

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2003



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

**3453/F**

**F**

Tuesday 17 June 2003 9.00 am to 10.30 am

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

For Examiner's Use			
Number	Mark	Number	Mark
1		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8			
9			
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** the 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**

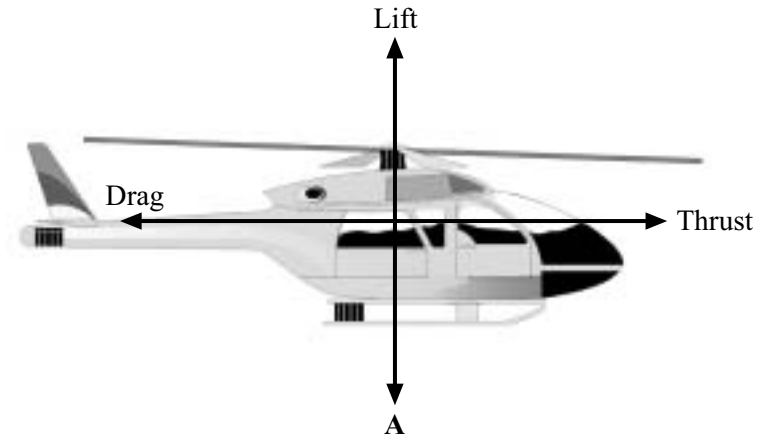
- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

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**FORCES**


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- 1 The diagram shows four forces acting on a helicopter.



- (a) Complete this sentence by choosing the correct word from the box.

<b>friction</b>	<b>mass</b>	<b>reaction</b>	<b>weight</b>
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Force A is called .....

*(1 mark)*

- (b) The helicopter moves forward at a steady speed at the same height.

Tick the correct statement.

The thrust is greater than the drag.

The thrust is equal to the drag.

The thrust is less than the drag.

*(1 mark)*

- (c) When the helicopter is flying at a steady height, the lift is 10 000 newtons.

What is the size of force **A**? ..... newtons  
(1 mark)

- (d) Which force must increase to make the helicopter:

(i) increase its height; .....

(ii) increase its forward speed? .....  
(2 marks)

5

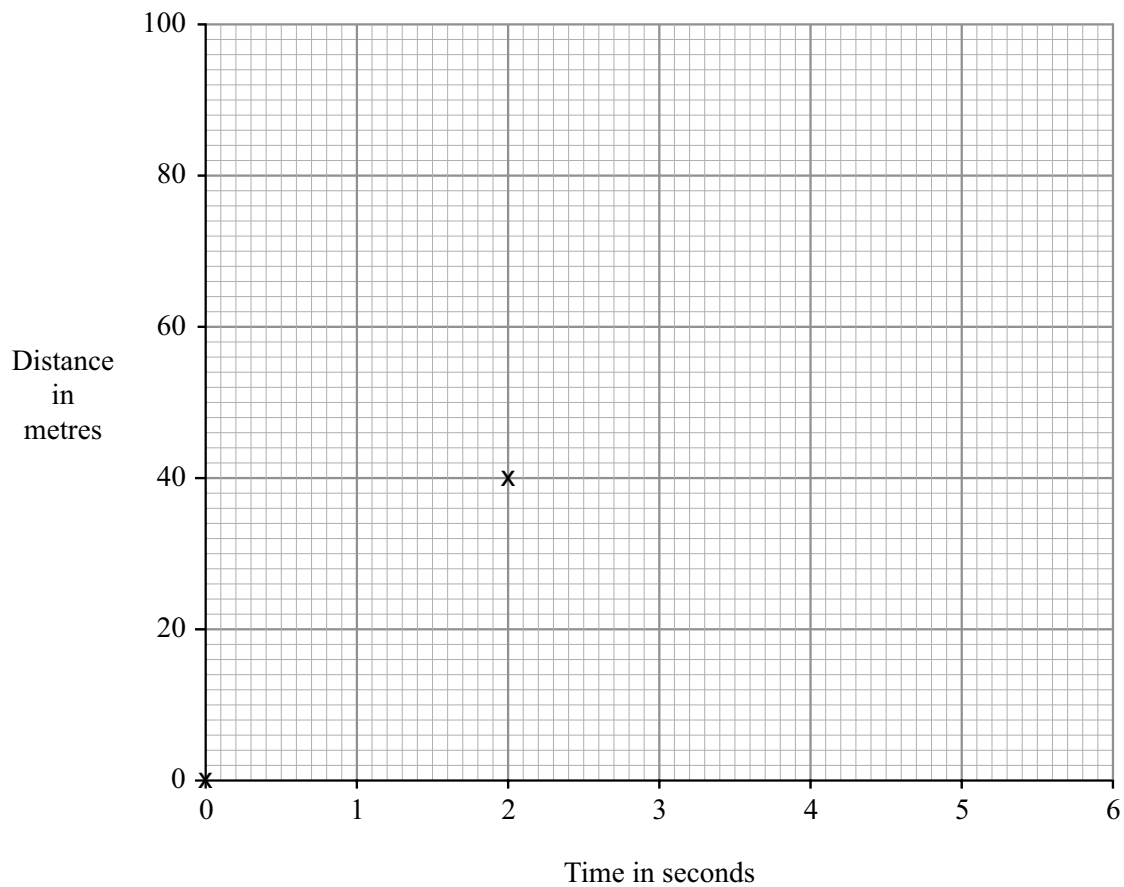
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**

