OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
PHYSICS A
Unit 3: Ideas in Context plus P7 (Higher Tier)

A333/02

OCE/16033

A33302

Candidate Forename		Candidate Surname	

Centre Number					Candidate Number				

INSTRUCTIONS TO CANDIDATES

* Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
* 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.
* Do **not** write in the bar codes.
* 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 page 2.
* Where you see this icon you will be awarded a mark for the quality of written communication in your answer.
* This document consists of **16** pages. Any blank pages are indicated.

Turn over

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

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

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

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

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

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

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]**

Turn over

(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.
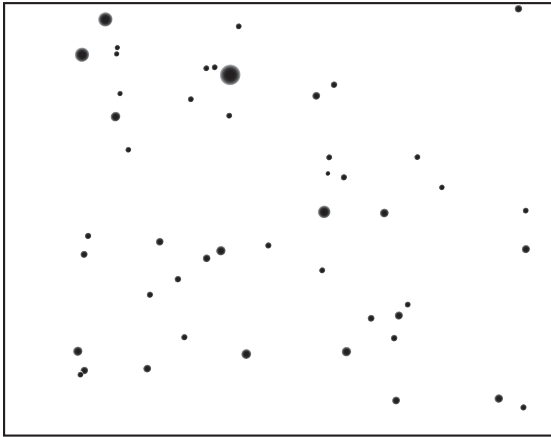
Your answer should include

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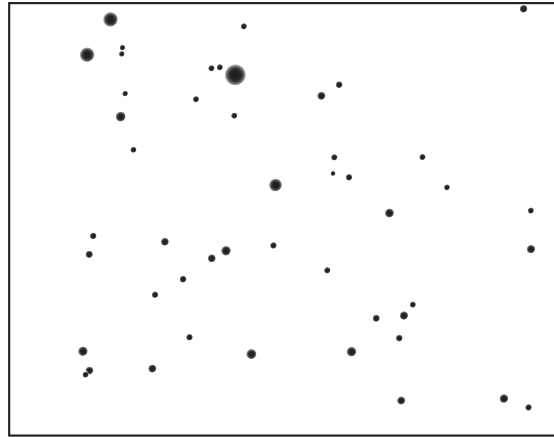- the main results of each.

....

....

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....

....

.... **[4]**

[Total: 15]

2 Angie is taking photos of the night sky.

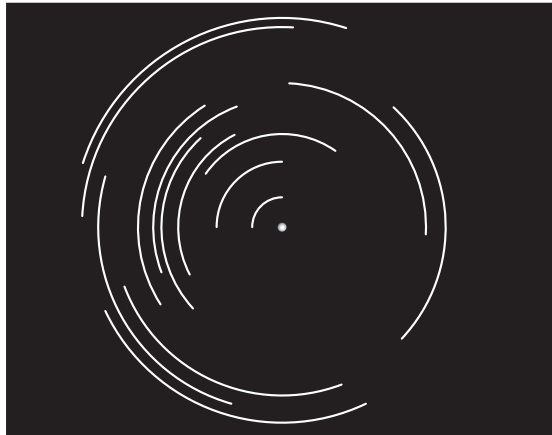Here are two of her pictures.

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.

   (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]**

Turn over

 (c) Angie takes a picture of the sky six months later at the same time of night.
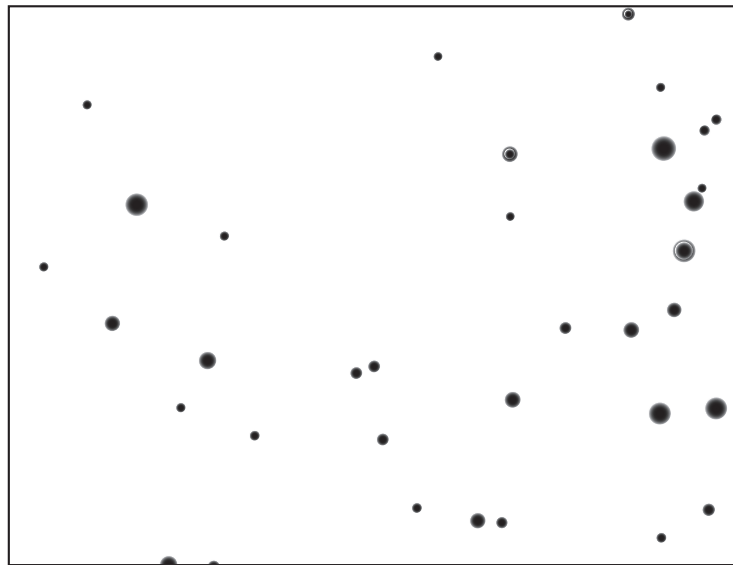
23rd January 2010

