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Candidate Name	Centre Number	Candidate Number

OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
General Certificate of Secondary Education

SCIENCE: DOUBLE AWARD A PAPER 6 **1983/6**
SCIENCE: PHYSICS (OPTIONS A & B) PAPER 2 **1982/2**
HIGHER TIER

Wednesday **22 JUNE 2005** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Calculators may be used.
Additional materials required:
Pencil
Ruler (cm/mm)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and candidate number in the spaces at the top of this page.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.

  This means, for example, you should
  - write in clear, ordered sentences,
  - use correct spelling, punctuation and grammar,
  - use correct scientific words.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	7	
2	8	
3	9	
4	16	
5	6	
6	11	
7	8	
8	7	
9	13	
10	5	
11	10	
TOTAL	100	

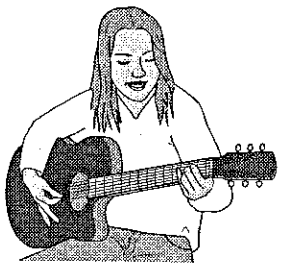
This question paper consists of 19 printed pages and 1 blank page.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 Maria is investigating sound waves.

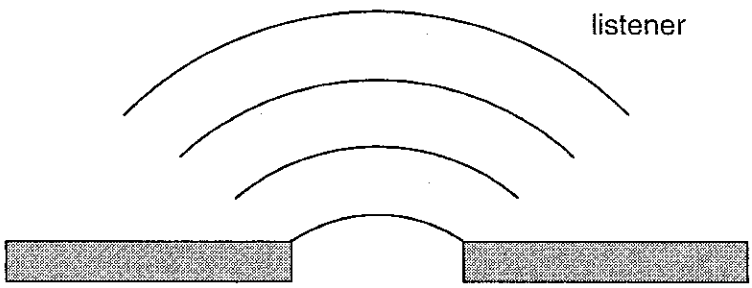
(a) She plays a note on her guitar.
The frequency of the note is 500 Hz.
The wavelength of the note is 68 cm.
Calculate the speed of sound.



You are advised to show how you work out your answer, including any equation used.

speed of sound = ... unit .....[4]

(b) When Maria plays this note on her guitar, the sound waves are easily diffracted.
The diagram represents these sound waves after they have travelled through an open doorway.



Maria

(i) Use your knowledge of diffraction to explain why the sound waves are easily diffracted.

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.....[2]

Maria's guitar can be heard around the corner but it cannot be seen.

(ii) Explain why light waves are not diffracted by a similar amount.

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.....[1]

[Total: 7]

2 Look at the photograph.
The snow on part of the roof has melted because the house is poorly insulated.

(a) By what process is energy transferred through the tiles on the roof?

.....[1]

(b) Nearly a third of the energy loss from a poorly insulated house is through the walls.

(i) Cavity wall insulation reduces energy transfer.
Use your ideas about conduction and convection to explain this.

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.....[2]

(ii) Some people put aluminium foil behind radiators to reduce energy transfer through the walls.
Explain how this reduces energy loss. Your answer **must** name the energy transfer process.
(One mark is for using correct scientific words.)

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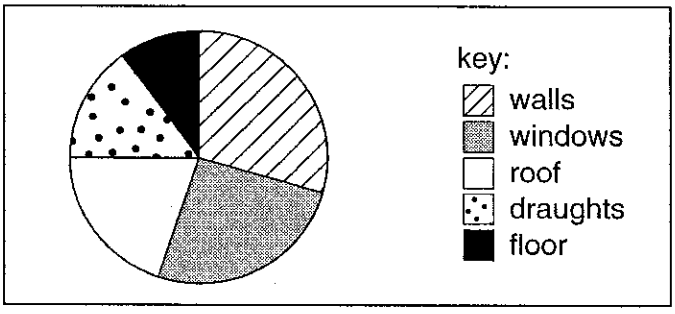
.....[3+1]

(c) The pie-chart shows where energy is lost from a house.