- 2 The table gives values of distance and time for a car travelling along a road.

Distance in metres	0	20	40	60	80	100
Time in seconds	0	1	2	3	4	5

- (a) Draw a graph of distance against time.  
Two of the points have been plotted for you.



(3 marks)

- (b) Use your graph to find:

- (i) the distance travelled in 2.5 seconds;

Distance = ..... metres

- (ii) the time at which the distance is 30 metres.

Time = ..... seconds

(2 marks)

- (c) Complete the sentence by crossing out the **two** lines which are wrong.

The car is

slowing down
moving at a steady speed
speeding up

.

(1 mark)

$\frac{\quad}{6}$

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**

- 3 (a) Write the following in order of size.  
Start with the smallest.

<b>galaxy</b>	<b>planet</b>	<b>solar system</b>	<b>Sun</b>	<b>Universe</b>
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.....

.....

.....

.....

.....

(3 marks)

- (b) Complete each sentence by choosing the correct words from the box.  
Do not use a word more than once.

<b>comets</b>	<b>constellations</b>	<b>planets</b>	<b>stars</b>
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- (i) The orbits of ..... are slightly squashed circles with the Sun quite close to the centre.
- (ii) ..... have orbits which are far from circular.
- (iii) ..... form when enough dust and gas from space are pulled together by gravitational attraction.

(3 marks)

## WAVES AND RADIATION

- 4 (a) Complete the **four** spaces in the table of electromagnetic waves.

Type of wave	Use
<b>gamma rays</b>	.....
<b>X-rays</b>	to produce shadow pictures of bones
.....	used in sunbeds to give a suntan
<b>light</b>	sent along optical fibres in endoscopes
<b>infra red rays</b>	.....
.....	to communicate with satellites
<b>radio waves</b>	to transmit radio programmes

(4 marks)

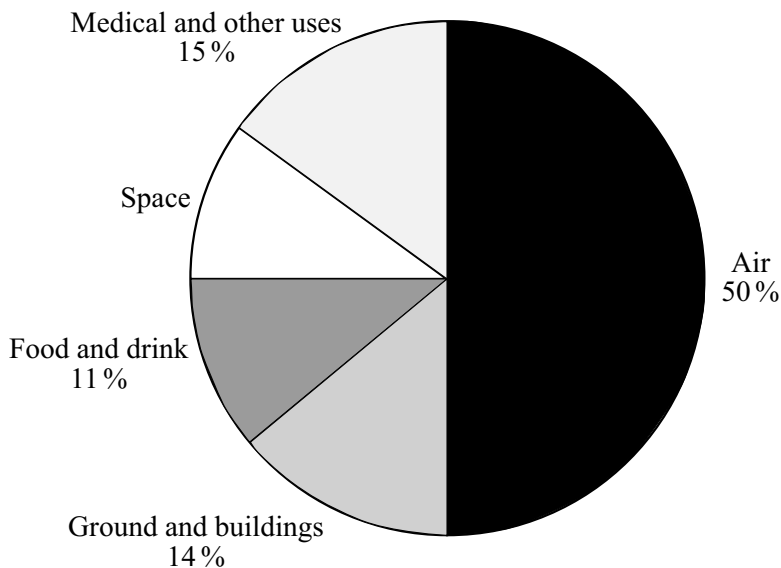
- (b) Complete the sentence by ticking (✓) the correct word.

The arrow on the left-hand side of the table above shows increasing ...

- frequency.
- speed.
- volume.
- wavelength.

(1 mark)

5 Radioactive substances give out radiation. There are radioactive substances all around us. The chart shows where radiation comes from.



(a) (i) Complete the sentence.

