UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

SCIENCE   **5124/02, 5125/02**

Paper 2 Physics

October/November 2006

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers on the lined paper provided and, if necessary, continue on separate answer paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
TOTAL	

This document consists of **10** printed pages and **2** lined pages.

UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 Some sailors use sound waves to measure the depth of water beneath their ship. A pulse of sound is transmitted to the sea bed and returns to the ship. Fig. 1.1 shows the arrangement.

path of pulse
of sound
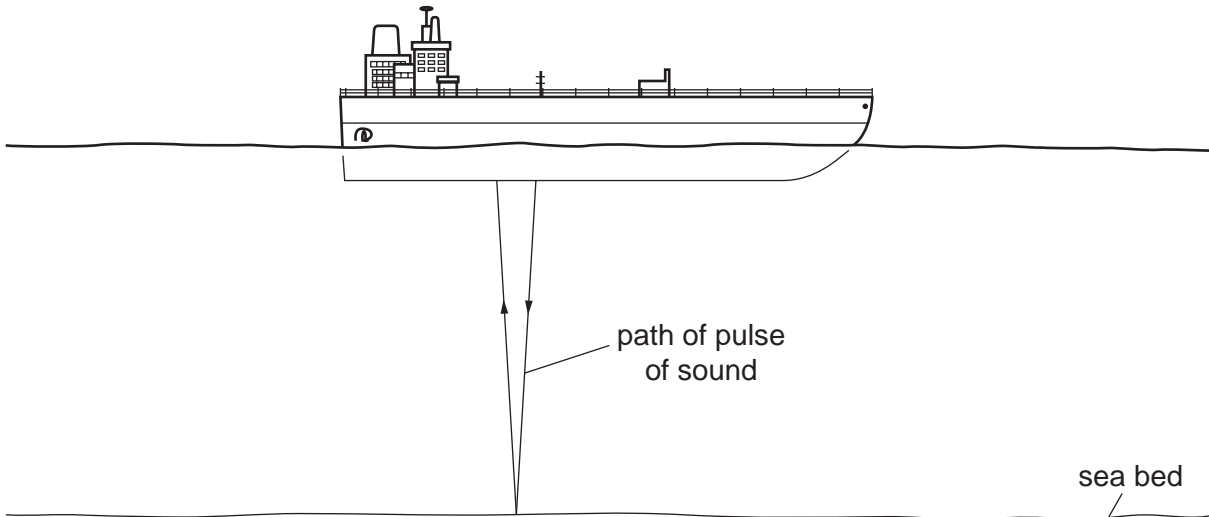
sea bed

Fig. 1.1

(a) State why the pulse of sound returns to the ship.

....

....[1]

(b) Sound is a longitudinal wave. Explain what is meant by a *longitudinal* wave.

....

....

....[1]

(c) The time taken for the sound pulse to reach the sea bed and then return to the ship is 0.10 s. The speed of sound in sea water is 1500 m / s.
Calculate the depth of the sea.

depth = ... m [3]

5124/02/O/N/06

2 A car has a mass of 1300 kg. It can accelerate from rest to 30 m / s in 12 s.

(a) Calculate the acceleration of the car.

acceleration = ... [2]

(b) Calculate the force needed to give this acceleration.

force = ... [3]

(c) At a speed of 40 m / s, the driving force is 5200 N. Calculate the work done when the car travels 200 m at this speed.

work done = ... J [2]

3 Some pupils tested a motorcyclist's crash helmet. They dropped a steel ball of mass 5.0 kg so that it hit the helmet with a speed of 7.8 m / s.

(a) Calculate the kinetic energy of the steel ball just before it hit the helmet.

kinetic energy = ... J [2]

(b) State the form of energy that the ball had before it was dropped.

....[1]

(c) The ball bounces off the helmet at a lower speed. State two energy transfers that occur when the ball hits the helmet.

1. ....

