

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2005



**PHYSICS (MODULAR) SPECIFICATION A  
FOUNDATION TIER**

**3453/F**

Wednesday 22 June 2005 9.00 am to 10.30 am

**F**

**In addition to this paper you will require:**  
a ruler.  
You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7			
8			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.
- Show all your working in calculations.

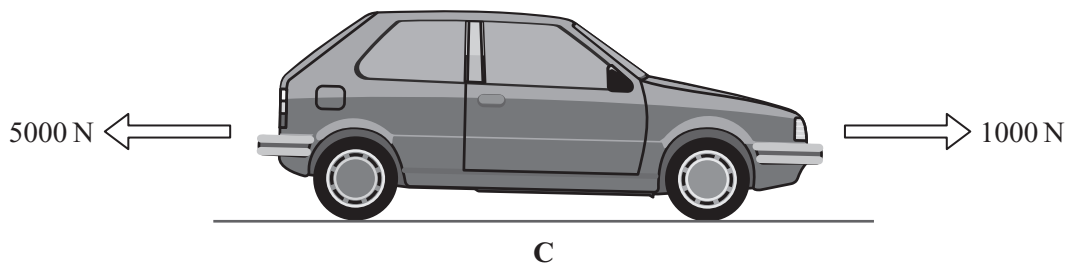
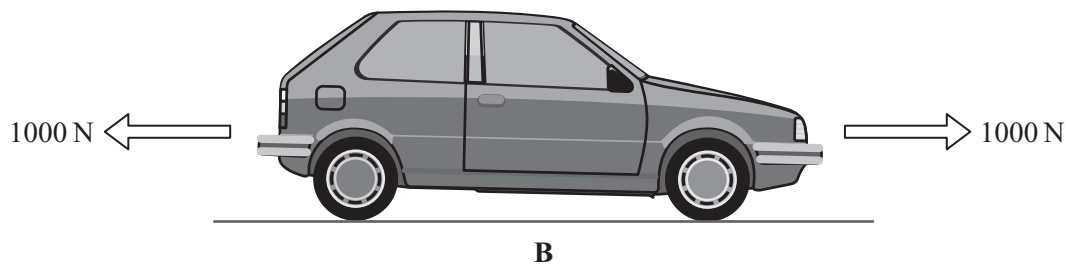
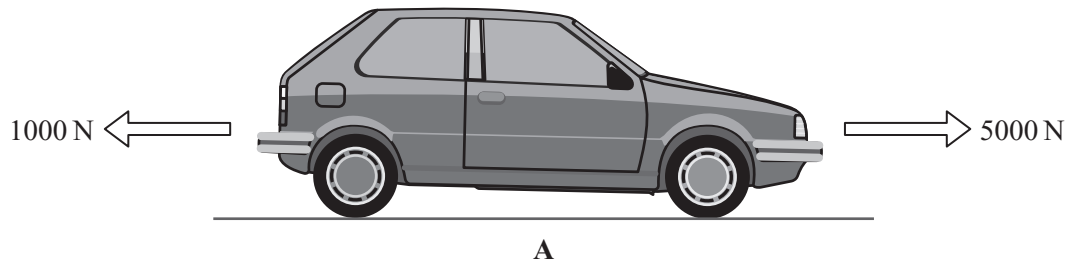
**Information**

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

## FORCES

1 A car travels on a level road.

The diagrams show the backward and forward forces acting on the car at three stages, **A**, **B** and **C**, of its journey.



(a) At which stage, **A**, **B** or **C**, do the forces acting on the car balance? .....  
(1 mark)

(b) What will be happening to the speed of the car at stage:

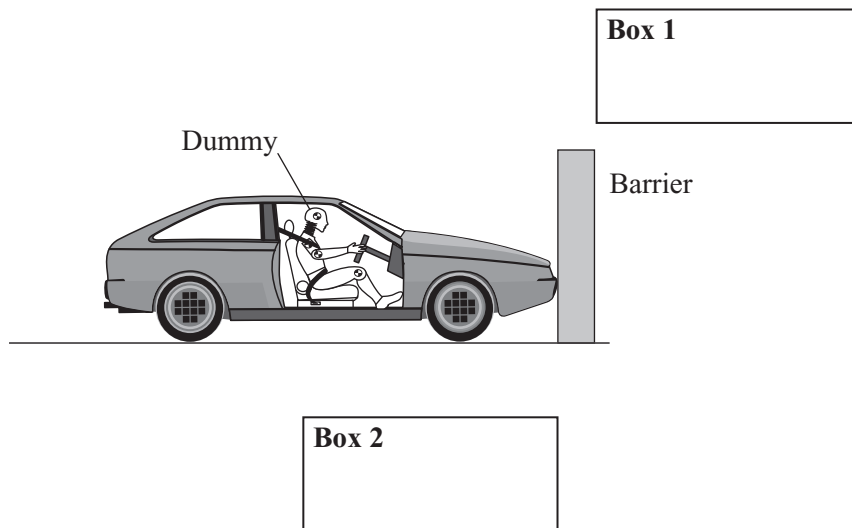
(i) **A**? It will be.....