Apart from medical and other uses, radiation from all of these sources is called

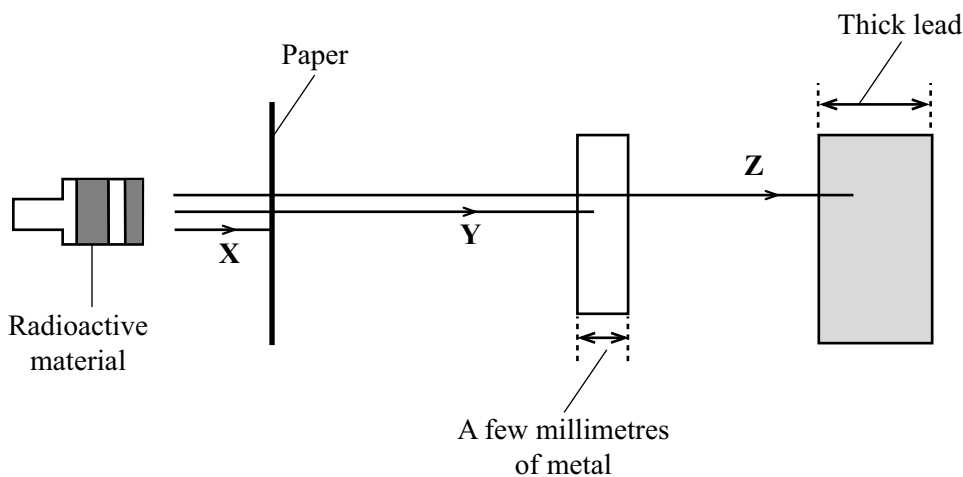
..... radiation. (1 mark)

(ii) What percentage of the radiation comes from space?  
Show clearly how you worked out your answer.

.....  
.....

Radiation from space = ..... %  
(2 marks)

(b) There are three types of radiation, *alpha*, *beta* and *gamma*, emitted by radioactive materials. The diagram shows what can stop each type of radiation.





Match the radiation, *alpha*, *beta* or *gamma*, to the statements below.

- (i) **X:** The radiation is stopped by a sheet of paper. ....
  - (ii) **Y:** Most of the radiation is stopped by a few millimetres of metal. ....
  - (iii) **Z:** Most of the radiation is stopped by thick lead. ....
- (2 marks)*

(c) People who work with radioactive materials have to wear a special badge. One is shown below.



(i) What is inside the badge to detect radiation?  
 .....  
*(1 mark)*

(ii) *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.*

Explain, as fully as you can, why large doses of radiation are dangerous.

.....

.....

.....

.....

.....

.....

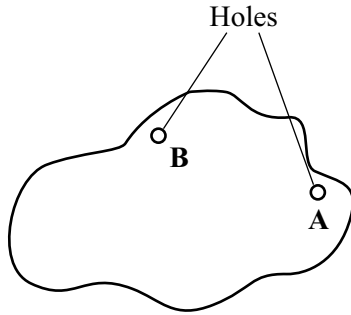
*(3 marks)*

**FORCES AND MOTION**

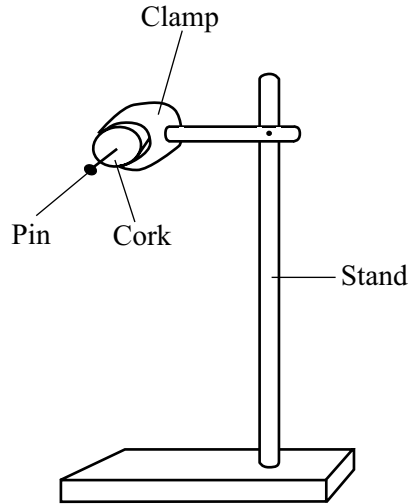
**6** **Figure 1** shows a thin sheet of card. It has two holes in it.

**Figure 2** shows a pin stuck into a cork held in a clamp.

We can use the apparatus in **Figure 2** to find the centre of mass of the card.

