UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

1594589560

PHYSICS **5054/02**

Paper 2 Theory **October/November 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.

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Section A

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

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1 A microphone has a weight W of 6.0 N. It is suspended by wire X from the ceiling in a radio studio.

Fig. 1.1 shows the microphone held in the correct position by a horizontal wire Y.

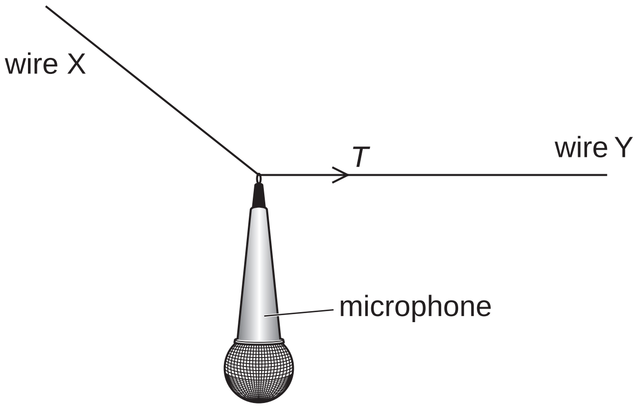

Fig. 1.1

(a) The tension T in wire Y is 8.0 N. Use a vector diagram to determine the magnitude and the direction of the resultant of W and T.

magnitude = ...

direction = ...
[4]

(b) The microphone is at rest. State the tension in wire X.

tension in X = ... [1]

For Examiner's Use

2 Fig. 2.1 shows a wooden walking-stick that has a metal head and a rubber foot. It balances on a pencil placed 0.50 m from its rubber foot.

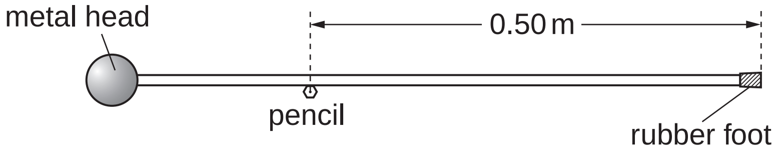

Fig. 2.1

(a) State the distance between the centre of mass of the walking-stick and the end of the rubber foot.

distance = ... [1]

(b) The pencil is moved along the walking-stick towards its rubber foot. State and explain the motion of the walking-stick.

....

....

....

.... [3]

3 A river flows over a cliff, producing a waterfall. The water, at a temperature of 7.2 °C, falls 700 m into a pool. The gravitational field strength is 10 N / kg.

For Examiner's Use

(a) Calculate the change in the gravitational potential energy of each kilogram of water due to its fall.

energy change = ... [2]

(b) Assume that all of this energy is converted into thermal energy (heat) in the water in the pool. Calculate the temperature of this water when it is in the pool. The specific heat capacity of water is 4200 J / (kg °C).

temperature = ... [3]

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4 A passenger aeroplane accelerates from rest along a runway. It accelerates at a uniform rate for 35 s. At this point it reaches a speed of 84 m / s and then takes off.

(a) **(i)** Calculate the acceleration of the aeroplane along the runway.

acceleration = ... [2]

(ii) Sketch a speed-time graph for the aeroplane as it travels along the runway.

[3]

(b) Two **horizontal** forces act on the aeroplane as it accelerates along the runway.

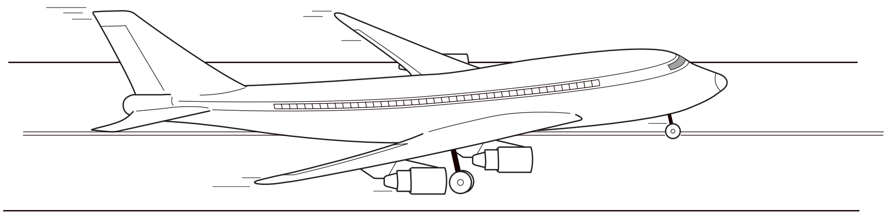

Fig. 4.1

(i) On Fig. 4.1, draw arrows to show the directions and the relative magnitudes of these forces. [1]

(ii) State what causes the smaller of these two forces.

.... [1]

For Examiner's Use

5 **(a)** State **two** differences between the properties of liquids and gases at normal pressures. Explain these differences in molecular terms.

Difference 1 ....

Explanation 1 ....

....

Difference 2 ....

Explanation 2 ....

....
[4]

(b) A nurse places a damp cloth on the forehead of a sick patient. As the water evaporates, the patient's forehead is cooled. Explain in terms of the water molecules how the cooling is produced.

....

....

....

.... [3]

For Examiner's Use

6 Fig. 6.1 shows a ray of white light from a ray-box passing into a glass prism. A spectrum is formed between P and Q on the screen.