2. ....[2]

4 Fig. 4.1 shows a claw hammer being used to pull a nail out of a piece of wood.

⇒ force at handle

X
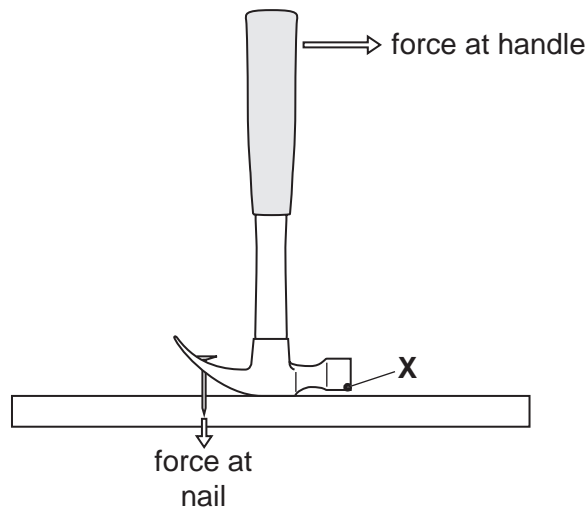
force at
nail

Fig. 4.1

(a) Explain why the force at the nail is greater than the force exerted at the handle of the hammer.

....

....

....

....[2]

(b) When the nail has been pulled out a short distance, point **X** of the hammer touches the wood. Point **X** is then the pivot. Describe and explain how this changes the force that needs to be exerted at the handle of the hammer.

....

....

....

....[2]

5 (a) The radiation that reaches Earth from the Sun is electromagnetic radiation.

State **one** way in which the components of the electromagnetic spectrum are similar.

....[1]

(b) Fig. 5.1 shows a girl operating a radio-controlled car. The transmitter emits radio waves that are detected by the model car. The frequency of the radio waves is 27 MHz.

Fig. 5.1

(i) State the speed of the radio waves as they travel through the air.

speed = ... m / s [1]

(ii) Explain what is meant by the *frequency is 27 MHz*.

....

....

....[2]

6 A 2.4 kW electric kettle is connected to a 240 volt mains supply.

(a) Calculate the current in the heating element of the kettle when it is working normally.

current = ... A [2]

(b) The kettle is protected by a 13 A fuse.
Explain how the fuse works.

....

....

....[2]

(c) Some appliances have double insulation. Explain how double insulation protects the user of the appliance.

....

....

....[2]

7 Fig. 7.1 shows an unmarked thermometer containing mercury.

Fig. 7.1

(a) Explain what is meant by the *ice point*.

....

....

....[2]

(b) Describe two changes to the design of the mercury-in-glass thermometer that would make it more sensitive.

1. ....

....

2. ....

....[2]

8 A "wind-up" torch does not have batteries. It uses the energy stored in a wound-up spring to generate the electrical energy that is needed. Fig. 8.1 shows a simplified diagram of the arrangement.
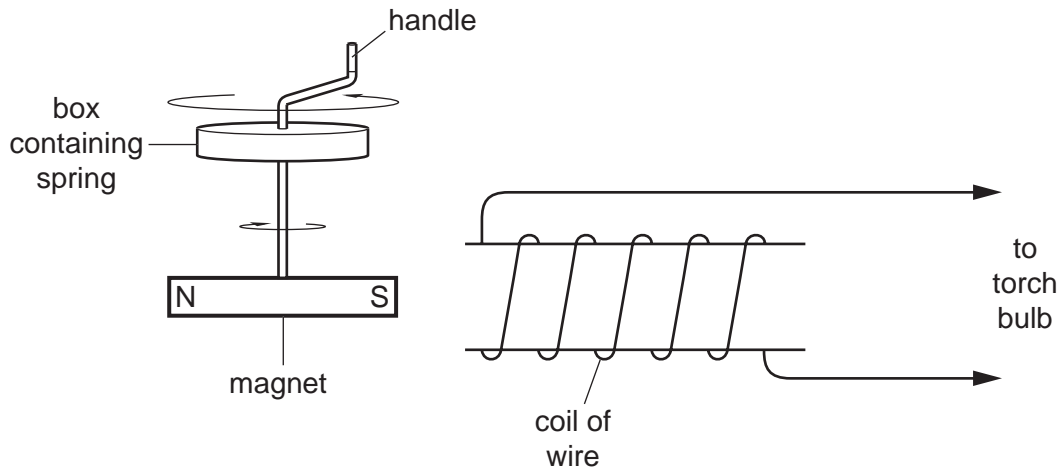

Fig. 8.1

(a) Explain why an e.m.f. is induced in the coil.

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....[2]

(b) As the spring unwinds, the force in the spring decreases. Explain why this results in the torch emitting less light.

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....[2]

(c) State how the coil could be changed to produce a larger induced e.m.f.

