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EDEXCEL GCSE PHYSICS: QUESTIONS BY TOPIC

Astronomy (7)

GCSE Physics (Foundation) Topic 7

12 questions · 124 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Physics 1PH0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

12 questions · 124 marks · lowest tariff first



7-MARK QUESTIONS

2 questions in this booklet



3 (a) Which of these planets is at the greatest distance from the Sun?

(1)

- ☐ A Jupiter
- ☐ B Mars
- ☐ C Neptune
- ☐ D Venus

(b) Use words from the box to complete the following sentences.

galaxy	planet	satellite
solar system	star	

(3)

- (i) Saturn is a
- (ii) The Moon is a
- (iii) Halley's Comet orbits a

(c) Figure 3 shows a Mars Exploration Rover.



(Source: *photojournal.jpl.nasa.gov*)

Figure 3

The mass of the rover is 190 kg.

- (i) The gravitational field strength on Earth is 10 N/kg.

Calculate the weight of the rover on Earth.

Use the equation

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

(1)

weight on Earth = ... N

- (ii) The weight of the rover on Mars is 700 N.

Calculate the gravitational field strength on Mars.

(2)

gravitational field strength on Mars = ... N/kg

(Total for Question 3 = 7 marks)

1 (a) The Sun is at the centre of our Solar System.

The planets orbit the Sun.

Which planet is nearest to the Sun?

(1)

- ☐ A Jupiter
- ☐ B Mars
- ☐ C Mercury
- ☐ D Venus

(b) The Moon orbits the Earth.

Which of these describes the Moon?

(1)

- ☐ A an asteroid
- ☐ B a comet
- ☐ C a nebula
- ☐ D a natural satellite

(c) Any object weighs less on the Moon than it does on the Earth.

The gravitational field strength on the Moon is different from the gravitational field strength on the Earth.

Suggest **two** reasons why the gravitational field strength on the Moon is different from the gravitational field strength on the Earth.

(2)

1

.....

2

.....



- (d) The gravitational field strength on the Moon is 1.6 N/kg.
The mass of a rock on the Moon is 6.0 kg.

Calculate the weight of this rock on the Moon.

State the unit of weight.

Use the equation

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

(3)

weight of rock = ... unit

(Total for Question 1 = 7 marks)

9-MARK QUESTIONS

2 questions in this booklet



5 This question is about stars.

(a) Use words from the box to complete the following sentences.

black hole	main sequence
nebula	red giant
	white dwarf

(i) Stars of similar mass to our Sun were formed from a cloud of gas and dust called a

(1)

(ii) Our Sun is a star.

(1)

(b) (i) Which will be the next stage in the evolution of our Sun?

(1)

- ☐ **A** red dwarf
- ☐ **B** red giant
- ☐ **C** white dwarf
- ☐ **D** white giant

(ii) The core of a star with a much bigger mass than our Sun is most likely to end as a

(1)

- ☐ **A** white dwarf
- ☐ **B** red giant
- ☐ **C** protostar
- ☐ **D** black hole



(c) A nuclear fusion reaction is happening in our Sun.

The nuclear fusion reaction produces helium and radiates energy.

(i) State **one** of the conditions necessary for this nuclear fusion reaction to start.

(1)

(ii) Describe what happens in this nuclear fusion reaction.

(2)

(iii) The intensity of the Sun's radiation in W/m^2 on the surface of Earth is 1.32×10^3 .

The intensity of the Sun's radiation in W/m^2 on the surface of Mars is 4.92×10^2 .

Calculate the ratio

$$\frac{\text{intensity of the Sun's radiation on the surface of Earth}}{\text{intensity of the Sun's radiation on the surface of Mars}}$$

(2)

ratio = ...

(Total for Question 5 = 9 marks)



3 Figure 8 shows two types of force that act in the Sun.

One type of force acts inwards, towards the centre of the Sun.

The other type of force acts outwards, away from the centre of the Sun.

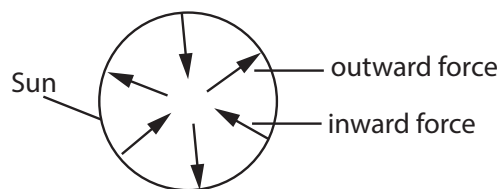


Figure 8

(a) Outward forces are a result of nuclear fusion in the Sun.

State what causes the inward forces.

(1)

(b) The inward and outward forces in stars like the Sun stay balanced for 10 billion years.

(i) In the Sun, these forces have been balanced for 46% of this time.

Calculate for how many billions of years these forces have been balanced in the Sun.

(2)

time = ... billion years

(ii) Describe what will happen to the Sun when the inward and outward forces become unbalanced.

(2)

(c) Nuclear fusion reactions take place in the Sun.

Describe what happens in a nuclear fusion reaction.

(2)

(d) In 1989, two scientists claimed that they could produce a nuclear fusion reaction in their laboratory.

They said their reaction could take place at room temperature in a test tube.

Explain why other scientists did not believe them.

(2)

(Total for Question 3 = 9 marks)

11-MARK QUESTIONS

6 questions in this booklet



7 (a) Figure 12 is a diagram showing a lens, with some light rays passing through it.

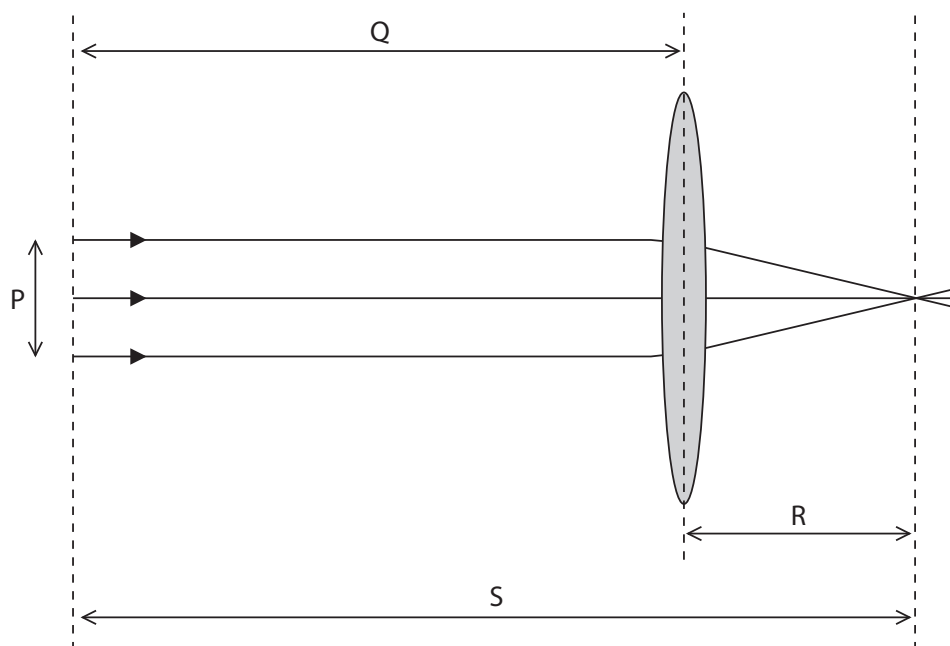


Figure 12

(i) This diagram shows a

- ☐ A converging lens forming a real image
- ☐ B diverging lens forming a real image
- ☐ C converging lens forming a virtual image
- ☐ D diverging lens forming a virtual image