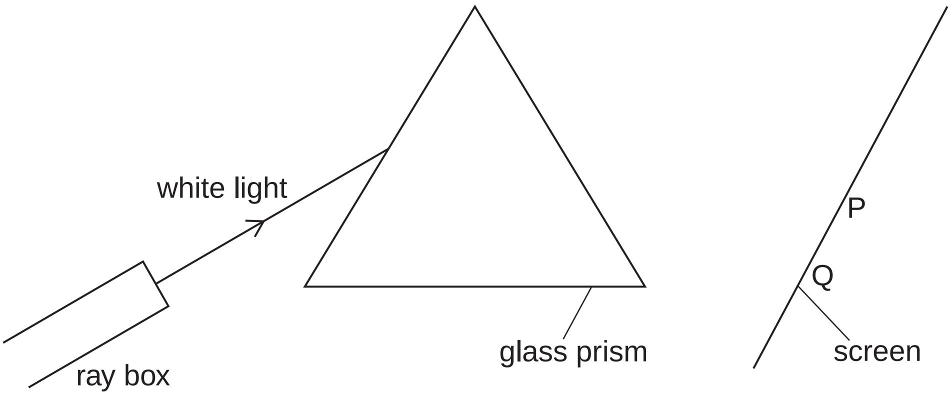

Fig. 6.1

(a) State the colour of the light at end P of the spectrum.

.... [1]

(b) State whether the value of each of these properties for blue light is greater than, equal to or less than the value for red light.

(i) speed in a vacuum .... [1]

(ii) wavelength .... [1]

(c) Fig. 6.2 shows the ray passing through a red filter before it reaches the prism.

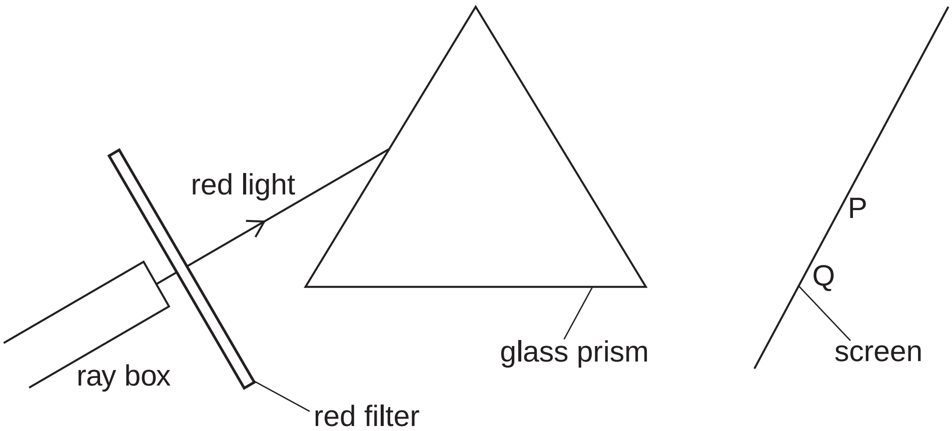

Fig. 6.2

Complete Fig. 6.2 to show the ray of red light passing through and emerging from the prism. [2]

For Examiner's Use

7 A motorcycle battery consists of six 2.0V cells in series. The battery supplies energy to the headlight.

(a) State the total electromotive force (e.m.f.) of the battery.

.... [1]

(b) The motorcycle headlight contains two identical filament lamps F and G. Filament lamp F is always lit but filament lamp G is turned on and off by switch D.
Fig. 7.1 is the circuit diagram.

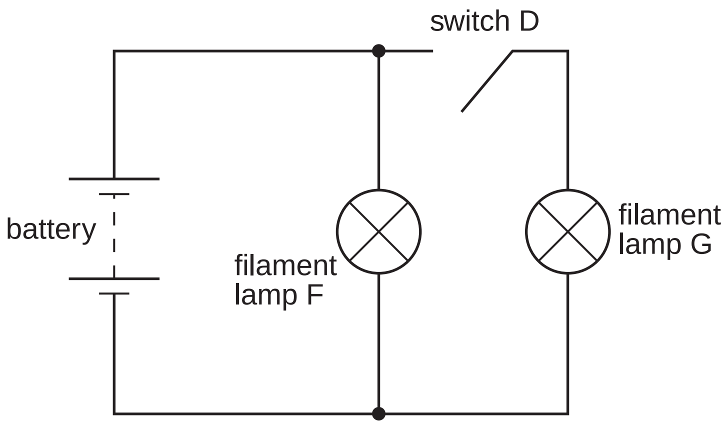

Fig. 7.1

When switch D is open, the battery supplies a current of 4.6 A.

Complete the table of Fig. 7.2.

	current supplied by battery / A	current in filament lamp F / A	current in filament lamp G / A
switch D open	4.6		
switch D closed			

Fig. 7.2 [3]

(c) Calculate the energy supplied by the battery as an electric charge of 200 C moves through the circuit.

energy supplied = ... [2]

For Examiner's Use

8 The reaction that takes place at the centre of the Sun can be represented as

$$2\,{}^{1}_{1}\text{p} + 2\,{}^{1}_{0}\text{n} \rightarrow {}^{4}_{2}\text{He}.$$

(a) State the name of this type of reaction.

.... [1]

(b) The speed of light is 3.0×10^{8} m/s.

(i) The mass of the helium nucleus (${}^{4}_{2}\text{He}$) produced is different from the total mass of the two protons and the two neutrons. The difference is 6.6×10^{-29} kg.

