Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A333/01

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Unit 3: Ideas in Context plus P7
(Foundation 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 (CW/SW) MEP60184 28702/1

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) The article says that 'the bad side is definitely the ozone depletion'.

The sentences below explain why ozone depletion is 'bad'.

Use words from the list below to complete the sentences.

ABSORBS

DAMAGES

LESS

LETS THROUGH

MORE

ONLY

Ozone in the atmosphere _____ ultraviolet radiation.

Less ozone means _____ ultraviolet radiation reaches the surface of the Earth.

Ultraviolet radiation often _____ living cells.

[3]

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

Complete the table below to show the differences.

	MAIN GAS INVOLVED	EFFECT
holes in the ozone layer	ozone	too much ultraviolet is a hazard to living organisms
the greenhouse effect		

[2]

(c) The article suggests that there is a correlation between an increase of sulfate particles in the upper atmosphere and a lowering of the Earth's temperature.

(i) What evidence is given in the article to support the idea that sulfate particles might cool the Earth?

_____

_____ **[1]**

(ii) Give a different example of a correlation between two things, <u>TAKEN FROM THE ARTICLE</u>.

_____

_____ **[2]**

(d) Suggest two ways that climate change can cause problems.

1 _____

2 _____ **[2]**

(e) 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.

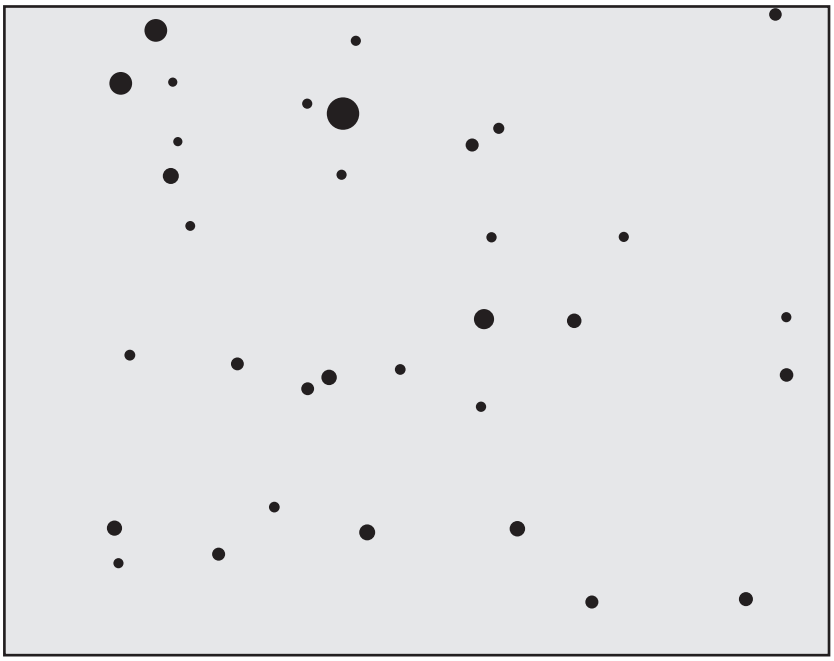
_____ **[1]**

[Total: 14]

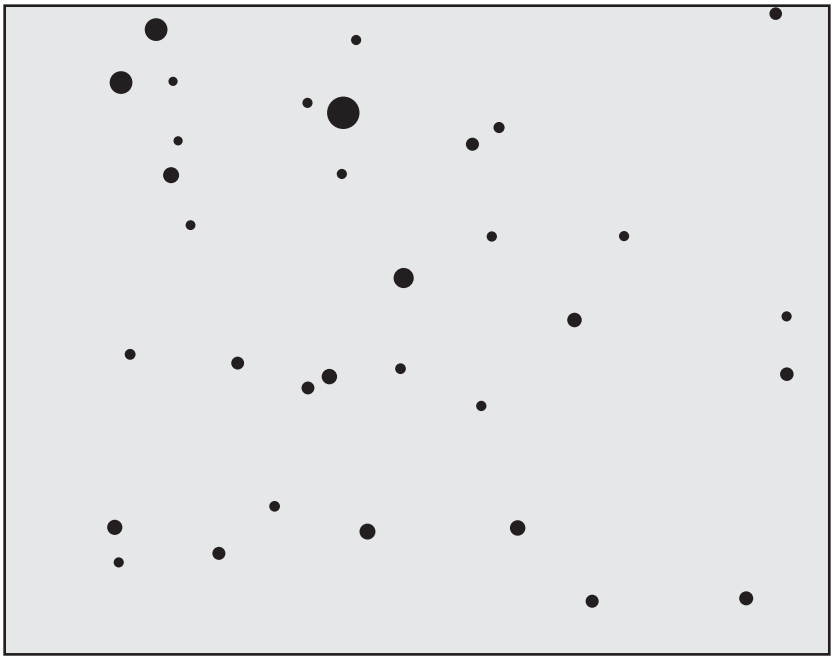
2 Angie is taking photos of the night sky.