(1)

(ii) Which length, labelled on Figure 12, shows the focal length of the lens?

- ☐ P
- ☐ Q
- ☐ R
- ☐ S

(1)

(b) Calculate the power of a lens of focal length 17 cm.

Use the equation

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

Give the answer to 2 significant figures.

(3)

power = ... dioptres



*(c) More than two thousand years ago the Earth was believed to be at the centre of the universe as shown in Figure 13.

The planets, the Moon and the Sun were believed to be in orbit around the Earth.

In 1543 Nicolaus Copernicus proposed that the Earth was a planet, and that the Earth and the other planets orbit around the Sun.

This model is shown in Figure 14.

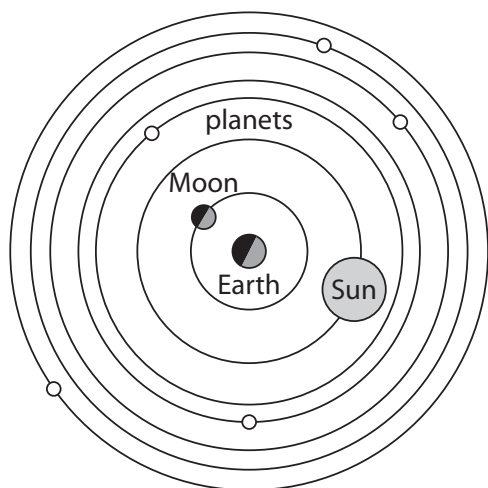


Figure 13

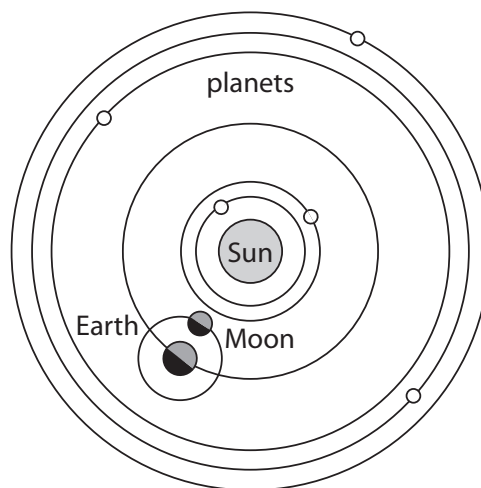


Figure 14

Discuss how evidence has changed our views of the universe.

(6)

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(Total for Question 7 = 11 marks)



10 (a) Which row of the table is correct for both force and velocity?

(1)

	force	velocity
☒ A	scalar	scalar
☒ B	scalar	vector
☒ C	vector	scalar
☒ D	vector	vector

(b) Figure 20 shows a satellite orbiting the Earth.

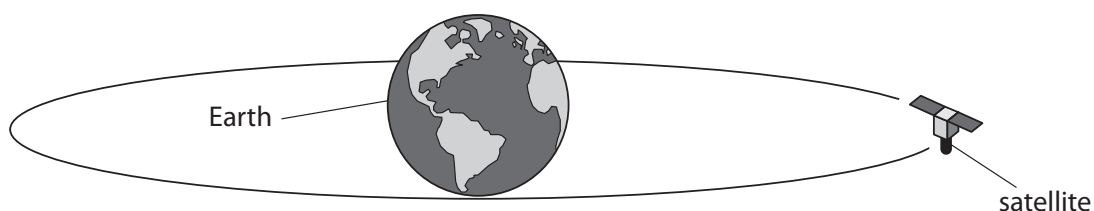


Figure 20

(i) State the name of the force that keeps the satellite in orbit around the Earth.

(1)

(ii) Draw an arrow on Figure 20 to show the direction of the force acting on the satellite, that keeps the satellite in orbit around the Earth.

Label this arrow 'F'.

(1)

(c) Satellites are used to gather data about the origin of the Universe.

The Big Bang theory is a theory about the origin of the Universe.

Evidence for the Big Bang theory is provided by red-shift and CMB radiation.

(i) Describe what is meant by red-shift.

(2)

(ii) Explain how red-shift provides evidence for the Big Bang theory.

(2)

(iii) The Cosmic Background Explorer (COBE) satellite observed CMB radiation from 1989 to 1993.

State what the 'M' in CMB radiation stands for.

(1)

(iv) State what is meant by 'cosmic background radiation'.

(1)



(v) Explain how the presence of CMB radiation provides evidence for the Big Bang theory.

(2)

(Total for Question 10 = 11 marks)



- 10 (a) The Sun has a mass of 2.0×10^{30} kg.
A white dwarf has a mass of 3.4×10^{29} kg.

Calculate the value of

$$\frac{\text{mass of this white dwarf}}{\text{mass of the Sun}}$$

(2)

value = ...

- (b) Figure 18 is a diagram giving some information about main sequence stars.
Luminosity is a measure of how bright something is.
An increase in luminosity means an increase in brightness.