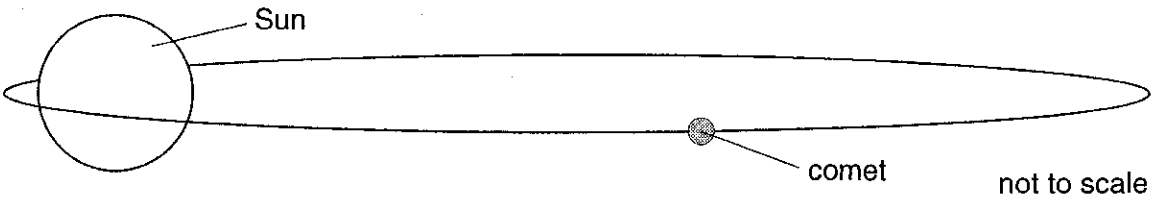
Suggest why it is better to insulate the walls or windows than it is to insulate the floor.



.....[1]

[Total: 8]

3 **(a)** The diagram shows the path of a comet as it orbits the Sun.



(i) Gravity is the force which keeps a comet in orbit around the sun.
Write an **X** on the diagram to show where, on the path of the comet, this force is greatest. [1]

(ii) The speed of a comet is not the same along its path. Describe how the speed changes during one complete orbit.

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.....[2]

(b) The most distant objects that astronomers have found are called quasars.

They are very bright, and light from them shows large amounts of red shift.

It is estimated that light from quasars has taken 12 billion years to reach the Earth.

(i) Explain what is meant by the term **red shift**.

.....

.....[1]

(ii) What information does this give about the motion of quasars relative to the Earth?

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.....[2]

(c) Many astronomers believe that the Universe is expanding and will continue to do so.

They also believe that the rate of expansion depends on the total mass of the Universe.

Explain how the **mass** of the material in the Universe determines the possible future of the Universe.

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.....[3]

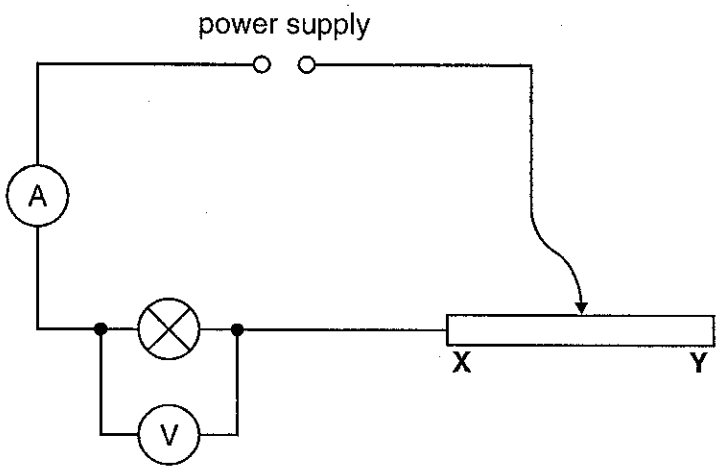
[Total: 9]

Turn over for Question 4.

4 This question is about current electricity.

George is investigating the resistance of a filament bulb.

He sets up the following circuit:



(a) The variable resistor is made of a long length of resistance wire **XY**.
A sliding contact can move from **X** to **Y**.
Using ideas about resistance and current, explain what happens to the brightness of the bulb as the contact is moved from **X** to **Y**.

(One mark is for a clear, ordered answer.)