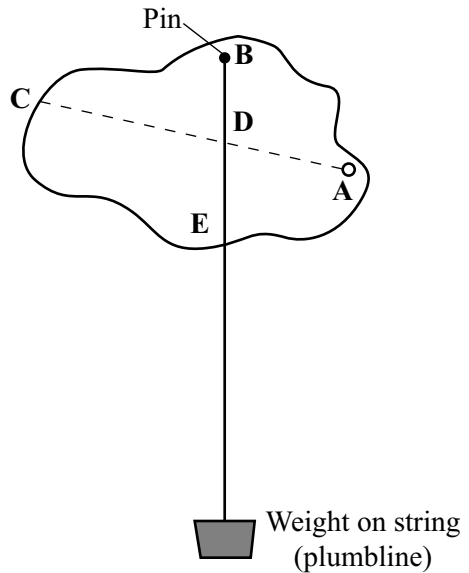
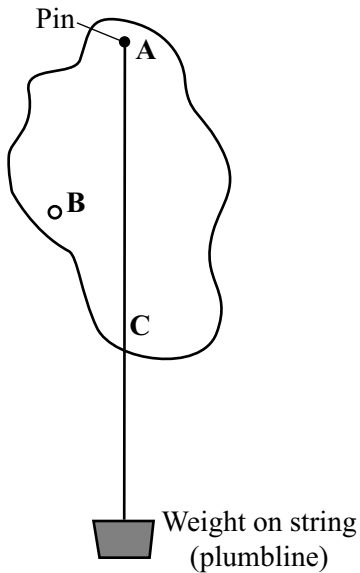


**Figure 1**



**Figure 2**

The next two diagrams show how we can find the centre of mass of the card.



(a) Which point, **A**, **B**, **C**, **D** or **E**, is the centre of mass?

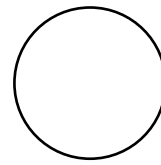
.....  
(1 mark)

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

<b>friction</b>	<b>mass</b>	<b>volume</b>	<b>weight</b>
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The centre of mass of an object is the point through which its ..... acts.  
(1 mark)

- (c) Label with an **X** the centre of mass of each of these shapes.



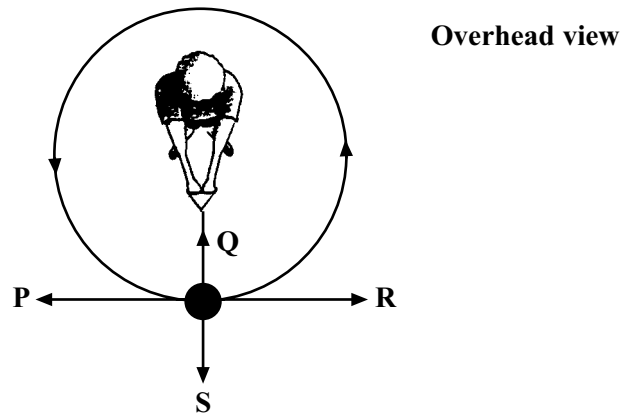
(2 marks)



**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**

- 7 The diagram shows an athlete about to throw the hammer. The hammer is a metal mass joined to a strong wire. The athlete moves the mass around in a circular path.



- (a) (i) In which direction, **P**, **Q**, **R** or **S**, does the centripetal force act? .....  
(1 mark)
- (ii) The athlete lets go of the wire.  
In which direction, **P**, **Q**, **R** or **S**, does the mass move? .....  
(1 mark)

- (b) Complete these sentences by crossing out the **two** lines in each box that are wrong.

- (i) When the mass moves in a circle at a steady speed the centripetal force is greater if the

mass is less	.
mass is greater	
speed is less	

- (ii) When the mass moves in a circle at a steady speed the centripetal force is greater if the

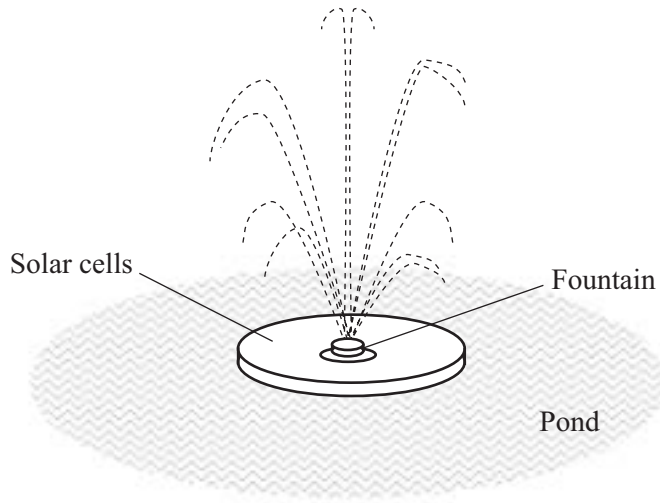
speed is less	.
wire is shorter	
wire is longer	

(2 marks)

—  
4

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

8 The diagram shows a solar powered fountain.



A motor pumps water from the pond to the fountain.  
The solar cells power the motor.

(a) Complete each sentence by choosing the correct words from the box.

