OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A183/01

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Module P7 (Foundation Tier)

MONDAY 24 JUNE 2013: Morning
DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number						Candidate number				

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)

READ INSTRUCTIONS OVERLEAF

DC (AC/JG) 2451900291 80009/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. 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).**

INFORMATION FOR CANDIDATES

- **Your quality of written communication is assessed in questions marked with a pencil ().**
- **A list of useful relationships is printed on pages three, four and five.**
- **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.**
- **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

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

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

amount of energy transferred = 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

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

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

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

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

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

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

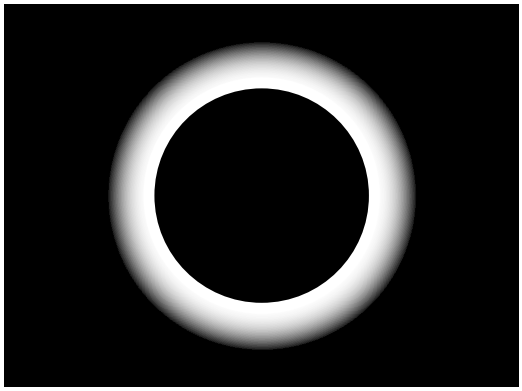
$$\frac{\text{pressure}}{\text{temperature}} = \text{constant}$$

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

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

Answer ALL the questions.

1 Explain how the Moon can cause a solar eclipse.



Include a diagram in your answer.

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

_____

_____

_____

_____

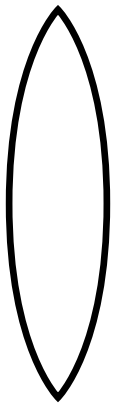
_____

_____ **[6]**

[TOTAL: 6]

2 The lenses in a telescope are used to bend the light from stars.

(a) (i) Complete the diagram to show how the light from a star will be bent by the lens.



[2]

(ii) The lens bends the light.

What is the name of this process?

Put a (ring) around the correct answer.

DIFFRACTION MAGNIFICATION

REFLECTION REFRACTION [1]

(iii) What happens to the light as it enters the lens?

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

The image becomes clearer. ☐

The light wave turns upside down. ☐

All the light is reflected by the lens. ☐

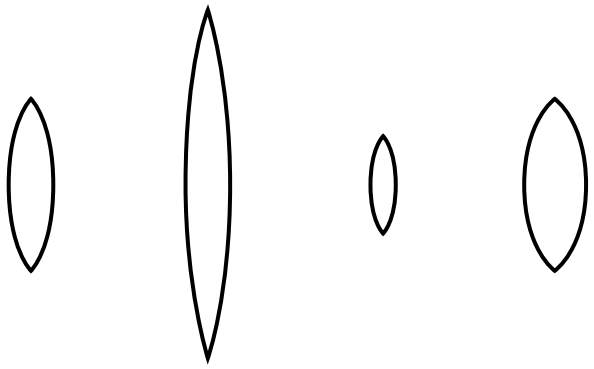
The speed of the light wave changes. ☐

The direction of the light wave changes. ☐

[2]

(b) Here is some information about four lenses.

All the lenses are made of the same high quality glass.



A B C D

Lens	Diameter in cm	Focal length in m
A	10	0.5
B	20	1
C	6	1
D	10	0.2

(i) Which lens is the most powerful?

_____ **[1]**

(ii) Calculate the power of lens A.

power = _____ dioptres [2]

(c) Here is a table of data about three more lenses.

Lens	Diameter in cm	Power in D
X	15	5
Y	40	1
Z	10	2

Which two lenses would be the BEST to use to make a telescope?

eyepiece lens _____

Justify your choice.

_____

_____

objective lens _____

Justify your choice.

_____

_____

[4]

[TOTAL: 12]

3 Astronomers control the Hubble Space Telescope using computers.

Why is computer control of the Hubble Space Telescope so useful for astronomers?

