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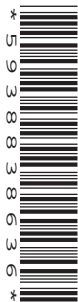
Friday 24 June 2016 – Morning

**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

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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

$$\text{distance} = \text{wave speed} \times \text{time}$$

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

#### Sustainable energy

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

$$\text{power} = \text{voltage} \times \text{current}$$

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

#### Explaining motion

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

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

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

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

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

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

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

#### Electric circuits

$$\text{power} = \text{voltage} \times \text{current}$$

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

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

#### Radioactive materials

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

**Observing the Universe**

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

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

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

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

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

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

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

4

Answer **all** the questions.

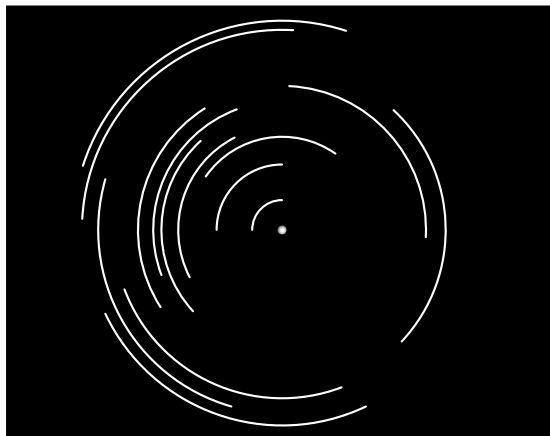
1 (a) Sue is looking at the **night** sky with the naked eye.

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

Neptune	<input type="checkbox"/>
the Moon	<input type="checkbox"/>
Saturn	<input type="checkbox"/>
stars	<input type="checkbox"/>
the Sun	<input type="checkbox"/>

[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.

.....

.....

.....

.....

..... [4]

5

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

Explain why.

.....

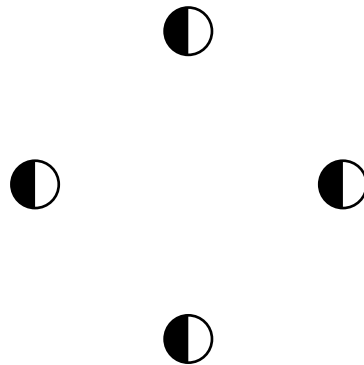
.....

.....

..... [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]

6

- 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]**

7

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]

8

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

.....  
..... [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.

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

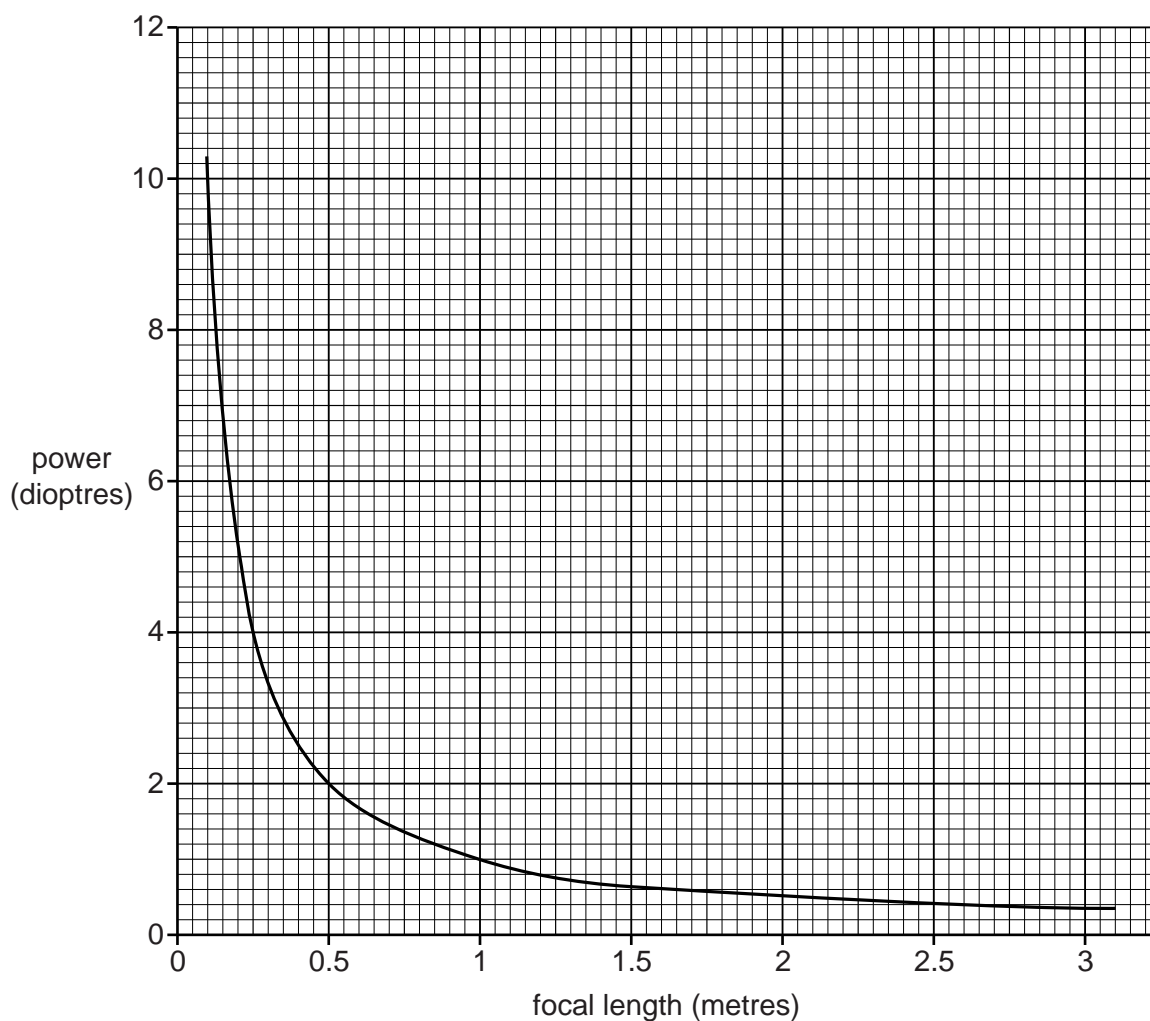
[Total: 8]





