OCR
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A333/01

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Ideas in Context and Unit P7 (Foundation Tier)

MONDAY 12 MAY 2008

Afternoon

Time: 60 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
Insert

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T58146

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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 useful relationships is included on page 2.

FOR EXAMINER'S USE		
Qu.	**Max**	**Mark**
1	**15**	
2	**10**	
3	**9**	
4	**7**	
5	**14**	
TOTAL	**55**	

This document consists of **15** printed pages, **1** blank page and an insert.

[Turn over

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

Further Physics, Observing the Universe

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

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

speed of recession = Hubble constant × distance

Answer **all** the questions.

1 Use the article on '**Should We Build New Nuclear Reactors?**' to help you answer this question.

(a) Write down **two** uses of radioactive materials.

1 .....

2 .....[2]

(b) Write down the **two** most common sources of exposure to radiation.

1 .....

2 .....[2]

(c) Describe what is meant by 'background radiation'.
Give one example of a source of background radiation.

meaning .....

.....

example .....[2]

(d) Write a short letter to the government giving your views on building new nuclear power stations.
Your answer should include

- your view
- **two** reasons for your view, other than cost.

One mark will be for a clear and ordered answer.

Dear Sir,

.....

.....

.....

.....

.....

.....

.....

.....

[3+1]

(e) (i) The article says 'ionising radiation produced is harmful to living cells'.
Explain how ionising radiation harms living cells.

.....

.....

.....[2]

(ii) Cancer cells can be killed using ionising radiation from radioactive materials.
Suggest some benefits and risks a patient suffering from cancer should consider when deciding whether to have radiation treatment or not.

.....

.....

.....

.....[3]

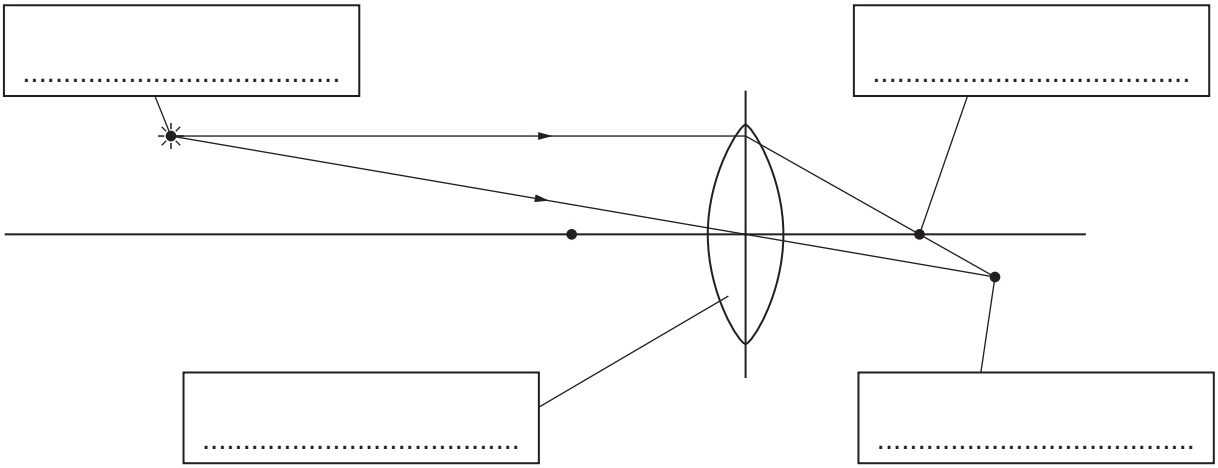
[Total: 15]

2 Billy is planning to make a telescope to look at distant stars.

He has some lenses made of glass.

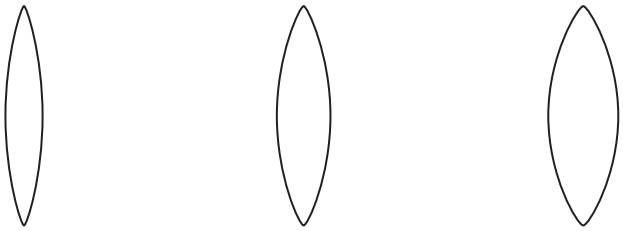
(a) He draws a diagram to show how a lens can produce an image from an object.

