AQA GCSE Physics | 8463

SPECIFICATION POINT 4.8.1.1

Our solar system

Past-paper questions

Tier	**Higher**
Question groups	**24**
Available paper years	**2003–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.8.1.1 Our solar system

Question 01

June 2003 | 3451H | Original Q4 | Legacy

4 (a) The table gives information about some planets.

Name of planet	Gravitational field strength in N/kg	Diameter of planet in thousands of km	Time for 1 orbit around the sun in years
Mercury	4	4.9	0.2
Venus	9	12.0	0.6
Earth	10	12.8	1.0
Jupiter	26	143.0	12.0

(i) Write down the equation that links gravitational field strength, mass and weight.

.....

(1 mark)

(ii) An astronaut has a mass of 75 kg. Calculate the weight of the astronaut on Venus. Show clearly how you work out your answer.

.....

.....

Weight of astronaut = ...newtons

(2 marks)

(iii) Why would the astronaut weigh more on the Earth than on Venus?

.....

.....

(1 mark)

(iv) The radius of the orbit of Jupiter is greater than the radius of the orbit of Mercury, Venus or the Earth. What evidence is given in the table to show this?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 01 · continued

MARGIN BLANK

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain briefly how stars like the Sun are thought to have been formed.

.....

.....

.....

.....

(2 marks)

7

4.8.1.1 Our solar system

Question 02

June 2003 | 3462H3 | Original Q4 | Legacy

4 (a) The table gives information about some planets.

Name of planet	Gravitational field strength in N/kg	Diameter of planet in thousands of km	Time for 1 orbit around the sun in years
Mercury	4	4.9	0.2
Venus	9	12.0	0.6
Earth	10	12.8	1.0
Jupiter	26	143.0	12.0

(i) Write down the equation that links gravitational field strength, mass and weight.

.....

(1 mark)

(ii) An astronaut has a mass of 75 kg. Calculate the weight of the astronaut on Venus. Show clearly how you work out your answer.

.....

.....

Weight of astronaut = ...newtons

(2 marks)

(iii) Why would the astronaut weigh more on the Earth than on Venus?

.....

.....

(1 mark)

(iv) The radius of the orbit of Jupiter is greater than the radius of the orbit of Mercury, Venus or the Earth. What evidence is given in the table to show this?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 02 · continued

MARGIN BLANK

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain briefly how stars like the Sun are thought to have been formed.

.....

.....

.....

.....

(2 marks)

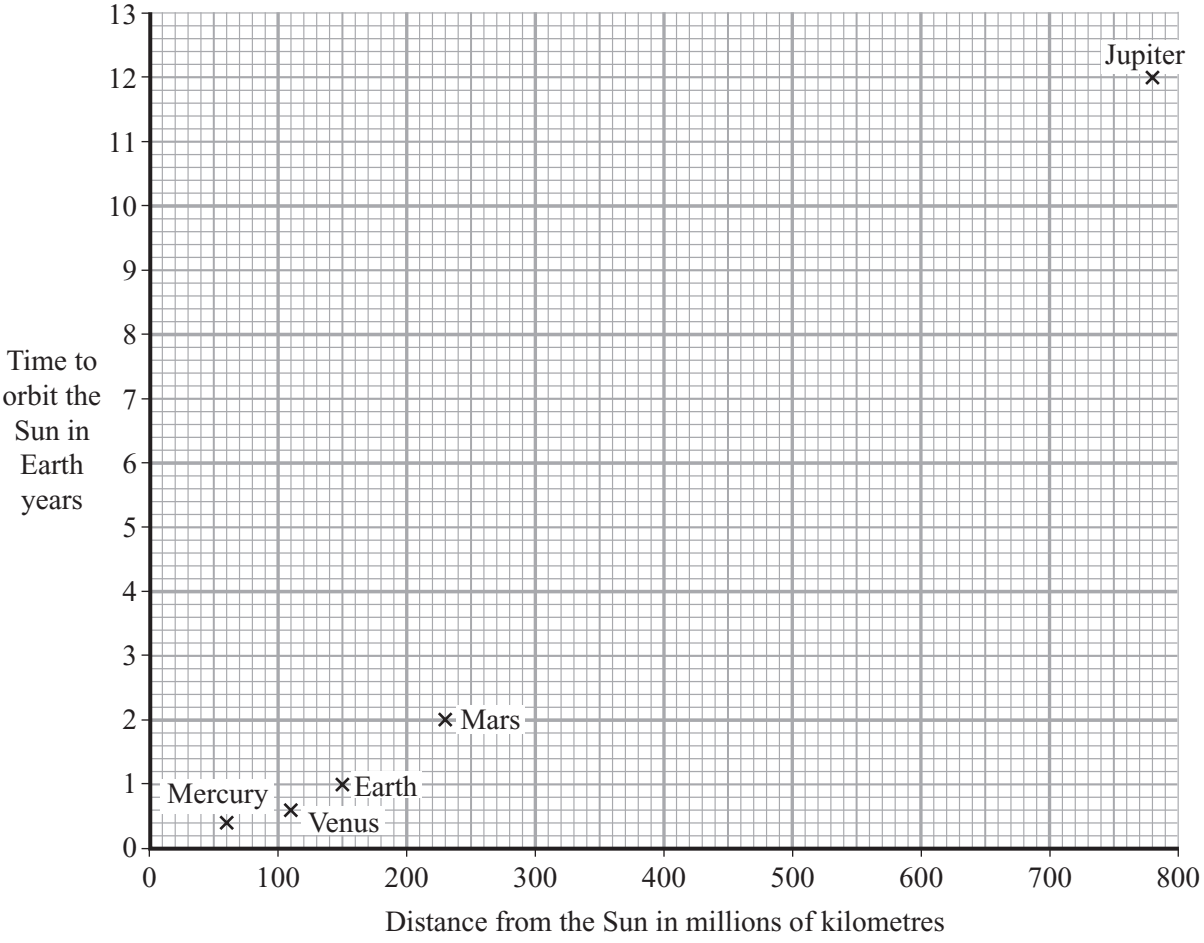
7

4.8.1.1 Our solar system

Question 03

June 2005 | 3451 | Original Q2 | Legacy

2 (a) The chart shows that the time taken by a planet to orbit the Sun depends on its distance from the Sun.



(i) How does the time taken by a planet to orbit the Sun depend on the distance the planet is from the Sun?

.....

.....

(1 mark)

(ii) Asteroids orbit the Sun. One asteroid is 550 million kilometres from the Sun.

Estimate how long this asteroid takes to orbit the Sun.

