Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

Leave blank

General Certificate of Secondary Education
June 2004

ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS (MODULAR) SPECIFICATION A FOUNDATION TIER 3453/F

Tuesday 22 June 2004 9.00 am to 10.30 am

F

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

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.

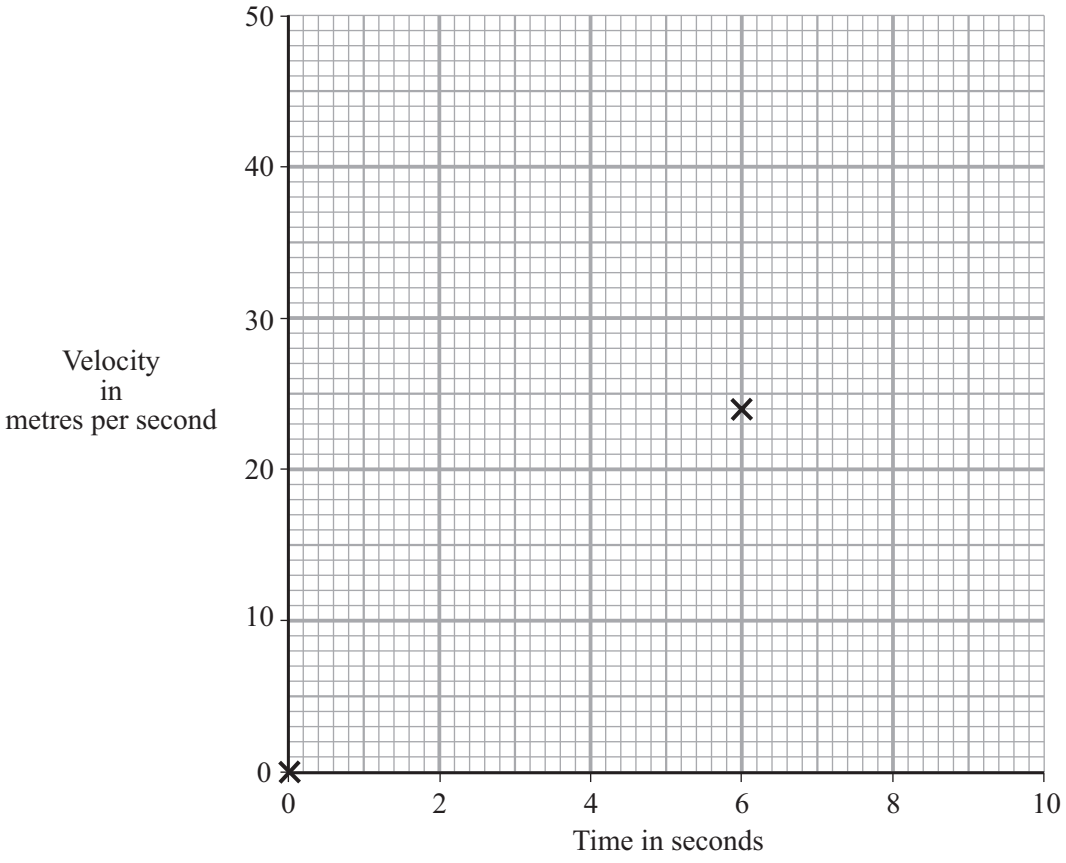
For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

FORCES

1 The table gives values of velocity for a small aircraft moving along a runway.

Velocity in metres per second	0	8	16	24	32	40
Time in seconds	0	2	4	6	8	10

(a) Plot a graph of velocity against time.
Two of the points have been plotted for you.



(3 marks)

(b) Use your graph to find:

(i) the velocity after 7.0 seconds;

Velocity = ...metres per second

(ii) the time at which the velocity is 12 metres per second.

Time = ...seconds
(2 marks)

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

The aircraft is

slowing down
moving at a steady speed
speeding up

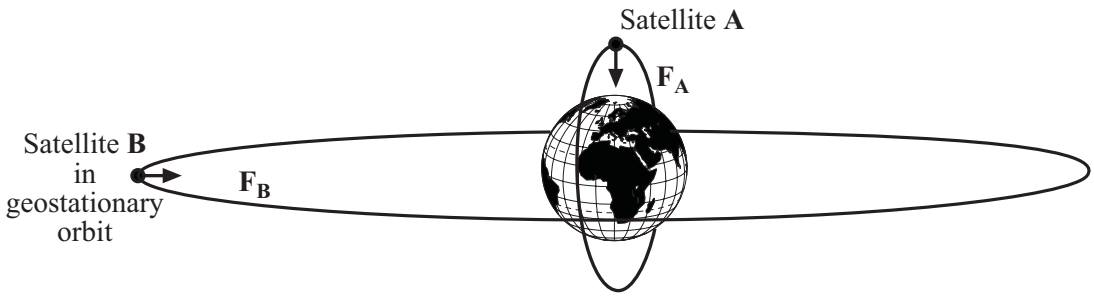
.

(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

2 The diagram shows two satellites going round the Earth.



The two satellites have the same mass.