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

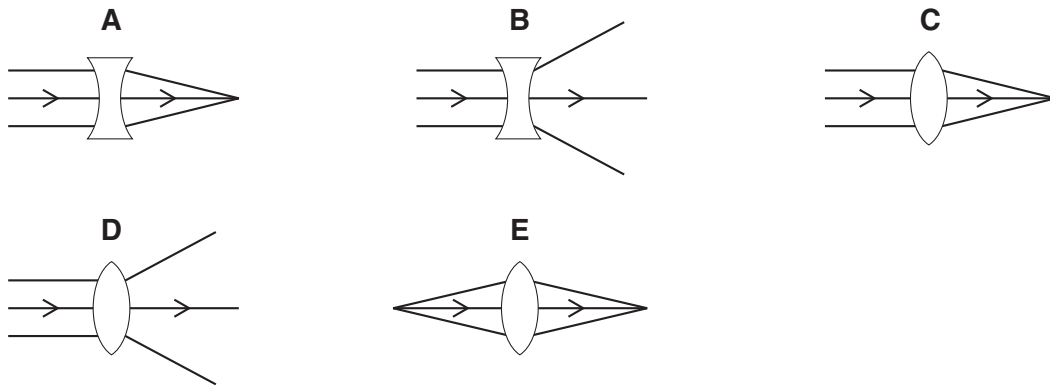Explain how these numbers help Angie find the Andromeda galaxy in the sky.

....

....

.... **[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]

Turn over

3 Fred is a lens maker.

(a) He makes four convex lenses from the same type of glass.

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

Which lens will be the most powerful?

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

(b) A second set of lenses have the following properties.

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 shows how the intensity of radiation varies with wavelength for three stars of different temperature.

intensity of
radiation
in arbitrary units

T=12 000 K
T=10 000 K
T=8000 K

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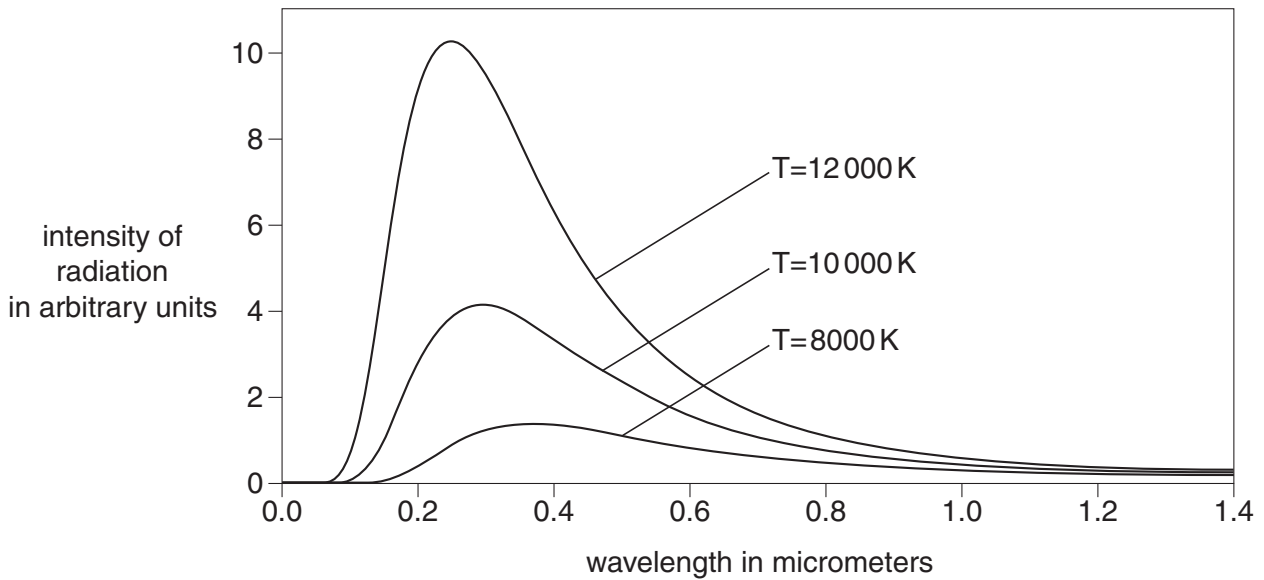
How does the temperature of a star affect the wavelength of radiation emitted by the star?