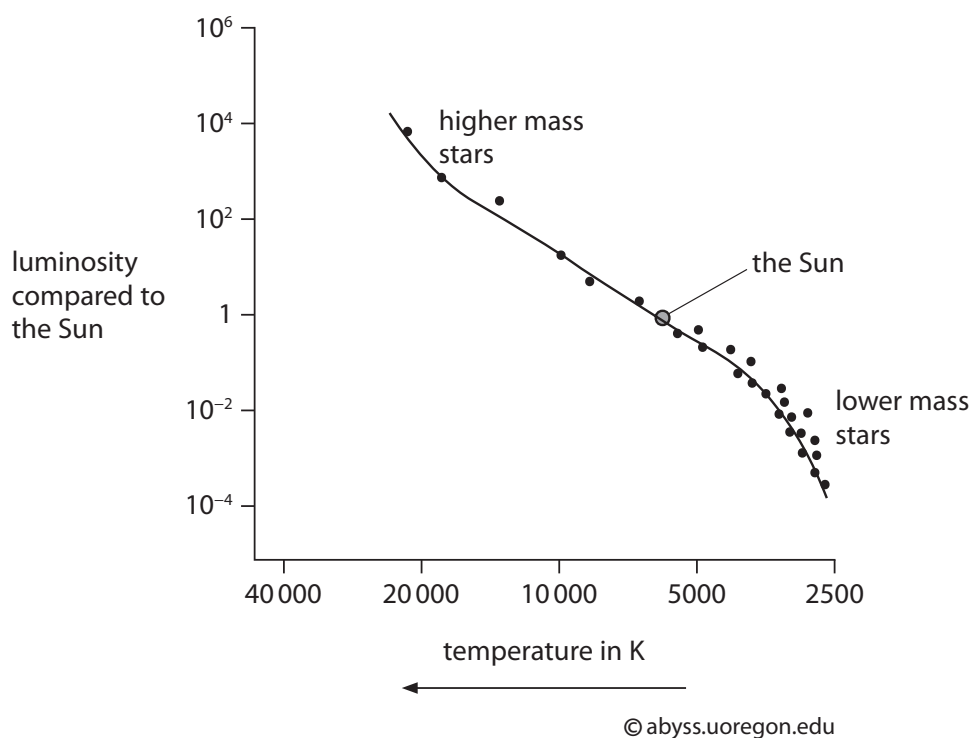


Figure 18

- (i) Estimate the temperature of the Sun.

(1)

temperature of the Sun = ... K

(ii) State how the brightness of a main sequence star changes with its temperature.

(1)

(iii) State how the brightness of a main sequence star changes with its mass.

(1)

(c) Nuclear fusion provides the energy source for stars including the Sun.

Describe what happens during nuclear fusion.

(3)

(d) A nebula may evolve into a main sequence star, such as the Sun.

Explain how a nebula may evolve into a main sequence star.

(3)

(Total for Question 10 = 11 marks)



10 The Big Bang theory is one theory for the origin of the Universe.

The Big Bang theory suggests:

- the Universe had a beginning
- the Universe is still expanding.

(a) Which of these provides evidence that the Universe had a beginning?

(1)

- ☐ **A** the discovery of other galaxies
- ☐ **B** the discovery of the moons of Jupiter
- ☐ **C** the discovery of planets orbiting distant stars
- ☐ **D** the discovery of cosmic microwave background (CMB) radiation

(b) Evidence that the Universe is still expanding comes from observations of light from distant galaxies.

Describe how light from distant galaxies shows that the Universe is still expanding.

(2)

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(c) The Steady State theory is also a theory about the origin of the Universe.

Give **one** similarity and **one** difference when comparing the Big Bang theory with the Steady State theory.

(2)

similarity.....

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difference.....

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- (d) Observations of the expanding Universe have shown that the further away a galaxy is from the Earth, the faster the galaxy is moving away from the Earth.

Figure 15 shows how the velocity of galaxies is related to their distance from the Earth.

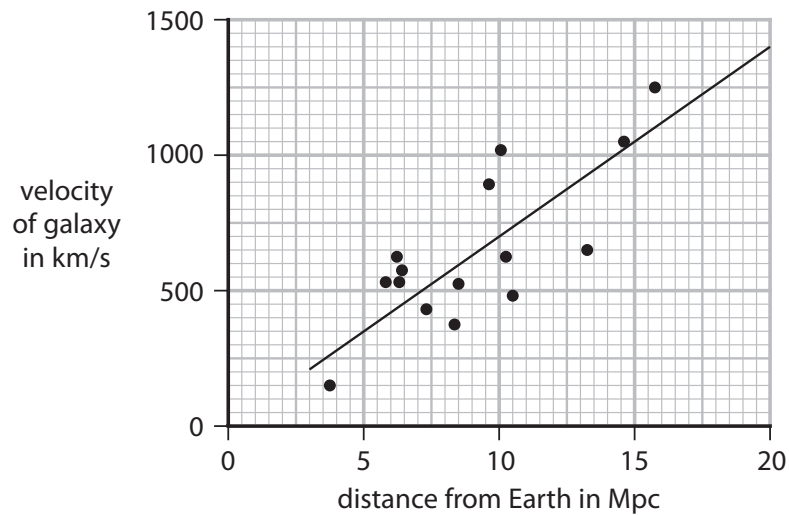


Figure 15

Mpc is a unit of distance used for large distances in space.

- (i) Use Figure 15 to estimate the velocity of a galaxy that is 15 Mpc away from the Earth. (1)

velocity = ... km/s

- (ii) Calculate the gradient of the line shown in Figure 15.

State the unit.

(3)

gradient = ... unit

(iii) The gradient of the line in Figure 15 can be used to estimate the age of the Universe.

Explain why the gradient of the line in Figure 15 can only provide an **estimate** of the age of the Universe.

(2)

(Total for Question 10 = 11 marks)



7 (a) A rock on the surface of the Earth has a mass of 12 kg.

(i) Calculate the weight of this rock on the surface of the Earth.

The gravitational field strength on the surface of the Earth is 10 N/kg.

Use the equation

$$W = m \times g$$

(2)

weight on the Earth = ... N

(ii) The weight of the same rock on the surface of the Moon is 20 N.

Calculate the gravitational field strength on the surface of the Moon.

(3)

gravitational field strength on the Moon N/kg



*(b) Describe the Solar System in terms of the Sun, the planets, and the other objects which move in the Solar System.

Your answer should include the patterns of movement of the planets and the other objects in the Solar System.

You may draw a labelled diagram if it helps your answer.

(6)

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(Total for Question 7 = 11 marks)

10 (a) Figure 19 shows two objects, **E** and **D**.

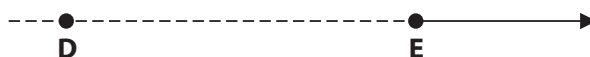


Figure 19

E emits a sound.

D detects the sound.

E is moving in the direction shown by the arrow, but **D** is not moving.

E emits a sound of wavelength 1.86 m.

D measures the wavelength of this sound as 1.98 m.

- (i) Calculate the difference between the wavelength that **E** emits and the wavelength that **D** detects.

(1)

difference in wavelength = ... m

- (ii) The velocity of sound is 330 m/s.