(ii) **B**? It will be.....

(iii) **C**? It will be.....

(3 marks)

- (c) Cars are tested for safety.  
The diagram shows a car, containing a dummy, hitting a barrier.



- (i) Draw an arrow in **Box 1** to show the direction of the force that the car exerts on the barrier. *(1 mark)*
- (ii) Draw an arrow in **Box 2** to show the direction of the force that the barrier exerts on the car. *(1 mark)*
- (iii) The car exerts a force of 1000 N on the barrier.

What size force does the barrier exert on the car?

Tick (✓) the correct answer.

Less than 1000 N

1000 N

More than 1000 N

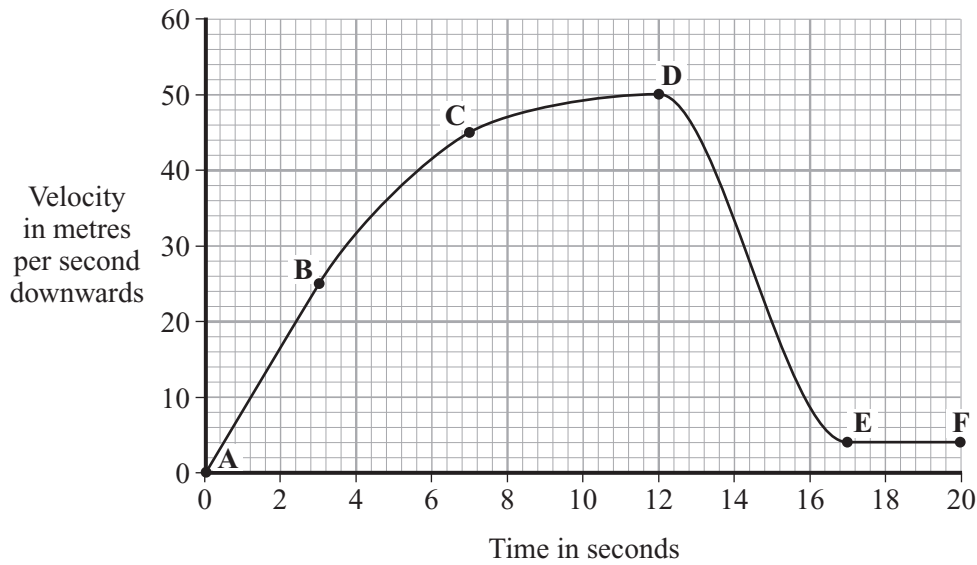
*(1 mark)*

7

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

2 The graph shows how the velocity of a parachutist changes with time during the first 20 seconds of a jump.



(a) Use the graph to find:

(i) the greatest velocity reached by the parachutist;

Greatest velocity = ..... metres per second downwards

(ii) the time at which the parachutist opened the parachute;

Time = ..... seconds

(iii) the terminal velocity after the parachute was opened.

Terminal velocity = ..... metres per second downwards  
(3 marks)

(b) Answer the following questions by putting a tick (✓) in the correct box.

Which part of the graph shows:

(i) the parachutist travelling at a constant velocity;

<b>A – B</b>	
<b>B – C</b>	
<b>C – D</b>	
<b>E – F</b>	

(ii) the parachutist slowing down;

<b>A – B</b>	
<b>C – D</b>	
<b>D – E</b>	
<b>E – F</b>	

(iii) the greatest acceleration?

