



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
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**PHYSICS**

Paper 2 Theory

**5054/02**

**May/June 2008**

**1 hour 45 minutes**

Candidates answer on the Question Paper.

Additional Materials: Answer Booklet/Paper.

**READ THESE INSTRUCTIONS FIRST**

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 or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

**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 pages provided, and, if necessary, continue on the separate answer paper provided.

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	
Q9	
Q10	
Q11	
Total	

This document consists of **16** printed pages.



Section A

Answer **all** the questions in this section.

For  
Examiner's  
Use

1 Fig. 1.1 is a block diagram of a power station.

The four boxes represent different parts of the power station. The first box is labelled boiler.

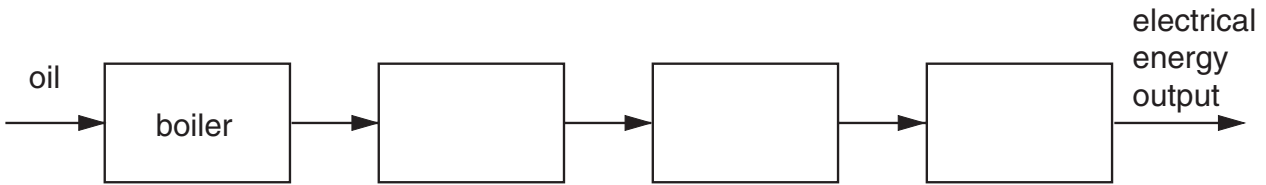


Fig. 1.1

Each of the other three boxes should contain **one** of the labels from the following list.

*generator, motor, transformer, turbine, solar panel*

(a) On Fig. 1.1, label the boxes using words from the list. [2]

(b) State **one** environmental problem caused by burning oil to produce electricity.  
.....  
..... [1]

(c) Oil is a non-renewable energy source.  
(i) State why oil is described as a non-renewable energy source.  
.....  
.....  
..... [1]

(ii) State **one** renewable energy source.  
.....  
..... [1]

- 2 Fig. 2.1 shows a device for punching holes in a piece of paper. A person applies a force  $F$  at the end of the arm. Just before the hole is made in the paper, the arm is at rest.

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Use

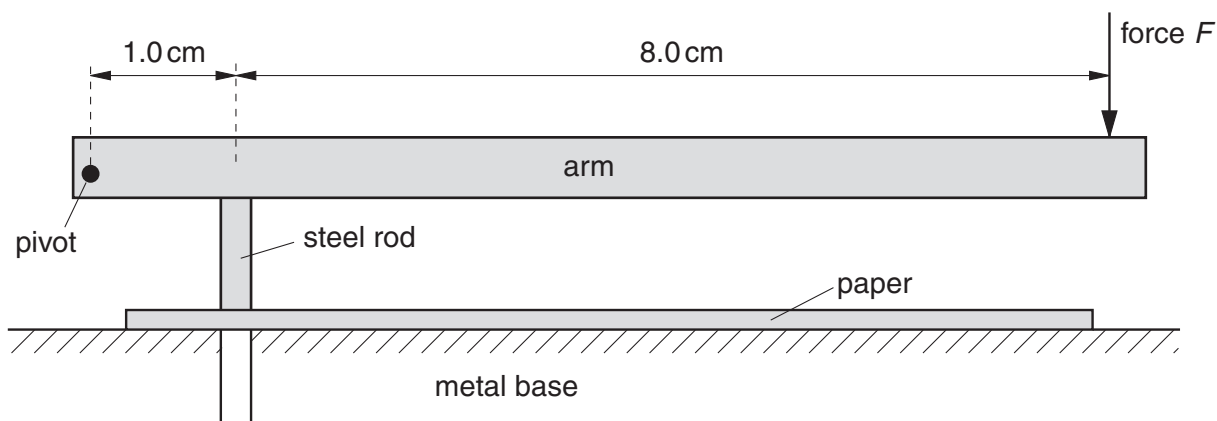


Fig. 2.1

- (a) Just before the hole is made, the force upwards on the steel rod is 7.2 N.

Calculate the value of  $F$ . Use the distances marked on Fig. 2.1.