He forgets to label the diagram with the **lens**, **object**, **image** and **focus**.
Complete the diagram by adding the missing labels.



[3]

(b) Three of Billy's lenses are made from the same glass.



A **B** **C**

(i) Which lens **A**, **B** or **C** is the most powerful?
Explain your answer.

most powerful lens .....

reason .....

.....[2]

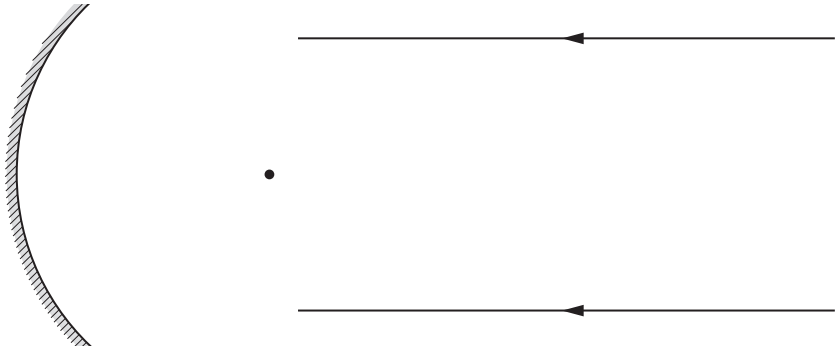
(ii) He decides to use lenses **A** and **C** for his telescope.
Which lens should he use for the eyepiece?
Explain why.

lens .....

reason .....[1]

(c) Sally says that most astronomical telescopes use concave mirrors.

(i) A concave mirror brings parallel light rays to a focus.
Complete the light rays on the diagram to show this.



[2]

(ii) Mirrors are used because it is easier to make very large mirrors than very large lenses.
Why is it important to have **large** lenses or mirrors in a telescope?

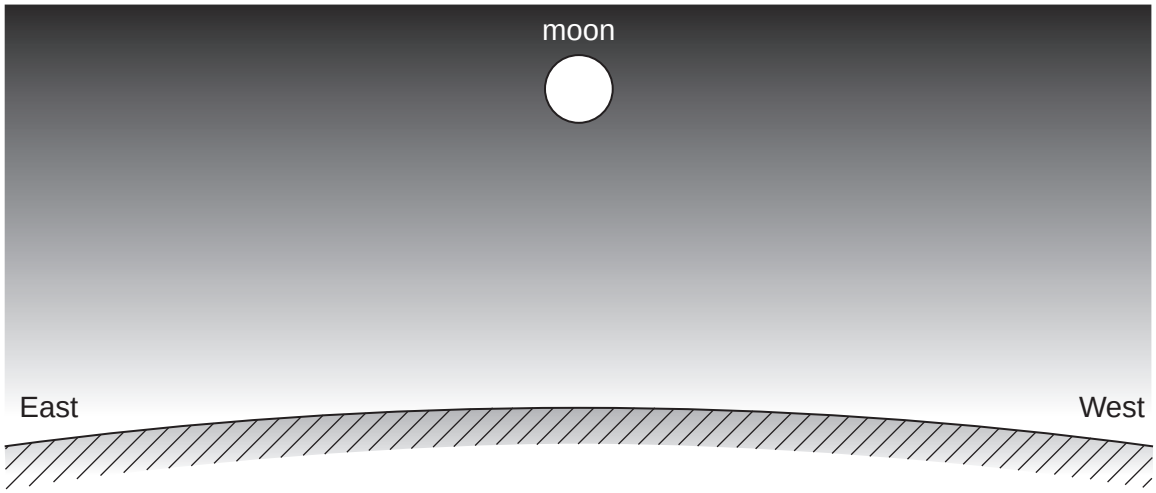
.....

.....[2]

[Total: 10]

3 **(a)** Sarah is making observations of the Moon.

(i) She records her observations during one night as the Moon moves across the sky.
The diagram shows the Moon in the middle of the night.