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....[1]
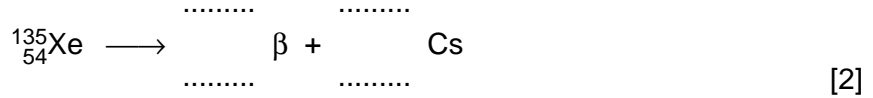
9 When a nucleus of xenon −135 ($^{135}_{54}$Xe) emits a beta-particle, it decays to form a nucleus of caesium (Cs).

(a) State what the number 135 represents in the symbol $^{135}_{54}$Xe.

....

....[1]

(b) Complete the equation to represent the decay of the xenon −135 nucleus.

$$^{135}_{54}\text{Xe} \longrightarrow \quad ^{.........}_{.........}\beta \ + \ ^{.........}_{.........}\text{Cs}$$

[2]

(c) Fig. 9.1 shows how the activity of a radioactive source changes with time. Use the graph to calculate a value for the half-life of the radioactive source. Show clearly how you obtained your answer.
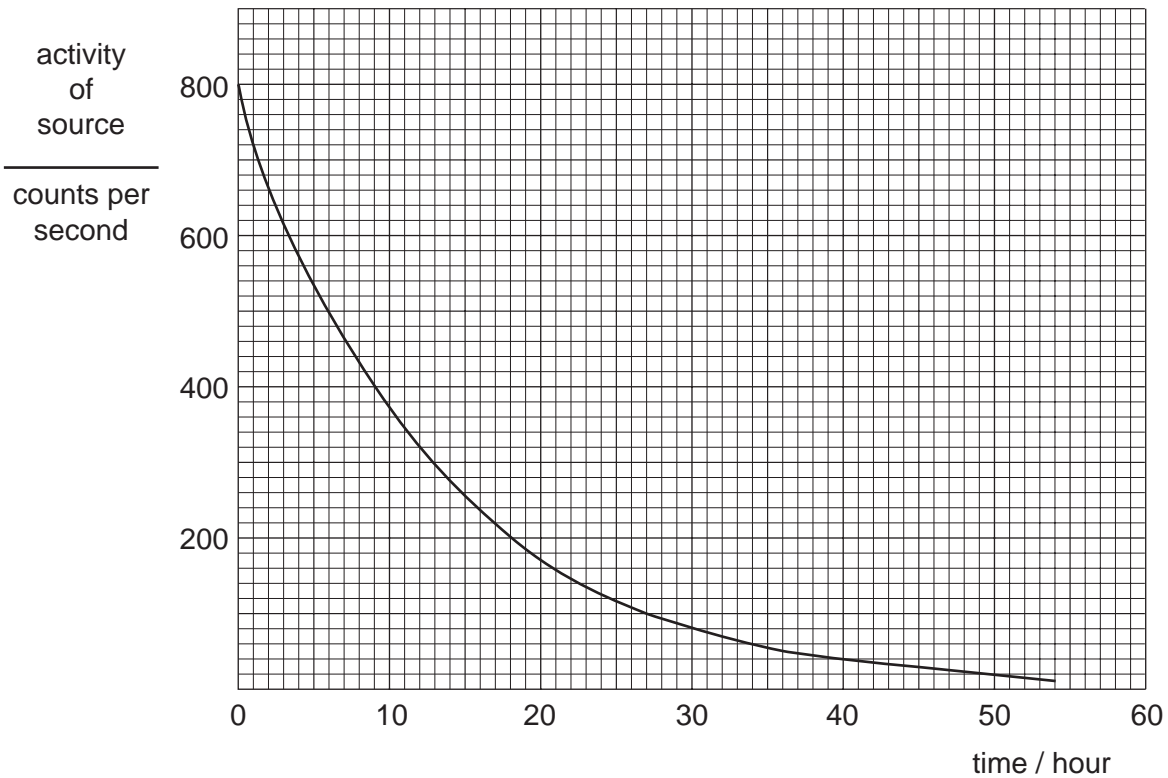
Fig. 9.1

half-life = ... [2]

Section B

Answer any **two** questions.

Write your answers on the lined paper provided and, if necessary, continue on separate answer paper.

