Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A333/02

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Unit 3: Ideas in Context plus P7
(Higher Tier)

WEDNESDAY 9 JUNE 2010: Afternoon

DURATION: 60 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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

OCR SUPPLIED MATERIALS:

Insert (inserted)

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (SM/SW) MEP60253 29256/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **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).**

INFORMATION FOR CANDIDATES

- **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 55.**
- **A list of physics equations is printed on pages 4–5.**
-  **Where you see this icon you will be awarded a mark for the quality of written communication in your answer.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

ELECTRIC CIRCUITS

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

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

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{time taken}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

FURTHER PHYSICS, OBSERVING THE UNIVERSE

$$\text{lens power} = \frac{1}{\text{focal length}}$$

$$\text{magnification} = \frac{\text{focal length of objective lens}}{\text{focal length of eyepiece lens}}$$

$$\text{speed of recession} = \text{Hubble constant} \times \text{distance}$$

Answer ALL the questions.

THIS QUESTION IS BASED ON THE ARTICLE 'CLIMATE 'FIX' COULD DEPLETE OZONE'.

1 (a) In the article, Dr Tilmes says '… to make decisions you need to know what is good about it and what is bad about it.'

(i) In what situation might it be a good idea to use the sulfate particles to cool the planet?

Your answer should include

- **a risk**
- **a benefit**
- **the situation when the benefit might outweigh the risk.**

_____

_____

_____

_____

_____ **[3]**

(ii) If the sulfate particles are used in the upper atmosphere, this can increase the risk to people.

Suggest one thing that individuals could do to reduce the risk to themselves.

_____ **[1]**

(b) The article suggests that in some circumstances there is a correlation between sulfate particles in the upper atmosphere and reducing global temperatures.

(i) The evidence provided in the article to support the correlation is not convincing.

Explain why.

Your answer should include

- **what the evidence is**
- **why it is not convincing.**

One mark is for a clear and well ordered answer.

_____

_____

_____

_____ **[2+1]**

(ii) Use your knowledge of global warming to suggest a scientific explanation of the correlation between sulfate particles and reducing global temperatures.

_____

_____

_____

_____ **[2]**

(iii) Explain why an answer to part (ii) makes the argument stronger for the link between sulfate particles in the upper atmosphere and reducing global temperatures.

_____

_____

_____ **[2]**

(c) Many people get confused between 'the greenhouse effect' and 'holes in the ozone layer'.

Explain the difference between the two.

Your answer should include

- **the main gases in the atmosphere involved**
- **the role of the gases**
- **the main results of each.**

_____

_____

_____

_____

_____

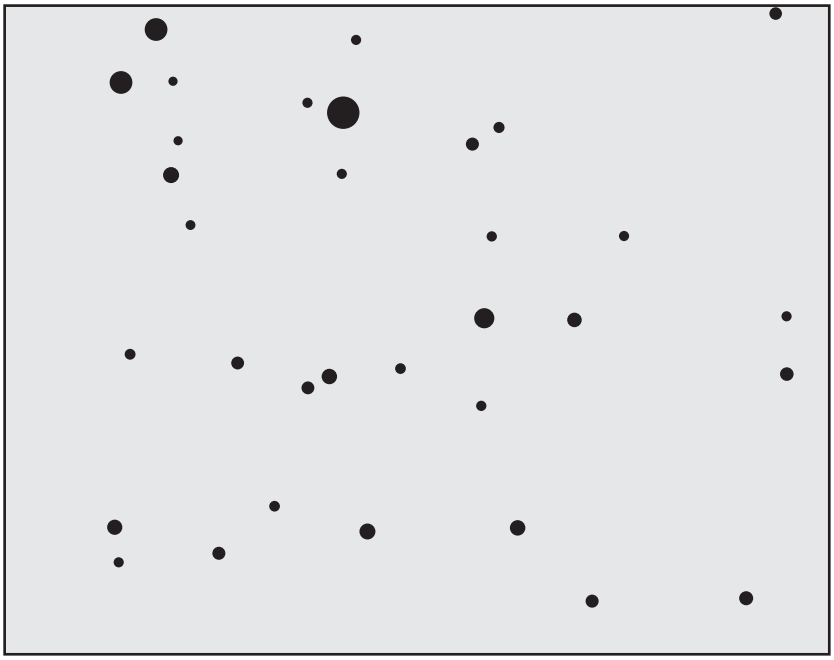
_____ **[4]**

[Total: 15]

