THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

Tuesday 14 May 2013 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE SCIENCE A

A141/01 Modules B1 C1 P1 (Foundation Tier)

A137020613

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

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

Duration: 1 hour

A141101

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.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- 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 **60**.
- A list of physics equations is printed on page 2.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric circuits

power = voltage × current

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive materials

energy = mass × [speed of light in a vacuum]^2

Answer **all** the questions.

1 **(a)** Put the following in order of size from the largest to the smallest.

A cell

B chromosome

C DNA molecule

D cell nucleus

largest → smallest

[2]

(b) Complete the following sentences.

Use words from the list.

carbohydrates **chromosomes** **fats** **genes** **proteins**

Collagen and enzymes are examples of …… .

The instructions for a cell to make these molecules are called

…… .

[2]

[Total: 4]

2 Heather is 24 years old. She is planning to have a baby.

Heather's father has Huntington's disease. This is a genetic disorder caused by a dominant allele.

(a) Which combination of alleles can Heather's father **not** have?

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

HH ☐

hH ☐

hh ☐

Hh ☐

[1]

(b) Write down **two** symptoms of Huntington's disease.

1 .....

2 .....

[2]

(c) Symptoms of Huntington's disease do not usually appear until the age of 40.

The disorder is usually fatal.

Heather is thinking of having a genetic test to find out whether she has Huntington's disease like her father.

Discuss the possible implications to Heather and her family of having this genetic test.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

[Total: 9]

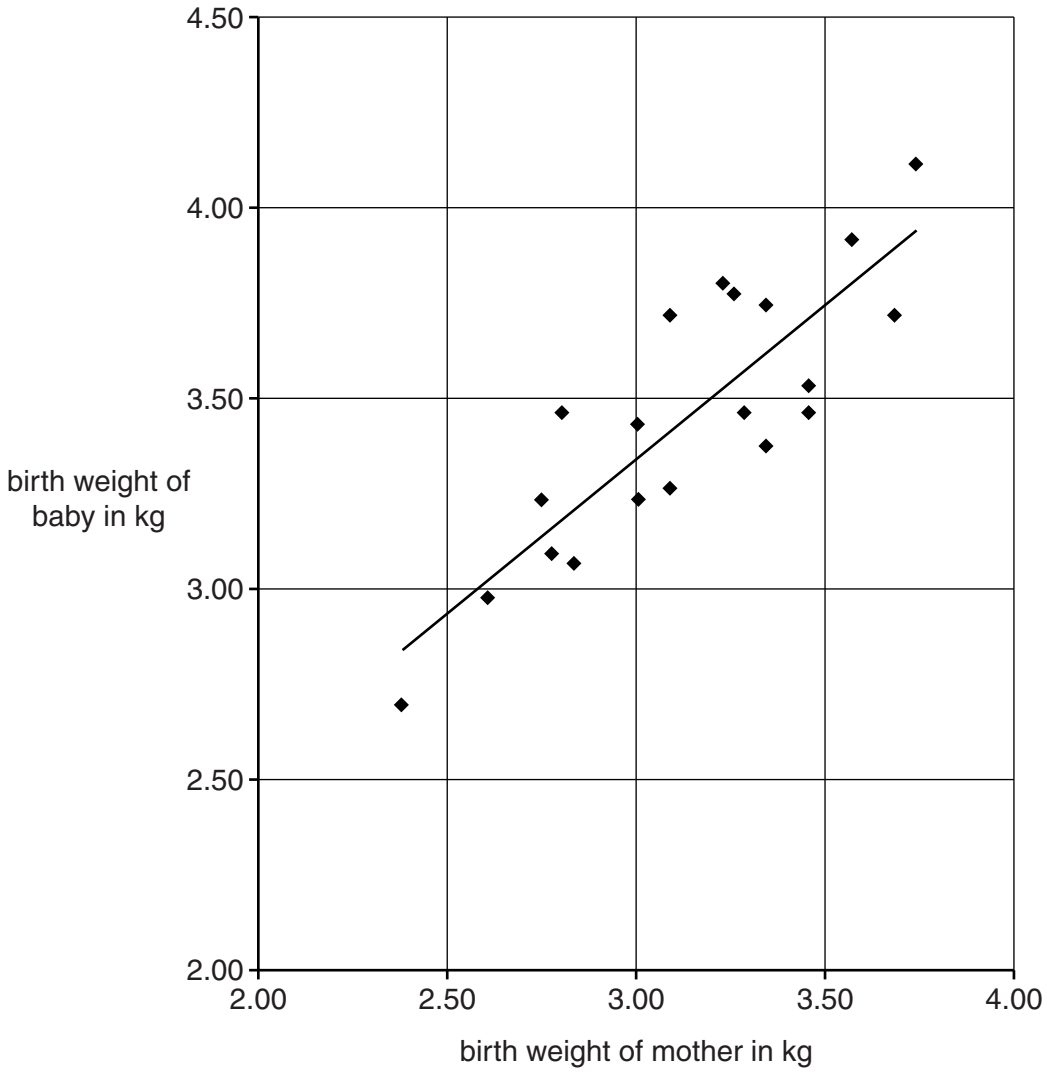
3 Leila is a midwife.