<b>A – B</b>	
<b>B – C</b>	
<b>C – D</b>	
<b>E – F</b>	

(3 marks)

6

**TURN OVER FOR THE NEXT QUESTION**

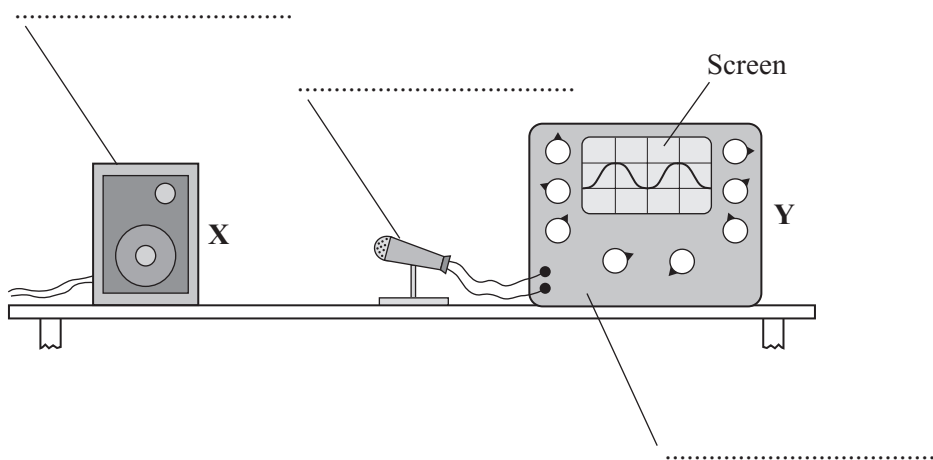
**Turn over** ►

**WAVES AND RADIATION**

- 3 (a) The diagram shows apparatus being used to compare sounds produced by box X.

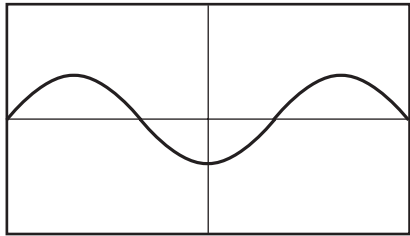
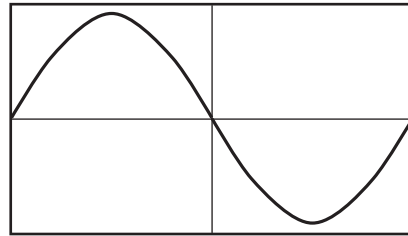
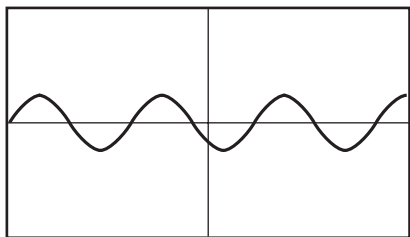
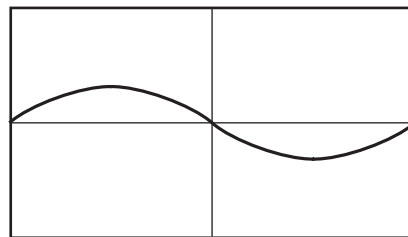
Choose words from the box to label the diagram.

**endoscope      loudspeaker      microphone      oscilloscope      scanner**



(3 marks)

- (b) Box **X** produces four musical notes.  
The diagrams show the traces, **A**, **B**, **C** and **D**, on the screen.  
The settings of **Y** are not changed.

**A****B****C****D**

Which trace, **A**, **B**, **C** or **D**, shows:

- (i) the loudest sound;  
(ii) the largest amplitude;  
(iii) the highest frequency?


(3 marks)

- (c) Electronic systems can be used to produce waves which have a frequency higher than humans can hear.

- (i) What is the name of these waves?

.....  
(1 mark)

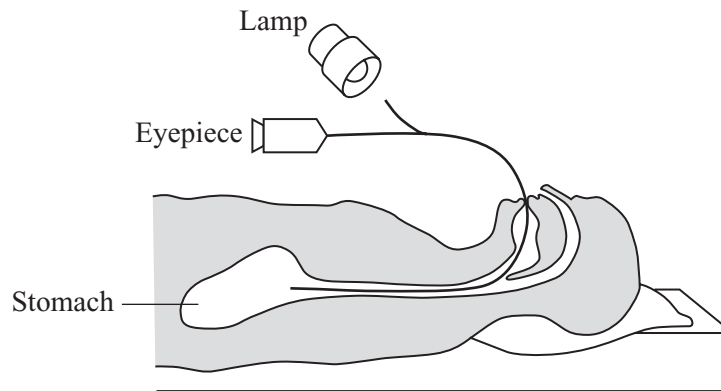
- (ii) Give **two** uses of these waves.

1.....

2.....