Draw a line to show the path of the Moon across the sky.
Include an arrow to show the direction it is moving along your line. [2]

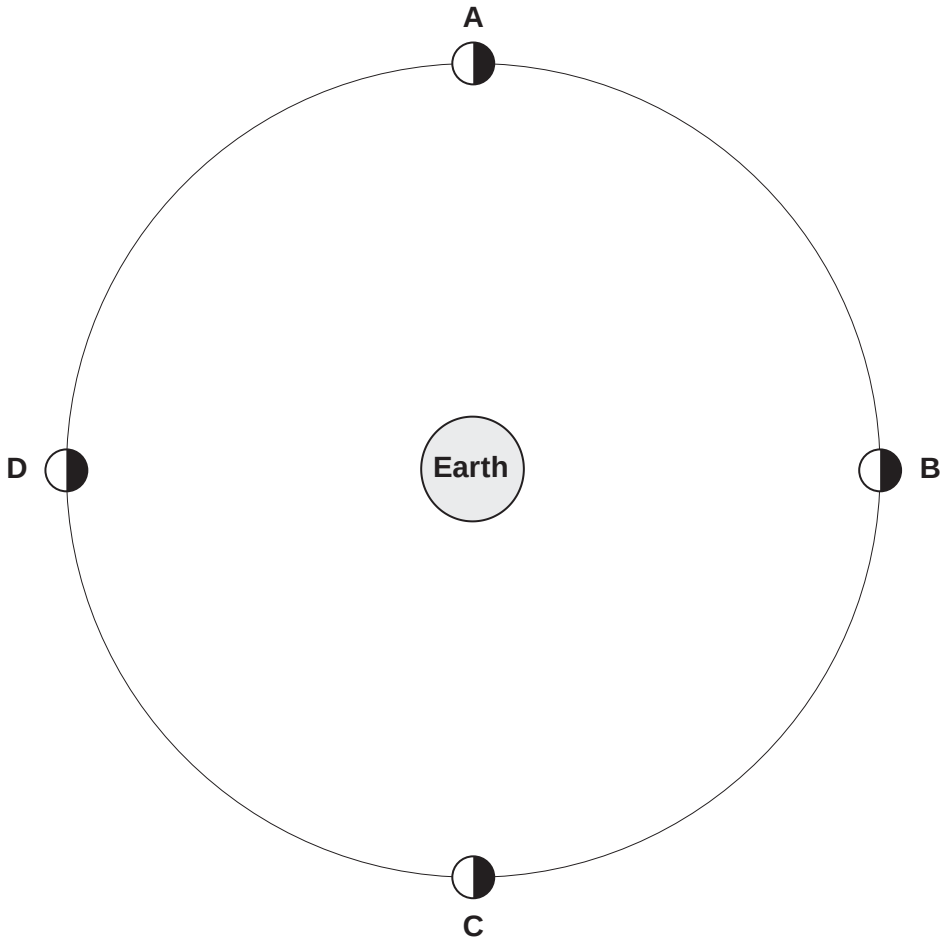
(ii) Explain why the Moon appears to move like this.

.....[1]

(iii) The Sun takes 24 hours to move once around the sky.
How long does it take for the Moon to go once around the sky?
Put a ring around the correct answer.

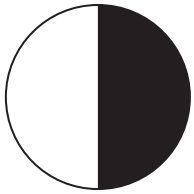
less than 24hrs **24hrs** **more than 24hrs** [1]

(b) Sarah has a diagram that shows the light and dark sides of the Moon as it orbits the Earth.



(i) Draw an arrow on Sarah's diagram to show a ray of light coming from the Sun. [1]

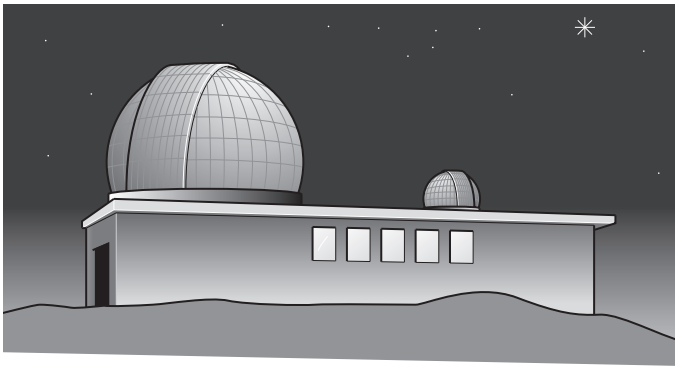
(ii) During a month Sarah sees the different phases of the Moon.
She draws these phases at each position **A**, **B**, **C**, and **D**.
Complete Sarah's table of observations.
One has been done for you.