10 **(a)** Fig. 10.1 shows how the volume of 10 g of ice changes as the temperature rises from −10 °C to +10 °C. The ice melts at 0 °C.
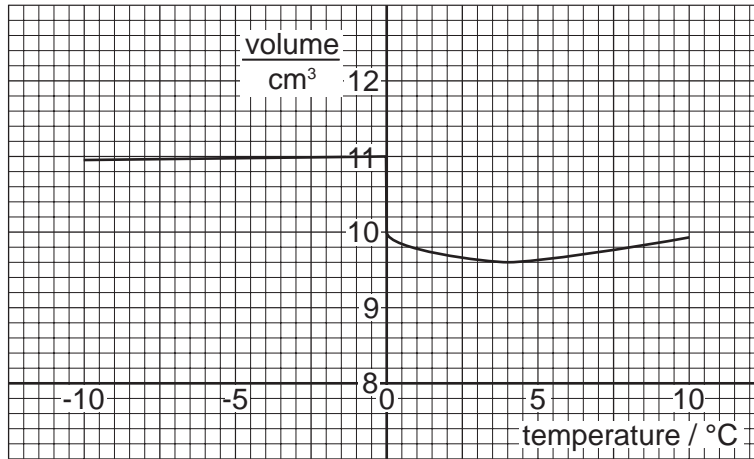
Fig. 10.1

   (i) Calculate the density of ice at 0 °C. [3]

   (ii) State and explain what happens to the density as ice melts at 0 °C. [2]

(b) Describe an experiment to determine the density of a small stone. [5]

11 **(a)** Three wires, **X**, **Y** and **Z**, are made from the same material.
Wire **X** has area of cross-section A and length l. Its resistance is 6 Ω.
Wire **Y** has area of cross-section A and length $2l$.
Wire **Z** has area of cross-section $2A$ and length l.

Copy and complete Fig. 11.1 to show the resistance of each wire.

wire	resistance / Ω
X	6
Y	
Z	

[2]

Fig. 11.1

(b) Three different resistors, of resistance 2 Ω, 4 Ω and 8 Ω, are connected in series with a 12 volt supply as shown in Fig. 11.2.

12 V supply

2 Ω   4 Ω   8 Ω
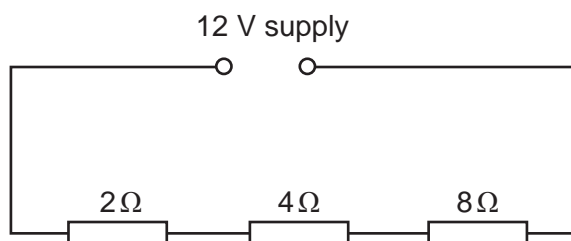
Fig. 11.2

State which resistor has the greatest potential difference across it. Explain your answer. [3]

(c) Describe an experiment, using an ammeter, a voltmeter and any other necessary equipment, to determine the resistance of a coil of wire. [5]

12 (a) A spring of length 10 cm stretches to a length of 13 cm when a weight of 6.0 N is hung from it. Calculate the length of the spring when the 6.0 N weight is replaced by a 4.0 N weight. (Assume the spring behaves elastically.) [3]

(b) Two identical springs support a load as shown in Fig. 12.1.

spring

rod
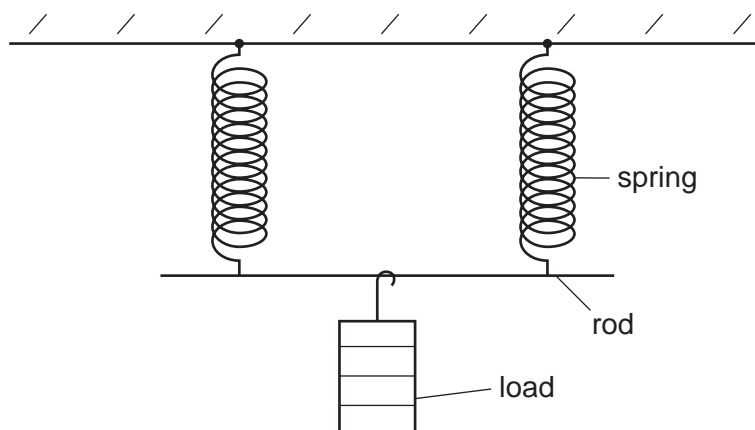
load

Fig. 12.1

The same load is then supported by one of the springs. State how the extension will change, compared to that in Fig. 12.1. Explain your answer. [2]

(c) Describe an experiment to determine the limit of proportionality of a spring. [5]

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