....

.... **[1]**

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

What is this temperature in kelvin?

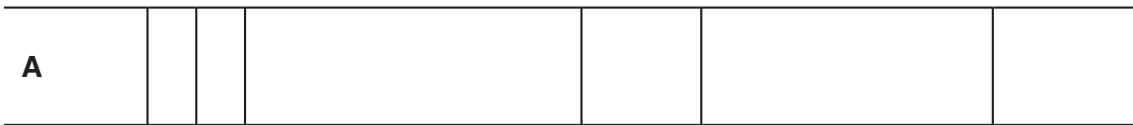temperature = ... K **[1]**

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

The diagram 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.

A

B

C

D

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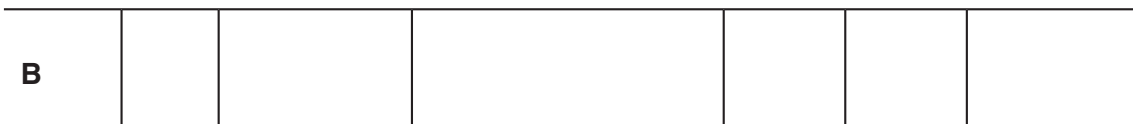
Which elements, from **A**, **B**, **C**, **D** and **E**, are in the star?

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

[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.

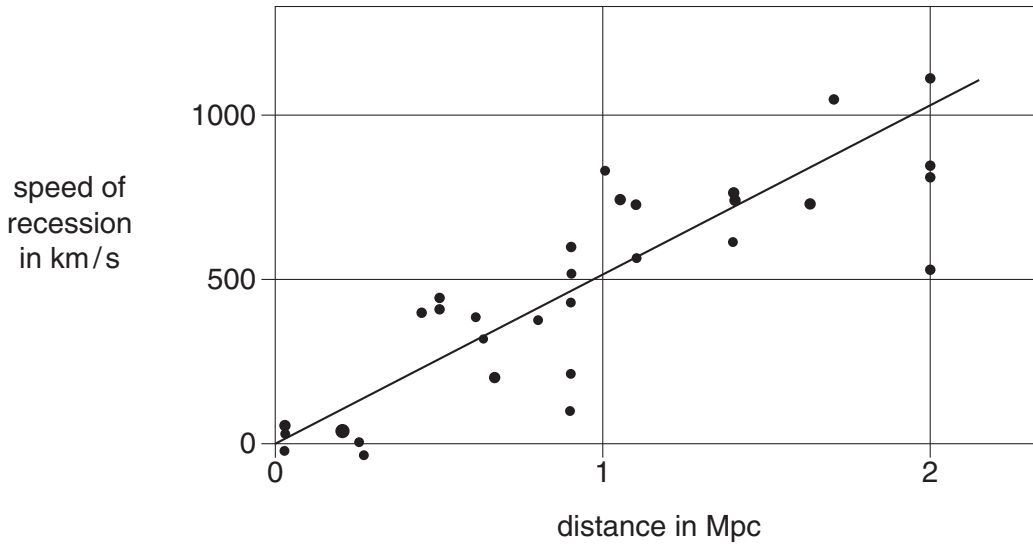..

....

....

.... **[3]**

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

.... **[1]**

[Total: 4]

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

(a) This graph 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]**

Turn over

(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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