<b>chemical</b>	<b>electrical</b>	<b>gravitational potential</b>	<b>heat (thermal energy)</b>
<b>light</b>	<b>movement (kinetic energy)</b>	<b>sound</b>	

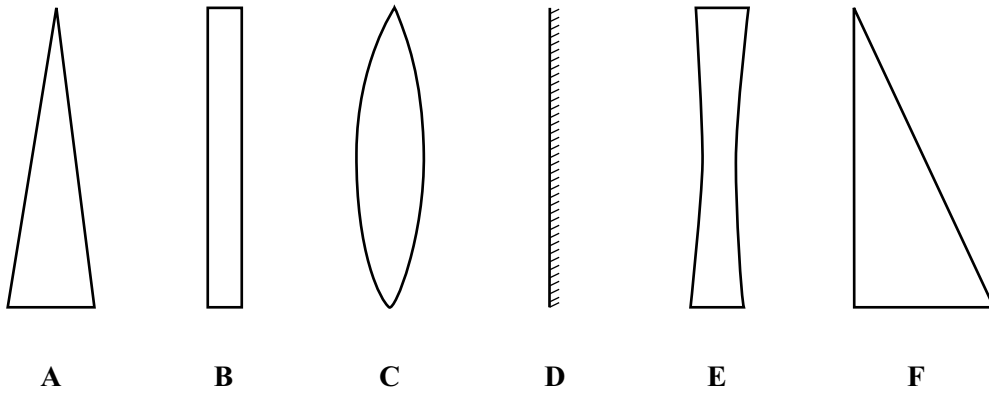
(i) The solar cells transfer ..... energy to electrical energy.  
*(1 mark)*

(ii) The motor is designed to transfer ..... energy to  
..... energy.  
*(2 marks)*

(iii) As the water rises, kinetic energy is transferred to .....  
energy.  
*(1 mark)*

(b) Name **one** form of wasted energy which is transferred when the motor is running.  
..... energy  
*(1 mark)*

9 The diagram shows side views of six pieces of glass.



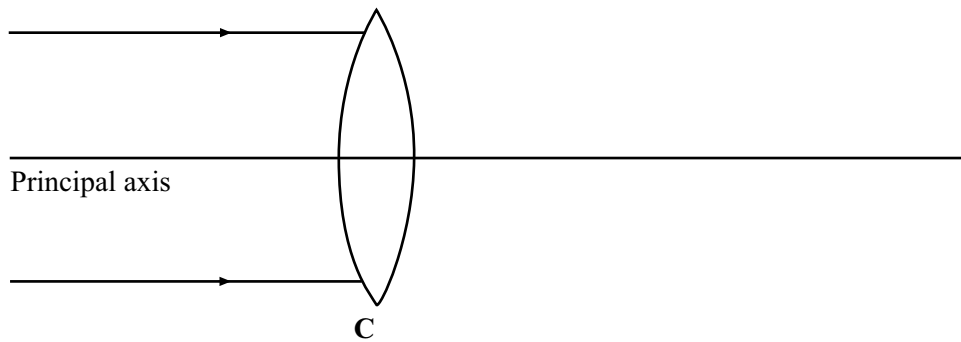
(a) Which of **A**, **B**, **C**, **D**, **E** or **F** is:

(i) a converging lens; .....

(ii) a diverging lens? .....

(2 marks)

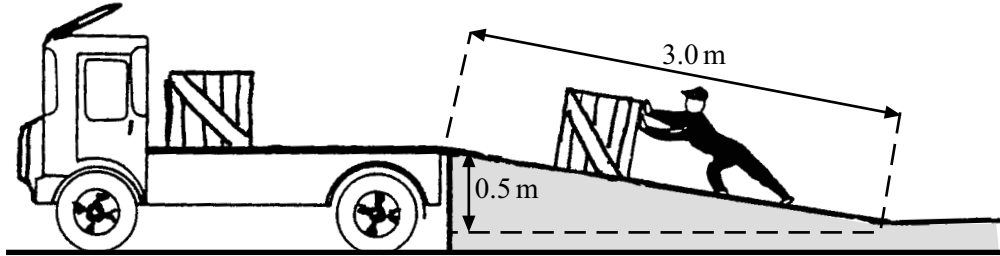
(b) Complete the path of the **two** rays of light to show what happens when they pass through **C**.



(3 marks)

**FORCES**

**10** The diagram shows a person pushing a crate up a slope on to a lorry.



(a) The person pushes the crate along the slope with a force of 200 N.

Calculate the work done pushing the crate along the slope.

Write down the equation you are going to use.