Time to orbit the Sun = ... Earth years

(1 mark)

4.8.1.1 Our solar system

Question 03 · continued

MARGIN BLANK

(b) The atmosphere on Venus contains a large percentage of a greenhouse gas.

	Mercury	Venus	Earth
Average surface temperature	230 °C	470 °C	20 °C

(i) Which **one** of these gases increases the greenhouse effect? Draw a ring around your answer.

argon **carbon dioxide** **nitrogen** **oxygen**

(1 mark)

(ii) Explain how the information in the table and the chart shows that the atmosphere of Venus produces a greenhouse effect.

.....

.....

.....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

4.8.1.1 Our solar system

Question 04

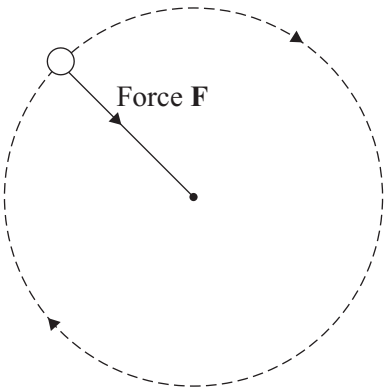
June 2005 | 3451 | Original Q5 | Legacy

5 (a) A student has fastened a ball to a piece of string and is swinging it round in a horizontal circle.



(i) The diagram below shows an overhead view of the movement of the ball.

Add an arrow, from the centre of the ball, to show the direction in which the ball would move if the string broke at this instant.



(1 mark)

(ii) Complete the table to show how force **F** changes if the student changes what he is doing. In each case, all the other factors stay the same.

If the student	Force F needs to
uses a ball with a greater mass	.....
swings the ball at a greater speed	.....
swings the ball with a shorter piece of string	.....

(3 marks)

MARGIN BLANK

(b) The Moon orbits the Earth in a circular path.

Use words from the box to complete the **three** spaces in the sentence.

direction	resistance	speed	velocity

You may use each word once, more than once or not at all.

The Moon's ..... is constant but its ..... changes because its ..... changes.

(2 marks)

(c) When any object moves in a circular, or nearly circular, path a force must act towards the centre of the circle.

(i) What word is used to describe this force?

.....

(1 mark)

(ii) The Moon orbits the Earth. What provides the force towards the Earth?

.....

(1 mark)

(iii) In an atom, name the particles which are moving in circular paths around the nucleus.

.....

(1 mark)

(iv) In the case of an atom, what word describes the forces which keep these particles moving in circular paths around the nucleus?

.....

(1 mark)

10

TURN OVER FOR THE NEXT QUESTION

4.8.1.1 Our solar system

Question 05

June 2005 | 3451 | Original Q8 | Legacy

8 Stars do not stay the same forever.

(a) Over billions of years the amount of hydrogen in a star decreases. Why?

.....

.....

(1 mark)

(b) Describe how a massive star (at least five times bigger than the Sun) will change at the end of the main stable period.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

(c) The inner planets of the solar system contain atoms of the heaviest elements.

(i) Where did these atoms come from?

.....

.....

(1 mark)

(ii) What does this tell us about the age of the solar system compared with many of the stars in the Universe?

.....

(1 mark)

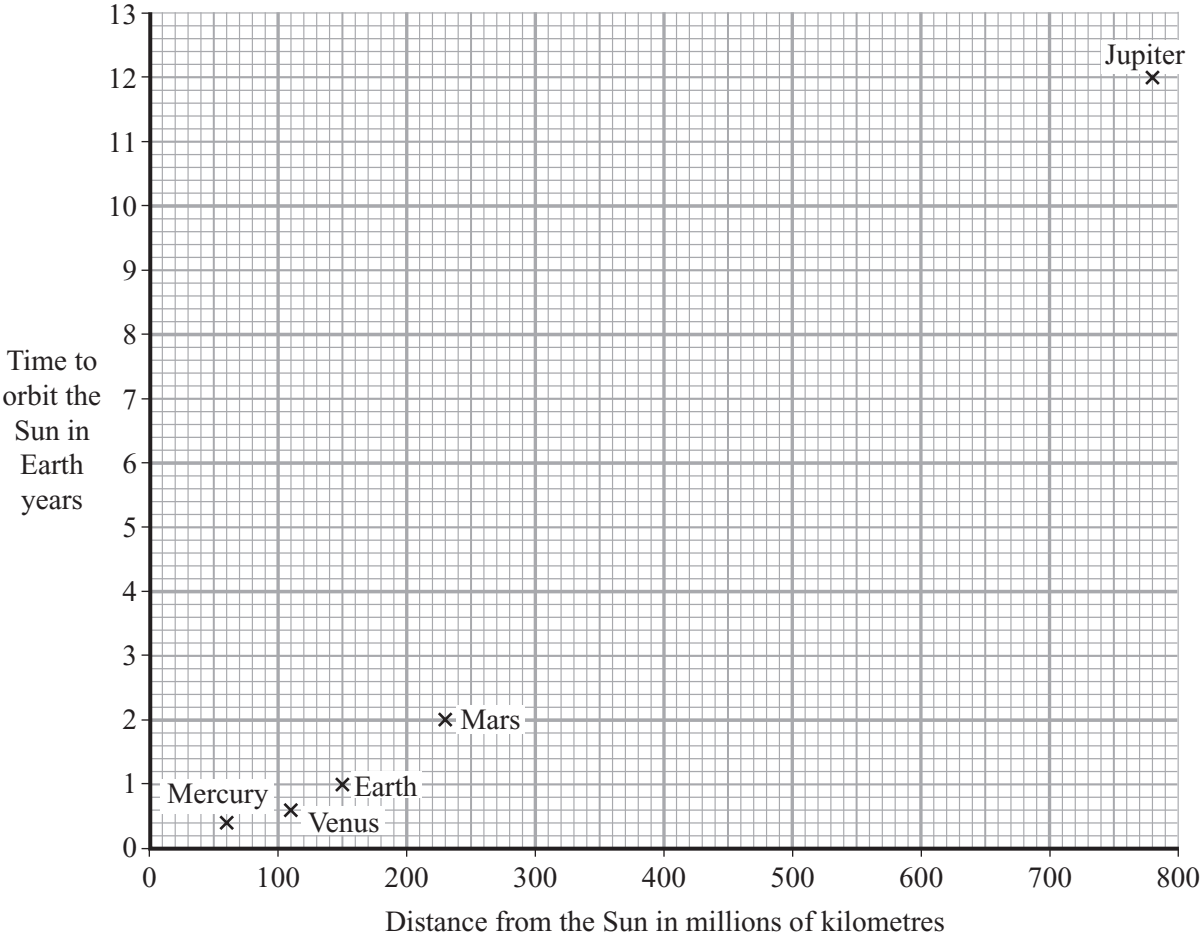
7

4.8.1.1 Our solar system

Question 06

June 2005 | 3462 | Original Q2 | Legacy

2 (a) The chart shows that the time taken by a planet to orbit the Sun depends on its distance from the Sun.



