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

Friday **16 JUNE 2006** 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	9	
2	6	
3	7	
4	11	
5	5	
6	8	
7	10	
8	18	
9	11	
10	15	
TOTAL	100	

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

Registered Charity Number: 1066969
[Turn over

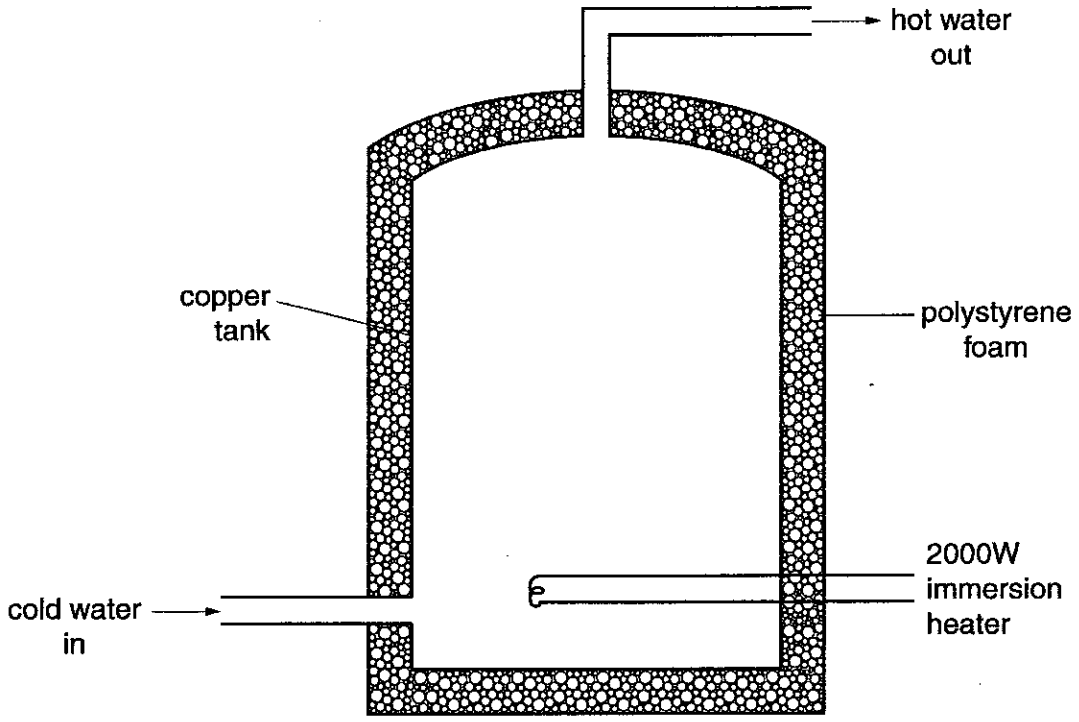
Answer **all** the questions.

1 This question is about energy transfer by conduction and convection.

The diagram shows a hot water tank made of copper.

The tank is insulated by a thick layer of polystyrene foam.

The foam contains lots of air.



(a) How does the polystyrene foam reduce the heat lost from the tank?

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.....[2]

(b) Explain why the immersion heater is placed at the bottom of the tank.

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.....[3]

(c) The 2000W immersion heater is switched on.
15 minutes later, the hot water has gained 1 500 000 J of thermal energy.
Calculate the efficiency of the heating system.

Use the equations below.
You are advised to show how you work out your answer.

$$\textbf{energy transferred} = \textbf{power} \times \textbf{time}$$

$$\textbf{energy efficiency} = \frac{\textbf{useful energy output}}{\textbf{total energy input}}$$

efficiency = ... [4]

[Total: 9]

2 This question is about household appliances.

Tina buys a juice extractor.

It is designed to operate with a supply voltage of **230V** and a current of **2A**.

(a) Calculate the power rating of the juice extractor.
You are advised to show how you work out your answer.

power rating = ... unit ..... [4]

(b) Tina uses the juice extractor for half an hour each week.

Electricity costs 11p per kWh.

How much does it cost her each week to use the juice extractor?