(2 marks)

4 The diagram shows how a doctor can see inside a patient's stomach.



Source: adapted from WITNEY, DROZDOWSKA & MAILE, *AQA GCSE Physics* (Hodder & Stoughton) 2002.  
Reproduced by permission of Hodder Arnold.

Complete each sentence by choosing the correct words from the box.

<b>critical</b>	<b>endoscope</b>	<b>external</b>	<b>internal</b>
<b>microscope</b>	<b>normal</b>	<b>optical</b>	<b>refraction</b>

Light can be sent along ..... fibres in a piece of equipment called an  
.....

Light travels along the fibres by repeated total ..... reflection.

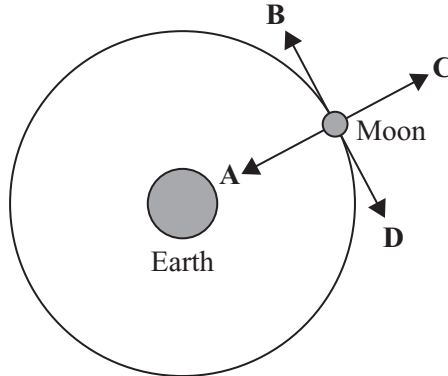
This happens because light hits the inside surface of the fibres at an angle greater than the  
..... angle. (4 marks)

4



**FORCES AND MOTION**

5 The diagram shows the Moon in its orbit round the Earth.



The Moon's direction of travel is changing all the time.  
A force is needed to produce this change in direction.

(a) In which direction, **A**, **B**, **C** or **D**, does this force act? .....  
(1 mark)

(b) Complete the sentence by choosing the correct word from the box.

**central**
**centrifugal**
**centrimetric**
**centripetal**
**circular**

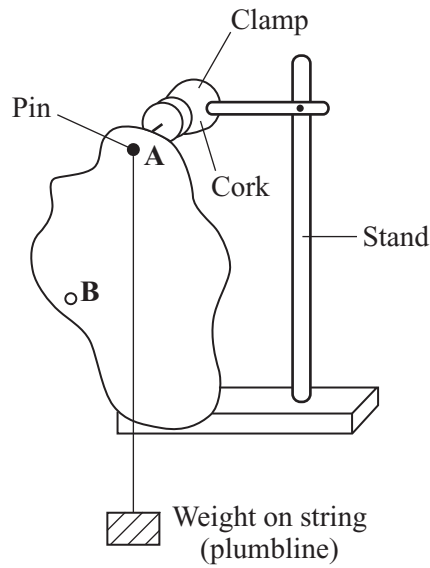
The force needed to keep an object moving in a circular path is called the  
..... force. (1 mark)

(c) What provides the force to keep the Moon moving in orbit?  
.....  
.....  
(2 marks)

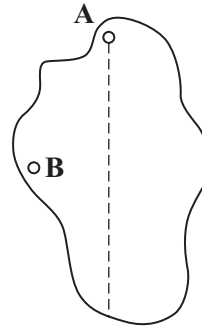
4

Turn over ►

6 **Diagram 1** shows apparatus being used by a student to find the centre of mass of a thin sheet of card.



**Diagram 1**



**Diagram 2**

The student draws a line on the thin sheet of card, marking the position of the string. This is shown in **Diagram 2**.

- (a) Describe how the student should continue the experiment to find the centre of mass of the sheet of card.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

.....

.....

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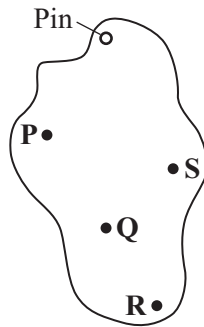
.....

.....

.....

(4 marks)

(b) **Diagram 3** shows the thin sheet of card hanging from the pin.



**Diagram 3**

Which point, **P**, **Q**, **R** or **S**, may be the centre of mass?

Give a reason for your answer.

Centre of mass .....

Reason .....

.....

.....

