OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P8.3 BEYOND EARTH

SCORE	PERCENTAGE
/118	%

STEMUP

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Gateway Physics A (9-1)

Beyond Earth

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **118**.
- The total number of marks may take into account some 'either/or' question choices.

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1 The Sun was formed from a cloud of dust and gas.

Which force brought together the particles of the cloud?

A electrostatic
B frictional
C gravitational
D magnetic

Your answer ☐

[1]

2 Which of these is evidence for an expanding universe?

A Light from galaxies is red shifted.
B Nuclear fusion occurs in stars.
C Many stars have orbiting planets.
D Stars were formed from dust and gas.

Your answer ☐

[1]

3(a) Rockets carry satellites into space.

These satellites are kept in orbit around a planet by a force.

What is the name of this force?

---

[1]

(b) Write down the name of the Earth's natural satellite.

---

[1]

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(c) A rocket carrying a vehicle called the Mars Rover was sent to Mars.



The Mars Rover has a mass of 185 kg.

The gravitational field strength (g) on Mars is 3.75 N/kg.

Calculate the weight of the Rover vehicle on Mars.

Show your working and give your answer to 3 significant figures.

State the unit for weight.

---

answer: _____ **unit**_____ **[5]**

(d) Why did the Mars Rover weigh more on Earth than on Mars?

---

[1]

4 How was the Sun formed?

A From dust and gas pushed together by gravity leading to a fission reaction.
B From dust and gas pulled together by gravity leading to a fusion reaction.
C From dust and gas pushed together by gravity leading to a fusion reaction.
D From dust and gas pulled together by gravity leading to a fission reaction.

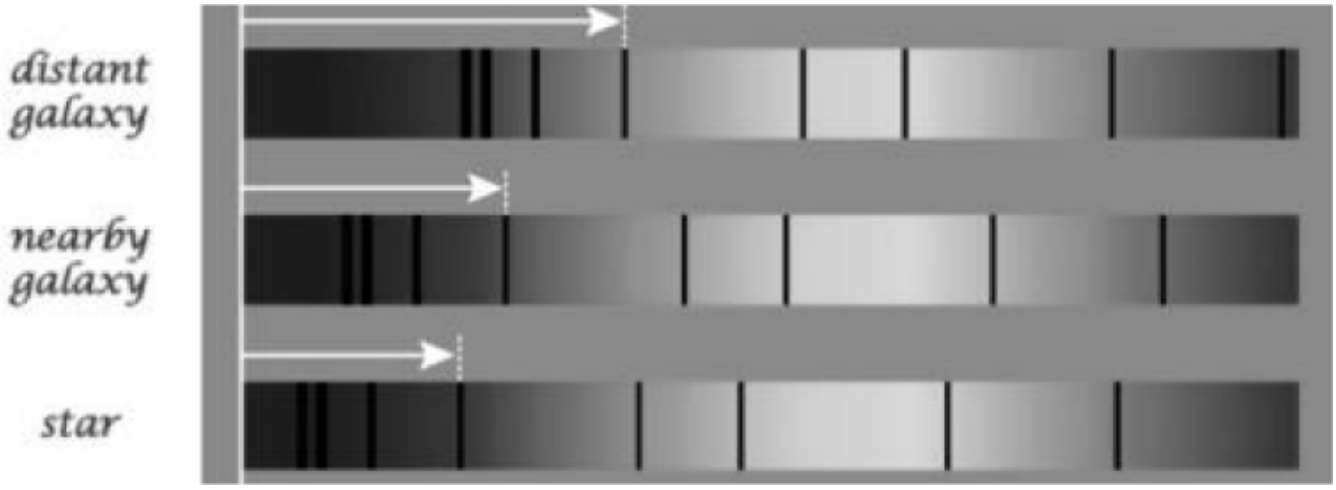
Your answer

[1]

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5 * Scientists collect evidence from the universe and develop theories to explain their observations.

Here are three absorption spectra showing red shift. The white arrows show the relative position of the same band in the absorption spectra of a star, a nearby galaxy and a distant galaxy.



Using your knowledge of red shift, describe how the information in the diagrams supports the idea of the Big Bang model.

[6]

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6 State **two** features of a satellite in a **polar orbit**?

Suggest a use for a satellite in a polar orbit.

---

[3]

7 Asteroids orbit the Sun.

What are asteroids and how have some asteroids damaged the Earth in the past?

---

[2]

8(a) Artificial satellites, such as TV Satellites, can be used for communication.

They are put into orbit around the Earth.

TV satellites are in a high orbit above the equator **and** move around the Earth once every 24 hours.

Explain how this orbit is an **advantage** for satellite TV.

---

[2]

(b) Some weather forecasting satellites have lower orbits than TV satellites.

How does this **lower** orbit affect the time they take to move around the Earth?

---

[1]

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(c) Satellites are taken into space by manned and unmanned rockets.

Rocket flight and space travel can be risky. However, the use of satellites can bring benefits.

Write about the risks and benefits of putting satellites into space.