(a) Complete each of the sentences by crossing out the **two** lines in each box that are wrong.

(i) The satellites are attracted to the Earth by a force called

air resistance
friction
gravity

.

(ii) Satellite **B** is further from the Earth than satellite **A**, so Force $\mathbf{F_A}$ is

smaller than $\mathbf{F_B}$
the same size as $\mathbf{F_B}$
bigger than $\mathbf{F_B}$

.

(iii) The time taken for one orbit by satellite **A** is

less than the time for satellite **B**
the same as the time for satellite **B**
more than the time for satellite **B**

.

(3 marks)

(b) The orbits of communication satellites are described as *geostationary*. Explain why.

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.

.....

.....

.....

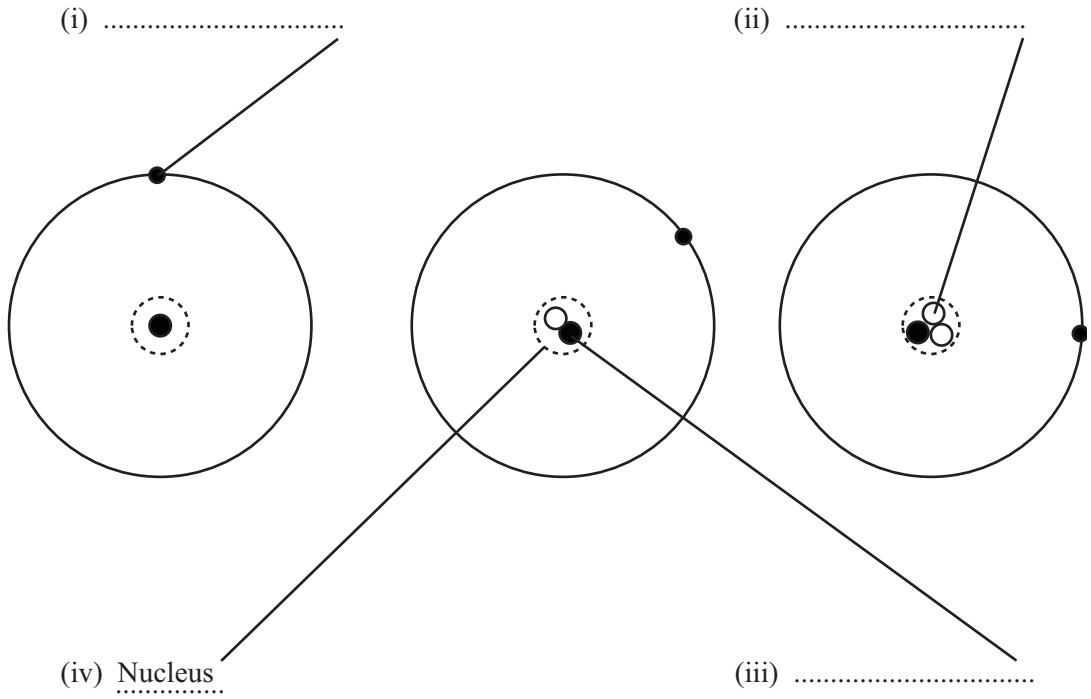
.....

(2 marks)

5

WAVES AND RADIATION

3 The diagrams show three different types of hydrogen atom.



(a) Choose words from the box to label the diagrams.

One has been done for you.

electron	**neutron**	**nucleus**	**proton**

(3 marks)

(b) (i) Choose **two** particles from the box which have the same mass.

.....and .....

(ii) Which particle named in the box has a positive charge?

.....

(3 marks)

(c) What name is given to atoms of the same element, with different numbers of particles in the nucleus?

.....

(1 mark)

7

4 The symbol below warns of danger from radiation.

(a) Different types of radiation have different effects on living cells. This is shown in the table.

Choose types of radiation from the list to complete the table.
Two have been done for you.

infra red radiation
gamma radiation
microwave radiation
ultraviolet radiation
X-radiation

Type of radiation	Effect of radiation
.....	can be absorbed by water in cells
.....	can produce a suntan
gamma radiation	can cause cancer
infra red radiation	can be felt as heat
.....	can produce shadow pictures of bones

(3 marks)

(b) Radiographers working in hospitals are exposed to different types of radiation.

Tick (✓) the **two** things that they can do which will reduce their exposure to radiation.

Keep as far away from the equipment as possible. ☐

Wash hands. ☐

Wear a badge containing photographic film. ☐

Wear a lead apron. ☐

Wear rubber boots. ☐

(2 marks)

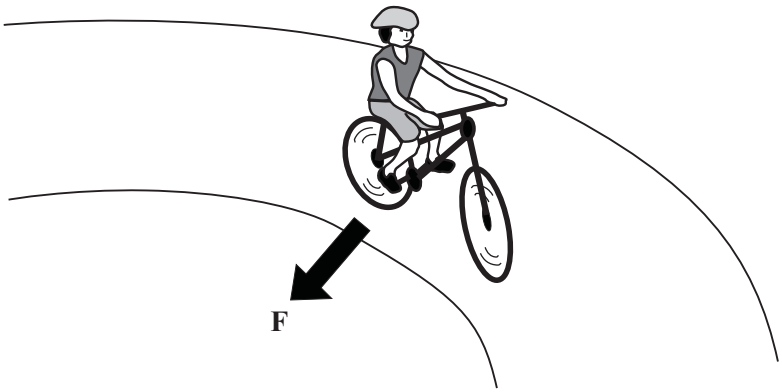
5

TURN OVER FOR THE NEXT QUESTION

NO QUESTIONS APPEAR ON THIS PAGE

FORCES AND MOTION

5 The diagram shows a cyclist going round a bend.



Force **F** is the force needed to keep the cyclist moving in a circle.