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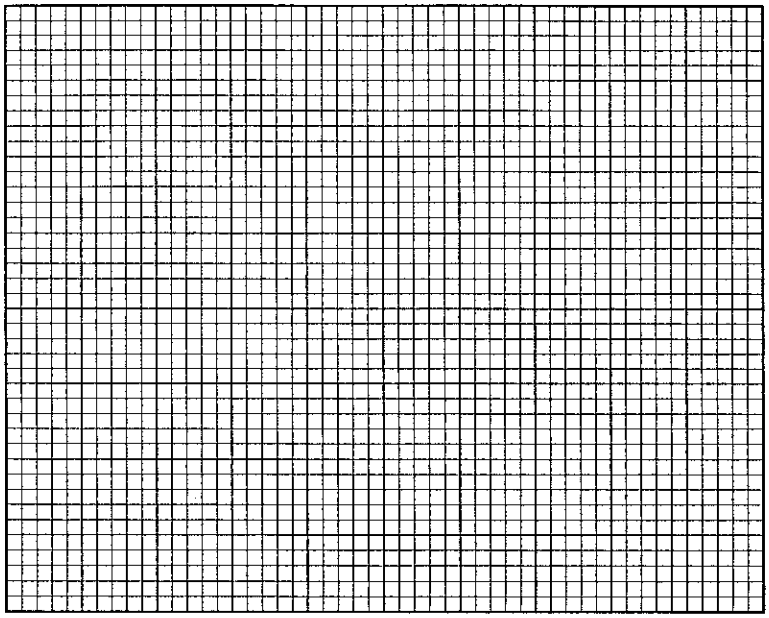
.....

.....[3 + 1]

(b) During the experiment, George took the following readings.

voltage across bulb in V	current through bulb in A
2.0	0.40
4.0	0.80
5.8	1.16
8.1	1.62
10.0	1.90
12.5	2.20

(i) Plot a graph of voltage on the vertical (y) axis against current on the horizontal (x) axis.



[4]

(ii) Explain what happens to the resistance of the filament bulb as the voltage across it is increased from 0 V to 12 V. **Use your graph to help you.**

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.....[4]

(c) The variable resistor **XY** is adjusted until the voltage is 4 V.

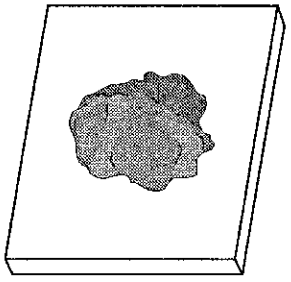
Calculate how much charge flows through the bulb in 10 minutes.
You are advised to show how you work out your answer, including any equation used.

charge = ... coulombs [4]

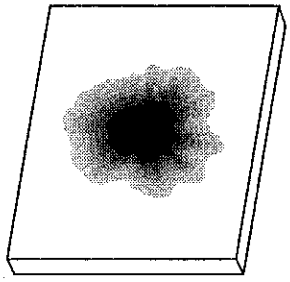
[Total: 16]

5 Read the following sentences about the discovery of radioactivity. Then use them to help you answer the questions.

Radioactivity was discovered by a French scientist called Henri Becquerel.
He left some rocks containing uranium on top of a photographic plate.
The plate was wrapped in thick black paper.
When he developed the plate, he found a dark patch on it.
He wondered if he had discovered a new type of radiation.



rock on undeveloped photographic plate wrapped in thick paper



developed photographic plate

(a) Suggest why Becquerel thought that the dark patch on the photographic plate was due to radiation from the uranium.

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.....[1]

(b) Use Becquerel's observations to suggest **two** properties of this radiation.

property 1 .....

.....

property 2 .....

.....[2]

(c) Use your ideas about radioactivity to explain which type of radioactive emission could **not** have been detected in this experiment.

.....

.....[2]

(d) Becquerel extended his experiment.
He put sheets of different materials, such as glass and metals, between the rocks and photographic plates.
The plates still showed dark patches when he developed them.

Suggest why Becquerel decided to extend his experiment using sheets of materials between the rocks and the photographic plates.

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.....[1]

[Total: 6]

Turn over for Question 6.

6 Navdeep does an experiment to find the half-life of a radioactive isotope, iodine-131.

His first job is to find the level of the background radiation.

(a) (i) What is background radiation?

.....

.....[1]

(ii) Write down **two** sources of background radiation.

1. .....

2. .....[2]

(b) (i) Explain what is meant by the **half-life** of a radioactive isotope.