---[3]

9 Rockets carry satellites into space.

(i) These satellites are kept in orbit around a planet by a force.

What is the name of this force?

---[1]

(ii) Write down the name of a natural satellite and describe how it is different from an artificial satellite.

---[2]

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10

(i) A rocket is in a stable orbit.

To keep the rocket in this orbit its speed needs to stay at 8000 m/s.

Suggest, by using ideas about gravitational and centripetal forces, why this speed needs to be maintained to keep it in this stable orbit.

---

[3]

(ii) The rocket re-enters the Earth's atmosphere safely.

In the final part of the descent its speed reduces steadily from 2000 m/s to 120 m/s just before touchdown. This takes place over a distance of 5×10^5 m.

Calculate the average **deceleration** over this distance.

---

answer _____ m/s^2

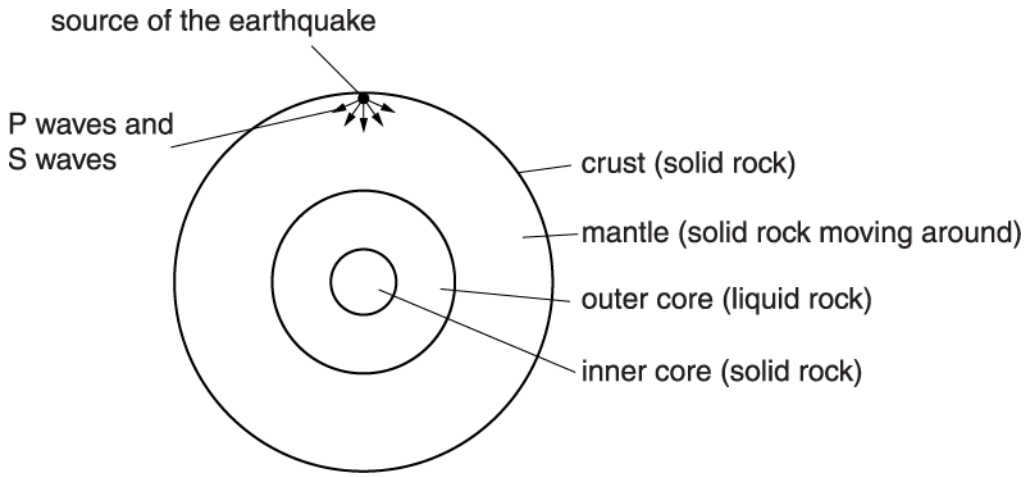
[3]

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11(a) Look at the diagram of the Earth.

An earthquake produces P waves and S waves.

Look at the diagram. It shows the initial directions of the P waves and S waves.



P waves and S waves are detected by seismometers on the Earth's surface.
Each type of wave from the earthquake is detected at different times by seismometers.

Which type of wave is received first?

Explain your answer.

---

[1]

(b) Scientists take measurements of P waves and S waves using seismometers.

After an earthquake, scientists can work out the exact position of the earthquake, using these measurements.

Suggest how they do this.

---

[2]

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(c) S waves do not travel through the Earth's inner core.

Explain why.

---

[1]

12 Rockets carry satellites into space.

These satellites can have different types of orbit around the Earth.

One type is a low polar orbit.

Another type is a geostationary orbit, which has an orbital period of 24 hours.

Describe and explain the differences in orbits, periods and speeds between geostationary orbits and low polar orbits.



The quality of written communication will be assessed in your answer to this question.

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[6]

13 This question is about nuclear energy.

Complete the crossword.

Across

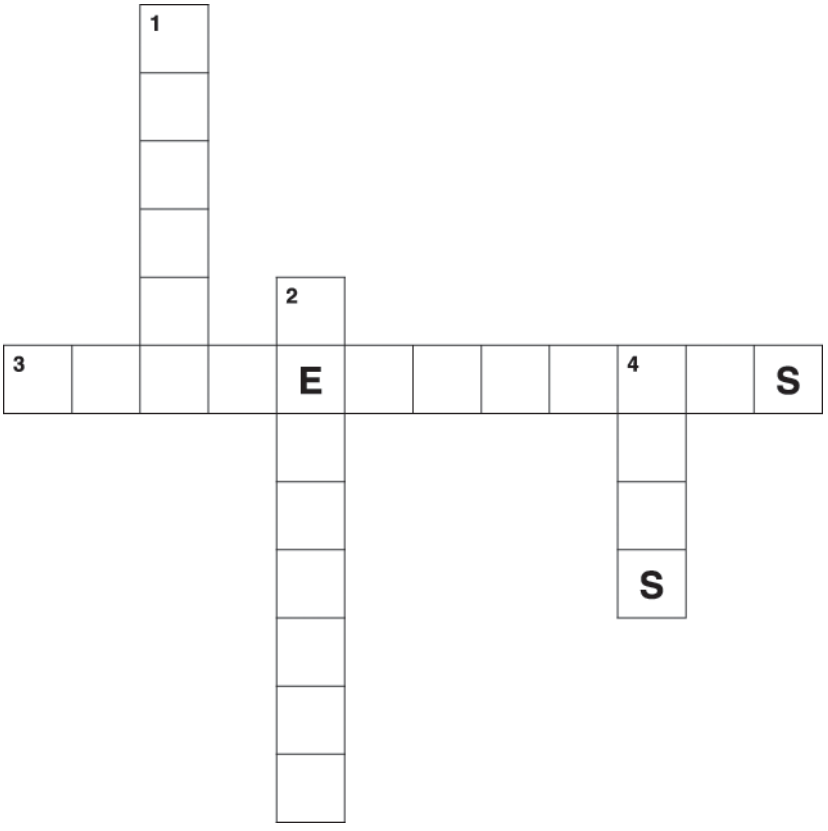
3 In stars, fusion happens at extremely high _ _ _ _ **e** _ _ _ _ _ _ **s**.