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

central	**centrifugal**	**centripetal**	**gravitational**

Force **F** is called the.....force.

(1 mark)

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

bigger	**smaller**	**the same size**

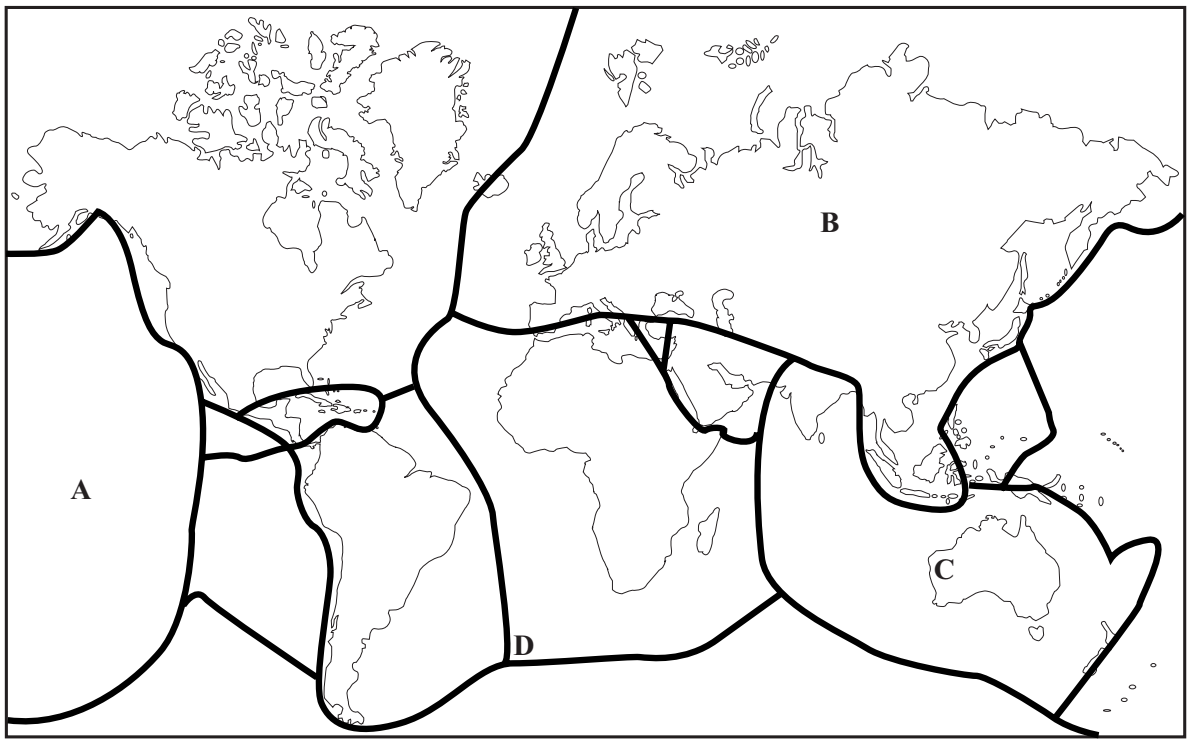
(i) When the cyclist in the diagram goes round the bend at a greater speed, the force **F** is ..... .

(ii) When the cyclist in the diagram goes round a bend with a larger radius at the same speed, the force **F** is ..... .

(2 marks)

3

6 The map shows how the Earth's surface is cracked into a number of large pieces.



Source: WITNEY, DROZDOWSKA & MAILE, *Waves* (Hodder & Stoughton) 2002
adapted and reprinted by permission of Hodder Arnold.

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

crust	**lithosphere**	**mantle**	**tectonic**

The Earth's ..... , which is the ..... and the upper part of the ..... , is cracked into a number of large pieces. The pieces, called ..... plates, are constantly moving.

(4 marks)

(b) At which of the points, **A**, **B**, **C** or **D**, is an earthquake most likely to happen? Explain why.

.....

.....

.....

.....

(2 marks)

(c) Scientists study earthquakes and the shock waves which they produce. They use the data they obtain to help them to predict earthquakes.

Put a cross (×) next to the statement that is **incorrect**.