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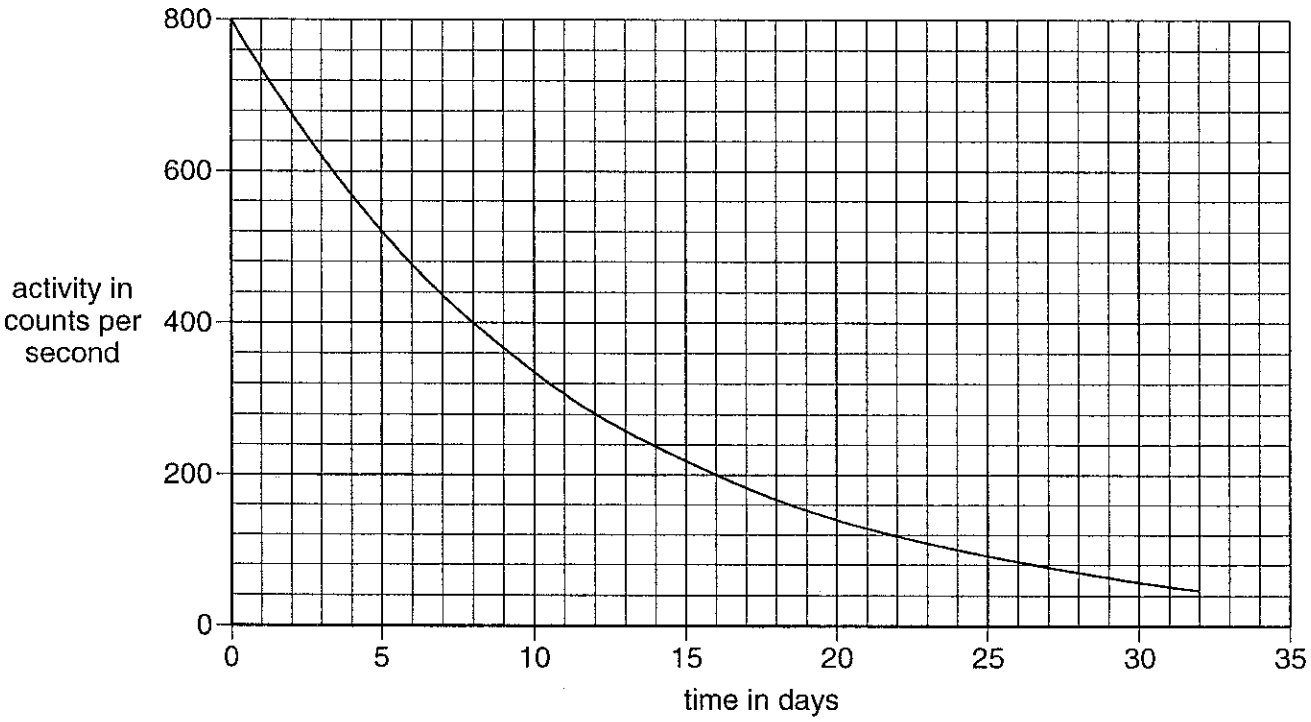
.....[1]

(ii) He measures the activity of a sample of iodine-131 for a period of time.

He plots this graph from his results.



Use the graph to find the half-life.

You **must** show clearly **on the graph** how you work out your answer.