(i) How does the time taken by a planet to orbit the Sun depend on the distance the planet is from the Sun?

.....

.....

(1 mark)

(ii) Asteroids orbit the Sun. One asteroid is 550 million kilometres from the Sun.

Estimate how long this asteroid takes to orbit the Sun.

Time to orbit the Sun = ... Earth years

(1 mark)

4.8.1.1 Our solar system

Question 06 · continued

MARGIN BLANK

(b) The atmosphere on Venus contains a large percentage of a greenhouse gas.

	Mercury	Venus	Earth
Average surface temperature	230 °C	470 °C	20 °C

(i) Which **one** of these gases increases the greenhouse effect? Draw a ring around your answer.

argon **carbon dioxide** **nitrogen** **oxygen**

(1 mark)

(ii) Explain how the information in the table and the chart shows that the atmosphere of Venus produces a greenhouse effect.

.....

.....

.....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

4.8.1.1 Our solar system

Question 07

June 2005 | 3462 | Original Q6 | Legacy

6 Stars do not stay the same forever.

(a) Over billions of years the amount of hydrogen in a star decreases. Why?

.....

.....

(1 mark)

(b) Describe how a massive star (at least five times bigger than the Sun) will change at the end of the main stable period.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

(c) The inner planets of the solar system contain atoms of the heaviest elements.

(i) Where did these atoms come from?

.....

.....

(1 mark)

(ii) What does this tell us about the age of the solar system compared with many of the stars in the Universe?

.....

(1 mark)

7

4.8.1.1 Our solar system

Question 08

June 2006 | 3451 | Original Q8 | Legacy

8 (a) The Sun's energy comes from nuclear reactions that convert hydrogen into helium.

What is this type of nuclear reaction called?

.....

(1 mark)

(b) The Sun has reached the main stable period of its life.

Explain, in terms of the forces acting inside the Sun, what this means.

.....

.....

.....

.....

(2 marks)

(c) Light from other galaxies shows a *red-shift*. This is used as evidence that the Universe began with a huge explosion.

(i) What causes *red-shift*?

.....

.....

(1 mark)

(ii) The further away a galaxy is, the bigger the red-shift. Why?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 08 · continued

BLANK

(d) Planets, other than the Earth, may be capable of supporting life. Space probes are used to analyse the atmosphere of other planets.

(i) How could this analysis give evidence that organisms may once have lived on the planet?

.....

.....

.....

.....

(2 marks)

(ii) How are the scientists on the SETI project trying to find evidence for the existence of extra-terrestrial intelligence?

.....

.....

.....

.....

(2 marks)

9

4.8.1.1 Our solar system

Question 09

June 2006 | 3462 | Original Q6 | Legacy

6 (a) The Sun's energy comes from nuclear reactions that convert hydrogen into helium.

What is this type of nuclear reaction called?

.....

(1 mark)

(b) The Sun has reached the main stable period of its life.

Explain, in terms of the forces acting inside the Sun, what this means.

.....

.....

.....

.....

(2 marks)

(c) Light from other galaxies shows a *red-shift*. This is used as evidence that the Universe began with a huge explosion.

(i) What causes *red-shift*?

.....

.....

(1 mark)

(ii) The further away a galaxy is, the bigger the red-shift. Why?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 09 · continued

BLANK

(d) Planets, other than the Earth, may be capable of supporting life. Space probes are used to analyse the atmosphere of other planets.

(i) How could this analysis give evidence that organisms may once have lived on the planet?

.....

.....

.....

.....

(2 marks)

(ii) How are the scientists on the SETI project trying to find evidence for the existence of extra-terrestrial intelligence?

.....

.....

.....

.....

(2 marks)

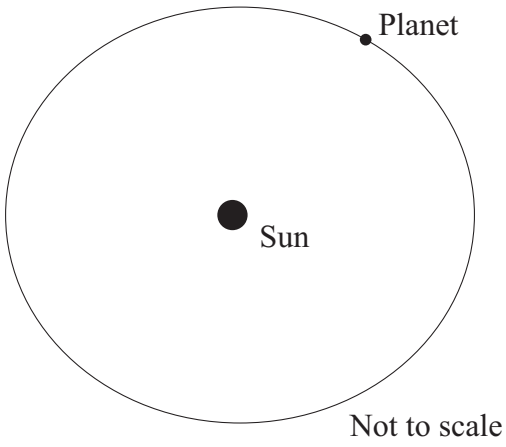
9

4.8.1.1 Our solar system

Question 10

January 2008 | PHY3H | Original Q3 | Legacy

3 (a) The diagram shows the orbit of a planet in the Solar System. The orbit is in the shape of a slightly squashed circle.



(i) What is the name of this orbit shape?

.....

(1 mark)

(ii) Complete the sentence.

The Sun is at one .....of this shape.

(1 mark)

(iii) What provides the centripetal force which allows the planet to maintain its nearly circular orbit?

.....

(1 mark)

(iv) What is the relationship between the time it takes each planet in the Solar System to complete its orbit and the planet's average distance from the Sun?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 10 · continued

BLANK

(b) Scientists have detected an object orbiting the Sun at a distance of about 17 billion kilometres. Some scientists think that the object, named Sedna, should be classified as a planet. However, some other scientists disagree.

What do you think scientists should do?

Put a tick (✓) in the box next to your answer.

Scientists should decide by voting. ☐

Scientists should wait until they have more evidence. ☐

Give a reason for your answer.

.....

.....

.....

(1 mark)

5

4.8.1.1 Our solar system

Question 11

January 2008 | PHY3H | Original Q8 | Legacy

8 Read the passage.

> In the Solar System, the inner planets, such as the Earth, contain elements which are heavier than the elements hydrogen and helium.
>
> Our star, the Sun, is a medium sized star.
>
> If a star is much more massive than the Sun it will eventually swell into a red giant, start to contract, continue to contract and finally explode.

(a) What is the explosion called?

.....

(1 mark)

(b) Explain why scientists believe that the Solar System was formed from the material produced when earlier stars exploded.

