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Structured Questions: Weight and Mass

These questions relate to the difference between mass and weight and the effect of gravity on objects. You will practice how to calculate the weight of on object on different planets and moons.

1 Use the table below to answer the following questions.

Object	Relative Mass (Earth mass = 1)	Gravitational field strength (N/kg)
Earth	**1**	**10**
Moon	**0.012**	**1.6**
mars	**0.18**	**4**
Jupiter	**320**	**25**
Ceres	**0.00015**	**0.28**

a On which object would you feel the **greatest** gravitational force?

b On which object would your **weight** be **the least**?

c On which of the objects would your **mass** be the **greatest**? Explain your answer.

d Describe how you would feel if you were trying to walk around on a planet with the same gravitational field strength as **Jupiter**.

e State the **relationship** between **mass of the object** and its **gravitational field strength.**

2 Copy the text and fill in the missing words from the list below. You can use the words once, more than once or not at all.

kilograms mass joules greater less same Newtons gravity kilogram

Weight is the force exerted on an object due to _____:

Weight is measured in _____. The weight of an object on the moon would be _____ than its weight on Earth.

The _____ of the object will stay the same where ever it is in the Universe..

We can calculate the weight of an object using: Weight = mass x gravitational field strength

Mass is measured in _____

Gravitational field strength is measured in Newtons per _____.

3 The following statements are all about gravity. Decide which statements are **true** and which statements are **false**. If they are false, explain **why** the answer is not correct.

a As you get further away from the centre of the Earth, your weight increases true / false

b My mass on the moon is less than on Earth true / false

c The moon exerts an equal and opposite sized gravitational force on the Earth true / false

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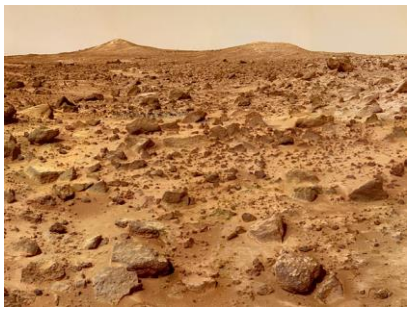

4 Using data from the table on the first side, calculate the following

a. The **weight** of a 80 kg man on Earth.

b. The man's **weight** when he is travelling to become the first man on a one way trip to Mars.

c. The man's **mass** now he has landed on Mars.

5 You pack 20 kg of stuff into a suitcase as you prepare for your first holiday on the Moon.

a How much does your luggage **weigh** on Earth?

b Calculate the **weight** of your luggage when you arrive on the Moon. (Use the table on the first page to help!)

c Describe your holiday on the Moon! How would you feel? What types of things could you do?

d A lot of people believe that you would 'float around on the moon' or 'float off into space'. Explain why this **isn't true**.

6 **Neil Armstrong** landed on the Moon in 1969. At home on **Earth**, he weighed 900 N with his space suit on. On the **Moon** the pull of gravity is not so strong. His weight was only **one sixth** of what it was on Earth.

a How many **Newtons** did Neil **weigh** on the Moon?

b Neil brought back some moon rocks which weighed 80 N on the **Moon**. How much did the rocks **weigh** on Earth?

c Explain why the gravity on the moon is **weaker**.

d What was Neil's **mass** on i) the Earth ii) the Moon?

BONUS TASKS

1 **Superman** came from a planet Krypton where the gravity was **extra strong**! How does this fact explain his **super strength** and his ability to 'leap tall buildings in a single bound'?

2 In the distant future, the human race has travelled across the galaxy to find a new **'Earth like' exoplanet** beyond our solar system. Unfortunately, upon arrival, they discover that it is already inhabited by short, wide, flat creatures and that its surface gravity is 40 N/kg. Explain why our invasion of this new planet might not go to plan. Why have the natives evolved to be that particular shape? Draw a comic strip or write a story about 'The Invasion That Fell Flat'.

3 The gravitational field strength of a planet depends both on its **radius** and **mass**. By taking this into consideration, explain why gas giants like Neptune and Uranus, that are much heavier and bigger than the Earth, only have the **same** surface gravitational field strength as our small rocky planet.