(2 marks)

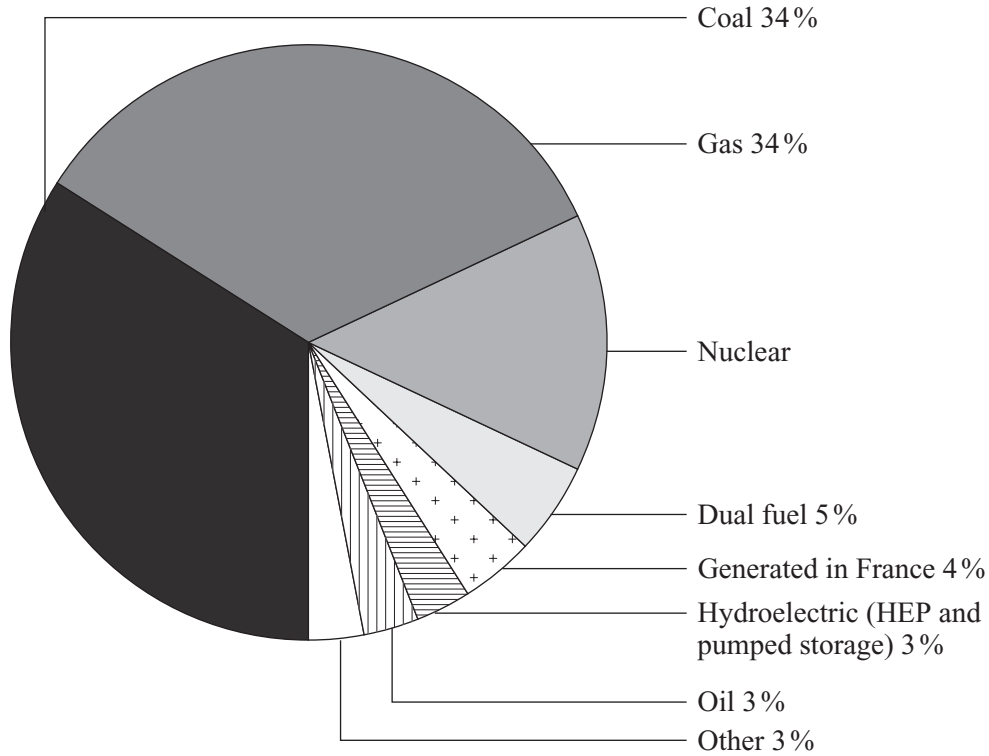
6

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

**QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES**

7 The chart shows the resources used to produce Britain's electricity.



(a) (i) What percentage of Britain's electricity is generated in nuclear power stations?

..... (1 mark)

(ii) 3% of Britain's electricity is generated by *other* means.

Give **two** *other* resources, not given in the chart, which are used to produce electricity.

1 .....

2 .....

(2 marks)

(b) About 70% of Britain's electricity is generated in fossil fuel power stations.

Give **one** advantage and **one** disadvantage, other than cost, of using fossil fuels.

Advantage .....

.....

Disadvantage .....

.....

(2 marks)

- (c) Give **one** advantage, other than cost, of generating electricity in a nuclear power station rather than a fossil fuel power station.

.....

.....

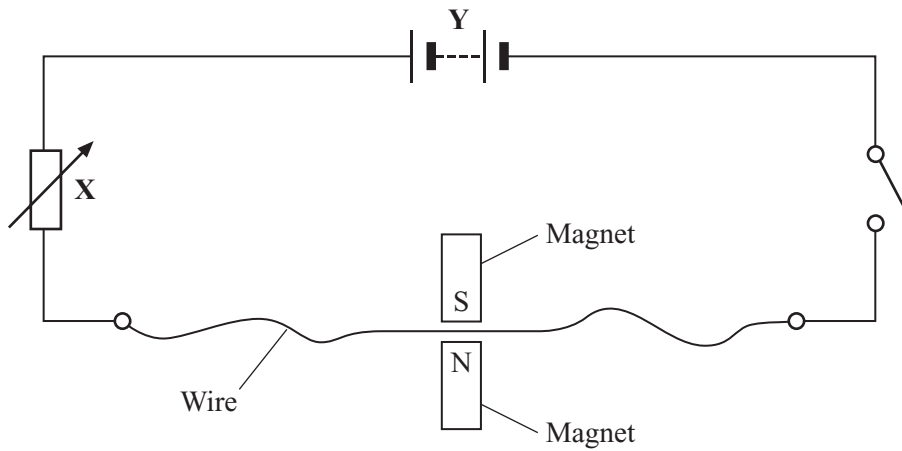
*(1 mark)*

$\frac{\quad}{6}$

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

8 The diagram shows a circuit used to investigate the force acting on a wire carrying an electric current in a magnetic field.



(a) What is component:

(i) **X**; .....

(ii) **Y**? .....

(2 marks)

(b) Some changes are made to the circuit.

When the switch is closed, what happens to the force acting on the wire if:

(i) component **X** is adjusted so that the current increases;

.....  
.....

(ii) component **Y** is reversed?

.....  
.....