.....

.....

.....

.....

.....

.....

(3 marks)

4

4.8.1.1 Our solar system

Question 12

March 2008 | PHY1BP | Original Q8 | Legacy

QUESTION EIGHT

Carbon-14 is a radioactive isotope of carbon. It is a beta (β) particle emitter with a half-life of approximately 5750 years. Carbon-14 makes up a tiny proportion of all naturally occurring carbon on our planet.

When living things die the carbon-14 they contain continues to decay and is not replaced. So the approximate age of the object which was once part of a living plant or animal, can be calculated by measuring the proportion of carbon-14 which it now contains.

8A An organism has been dead for 17 000 years.

Approximately how many half-lives of carbon-14 have passed during this time?

1 2

2 3

3 4

4 5

8B A small sample of material taken from a plant contains 32 billion atoms of carbon-14.

Approximately how many of these atoms will it contain in 13 000 years time?

1 4 billion

2 7 billion

3 15 billion

4 30 billion

8C It is difficult to date samples more than 50 000 years old using carbon-14.

This is because . . .

1 all the carbon-14 will have decayed away.

2 carbon-14 did not exist more than 50 000 years ago.

3 so little carbon-14 remains that it is very difficult to detect and measure.

4 from the start there was no carbon-14 in samples of this age.

4.8.1.1 Our solar system

8D Carbon-14 dating **cannot** be used for . . .

1 a cotton cloak.

2 a gold plate.

3 a paper scroll.

4 a wooden mast.

Turn over for the next question

4.8.1.1 Our solar system

Question 13

June 2008 | PHY3H | Original Q2 | Legacy

2 (a) Thousands of artificial satellites are now in orbit around the Earth. A student used the Internet to collect information about four of them.

The table shows the data that the student collected.

Satellite	Altitude (= height above the surface of the Earth) in kilometres	Period of orbit in hours
A	300	1.5
B	850	1.7
C	20 000	12.0
D	36 000	24.0

2 (a) (i) What conclusion, on the relationship between the altitude of a satellite and its period of its orbit, can the student come to from this data?

.....

.....

(1 mark)

2 (a) (ii) Any conclusion from the data in the table may not be valid for all satellites.

Give **two** reasons.

1 .....

.....

2 .....

.....

(2 marks)

2 (b) The Moon is the Earth's only natural satellite.

Explain how the Moon stays in a nearly circular orbit around the Earth.

.....

.....

.....

(2 marks)

Question 2 continues on the next page

4.8.1.1 Our solar system

Question 13 · continued

for mark

2 (c) Two students see a film in which people on a spaceship hear an explosion on another spaceship.

The students think that this is not possible. What scientific evidence supports their opinion?

.....

.....

(1 mark)

2 (d) Some people say that space should not be explored.

Do you agree with them? Explain your answer.

.....

.....

.....

(2 marks)

8

4.8.1.1 Our solar system

Question 14

5 The table gives data on the Solar System.

Name of planet	Average distance from the Sun in millions of kilometres	Average orbital speed in kilometres per second
Mercury	60	48
Venus	108	35
Earth	150	30
Mars	228	24
Jupiter	778	13
Saturn	1430	9.6
Uranus	2860	6.8

5 (a) A student studies this data and comes to the following conclusion.

> For the planets in the table, the average orbital speed is very nearly inversely proportional to the planet's average distance from the Sun.

5 (a) (i) This conclusion is **not** correct.

Use the data for Saturn and Uranus to explain how the student's conclusion is not correct.

.....

.....

.....

.....

(2 marks)

4.8.1.1 Our solar system

Question 14 · continued

for mark

5 (a) (ii) For all the listed planets, write a correct conclusion for the connection between the average distance from the Sun and the orbital speed.

.....

.....

.....

.....

(2 marks)

5 (b) The student knows the following:

The planets all move in ellipses (slightly squashed circles).

What is the connection between this statement and the headings in the table?

.....

.....

.....

.....

(2 marks)

6

4.8.1.1 Our solar system

Question 15

6 This page is from a science magazine.

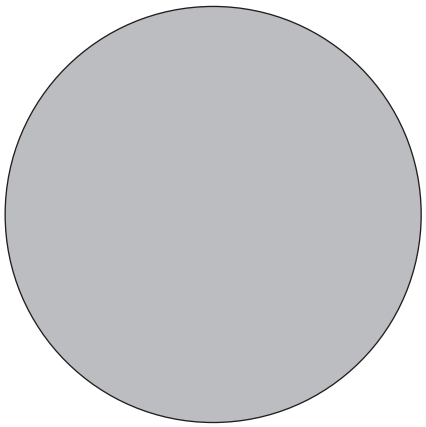
The Red Planet

The two natural satellites, or moons, of Mars are Phobos (fear) and Deimos (terror). They are named after the horses which pulled the chariot of Mars, the god of war in the mythology of Ancient Greece.

Phobos takes less than eight hours to orbit Mars and gets slightly closer every time it does so. Scientists predict that in about 100 million years time it will either be ripped apart by the gravitational force or will crash onto the surface of Mars.

Deimos

Phobos



Not to scale

4.8.1.1 Our solar system

Question 15 · continued

for mark

6 (a) Suggest how scientists have arrived at their prediction of about 100 million years.

.....

.....

.....

.....

(2 marks)

6 (b) The centripetal force on Phobos is gradually changing as it orbits Mars.

Is the force increasing or decreasing?

.....

Explain your answer.

.....

.....

.....

(2 marks)

6 (c) Scientists expect that the mass of Mars and the mass of Phobos will not increase.

Explain what will happen to the gravitational force on Phobos as it orbits Mars.

.....

.....

.....

.....

(2 marks)

6

4.8.1.1 Our solar system

Question 16

June 2009 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Some types of electromagnetic radiation from space are absorbed by the Earth's atmosphere.

	Short wavelength radio	Short wavelength microwaves	Infra red	Visible light	Ultraviolet	X-rays	Gamma rays
Percentage absorbed by atmosphere	0	95	96	5	98	100	100

Different objects or events in the universe emit different types of electromagnetic radiation.

	Gamma ray bursts	Nebulae	Pulsars	Stars	Universe background radiation
Radiation emitted	gamma rays	infra red	radio	all types	short wavelength microwaves

The planets and moons of the solar system reflect light from the Sun.

7A Early civilisations observed the sky with the naked eye.

Which objects did they see?

1 moons, nebulae and pulsars

2 gamma ray bursts, moons and planets

3 nebulae and pulsars

4 moons, planets and stars

7B Telescopes that could detect electromagnetic waves of the lowest frequency were built in the 20th century. These telescopes are on the surface of the Earth.

