THIS IS A LEGACY SPECIFICATION

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Wednesday 30 May 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS A

A333/01 Unit 3: Ideas in Context plus P7 (Foundation Tier)

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)

Duration: 60 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

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.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

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

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

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

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.

1 This question is based on the article **'Scientists review evidence for the extinction of the dinosaurs'.**

(a) Which of the following statements about asteroids are correct?

Put ticks (✓) in the boxes next to the **two** correct statements.

Most asteroids are smaller than moons. ☐

Most asteroids are larger than moons but smaller than planets. ☐

Some asteroids are larger than planets. ☐

Most asteroids are found orbiting the Sun between Mars and Jupiter. ☐

Most asteroids are on a collision course with the Earth. ☐

[2]

(b) Use the graph in the article to answer the following questions.

(i) What is the average time between impacts for 1000 m diameter asteroids colliding with the Earth?

answer .... million years **[1]**

(ii) The average time between asteroid impacts that have global consequences is 1 million years.

What is the minimum diameter of an asteroid that will have global consequences if it collides with the Earth?

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

(c) Which two pieces of evidence do **not** support the asteroid impact theory?

Put ticks (✓) in the boxes next to the **two** statements that do not support the asteroid theory.

Iridium is found in rock layers around the world.	☐
Super volcanic eruptions happened in India.	☐
'Shocked quartz' is found at the KT boundary.	☐
Ecosystems were destroyed rapidly.	☐
Volcanoes give out large amounts of sulfur dioxide.	☐

[2]

(d) Different scientists studied rocks near the Chicxulub impact site.

Some said the rocks show that the asteroid impact happened 300 000 years before the KT extinction.

Others said the rocks show that it happened at the same time as the KT extinction.

Suggest how the scientists could study the same rocks but come to different conclusions.

....

....

....

.... **[2]**

(e) **(i)** The article was published in the scientific journal *Science*.

Articles in this journal are peer reviewed.

What is meant by peer reviewed?

One mark is for a clear and well-ordered answer.

....

....

.... **[3]**

(ii) This article is a summary review that is quite common in scientific journals.

It is not reporting **new** experimental data.

Suggest the purpose of this summary review article and explain why it is important.

....

....

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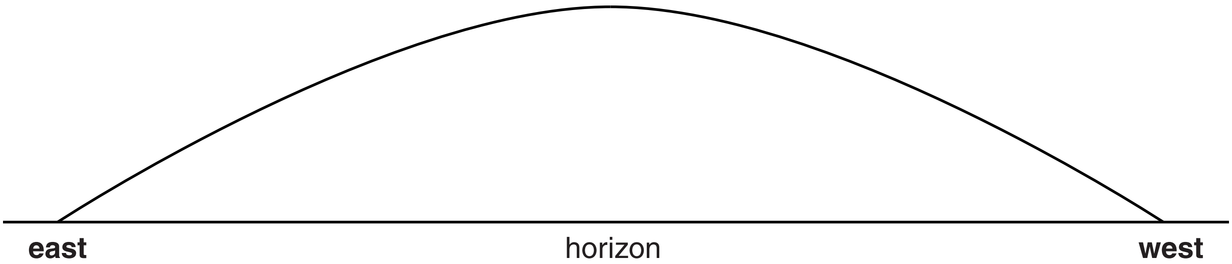
.... **[2]**

[Total: 13]

2 **(a)** The diagram shows the path of the Sun across the sky during a day.



(i) On the diagram draw an arrow to show the direction the Sun moves. **[1]**

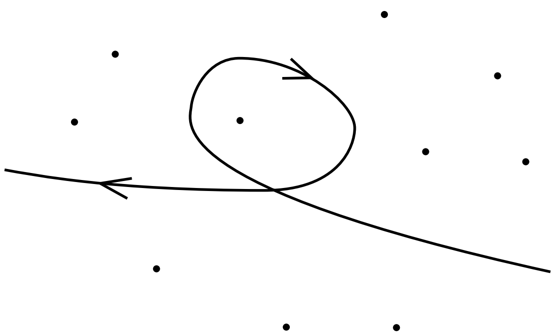
(ii) Why does the Sun appear to move across the sky like this?

.... **[1]**

(iii) Write down two other astronomical objects that can be seen to move across the sky in a similar way.

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

(b) Over a few months some astronomical objects follow a path as shown below when seen against the star background.



