Mass, Weight & Density

Mass

Amount of matter present in an object

* It is a measure of how much resistance an object offers against unbalanced force also known as "Inertia"

- Mass is Scalar Quantity
- SI unit is Kilogram (kg)
- Mass remains same everywhere (on Surface of a planet or Space etc)
- Mass is measured by top-pan balance / beam balance

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Weight

The gravitational force acting on a mass vertically downwards.

- Weight is vector quantity
- SI unit is Newtons (N)
- Weight varies directly with gravitational force
- Gravity is weaker on Moon, so weight will be less
- Weight is measured by force meter or Newton meter
- Weight can be calculated by the formula:

$W = mg$; $m \rightarrow$ mass (in kg)

$g \rightarrow$ gravitational field strength (Nkg^{-1})

Gravitational Field Strength

Gravitational force per unit mass

$g = \frac{F}{m}$; unit : $N\,kg^{-1}$

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* on Surface of Earth, $g = 9.81\ N\,kg^{-1}$

it means Earth exerts a force of 9.81 Newtons on 1 kg mass.

Example:

A rock of mass 20 kg is taken to moon, find its weight on the Surface of Moon.

(value of g on Surface of Moon = $1.63\ N\,kg^{-1}$)

Sol

$W = mg$

$= 20 \times 1.63$

$= 32.7\ N$

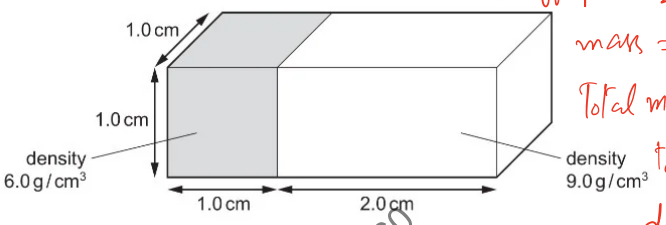
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Past Paper Practice

QUESTION # 19: O/N 17 P12 Q6

6 Two blocks are joined together.



One block has a density of 6.0 g/cm³ and the other has a density of 9.0 g/cm³.

What is the overall density of the two blocks joined together?

A 7.0 g/cm³ **B** 7.5 g/cm³ **C** 8.0 g/cm³ **D** 15 g/cm³

Volume of small part = 1 cm³
mass = density × vol
= 6 × 1 = 6 g
Volume of bigger part = 2 × 1 × 1 = 2 cm³
mass = 9 × 2 = 18 g
Total mass = 24 g
total vol = 3 cm³
density = 24/3
= 8 g cm⁻³

QUESTION # 20: O/N 18 P11 Q6

6 What happens to an object when it is moved to a location where the gravitational field strength is slightly greater?

A Its density decreases.
B Its mass decreases.
C Its weight increases.
D Its volume increases.

(property of weight)

QUESTION # 2: M/J 17 P11 Q10

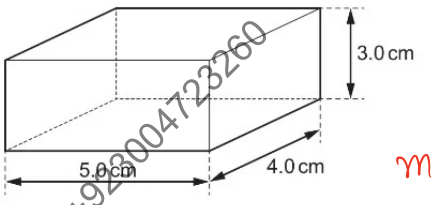
10 An astronaut travels to the International Space Station.

Which row describes how his mass and his weight compare with their sizes on Earth?

	mass	weight
A	different	different
B	different	the same
C	the same	different
D	the same	the same

QUESTION # 3: M/J 17 P12 Q11

11 The diagram shows a rectangular block.



(not to scale)

The density of the block is 2.5 g/cm^3.

What is the mass of the block?

A 18 g **B** 24 g **C** 50 g **D** 150 g

mass = density × vol
= 2.5 × (5 × 4 × 3)
= 150 g

QUESTION # 4: M/J 18 P11 Q6

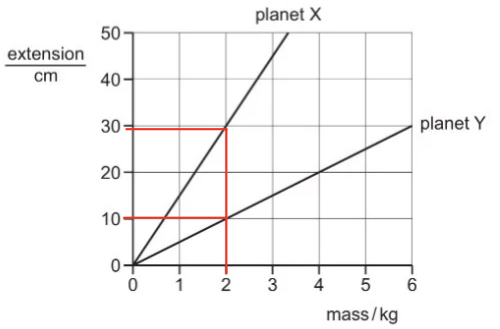
6 Which piece of equipment is used to measure mass?

A balance
B manometer
C measuring cylinder
D newton meter

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QUESTION # 23: O/N 18 P12 Q6

6 The graph shows how the extension of a spring changes with the masses suspended from it when the spring is on planet X and when the spring is on planet Y.



Which conclusion can be drawn from these graphs?

A It is not possible to compare the gravitational field strengths on planets X and Y.

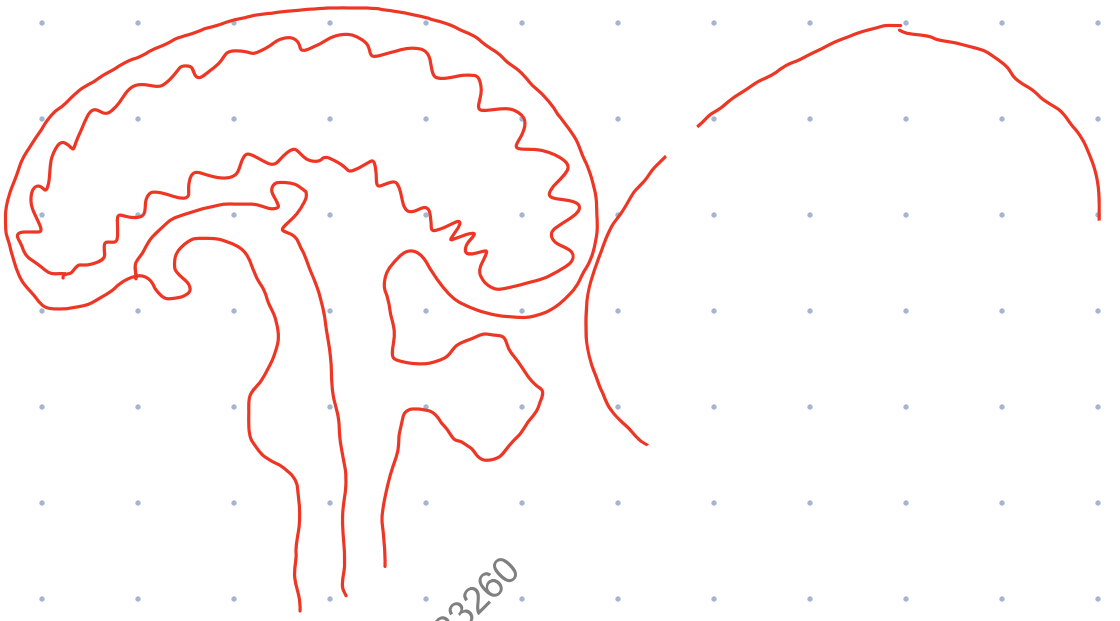
B The gravitational field strength on planet X is equal to the gravitational field strength on planet Y.

C The gravitational field strength on planet X is one third of the gravitational field strength on planet Y.

D The gravitational field strength on planet X is three times the gravitational field strength on planet Y.

* extension is three times on planet X

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