From the information in the tables, which of the following, which could not have been observed before, could then be easily observed from the Earth's surface?

1 pulsars

2 gamma ray bursts

3 nebulae

4 stars

4.8.1.1 Our solar system

Question 16 · continued

7C In 1989, the background radiation from the universe was mapped from a telescope in space.

Why was this **not** done with telescopes based on Earth?

1 Because only 2% of ultraviolet radiation penetrates Earth's atmosphere.

2 Because only 4% of infra red radiation penetrates Earth's atmosphere.

3 Because only 5% of short wavelength microwave radiation penetrates Earth's atmosphere.

4 Because only 95% of visible radiation penetrates Earth's atmosphere.

7D The first table suggests that, with the exception of . . .

1 radio, the percentage of radiation absorbed by the atmosphere, increases with increasing wavelength.

2 radio, the percentage of radiation absorbed by the atmosphere, decreases with increasing wavelength.

3 visible light, the percentage of radiation absorbed by the atmosphere, increases with increasing wavelength.

4 visible light, the percentage of radiation absorbed by the atmosphere, decreases with increasing wavelength.

4.8.1.1 Our solar system

Question 17

1 A student collects data from the Internet about planets in the solar system.
She arranges the data into a table.

Name of the planet	Distance from the Sun in millions of kilometres	Time taken for one orbit of the Sun in years	Time taken to spin on its axis in hours	Average temperature on the side facing the Sun in °C
Mercury	60	0.24	1400	+430
Venus	110	0.60	5800	+470
Earth	150	1	24	+20
Mars	230	2	25	–20
Jupiter	780	12	10	–150
Saturn	1400	30	10	–180
Uranus	2900	84	17	–220
Neptune	4500	160	16	–230

1 (a) Name the **two** variables in the student's table which **always** have the relationship:

As one increases, so does the other.

..... and .....

(1 mark)

1 (b) (i) Give an example of **two** variables in the student's table which **generally** have the relationship:

As one increases, the other decreases.

..... and .....

(1 mark)

4.8.1.1 Our solar system

Question 17 · continued

for mark

1 (b) (ii) Which piece of data does not seem to fit the relationship in (b)(i)?

.....

(1 mark)

1 (c) Scientists plan to launch a satellite which will orbit Mars above its equator.
It will be a geostationary satellite.

How many hours will it take to orbit Mars?

..... hours

(1 mark)

1 (d) Mars has two moons.

Neither of them is in a geostationary orbit and they both take different times to orbit the planet.

Which **one** of these statements is correct.
Put a tick (✓) in the box next to your answer.

The two moons will always be above the same point on the surface of Mars. ☐

The two moons will be in different positions at different times. ☐

You can never see both moons at the same time. ☐

(1 mark)

1 (e) Use words from the box to complete the **three** spaces in the passage.

circular	**direction**	**friction**	**gravitational**	**speed**	**universal**

The moons of the planet Neptune move in circular paths around the planet.

They continuously accelerate towards the centre of Neptune.

The acceleration changes the ..... of each moon but does not change its ..... . The force causing the acceleration is a ..... force.

(2 marks)

7

4.8.1.1 Our solar system

Question 18

June 2010 | PHY3H | Original Q1 | Legacy

1 (a) A student finds data on the Internet for her project on the Solar System. She checks this data on other websites.

The table shows the checked data.

Name of planet	Diameter in km	Distance from Sun in millions of km	Period in days
Mercury	4 840	58	87
Venus	12 390	108	224
Earth	12 760	149	365
Mars	6 800	228	686
Jupiter	142 800	778	4 332
Saturn	119 400	1 428	10 759
Uranus	47 600	2 870	30 685
Neptune	48 400	4 497	60 190

1 (a) (i) In the table, the period of each planet is given in days.

What is meant by the *period* of a planet?

.....

(1 mark)

1 (a) (ii) Suggest why the student checks the data on other websites.

.....

.....

(1 mark)

1 (a) (iii) What is the relationship, if any, between a planet's distance from the Sun and its period?

.....

.....

(1 mark)

4.8.1.1 Our solar system

Question 18 · continued

1 (a) (iv) What is the relationship, if any, between a planet's diameter and its period?

.....

.....

(1 mark)

1 (b) What is the force which provides the centripetal force to keep planets in their orbits?

.....

(1 mark)

1 (c) What is the name of the galaxy which contains the Solar System?

.....

(1 mark)

1 (d) Complete the following sentence by drawing a ring around the correct word in the box.

The universe is made up of

hundreds
thousands
millions
billions

of galaxies. *(1 mark)*

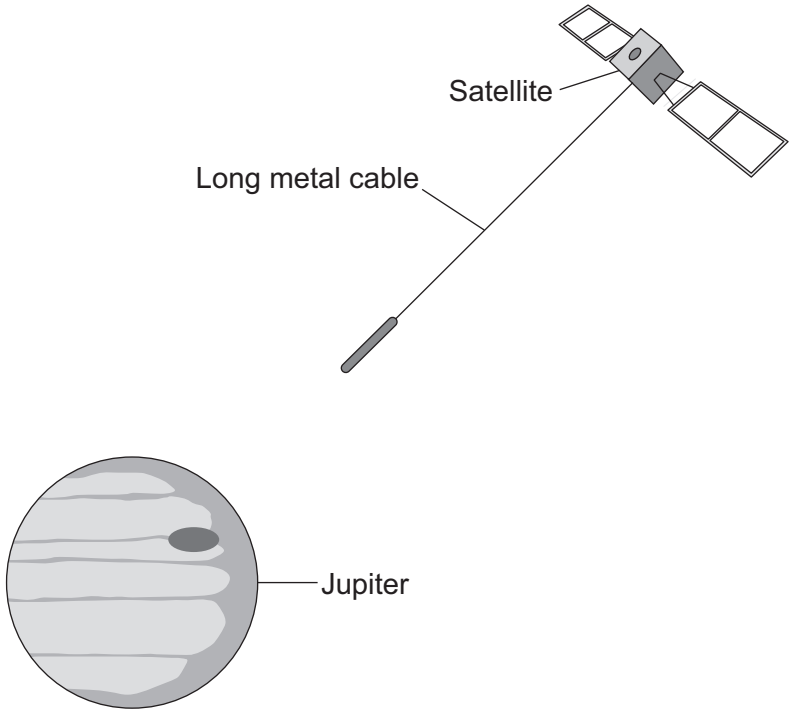
7

4.8.1.1 Our solar system

Question 19

7 Jupiter has a magnetic field which is more powerful than the magnetic field of any other planet in the Solar System.

Some scientists have suggested that, in the future, a long metal cable could hang from a satellite which orbits Jupiter. The cable would be part of a complete circuit.
This arrangement would produce electricity for the satellite.