Calculate the velocity of **E**.

(2)

Use the equation

$$\text{velocity of E} = \frac{\text{velocity of sound} \times \text{difference in wavelength}}{\text{wavelength E emits}}$$

velocity of **E** = ... m/s

(b) The wavelength of light emitted from distant galaxies is different when the light is detected on Earth.

Explain how this difference in wavelength shows that the Universe is expanding. (2)

(c) CMB radiation provides evidence that the Universe had a definite beginning.

Use the table in Figure 20 to give a typical value for the wavelength of CMB radiation.

type of radiation	typical wavelength
gamma rays	$1.0 \times 10^{-12} \text{ m}$
X-rays	$3.0 \times 10^{-11} \text{ m}$
ultraviolet	200 nm
visible	600 nm
infrared	$4.0 \mu\text{m}$
microwaves	1.0 mm
radio waves	50 m

Figure 20 (2)

wavelength = ...

(d) During the evolution of a star, the nebula collapses and becomes a main sequence star.

(i) State what causes the nebula to collapse. (1)

(ii) Explain why the nebula stops collapsing as it becomes a main sequence star.

(3)

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(Total for Question 10 = 11 marks)



13-MARK QUESTIONS

2 questions in this booklet



- 7 (a) Figure 15 shows an artificial satellite in orbit around the Earth.

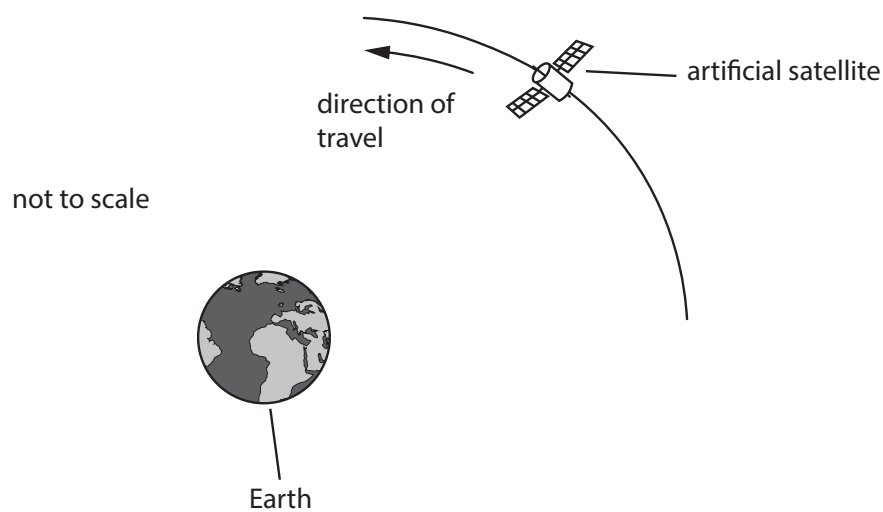
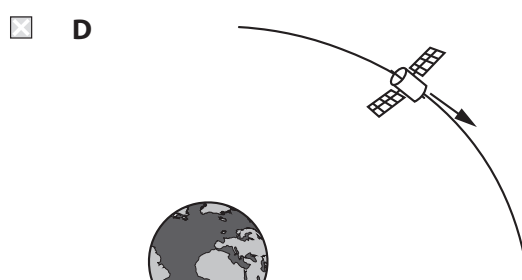
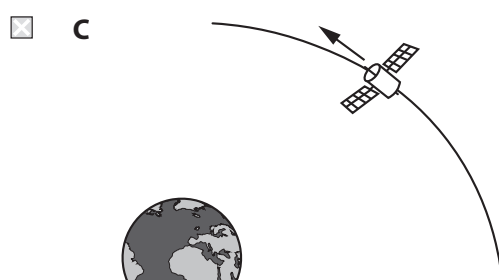
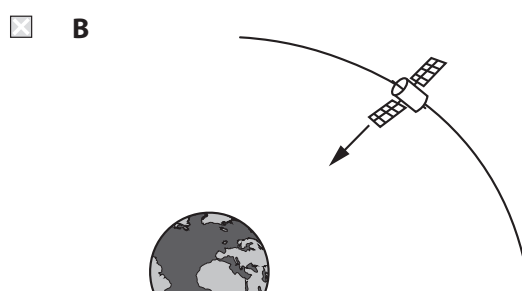
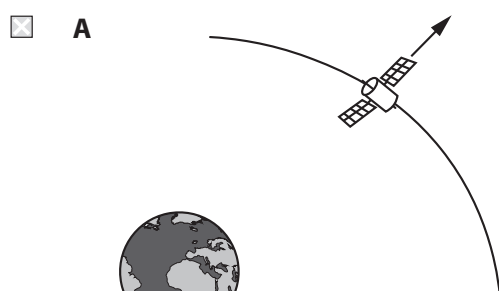


Figure 15

- (i) Which of these shows the direction of the force that keeps the satellite in orbit around the Earth?

(1)



(ii) The satellite travels at a constant speed around the Earth.

Explain why the satellite is accelerating even though it travels at a constant speed.

(2)

(b) The Hubble Space Telescope is an artificial satellite in orbit about 500 km above the Earth’s surface.

This telescope is used to observe the light from very distant objects in the Universe.

Explain why the Hubble Space Telescope must be high above the Earth’s surface to make its observations.

(2)



(c) There are many other artificial satellites in orbit around the Earth.

Figure 16 shows the time taken to complete one orbit for satellites at different heights above the Earth's surface.

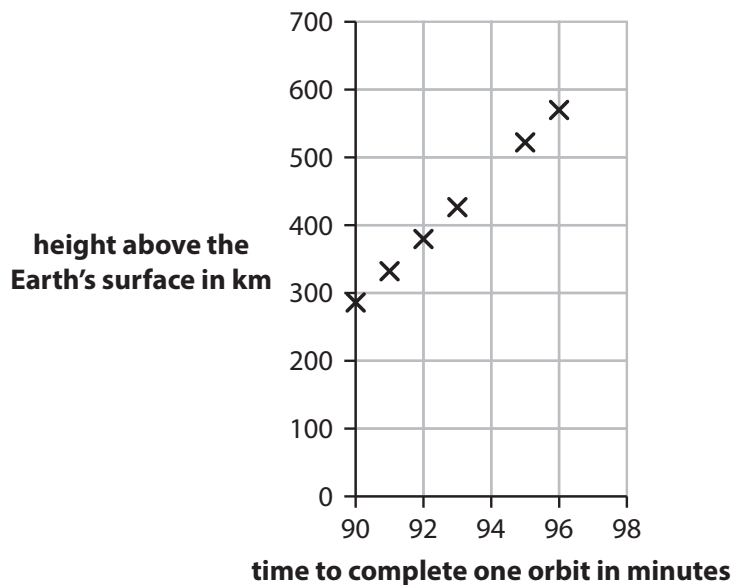


Figure 16

Describe the relationship shown in Figure 16.