$F = \dots\dots\dots$  [2]

- (b) The steel rod pushes the paper into the hole in the metal base with a force of 7.2 N. The end of the steel rod has an area of  $2.8 \times 10^{-5} \text{ m}^2$ .

Calculate the pressure exerted on the paper.  
State the formula that you use in your calculation.

pressure =  $\dots\dots\dots$  [2]

- (c) The force downwards on the paper due to the rod and the force upwards on the rod due to the paper are related by Newton's third law. State Newton's third law.

.....  
 .....  
 ..... [1]

3 During a marathon race, the runner shown in Fig. 3.1 is very hot.



Fig. 3.1

At the end of the race, evaporation and convection cool the runner.

(a) (i) Explain how evaporation helps the runner to lose energy. Use ideas about molecules in your answer.

.....  
.....  
.....  
..... [2]

(ii) Explain why hot air rises around the runner at the end of the race.

.....  
.....  
.....  
..... [1]

(b) At the end of the race, the runner is given a shiny foil blanket, as shown in Fig. 3.2. Wearing the blanket stops the runner from cooling too quickly.



Fig. 3.2

Explain how the shiny foil blanket helps to reduce energy losses.

Use ideas about conduction, convection and radiation in your answer.

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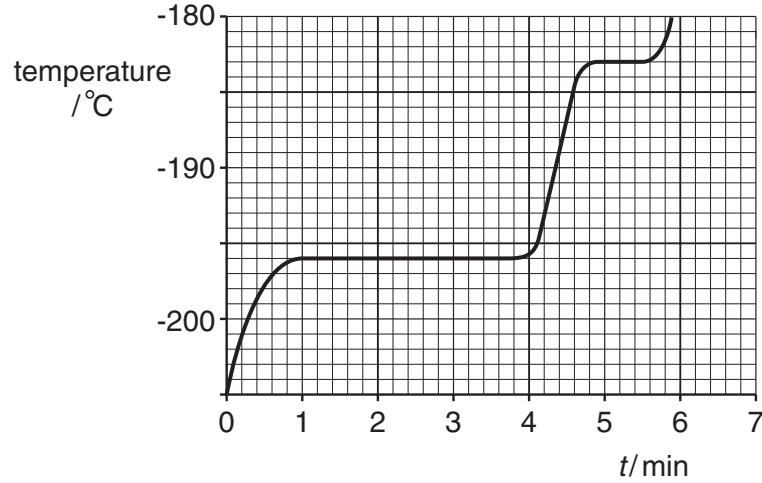
.....

.....

.....

..... [3]

- 4 Liquid air contains a mixture of oxygen and nitrogen. The boiling point of nitrogen is  $-196\text{ }^{\circ}\text{C}$  and the boiling point of oxygen is  $-183\text{ }^{\circ}\text{C}$ . A sample of liquid air in a beaker is allowed to warm up slowly. Fig. 4.1 shows how the reading of a thermometer in the beaker varies with time  $t$ .



**Fig. 4.1**

- (a) Describe the two changes of state that occur and state when they occur.

.....

.....

.....

..... [3]

- (b) The liquid air contains 200 g of liquid oxygen and 800 g of liquid nitrogen. The specific heat capacity of liquid oxygen is  $1.7\text{ J}/(\text{g }^{\circ}\text{C})$  and the specific heat capacity of liquid nitrogen is  $2.0\text{ J}/(\text{g }^{\circ}\text{C})$ . Calculate the thermal energy needed to warm the liquid from  $-205\text{ }^{\circ}\text{C}$  to  $-196\text{ }^{\circ}\text{C}$ . State the formula that you use in your calculation.

energy = ..... [4]

- 5 (a) Each object in the table below emits one main type of electromagnetic wave. Complete the table by writing in the name of the type of wave. One line has been written for you.

Object	Main type of electromagnetic wave emitted
radio transmitter	radio wave
remote control for a television	
radioactive source	

[2]

- (b) X-rays are used in hospitals to produce images of bones and to show whether bones are broken.

- (i) State what is used to detect X-rays.