Earthquakes and volcanoes occur in similar places. ☐

It is easy to predict in which region earthquakes will occur. ☐

It is easy to predict when earthquakes will occur. ☐

Scientists use seismometers to study earthquake waves. ☐

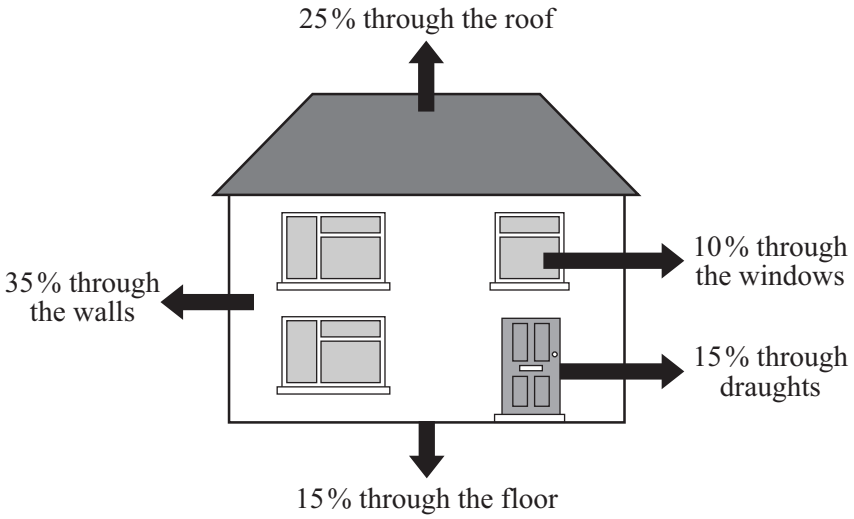
(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

7 The diagram shows how heat escapes from a house.



(a) (i) Through which part of this house is most heat lost?

.....

(1 mark)

(ii) Complete the sentence below.

The amount of heat lost through the floor can be **reduced** by fitting.....

..... .

(1 mark)

(iii) Complete the sentence below.

The amount of heat lost through the windows can be **reduced** by fitting.....

..... .

(1 mark)

(b) The table shows the cost of fitting various things to reduce heat loss from the house. It also shows the money saved each year when they have been fitted.

Fitting	Cost	Money saved per year
Cavity wall insulation	£450	£250
Draught-proofing	£25	£50
Double-glazing	£1200	£60
Loft insulation	£150	£100

Using the information given in the table, explain which is the most cost-effective thing to fit.

.....

.....

.....

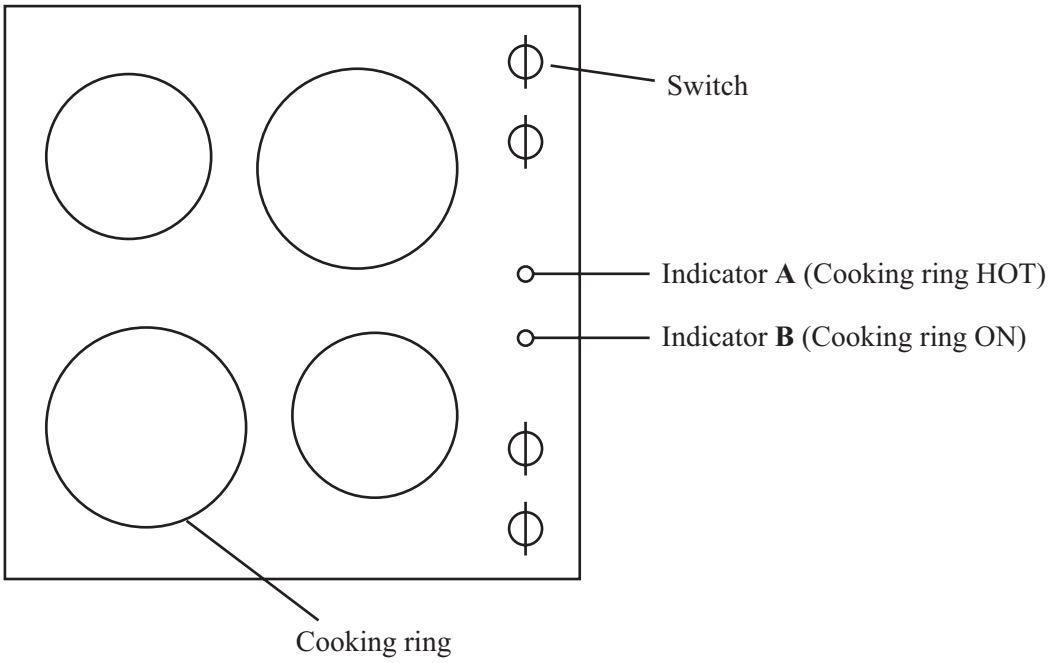
.....

(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

8 The diagram shows an electric cooker with four cooking rings, as seen from above.



(a) An electronic system controls the indicators **A** and **B**.

(i) What could be used as the input sensor for indicator **A**?

.....

(1 mark)

(ii) Which part of an electronic system decides on the action needed?

.....

