

GCSE Combined Science: Trilogy

Worksheet: Gravity

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Gravity

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

An astronaut’s tool bag has a mass of 10 kg.
The gravitational field strength on the surface of Venus is 8.9 N/kg.

0 1 . 1

Calculate the weight of the tool bag on Venus.
Use the equation:
weight = mass × gravitational field strength

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.....

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.....

Weight = N
[2 marks]

0 2

An atmospheric probe has a mass of 255 kg.
The gravitational field strength in the upper atmosphere of Uranus is 8.7 N/kg.

0 2 . 1

Calculate the weight of the probe in the upper atmosphere of Uranus.
Use the equation:
weight = mass × gravitational field strength

.....

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.....

Weight = N
[2 marks]

0 3

A boulder has a weight of 4900 N on the Earth.
gravitational field strength = 9.8 N/kg

0 3 . 1

Which quantity is measured in newtons?
Tick (✓) **one** box.

- Mass ☐
- Volume ☐
- Weight ☐
- Density ☐

[1 mark]

0 3 . 2

State the direction in which the weight of the boulder acts.

.....

.....

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.....
[1 mark]

0 3 . 3

Use $W = m g$ to calculate the mass of the boulder.

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Mass = kg

[2 marks]

0 3 . 4

Explain why the mass of the boulder would be the same on the surface of the Moon.

.....

.....

[1 mark]

0 4

An astronaut's backpack has a mass of 12 kg.

0 4 . 1

Calculate the weight of the backpack on the Earth.
gravitational field strength = 9.8 N/kg
Use the equation:
weight = mass $\times$ gravitational field strength

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Weight = N

[2 marks]

0 4 . 2

The gravitational field strength on the Moon is 1.6 N/kg.
Calculate the weight of the backpack on the Moon.

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Weight = N

[2 marks]

0 4 . 3

What is the mass of the backpack on the Moon?

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Mass = kg

[1 mark]

0 4 . 4

Name the instrument used to measure weight.

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.....

.....

[1 mark]

.....

0 5

A parcel has a mass of 50 kg everywhere on the Earth. Table 1 shows the parcel's weight, as measured by very sensitive scales, at two locations where the value of g is slightly different.

Table 1

Location	g in N/kg	Weight in N
North Pole	9.83	491.5
Equator	9.78	489.0

0 5 . 1

Show that the values in Table 1 are consistent with $W = m g$.

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[2 marks]

0 5 . 2

Explain why the weight of the parcel is not exactly the same at the two locations, even though its mass is unchanged.

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[2 marks]

0 5 . 3

A courier's scales at the Equator show the parcel's weight as 489.0 N and the courier concludes that 'the parcel must be missing some contents, because it seems lighter than it should be'.
Evaluate this conclusion.

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[2 marks]

0 6

An atmospheric probe has a mass of 275 kg.

gravitational field strength on Earth = 9.8 N/kg

gravitational field strength in the upper atmosphere of Saturn = 9.0 N/kg

0 6 . 1

Calculate the weight of the probe on Earth.

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Weight on Earth = N

[2 marks]

0 6 . 2

Calculate the difference between the weight of the probe on Earth and its weight in the upper atmosphere of Saturn.

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Difference in weight = N

[2 marks]

0 7

A student wants to determine the weight of a rock sample, and understands that weight is not the same thing as mass.

0 7 . 1

Explain the difference between mass and weight, including why the rock's weight would be different on the Moon than on Earth, and describe how the student could measure the rock's weight using a newtonmeter, including how to check the newtonmeter for a zero error before use.

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[6 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Gravity · 31 marks

Question 1 (2 marks)

01.1 [2 marks]

Answer: 89 N

- $W = 10 \times 8.9$ (1)
 - 89 (N) (1)
-
-

Question 2 (2 marks)

02.1 [2 marks]

Answer: 2218.5 N

- $W = 255 \times 8.7$ (1)
 - 2218.5 (N) (1)
-
-

Question 3 (5 marks)

03.1 [1 mark]

Correct: Weight

03.2 [1 mark]

Answer: Towards the centre of the Earth (vertically downwards).

- towards the centre of the Earth / vertically downwards (1)

Notes: Allow towards the Earth.

