OCR
Oxford Cambridge and RSA

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Friday 24 June 2016 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A/FURTHER ADDITIONAL SCIENCE A

A183/01 Module P7 (Foundation Tier)

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

* A 1 8 3 0 1 *

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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil ( ).
- A list of useful relationships is printed on pages **2** and **3**.
- 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**.
- This document consists of **16** 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

Observing the Universe

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

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

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

$$\text{pressure} \times \text{volume} = \text{constant}$$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant}$$

$$\frac{\text{volume}}{\text{temperature}} = \text{constant}$$

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

Answer **all** the questions.

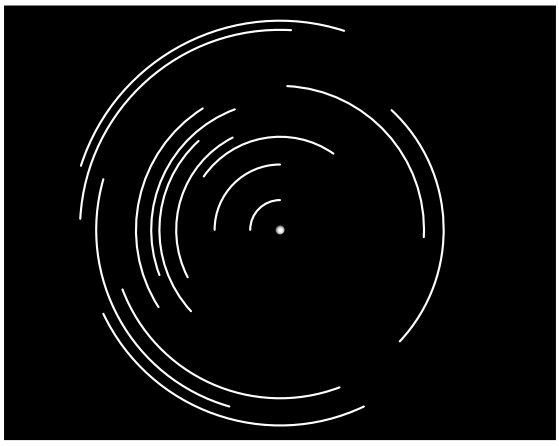
1 **(a)** Sue is looking at the **night** sky with the naked eye.

(i) Which of the following will Sue **not** be able to see?
Put ticks (✓) in the boxes next to the **two** correct answers.

Neptune	☐
the Moon	☐
Saturn	☐
stars	☐
the Sun	☐

[2]

(ii) Sue takes a photograph of the night sky.
She takes the photograph over a number of hours showing how the stars move across the sky.



Sue forgot to write down in which direction she was pointing and how many hours the photograph took.
Sue thinks

- she was pointing **East**
- the photograph shows **6** hours of the stars moving across the sky.

Is Sue correct?
Justify your answer.

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..... **[4]**

(iii) Six months later she looks at the night sky at the same time.
The stars in the night sky look different.

Explain why.

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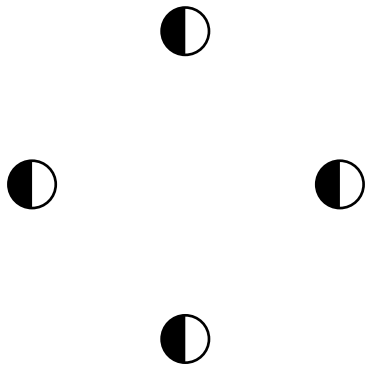
..... **[2]**

(b) The diagram shows the Moon in different parts of its orbit.

Complete the diagram below by adding the Earth and the Sun.
Label the Earth and the Sun.



[2]

(c) What sort of quantities are right ascension and declination?
Put a (ring) around the correct answer.

angles **brightness** **distances** **masses**

[1]

[Total: 11]

2 The Moon and the Sun appear to be the same size in the sky.

Explain how a solar eclipse occurs and why the apparent size of the Moon and the Sun is so important.
You should include a diagram in your answer.

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

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

[Total: 6]

3 Scientists believe that the Universe began with a 'big bang'.

(a) How long ago do they think the 'big bang' happened?
Put a (ring) around the correct answer.

14 000 years **14 000 thousand years** **14 000 million years** **14 000 billion years**

[1]

(b) Galaxies are still moving apart today.

Calculate the speed of recession of a galaxy that is 300 Mpc away.
Hubble constant = 70 km/s per Mpc

speed of recession = ... km/s **[2]**

(c) The Universe has been cooling down ever since the 'big bang'.
The temperature of space now is about 3 kelvin.

What is this temperature in degrees Celsius?

temperature = ... °C **[2]**

[Total: 5]

4 **(a)** Here are the distances to some young stars that appear close together in the sky.

star	distance in light years
A	165
B	180
C	160
D	250
E	175

Four of these stars formed from the same gas cloud.

What is the mean distance to the **four** stars formed from the gas cloud?
Explain your answer.

mean distance = ... light years

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

(b) **(i)** What two elements are gas clouds in space mainly made of?

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

(ii) Explain how a star forms from a gas cloud.

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

[Total: 8]

5 Describe what happens to a **low mass** star like the Sun as it gets older.
You should include the nuclear reactions taking place.