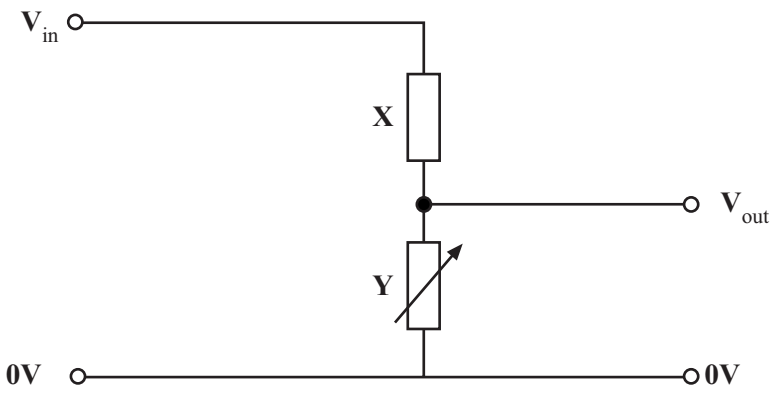
(1 mark)

(iii) What could be used as the output device for both **A** and **B**?

.....

(1 mark)

(b) The input sensor for indicator **A** is used as the resistor **X** in the circuit below.



(i) The value of **Y** can be changed.

What is **Y**?

.....

(1 mark)

(ii) Explain how changing the value of **Y** will affect the way in which indicator **A** works.

.....

.....

.....

.....

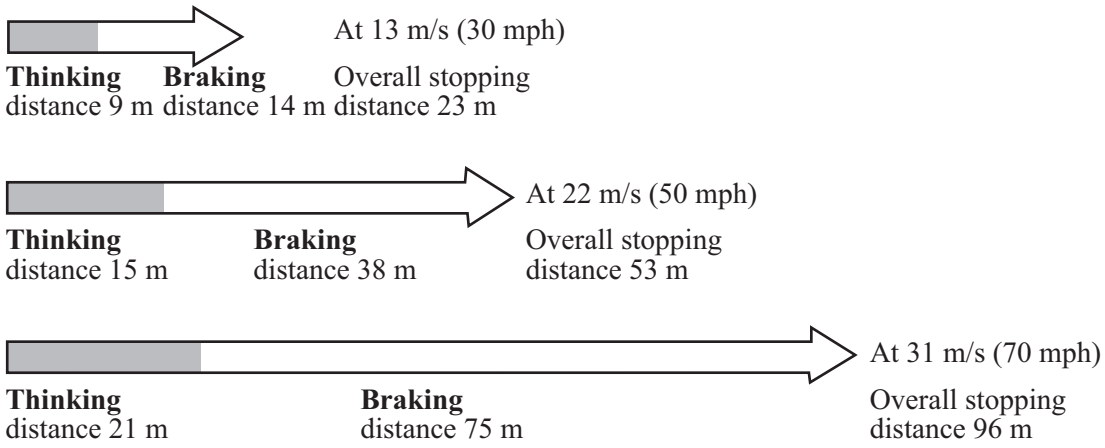
(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

FORCES

9 The diagrams below show the total stopping distance of a motorcyclist travelling at different speeds.



(a) Describe how the thinking distance and the braking distance change with the speed of the motorcyclist.

.....

.....

.....

.....

.....

.....

(2 marks)

(b) (i) Name **two** factors, other than the speed of the motorcycle, which would increase the thinking distance of the motorcyclist.

1 .....

.....

2 .....

.....

(2 marks)

(ii) Name **two** factors which would increase the braking distance of the motorcyclist on a wet road.

1 .....

.....

2 .....

.....

(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

10 A space probe, Beagle 2, was launched in 2003 by the European Space Agency. It is part of the *Mars Express* programme.
The project leader, Professor Colin Pillinger, commented: "Britain has a history of exploring our planet. It is about time we started exploring the other planets as well".
Space probes are designed to send pictures back to Earth, and collect samples of soil and rock.

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

fossils	**hydrogen**	**iron**	**sulphur**	**water**

If scientists found ..... or ..... on Mars, it would indicate that there may be, or once was, life there. *(2 marks)*

(b) The sending of probes deep into space is very expensive, and the space flights would take too long. For over forty years, a *SETI* team in the USA has been monitoring signals coming from space.

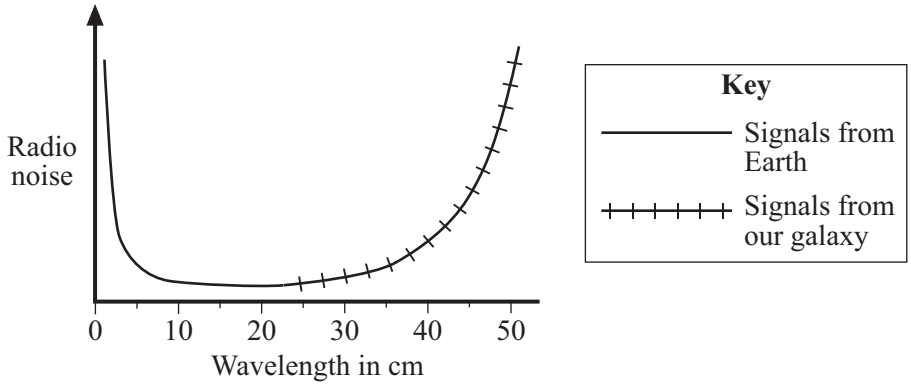
(i) What is *SETI*?

