

$$S = \frac{1}{2} g t^2$$

$$v = g t$$

$$g_{\text{earth}} = 9.81 \text{ m/s}^2$$

$$g_{\text{moon}} = 1.62 \text{ m/s}^2$$

Motion of a falling object (Earth & Moon) - Level 3 - Challenge

1. A tool is dropped from a **height of 20 m** on **Earth**.



- Calculate the **time** taken to reach the ground.

Given:

$$s = 20 \text{ m}$$

$$g = 9.81 \text{ m/s}^2$$

$$u = 0 \text{ m/s}$$

$$S = \frac{1}{2} g t^2$$

$$20 = \frac{1}{2} (9.81) t^2$$

$$t^2 = 40/9.81 = 4.08$$

$$t = \sqrt{4.08} \approx 2.02 \text{ s}$$

Answer: $t = 2 \text{ s}$

- Calculate the **final velocity**.

$$v = gt = (9.81) \times (2.02) = 19.8 \text{ m/s}$$

Answer: $v = 19.8 \text{ m/s}$

2. The same tool is dropped from **20 m** on the **Moon**.

- Calculate the **final velocity**

Given:

$$g = 1.62 \text{ m/s}^2$$

Time taken

$$S = \frac{1}{2} g t^2$$

$$20 = \frac{1}{2} (1.62) t^2$$

$$t^2 = 40/1.62 = 24.69$$

$$t = \sqrt{24.69} \approx 4.97 \text{ s}$$

Answer: $t = 5 \text{ s}$

Final velocity:

$$v = gt = (1.62) \times (4.97) = 8.05 \text{ m/s}$$

Answer $v = 8.05 \text{ m/s}$



Compare your answers with part 1.

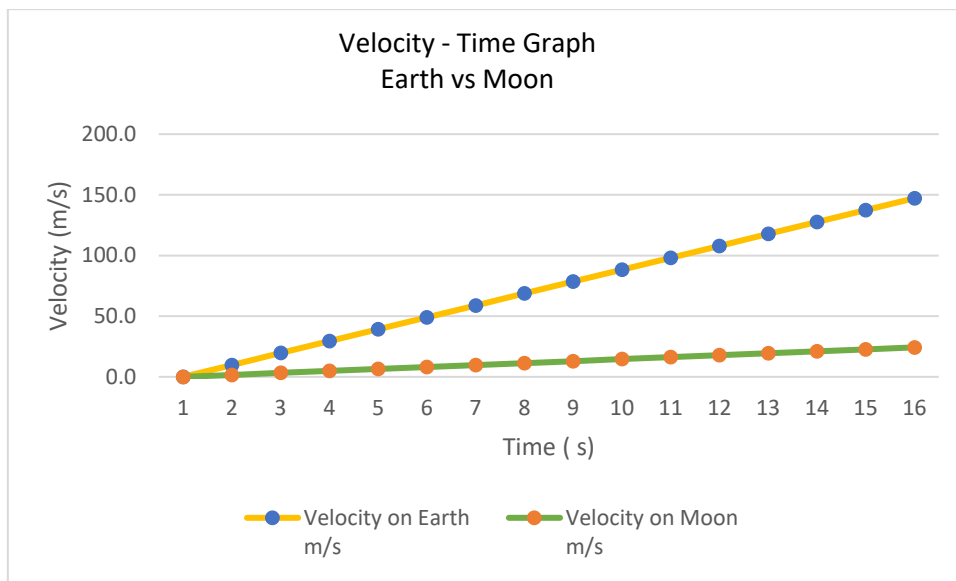
- The object takes longer to reach the ground on the Moon.
 - The final velocity is much smaller on the Moon.
 - This is because gravity on the Moon is weaker than on Earth.
3. Two objects are dropped at the same **time**, one on **Earth** and one on the **Moon**. Explain why the object on **Earth** reaches the ground first.

The object on Earth reaches the ground first because Earth has a stronger gravitational pull, causing the object to accelerate faster than on the Moon.

4. Sketch a **Velocity - Time** Graph for:

- A falling object on **Earth**
- A falling object on the **Moon**

On the same axes.



5. An astronaut says:

"Objects fall slower on the Moon because there is no gravity"

Do you agree? Explain your answer.



The statement is **incorrect**. There is **gravity on the Moon**, but it is **weaker than on Earth**.

This is why objects fall more slowly, not because gravity is absent.