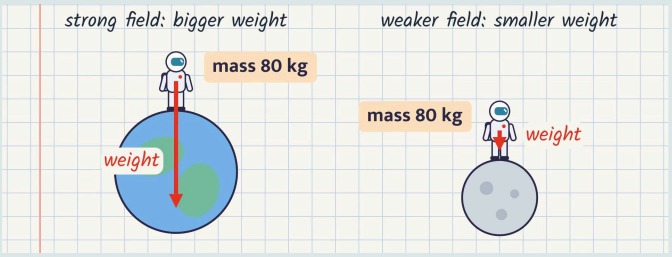
Weight and mass

W = m g, centre of mass, newtonmeters

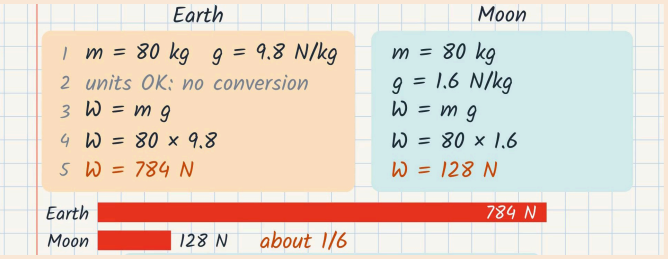
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Summary sheet

1 Mass vs weight



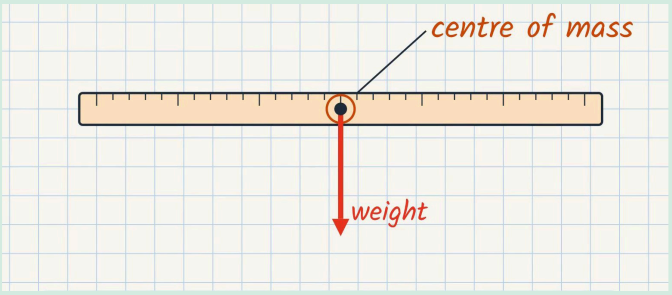
- **Mass** is how much stuff is in an object, in **kilograms (kg)**. It is the same everywhere.
- **Weight** is the force on an object due to gravity, in **newtons (N)**. A weaker gravitational field (the Moon) means a smaller weight, but the same mass.

2 The equation



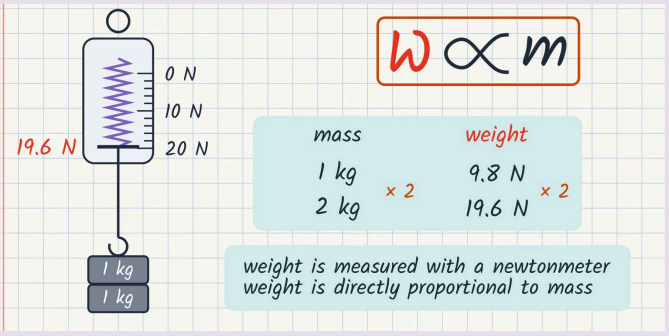
- **W = m g**: weight (N) = mass (kg) × gravitational field strength (N/kg). On Earth g ≈ 9.8 N/kg; the exam gives the value.
- 80 kg astronaut: Earth 80 × 9.8 = **784 N**; Moon 80 × 1.6 = **128 N**, about a sixth.

3 Centre of mass



- We treat all of the weight as acting at one point, the **centre of mass**. Draw the weight arrow from there.
- For a ruler it is in the middle, so it balances on one finger at that point.

4 Measuring weight



- Weight is measured with a **newtonmeter** (a calibrated spring balance).
- Double the mass and the weight doubles: weight is **directly proportional** to mass.

$$W = m\,g$$

weight = mass × gravitational field strength

Exam tip

Watch the units: a weight is in newtons, not kilograms. If the mass is in grams, change it to kilograms first.

Check yourself

- 1 What is the weight of a 2 kg bag? (g = 9.8 N/kg)
- 2 An object weighs 49 N on Earth. What is its mass? (g = 9.8 N/kg)

Answers: 1. 2 × 9.8 = 19.6 N 2. m = W ÷ g = 49 ÷ 9.8 = 5 kg