.....
(1 mark)

(ii) What piece of equipment does a *SETI* team use?

.....
(1 mark)

(iii) The graph shows radio noise, of various wavelengths, detected by a *SETI* team.



Choose a range of wavelengths from the box to complete the sentence.

0 – 5	**10 – 20**	**30 – 40**	**40 – 50**

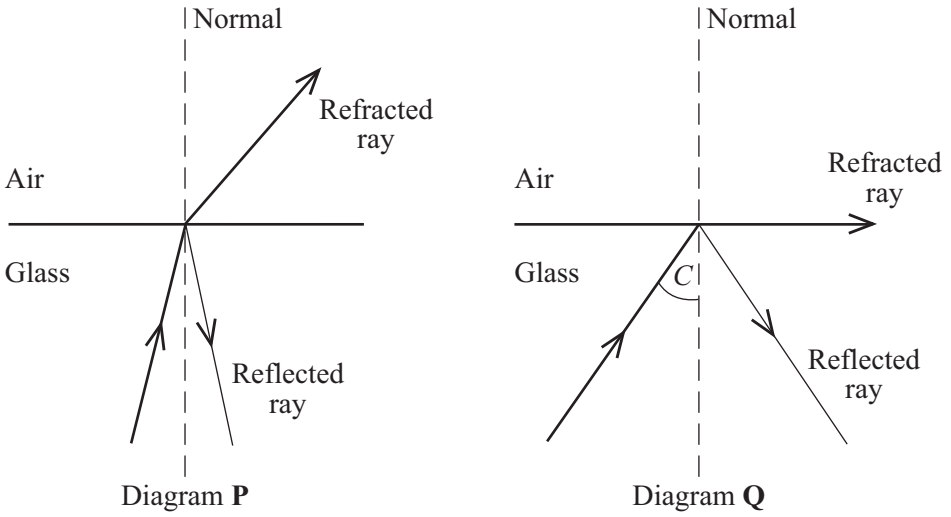
To monitor signals coming from space, the *SETI* team would investigate radio signals with wavelengths in the range ..... cm. *(1 mark)*

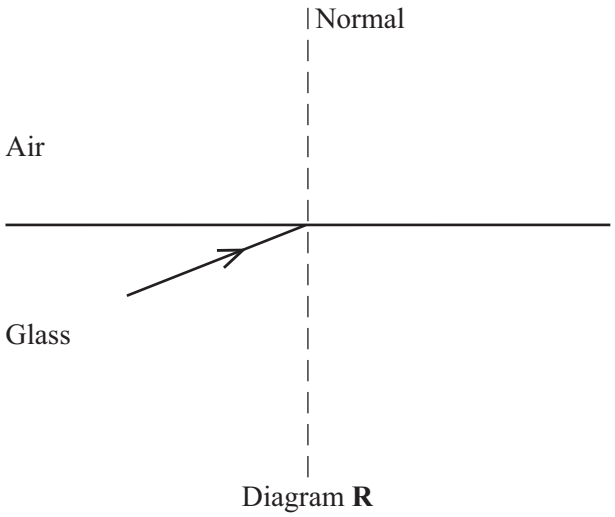
WAVES AND RADIATION

11 (a) The diagrams show three different rays hitting the boundary between glass and air. The rays hit the boundary at different angles.

Complete diagram **R** to show what happens to the ray of light after it hits the boundary.

(1 mark)

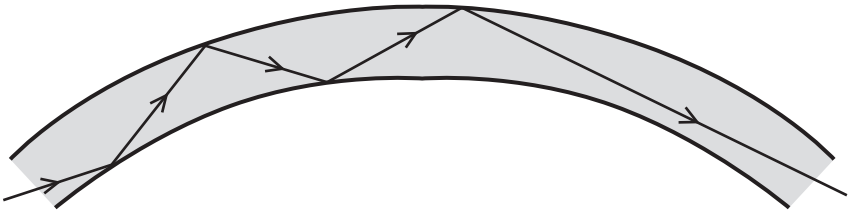




QUESTION 11 CONTINUES ON THE NEXT PAGE

(b) Information can be carried by light travelling along optical fibres.

The diagram shows a ray of light travelling through an optical fibre.



(i) Name the process by which the ray of light travels through the fibre.

.....

(1 mark)

(ii) Explain, as fully as you can, why information is sent by means of light travelling along optical fibres, rather than by electrical signals in metal cables.

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.

.....

.....

.....

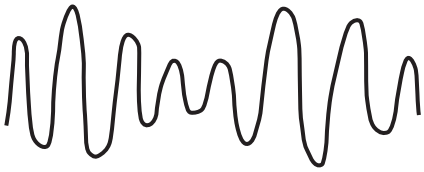
.....