Down

1 Nuclei of hydrogen isotopes undergo fusion to form _ _ _ _ _ _ nuclei.

2 Scientists stop nuclear fission reactions going out of control in a reactor by absorbing some of the _ **e** _ _ _ _ _ _.

4 Scientists stop nuclear reactions going out of control by placing metal _ _ _ **s** in the reactor.



[2]

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14(a) In 2011 there was a major earthquake in Japan. This was followed by a devastating tsunami.

Scientists did not predict the earthquake accurately.

Immediately after the earthquake they did predict the tsunami.

Explain why the tsunami was predictable.

---

[1]

(b) Scientists are getting better at making predictions.

Suggest what scientists could do to improve their monitoring of earthquakes.

---

[1]

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15(a) Our understanding of the Solar System has developed over centuries.

Astronomer	Dates	
Ptolemy	87 to 150 AD	He believed the **Earth** was the centre of the Universe.
Copernicus	1473 to 1543 AD	He believed the **Sun** was the centre of the Solar System.
Galileo	1564 to 1642 AD	He showed that Copernicus' model was right and that Ptolemy's was wrong.

(i) What did Copernicus do to develop his theory?

---

[1]

(ii) How was Galileo able to support Copernicus' theory?

---

[1]

(iii) Why were Copernicus' and Galileo's ideas **controversial** at the time?

---

[1]

(b) The Big Bang Theory, developed in 1949, states that the Universe began with an ‘explosion’.

This made the Universe expand.

What can we conclude about the movement of galaxies from the Big Bang Theory?

---

[2]

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(c) The Big Bang Theory has been accepted by many scientists.

The theory might be changed by future scientists.

Explain why.

---[1]

16 Scientists study space.

They collect evidence to help develop theories.

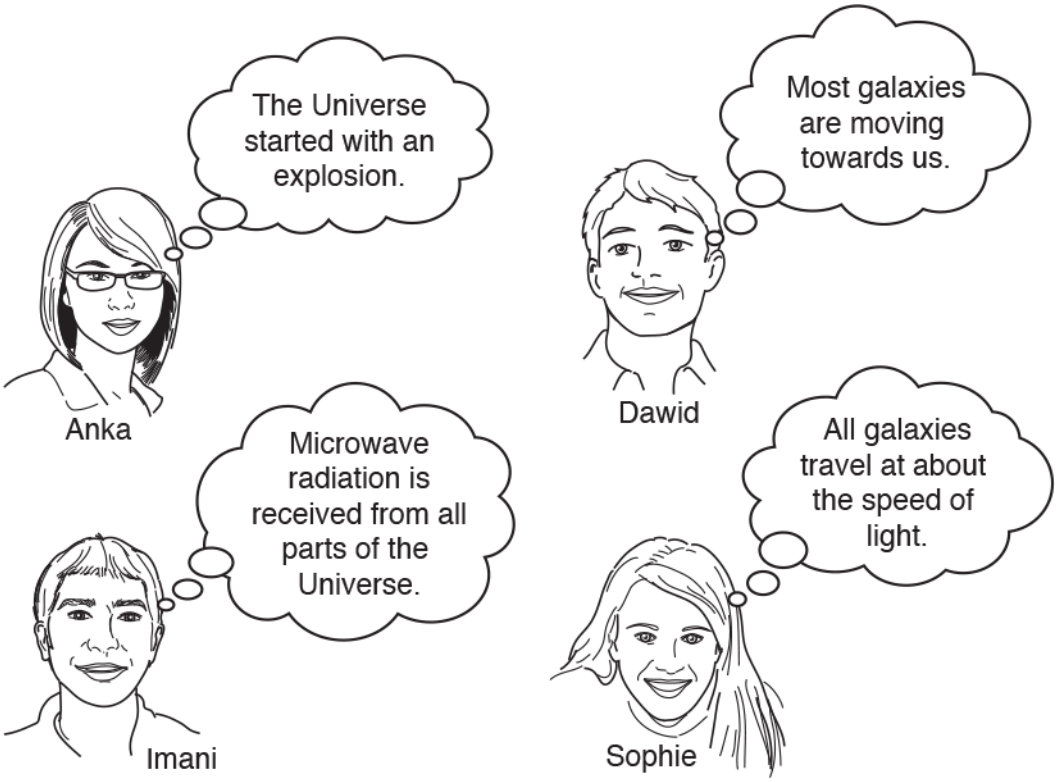
The **Big Bang** is a well-known theory.

