

Why weight changes from planet to planet

Grade 7 science (Year 8 · Class 7) · Worksheet answers

Each answer shows the formula, the substitution and the result in bold with its unit. Check that weights are in newtons and masses are in kilograms before you finish, and that you never write weight in kilograms.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-4

Problem 1 Mass or weight?

1. Mass: **kilogram (kg)**; measured with a **balance**.
2. Weight: **newton (N)**; measured with a **spring scale**.

Problem 2 The weight formula

$$W = m \times g.$$

W is weight in newtons (N); m is mass in kilograms (kg); g is gravitational field strength in newtons per kilogram (N/kg).

Problem 3 A bag of rice on Earth

$$W = m \times g = 5.0 \times 9.8 = \mathbf{49\ N}.$$

Problem 4 True or false?

1. **False:** mass is measured in kilograms; newtons measure force.
2. **True.**
3. **True:** weight is the force of gravity on an object.

Problem 5 Grams to newtons

1. $750 \div 1000 = \mathbf{0.75\ kg}.$
2. $W = 0.75 \times 9.8 = \mathbf{7.35\ N}.$

Problem 6 Reading the gravity chart

1. **Jupiter** (24.8 N/kg).
2. The **Moon** (1.6 N/kg).

3. **8.9 N/kg.**

Problem 7 Bathroom scale

1. It shows a **mass**.
2. $W = 48 \times 9.8 = \mathbf{470.4\ N}$, about 470 N.

Problem 8 Rover on Mars

1. $W = 180 \times 9.8 = \mathbf{1764\ N}$.
2. $W = 180 \times 3.7 = \mathbf{666\ N}$.
3. The mass is still **180 kg**.

Problem 9 Mass from weight

$$m = W \div g = 245 \div 9.8 = \mathbf{25\ kg}.$$

Problem 10 Planet X graph

1. About **22.2 N**.
2. Gradient = $37 \div 10 = \mathbf{3.7\ N/kg}$.
3. The gradient equals g, so the planet is **Mars**.

Problem 11 Earth against Jupiter

1. Earth: $2.0 \times 9.8 = \mathbf{19.6\ N}$. Jupiter: $2.0 \times 24.8 = \mathbf{49.6\ N}$.
2. $49.6 \div 19.6 = \mathbf{2.5\ times}$ (2.53).

Problem 12 Jumping on the Moon

1. The Moon's gravity is weaker, so the astronaut's weight is smaller. The same leg push can lift a lower weight to a greater height.
2. The mass **stays the same**.

Problem 13 Reading a spring scale

1. $m = 14.7 \div 9.8 = \mathbf{1.5\ kg}$.
2. $W = 1.5 \times 1.6 = \mathbf{2.4\ N}$.

Problem 14 Complete the table

Row 1: $3.0 \times 1.6 = \mathbf{4.8\ N}$.

Row 2: $8.0 \times 8.9 = \mathbf{71.2\ N}$.

Row 3: $98 \div 9.8 = \mathbf{10\ kg}$.

Problem 15 Spot the error

1. Mass is measured in kg, not weight, and the mass does not change on the Moon.
2. Mass: **80 kg** in both places. Weight on Earth: $80 \times 9.8 = \mathbf{784\ N}$. Weight on the Moon: $80 \times 1.6 = \mathbf{128\ N}$.

Problem 16 Lifting a container

1. $W = 250 \times 9.8 = \mathbf{2450\ N}$.
2. Net force = $3000 - 2450 = \mathbf{550\ N\ upwards}$.
3. The forces are unbalanced, so the container **speeds up upwards**.

Problem 17 Three worlds

1. $m = 117.6 \div 9.8 = \mathbf{12\ kg}$.
2. $W = 12 \times 24.8 = \mathbf{297.6\ N}$.
3. $W = 12 \times 1.6 = \mathbf{19.2\ N}$.

Problem 18 Mystery planet

1. $g = W \div m = 30 \div 4.0 = \mathbf{7.5\ N/kg}$.
2. It lies between **Mars (3.7)** and **Venus (8.9)**.
3. $W = 10 \times 7.5 = \mathbf{75\ N}$.

Problem 19 Hammer and feather

1. Hammer: $1.3 \times 1.6 = \mathbf{2.08\ N}$. Feather: $0.0030 \times 1.6 = \mathbf{0.0048\ N}$.
2. Gravity pulls with a force proportional to mass, so the heavier hammer has more weight but also more mass to move. There is no air on the Moon, so nothing else acts and both fall together.
3. On Earth air resistance is large compared with the feather's tiny weight, so it falls slowly.

Problem 20 Scale on the Moon

1. $W = 50 \times 1.6 = \mathbf{80\ N}$.
2. Reading = $80 \div 9.8 = \mathbf{8.2\ kg}$ (8.16).
3. The scale was calibrated for Earth. Her mass is still 50 kg, but the weaker gravity makes the scale show a smaller number.