AQA GCSE Space Physics

Orbital Motion Notes and Questions

GCSE Notes: Gravity and Orbits

Gravity is the force that keeps planets, moons and satellites in orbit. An orbit is the path one object takes around another object in space.

Planets orbit stars. In our solar system, the planets orbit the Sun because the Sun has a very large mass and a strong gravitational pull.

Moons are natural satellites. This means they are natural objects that orbit planets. For example, the Moon orbits the Earth because Earth's gravity pulls it towards the Earth.

Artificial satellites are made by humans. They are launched into space and placed in orbit around Earth or another planet. They are used for things such as GPS, weather forecasting, communication and taking pictures of Earth.

Planets, moons and artificial satellites are similar because they all move in orbits and are all affected by gravity. They are different because planets orbit stars, moons orbit planets, and artificial satellites are human-made machines.

Gravity does not make an orbiting object stop moving. Instead, gravity changes the direction of the object's motion. This makes the object move in a curved path around the planet or star.

Without gravity, a planet or satellite would travel off in a straight line into space. With gravity, it is pulled towards the object it is orbiting, so its path bends into an orbit.

In a circular orbit, the speed of the object can stay the same. However, its direction is always changing because it is moving around a circle.

Velocity means speed in a particular direction. So even if the speed is unchanged, the velocity changes because the direction changes.

A change in velocity means acceleration. This is why an object in a circular orbit is accelerating, even when its speed stays constant.

The force causing this acceleration is gravity. Gravity acts towards the centre of the orbit. This inward force is called the centripetal force.

A satellite stays in orbit because it has sideways motion as well as being pulled inwards by gravity. It is constantly falling towards Earth, but it keeps moving forwards, so it keeps missing Earth.

A stable orbit means the satellite keeps following the same path around the planet or star. It does not spiral inwards or fly away into space.

For a stable orbit, the speed and radius must be matched. The radius is the distance from the object being orbited to the orbiting object.

If the speed of an orbiting object changes, the radius of the orbit must also change for the orbit to stay stable. A faster object needs a larger orbit, while a slower object needs a smaller orbit.

A simple way to remember this is: gravity pulls inwards, the satellite moves forwards, and the two together produce an orbit.

Questions

1. What force keeps planets, moons and satellites moving in orbits?
2. What object do the planets in our solar system orbit?
3. What is meant by a natural satellite?
4. What is the difference between a natural satellite and an artificial satellite?
5. Give two uses of artificial satellites in everyday life.
6. Explain why a planet or satellite would travel in a straight line if gravity did not act on it.
7. Describe how gravity changes the motion of a satellite so that it follows a curved path.
8. In a circular orbit, the speed of a satellite can stay the same. Explain why its velocity is still changing.

9. Explain why an object in a circular orbit is accelerating, even if its speed is constant.
10. A satellite moves faster in its orbit. Explain why the radius of its orbit must change if the satellite is to remain in a stable orbit.