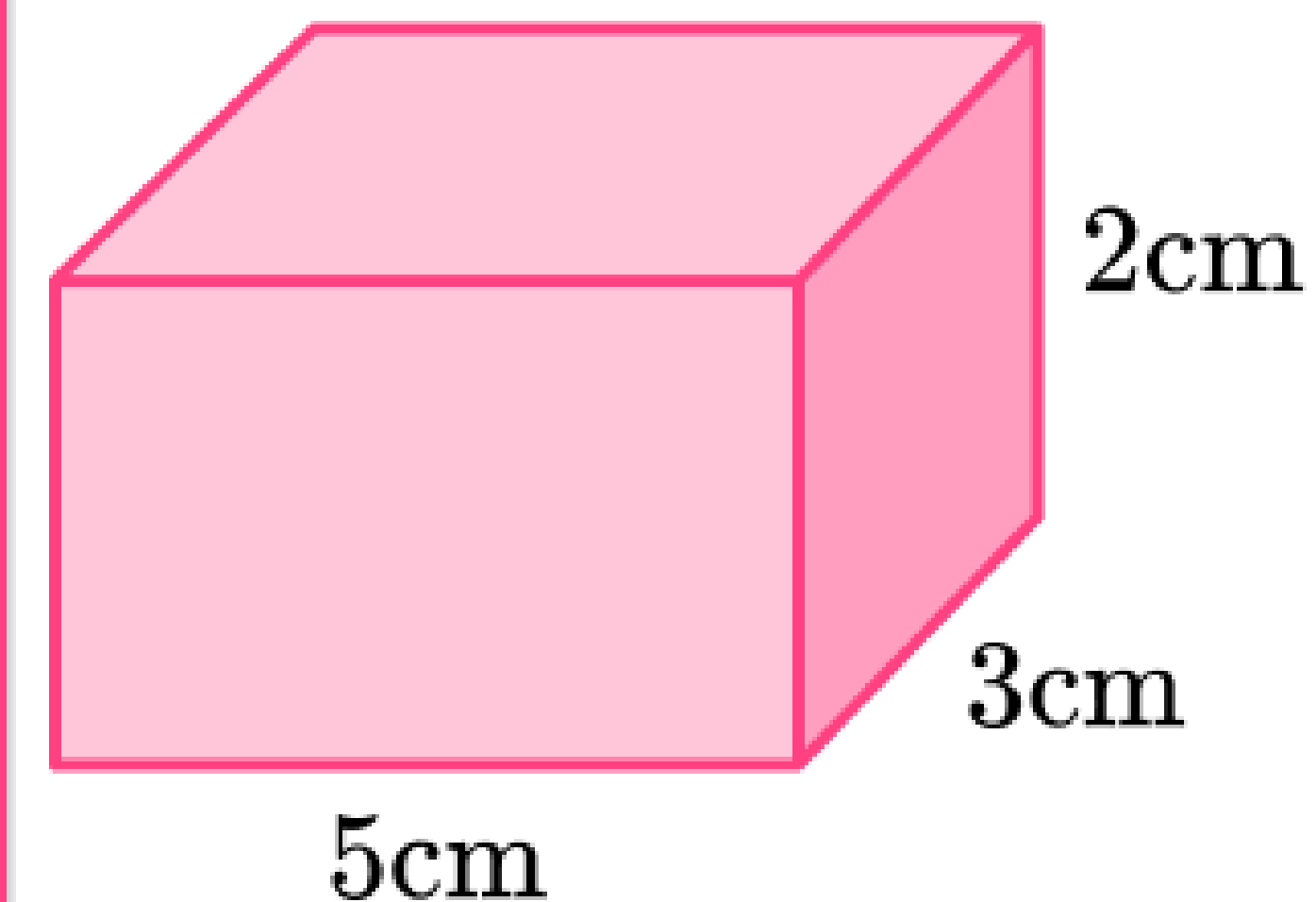
Volume	m^3
Force	N or $kg\ m/s^2$
Density	kg/m^3
Velocity	m/s
Acceleration	m/s^2
Energy	J or N.m
Time	s
Speed	m/s
Torque	N.m
Work	N.m