Below are two of her pictures.

23rd July 2009



28th July 2009



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

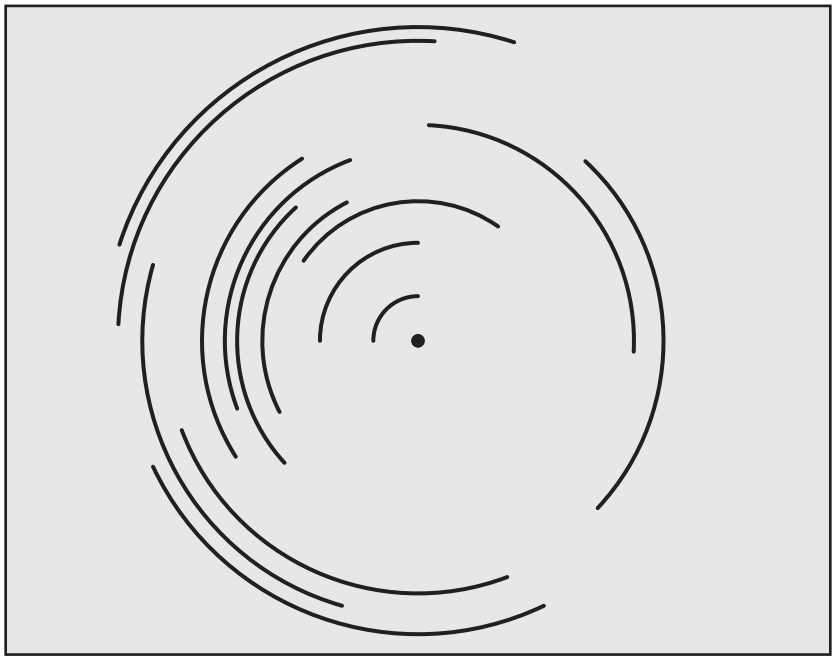
(ii) Suggest why the Ancient Greeks called the planets 'wandering stars'.

_____

_____ **[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]**

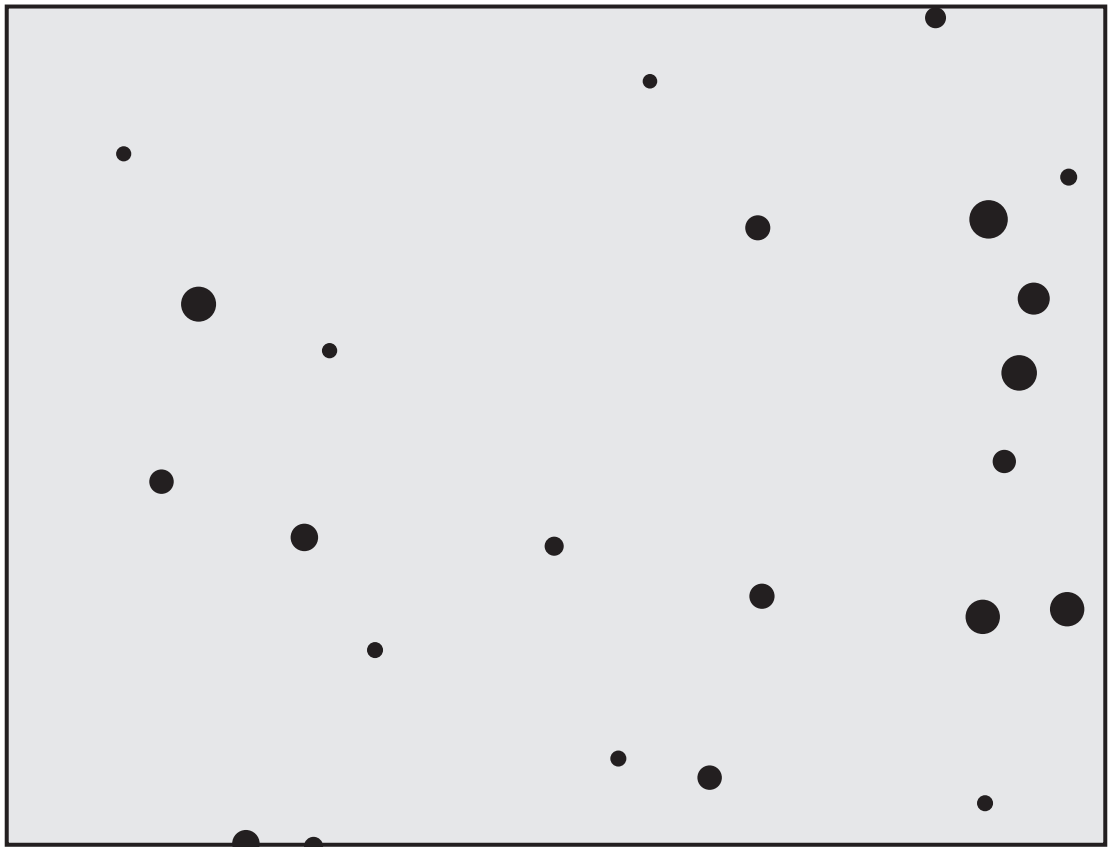
(ii) For how long was the camera taking the photograph, to the nearest hour?

