

Mass and Weight – GCSE Physics

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1. Introduction:

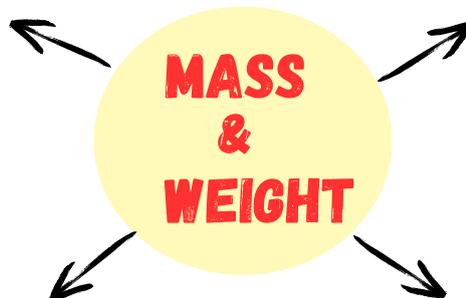
- To understand how things move, interact, and behave in the physical world, the concepts of **Mass** and **Weight** are studied.
- Mass and Weight concept is important,



To Understand Forces and Motion



Space and Astronomy



In Engineering and Design



Safety and Everyday Life

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2. What is Mass?

- Mass is how much matter is in an object.
- It is the property of physical objects that measures:
 - **Inertia:** Resistance to acceleration when a force is applied.
 - **Gravitational influence:** Shows the strength of attraction between two objects.

✨ Key Points ✨

- SI Unit of Mass is **Kilogram (Kg)**.
- It is a Scalar Quantity.
- Mass never changes no matter where the object is—on Earth, on the Moon, or in space.
- It measures **Inertia**.

Example:

A Rocket has a mass of 2,000 kg, whether it's on Earth, the Moon, or floating in space, it's still 2,000 kg.



In all Scenario the Mass of Rocket will remain same (e.g., 2,000 kg)

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3. What is Weight?

- Measure of the Gravitational pull of an object.
- It depends on both the object's **Mass** and the **local Gravitational Acceleration**.

✨ Key Points ✨

- SI Unit of Weight is **Newton (N)**.
- It is a Vector Quantity.
- It changes with gravity, so weight varies depending on where the object is (Earth, Moon, or space).
- It measures **Gravitational force**.

Example:

A person with a mass of 60 kg,



On Earth:

$$\text{weight} = 60 \times 9.8$$

$$\text{weight} = 588 \text{ N}$$



On Moon:

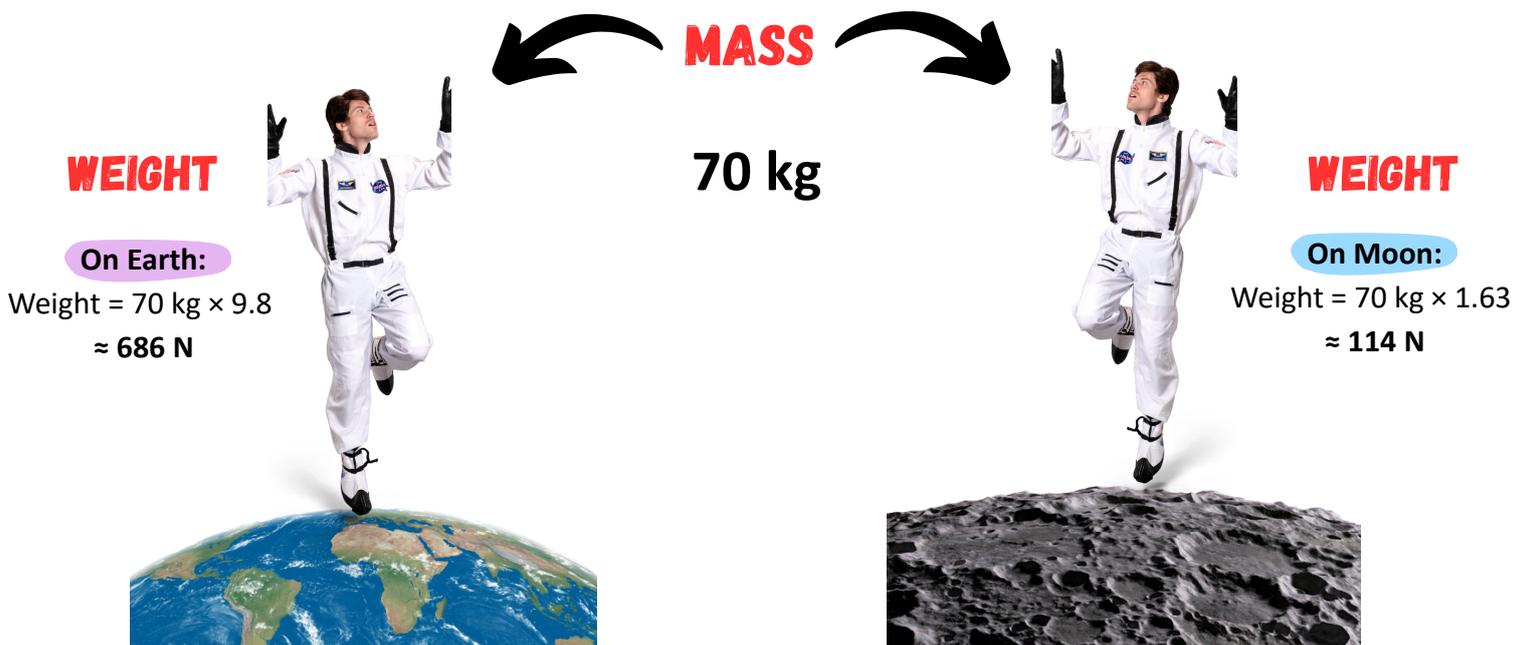
$$\text{weight} \approx 60 \times 1.6$$

$$\text{weight} = 96 \text{ N}$$

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4. Difference between Mass and Weight:

Mass	Weight
Matter is a how much matter an object contains.	Weight is the Force exerted on a mass by Gravity.
It is constant for a body and doesn't change with location.	It is not a constant and change from one place to another.
It is a Scalar Quantity.	It is a Vector Quantity.
SI Unit: Kilogram (Kg)	SI Unit: Newton (N)
Example: An Astronaut has a mass of 70 kg whether it's on Earth, the Moon, or in space.	Example: The same Astronaut weighs 686N on Earth, but only about 114N on the Moon.



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5. Calculating Mass and Weight

Formula for Mass:

$$m = \frac{W}{g}$$

Where,

- **W** = Weight
- **g** = Acceleration due to Gravity

Example: A bag of rice has a weight of 49 newtons on Earth. What is the mass of the bag?

Solution:

Given: • **W** = 49N

Take gravitational acceleration,

$$g=9.8 \text{ m/s}^2$$

Using the formula,

$$m = \frac{W}{g}$$

Putting the values,

$$m = \frac{49\text{N}}{9.8 \text{ m/s}^2}$$

$$m = 5\text{Kg}$$

The mass of the bag of rice is 5 kilograms.

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Formula for Weight:

$$W = m \times g$$

Where,

- **m** = Mass
- **g** = Acceleration due to Gravity

Example: An object has a mass of 8 kilograms. What is its weight on Earth?

Solution:

Given: • **m** = 8kg

Take gravitational acceleration,

$$g=9.8 \text{ m/s}^2$$

Using the formula,

$$W = m \times g$$

Putting the values,

$$W = 8\text{kg} \times 9.8 \text{ m/s}^2$$

$$W = 78.4\text{N}$$

The weight of the object is 78.4 newtons.

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6. FAQs

1. What is the difference between mass and weight in simple words?

Mass is how much matter you have. **Weight** is how strongly gravity pulls on that matter.

2. Why does weight change on other planets but mass doesn't?

Gravity is different on every planet. Your mass doesn't change, but the force (weight) does.

Example: 60 kg mass

- Earth: $60 \times 10 = 600 \text{ N}$

-Moon: $60 \times 1.6 = 96 \text{ N}$

3. What is the SI unit of mass and weight?

Mass- Kilogram (**kg**)

Weight- Newton (**N**)

4. How can I calculate my weight on another planet?

Use $W = m \times g$

If you know your mass and the planet's gravity, multiply them.

Example: 70 kg on Mars ($g = 3.7$)- $70 \times 3.7 = 259 \text{ N}$

5. Is weight a force or a measurement of mass?

Weight is a force. **Mass** is how much matter you have.

Weight = gravity pulling on that matter.