.....  
 ..... [1]

- (ii) Explain the properties of X-rays that enable an image of a bone to be produced.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [2]

6 A filament lamp is labelled 240V, 0.20 A.

For  
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Use

(a) Calculate the resistance of the lamp at normal brightness.

resistance = ..... [2]

(b) The lamp is connected to a 240V supply and switched on at time  $t = 0$ .

Fig. 6.1 shows the variation with  $t$  of the resistance of the lamp.

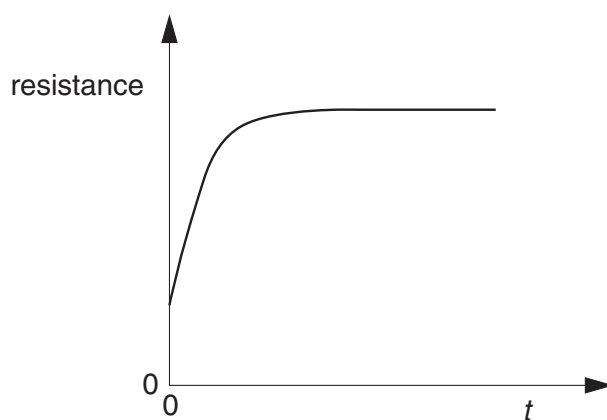


Fig. 6.1

Describe how the current in the lamp varies with  $t$ .

.....

.....

.....

.....

..... [2]

(c) A second filament lamp has higher resistance.

State **two** differences between the two filaments that may cause the change in resistance.

1 The filament in the second lamp is .....

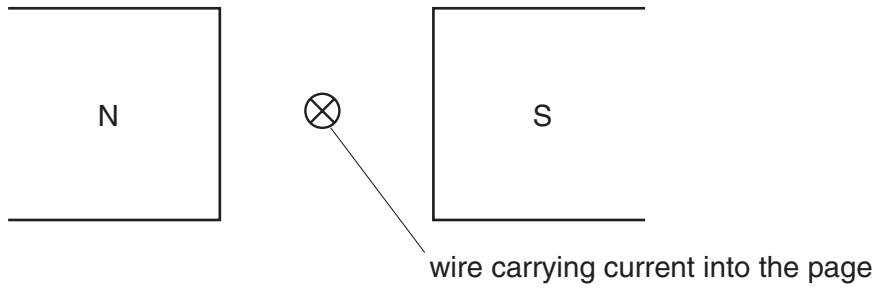
.....

2 The filament in the second lamp is .....

..... [2]



- 7 (a) Fig. 7.1 shows a straight wire between the poles of a magnet. The wire carries a current into the page.



**Fig. 7.1**

- (i) State the direction of the magnetic field between the poles of the magnet.  
..... [1]

- (ii) On Fig. 7.1, draw an arrow to show the direction of the force acting on the wire. [1]

- (b) Fig. 7.2 shows two wires.  
Each wire carries a current into the page.



**Fig. 7.2**

- (i) On Fig. 7.2, draw the magnetic field due to the currents in the wires. [3]

- (ii) There is a force on each wire due to the current in the other wire.  
On Fig. 7.2, draw an arrow on each wire to show these forces. [1]

- 8 Fig. 8.1 shows the part of a cathode-ray oscilloscope in which an electron beam is produced.