What is the Big Bang theory?

---[1]

17 Four students discuss ideas about the origin of the Universe.

Look at their ideas.



Only two students have correct ideas about the origin of the Universe.

(i) Which **two** students have correct ideas about the origin of the Universe?

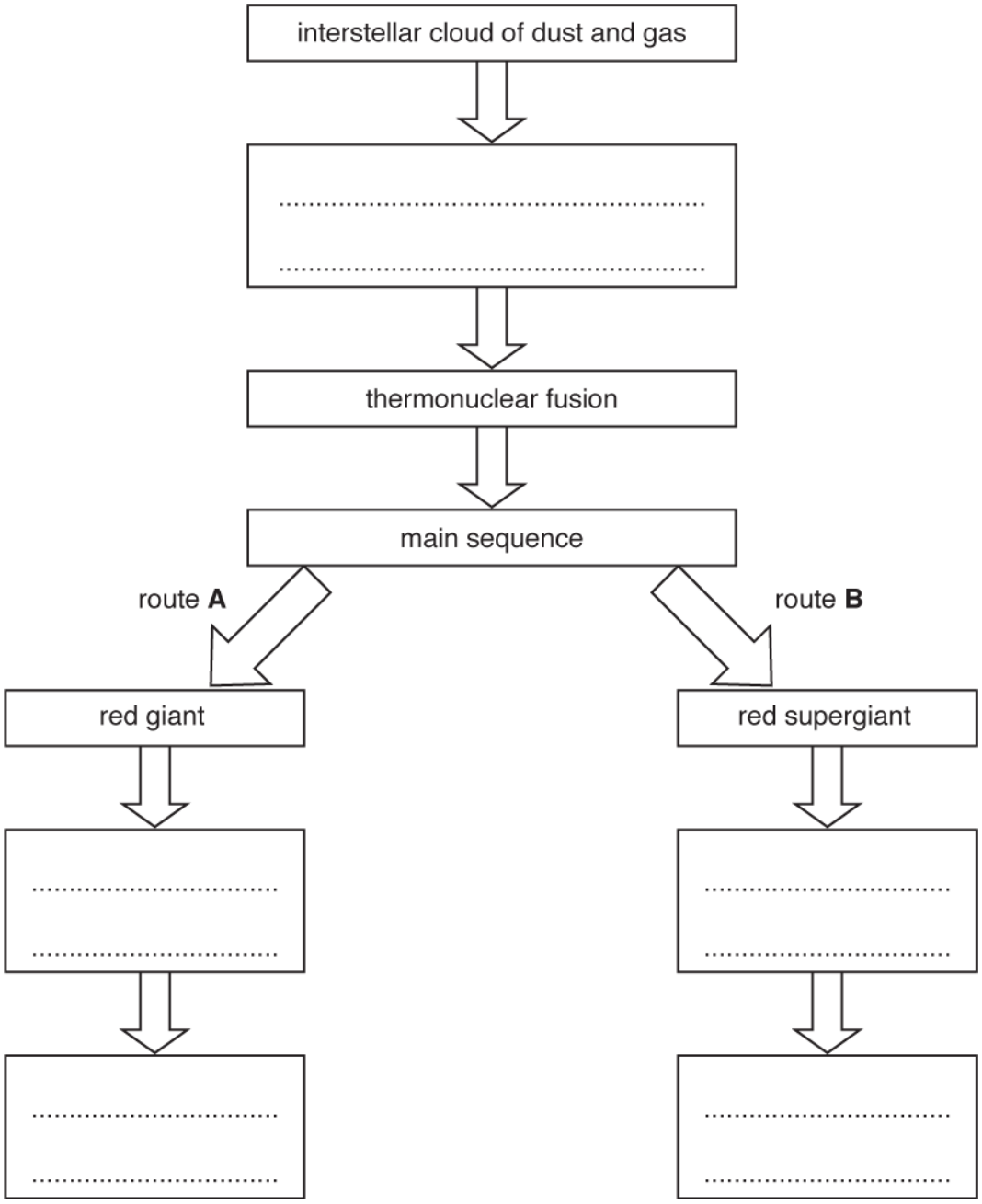
---------- and ---------- [2]

(ii) For one of the **incorrect** ideas, write the correct information.

---------- [1]

18 Chloe and Marcus draw a flow chart for the life-cycle of a star.

Look at their flow chart.



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(i) Their flow chart is incomplete.

Fill in the **five** missing parts of the life-cycle of a star.

Write your answers in the boxes on the flow chart.

[3]

(ii) Explain what determines whether a star follows route **A** or route **B** after the main sequence.