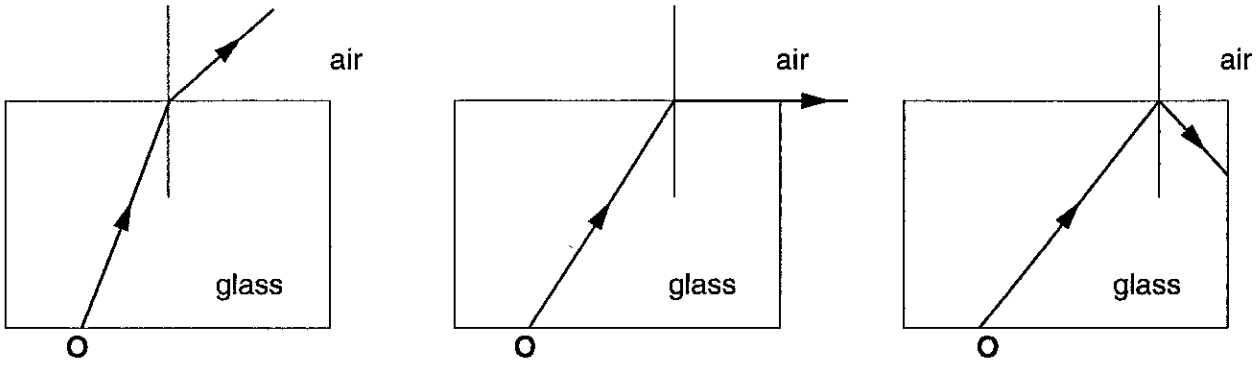
Use the equation below. You are advised to show how you work out your answer.

cost of electricity (p) = **power** (kW) × **time** (h) × **cost** (p per kWh)

cost = ... p [2]

[Total: 6]

3 **(a)** The diagrams show rays of light, travelling in glass from the point **O**.



(i) Write a letter **C** on one of the diagrams to show the critical angle. [1]

(ii) Finish this sentence:

Total internal reflection will only take place if the angle of incidence is .....

..... . [1]

(b) Optical fibres can be used in endoscopes to allow doctors to carry out keyhole surgery.

(i) Finish the diagram to show how light travels along an optical fibre.

[2]

(ii) Explain how an endoscope allows the doctor to see inside the patient's body.

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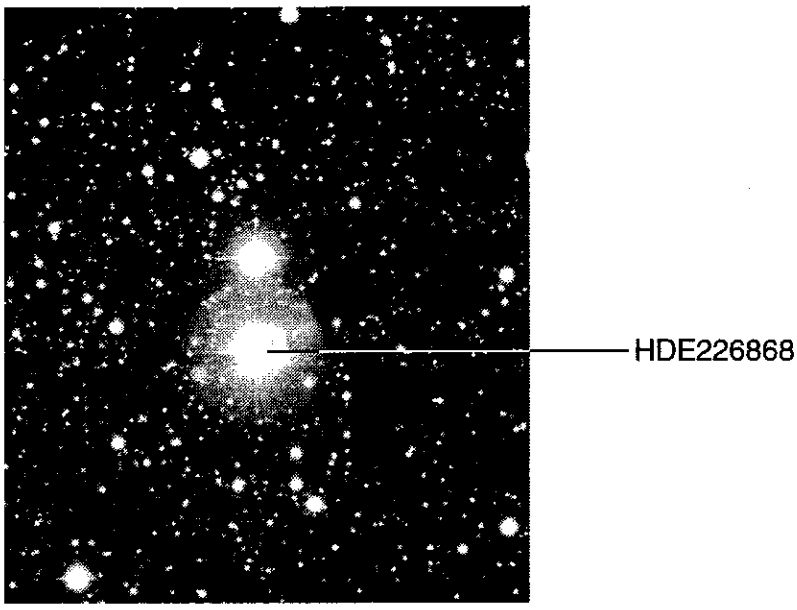
.....[3]

[Total: 7]

[Turn over

4 HDE226868 is a large star, thirty times bigger than our own Sun.



This star's future is different from our Sun's because it is so much bigger.

(a) Use your knowledge of the life cycle of stars to describe this large star's likely future.

(One mark is for using correct scientific words.)

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.....[4+1]

(b) Explain how scientists use information from distant bodies to estimate the age of the Universe.

Use your ideas about red shift.

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.....[3]

(c) Scientists have different theories about the future of the Universe.

Its future depends on how much mass there is in the Universe.

What do scientists think will happen to the Universe if there is **more** mass than we know about at the present time?