For  
Examiner's  
Use

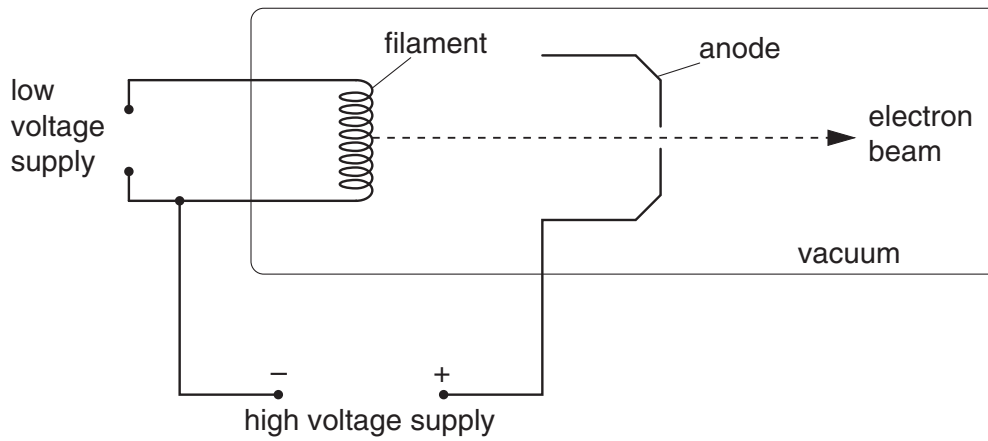


Fig. 8.1

- (a) State why the filament emits electrons.

..... [1]

- (b) State

- (i) how the electrons are made to move at high speed,

.....  
 .....  
 ..... [1]

- (ii) why a vacuum is needed inside the oscilloscope.

.....  
 .....  
 ..... [1]

- (c) In each second,  $8.0 \times 10^{14}$  electrons pass through the hole in the anode.  
 The charge on an electron is  $1.6 \times 10^{-19}$  C. Calculate the current in the electron beam.

current = ..... [2]

## Section B

Answer **two** questions from this section.

Use the lined pages provided and, if necessary, continue on the separate sheets available from the Supervisor.

- 9 When a car driver sees an emergency ahead, he applies the brakes. During his reaction time the car travels at a steady speed and covers a distance known as the thinking distance. The braking distance is the distance travelled by the car after the brakes are applied.

(a) State the energy change that occurs as the car brakes. [2]

- (b) Fig. 9.1 shows the speed-time graph of a car. The driver sees the emergency at time  $t = 0$ . The total mass of the car is 800 kg.

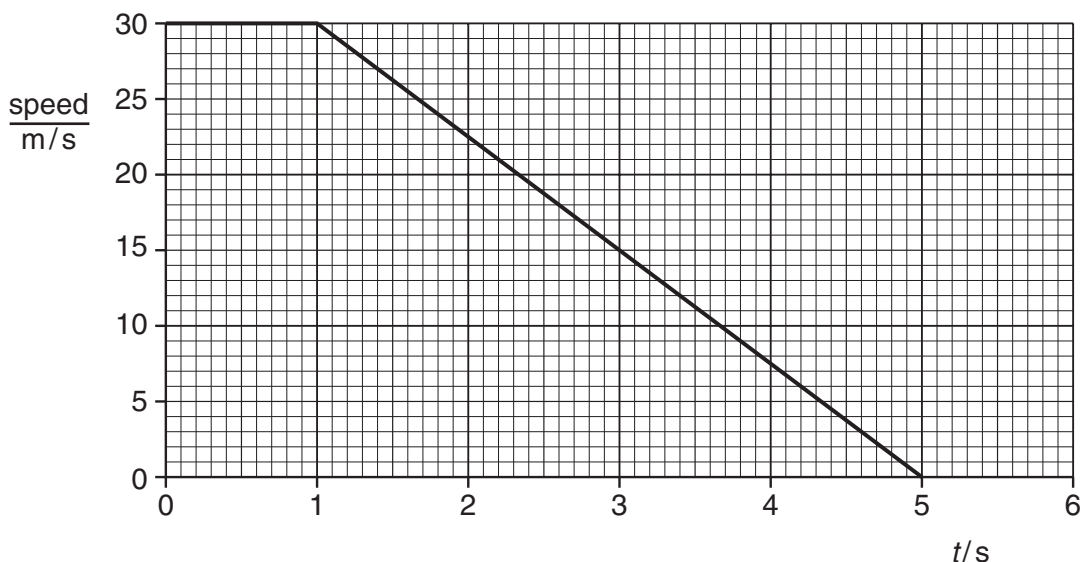


Fig. 9.1

Determine

- (i) the thinking distance, [1]
- (ii) the braking distance, [2]
- (iii) the deceleration of the car during braking, [2]
- (iv) the force provided by the brakes. [2]
- (c) Using ideas about friction and deceleration, state and explain how the braking distance is affected by
- (i) using new tyres rather than badly worn tyres, [2]
- (ii) the car skidding on a wet road, [2]
- (iii) the car carrying a heavy load of passengers. [2]

10 (a) Water waves are transverse waves. Sound is a longitudinal wave.