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

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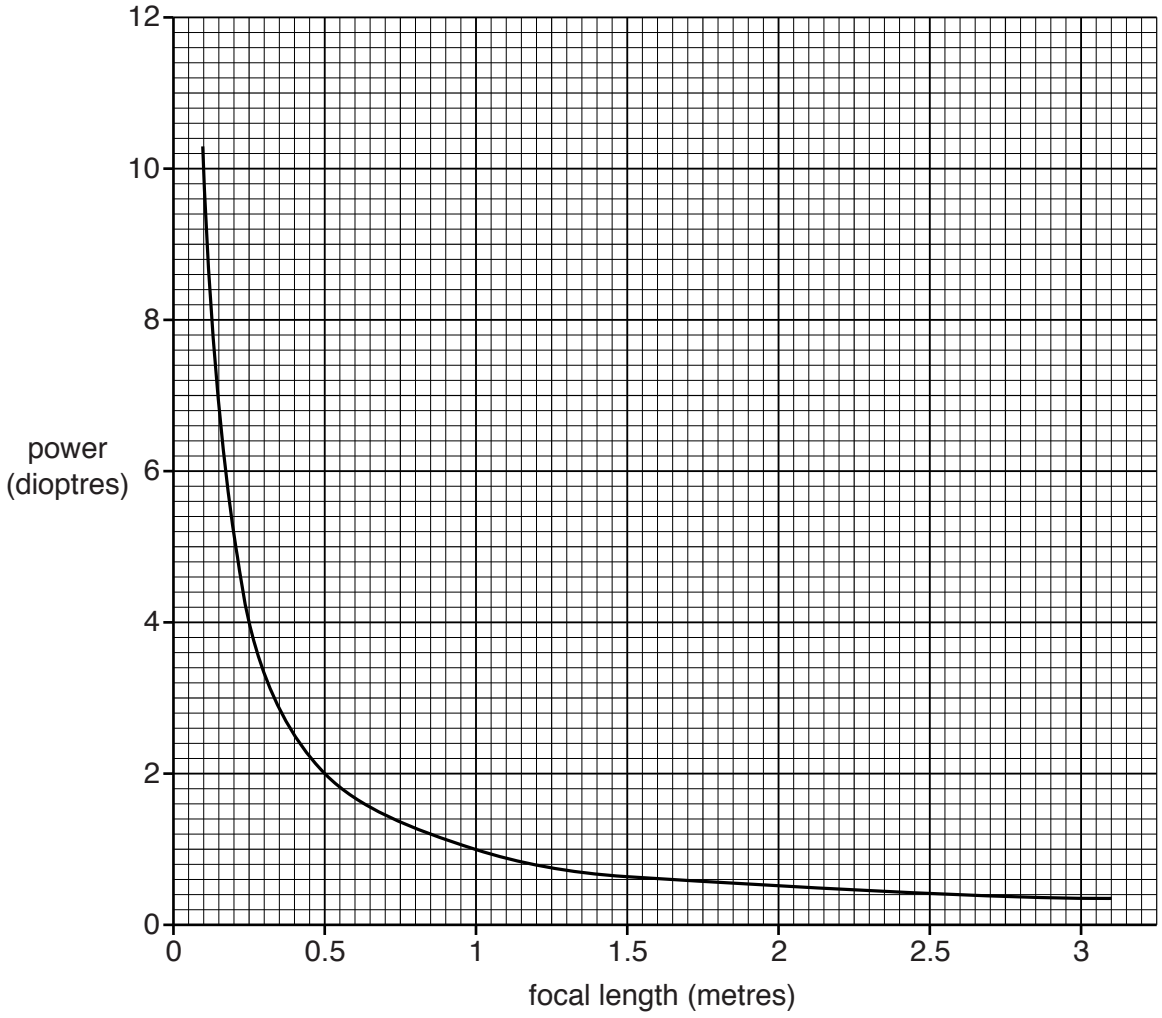
..... **[6]**

[Total: 6]

6 **(a)** This graph shows the relationship between power and focal length for converging lenses.



Use the graph to fill in the blanks in the table.

Lens	Diameter (cm)	Power (dioptres)	Focal length (metres)
A	20	10	0.1
B	10	5	……..
C	2.5	……..	1
D	50	2.5	0.4

[2]

(b) A suggestion is made that lens **D** would be the best objective lens for a telescope.

Is this correct?
Justify your answer.

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

(c) Here are some sentences about how lenses bend light.
Put a (ring) around the correct choice to complete each sentence.

When light enters a lens the **colour / frequency / speed** of the light changes.

This change causes a change in the **amplitude / frequency / wavelength** of the light, which can cause the light to bend.