[1]

19(a) Satellites orbit larger objects in space.

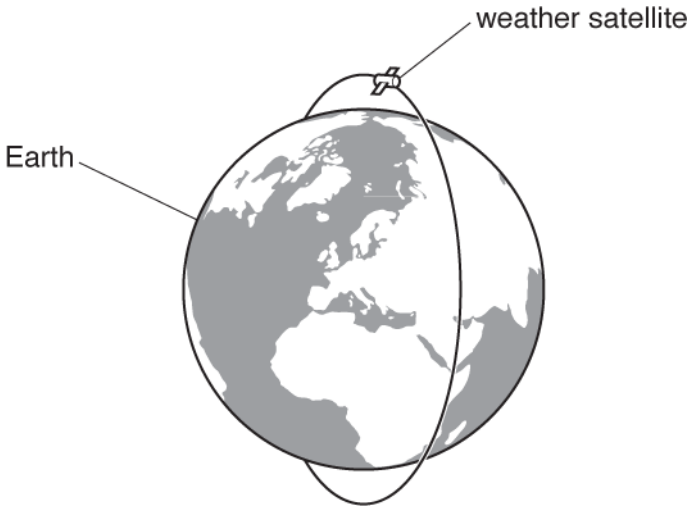
The Moon is a natural satellite of the Earth. It has a circular orbit.

Explain why the Moon remains in orbit around the Earth.

[2]

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(b) Artificial satellites are used for weather forecasting.



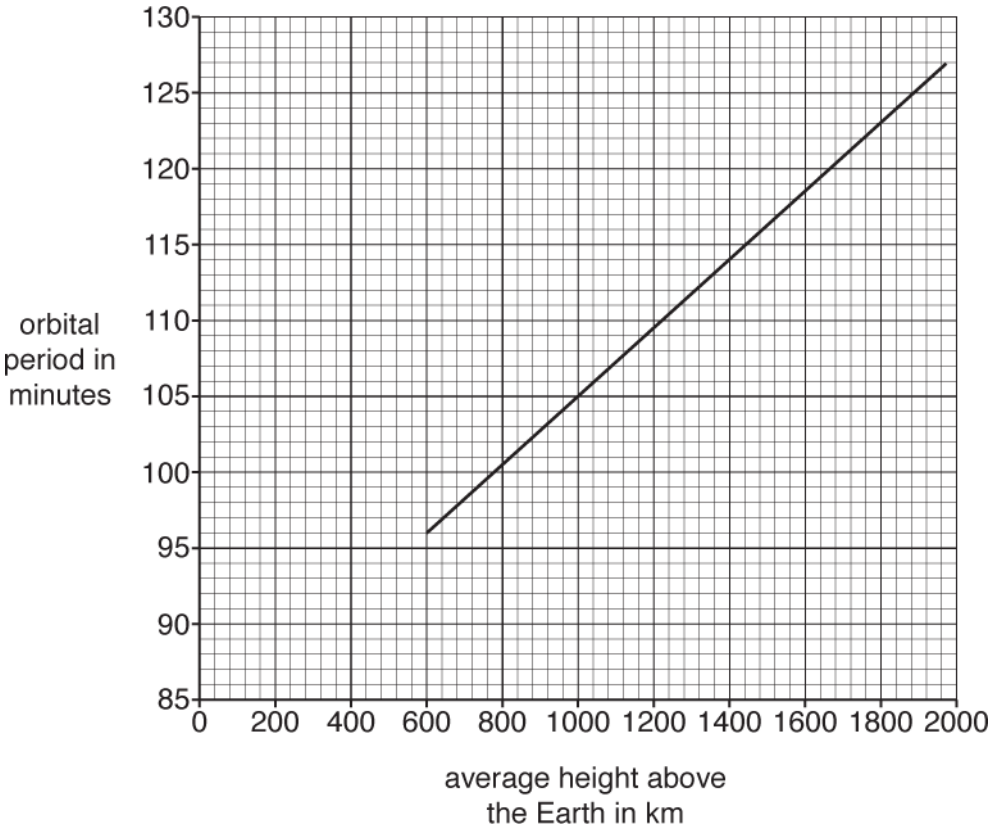
Write down one **other** use of artificial satellites.

---------- [1]

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(c) Weather forecasting satellites are in a low orbit.

The average height of a satellite above the Earth is linked to its orbital period.



(i) A scientist suggests that doubling the height above the Earth from 1000 km to 2000 km will double the time period.

Is he correct?

Use calculations in your answer.

---

[2]

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(ii) Write down one **advantage** of a low orbit for weather satellites.

