



Mass, Weight and Gravity

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Q1 Which is the correct explanation for why the Moon orbits the Earth? Tick the appropriate box.

- There is an attractive force between the weights of the Earth and Moon.
- They attract each other as they have masses caused by them having weight.
- The weight of the Moon acts downwards.
- There is an attractive force between the masses of the Earth and Moon.
- The mass of the Moon acts downwards.

All masses attract each other but with massive masses like that of the planet you are standing on you do not notice other masses having a pull at you!

There is a line of force between the centres of the Moon and the Earth along which they pull at each other. If that was not there the Moon would fly off in a straight line

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Q2 Two mad scientists are planning a trip to Mars.

a) Professor White tells Professor Brown —

"We won't need so much fuel for the return trip — the rocket will have less mass on Mars."

Is Professor White's reasoning correct? Explain your answer.
Mass always stays the same - it is weight that changes on a different planet. So he is wrong.

b) Professor Brown wants to investigate gravity on Mars. He takes to Mars a small fire extinguisher which weighs 50 N on Earth. He also takes his bathroom scales.

On Mars, Professor Brown weighs the fire extinguisher.



This is a very poor question! Rather than clarifying the difference between weight and mass it confuses you by having scales 'weigh' in kg!

It is not clear what type of scales they are. Spring loaded balance systems read the same wherever they are... here they want you to realize that the scales will 'give you the mass' by calculating it (using Earth's gravitational pull) from the force on the top pan.

On Earth the fire extinguisher weighs 50N, assuming $g_{\text{earth}} = 10 \text{ N/kg}$ its mass is 5kg ($w=mg$ so $m = w/g = 50/10 = 5\text{kg}$)

On Mars it weighs $1.9 \times 10 = 19\text{N}$ but its mass would still be the same - 5kg.

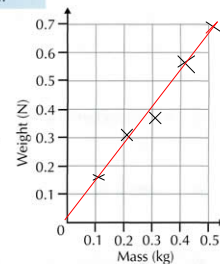
$$g_{\text{Mars}} = w/m = 19/5 = 3.8 \text{ N/kg}$$

Acceleration due to gravity on Earth is the same numeric figure as the gravitational field strength 10 m/s^2 so on Mars it will be 3.8 m/s^2

Q3 A space probe lands on the icy surface of Europa, a moon of Jupiter. It weighs a set of known masses. The results are shown below.

Mass (kg)	0.1	0.2	0.3	0.4	0.5
Weight (N)	0.15	0.30	0.36	0.55	0.68

- a) i) Plot a graph of this data on the axes given.
 ii) Use your graph to estimate the gravitational field strength at Europa's surface.



$w = mg$ so the gradient of the graph is the gravitational field strength = $0.68/0.5 = 1.36 \text{ N/kg}$ (or around that value from the line you have drawn)

- b) Suggest why several masses were weighed, not just one.
You are more likely to stop anomalies if you have a range of readings. You are therefore more likely to get a reliable result.

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