(2)

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*(d) A long time ago, many people thought that the objects seen in the sky were arranged as shown in Figure 17.

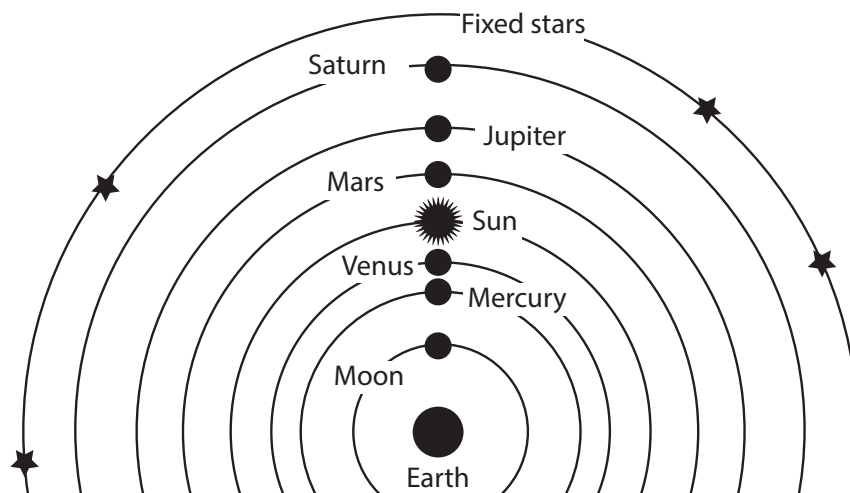


Figure 17

Compare the arrangement shown in Figure 17 with what we now know about the Solar System.

Your answer should refer to

- the objects that are in the Solar System
- how these objects are arranged.

You may draw a diagram to help your answer.

(6)

(Total for Question 7 = 13 marks)

7 (a) Figure 11 gives the values of gravitational field strength, g , on the surfaces of Earth, the Moon and Mars.

	value of g in N/kg
Earth	10
The Moon	1.6
Mars	3.7

Figure 11

(i) Calculate the ratio

$$\frac{\text{value of } g \text{ on Earth}}{\text{value of } g \text{ on Mars}}$$

(2)

ratio = ...

(ii) A person has a weight of 730 N on Earth.

Calculate the person’s weight on the Moon, using information from Figure 11.

(2)

weight on the Moon = ... N

- (iii) The gravitational field strength, g , is different on the surfaces of Earth, the Moon and Mars.

Explain why this is the case.

(2)

- (b) Asteroids have elliptical (oval) orbits around

(1)

- ☐ **A** the Sun
- ☐ **B** the Moon
- ☐ **C** Mars
- ☐ **D** the Earth

*(c) Scientists have been searching beyond the Solar System to find planets where life could exist.

One requirement for life to exist on a planet is that there is water on the surface of the planet.

The planets where surface water could exist are in a region called the habitable zone.

Figure 12 is a diagram showing our Sun, with its five closest planets, and a more distant star with three of its planets labelled A, B and C. The habitable zone is shaded.

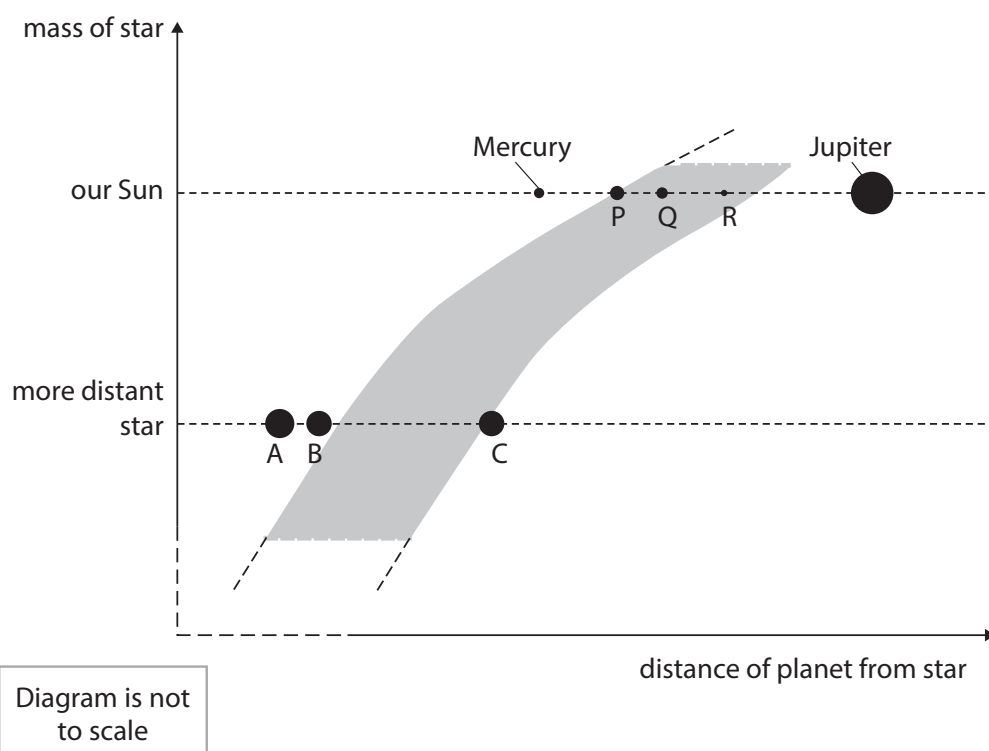


Figure 12

(Source adapted from: https://www.researchgate.net/publication/23993674_Darwin_-_A_Mission_to_Detect_and_Search_for_Life_on_Extrasolar_Planets/figures?lo=1)

Discuss the chance of life existing on the planets shown in Figure 12.

Your answer should refer to

- the five planets shown from our Solar System, giving the names of P, Q and R.
- the three planets, A, B and C, orbiting the more distant star.