---

[1]

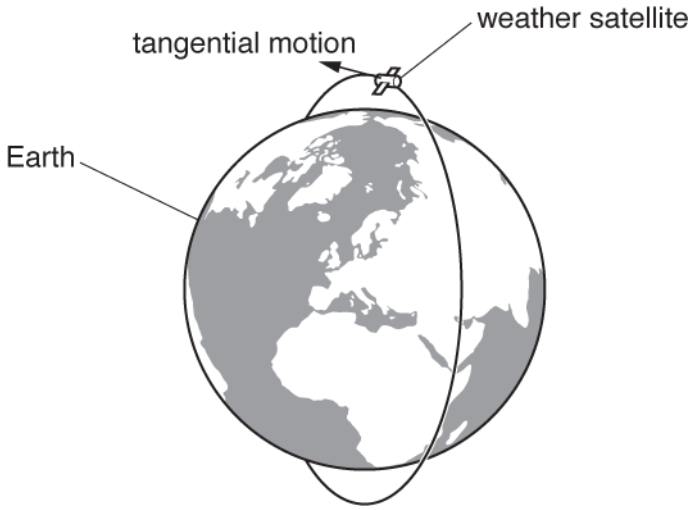
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20(a) Satellites are objects that orbit larger objects in space.

Artificial satellites constantly accelerate towards the Earth.

Their tangential motion keeps them moving around the Earth.

Look at the diagram.



Explain what will happen if the tangential motion is too fast or too slow.

---

[2]

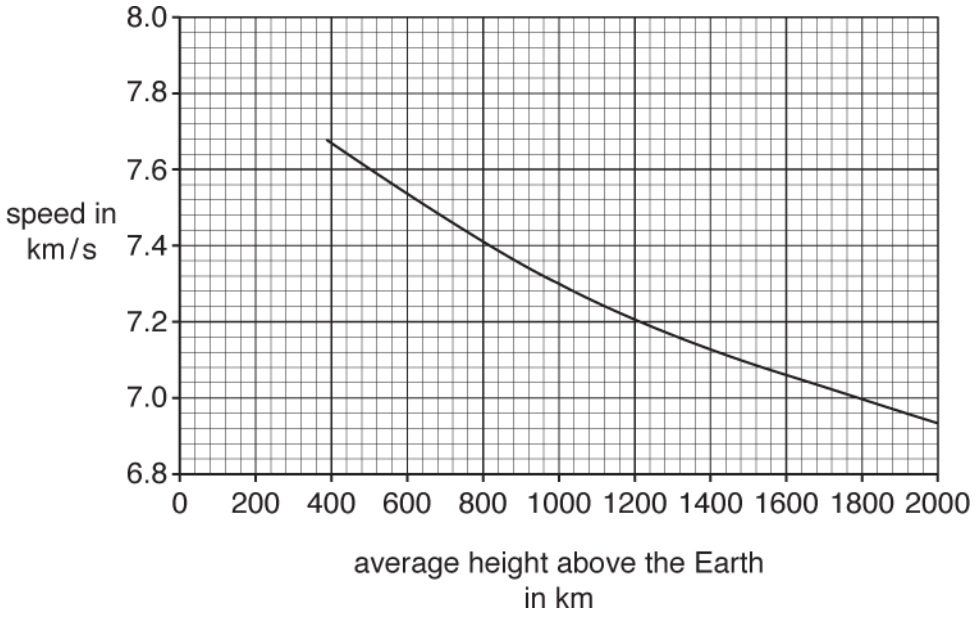
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(b) Weather forecasting satellites are in a Low Earth Orbit (LEO).

The average height of a satellite above the Earth is linked to its speed.



(i) This artificial satellite is in orbit at an average height of 200 km above the Earth.

Use the graph to estimate its speed.

Speed _____ km/s **[1]**

(ii) Explain why artificial satellites have different speeds.

_____

_____

_____ **[2]**

(iii) Write down one **advantage** of a Low Earth Orbit (LEO) weather satellite.

_____

_____ **[1]**

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21 A planet moves in a circular orbit around its star.

Which statement is correct?

A The planet travels at changing speed and changing velocity.

B The planet travels at changing speed but constant velocity.

C The planet travels at constant speed and velocity.

D The planet travels at constant speed but changing velocity.

Your answer [ ] [1]

22 An artificial satellite is kept in its low polar orbit by a gravity force from a planet.

The satellite is moved to a higher orbit above the planet.

Which statement is correct about the satellite in this higher orbit?

A The force of gravity is greater and its speed decreases.

B The force of gravity is greater and its speed increases.

C The force of gravity is less and its speed decreases.

D The force of gravity is less and its speed increases.

Your answer [ ] [1]

23 Which row **A**, **B**, **C** or **D**, describes what has happened to light that has undergone red shift?

	Wavelength	Frequency
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

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Your answer  [1]

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24 Which statement is **correct** about geostationary satellites?

A They are above the equator and they orbit the Earth in about 90 minutes at a high orbit.

B They are above the equator and they orbit the Earth in 24 hours at a high orbit.

C They are above the equator and they orbit the Earth in 24 hours at a low orbit.

D They are above the poles and they orbit the Earth in 24 hours at a low orbit.

Your answer [ ] **[1]**

25 The table contains statements about red-shift and galaxies.

Which row in the table is correct?