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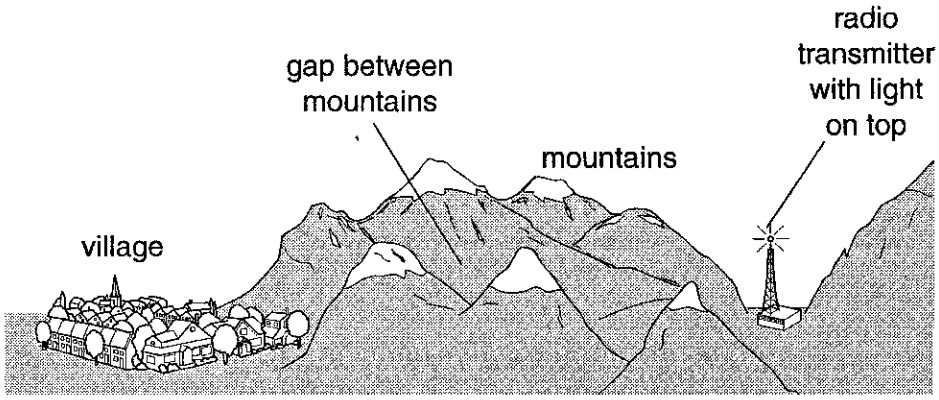
.....[3]

[Total: 11]

5 Radio waves are very useful in transmitting information over very long distances. They can be used to transmit messages around large objects such as mountains.



People in the village can receive radio signals from the transmitter but they cannot see the light on top of it.
Explain why.

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

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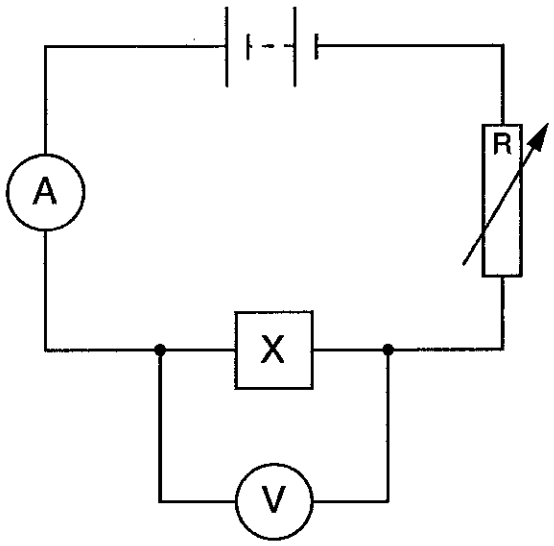
.....[4+1]

[Total: 5]

6 Mike wants to find out how the voltage and current are related for a component labelled **X**.

This circuit diagram shows him how to wire the circuit.



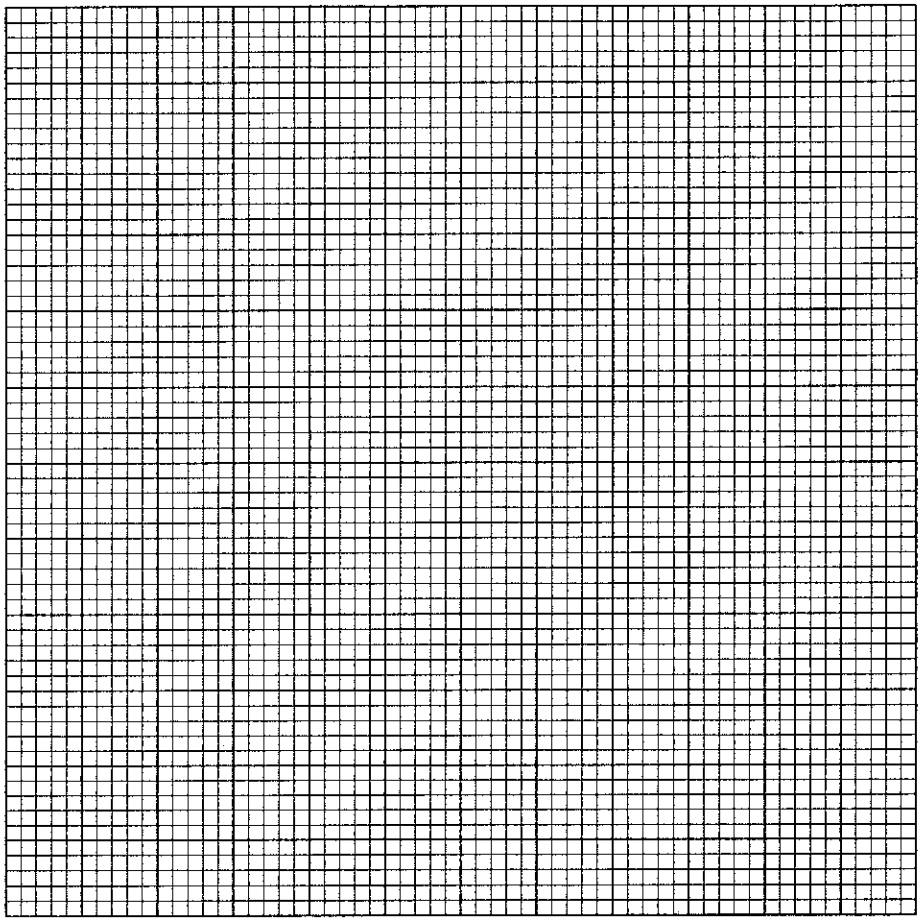
Mike adjusts component **R** and makes six sets of readings for current and voltage.