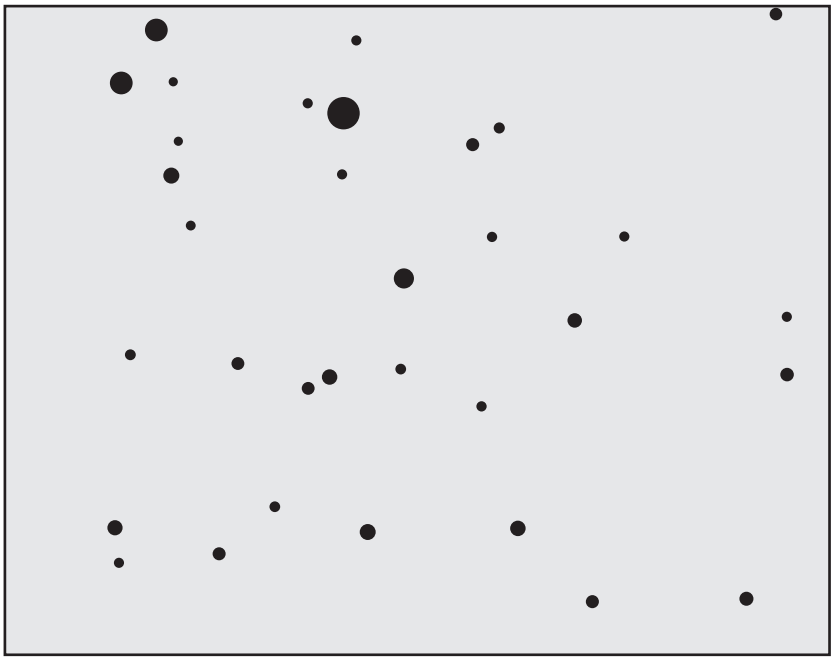
2 Angie is taking photos of the night sky.

Below are two of her pictures.

23rd July 2009



28th July 2009



(a) (i) Clearly label the planet on one of the pictures. [1]

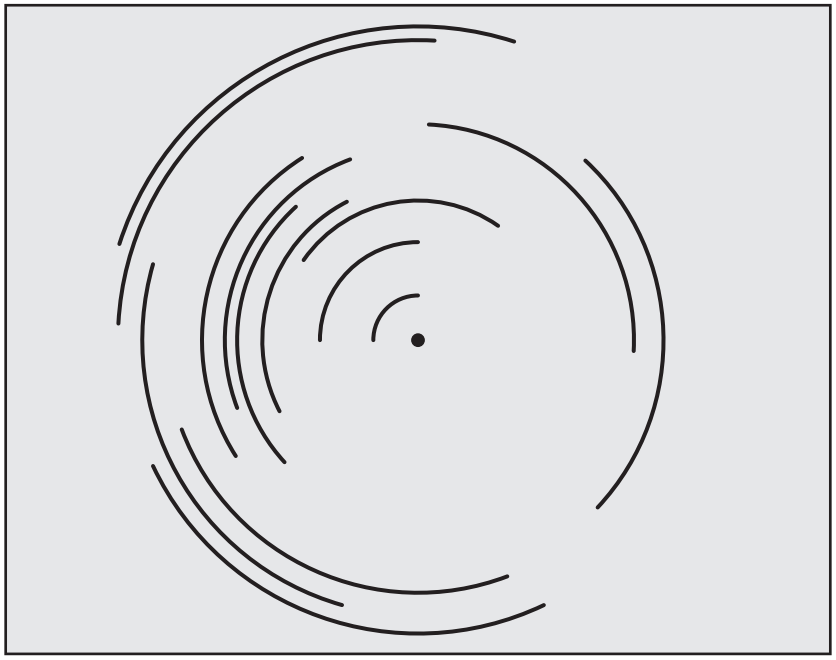
(ii) Suggest why the Ancient Greeks called the planets 'wandering stars'.

_____

_____ **[1]**

(b) Angie points her telescope and camera at the pole star and takes a photograph over a few hours.

Her photograph is shown below.



(i) Explain why most of the stars appear as lines in the photograph.

