Astronomy

Question Paper

Level	GCSE
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1P)
Topic	Force & Motion
Sub-Topic	Astronomy
Booklet	Question Paper

Time Allowed: **62 minutes**

Score: **/52**

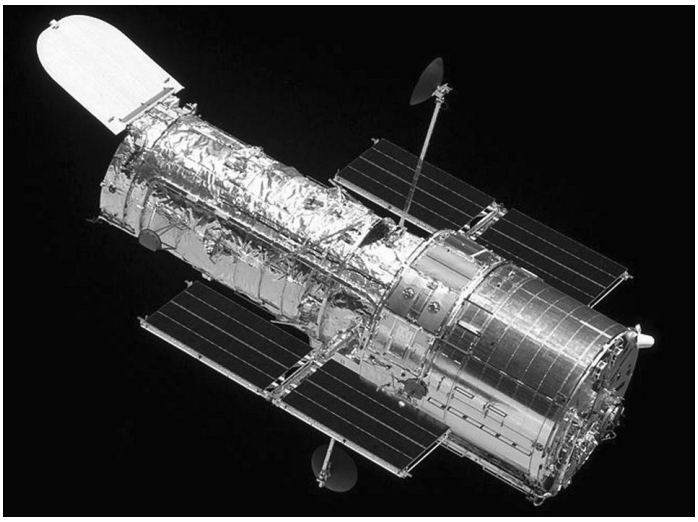
Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1. The Hubble Space Telescope is in orbit around the Earth.

It detects visible light from distant objects.



(a) Name the force that keeps the telescope in orbit around the Earth.

(1)

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(b) The Hubble Space Telescope moves in a circular orbit.

Its distance above the Earth's surface is 560 km.

(i) The radius of the Earth is 6400 km.

Calculate the radius of the orbit of the Hubble Space Telescope.

(1)

Radius = ... km

(ii) The Hubble Space Telescope completes one orbit in 96 minutes.

Calculate its orbital speed in m/s.

(3)

Orbital speed = ... m/s

(c) The Chandra Telescope also orbits the Earth, but does not move in a circular orbit.

Its distance from the Earth and its speed change as it orbits the Earth.

It travels fastest when it is closest to the Earth.

Use ideas about energy to explain why.

(3)

(d) The Chandra Telescope detects X-rays from distant objects.

(i) State the name of the type of wave that includes X-rays and visible light.

(1)

(ii) Describe **two** differences between X-rays and visible light.

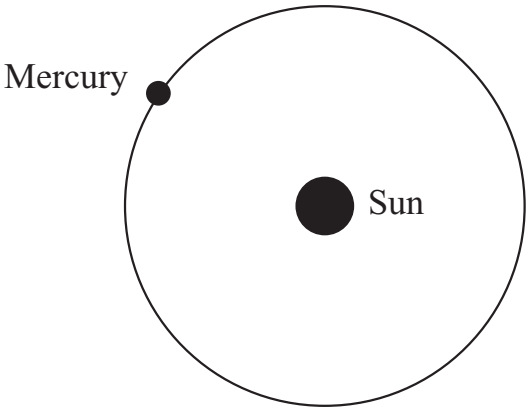
(2)

1

2

(Total for Question 1 = 11 marks)

2. The planet Mercury orbits the Sun.



(a) Mercury takes 88 days to orbit the Sun.

The average radius of the orbit is 58 million km.

Calculate the average orbital speed of Mercury.

Give the unit.

(3)

Average orbital speed = ... Unit .....

(b) Comets also orbit the Sun.

(i) Name the force that causes comets and planets to orbit the Sun.

(1)

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(ii) Add to the diagram opposite to show the orbit of a typical comet.

(1)

(iii) The speed of a comet changes during its orbit.

On the orbit you have drawn, label with the letter **X** the position where the comet travels at its **fastest** speed.

(1)

(iv) Explain why the comet travels fastest at point **X**.

(2)

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(Total for Question 2 = 8 marks)

3. This question is about the Solar System.

(a) The object at the centre of our Solar System is

(1)

- ☒ **A** a comet
- ☒ **B** the Earth
- ☒ **C** the Moon
- ☒ **D** the Sun

(b) Earth and Mars are planets in our Solar System.

The table shows some data for these planets.

planet	radius of orbit in km	time of orbit in days
Earth	150 000 000	365
Mars	250 000 000	690

(i) Calculate the orbital speed of Mars in km / day.

(2)

speed = ... km / day

(ii) The distance between Earth and Mars varies between 100 million km and 400 million km.

Explain why this distance is not constant.

You may draw a diagram to help your answer.

(2)

(c) Visible light from Mars reaches the Earth.

The speed of light is 300 000 km/s.

(i) Show that when the planets are 170 000 000 km apart, it takes about 600 s for light to travel this distance.

(3)

(ii) Scientists land a remote-controlled vehicle on Mars.

The vehicle sends images back to Earth showing its surroundings on Mars.

Sometimes these images show rocks ahead that could damage the vehicle.

A scientist on Earth sends radio signals that control this vehicle.

The speed of the vehicle is limited to 0.04 m/s.

Suggest why the speed is kept low.

(2)

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(Total for Question 3 = 10 marks)

4. The Astra satellite is in an orbit around the Earth.

(a) The satellite uses microwave signals for communication.

Microwaves are part of the electromagnetic spectrum.

(i) Which part of the electromagnetic spectrum has longer wavelengths than microwaves?

(1)

☒ **A** gamma rays

☒ **B** radio waves

☒ **C** ultraviolet light

☒ **D** visible light

(ii) Which of these statements is correct?

(1)

☒ **A** Microwaves always travel faster than radio waves.

☒ **B** Microwaves always travel slower than radio waves.

☒ **C** Microwaves and radio waves travel at the same speed in a vacuum.

☒ **D** Microwaves and radio waves travel at the same speed in all materials.

(iii) State one property of electromagnetic waves that makes microwaves suitable for communications with a satellite in space.

(1)

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(b) The Astra satellite takes 24 hours to orbit the Earth once.

It travels at a speed of 3.1 km/s.

Calculate the orbital radius of the satellite and give the unit.

(4)

orbital radius = ... unit .....

(c) The Astra satellite orbits above the equator and travels in the same direction as the rotation of the Earth.

Suggest why this type of 24-hour orbit is an advantage for communications.

(1)

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(Total for Question 4 = 8 marks)

5. The Moon orbits the Earth.

(a) State a difference between the orbit of a moon and the orbit of a planet.

(2)

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(b) The radius of the Moon's orbit is 385 000 km.

It takes 27 days for the Moon to complete one orbit.

Calculate the orbital speed of the Moon.

Give a suitable unit.

(3)

orbital speed = ... unit .....

(c) In 1971, astronaut Alan Shepard hit a golf ball on the surface of the Moon.

The golf ball had a mass of 50 g and he transferred 56 J of energy to it.

(i) State the equation linking kinetic energy, mass and velocity.

(1)

(ii) Calculate the initial velocity of the ball.

(3)

initial velocity = ... m/s

(d) At its highest point the ball had gained 12 J of gravitational potential energy.

(i) State the kinetic energy of the ball at its highest point.

(1)

kinetic energy = ... J

(ii) State the equation linking gravitational potential energy, mass, *g* and height.

(1)

(iii) Calculate the maximum height that the ball reached.
(gravitational field strength on the Moon, *g* = 1.6 N/kg)

(2)

maximum height = ... m

(e) Suggest why the ball travelled further on the Moon than it would have done on Earth.

(2)

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(Total for Question 5 = 15 marks)