$$F = ma$$

$$= kg \frac{m}{s^2}$$

$$J = \frac{x}{t} \frac{m}{s}$$

الحجم
What is volume of a
rectangular prism?
منشور متوازي



الارتفاع العرض الطول الحجم

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

$$\text{Volume} = 3 \times 5 \times 2$$

$$\text{Volume} = 30\text{cm}^3$$

The density of paper is 800 kg/m^3 A typical sheet of paper has a width of 0.21 m and a length of 0.3 m. The thickness of a pack of 500 sheets of paper is 0.05 m.

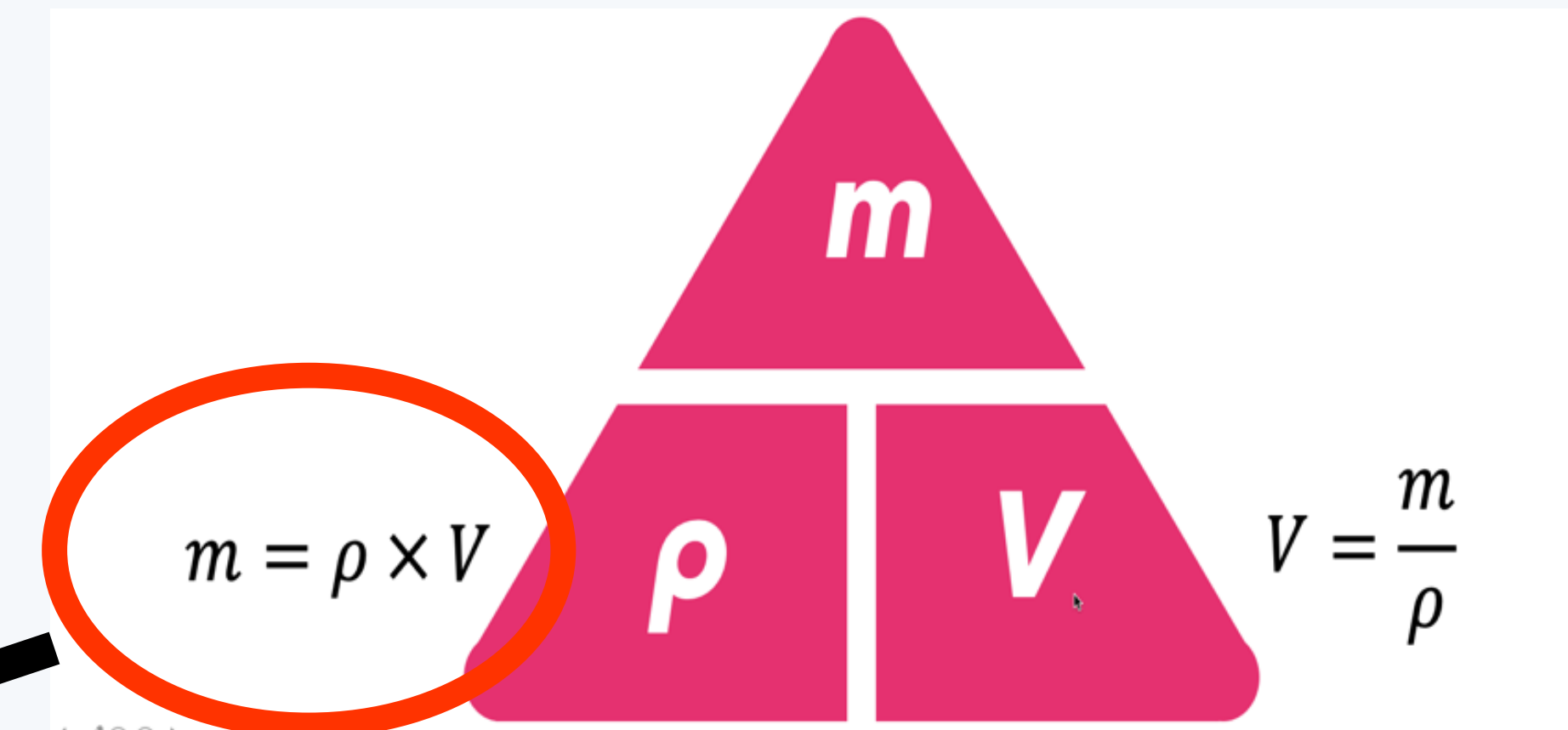
ورقة واحدة

What is the mass of a single sheet of paper?