_____

_____ **[1]**

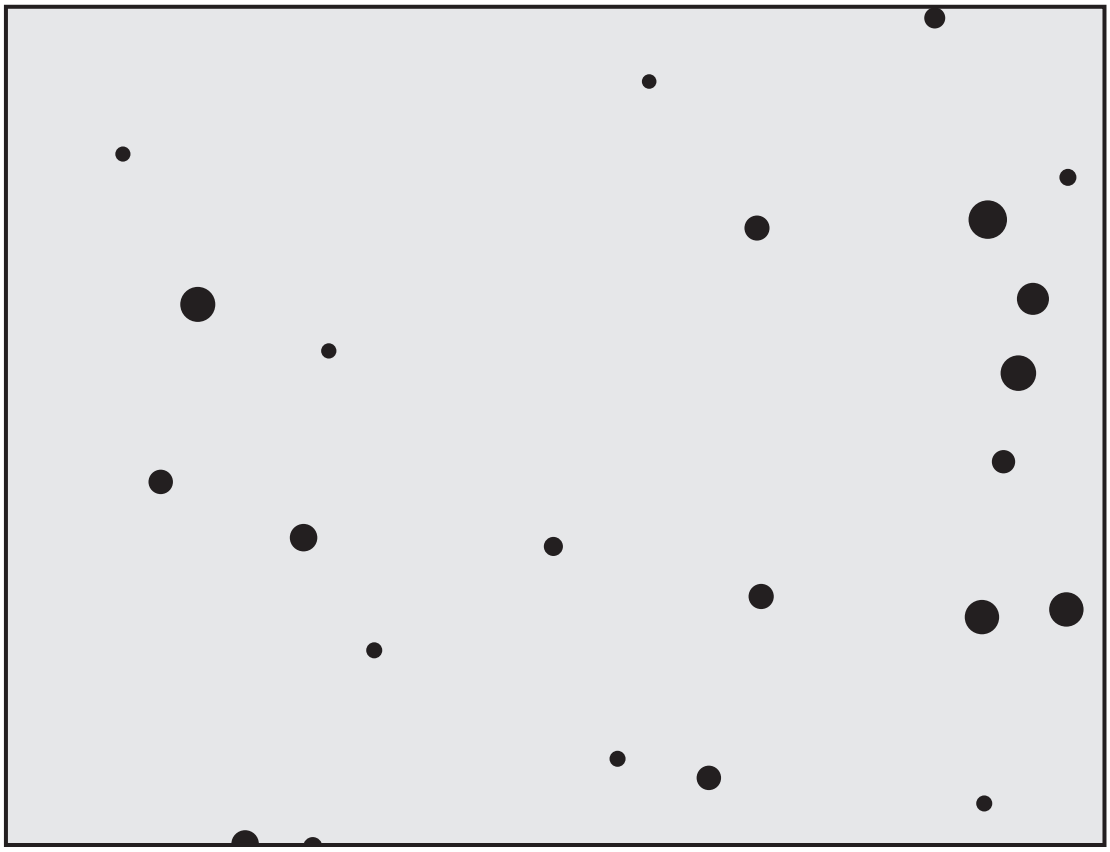
(ii) For how long was the camera taking the photograph, to the nearest hour?

answer _____ hours [1]

(c) Angie takes a picture of the sky six months later at the same time of night.

Her picture is shown below.

23rd January 2010



Why are different stars seen in the picture?

You may use a diagram to help in your explanation.

_____

_____

_____ **[2]**

(d) A solar day is the time it takes for the Sun to move once across the sky.

A sidereal day is the time it takes for the Earth to rotate once on its axis.

Explain why the solar day is longer than the sidereal day.

_____

_____ **[2]**

(e) Angie wants to look at the Andromeda galaxy.

She looks up its position using the internet:

altitude: +32 deg 20 min
azimuth: +11 deg 12 min

Explain how these numbers help Angie find the Andromeda galaxy in the sky.

_____

_____

_____ **[2]**

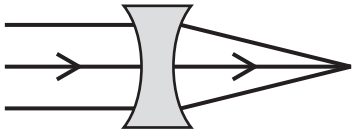
(f) (i) Angie focuses her telescope on a very distant star.

The light from the star passes through the objective lens of the telescope.