(2 marks)

(c) The force acting on a piece of wire in a magnetic field is used in electric motors.

(i) Complete the sentence.

In electric motors, ..... energy is usefully transferred to

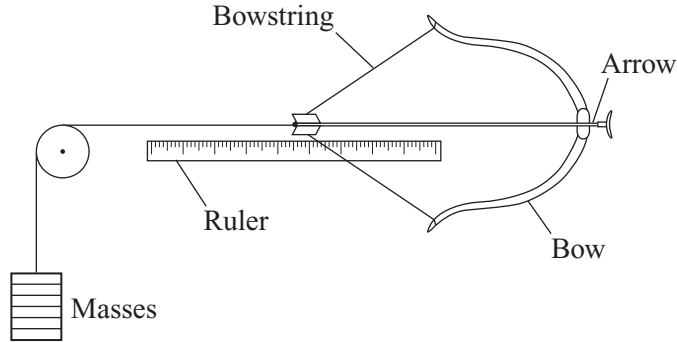
..... energy. (2 marks)

(ii) Give **one** form of wasted energy produced in electric motors.

.....  
(1 mark)

**FORCES**

9 Some students carried out an investigation with a toy bow and arrow.



The students added masses to bend the bow, as shown in the diagram. They measured the movement of the arrow, using a ruler. From their results the students calculated the energy stored in the bow. To do this, they calculated the work done in bending the bow.

(a) (i) Write down the equation used to calculate the work done.

.....  
(1 mark)

(ii) The average force applied to pull the arrow back 0.4 m was 20 N.

Calculate the work done and give the unit.

Show clearly how you work out your final answer.

.....  
.....  
.....  
.....

Work done.....  
(3 marks)

(b) The work done is stored as energy.

(i) What type of energy is usefully stored in the bent bow?

.....  
(1 mark)

(ii) What type of energy does the arrow have when it is released?

.....  
(1 mark)

10 This question is about the life of stars.

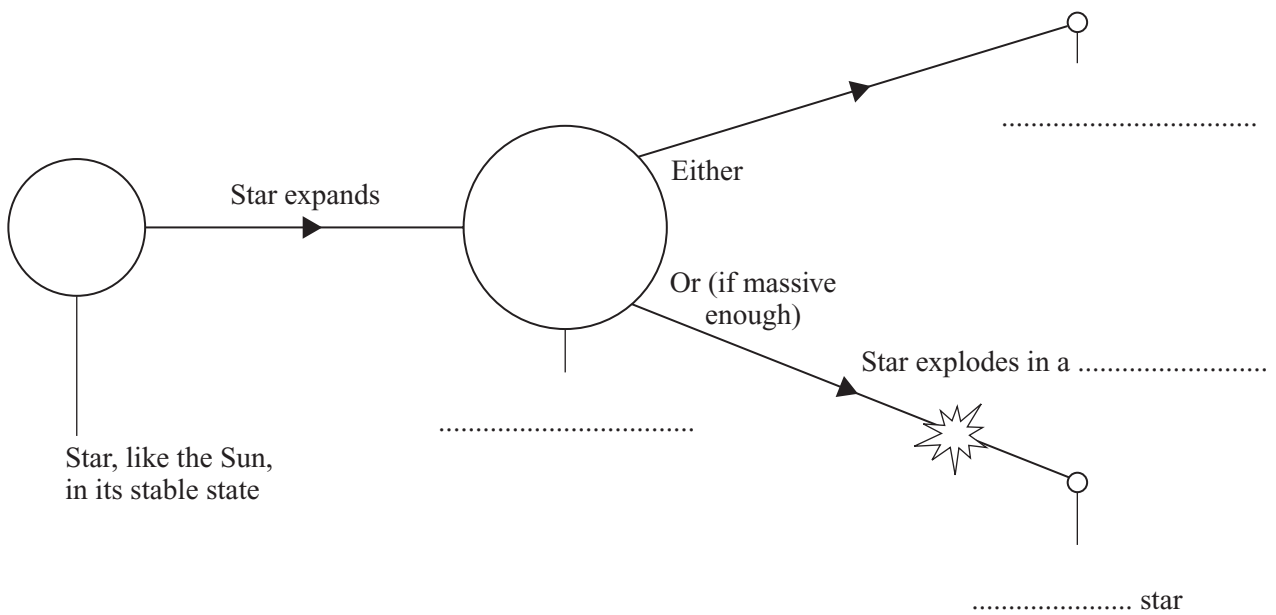
(a) Complete the sentences.