	Statement 1	Statement 2
A	All galaxies move apart at the same speed.	They show both red-shift and blue-shift.
B	Distant galaxies show more red-shift.	The distant galaxies are moving apart faster than nearby ones.
C	Distant galaxies show more red-shift.	The distant galaxies are moving apart slower than nearby ones.
D	There are no galaxies that show blue-shift.	All galaxies are moving away from each other.

Your answer [ ] **[1]**

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26 All bodies emit electromagnetic radiation.

Body **R** is at a higher temperature than body **S**.

Which statement is correct?

A **R** emits radiation with a mean higher frequency.

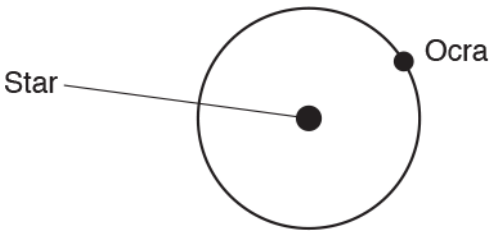
B **R** emits radiation with a mean longer wavelength.

C **S** emits radiation with a higher intensity.

D **S** emits radiation with a mean shorter wavelength.

Your answer ☐ [1]

27 Planet Ocra is in a circular orbit around a star.



Which statement is correct?

A The acceleration of Ocra is zero.

B The speed of Ocra is changing.

C The velocity of Ocra is changing.

D The velocity of Ocra is zero.

Your answer ☐ [1]

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28 Nuclear **fusion** is a reaction that happens in stars. This equation for fusion is incomplete.



(i) What else is produced in this reaction?

---

[1]

(ii) Stars are formed from dust and gas.

What causes the dust and gas to undergo fusion?

---

[1]

29 An artificial satellite orbits the Earth in a circular path.

The satellite is moved further away from Earth to another orbit.

Which row in the table is correct?

	Force of gravity	Speed in orbit	Time period
A	decreases	decreases	decreases
B	decreases	decreases	increases
C	decreases	increases	increases
D	increases	increases	increases

Your answer ☐ [1]

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30 *The Earth contains a crust, mantle and core as shown in **Fig. 22.1**.

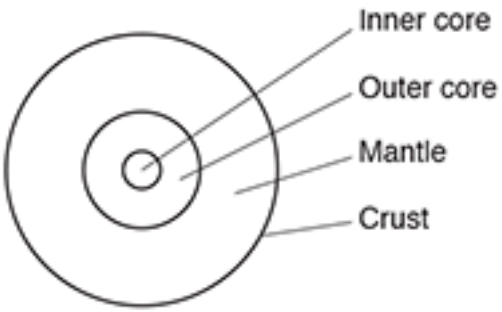


Fig. 22.1

Table 22.1 gives some data about seismic waves and the Earth.

	Density (g / cm^3)	P wave speed (km / s)	S wave speed (km / s)
Top of crust	2.2	5.55	3.25
Top of mantle	3.4	7.97	4.55
Top of outer core	9.9	8.10	-
Bottom of outer core	12.2	10.30	-

Table 22.1

Describe what information the data in **Table 22.1** gives about the structure of the Earth.

In your answer you should explain any trends in the data in **Table 22.1**.

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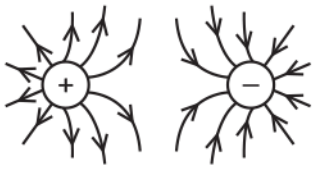
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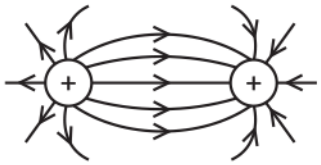
[6]

31 Look at the field line diagrams for positive and negative charges.

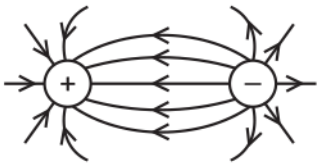
A



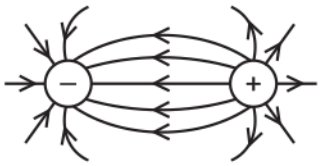
B



C



D



Which field line diagram is correct?

Your answer [1]

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32(a) A student looks at two identical metal spoons, **A** and **B**.

Spoon **A** was placed in hot water at 70 °C.

Spoon **B** is at 20 °C.

Which spoon emits the most radiation?

Tick (✓) **one** box.

Spoon **A** ☐

Spoon **B** ☐

Explain your answer.

---

[1]

(b) Explain why both spoons look identical to the student, even though they are at different temperatures.

---

[1]

33 This is a diagram to show a nuclear fusion reaction:



(i) Explain why this is nuclear fusion.

---

[1]

(ii) It is difficult for nuclear fusion reactions to occur on Earth.

Explain why nuclear fusion reactions occur in the Sun.

---

[2]

(iii) What will happen to our Sun when it runs out of hydrogen?

---

[1]

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34 Use the words from the list to complete the sentences about the Universe.

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

Big-Bang Contracting CMBR Expanding

LDR Red giant Red shift Solar system

The ..... is a model of how the universe began.