She is investigating if there is a link between a mother's own birth weight and the birth weight of her first baby.

Every baby is weighed soon after it is born. This value is their birth weight.

Leila asks some mothers to take part in the study.

She plots a graph of her results.



(a) Look at the graph.

Put ticks (✓) in the boxes next to the **three** statements that are true.

Two babies weighed over 4 kg when they were born.	☐
Two mothers weighed exactly 3 kg when they were born.	☐
Ten mothers took part in the study.	☐
The birth weight of a baby is generally greater than the birth weight of its mother.	☐
There is a correlation between the birth weight of a baby and the birth weight of its mother.	☐

[2]

(b) Leila knows that a baby's birth weight is affected by both its genes and the environment.

Suggest **two** environmental factors that are likely to affect a baby's birth weight.

1 .....

2 .....

[2]

(c) Leila thinks that only the **mother's** genes will have a **genetic** effect on the birth weight of her baby.

Explain why Leila is **not** correct.

.....

..... **[1]**

(d) One of the mothers in Leila's study gave birth to twins.

Leila did not include the birth weight of these twins in her study.

Suggest why.

.....

.....

.....

..... **[2]**

[Total: 7]

4 This question is about burning hydrocarbons.

(a) Finish these sentences about hydrocarbons.
Choose the correct words from this list.

acid rain

argon

nitrogen oxides

carbon particulates

water

Hydrocarbons contain only carbon and hydrogen atoms.

When hydrocarbons burn in lots of air the carbon atoms react with oxygen to make carbon dioxide.

The hydrogen atoms react with oxygen to make …… .

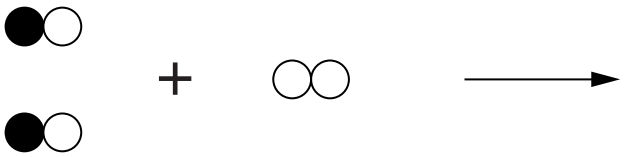
When hydrocarbons are burned with less air, carbon monoxide and

…… are also made.

[2]

(b) Carbon monoxide burns in oxygen to make carbon dioxide.

Complete the diagram to show what happens to the molecules during this reaction.



carbon monoxide oxygen carbon dioxide

[2]

[Total: 4]

5 A coal-fired power station gives off sulfur dioxide in the flue gases.

Sulfur dioxide is a pollutant.

Engineers install equipment to remove sulfur dioxide from the flue gases.

The engineers want to know if the new equipment is working.

They measure the sulfur dioxide in the flue gases the day before and the day after the new equipment is put in.

(a) On both days the engineers keep the amounts of coal burned and air used per hour the same.

Why do they keep these amounts the same?

.....

.....

.....

..... **[2]**

(b) On the first day the engineers take several measurements of sulfur dioxide concentration.

These measurements show that the sulfur dioxide concentration varies slightly.

Which two statements, when put together, explain this?

Put ticks (✓) in the boxes next to the **two** correct answers.