..... (1 mark)

Show clearly how you work out your final answer.

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

Work done = ..... J  
 (2 marks)

(b) The mass of the crate is 60 kg.

(i) Calculate the approximate weight of the crate.

Show clearly how you work out your final answer.

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

Weight = ..... N  
 (2 marks)

- (ii) Explain why more energy is transferred by pushing the crate along the slope than by lifting the crate the vertical distance 0.5 m.

.....

.....

.....

.....

(2 marks)



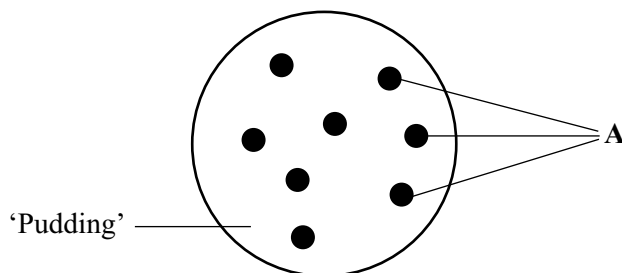
**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**



**WAVES AND RADIATION**

**11** The diagram shows the ‘plum pudding’ model of an atom.



(a) Scientists thought that the ‘pudding’ was positively charged.

(i) Name the particles labelled **A** in the diagram.

..... (1 mark)

(ii) Complete this sentence by choosing the correct words from the box.

<b>negatively charged</b>	<b>positively charged</b>	<b>uncharged</b>
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The particles labelled **A** are ..... (1 mark)

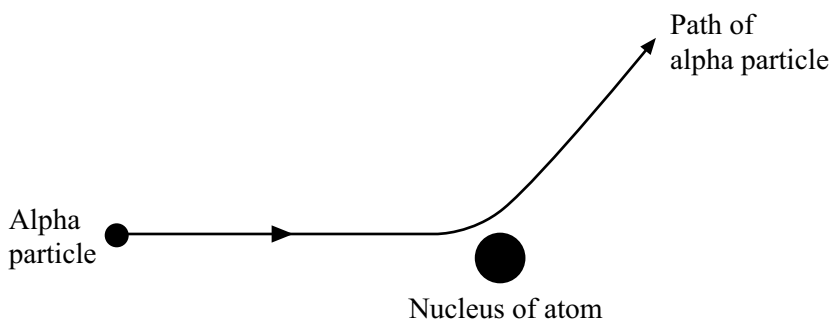
(b) A new model of an atom was suggested by Rutherford and Marsden.

They fired alpha particles at thin metal foil.

Alpha particles are positively charged.

In their model each atom has a nucleus.

The diagram below shows the path of an alpha particle as it passes the nucleus of an atom.

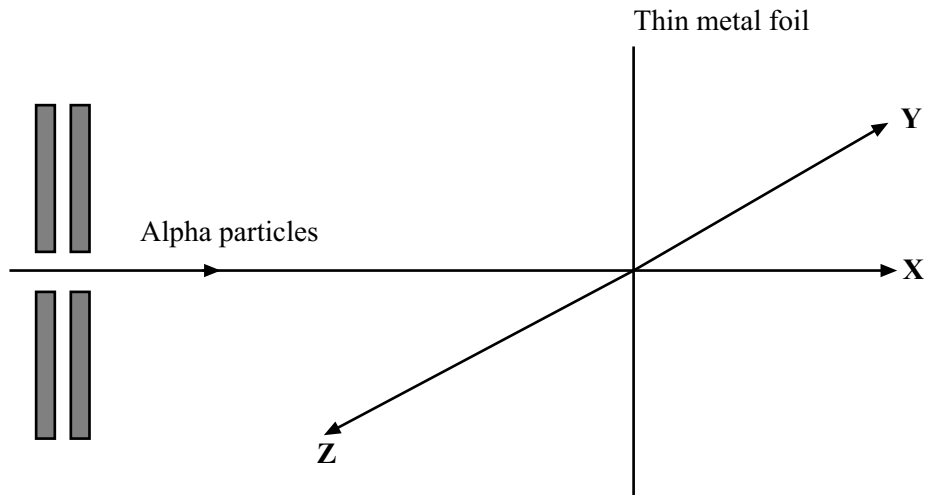


(i) Explain why the alpha particle changes direction.

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

(2 marks)

(ii) The diagram shows different paths taken by alpha particles when they were fired by Rutherford and Marsden at the thin metal foil.