He writes the results in a table.

current in amps	voltage in volts
0.0	0.0
0.2	2.0
0.4	5.4
0.6	6.0
0.8	8.1
1.0	9.9

(a) Plot these results on the grid.

You will need to choose suitable scales for the axes.



[4]

(b) One of Mike's readings seems to be wrong.

Draw a (ring) around this point. [1]

(c) Finish the graph by drawing the **best** line. [1]

(d) **(i)** What electrical component is **X**?

Use the graph to help you answer this.

Put a (ring) around the correct answer.

bulb **diode** **LED** **resistor** [1]

(ii) Explain your choice.

.....[1]

[Total: 8]

7 This question is about the generation and transmission of electricity.

(a) As the reserves of fossil fuels are running out we need to find alternative energy sources.

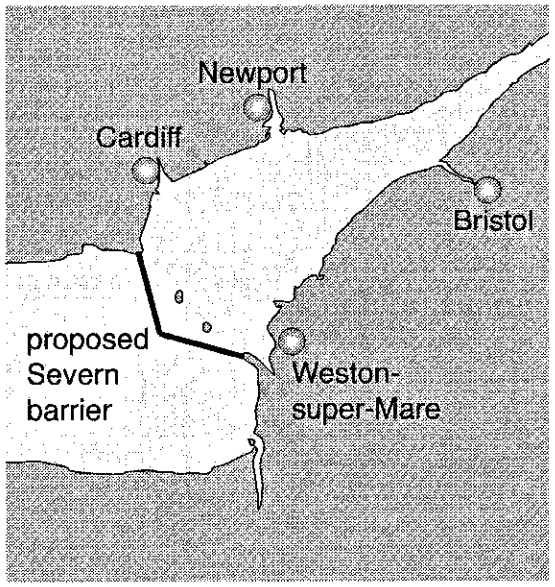
One alternative is the tide.

There are proposals to build a barrier across the River Severn.

Electricity can then be generated using the incoming and outgoing tides.

Look at the fact sheet below about tidal barriers.

map of Severn barrier



- Once you've built the barrier, tidal power is free.
- They are very expensive to build.
- They produce no greenhouse gases or other waste.
- They are not expensive to maintain.
- They affect a very wide area, including the feeding sites of many birds.
- They only provide power for around 10 hours each day, when the tide is actually moving in or out.
- They need no fuel.

(i) Write the letter **A** against two of the **advantages** of tidal barriers. [2]

(ii) Write the letter **D** against two of the **disadvantages** of tidal barriers. [2]

(b) Electricity from a power station is generated at 25 000 V, 8000 A.

The power station is linked to a transformer that changes the voltage before electricity enters the National Grid.

The National Grid transfers the electricity around the country at 400 000 V.

(i) **Using this information,** explain how the number of turns on the two coils in a transformer allows this change in voltage to happen.

.....

.....

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.....[3]

(ii) Calculate the output current from the transformer.