- (i) Describe the difference between transverse waves and longitudinal waves. In your account, draw a diagram of each type of wave. [4]
- (ii) Sound contains regions of compression and regions of rarefaction. Describe what is meant by a compression and by a rarefaction. [2]

(b) A ripple tank is used to demonstrate the reflection of water waves.

- (i) Draw a labelled diagram of a ripple tank. [2]
- (ii) Draw a diagram showing the reflection of waves from a plane barrier in a ripple tank. [2]

(c) Fig. 10.1 shows a water wave passing a floating log. The log is stationary.

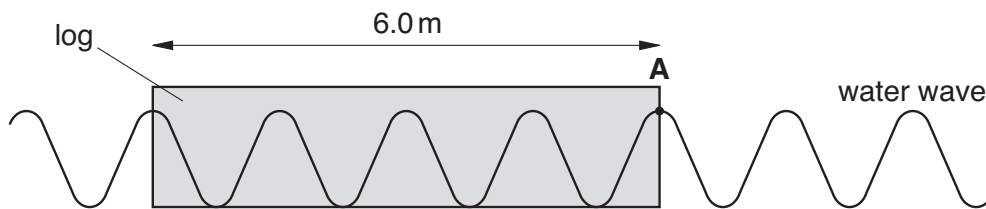


Fig. 10.1

The log is 6.0 m long and 5 complete waves take 10 seconds to pass point A.

Determine

- (i) the wavelength of the water waves, [1]
- (ii) the frequency of the water waves, [2]
- (iii) the speed of the water waves. [2]

11 (a) A scientist has three radioactive sources. The first source emits only alpha-particles, the second source emits only beta-particles and the third source emits only gamma-rays.

(i) Explain how the scientist demonstrates that the three types of radiation have different penetrating powers.

In your account

- draw a diagram of the apparatus used,
- state what materials are used to show the different penetrating powers,
- explain how the apparatus is used.

[5]

(ii) State **two** different safety precautions the scientist must follow when handling the radioactive sources. [2]

(iii) Explain why the half-lives of the radioactive sources used in the demonstration should be greater than 1 second. [2]

(b) Fig. 11.1 shows radiation moving into the magnetic field between the poles of a strong magnet.

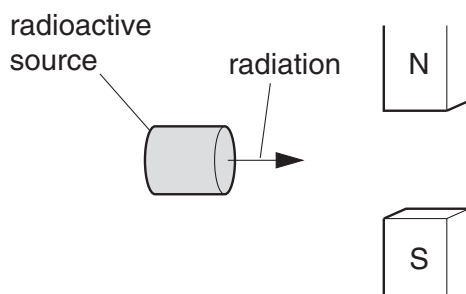


Fig. 11.1

The radioactive source emits alpha-particles, beta-particles and gamma-rays. For each type of radiation, describe the path taken by the radiation.

You may draw a diagram to help your explanation.

[3]

(c) Fig. 11.2 represents three different nuclei.

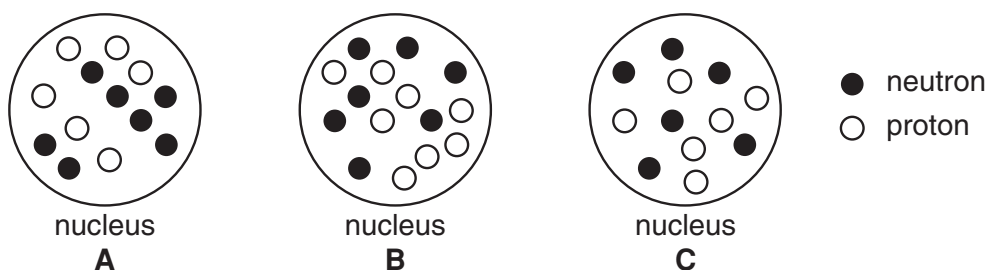


Fig. 11.2

State and explain which nuclei are from different isotopes of the same element.

[3]

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