position	phase of Moon
A	
B	
C	
D	

[4]

[Total: 9]

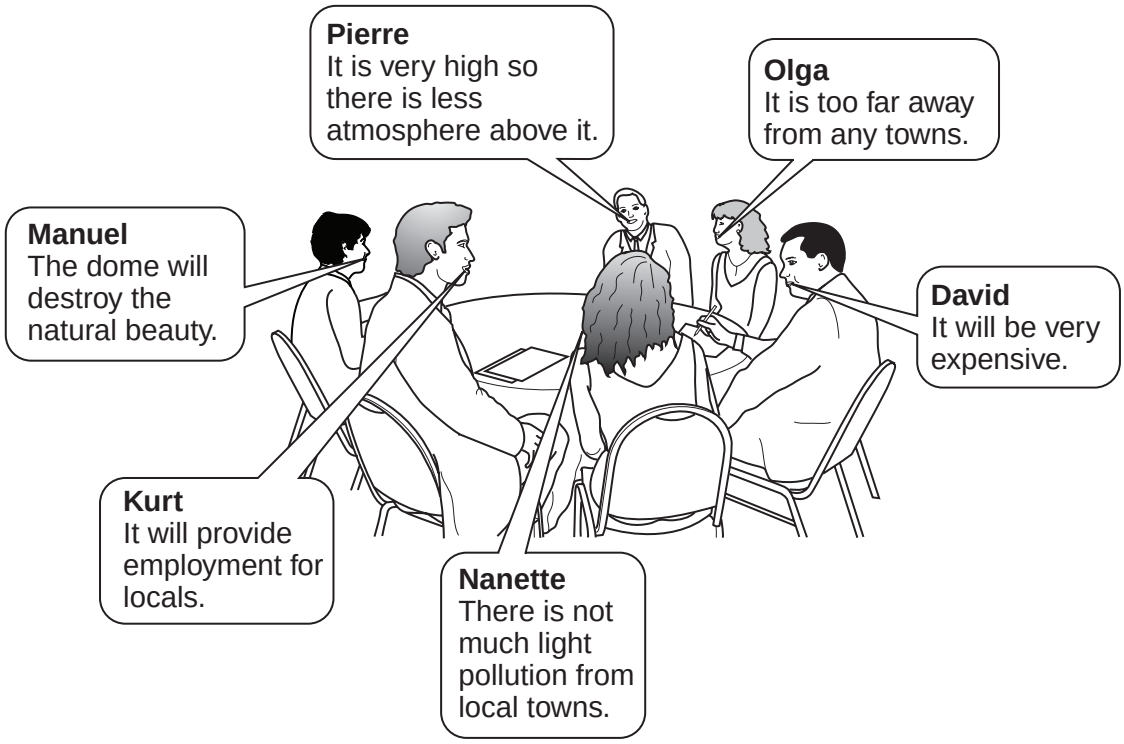
4 A group of countries are planning to build a new astronomical observatory.



(a) Write down the geographical location of a major astronomical observatory on Earth.

.....[1]

(b) At a meeting to decide where to build the new observatory several factors were discussed.



(i) Write down the names of **two** people who are talking about astronomical factors.

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

(ii) Who is giving an economic argument **in favour** of building the observatory?

.....[1]

(c) One group of astronomers want the new telescope to be in space.

Give **one** advantage and **one** disadvantage of using a telescope in space.

advantage .....

.....

disadvantage .....

.....[2]

(d) Write down **one** advantage of a group of countries working together for a 'big science' project like this.

.....

.....[1]

[Total: 7]

5 The photograph shows stars forming in a gas cloud.

When a cloud of gas is compressed a protostar forms.

(a) What causes the gas cloud to compress?

.....[1]

(b) As the gas cloud compresses the temperature of the gas increases.