10

- 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 (dioptries)	Focal length (metres)
<b>A</b>	20	10	0.1
<b>B</b>	10	5	.....
<b>C</b>	2.5	.....	1
<b>D</b>	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.

.....

.....

..... [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.

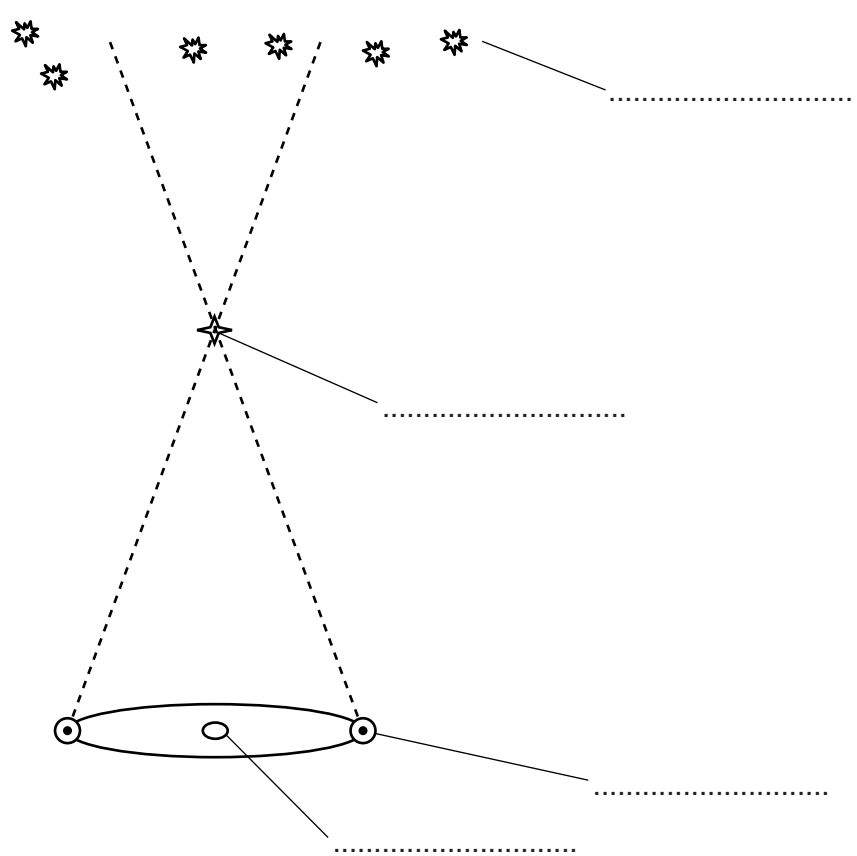
If the light ray is at right angles to the surface of the lens the light ray is **bent / not bent / stopped**.

[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]

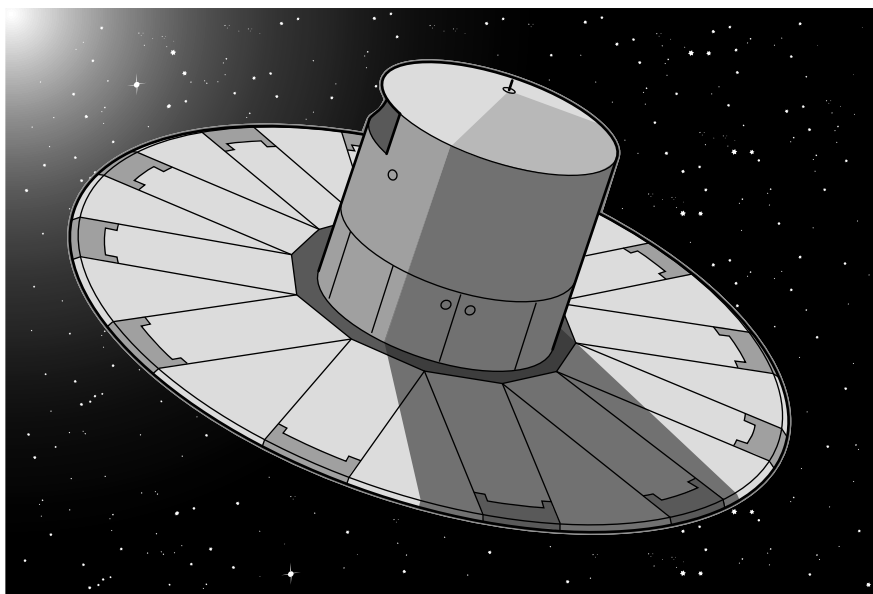
(b) A star has a parallax angle of 0.71 seconds of arc.

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?

.....  
.....  
.....  
..... [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]



**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).

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

A large area of the page is filled with horizontal dotted lines, providing a space for writing answers. A solid vertical line runs down the left side of this area, creating a margin.



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