Coal does not have any sulfur in it.	☐
There is no sulfur dioxide in the flue gases.	☐
The engineers have taken too many measurements.	☐
Pieces of coal have different amounts of sulfur in them.	☐
The more sulfur there is in the coal, the more sulfur dioxide is made.	☐

[2]

(c) Coal-fired power stations make other pollutants.

State what other pollutants are made by power stations, and describe how the amounts of pollutants made can be reduced.

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

.....

.....

.....

.....

.....

.....

.....

.....

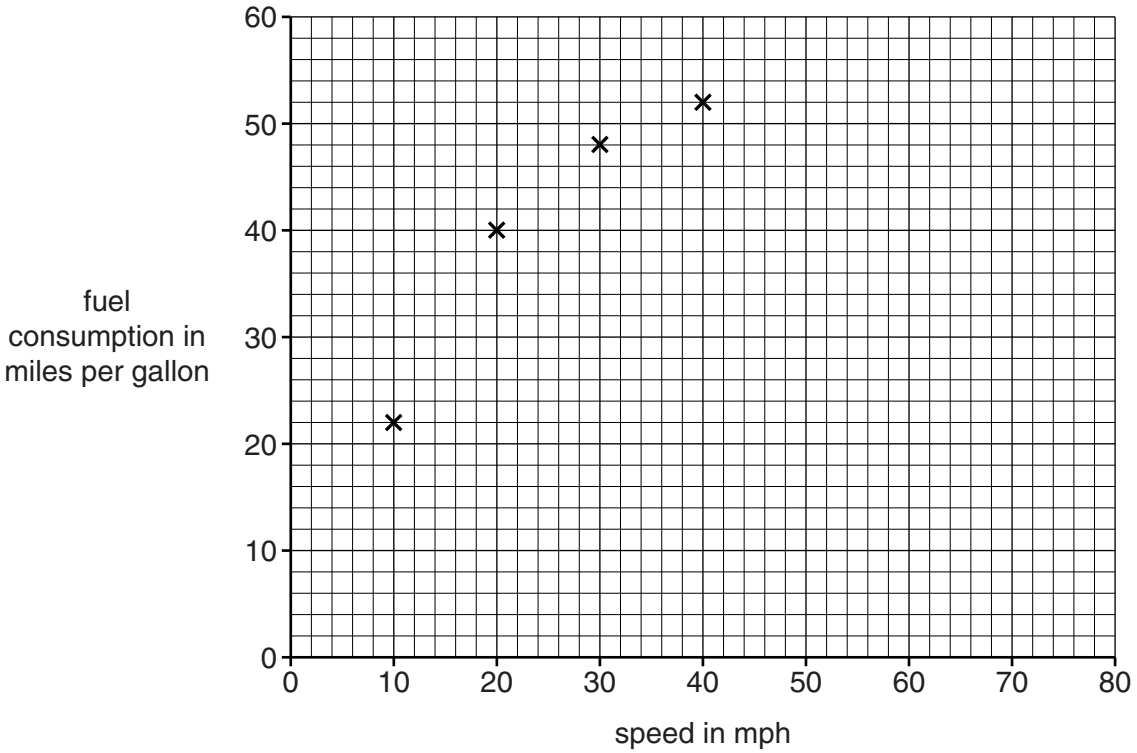
.....

..... **[6]**

[Total: 10]

6 Joe and Anne investigate how much fuel their car burns at different speeds.

They plot a graph of the data.