(6)

(Total for Question 7 = 13 marks)

MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Mark
3(a)	☒ C Neptune	(1)

Question number	Answer	Additional guidance	Mark
3(b)	(i) planet (1) (ii) satellite (1) (iii) star (1)	in this order accept recognisable spellings	(3)

Question number	Answer	Additional guidance	Mark
3(c)(i)	1900 (N)	allow 1862 1864 190×10 $190 \times 9.8(1)$	(1)

Question number	Answer	Additional guidance	Mark
3(c)(ii)	rearrangement (1) $\frac{700}{190}$ evaluation (1) 3.7 (N/kg)	(g =) $\frac{W}{m}$ allow numbers that round up to 3.7 (N/kg) award full marks for the correct answer without working	(2)

(Total for Question 3 = 7 marks)

Question number	Answer	Mark
1(a)	C Mercury A is incorrect Jupiter is the fifth planet from the Sun B is incorrect Mars is the fourth planet from the Sun D is incorrect Venus is the second planet from the Sun	(1) AO1

Question number	Answer	Additional guidance	Mark
1(b)	D a natural satellite A is incorrect, the Moon is not an asteroid B is incorrect, the Moon is not a comet C is incorrect, the Moon is not a nebula		(1) AO1

Question number	Answer	Additional guidance	Mark
1(c)	Any two of the following 1. mass (1) 2. radius (1) 3. density (1)	allow made of different substance/ material if no other mark awarded, allow 1 mark for (Moon is) smaller or Earth is bigger	(2) AO2

Question number	Answer	Additional guidance	Mark
1(d)	substitution (1) (W=) 6.0×1.6 evaluation (1) 9.6 unit (independent mark)(1) newton	award full marks for correct answer without working. accept N, n and/or Newton 9.6 N/n gains full marks	(3) AO2(2) AO1(1)

Total marks for question 1 = 7



5(a)(i)	nebula (1)	allow any recognisable spelling	(1) AO1
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	Answer	Additional guidance	Mark
5(a)(ii)	main sequence (1)	allow any recognisable spelling	(1) AO1

	Answer	Additional guidance	Mark
5(b)(i)	B red giant (1)		(1) AO1

	Answer	Additional guidance	Mark
5(c)(ii)	description to include: (two) isotopes/nuclei/atoms (1) fusing (1)	hydrogen allow joining / coming together / bonding IGNORE collide	(2) AO2

	Answer	Additional guidance	Mark
5(c)(iii)	substitution (1) $\frac{1.32}{4.92} \times 10^3$ evaluation (1) 2.68	accept 110 : 41 for 2 marks 11 : 41 for 1 mark POT error scores 1 award full marks for the correct answer without working	(2) AO2

(Total for Question 5 = 9 marks)

	Answer	Additional guidance	Mark
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Question number	Answer	Additional guidance	Mark
3(a)	gravitational attraction	gravity gravitational field /force	1 AO1.1

Question number	Answer	Additional guidance	Mark
3 (b)(i)	$\frac{10 \times 46}{(100)}$ (1) (time=) 4.6 (billion years) (1)	accept 4 600 000 000 4.6×10^9 award one mark for power of ten error award one mark for answer of 5.4 or 5 400 000 000 or 5.4×10^9 (has found time remaining with no power of ten error) award full marks for the correct answer without working	2 AO2.1

Question number	Answer	Additional guidance	Mark
3(b)(ii)	a description to include any two from {volume/ diameter/radius/ size} changes (1) (Sun becomes) a red giant (1) cools down (1) (eventually becomes) a white dwarf (1)	ignore explode / implode do not accept red super giant / supernova lose heat (energy) accept black dwarf	2 AO2.1

Question number	Answer	Additional guidance	Mark
3(c)	description to include any two from: (two) isotopes/nuclei/atoms (1) fusing (1) release / emit energy (1) decrease in mass (1)	hydrogen joining / coming together allow heat for energy	2 AO1.1

Question number	Answer	Additional guidance	Mark
3(d)	an explanation linking any two from (their) laboratory (equipment) is unlikely to be able to produce required conditions (1) need (very) high temperatures (1) need (very) high pressure (1) results had not been peer reviewed (1) no other scientist produced similar results (1)	requires much more equipment than available in a typical laboratory high (particle) speed / KE high (particle) [density not checked by other scientists	2 A03.3

Total for question 3 = 9 marks

Question Number	Answer	Mark
7(a)(i)	A converging lens forming a real image The only correct answer is A B 'diverging lens forming a real image' is incorrect since the lens drawn in the diagram is not diverging C 'converging lens forming a virtual image' is incorrect, since the diagram shows rays coming to a focus (on a screen if placed there) D 'diverging lens forming a virtual image' is incorrect, since the diagram shows neither a diverging image or the formation of a virtual image	(1) AO 3 1a

Question Number	Answer	Mark
7(a)(ii)	C 'R' The only correct answer is 'R' 'P' is incorrect, being a distractor, showing a width of rays 'Q' is incorrect, being a distractor showing an arbitrary distance to the lens distance 'S' is incorrect, being a distractor showing an overall distance	(1) AO 3 1b

Question Number	Answer	Additional guidance	Mark
7(b)	substitution (1) <u>1</u> 17 or 0.17 evaluation (1) 5.882... evaluation to 2sf (1) 5.9 (any answer to 2 sf for this mark, but not if wrong rounding is seen)	lose this mark if there is any other power of 10 error but then apply ecf (e.g. 1/1.7) so 0.588 then = 1 mark for that ecf independent mark award full marks for the correct answer without working	(3) AO 2 1

Question Number	Answer	Mark
7(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 strand 1 (6) • idea that telescopic evidence supported the heliocentric model e.g. observing the moons of Jupiter supported a sun-centred solar system • detail e.g. it was Galileo's observations of the moons of Jupiter • the moons rotate around Jupiter i.e. not everything rotates about the earth • other observations by telescope – discoveries of the planets Uranus and Neptune + the asteroid belt • (detailed) photographic evidence • use of computer modelling • satellite observations • heliocentric model verified by Voyager missions (space probes)	(6) AO 1 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) - Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	- Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) - Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	- Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) - Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

(Total for Question 7 = 11 marks)



Question Number	Answer	Mark			
10(a)	<table border="1"> <tr> <td>D</td><td>vector</td><td>vector</td></tr> </table> The only correct answer is D A 'scalar scalar' is incorrect, both force and velocity are vectors B 'scalar vector' is incorrect, with force being described incorrectly as a scalar C 'vector scalar' is incorrect, with velocity being described incorrectly as a scalar	D	vector	vector	(1) AO 1 1
D	vector	vector			