Volume = length $\times$ width $\times$ height

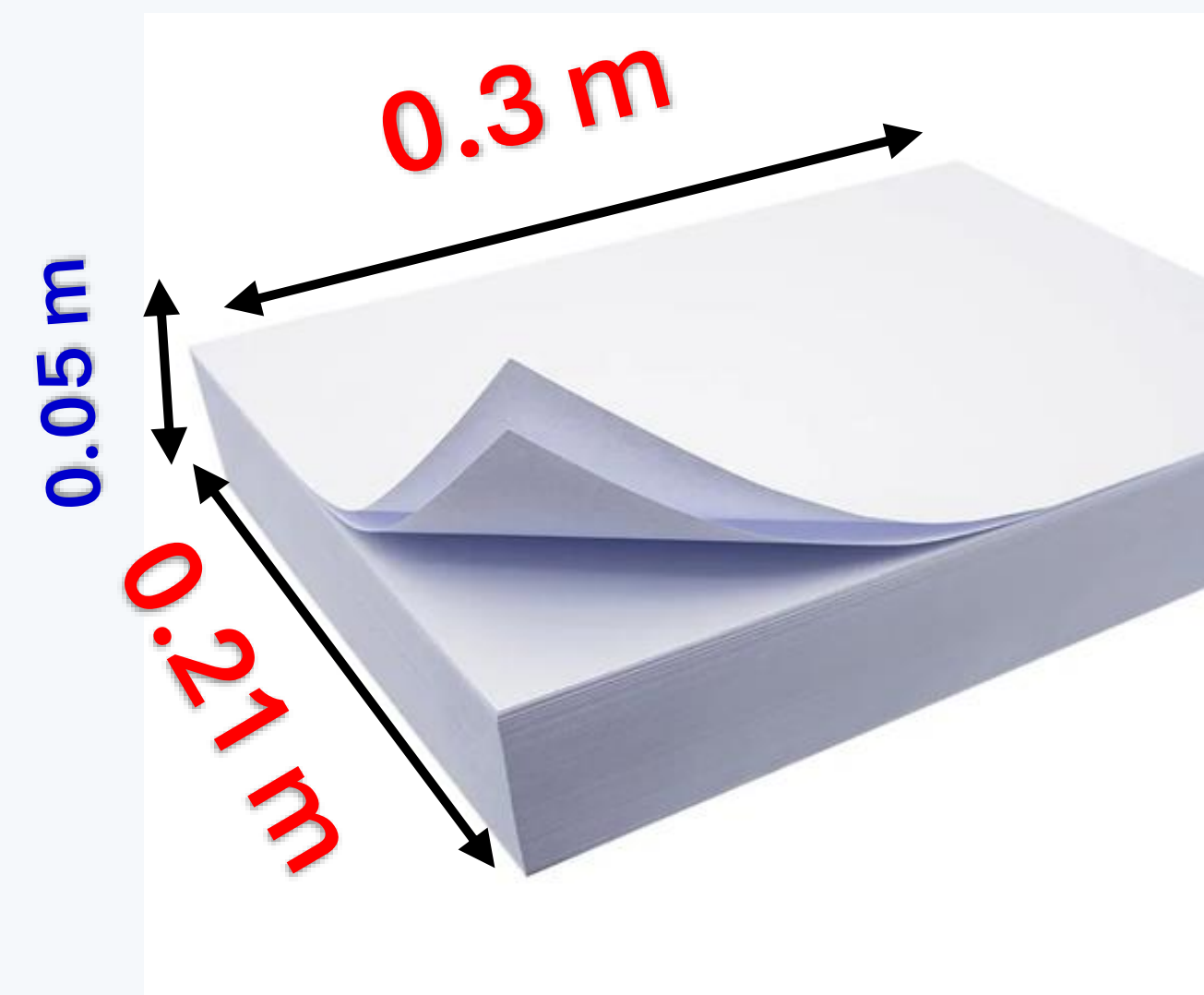
$$V = 0.3 \times 0.21 \times 0.05 = 0.00315 \text{ m}^3$$