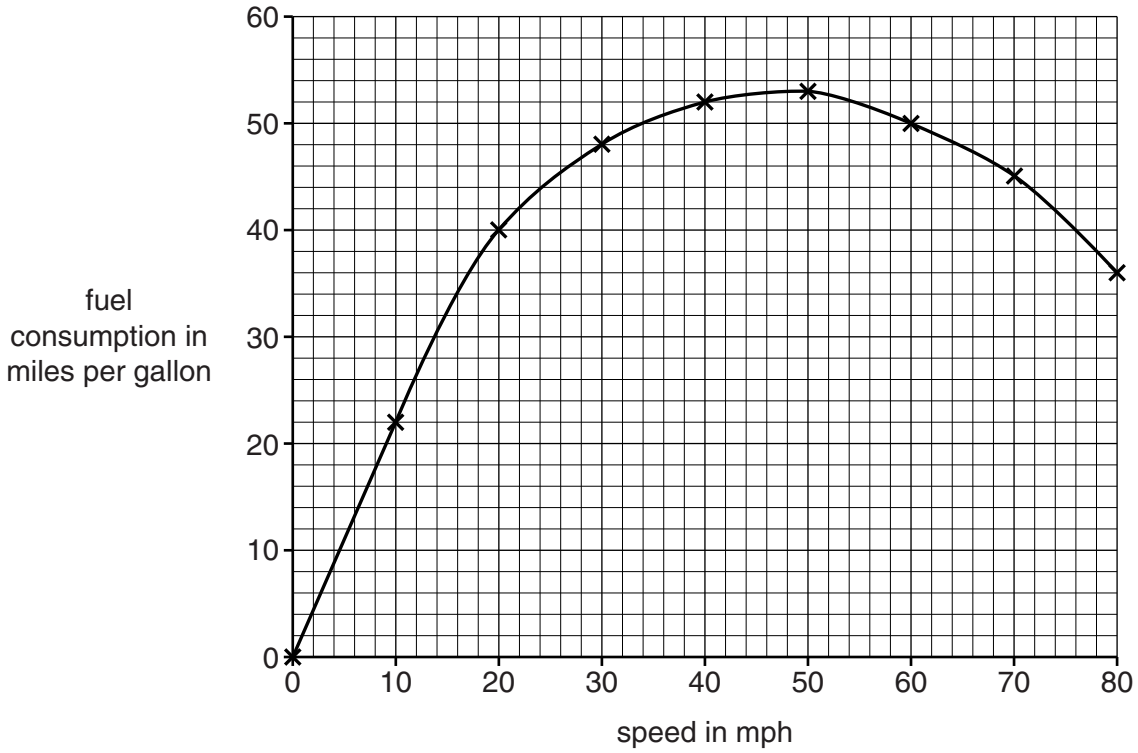
(a) Finish the sentence to show the correlation shown by this data.

As the speed …… the fuel consumption …… . **[1]**

Joe and Anne see this item in a newspaper.

> HIGHER SPEED LIMITS ON MOTORWAYS
>
> The Government plans to increase the speed limit on motorways from 70 mph to 80 mph.
> The Government believes shorter travelling times will save the country money.

Joe and Anne collect more data up to a speed of 80 mph.
They plot a new graph.



(b) (i) Use the graph to find the petrol consumption at 75 mph.

answer ..... miles per gallon **[1]**

(ii) Joe wants to drive as far as possible using one gallon of petrol.
What speed should he drive at?

answer ..... mph **[1]**

(c) Anne is worried about changes in air pollution if the speed of motorway traffic increases from 70 mph to 80 mph.

Joe says it doesn't matter how fast you go.

Use the graph to explain who you think is right and why.

.....

.....

.....

.....

..... **[3]**

[Total: 6]

7 This question is about the Earth's crust and earthquakes.

(a) Scientific explanations of changes in the Earth developed during the 20th century.

(i) When Alfred Wegener suggested that the continents moved, geologists did not accept his explanations.

Why did they **not** accept his explanations?

Put ticks (✓) in the boxes next to the **two** correct reasons.

Wegener was not a geologist. ☐

The continents looked as if they fitted together. ☐

Similar fossils are found in different continents. ☐

The older explanations were simpler than Wegener's. ☐

The continents were moving faster than Wegener said. ☐

[2]

(ii) In the 1950s, measurements on the Atlantic Ocean floor showed that the seafloor was spreading.

What do these measurements suggest?

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

The Earth is getting smaller. ☐

Wegener's ideas were wrong. ☐

The Atlantic Ocean is getting smaller. ☐

The American and European continents are moving apart. ☐

[1]

(b) Earthquakes produce P-waves and S-waves.

(i) Which of these waves can travel through solids?

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

only P-waves ☐

only S-waves ☐

both P-waves and S-waves ☐

neither P-waves nor S-waves ☐

[1]

(ii) An earthquake produces both P-waves and S-waves.