Question Number	Answer	Additional guidance	Mark
10(b)(i)	gravitational / centripetal (1)	accept gravity / weight / gravitational field strength	(1) AO 2 1

Question Number	Answer	Additional guidance	Mark
10(b)(ii)	arrow from the satellite towards the centre of Earth – by eye (1)	direction must be clear	(1) AO 2 1

Question Number	Answer	Additional guidance	Mark
10(c)(i)	a description to include: wavelength (of e.m. radiation) increased / frequency decreased (1) as the (star) moves away (from us) (1)	don't penalise planet instead of object stretched/moves to(wards) red end of spectrum spectral lines move towards the red end of the spectrum	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
10(c)(ii)	• an explanation linking: • big bang has expanding universe (1) • with galaxies moving away (from each other) (1)	from (original) explosion started at a point accept stars moving away (not objects or planets here) the further away they are the greater is their (recessional) speed idea	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
10(c)(iii)	microwave		(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
10(c)(iv)	(radiation) that comes from all over the sky / space / the universe	from the big bang / explosion	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
10(c)(v)	an explanation linking: • the Big Bang theory has a beginning / initial explosion (1) • that releases / gives out radiation (1)	explosion from a point radiation still present	(2) AO 1 1

(Total for Question 10 = 11 marks)

Question number	Answer	Additional guidance	Mark
10 (a)	substitution (1) $\frac{3.4 \times 10^{29}}{2.0 \times 10^{30}}$ evaluation (1) 0.17	award 1 mark for 1.7 to any incorrect power of 10 ignore any units given award full marks for the correct answer without working	(2)

Question number	Answer	Additional guidance	Mark
10(b)(i)	accept any temperature between 5500 and 7500 (K) (1)		(1)

Question number	Answer	Additional guidance	Mark
10(b)(ii)	the higher the brightness the greater the temperature	or reverse argument allow luminosity for brightness allow heat for temperature	(1)

Question number	Answer	Additional guidance	Mark
10(b)(iii)	the greater the mass the higher the brightness	or reverse argument allow luminosity for brightness allow bigger/heavier for greater mass in this context	(1)

Question number	Answer	Additional guidance
10 (c)	A description to include any three of the following (smaller) nuclei / atoms / particles (1) come together / join (1) to produce a larger nucleus / atom / particle (1) needing high temperature / pressure (1) overcoming repulsion (between nuclei) (1) energy released (1)	two named eg hydrogen (nuclei) allow fuse not 'bond' helium for nucleus accept fast (moving) nuclei ignore energy created

Question number	Answer	Additional guidance	Mark
10 (d)	An explanation to include any three from: nebula as a cloud of gas/dust (1) gas / atoms pulled together / towards each other (1) by gravitational force (1) temperature increase (1) hot enough for nuclear fusion (1)	density increase gravity (acting) (resultant) heating s	(3)

(Total for Question 10 = 11 marks)

Question number	Answer	Mark
10 (a)	The only correct answer is D the discovery of cosmic microwave background (CMB) radiation A is not correct because it does not indicate the Universe had a beginning B is not correct, it is evidence against the geocentric model of the Universe C is not correct, it is evidence for other solar systems	(1) AO1

Question number	Answer	Additional guidance	Mark
10 (b)	A description to include: wavelength (of the light) (1) appears to increase (1) [increase must be linked with wavelength]	Red shift/Doppler effect (Red shift) shows galaxy moving away accept answers in terms of frequency	(2) AO1

Question number	Answer	Additional guidance	Mark
10 (c)	similarity (both have) expanding <u>Universe</u> (1) difference one from: Steady State, Universe has no beginning (1) Steady State theory requires the continual formation of new matter, the Big Bang theory does not (1)	different interpretation of CMBR	(2) AO1

Question number	Answer	Additional guidance	Mark
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Question number	Answer	Additional guidance	Mark
10 (d)(ii)	attempt at $\frac{\Delta y}{\Delta x}$ (1) evaluation (1) 70 ± 5 unit (1) km/s/Mpc	could be seen on graph award 2 marks for correct answer without working independent mark km/s Mpc s⁻¹ or per second	(3) AO3

Question number	Answer	Additional guidance	Mark
10 (d)(iii)	an explanation linking: points are scattered widely about the line (on graph) (1) giving wide range of possible gradients (1)	there are many possible best fit lines	(2) AO3

(Total for Question 10 = 11 marks)

7(a)(i)	substitution (1) 12 x 10 evaluation (weight =) 120 (N)		(2) A02
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	Answer	Additional guidance	Mark
7(a)(ii)	rearrangement (1) $(g) = \frac{W}{m}$ substitution (1) <u>20</u> 12 evaluation (1) (g on Moon =) 1.7 (N/kg)	rearrangement and substitution in either order accept answers that round to 1.7 e.g. 1.67 (N/kg) award full marks for the correct answer without working 1.6 scores 2 marks 240 scores 1 mark 0.6 scores 1 mark 20 × 12 scores 1 mark <u>12</u> scores 1 mark 20	(3) A03

Question number	Indicative content	Mark
*7(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 • planet names: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune • planet(s) orbit the Sun • all planets orbit the Sun • each planet in its own orbit • (all) planet orbits are in the same plane • planets spin (on own axis) • moons orbit planets • some planets have multiple moons • dwarf planets orbit the Sun • asteroids orbit the Sun • comets orbit the Sun • comet orbits not in the same plane as planets	(6) AO1

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents a description with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents a description that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)



Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> isolated facts about the objects or the patterns of movement	<u>Possible candidate responses</u> names at least 2 planets
Level 2	3–4	<u>Additional guidance</u> Detailed description of pattern of movement for one set of objects. OR limited description of pattern of movement for two set of objects	<u>Possible candidate responses</u> planets orbit the Sun AND moons orbit planets
Level 3	5–6	<u>Additional guidance</u> Detailed descriptions of pattern of movement for two sets of objects. OR Detailed description of pattern of movement for one set of objects plus limited description for two sets.	<u>Possible candidate responses</u> <u>all</u> planets orbit the Sun, comets orbit the Sun, asteroids orbit the Sun

(Total for Question 7 = 11 marks)



10 (a)(i)	$(1.98-1.86) = (+/-) 0.12$		(1) AO2
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	Answer	Additional guidance	Mark
10(a)(ii)	$(\text{velocity}) = \frac{330 \times 0.12}{1.86} \quad (1)$ $(+/-) 21.3 \text{ (m/s)} \quad (1)$	ecf from 10ai accept numbers that round to 21 (m/s) award 1,2 marks for (i) and (ii) for the correct answer for (ii) even without working	(2) AO2