7 (a) (i) What is the name of the effect that would produce electricity for the satellite?

.....

(1 mark)

7 (a) (ii) Describe how a potential difference is produced across the ends of the metal cable.

.....

.....

.....

.....

(2 marks)

4.8.1.1 Our solar system

Question 19 · continued

7 (a) (iii) Why will the potential difference produce an electric current?

.....

.....

(1 mark)

7 (b) Other satellites in the Solar System could use the same effect to produce electricity in a similar way.

Suggest **two** reasons why the potential difference produced for another satellite might be **smaller** than the potential difference for the satellite in the diagram.

1 .....

.....

2 .....

.....

(2 marks)

6

4.8.1.1 Our solar system

Question 20

June 2011 | PHY3H | Original Q3 | Legacy

3 Jupiter is the largest planet in the solar system. It has over sixty moons. The four largest moons were observed by Galileo using his telescope over four hundred years ago.

The table displays some of the data on these four largest moons which is now known to scientists.

Name	Distance from Jupiter in kilometres	Time to orbit Jupiter in days	Diameter in kilometres	Mass in quintillion tonnes
Callisto	1 883 000	16.9	4806	108
Europa	671 000	3.6	3130	48
Ganymede	1 070 000	7.2	5268	148
Io	422 000	1.8	3630	89

1 quintillion tonne = 1 000 000 000 000 000 000 tonnes

3 (a) A centripetal force acts on each of these moons.

State clearly what provides the centripetal force.

.....

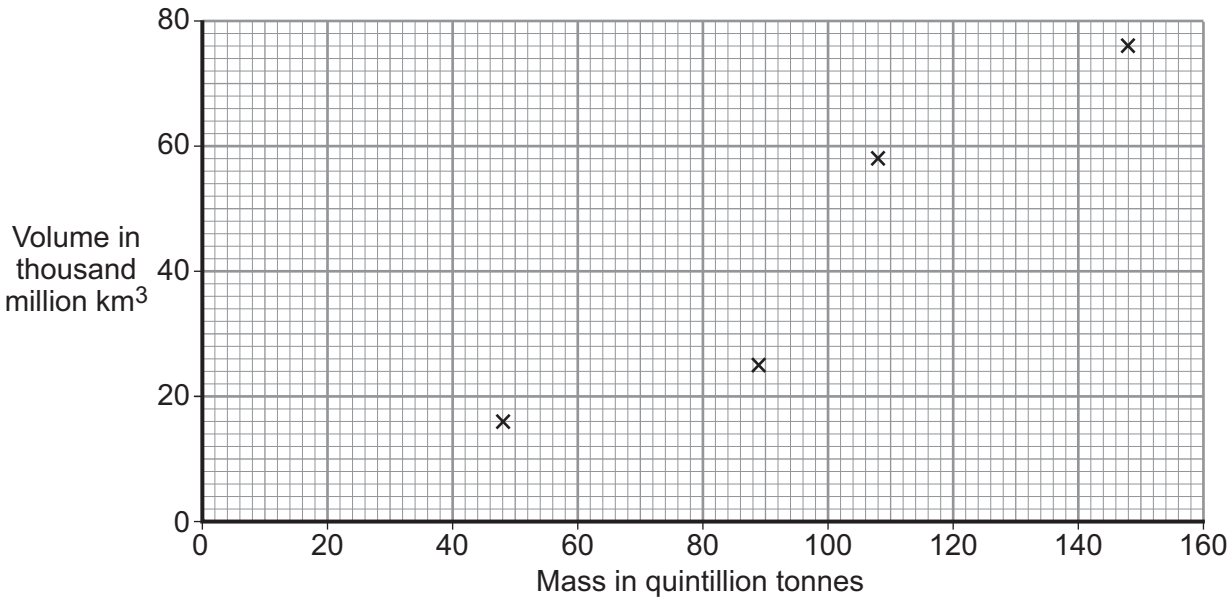
.....

(1 mark)

4.8.1.1 Our solar system

Question 20 · continued

3 (b) The graph shows the volume against mass for these large moons.



Use the graph to estimate the volume of a moon with a mass of 20 quintillion tonnes.

Show clearly on the graph how you used it to get to your estimate.

Estimated volume of moon = ... thousand million km^3

(2 marks)

3 (c) For these large moons, what is the relationship, if any, between the moon's *distance* from Jupiter and the *time* it takes for the moon to orbit Jupiter?

.....

.....

(1 mark)

3 (d) One reason why astronomers now have more data on the moons of Jupiter is that present-day astronomers have telescopes which are much more powerful than Galileo's telescope.

Give **one** other reason.

.....

.....

(1 mark)

5

4.8.1.1 Our solar system

Question 21

June 2016 | PH2HP | Original Q6 | Legacy

6 (a) Brown dwarf stars are thought to have been formed in the same way as other stars.
They are too small for nuclear fusion reactions to take place in them.
Brown dwarf stars emit infrared radiation but are not hot enough to emit visible light.

6 (a) (i) Describe how a star is formed.

[2 marks]

6 (a) (ii) Describe the process of nuclear fusion.

[1 mark]

6 (a) (iii) Scientists predicted that brown dwarf stars existed before the first one was discovered in 1995.

Suggest **one** reason why scientists are now able to observe and identify brown dwarf stars.

[1 mark]

4.8.1.1 Our solar system

Question 21 · continued

6 (b) In the 18th century some scientists suggested a theory about how the planets formed in the Solar System. The theory was that after the Sun formed, there were cool discs of matter rotating around the Sun. These cool discs of matter formed the planets. The scientists thought this must have happened around other stars too.

6 (b) (i) Thinking about this theory, what would the scientists have predicted to have been formed in other parts of the Universe?

[1 mark]

6 (b) (ii) Since the 1980s scientists studying young stars have shown the stars to be surrounded by cool discs of rotating matter.

What was the importance of these observations to the theory the scientists suggested in the 18th century?

[1 mark]

6 (c) The Earth contains elements heavier than iron.

Why is the presence of elements heavier than iron in the Earth evidence that the Solar System was formed from material produced after a massive star exploded?