The P-waves travel at 8 km/s while the S-waves travel at 5 km/s.

The waves are detected a few hundred kilometres away.

Which of the following statements are correct?

Put ticks (✓) in the boxes next to the **two** correct statements.

The S-waves are slower than the P-waves. ☐

The S-waves will travel 5 km in 2 minutes. ☐

The S-waves will travel 15 km in 3 seconds. ☐

The S-waves are detected before the P-waves. ☐

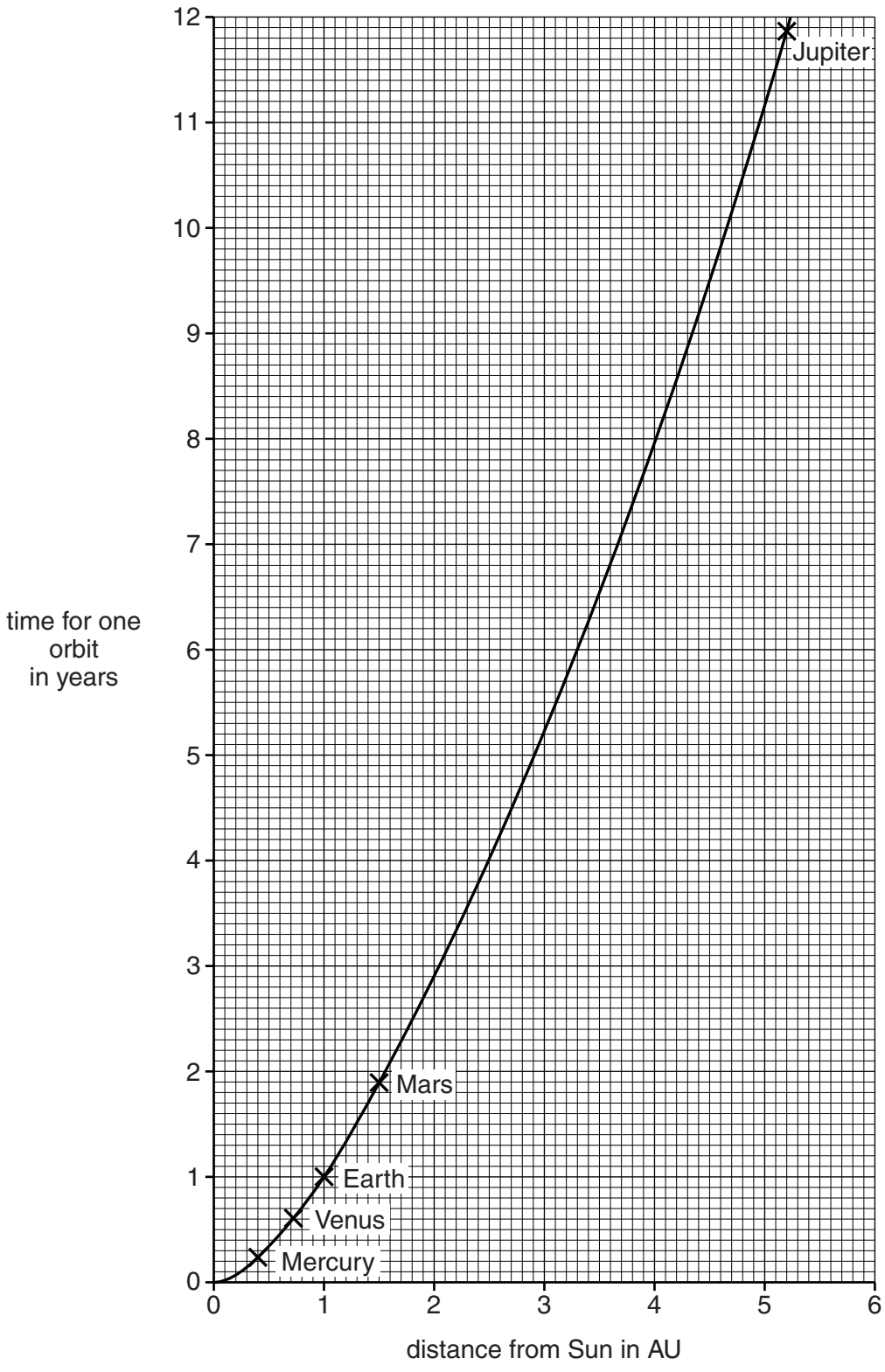
The S-waves and the P-waves are detected at the same time. ☐

[2]

[Total: 6]

8 The graph shows how the time taken for one orbit of a planet around the Sun depends on its distance from the Sun.

The distances are measured in AU, where 1 AU = the distance from the Earth to the Sun.