(2 marks)

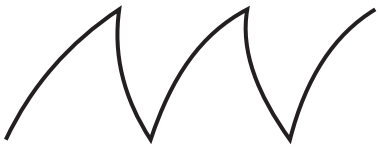
(c) The diagrams show four types of signal, **L**, **M**, **N** and **P**.

L

M



N



P

(i) Which of the signals, **L**, **M**, **N** or **P**, is a digital one? .....

(1 mark)

(ii) Explain, as fully as you can, why information is often sent as digital signals, rather than as analogue ones.

.....

.....

.....

.....

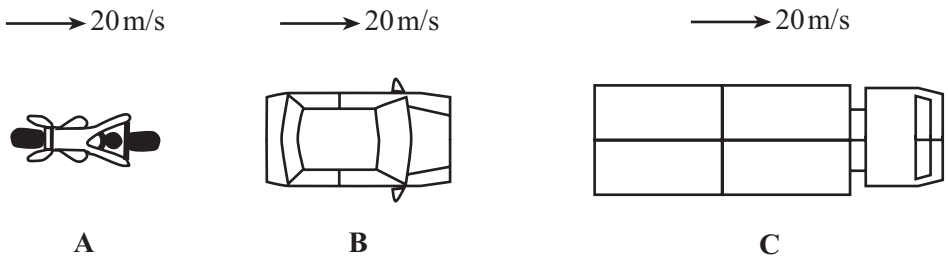
(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

FORCES AND MOTION

12 (a) The diagram shows three vehicles, **A**, **B** and **C**, travelling along a road at 20 m/s.



Which vehicle, **A**, **B** or **C**, has the greatest momentum?

Give the reason for your answer.

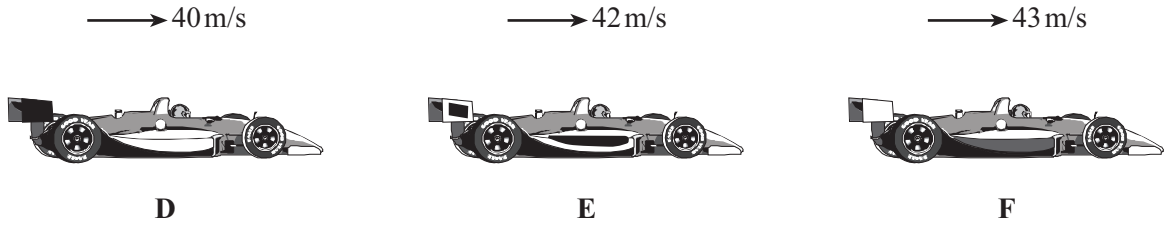
Vehicle:.....

Reason: .....

.....

(2 marks)

(b) The next diagram shows three racing cars, **D**, **E** and **F**, all with the same mass, travelling at different speeds along the straight part of the track.



Which racing car, **D**, **E** or **F**, has the greatest momentum?

Give the reason for your answer.

Vehicle:.....

Reason: .....

.....

(2 marks)

(c) Racing car **D** has a mass of 1250 kg.

Calculate its momentum.

Write down the equation you are going to use.

.....

(1 mark)

Show clearly how you work out your answer, and include the unit.

.....

.....

.....

.....

.....

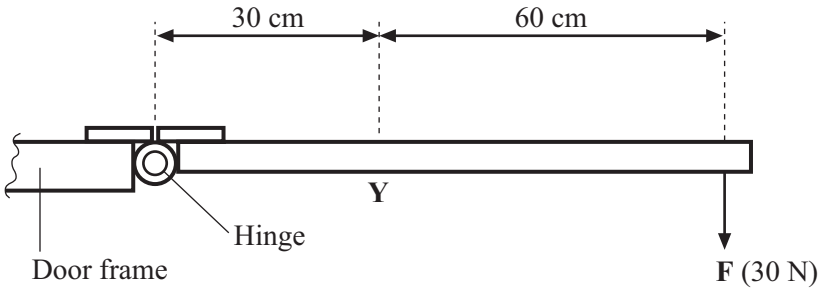
Momentum = ...

(3 marks)

8

TURN OVER FOR THE NEXT QUESTION

13 The diagram shows an overhead view of a door.
The door is fixed to the door frame by a hinge. It can be opened by applying a force of 30 N.



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

..... = ... × perpendicular .....

between line of action and pivot.

(1 mark)

(ii) Calculate the turning effect of the force, **F**, in the diagram.

Show clearly how you work out your answer.

.....

.....

.....

.....

Moment = ... Ncm

(2 marks)

(b) Someone pushes the door open by applying a force at **Y**. The force needed to open the door is **not** 30 N. Explain why the force needed to open the door is different.

.....

.....

.....

.....

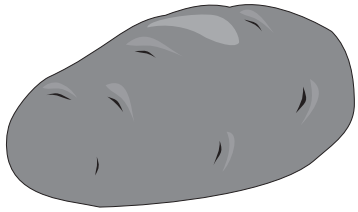
(2 marks)

5

LEAVE MARGIN BLANK

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

14 The drawing shows a hot baked potato.



(a) The amount of energy radiated by the potato depends on the size and nature of its surface. What else affects the amount of energy radiated by the potato?

