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Mass and Weight

1. What is the difference between mass and weight?

Mass is the amount of stuff inside something (measured in kg)

Weight is the force pulling something down, due to gravity (measured in newtons)

2. Define the term "gravitational field strength" and explain its significance in determining weight.

Force per unit of mass

Weight = mass x gravitational field strength

3. On Earth, what is the approximate value of gravitational field strength, and what unit is it measured in?

10 N/kg (or 9.8 N/kg to be a bit more precise)

4. If an object has a mass of 5 kg, what is its weight on Earth?

W = m g
= 5 x 10
*= **50 N***

or

W = m g
= 5 x 9.8
*= **49 N***

5. If a person has a weight of 600 N on Earth, what is their mass?

W = m g
600 = m x 10
*600 / 10 = m = **60 kg***

or

W = m g
600 = m x 9.8
*600 / 9.8 = m = **61 kg***

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6. How does the weight of an object change when taken to a location where the gravitational field strength is greater than that of Earth?

If the gravitation field strength increases, the weight will also increase.

7. What is the weight of a 10 kg object on the surface of the Moon, where the gravitational field strength is approximately 1.6 N/kg?

$W = m\ g$

$= 10 \times 1.6$

$= \mathbf{16\ N}$

8. Calculate the mass of an object that weighs 150 N on Jupiter, where the gravitational field strength is approximately 24.8 N/kg.

$W = m\ g$

$150 = m \times 24.8$

$150 / 24.8 = m \qquad = \mathbf{6.0\ kg}$

9. On Mars, the gravitational field strength is about 3.7 N/kg. If a person has a mass of 70 kg, what is their weight on Mars?

$W = m\ g$

$= 70 \times 3.7$

$= \mathbf{259\ N}$

10. How does weight differ from mass in terms of its dependence on location?

Mass does not change with location.

Weight changes depending upon the gravitational field strength at the location.

11. If an object weighs 500 N on Saturn, where the gravitational field strength is about 10.4 N/kg, what is its mass?

W = m g

500 = m x 10.4

500 / 10.4 = m = ***48 kg***

12. What effect does a decrease in gravitational field strength have on the weight of an object?

If the gravitational field strength decreases, so does the weight.

13. If the gravitational field strength on a distant planet is 15 N/kg and an object has a mass of 8 kg, what is its weight?

W = m g

= 8 x 15

= ***120N***

14. How does the weight of an object on the surface of the Earth compare to its weight on the surface of the Moon?

On the Moon the gravitational field strength is much less than on the Earth. The weight is therefore less on the Moon.

(about six times less)

15. If an object has a mass of 50 kg, calculate its weight on Venus, where the gravitational field strength is approximately 8.87 N/kg.

$W = m\ g$

$= 50 \times 8.87$

$= \mathbf{444\ N}$