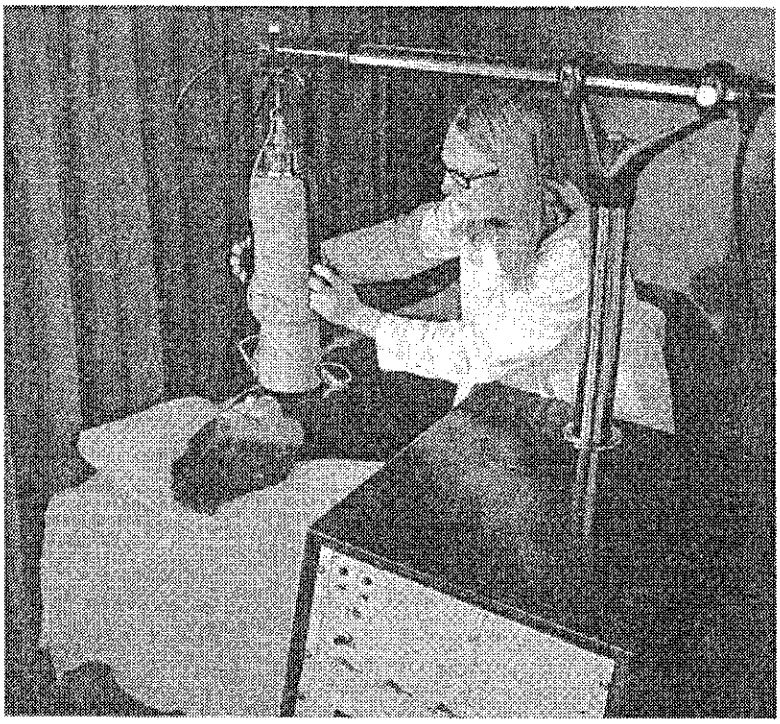
half-life = ... days [2]

(c) Now read this information about the use of iodine-131.

Iodine-131 is used as a radioactive tracer in the human body.

It is used to see if the thyroid gland is working properly.

The radioactive iodine-131 is monitored by a doctor for several days after it has been administered to the patient.



Another isotope, iodine-128, has a half life of 25 minutes.

(i) Why is iodine-128 **not** suitable in this situation?

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.....[1]

(ii) Using radioactive tracers in this way has both **benefits and risks** for the patient. Suggest how a doctor could explain these benefits and risks to a patient.

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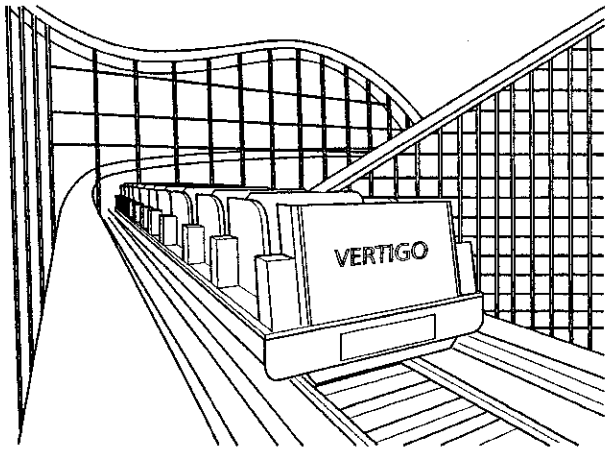
.....[4]

[Total: 11]

7 Mark is in a train on a roller coaster.



Mark's weight is 800 N.

(a) The height of the first hill is 60 m.

Calculate the work done by the roller coaster motor to lift Mark 60 m.

You are advised to show how you work out your answer, including any equation used.

work done = ... unit ..... [4]

(b) The train motor is not 100% efficient.

Use the example of this roller coaster and your ideas about **energy** to explain this.

(One mark is for using correct spelling, punctuation and grammar.)

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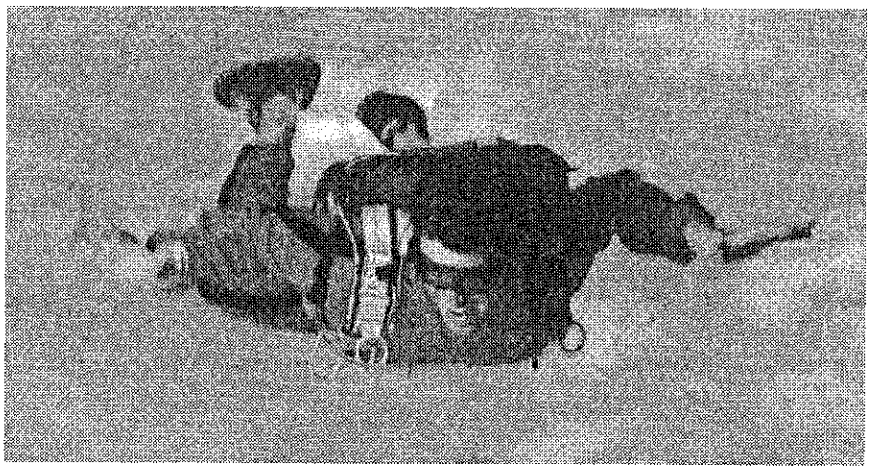
.....[3+1]

