

Exercise walk-through

8.2

Orbital motion, natural and artificial satellites (4.8.1.3)

AQA · GCSE · Physics

Exercises 2.1·2.3

2.1 State the force that keeps a satellite in orbit, and its direction relative to the motion. [2]

2.2 Name the natural satellite of the Earth and give one example of an artificial satellite. [2]

2.3 (HT) A planet orbits at constant speed. Explain why its velocity is changing. [2]

Exercises 2.1·2.3

2.1 State the force that keeps a satellite in orbit, and its direction relative to the motion. [2]

2.1 Gravity; towards the centre of the orbit – at right angles to the motion.

2.2 Name the natural satellite of the Earth and give one example of an artificial satellite. [2]

2.2 The Moon is the Earth's natural satellite; any artificial one, e.g. a GPS or communication satellite.

2.3 (HT) A planet orbits at constant speed. Explain why its velocity is changing. [2]

2.3 Velocity is a vector; its direction changes continuously around the circle; so the velocity changes even though the speed does not.

Exercises 3.1·3.2

3.1 A satellite orbits the Earth in a circle at constant speed.

- (a) Explain why the satellite accelerates even though its speed is constant. [3]
- (b) State the direction of the force causing this, and name the force. [2]
- (c) The satellite's speed is increased. Explain what must happen to its orbit radius for stability. [2]

3.2 Explain the similarities and distinctions between the Moon and a GPS satellite. [3]

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3.1 (a) Acceleration is a change in velocity; velocity is a vector, and its direction changes continuously in a circle; so the satellite accelerates even at constant speed. **3.1** (b) Towards the centre of the orbit – at right angles to the motion; the Earth's gravitational pull. **3.1** (c) A stable orbit at the higher speed needs a smaller radius; otherwise gravity would not bend the path enough and the satellite would spiral outward.

3.2 Explain the similarities and distinctions between the Moon and a GPS satellite. [3]

3.2 Similarity: both orbit a larger body and are kept in orbit by the same gravitational force. Distinction: the Moon is a natural satellite orbiting the Earth; a GPS satellite is artificial – made and launched by humans – also orbiting the Earth but in a chosen orbit.

Exercise 3.3

3.3 A space probe approaches Mars and needs to enter a lower, faster orbit.

- (a) State what happens to the gravitational force strength as the orbit gets closer to the planet. [1]
- (b) Explain, in terms of gravity and velocity, why a lower orbit means a faster satellite. [3]

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(a) State what happens to the gravitational force strength as the orbit gets closer to the planet. [1]

(b) Explain, in terms of gravity and velocity, why a lower orbit means a faster satellite. [3]

3.3 (a) The gravitational force gets stronger (closer to the planet). **3.3** (b) Closer in, gravity is stronger; a stronger force at right angles changes the direction of motion faster, curving the path more sharply; so the satellite can maintain a circular path only at a higher speed – lower orbits are faster.