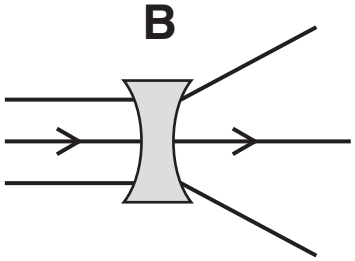
Which diagram, A, B, C, D or E, correctly shows the light passing through the lens?

answer _____ [1]

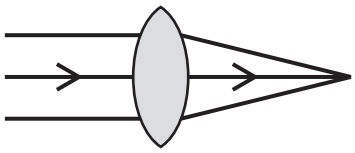
A



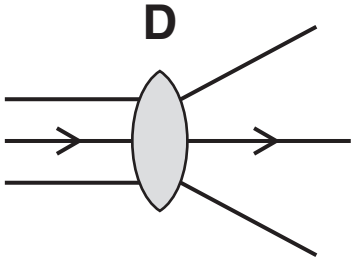
B



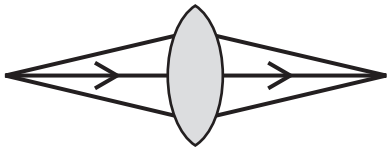
C



D



E



(ii) Angie's telescope is at the bottom of her garden.

She wants to control it and view the images on her computer in her bedroom.

What advantages will Angie get from using a computer to remotely control her telescope?

_____

_____

_____ **[2]**

[Total: 13]

3 Fred is a lens maker.

(a) He makes four convex lenses from the same type of glass. The table below shows the properties of the lenses.

Which lens will be the most powerful?

answer _____ [1]

LENS	DIAMETER IN cm	THICKNESS AT MIDDLE IN cm
A	5	0.25
B	5	0.5
C	5	0.75
D	5	0.3

(b) The table below shows the properties of a second set of lenses. Use the information to answer the questions on page 17 opposite.

LENS	DIAMETER IN cm	POWER IN D
W	4	20
X	5	1
Y	10	0.67
Z	7	1.25

(i) What is the focal length of lens W?

focal length = _____ [2]

(ii) Fred decides to use lens Z as an objective lens in a simple telescope.

Which lens should he choose as his eyepiece lens?

answer _____ [1]

(iii) Which of the lenses, W, X, Y or Z, would be the best objective lens in a telescope for observing faint objects?

Explain your answer.

lens _____

explanation _____

_____ [3]

(c) Fred also makes telescopes which do not use convex lenses as their objectives.

What does Fred use in place of the lens?

_____ [1]

[Total: 8]

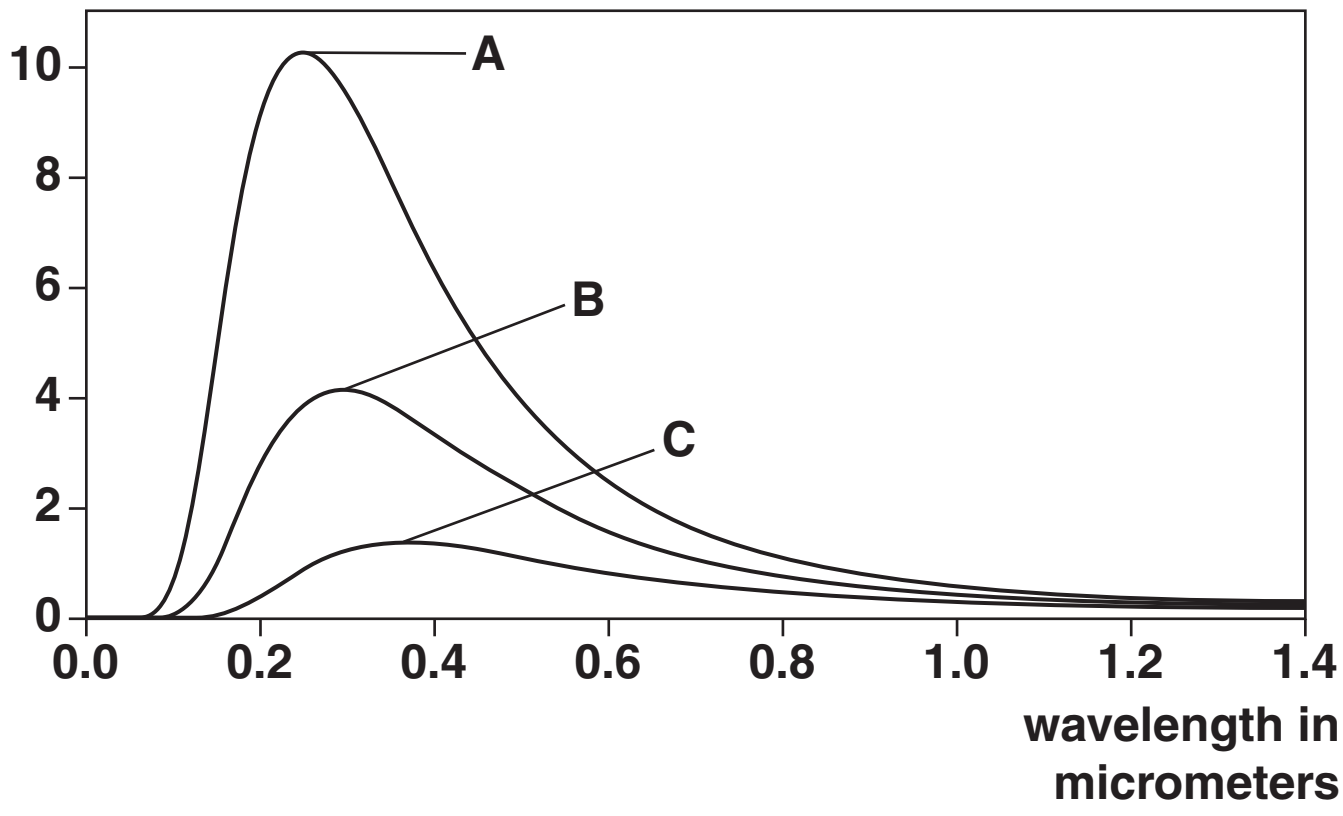
4 All the information we have about stars comes from the electromagnetic radiation we receive from the stars.