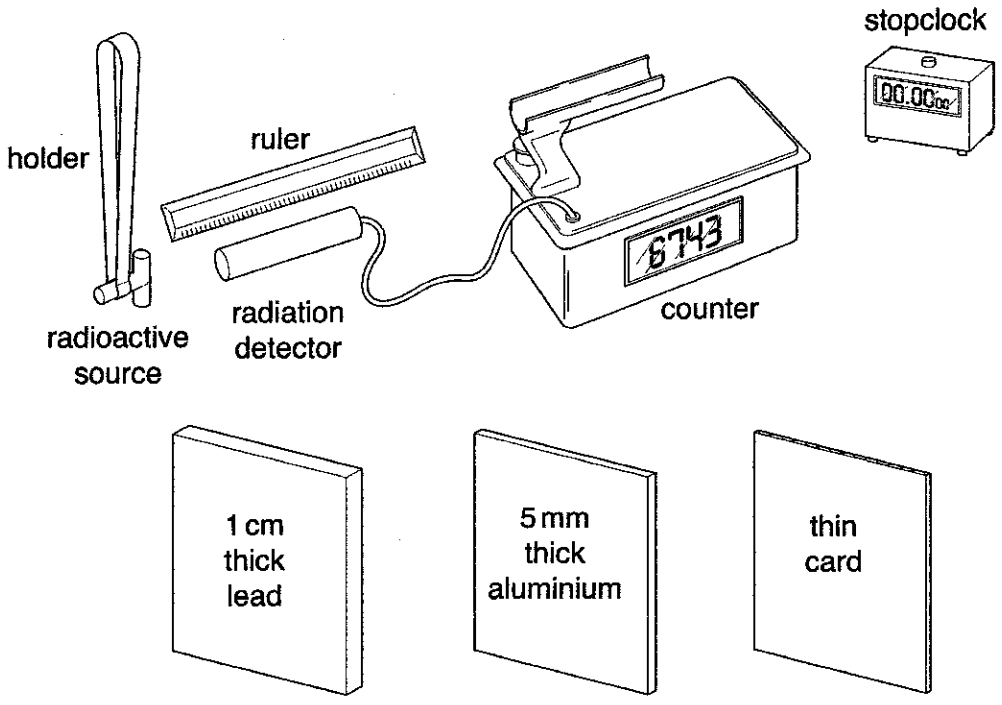
You are advised to show how you worked out your answer.

output current = ... A [3]

[Total: 10]

8 This question is about radioactivity.

(a) Matthew's teacher does an experiment to show the penetrating powers of the different types of radiation.
He uses this apparatus.



(i) Suggest **two** safety precautions Matthew's teacher must take when doing the experiment.

1. .....

2. .....[2]

(ii) What must he measure, using the radiation detector, before he starts using the radioactive source?

.....[1]

(iii) Suggest how Matthew's teacher uses the apparatus to show the different penetrating powers of alpha, beta and gamma radiation.

(One mark is for using correct spelling.)

.....

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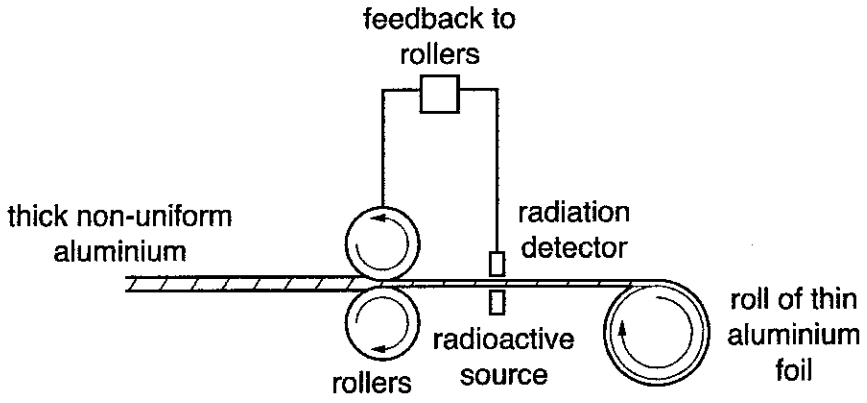
.....[3+1]

(b) The diagram represents a system that produces thin aluminium foil of uniform thickness.
The radioactive source and detector are used to monitor the thickness of the aluminium.



(i) State which type of radiation the source emits.

.....[1]

(ii) Explain why you would use this type of radiation.

.....

.....

.....[2]

(iii) Describe how the system monitors and controls the thickness of the foil.

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.....[3]

(c) France has recently closed its last coal mine.
It now produces nearly all of its electricity from nuclear power.
The United Kingdom produces nearly a third of its electricity from nuclear power.
Many scientists argue that using nuclear power is a better way of generating electricity than burning fossil fuels.
Others say nuclear power is too dangerous.

(i) Suggest **three** ways that scientists discuss these different views with each other.

1. .....

2. .....

3. .....[3]

(ii) Suggest why different groups of scientists can have such different views.

.....

.....[2]

[Total: 18]

9 Julia sees this advertisement in a shopping catalogue.

Induction Torch

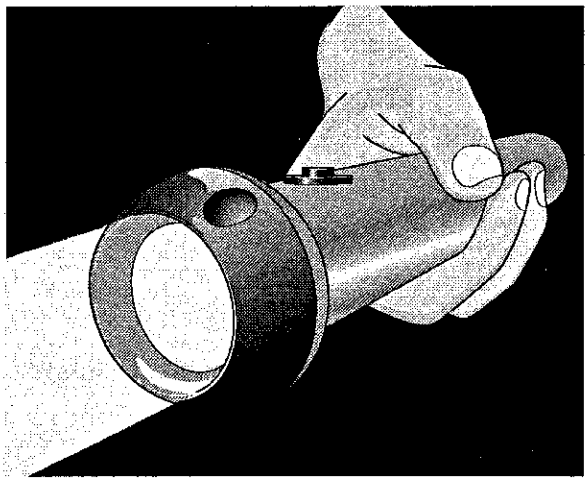
Requires no bulb or batteries!!