[1 mark]

7

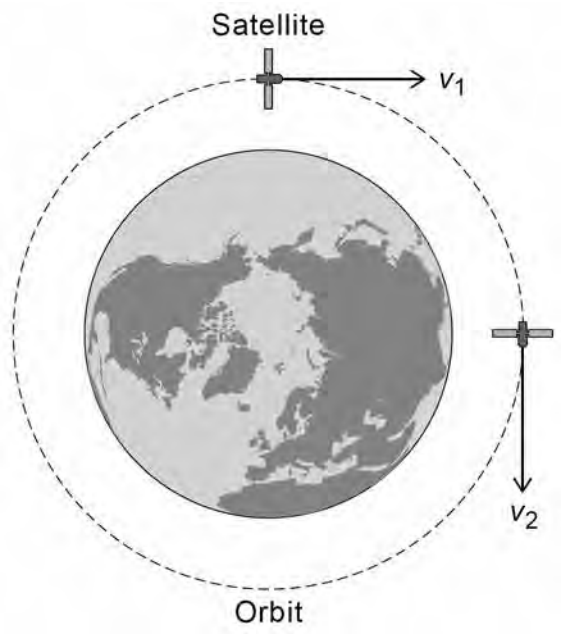
4.8.1.1 Our solar system

Question 22

0 8 A satellite is in a circular orbit around the Earth.

Figure 14 shows the velocity of the satellite at two different positions in the orbit.

Figure 14



0 8 . 1 Explain why the velocity of the satellite changes as it orbits the Earth.

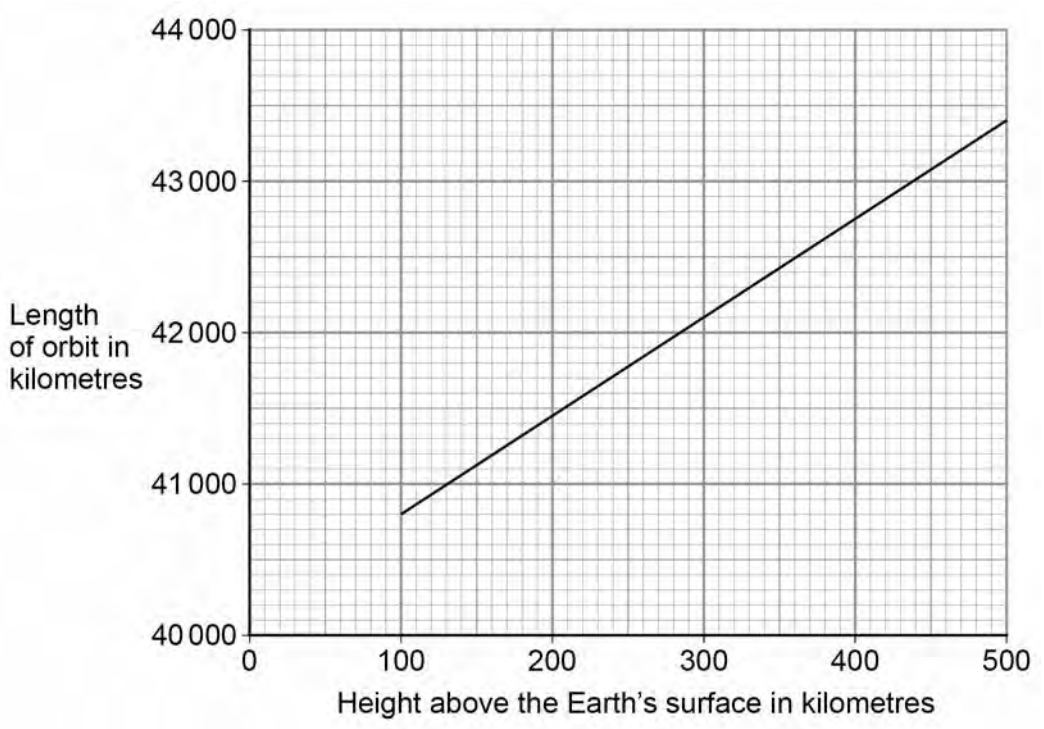
[3 marks]

Question 8 continues on the next page

Question 22 · continued

0 8 . 2 **Figure 15** shows how the length of a satellite orbit depends on the height of the satellite above the Earth's surface.

Figure 15



A satellite orbits 300 km above the Earth's surface at a speed of 7.73 km/s.

Calculate how many complete orbits of the Earth the satellite will make in 24 hours.

[5 marks]

Number of complete orbits = _____

4.8.1.1 Our solar system

Question 22 · continued

In 1772, an astronomer called J Bode developed an equation to predict the orbital radii of the planets around the Sun.

Table 3 shows Bode's predicted orbital radii and the actual orbital radii for the planets that were known in 1772.

Table 3

Planet	Predicted orbital radius in millions of kilometres	Actual orbital radius in millions of kilometres
Mercury	60	58
Venus	105	108
Earth	150	150
Mars	240	228
Jupiter	780	778
Saturn	1500	1430

0 8 . 3 The predicted data can be considered to be accurate.

Give the reason why.

[1 mark]

0 8 . 4 J Bode used his equation to predict the existence of a planet with an orbital radius of 2940 million kilometres.

The planet Uranus was discovered in 1781.

Uranus has an orbital radius of 2875 million kilometres.

Explain why the discovery of Uranus was important.

[2 marks]

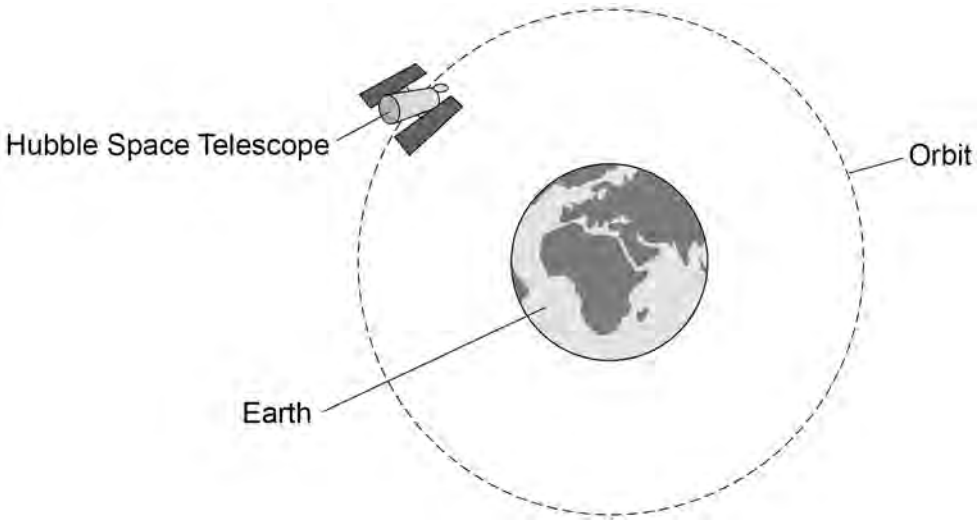
11

4.8.1.1 Our solar system

Question 23

0 6 **Figure 15** shows the Hubble Space Telescope orbiting the Earth.