(i) As the temperature increases, the pressure in the gas cloud changes.
Explain how the pressure changes.
Your answer should include
- what happens to the pressure
- how the behaviour of the particles of the gas changes.

.....

.....

.....[2]

(ii) Initially the temperature of the cloud is about 3 K.
What temperature is 3 K in °C?

..... °C [1]

(c) As the temperature inside the protostar increases all the electrons are removed from the atoms. This leaves positively charged nuclei.

(i) The nucleus of an atom can contain two types of particle.
Complete the table to show the names of the particles.

name of particle	charge on particle
	positive
	none

[1]

(ii) There is a strong attractive force which holds the particles together.
Another force pushes some of the particles in the nucleus apart.
What is this force?

.....[1]

(d) When the temperature is high enough, nuclei can fuse together to form new elements. This releases energy.

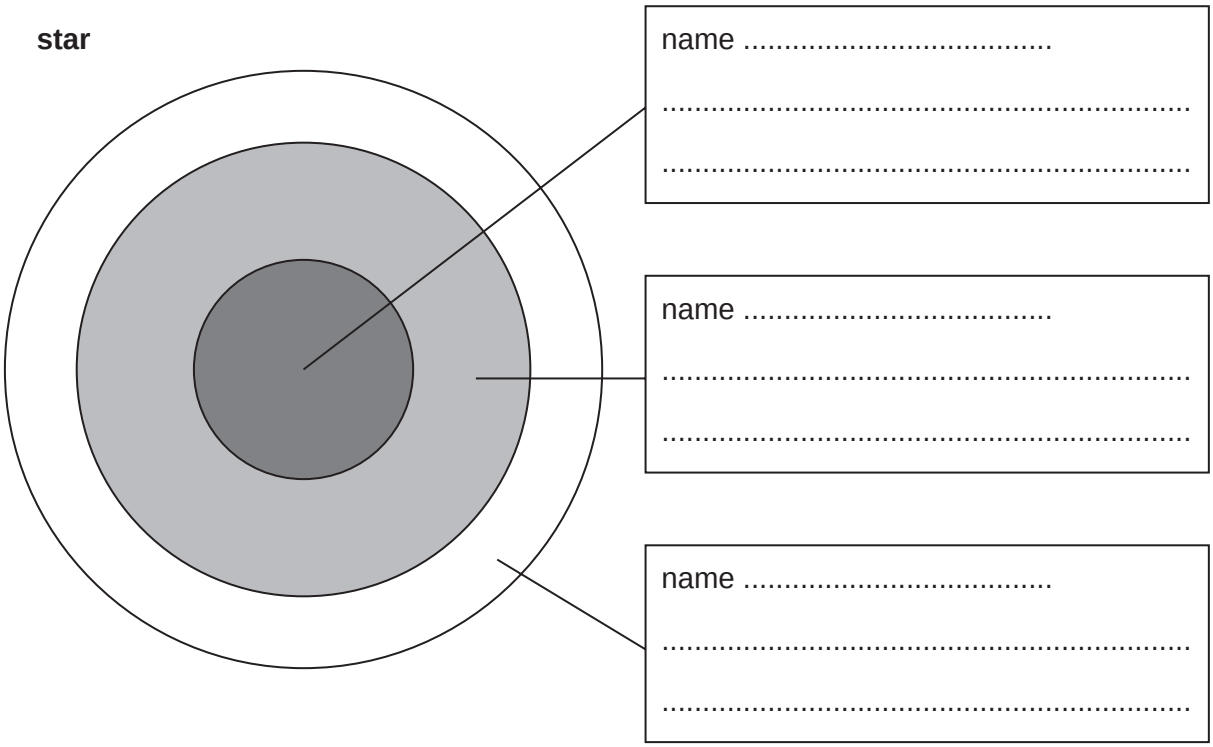
(i) Complete the equation for this fusion reaction with the names of the elements.

4 [.....] → [.....] + energy

[2]

(ii) The energy produced by the nuclear fusion is radiated into space.

The diagram shows the different regions inside a **star**.
Label each region with its name and say what is happening to the energy in that region.



[6]

[Total: 14]

END OF QUESTION PAPER

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