Stars, including the Sun, form when enough ..... and .....  
from space is pulled together by ..... attraction.

Smaller masses may also form and be attracted by stars to become .....  
(4 marks)

(b) The diagram shows part of the life of a star.

Complete the labelling on the diagram.



(4 marks)



**NO QUESTIONS APPEAR ON THIS PAGE**

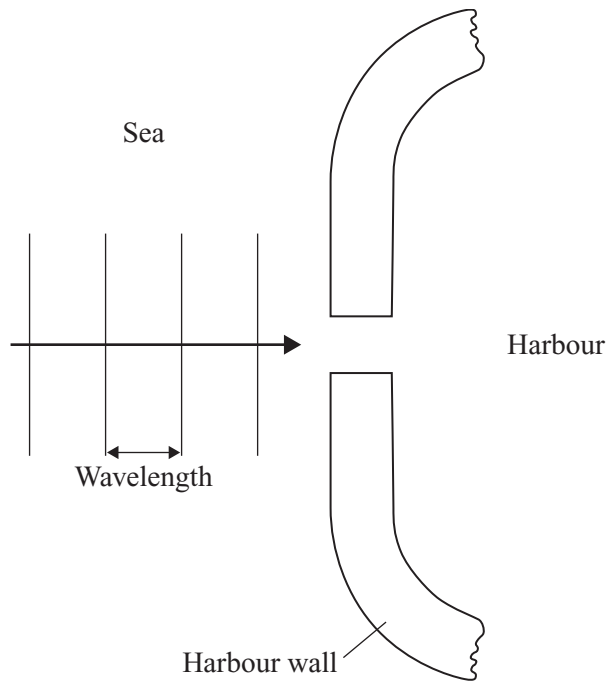
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ►**

**WAVES AND RADIATION**

**11** The diagram shows some waves approaching a harbour.

- (a) (i) Complete the diagram to show what happens to the waves after they pass through the harbour entrance.

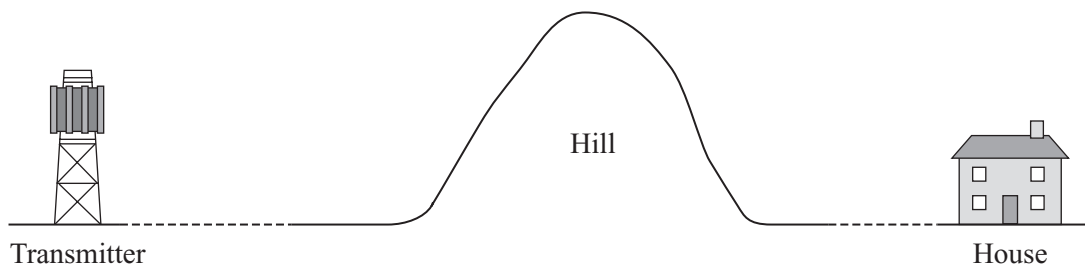


(2 marks)

- (ii) What is the name of the effect that you have drawn?

.....  
(1 mark)

- (b) The diagram shows a transmitter for radio and television signals.



The reception of signals at the house varies as shown in the table.

Programme	Wavelength	Reception
TV	0.5 metres	very poor
VHF radio	3 metres	poor
LW radio	1500 metres	very good

Use the information in the table to help you to explain why reception is best for LW radio.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

.....

.....

.....

.....

.....

(4 marks)

7

**TURN OVER FOR THE NEXT QUESTION**

Turn over ►

12 Part of a newspaper article is shown below.

**Farmed salmon may contain radioactive waste**

Fears have been raised about the safety of farmed salmon after the discovery of traces of *radioactive* waste in some salmon.

Technetium-99, a by-product of nuclear reprocessing, was found in the fish.

(a) What is meant by *radioactive*?

.....  
.....

(1 mark)

(b) Technetium-99 can also be written  ${}_{43}^{99}\text{Tc}$ .

One of the two numbers is the atomic (proton) number.

The other number is the mass (nucleon) number.

(i) How many protons are present in the nucleus of any technetium atom?

.....

(ii) How many neutrons are present in the nucleus of a technetium-99 atom?

.....

(2 marks)

(c) Technetium-99 emits beta ( $\beta$ ) radiation and has a *half-life* of 4 200 000 years.

(i) What is meant by *half-life*?

.....  
.....

(1 mark)

(ii) Why is beta ( $\beta$ ) radiation more dangerous than alpha ( $\alpha$ ) radiation when the source of the radiation is outside the body?