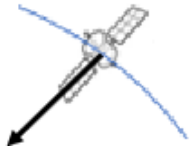
	Answer	Additional guidance	Mark
10(b)	(there is) an increase in wavelength (of light) (1) shows <u>galaxies</u> are moving away (from Earth) (1)	allow wavelength stretches allow red shift ignore shift to red end of spectrum ignore objects / stars / planets	(2) AO1

	Answer	Additional guidance	Mark
10(c)	$1(.0) \quad (1)$ mm (1)	Allow values between 1.0 and 1.9 allow $1 \times 10^{-3} \text{ m}$ or 0.001 m for 2 marks if nothing in answer line, credit answer indicated in table	(2) AO3

	Answer	Additional guidance	Mark
10 d(i)	gravitational attraction / gravitational force (causing collapse) (1)	allow gravity ignore weight ignore gpe ignore gravitational energy	(1) AO1

	Answer	Additional guidance	Mark
10 d(ii)	An explanation linking: (gravity causing) increase in temperature (1) (until hot enough for) fusion (1) (until) balance (between gravity and fusion/thermal) (1)	 allow increase in pressure/density hydrogen to form helium allow nuclear reactions ignore fission allow equilibrium / counteracts	(3) AO1

Total for Question 10 = 11 marks.

Question number	Answer	Additional guidance	Mark
7 (a)(i)	 B A is incorrect because the force of gravity acts towards the centre C and D are incorrect because the force does not act tangentially		1 AO1.1

Question number	Answer	Additional guidance	Mark
7 (a)(ii)	an explanation linking any two from velocity is changing (1) direction is changing (1) there is a resultant force (on the satellite) (1)	velocity / acceleration is a vector accept unbalanced forces the direction of the velocity is changing scores 2 marks	2 AO1.1

Question number	Answer	Additional guidance	Mark
7 (b)	an explanation linking any two from improves clarity (of images) (1) light (from distant objects) is (very) faint (1) idea that atmosphere absorbs/scatters light (1) (HST) is above the atmosphere (1) light pollution (on/from Earth) (1)	accept air for atmosphere	2 A01.1

Question number	Answer	Additional guidance	Mark
7 (c)	a description to include time (to complete orbit) increases as height increases (1) relationship is linear (1)	accept positive correlation accept reverse argument (can draw) a straight line (through the points) accept directly proportional in this context	2 A03.1

Question number	Indicative content	Mark
*7(d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. May be shown in a diagram. Objects • fixed stars are not part of solar system • additional planets are in solar system • these include Neptune and Uranus • asteroids / minor planets / comets are in solar system • planets have their own moons • the Sun is a star and is very much larger than the planets Arrangement of objects in Solar System • Earth not at the centre • Sun is in the centre • Earth between Venus and Mars • Moon (still) orbits Earth. • planets orbit the Sun. • asteroids / comets orbit Sun • orbits are not circular • (relative) distance between planets and Sun much larger • stars are very large distance from Solar System.	6 AO1.1 AO3.1

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)



		Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	- Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) - Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> Facts about either objects or arrangement	<u>Possible candidate responses</u> The Earth is not at the centre. There are additional planets
Level 2	3–4	<u>Additional guidance</u> Partially complete comparison of objects and arrangement	<u>Possible candidate responses</u> Earth is a planet. Neptune is another planet. All the planets orbit the Sun.
Level 3	5–6	<u>Additional guidance</u> Detailed comparison of objects and arrangement	<u>Possible candidate responses</u> All the planets including the Earth go round the Sun. The moon goes round the Earth. The stars are a long way from the Solar System and are not part of it.

Question number	Answer	Additional guidance	Mark
7(a) (i)	substitution (1) $\frac{10}{3.7}$ evaluation (1) 2.7 (N)	10:3.7 2.7027... or 2.7:1 allow 1:2.7 allow 0.37:1 OR 1:0.37 (for inverted ratio) award full marks for correct answer without working	(2) AO2.1

Question number	Answer	Additional guidance	Mark
7(a) (ii)	substitution into equation with ratio (1) $(730 \div) \frac{10}{1.6}$ evaluation (1) 120 (N)	6.25 or 6.3 used accept 116.8 award full marks for correct answer without working	(2) AO2.1

Question number	Answer	Additional guidance	Mark
7 (a) (iii)	An explanation including (it depends on) mass of planet (1) (it depends on) radius / diameter / size of planet (1)	ignore references to weight if no other mark awarded allow 1 mark for (depends on) density	(2) AO1.1

Question number	Answer	Mark
7 (b)	A the Sun (1) B, C and D are incorrect because the orbits are not around those objects	(1) AO1.1

Question number	Indicative content	Mark
*7(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Planets in our Solar System • identifies planet(s): P Venus, Q the Earth, R Mars • planets P, Q and R in zone, so could have life • OR P just in zone / marginal idea • Mercury outside the zone/too hot • Jupiter outside the zone/too cold • Earth the most central to the zone • Earth has life Planets A, B and C • A and B are outside the zone • A and B too hot • C almost in the zone / marginal idea • B might just have some water on its surface • C is the most promising for life	(6) AO3.2

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Deconstructs scientific information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. • Judgements are supported by limited evidence. (AO3)
Level 2	3-4	• Deconstructs scientific information and provides some logical connections between scientific concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently. • Judgements are supported by evidence occasionally. (AO3)
Level 3	5-6	• Deconstructs scientific information and provide logical connections between scientific concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently. • Judgements are supported by evidence throughout. (AO3)



Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> Isolated facts (use of limited evidence)	<u>Possible candidate responses</u> - recognises Solar System planet(s) - planets P, Q and R in zone - A and B outside the zone
Level 2	3–4	<u>Additional guidance</u> Discussion informed by some evidence from the chart. Talks about the possibility of life Addressing solar system planets, identifying at least one. OR Addressing the distant planets A, B and C	<u>Possible candidate responses</u> - identifies planet(s) e.g. P Venus, Q the Earth, R Mars - planets P, Q and R in zone, so could have life - C on the edge of the zone
Level 3	5–6	<u>Additional guidance</u> Detailed discussion drawing on evidence with conclusions informed by scientific knowledge Talks about the possibility of life Addressing solar system planets, identifying at least two. AND Addressing the distant planets A, B and C	<u>Possible candidate responses</u> - Earth the most central to the zone and Earth has life - C almost in the zone so might just have life

Total for Question 7 = 11 marks