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.

_____

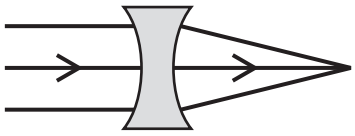
_____

_____ **[2]**

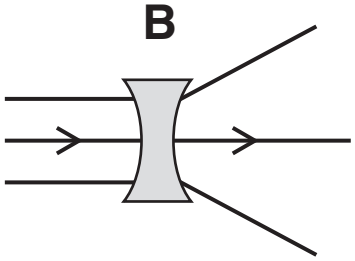
(f) (i) Angie focuses her telescope on a very distant star.

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

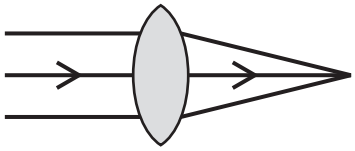
A



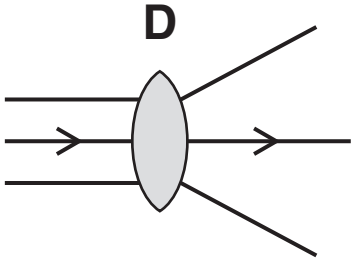
B



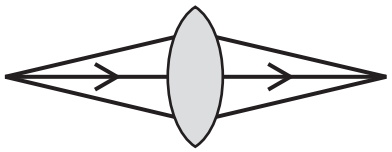
C



D



E



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

answer _____ **[1]**

(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?

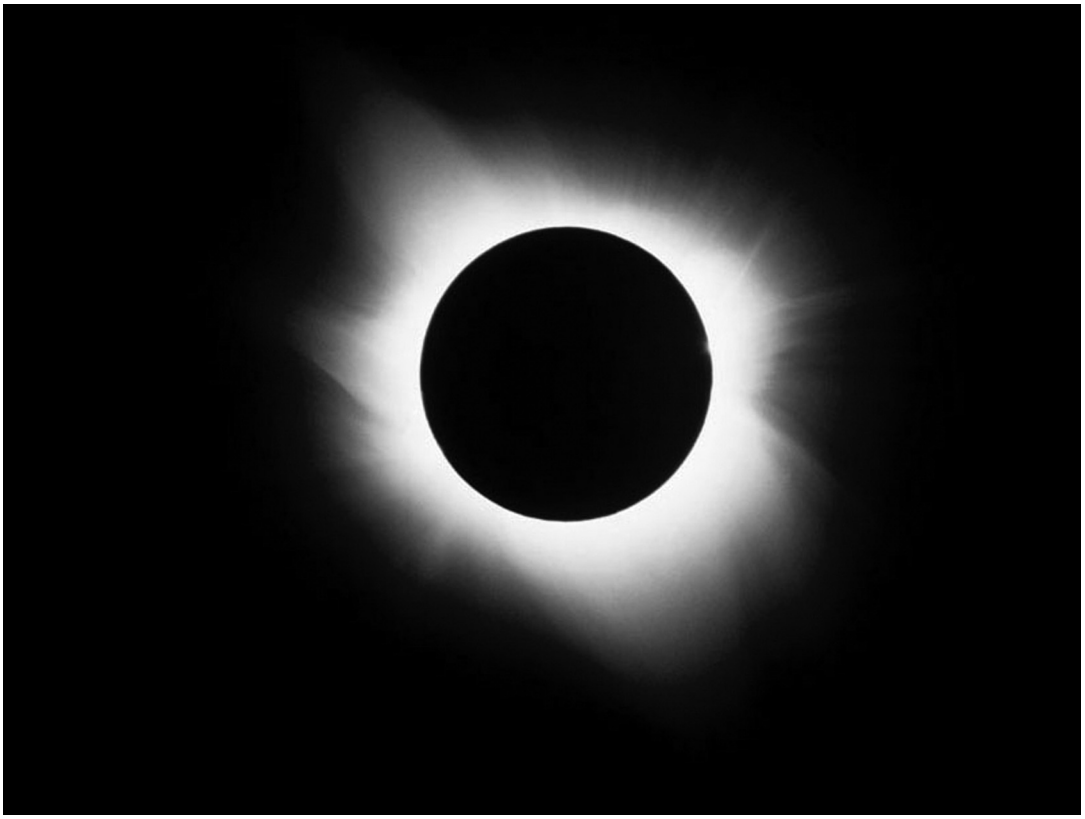
_____

_____

_____ **[2]**

[Total: 13]

3 The picture below is of a solar eclipse.



Explain how a solar eclipse happens.

