

Orbital motion and satellites

4.8.1.3 · Space physics · revision notes

How gravity keeps planets, moons and artificial satellites in their orbits, and how these objects are similar and different. GCSE Physics only, not in Combined Science.

Key facts

- Gravity provides the force that keeps planets and satellites in their orbits
- Planet: orbits a star. Moon: a natural satellite that orbits a planet
- Artificial satellite: made by people and launched into orbit
- One circular orbit: distance = $2 \times \pi \times \text{radius}$
- Speed = distance ÷ time (time in seconds for m/s)

Notes

Gravity and orbits

- Gravity is the force that keeps planets, moons and artificial satellites moving in their orbits.
- You can treat these orbits as circles.
- Without gravity, an orbiting object would carry on moving in a straight line and fly off into space.

Planets, moons and artificial satellites

- A **planet** orbits a star (in our solar system, the Sun).
- A **moon** is a natural satellite: it orbits a planet.
- An **artificial satellite** is made and launched by people. Most orbit the Earth, for jobs such as communications, weather monitoring and navigation.
- Similarities: all are kept in orbit by gravity, all orbit a more massive object, and all move in (nearly) circular orbits.
- Differences: what they orbit, whether they are natural or made by people, their size, and the time they take to complete one orbit.

How to answer each type of question

Give a similarity or a difference between orbiting objects

1 to 2 marks

Grade 4

1. Say what each object orbits: a star, a planet, or (for most artificial satellites) the Earth.
2. Say whether each object is natural or made by people.
3. For a similarity use gravity or the circular orbit. For a difference, write about both objects.

Example. The Moon and a weather satellite both orbit the Earth.

Give **one** similarity and **one** difference between the Moon and the weather satellite.

Model answer. Similarity: both are kept in orbit by the Earth's gravity (1).

Difference: the Moon is a natural satellite, whereas the weather satellite was made and launched by people (1).

Also accept for the difference: the Moon is much bigger, or the Moon takes longer to complete one orbit.

Don't lose marks

- ✗ Saying there is no gravity in space, or no force on a satellite. Gravity is what keeps it in orbit.
- ✗ Saying the resultant force acts outwards or in the direction of motion. It is gravity, acting towards the centre.
- ✗ Leaving the time in minutes or hours in a speed calculation. Convert to seconds to get m/s.
- ✗ Using a height above the Earth's surface as the orbit radius. The radius is measured from the centre of the Earth, so add the Earth's radius if you are given a height.
- ✗ Mixing up the objects: a moon orbits a planet, not the Sun; an artificial satellite is not a moon.

More tips

Memory tricks

- Imagine whirling a ball on a string: the string pulls the ball inwards, like gravity. If the string breaks, the ball flies off in a straight line.
- Sense check: satellites orbiting the Earth usually travel at a few thousand metres per second. A much smaller answer usually means the time was left in minutes or hours.

Exam technique

- For similarity and difference questions, write a full comparison, e.g. 'A moon orbits a planet, whereas a planet orbits a star.'
- In orbit calculations, show each step (distance, time in seconds, speed) and give the unit.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

State the force that keeps objects in orbit

Gravity provides the force that keeps planets, moons and artificial satellites in their orbits.

Grade 4**Tell apart planets, moons and artificial satellites**

Planets orbit a star, moons orbit planets, and artificial satellites are made and launched by people.

Grade 5**Give similarities between orbiting objects**

All are held in orbit by the gravity of a more massive object and move in (nearly) circular orbits.

Free notes, worksheets, practice papers and mock exams at chhetriacademy.com. Written for this site; not taken from past papers.
Stuck? 1-to-1 tutoring with a free 30-minute trial lesson.