(a) (i) What is the relationship between the temperature and luminosity of a star?

_____ **[1]**

(ii) The graph below shows how the intensity of radiation varies with wavelength for three stars of different temperature. The stars are labelled A, B and C.

key to graph
A T = 12 000 K
B T = 10 000 K
C T = 8 000 K



How does the temperature of a star affect the wavelength of radiation emitted by the star?

_____

_____ **[1]**

(iii) The surface temperature of a star is 6700 °C.

What is this temperature in kelvin?

temperature = _____ K [1]

(b) Much of the information about stars is found in the spectrum of the star.

The diagram opposite shows the spectrum from a star.

The spectrum can be used to work out which chemical elements are in the star.

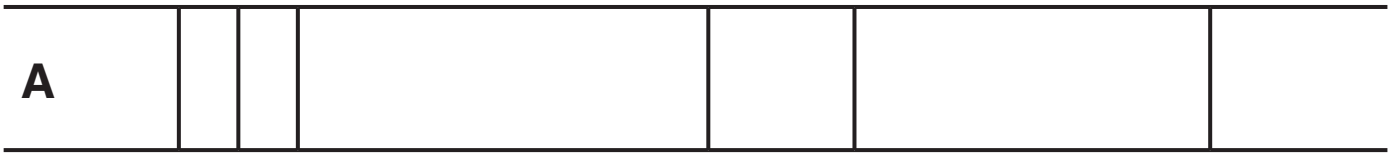
The spectrum from a star:

Use the line spectra for the elements shown below to work out which elements are in the star.

Which elements, from A, B, C, D and E, are in the star?

answer _____ [2]

A



B

C

D

E

[Total: 5]

5 At the beginning of the 20th century scientists could not explain how stars produced so much energy.

(a) Scientists understood why a star's temperature increased when it first formed from a gas cloud.

Explain why the temperature of a star increases as it forms from a gas cloud.

_____

_____

_____

_____ **[3]**

(b) What is the process by which stars produce so much energy?

_____ **[1]**

[Total: 4]

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Question 6 begins on page 24