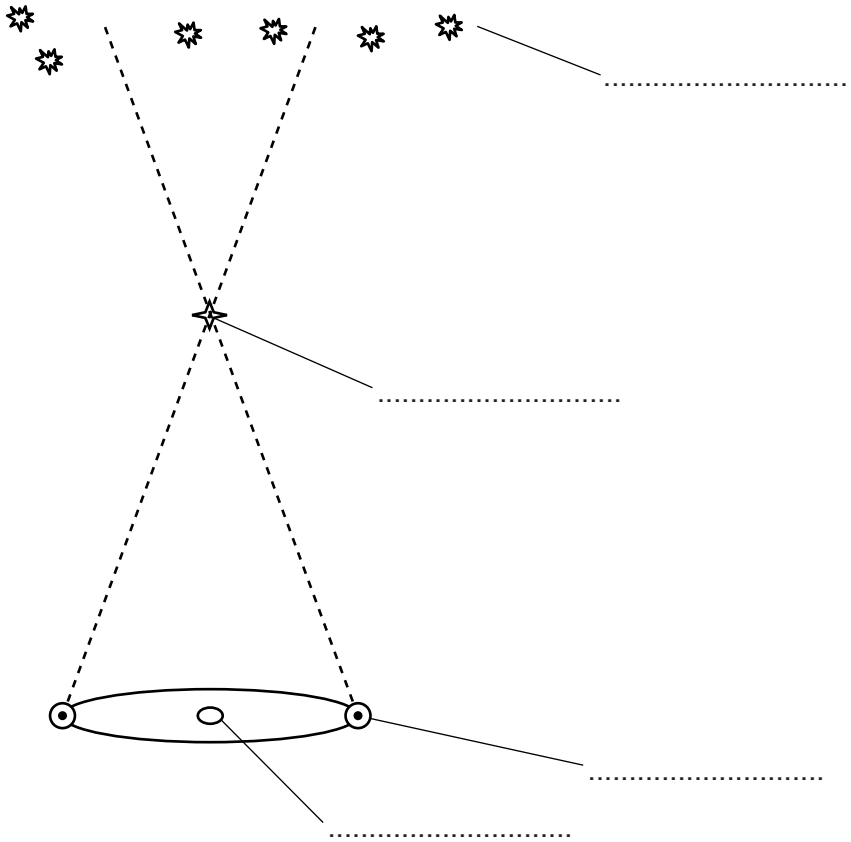
If the light ray is at right angles to the surface of the lens the light ray is **bent / not bent / stopped**.

[3]

[Total: 7]

7 Parallax can be used to find the distance to stars.

(a) (i) The diagram can show how parallax is used to find the distance to a star. Complete the labels on the diagram.



[4]

(ii) Draw a line on the diagram to show the parallax angle.
Label the **angle P**. **[1]**

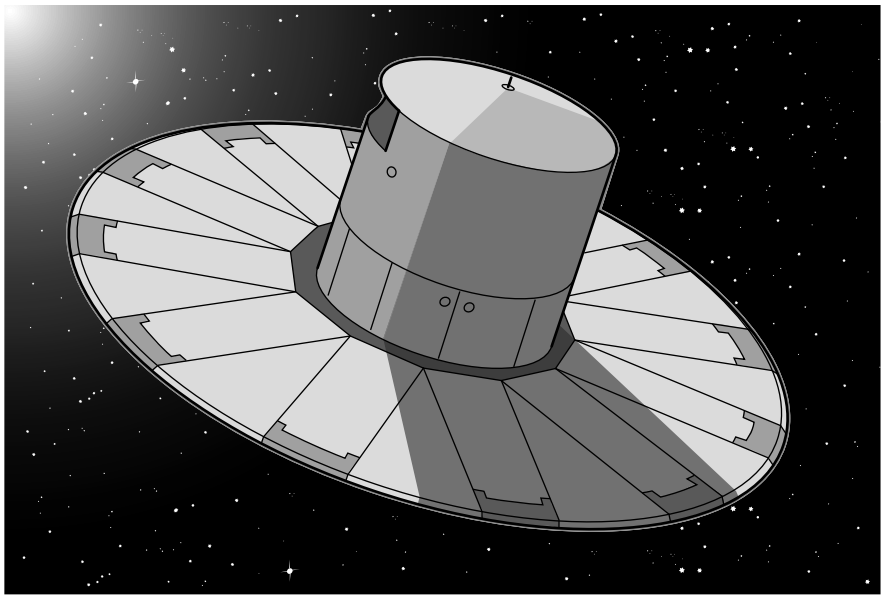
(b) A star has a parallax angle of 0.71 seconds of arc.

Calculate the distance to the star and state the unit.

distance to star = ... unit ..... **[3]**

[Total: 8]

8 In 2014 the European Space Agency launched a space telescope called Gaia. Its main purpose is to measure the parallax of stars more accurately than ever before.



(a) The European Space Agency is an international organisation.
What are the advantages of having an international organisation involved in a project such as developing a space telescope?

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

(b) The final decision about Gaia was not made by the scientists.

(i) Suggest who would have made the final decision to build Gaia.

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

(ii) Suggest arguments for and against a space telescope. You should include both scientific and non-scientific reasons.

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

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

[Total: 9]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).