(a) Describe **in detail** the way in which the time for one orbit depends on the distance.

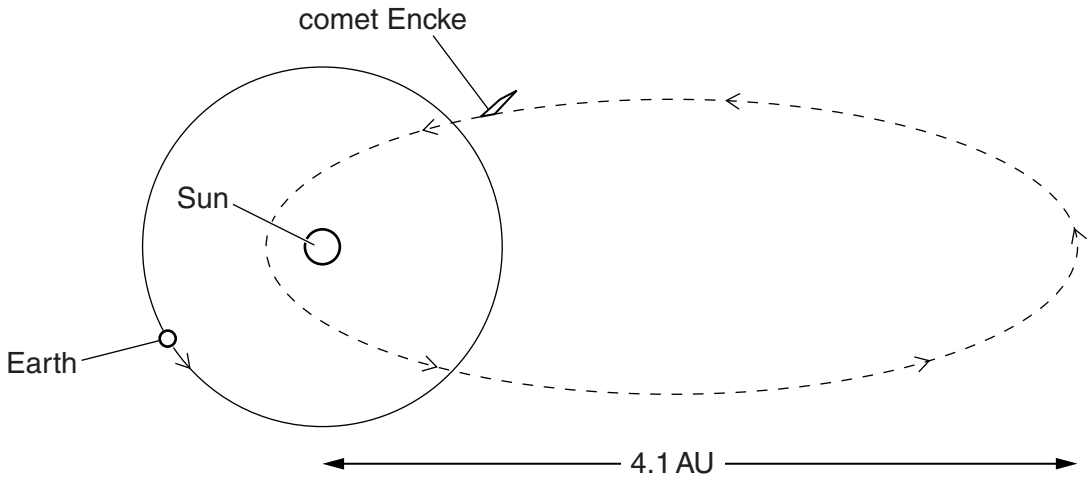
.....

.....

.....

..... **[2]**

(b) Comet Encke also orbits the Sun.



At its furthest point in the orbit, Encke is 4.1 AU from the Sun.

The time taken for Encke to complete one orbit of the Sun is 3.3 years.

These data do not fit the pattern of the graph.

Plot these data for Encke on the graph and suggest why it does not fit the same pattern as the planets.

.....

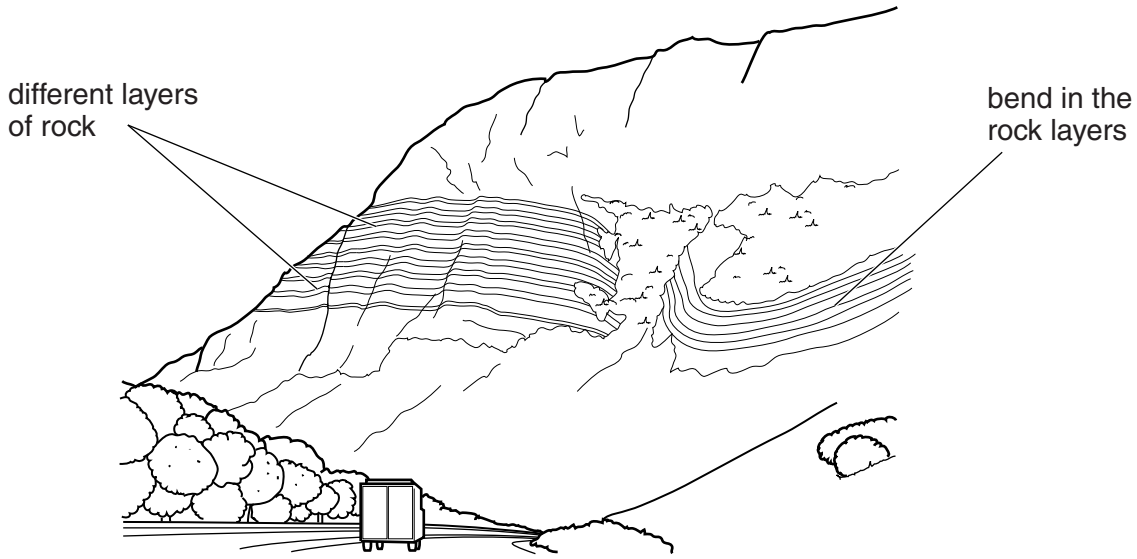
.....