Figure 15



0 6 . 1 What name is given to objects that orbit a planet?

[1 mark]

Question 6 continues on the next page

4.8.1.1 Our solar system

Question 23 · continued

0 6 . 2 A space telescope uses microwaves to communicate with the Earth.

A microwave has a wavelength of 12.5 cm.

The speed of microwaves through space is 3.0×10^8 m/s.

Calculate the frequency of the microwave.

Use the Physics Equations Sheet.

Give your answer in standard form.

[5 marks]

Frequency (in standard form) = _____ Hz

0 6 . 3 Explain the effect of the Earth's gravitational force on the motion of the Hubble Space Telescope.

[3 marks]

4.8.1.1 Our solar system

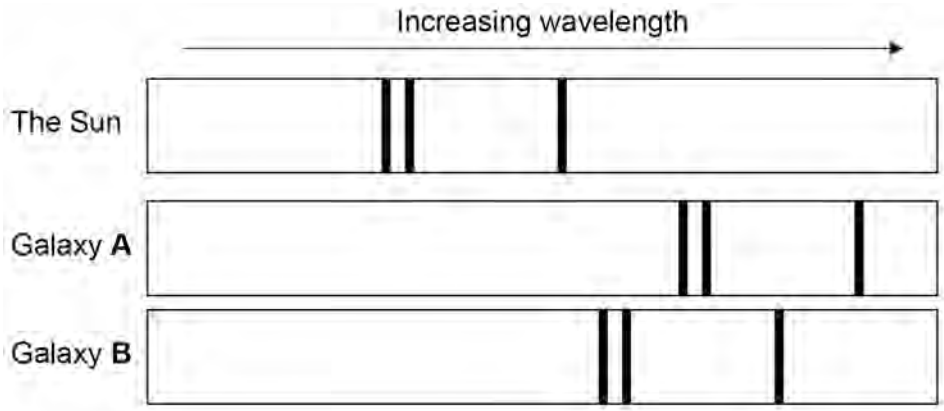
Question 23 · continued

0 6 . 4 The Hubble Space Telescope can detect visible light from distant galaxies.

The visible light spectra from stars and galaxies include dark lines at specific wavelengths.

Figure 16 shows the visible light spectra from the Sun and two galaxies.

Figure 16



Explain what conclusions can be made about galaxies **A** and **B**.

[3 marks]

12

4.8.1.1 Our solar system

Question 24

0 3 The Universe contains many stars.

0 3 . 1 The Sun is the star at the centre of our solar system.

Give **three** other types of object that form our solar system.

[3 marks]

1 _____

2 _____

3 _____

Some main sequence stars will eventually form black holes.

Table 3 gives the mass of four stars.

Table 3

Star	Mass in kg
Arcturus	2.2×10^{30}
Betelgeuse	2.2×10^{31}
Cygni A	1.4×10^{30}
The Sun	2.0×10^{30}

0 3 . 2 Which star in **Table 3** is most likely to form a black hole?

[1 mark]

_____

4.8.1.1 Our solar system

Question 24 · continued

0 3 . 3 The distance from Cygni A to the Earth is 1.1×10^8 gigametres.

Which distance is the same as 1.1×10^8 gigametres?

[1 mark]

Tick (✓) **one** box.

1.1×10^{11} m ☐

1.1×10^{14} m ☐

1.1×10^{17} m ☐

1.1×10^{20} m ☐

Question 3 continues on the next page

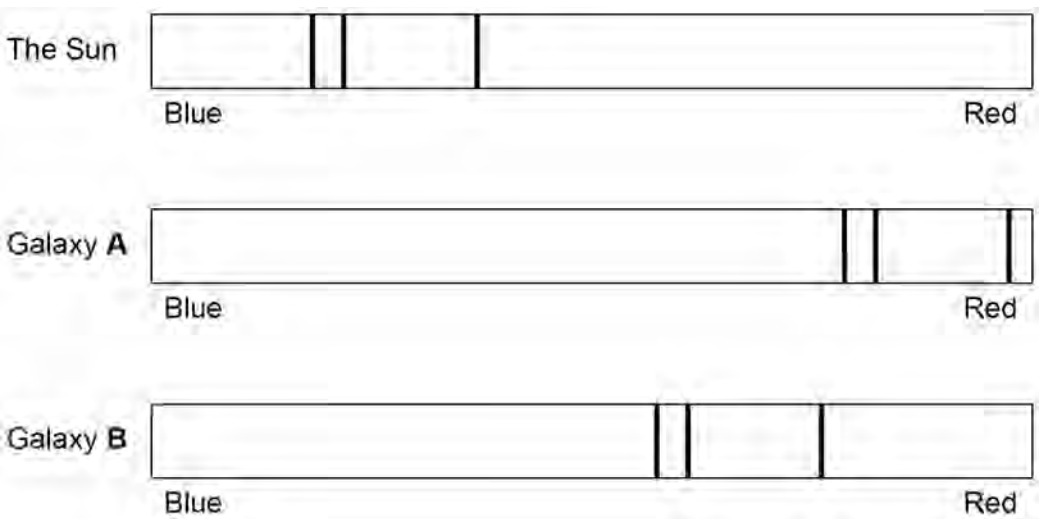
Question 24 · continued

0 3 . 4 The light spectrum from every galaxy includes dark lines.

The lines have the same pattern.

Figure 7 shows the position of dark lines in the visible spectra of light from the Sun and from two distant galaxies.

Figure 7



Explain what these light spectra tell us about the velocities of galaxy **A** and galaxy **B**.

[3 marks]

4.8.1.1 Our solar system

Question 24 · continued

0 3 . 5 The distance between Arcturus and the Earth is 3.6×10^{14} km.

speed of light = 3.0×10^{8} m/s

Calculate the time taken for light from Arcturus to reach the Earth.

Use the Physics Equations Sheet.

[4 marks]

Time taken = _____ s

0 3 . 6 When stars are formed, they contain mostly hydrogen.

Describe how stars produce all other naturally occurring elements.

[4 marks]

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