[Total: 8]

8 Jan is a free fall parachutist.



As he falls, there are **two** forces acting on him.

(a) Write down the name of these two forces and the direction in which they act.

force 1 name ..... direction .....

force 2 name ..... direction .....[2]

(b) Describe what happens to the size of these forces as he falls and explain why he eventually reaches a maximum speed.

(One mark is for using correct spelling, punctuation and grammar.)

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.....[4 + 1]

[Total: 7]

9 This question is about transmitting electricity.

(a) Chris has bought an old cottage. It has no electricity supply.

It is two kilometres from the nearest 230 volt mains electricity supply.

(i) Chris wants to connect his cottage directly to the mains supply with long cables.

He is told this will not work. Explain why.

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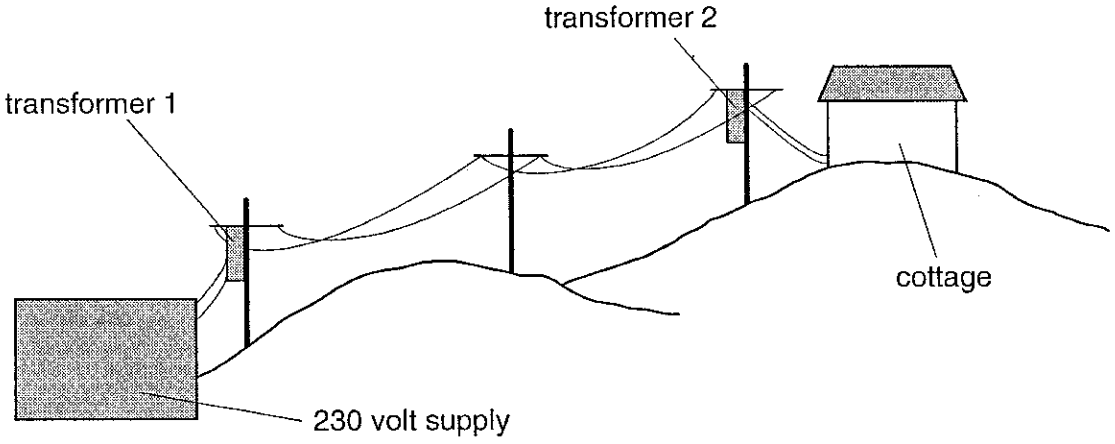
.....[1]

(ii) Chris needs to use two transformers to solve this problem.



Describe how these transformers are used.

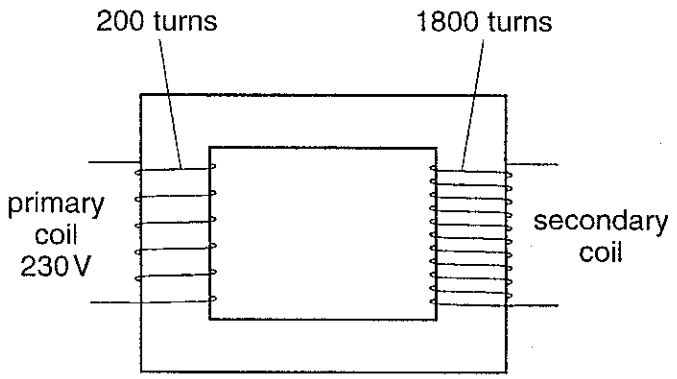
transformer 1 .....

.....

transformer 2 .....