This really is an essential for every household.

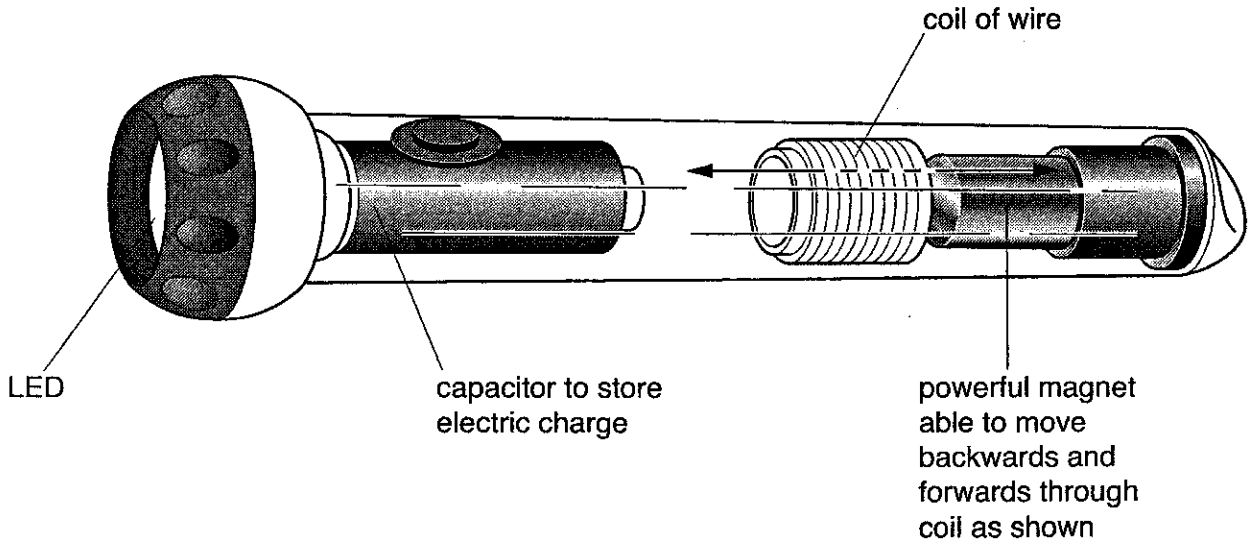
It uses the Faraday Principle of Electromagnetic Induction that guarantees replacement parts will never be needed!

All you do is give it a shake for 15–30 seconds, and it will provide up to 5 minutes of continuous bright light!

The super bright blue LED light is highly visible, allowing you to see exactly what you need to see, or get someone's attention.



Julia buys an induction torch. She shows it to her science teacher who points out the parts to her.



(a) Use your ideas about electromagnetism to explain how shaking the torch produces a current.

(One mark is for using correct scientific words.)

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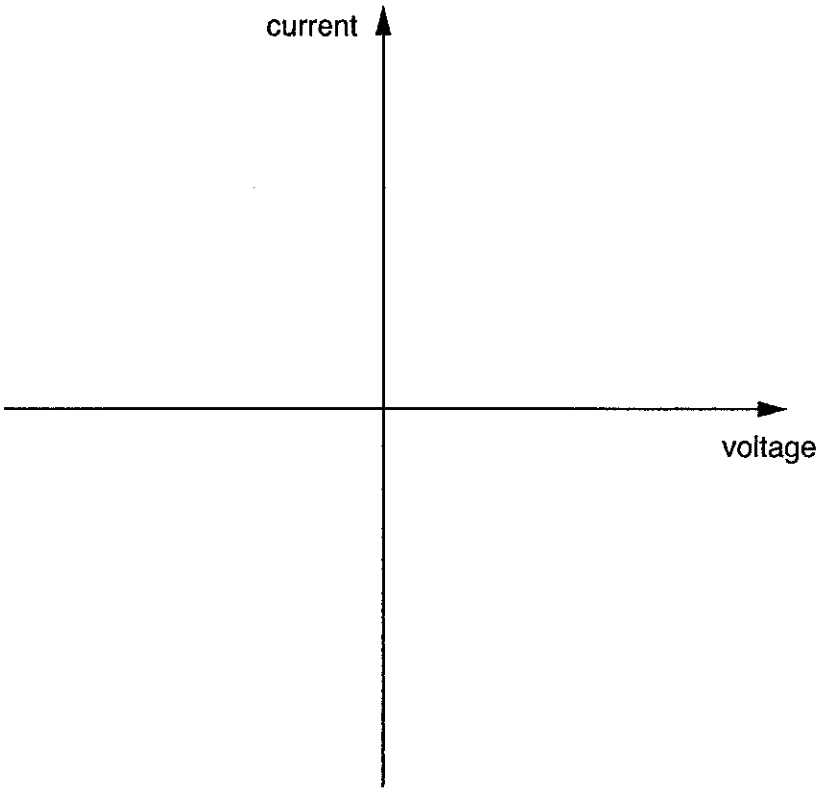
.....[3+1]