.....  
.....  
.....

(2 marks)

- (iii) Why is alpha ( $\alpha$ ) radiation more dangerous than beta ( $\beta$ ) radiation when the source of the radiation is inside the body?

.....

.....

*(1 mark)*

7

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

## FORCES AND MOTION

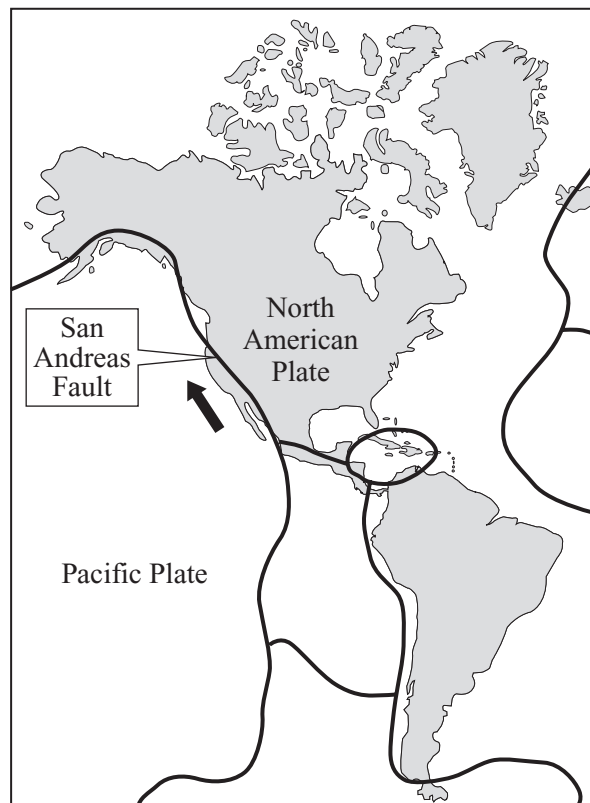
- 13 (a) At one time, people believed that the main features of the Earth's surface were the result of the shrinking of the Earth's crust.

What did they think caused the Earth's crust to shrink?

.....  
 .....

*(1 mark)*

- (b) We now believe that the Earth's lithosphere is cracked into a number of large pieces called tectonic plates.  
 Along the coast of California, the San Andreas fault separates the Pacific plate from the North American plate.



The Pacific plate is moving roughly north-westwards relative to the North American plate.

- (i) Complete the sentence.

The approximate speed of the plates relative to each other is a few .....  
 every year.

*(1 mark)*

(ii) Describe what causes the movement of tectonic plates.

.....

.....

.....

.....

.....

.....

.....

*(3 marks)*

(c) (i) Where, in relation to tectonic plates, are earthquakes and volcanoes most likely to occur?

.....

.....

*(1 mark)*

(ii) In California, small tremors occur every day.  
Scientists monitor the position and intensity of the tremors.

Give **one** reason why it is difficult to predict when a large earthquake will occur.

.....

.....

*(1 mark)*



**TURN OVER FOR THE NEXT QUESTION**

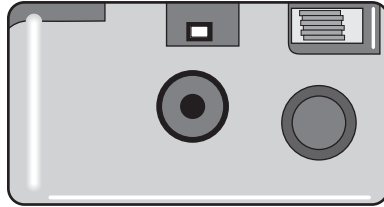
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**QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES**


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- 14 (a) The converging lens in a camera produces a real image.



Explain the difference between a real image and a virtual image.

.....

.....

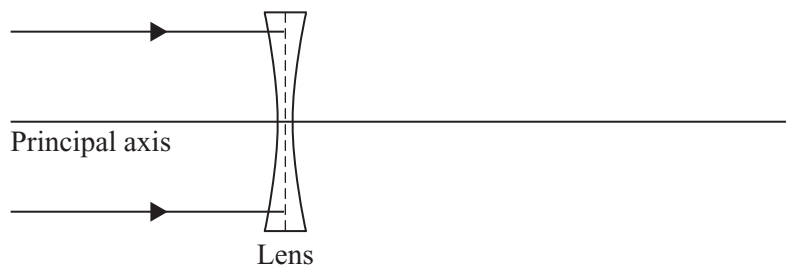
.....

.....

.....

(3 marks)

- (b) Complete the diagram to show what happens to the **two** rays of light after they enter the lens shown below. Put an **F** on the ray diagram to label the focus of the lens.



(3 marks)

**END OF QUESTIONS**

6