.....

..... **[2]**

[Total: 4]

9 The diagram shows rocks in a deep valley.



Before the 18th century, it was thought that the Earth was created a few thousand years ago and had stayed the same ever since.

Ideas have changed since then.

How does evidence from rocks support the change in scientific ideas?

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

.....

.....

.....

.....

.....

.....

.....

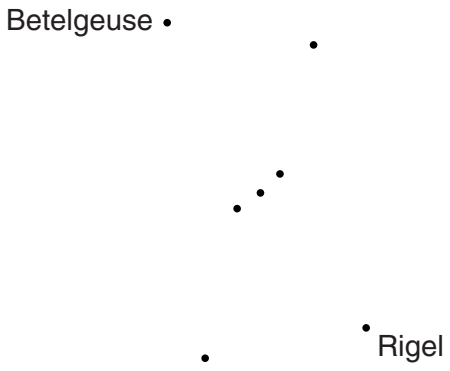
.....

.....

..... **[6]**

[Total: 6]

10 The constellation Orion includes the bright stars Betelgeuse and Rigel.



The following table gives data on these two stars.

Star	Colour	Actual brightness	Brightness as seen from the Earth	Distance from the Earth in light years
Betelgeuse	red	1	1.3	600
Rigel	blue-white	4	1	900

(a) The table shows that Betelgeuse looks brighter than Rigel when seen from the Earth. Use data from the table to **explain** why.

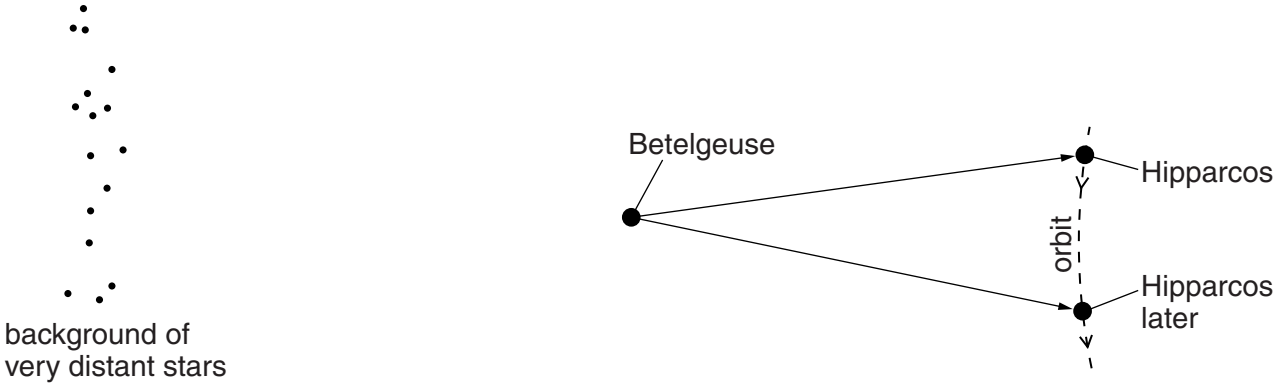
.....

.....

.....

..... **[2]**

(b) The distance data in the table were measured by a satellite called Hipparcos. This measured the position of the stars from different places in its orbit around the Sun.



(not to scale)

Explain how observing a star from different positions allows the distance to be found.

.....

.....

.....

..... **[2]**

[Total: 4]

END OF QUESTION PAPER