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

_____

_____

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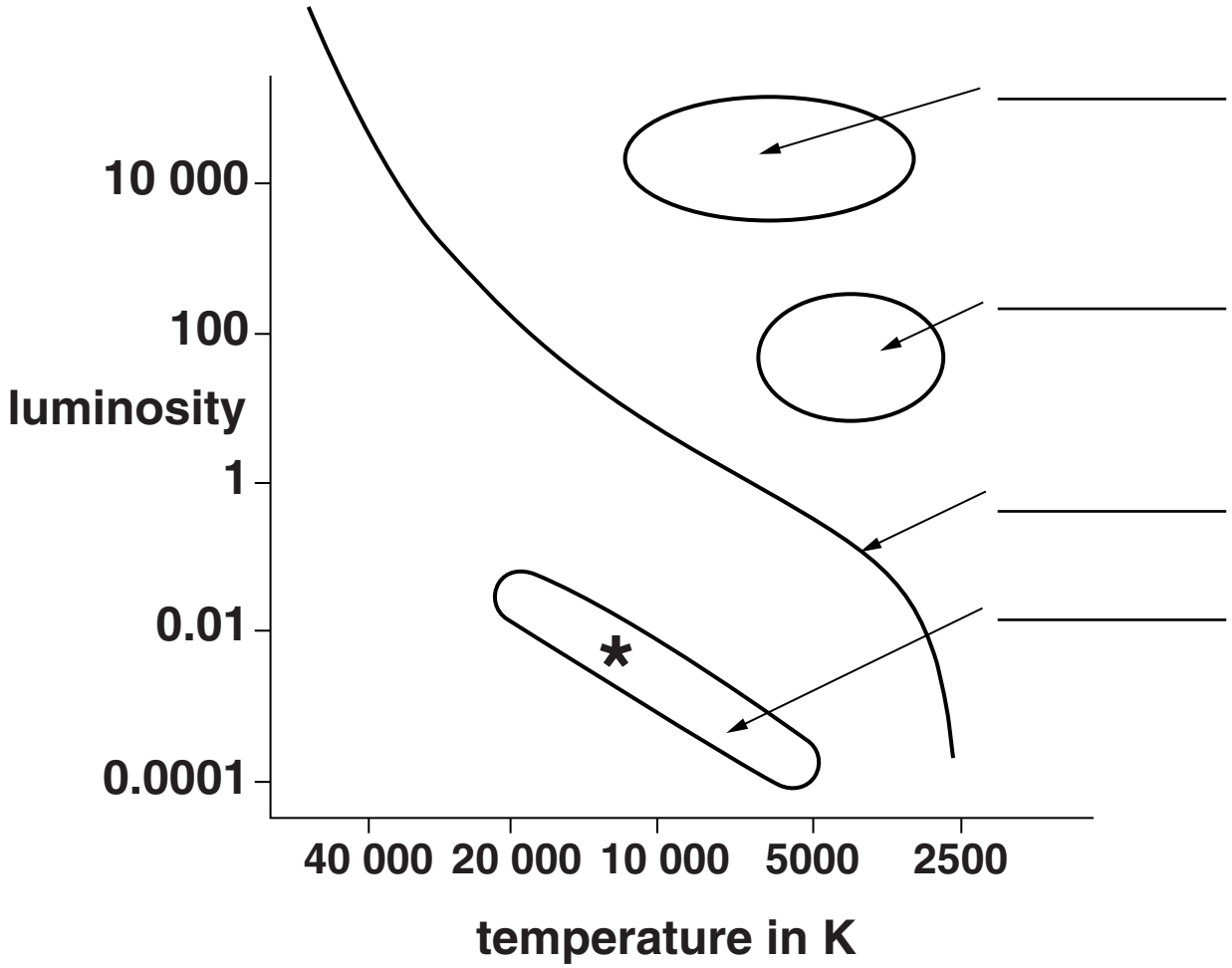
_____ **[6]**

[TOTAL: 6]

4 The graph shows a Hertzsprung-Russell diagram.



The luminosity of the Sun is 1.

(a) Complete the labels for the regions on the Hertzsprung-Russell diagram. [4]

(b) Put a cross on the Hertzsprung-Russell diagram to show the position of the Sun. [1]

(c) At the end of their lives most stars cool down and emit less and less energy.

Draw an arrow on the Hertzsprung-Russell diagram to show the direction the star (*) would move as it cools down and emits less energy. [2]

[TOTAL: 7]

5 A group of people are meeting to discuss where to build a new astronomical observatory to help find out how the Universe started.

EDWARD
It must be built away from the city lights.

CHRIS
Where will we get the people to work there?

ANN
We need a high elevation.

FRANCES
The air should be dry and have little air pollution.

BYRON
The weather should be clear most nights.

DANNI
This could be very expensive to build.

(a) (i) Who is talking about reducing effects from the Earth's atmosphere?

_____ and _____

and _____ [2]

(ii) Who is talking about light pollution?

_____ [1]

(iii) Who is giving non-astronomical reasons?

_____ and _____ [2]

(b) Which two groups of people are likely to be at the meeting?

Put ticks (✓) in the boxes next to the TWO best answers.

astronauts	☐
hospital workers	☐
politicians	☐
scientists	☐
teachers	☐

[2]

(c) Outside the meeting there is a group of protestors.

Suggest and explain why people might protest against building an astronomical observatory.

_____

_____

_____

_____

_____ **[3]**

[TOTAL: 10]

6 Scientists often disagree about how to interpret data. Additional data can often help them agree on the conclusion.

The Curtis-Shapley debate was an example of a disagreement. Additional evidence from Edwin Hubble resolved the problem.

Use this example to show how scientists can disagree about how to interpret data, until more evidence resolves the problem.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

[TOTAL: 6]

7 Jo is an astrophysicist interested in the physics of stars.

(a) Jo knows that there is a force holding the gas in a star.

What is the force? _____ [1]

(b) Jo is trying to make a mathematical model for the temperature of the gas inside stars.

(i) Write down two equations Jo would need to use.

equation 1

equation 2

[2]

(ii) Where is the temperature greatest inside a star?

_____ [1]

(iii) What are the two main methods of energy transfer inside a star?

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

combustion	☐
conduction	☐
convection	☐
radiation	☐
reflection	☐

[2]

(c) (i) Jo knows the surface temperature of the Sun is about 5800 K.

What is this temperature in °C?

temperature = _____ °C [2]

(ii) The radiation from a red giant has a lower peak frequency than the radiation from the Sun.

What does this tell us about the surface temperature of a red giant?

_____ [1]

(d) In a red giant the main source of energy is the fusion of helium nuclei in the CORE.

Explain how this shows that the core temperature of the red giant must be higher than the core temperature of the Sun.

_____

_____

_____

_____ **[2]**

(e) The luminosity of a star depends upon its temperature.

How can the luminosity of a star be used to get an estimate of its distance from the Earth?

_____

_____

_____ **[2]**

[TOTAL: 13]

END OF QUESTION PAPER

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