.....[3]

(b) The diagram represents a transformer.
The primary coil has 200 turns and the voltage across this coil is 230 V.
The secondary coil has 1800 turns.



In the following calculations, you may assume that the transformer is 100% efficient.

(i) Calculate the voltage across the secondary coil.
You are advised to show how you work out your answer including any equation used.

voltage = ...V [3]

The power supplied to the primary coil is 4600 watts.

(ii) Calculate the current supplied to the primary coil when in use.
You are advised to show how you work out your answer including any equation used.

current = ...A [3]

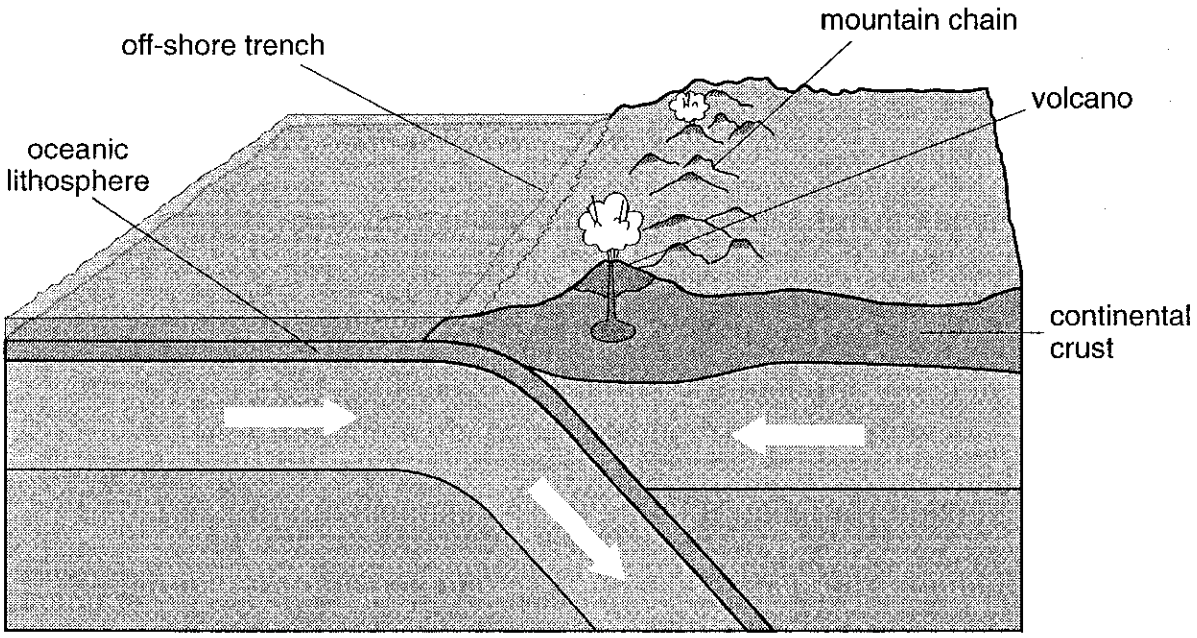
(iii) Calculate the current in the secondary coil when in use.
You are advised to show how you work out your answer including any equation used.

current = ...A [3]

[Total: 13]

10 The diagram represents the collision between an oceanic plate and a continental plate.

The denser oceanic plate descends under the continental plate.



(a) Metamorphism is often found at subduction zones.

(i) What are **subduction zones**?

.....

.....[1]

(ii) What is **metamorphism**?

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.....[2]

(b) The Himalayan mountain range is at the boundary of two continental plates. Suggest and explain how the mountain range was formed.

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.....[2]

[Total: 5]

11 This question is about electric charge.

Vicky rubs a plastic rod with a duster. The rod becomes positively charged.

(a) Explain why the rod becomes positively charged.