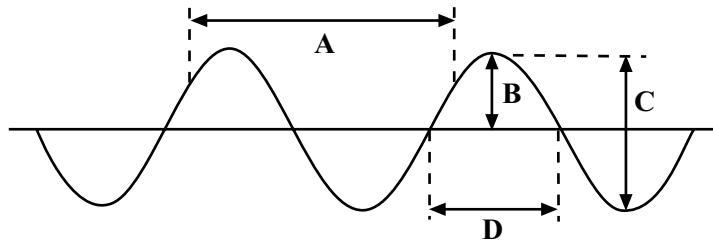


The boxes on the left show some observations from the experiment.  
The boxes on the right give their explanations.  
Draw a straight line from each observation to its explanation.  
One has been done for you.

Observation	Explanation
some alpha particles travel along path <b>Y</b>	because the nucleus has a very large positive charge and a large mass
most of the alpha particles follow path <b>X</b>	because the nucleus is very small
some alpha particles rebound backwards along path <b>Z</b>	because most of each atom is empty space
very few alpha particles follow path <b>Z</b>	because the nucleus is positively charged

(2 marks)

12 The diagram shows a transverse wave.



(a) Which of **A**, **B**, **C** or **D** is:

(i) the wavelength; .....

(ii) the amplitude? .....

(2 marks)

(b) Light waves carry different information to sound waves.

Give **two** other ways in which light waves are different to sound waves.

.....

.....

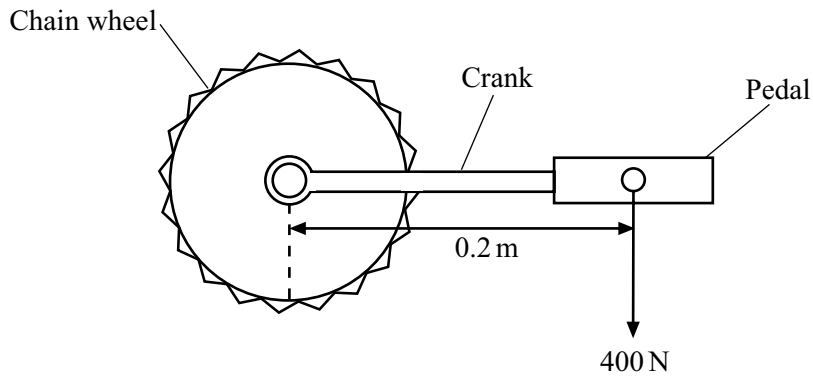
.....

.....

(2 marks)

**FORCES AND MOTION**

**13** The diagram shows a bicycle pedal, crank and chain wheel.



- (a) (i) Complete the **three** spaces to give the equation which is used to calculate the turning effect of a force.

..... = .....

x perpendicular

.....

between line of action and pivot.

*(1 mark)*

- (ii) Calculate the turning effect of the force shown in the diagram.

.....

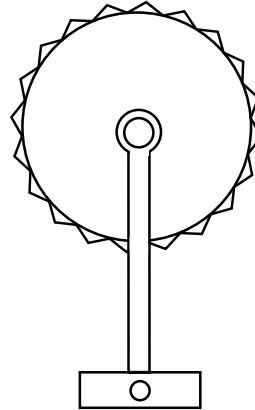
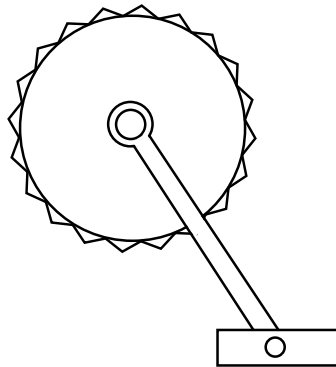
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Turning effect = ..... Nm

*(2 marks)*

(b) These diagrams show two other positions of the pedal.



The cyclist keeps the size and direction of the force constant.  
Explain why the turning effect changes as the cyclist pedals the bicycle.

.....  
.....

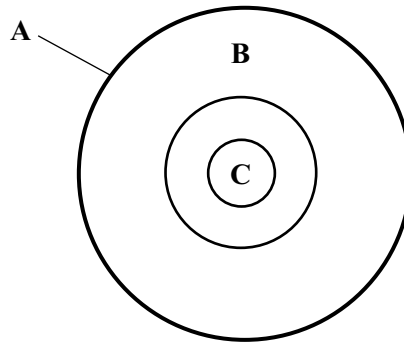
(1 mark)

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**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**

14 The diagram shows a cross-section through the Earth.



(a) Name the parts labelled **A**, **B** and **C**.

**A** .....

**B** .....

**C** .....

(3 marks)

(b) The diagrams show where we think the continents were 200 million years ago, and where they are today.