03.3 [2 marks]

Answer: 500 kg

- $m = 4900 \div 9.8$ (1)
 - 500 (kg) (1)
-

03.4 [1 mark]

Answer: Mass does not depend on gravitational field strength; it is the amount of matter, which is unchanged.

- mass does not depend on gravitational field strength / mass is the amount of matter in the boulder, which does not change (1)
-

Question 4 (6 marks)

04.1 [2 marks]

Answer: 117.6 N (118 N)

- $W = 12 \times 9.8$ (1)
- 117.6 (N) (1)

Notes: Allow 118 N. An answer of 117.6 scores 2 marks.

04.2 [2 marks]

Answer: 19.2 N

- $W = 12 \times 1.6$ (1)
 - 19.2 (N) (1)
-

04.3 [1 mark]

Answer: 12 kg

- 12 (kg) (1)
-

04.4 [1 mark]

Answer: A newtonmeter (calibrated spring balance).

- newtonmeter / (calibrated) spring balance (1)
-

Question 5 (6 marks)

05.1 [2 marks]

Answer: $50 \times 9.83 = 491.5 \text{ N}$ and $50 \times 9.78 = 489.0 \text{ N}$, matching the table.

- $50 \times 9.83 = 491.5 \text{ (N)}$ (1)
 - $50 \times 9.78 = 489.0 \text{ (N)}$, both matching Table 1 (1)
-

05.2 [2 marks]

Answer: g differs slightly between the locations; since $W = mg$, a smaller g gives a smaller weight for the same mass.

- the gravitational field strength (g) is slightly different at the two locations (1)
 - weight = mass $\times g$, so a smaller value of g gives a smaller weight for the same mass (1)
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05.3 [2 marks]

Answer: The difference is explained by g being smaller at the Equator; the conclusion is not justified without checking mass directly.

- the (small) difference is fully explained by the slightly smaller value of g at the Equator, not by missing contents (1)
 - the conclusion is not justified: the parcel's mass (which shows whether contents are missing) is unaffected by location, so it should be checked directly (e.g. with a beam balance) rather than by weight alone (1)
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Question 6 (4 marks)

06.1 [2 marks]

Answer: 2695 N

- $W = 275 \times 9.8$ (1)
 - 2695 (N) (1)
-

06.2 [2 marks]

Answer: 220 N (less in the upper atmosphere of Saturn)

- weight in the upper atmosphere of Saturn = $275 \times 9.0 = 2475 \text{ (N)}$ (1)
- difference = 220 (N) (1)

Notes: Allow ECF from the first part. Allow $(9.8 - 9.0) \times 275$ for both marks.

Question 7 (6 marks)

07.1 [6 marks]

Answer: Level-of-response answer: mass (kg) is the amount of matter in an object and does not change with location; weight (N) is the force due to gravity, $W = mg$, and depends on gravitational field strength, which is smaller on the Moon, so the same mass weighs less there; weight is measured by hanging the object from a newtonmeter and reading its scale, after checking it reads zero with nothing attached (and correcting or re-zeroing if it does not).

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- mass is a measure of the amount of matter in an object (in kg) and does not change depending on location
- weight is the force acting on an object due to gravity (in N), and depends on both the object's mass and the gravitational field strength at that location ($W = mg$)
- the Moon's gravitational field strength is smaller than the Earth's, so an object of the same mass weighs less on the Moon than on Earth
- weight can be measured directly using a newtonmeter: hang the object from the hook and read the force shown on the scale
- before use, check for a zero error by seeing whether the newtonmeter reads exactly zero with nothing attached
- if it does not read zero, either re-zero/recalibrate the newtonmeter, or subtract the same offset from every subsequent reading

Notes: Level 1 (1–2 marks): states that mass and weight are different, or gives an isolated fact about the newtonmeter. Level 2 (3–4 marks): explains the mass/weight distinction and the effect of a smaller gravitational field on the Moon, or describes the newtonmeter method, but not both fully. Level 3 (5–6 marks): a full account covering the mass/weight distinction with $W = mg$, the effect of the Moon's smaller gravitational field, and a correct method including checking for (and dealing with) a zero error.