Which of the following objects could follow this path?

Put a ring around the correct answer.

galaxies **planets** **stars** **the Moon** **[1]**

(c) Sometimes the Sun is eclipsed by the Moon.

Draw a diagram to show how the Moon can cause an eclipse of the Sun.

[3]

(d) Why are different stars seen in the sky in the summer and winter?

You may draw a diagram to help your explanation.

....

....

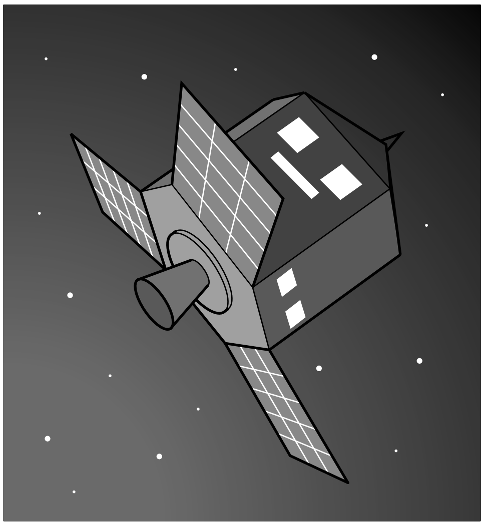
....

.... **[3]**

[Total: 11]

3 The Hipparcos space satellite was a scientific mission of the European Space Agency.

Hipparcos is short for "**Hi**gh **p**recision **par**allax **co**llecting **s**atellite".



The telescope on the Hipparcos satellite measured the position and distance of stars very accurately.

(a) What advantages does a telescope in space have compared to a telescope on Earth?

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

- There is less interference from the atmosphere. ☐
- They are easy to repair. ☐
- The space project may lose funding. ☐
- They can use more parts of the electromagnetic spectrum. ☐
- They are closer to the stars. ☐

[2]

(b) (i) The mission was organised by the European Space Agency.

The European Space Agency is an international organisation funded by over 15 European countries.

Why is international co-operation essential for this type of project?

....

....

.... **[2]**

(ii) Write down another example of an astronomical project involving international cooperation.

.... **[1]**

(c) **(i)** The Hipparcos satellite used the parallax method to measure the distance to stars. To do this it must measure the position of the stars very accurately.

Which statement describes the parallax method?

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

Parallax compares the position of stars at different times. ☐

Parallax counts the number of stars in part of the sky. ☐

Parallax compares the size of stars. ☐

Parallax looks at the colour of stars. ☐

[1]

(ii) What is the distance to a star which has a parallax angle of 1 second of arc?

distance = ... units....................................... **[2]**

(d) One way astronomers can measure the distance to a nearby galaxy is to observe a Cepheid variable star in that galaxy.

Which observations of the Cepheid variable star are used?

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

the time it takes for light to come from the star ☐

the period of the star ☐

the diameter of the galaxy ☐

the brightness of the star ☐

the colour of the star ☐

[2]

[Total: 10]

4 The energy that makes stars shine comes from the fusion of elements in the star.

(a) The fusion of hydrogen takes place in the Sun.

(i) What element is formed by the fusion of hydrogen in the Sun?

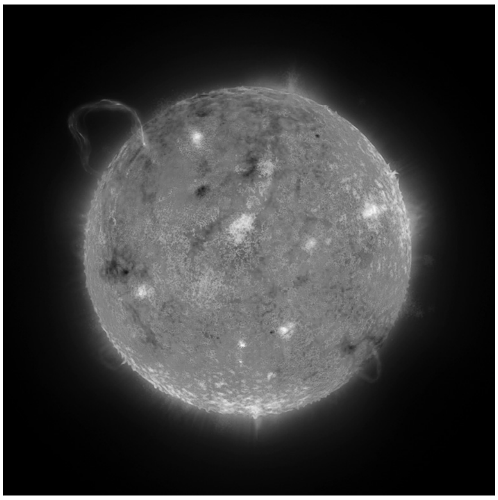
.... **[1]**

(ii) How do we know what elements are in the Sun?

....

.... **[1]**

(b) The Sun produces vast amounts of energy.



Complete the following sentences that describe how energy is transmitted through the Sun and emitted into space.

For each sentence you should choose the correct part of the Sun.

Use words from this list.

core **crust** **convective zone** **conductive zone**

mantle **radiative zone** **photosphere**

The fusion of reactions produce energy in the .... of the Sun.