(b) The LED in the torch has similar current/voltage characteristics to a silicon diode.

Sketch a graph of current against voltage for the LED.



[3]

(c) Julia shakes the torch for 30 seconds. The capacitor stores 9 coulombs of charge.

She switches on the torch which stays alight for 5 minutes.

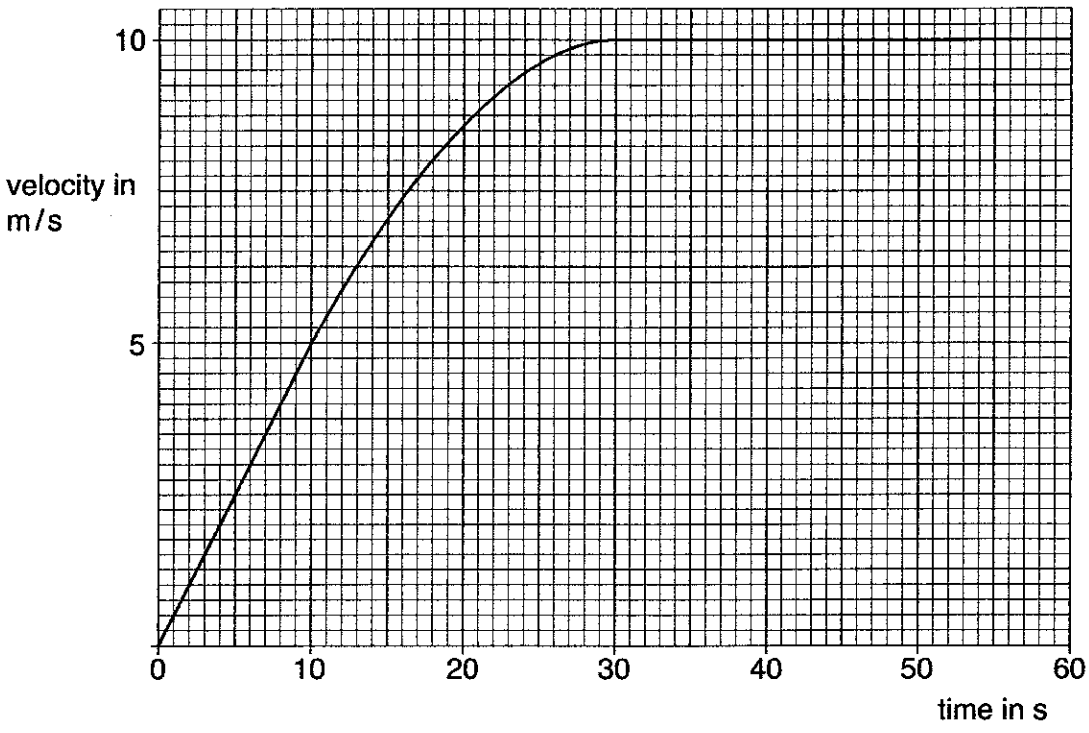
Calculate the average current in the LED.

You are advised to show how you work out your answer.

current = ... A [4]

[Total: 11]

10 John is riding his bicycle on a long, flat, straight road.
It is a summer's day with no wind.
The graph shows how his velocity changes with time.