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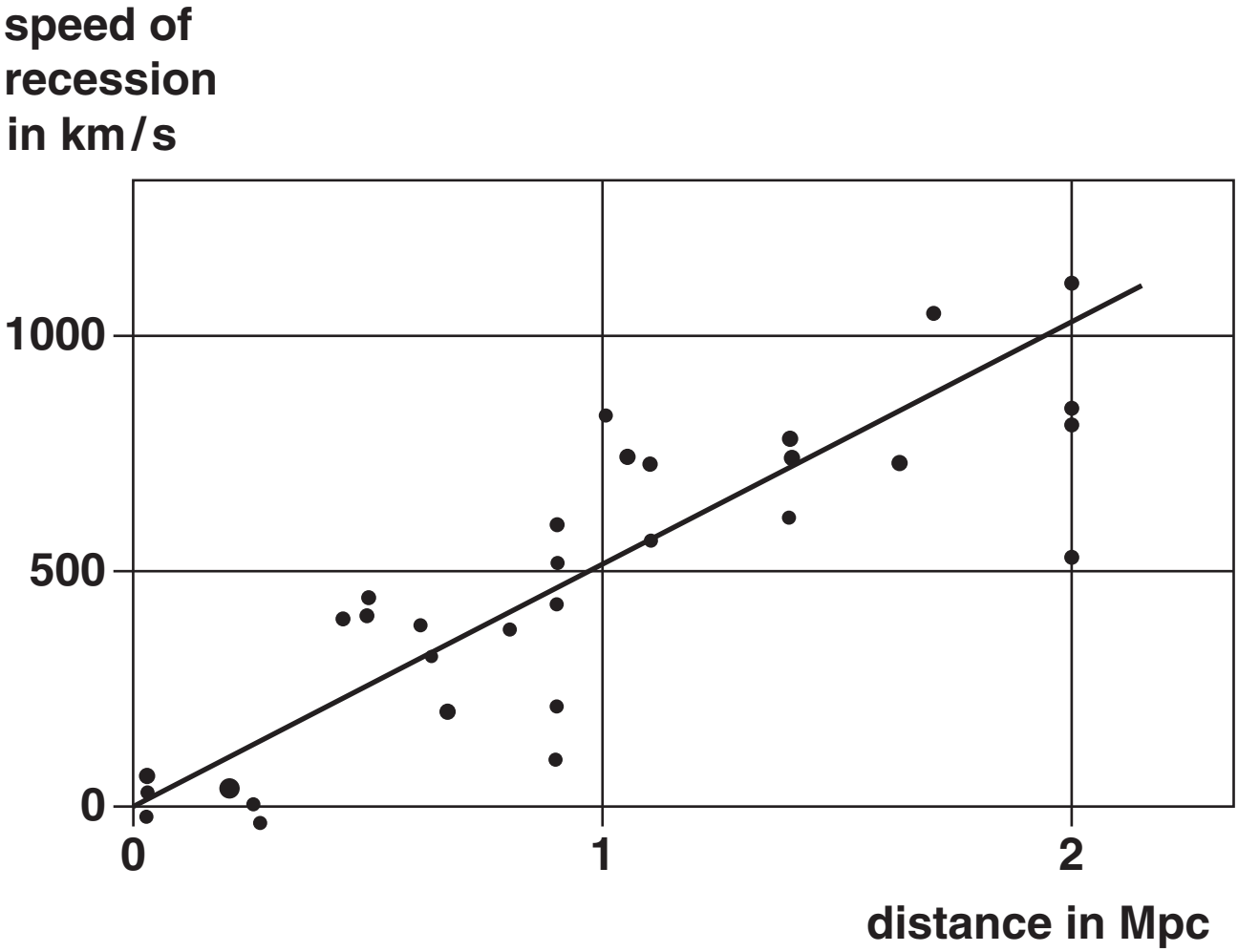
6 Edwin Hubble was an astronomer working in the early 20th century.

(a) The graph below shows the results of Edwin Hubble's research into galaxies, published in 1929.



(i) The Hubble constant is the gradient of the graph.

Use the graph to find the value of the Hubble constant.

Hubble constant = _____ km / s per Mpc [2]

(ii) Hubble's data was very inaccurate.

A recent estimate of the Hubble constant is 71 km / s per Mpc.

Use this value to calculate the distance to a galaxy with a speed of recession of 750 km / s.

Show your working.

distance = _____ [3]

(b) Hubble measured the distance to galaxies using Cepheid variable stars.

(i) Explain how Cepheid variable stars can be used to measure distance.

_____

_____

_____

_____

_____ **[3]**

(ii) Before the Cepheid variable method could be used, the distance to the nearest Cepheid variables had to be found.

To do this, TWO other methods for measuring the distance to the nearest Cepheid variables had to be used.

How would the distance to the nearest Cepheid variables be found?

_____

_____

_____

_____ **[2]**

[Total: 10]

END OF QUESTION PAPER

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