Light from distant galaxies has a longer wavelength when it reaches Earth than when it was emitted.

This is called ..... .

Distant galaxies are moving away faster so the universe is ..... .

[3]

35 Which statement about geostationary satellites is correct?

A They appear to be in a fixed position relative to a point on the Earth.
B They are in a polar orbit.
C They are positioned 400 km above the Earth's surface.
D They take 2 hours to orbit the Earth.

Your answer [1]

36 The average temperature on the Earth has increased over the last century.

Which statement explains why?

A Radiation absorbed by the Earth has decreased.
B Radiation absorbed is less than radiation emitted.
C Radiation absorbed is greater than radiation emitted.
D Radiation emitted by the Earth has increased.

Your answer [1]

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37 Which statement about a star that explodes into a supernova is correct?

A The star has more mass than the sun.
B The star is older than the sun.
C The star will become a white dwarf.
D The star's core expands.

Your answer [ ] [1]

38(a) Edwin Hubble discovered that all distant galaxies were moving away from the Earth.

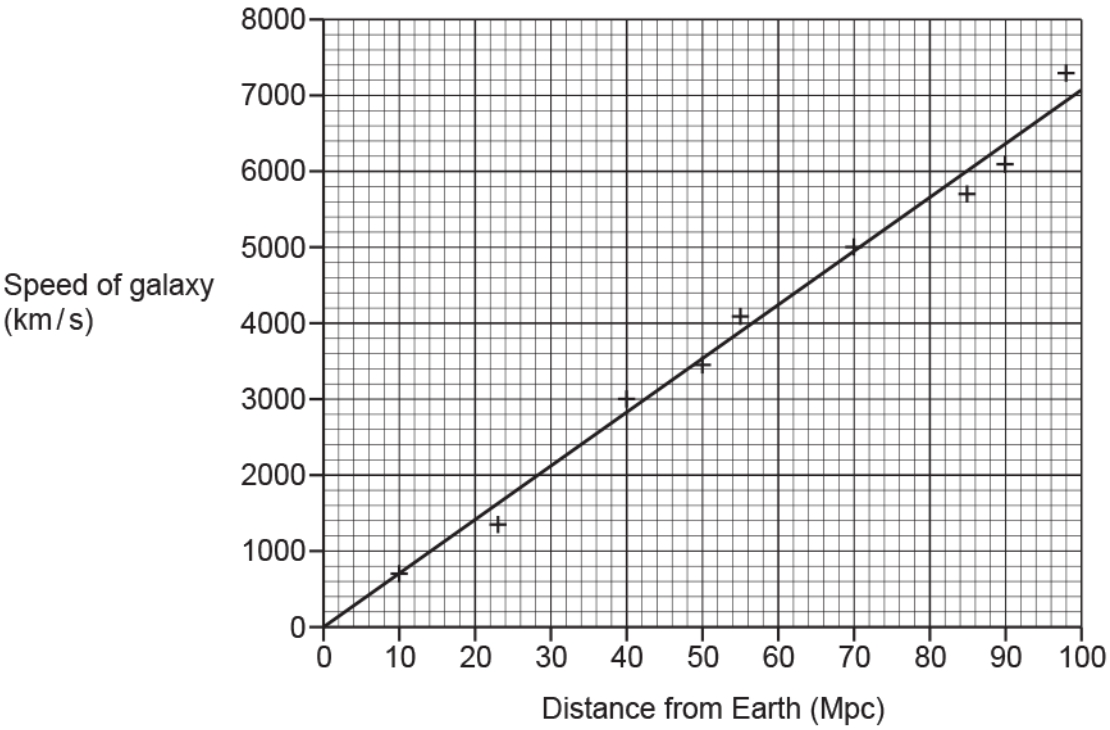
Explain how he could tell that all distant galaxies were moving away from the Earth.

---

[2]

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(b) This graph shows how the speed of a galaxy changes with distance from the Earth.



(i) Use data from the graph to show that the speed of the galaxy is proportional to the distance from the Earth.

---

[2]

(ii) Explain how data from the graph provides evidence for the Big-Bang.

---

[1]

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(c) Before Edwin Hubble could publish his results, his work was peer reviewed.

Suggest why peer review is important.

---

[1]

(d) The parsec (pc) is a unit used for measuring large distances in the Universe.

(i) A galaxy is at a distance of 82 Mpc from the Earth.

Use the graph to determine the speed of this galaxy.

Give your answer in metres per second (m / s).

Speed = ... m / s **[2]**

(ii) Calculate the time it takes for the galaxy to travel 2.53×10^{24} m.

Use your answer to **(i)** to help you.

Time = ... s **[3]**

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39 Which statement about nuclear **fusion** is correct?

A Energy is released because mass is converted to energy.

B Helium is converted into hydrogen.

C It is the main way in which nuclear power generates electricity.

D It is the splitting of a heavy nucleus into smaller nuclei.

Your answer [ ] [1]

END OF QUESTION PAPER

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