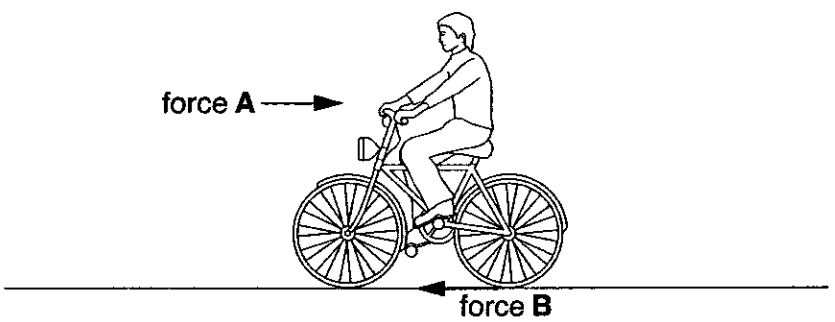
(a) (i) Use the graph to calculate John's acceleration during the first 10 seconds.
You are advised to show clearly on the graph how you work out your answer.

acceleration = ... m/s^2 [3]

(ii) Use the graph to calculate how far John travels between the 20^{th} and the 30^{th} second.
You are advised to show how you work out your answer.

distance travelled = ... m [3]

(b) The diagram shows John on his bicycle and two of the forces acting on the bicycle.



(i) What happens to the size of force **A** during the first 10 seconds?

.....[1]

(ii) During the first 10 seconds, the graph is a straight line.
Explain why force **B** must increase during this time.

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.....[3]

(iii) The graph is horizontal between 30 seconds and 60 seconds.
State and explain what happens to forces **A** and **B** in this time.

.....

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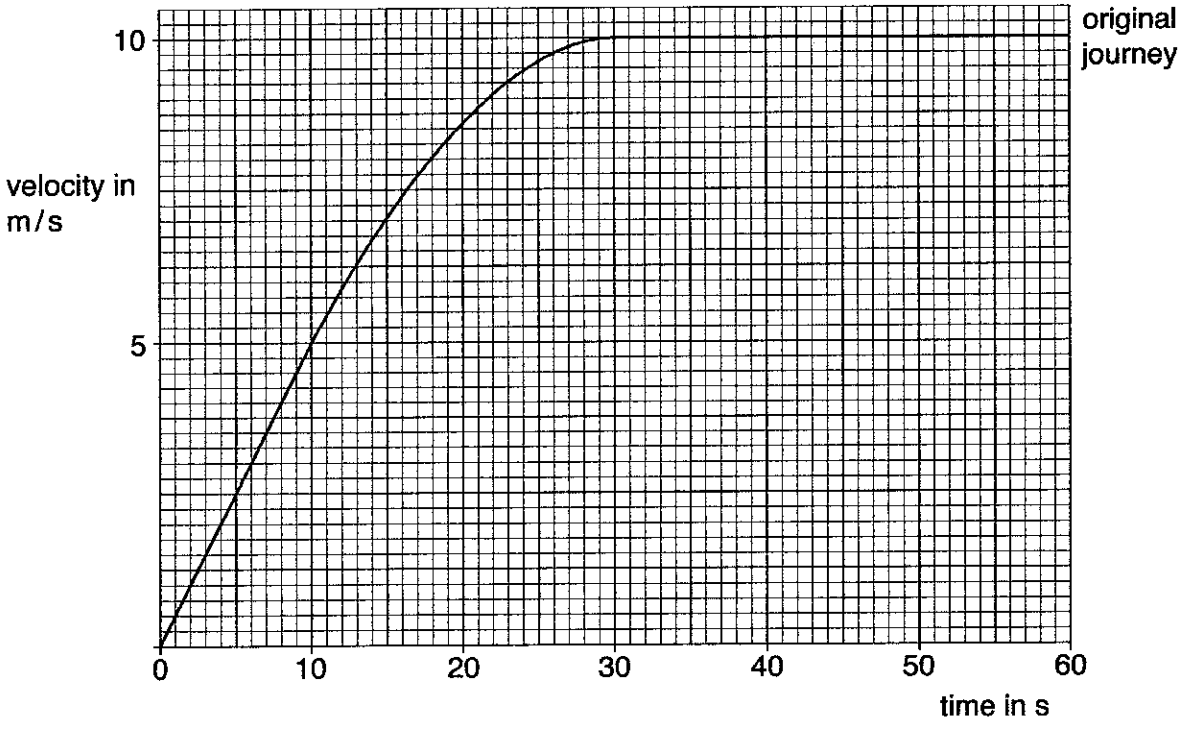
.....[2]

(c) John repeats the journey.
He exerts exactly the same forces as in his previous journey but there is a steady wind blowing in his face.
Use the axes below to show how his velocity changes on this journey.



[3]

[Total: 15]

END OF QUESTION PAPER