You should draw a diagram to help.

_____

_____

_____ **[3]**

[Total: 3]

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Question 4 begins on page 18

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4 Fred is a lens maker.

The table below shows the properties of some of the lenses Fred made.

LENS	DIAMETER IN cm	POWER IN D	FOCAL LENGTH IN m
W	4	10	0.1
X	5	1	1
Y	10	0.67	1.5
Z	7		0.8

(a) (i) Lenses W, X and Y are made from the same type of glass.

Which lens has the most curved surface?

answer _____ [1]

(ii) Calculate the power of lens Z.

power = _____ unit _____ [3]

(iii) Fred is building a telescope to observe <u>VERY FAINT</u> stars.

He chooses lens Y as the objective lens that collects the light.

Put ticks (✓) in the boxes next to the <u>TWO</u> sentences below that best explain why he chooses lens Y.

Lens Y has the largest diameter. ☐

Lens Y has the longest focal length. ☐

Lens Y is the most powerful. ☐

Lens Y will collect the most light. ☐

[2]

(b) Fred makes a telescope that only uses lenses.

What is the smallest number of lenses that he must use?

number of lenses = _____ [1]

(c) Fred also makes telescopes that do not use a lens to collect the light.

These are called reflectors.

What is used to collect the light?

_____ [1]

[Total: 8]

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Question 5 begins on page 22

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5 All the information we have about stars comes from the electromagnetic waves we receive from the stars.

(a) (i) Which of the following increase with the temperature of a star?

Put a (ring) around the TWO correct answers.

AGE

DISTANCE

LUMINOSITY

MAXIMUM WAVELENGTH

PEAK FREQUENCY OF LIGHT

[2]

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

What is this temperature in kelvin?

temperature = _____ K [1]

(b) Astronomers often look at the spectrum of a star's light.

(i) The diagram below shows the spectrum from a star.

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

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

Which <u>TWO</u> elements, from A, B, C and D, are in the star?

A

B

C

D

answer _____ and _____ [2]

(ii) Complete the sentences about lines in a spectrum.

Choose words from the list below.

ELECTRONS

LIGHT

LINE

NEUTRONS

PARALLAX

The lines in a spectrum from a star are caused

by the movement of _____ in atoms.

This type of spectrum is called a

_____ spectrum.

[2]

[Total: 7]

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Question 6 begins on page 26

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

(a) It was not until the structure of atoms was understood that an explanation for stars producing so much energy was found.

One of the key experiments was the Rutherford-Geiger-Marsden alpha particle scattering experiment.

What did the results of the Rutherford-Geiger-Marsden alpha particle scattering experiment tell us about atoms?

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

Atoms have a small positive centre. ☐

Atoms are the smallest possible particles. ☐

Atoms are surrounded by large positive charges. ☐

Atoms only contain large negative charge. ☐

[1]

(b) (i) What is the process by which stars produce such large amounts of energy?

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

reflection	☐
nuclear fusion	☐
combustion	☐
nuclear fission	☐

[1]

(ii) Describe briefly how the energy produced in the CENTRE of the Sun is transferred to the Earth.

Your answer should include

- **the two main methods of energy transfer inside the Sun**
- **the method of energy transfer to the Earth.**

One mark is for a clear and well ordered answer.

_____

_____

_____

_____

_____ **[3+1]**

[Total: 6]

7 (a) The nearest star to the Earth, other than the Sun, is about 1 parsec (pc) away.

A galaxy is about 1 megaparsec (Mpc) away.

How many times further away is the galaxy than the star?

answer _____ [1]

(b) Measuring the distance to stars and galaxies is difficult.

Many different methods are used.

Below are four methods.

A brightness and colour of stars
B Cepheid variable stars
C parallax
D speed of recession of galaxies

(i) Which method, A, B, C or D, showed that some nebulae were outside the Milky Way galaxy?

answer_____ [1]

(ii) An astronomer used method D on a galaxy.

She found the galaxy is at a distance of 200 Mpc.

The Hubble constant is 70 km/s per Mpc.

Calculate the speed of recession of the galaxy.

Show your working.

speed = _____ km/s [2]

[Total: 4]

END OF QUESTION PAPER

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