$$m = \rho V$$

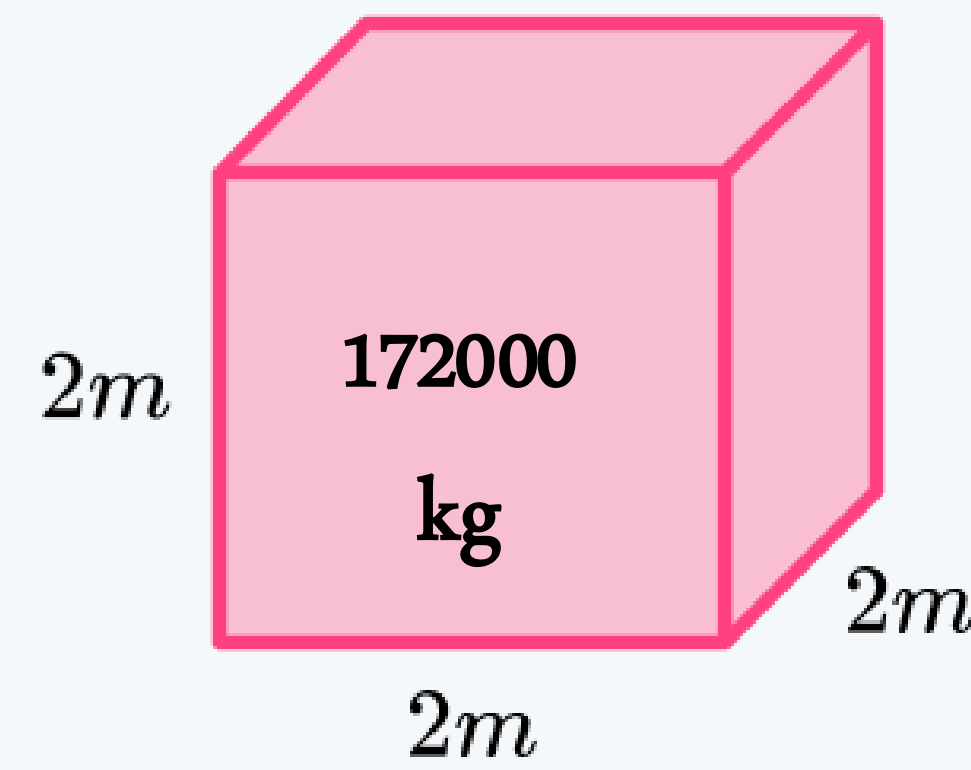


$$m = 800 \times 0.00315 = 2.52 \text{ kg}$$

Mass of 500 sheets



$$\text{So the mass of 1 sheet} = \frac{2.25}{500} = 0.00504 \text{ kg} = 5.04 \text{ gram}$$



Practical Question: Who am I?

What is the material from which this cube is made of?

To know the material, we should know the density

$$\rho = \frac{m}{V} = \frac{172000}{2 \times 2 \times 2} = 21500 \frac{\text{kg}}{\text{m}^3}$$

Material	Density $\frac{\text{kg}}{\text{m}^3}$
Platinum	21500
Iron	7800
Gold	19400



Homework

Due before next session.



A brick has a density of 500 kg/m^3 and a mass of 10.5 kilograms.

Work out the volume of the brick, in m^3 .

A piece of aluminium has a density of 2.6 g/cm^3 and a volume of 15 cm^3 .

Work out the mass of the aluminium, in grams.

AI solved assessments are NOT allowed