**200 million years ago**



**Today**

What evidence suggests that **X** and **Y** were once joined?

.....

.....

.....

.....

(2 marks)

(c) The Earth's lithosphere is cracked into a large number of pieces. These pieces are constantly moving.

(i) What are these pieces called?

.....  
(1 mark)

(ii) What types of destructive event may occur at the boundaries between the pieces?

.....  
.....  
(2 marks)

8

**TURN OVER FOR THE NEXT QUESTION**

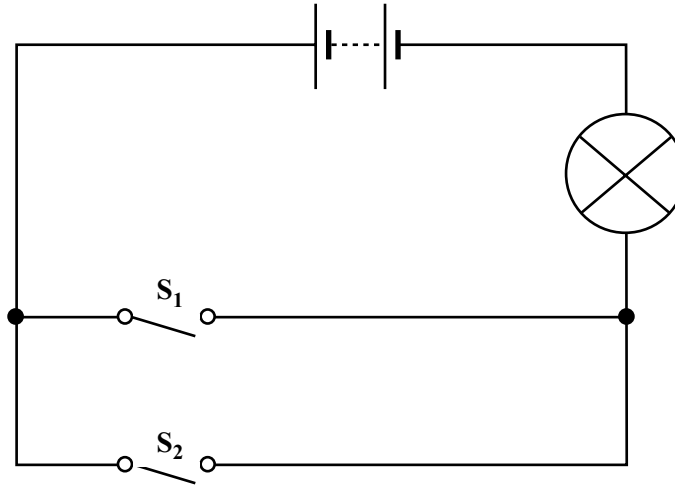
**Turn over ▶**

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**QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES**


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- 15 (a) The circuit contains a lamp and two switches,  $S_1$  and  $S_2$ .



- (i) Complete the truth table for the above circuit.

Switch $S_1$	Switch $S_2$	Lamp
OFF (0)	OFF (0)	OFF (0)
ON (1)	OFF (0)	
OFF (0)	ON (1)	
ON (1)	ON (1)	

(1 mark)

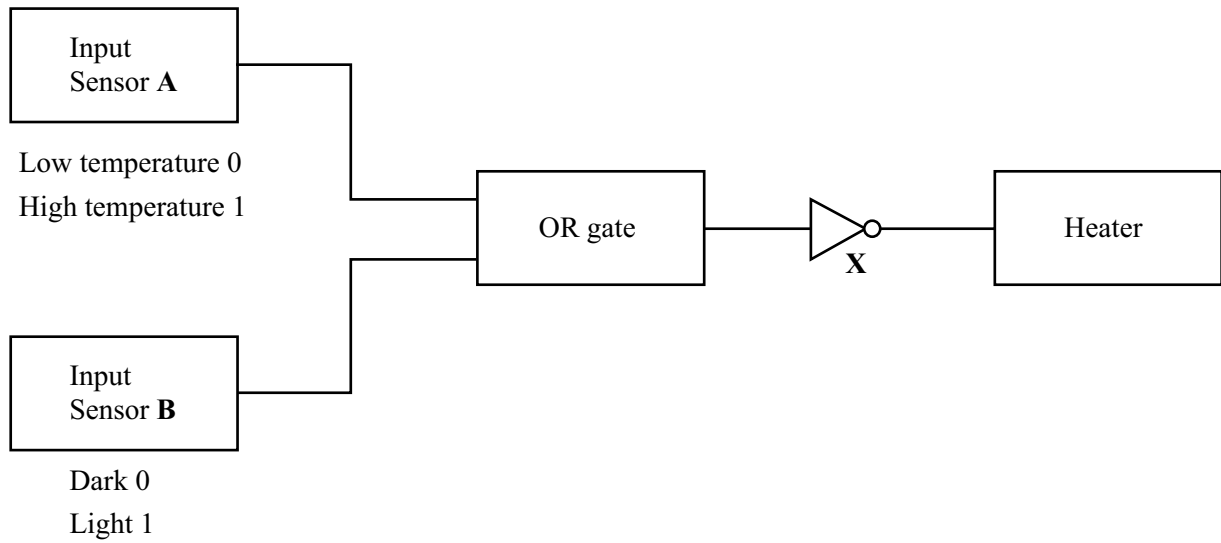
- (ii) Which type of logic gate produces this truth table?

.....

(1 mark)



(b) The diagram shows an electronic system used to switch on a heater in a greenhouse.



What is:

- (i) X; .....
- (ii) input sensor A; .....
- (iii) input sensor B? .....

(3 marks)

(c) When will the heater be ON?

Explain your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