This energy is transported outwards as photons in the ....

Just under the surface the energy is transported as great currents of gas.

These rise to the surface and then drop back down again to form loops.

This is the .... Finally the energy is radiated into space from the .... **[4]**

(c) When most of the hydrogen in the core of the Sun is used up, the Sun will change.

Which statements describe the Sun after this change?

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

It will be a red giant. ☐

It will be a supernova. ☐

It will fuse helium in its core. ☐

It will have a core of iron. ☐

It will go out. ☐

[2]

(d) When fusion ceases in a large star, the star explodes as a supernova.

Which two types of objects can be left after a supernova?

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

neutron star ☐

red supergiant ☐

white dwarf ☐

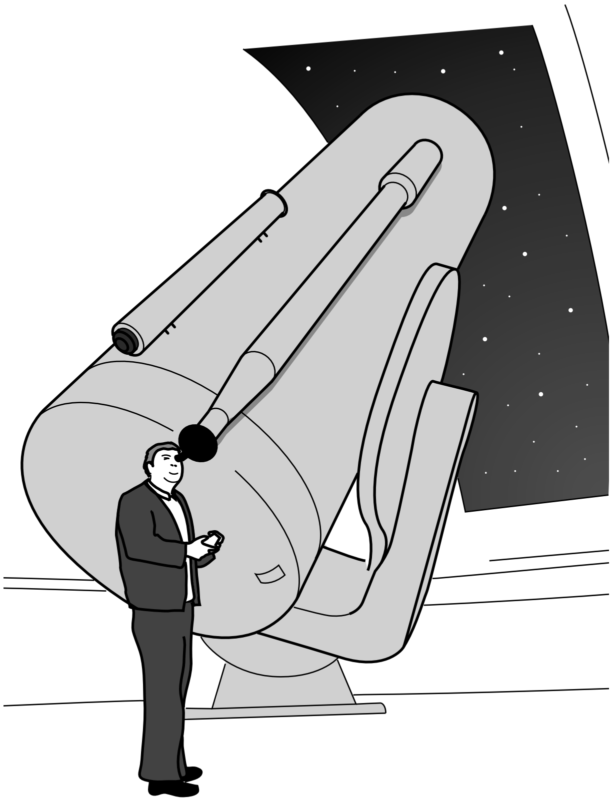
protostar ☐

black hole ☐

[2]

[Total: 10]

5 Edwin Hubble did much of his research using a large telescope at Mount Wilson in America.



(a) The large telescope is a reflecting telescope with a curved mirror.

(i) Draw a diagram to show how a mirror can bring light to a focus.

[2]

(ii) Explain why astronomical telescopes need to be so large.

....

....

.... **[2]**

(b) The large telescope has a much smaller telescope attached to its side.

This sighting telescope does not magnify as much, but can see more of the sky.

It is used to point the large telescope in the right direction.

The sighting telescope uses glass lenses.

(i) Which of the following statements about the sighting telescope are correct?

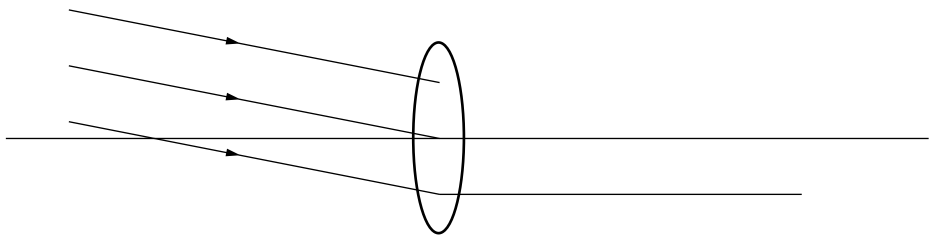
Put ticks (✓) in the boxes next to the **two** correct statements.

Each lens has a different power.	☐
The objective lens is more powerful than the eyepiece lens.	☐
The most powerful lens has the longest focal length.	☐
There must be a minimum of 3 lenses.	☐
The eyepiece lens has the most curved surface.	☐

[2]

(ii) Complete the diagram to show how the objective lens will bring the light from a star to a focus.

Label the point where the image of the star is formed.



[3]

(iii) Modern day large telescopes rarely have sighting telescopes.

Suggest reasons why.

....

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.... **[2]**

[Total: 11]

END OF QUESTION PAPER

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