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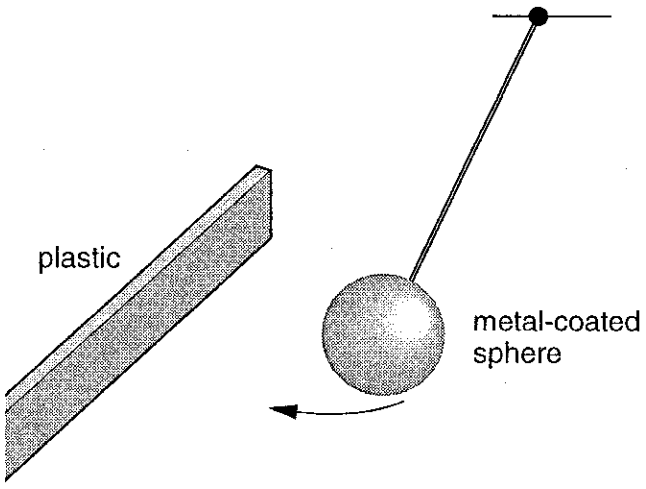
.....[2]

She then holds the rod close to a small, uncharged, metal-coated sphere. The sphere is hanging on an insulating thread.

The sphere is attracted towards the rod.

(b) Use your ideas about electron movement to explain why the sphere is attracted towards the plastic rod.

You can draw on the diagram to help your answer.



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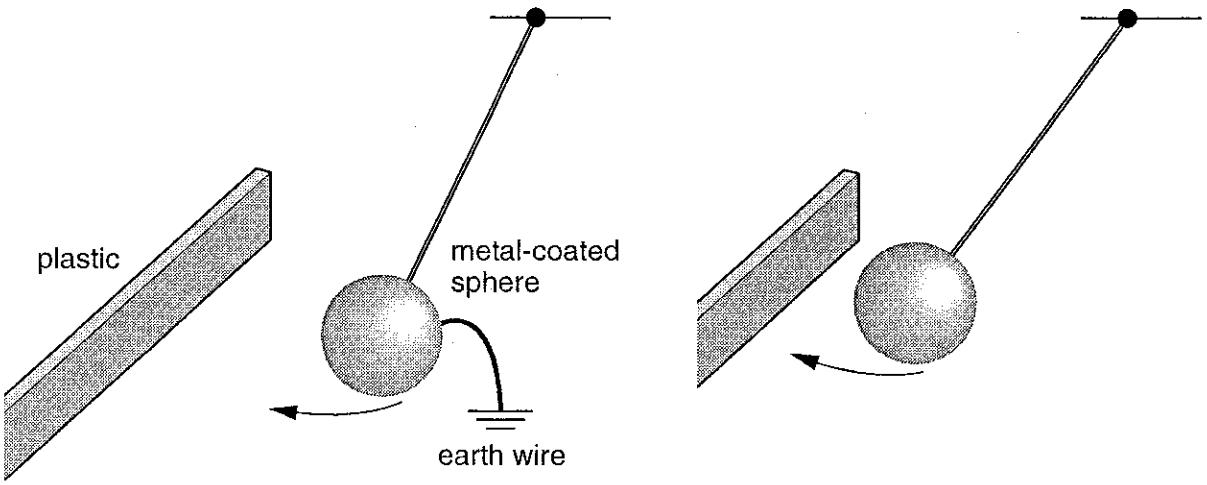
.....[3]

(c) Vicky briefly touches the metal-coated sphere with an earthed metal wire.
When she removes this wire, she notices that the sphere is attracted even closer to the plastic rod.



Use your ideas about electron movement to explain this.

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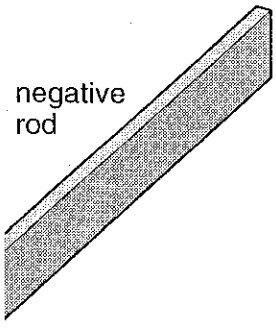
.....[2]

(d) Vicky now takes away the positively charged rod. She replaces it with a negatively charged rod.

(i) Finish the diagram to show how the metal coated sphere hangs now.



[1]

(ii) Explain your diagram.

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.....[2]

[Total: 10]

END OF QUESTION PAPER