.....

(1 mark)

(b) Cooks often keep hot potatoes in shiny foil.

Explain why.

.....

.....

.....

.....

(2 marks)

(c) When potatoes, wrapped in foil, are cooked on a barbecue, the foil goes black.

What effect does this have on the temperature of the potatoes when they are taken off the barbecue, compared with that of hot potatoes in clean shiny foil?
Give a reason for your answer.

Effect: .....

.....

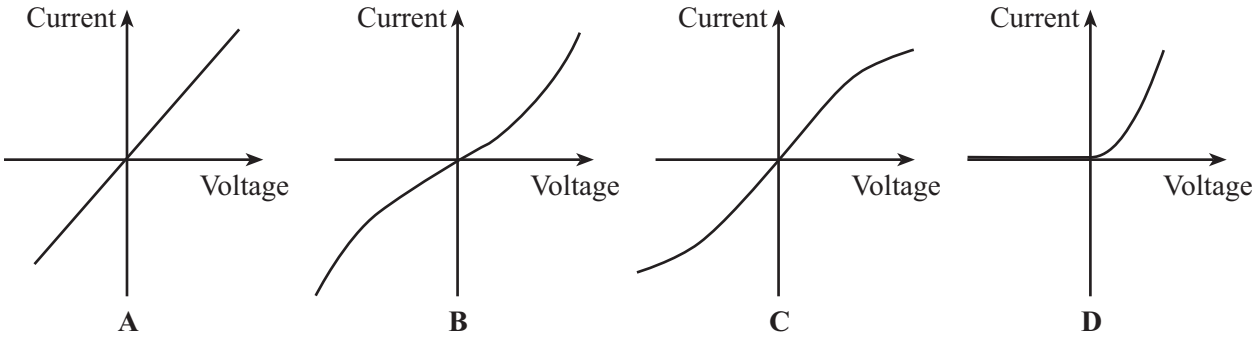
Reason: .....

.....

(2 marks)

5

15 The graphs **A**, **B**, **C** and **D** show how the current through a component varies with the potential difference (voltage) across it.



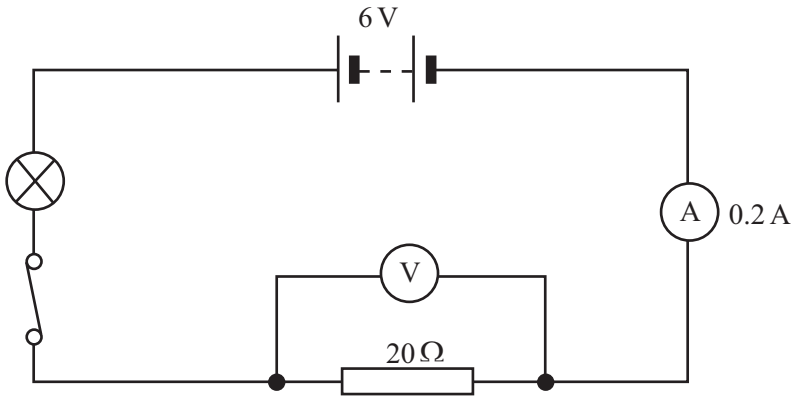
(a) Which graph, **A**, **B**, **C** or **D**, represents:

(i) a diode; .....

(ii) a filament lamp? .....

(2 marks)

(b) The diagram shows a simple circuit.



(i) Write down an equation used to calculate potential difference.

.....

(1 mark)

(ii) Calculate the reading on the voltmeter.

Show clearly how you work out your answer.

.....

.....

.....

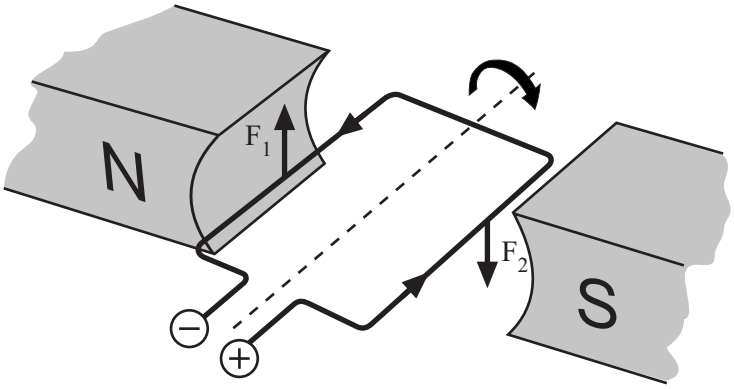
.....

Voltmeter reading = ... V

(2 marks)

5

16 The diagram shows a simple electric motor.



Source: adapted from KEITH JOHNSON, *Physics for You* (Stanley Thornes) 1996

The coil turns as shown in the diagram.

(a) State **two** ways of reversing the direction of forces $\mathbf{F_1}$ and $\mathbf{F_2}$.

1 .....

.....

2 .....

.....

(2 marks)

(b) Give **two** ways in which the size of the forces can be increased.

1 .....

.....

2 .....

.....

(2 marks)

4

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE