

Mass, Weight and Free Fall

Chapter 9: Gravitation · Topic 2

Key Concept

Free fall describes the motion of an object falling under the influence of gravity alone, with no other forces (like air resistance) acting on it — in a true vacuum, all objects fall at the same rate regardless of their mass, since gravitational acceleration (approximately 9.8 m/s^2 on Earth) affects all masses equally. In reality, air resistance often makes lighter or less streamlined objects, like a feather, fall slower than denser objects like a stone, unless the fall occurs in a vacuum.

Quick Revision Notes

- Mass = amount of matter (constant everywhere); Weight = force due to gravity ($W = mg$, varies by location).
- Weight differs on the Moon versus Earth because gravity differs, even though mass is unchanged.
- Free fall: motion under gravity alone, with all objects falling at the same rate in a vacuum.
- Air resistance causes lighter/less streamlined objects to fall slower in real (non-vacuum) conditions.

Practice Questions

- 1 Explain why an astronaut's weight is less on the Moon than on Earth.
- 2 Why does a feather fall slower than a stone in air, but at the same rate in a vacuum?
- 3 Calculate the weight of a 10kg object on Earth ($g=9.8 \text{ m/s}^2$).