Explain why energy is released during the reaction.

....

....

.... [2]

(ii) Calculate the energy released in this reaction. State the formula used.

energy = ... [3]

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 Fig. 9.1 shows one swimmer in a race starting before the signal.

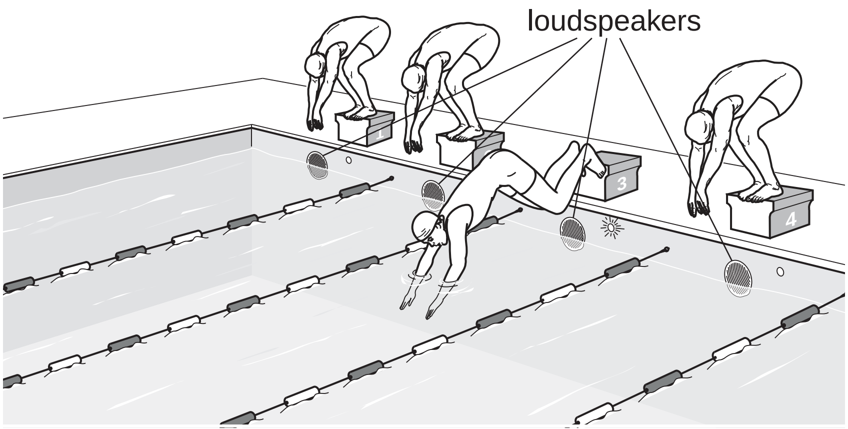

Fig. 9.1

The swimmer is called back by a loud, low-pitched sound from a loudspeaker positioned just at water level. The speed of sound in air is 330 m/s.

(a) (i) Describe how the loudspeaker causes sound to travel through the air. [3]

(ii) Explain, in terms of wave properties, what is meant by *loud* and *low-pitched*. [3]

(iii) The swimmer is 0.57 m from the loudspeaker when he hears the sound. Calculate the time taken for the sound to reach him through the air. [2]

(iv) Explain how the time taken differs when sound travels the same distance through air and through water. [2]

(b) The loudspeaker produces sound of frequency 0.20 kHz.

(i) Calculate the wavelength of this sound. [3]

(ii) Draw a diagram to show what is meant by the term *wavelength* when applied to a **longitudinal** wave such as sound. [2]

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10 Fig. 10.1 shows a wire passing through a hole in a horizontal, plastic board.

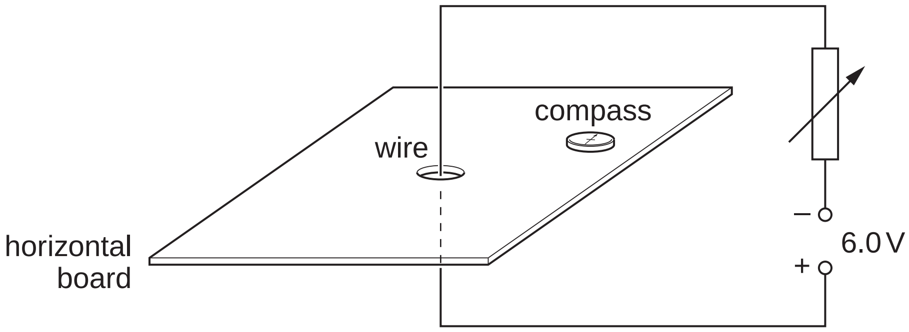

Fig. 10.1

The wire carries a current vertically upwards. A student moves a small compass around the board and plots the magnetic field lines due to the current.

(a) **(i)** Draw a diagram of the board as seen from above and mark on it the magnetic field lines due to the current. [3]

(ii) The current is increased. Describe how the magnetic field changes. [1]

(b) A 6.0 V power supply produces a current of 8.0 A in the wire. Calculate

(i) the total resistance of the circuit, [2]

(ii) the charge that flows through the wire in 2.0 minutes. [2]

(c) The north pole of a bar magnet is held on the left of the wire and the south pole of another bar magnet is held on the right, as shown in Fig. 10.2.

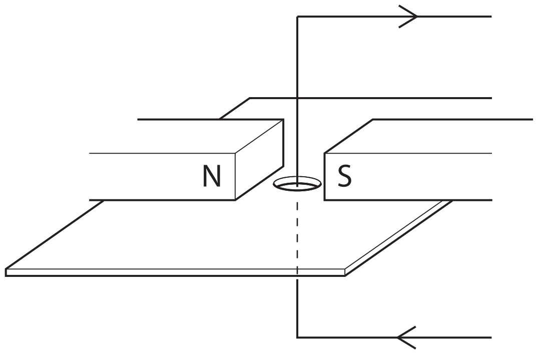

Fig. 10.2

(i) State the direction of the magnetic field at the wire due to these two poles. [1]

(ii) The wire is flexible. Describe the effect of this magnetic field on the current-carrying wire. [2]

(iii) The current in the wire is now reversed. State the effect of this on the wire. [1]

(iv) Describe how this effect is put to use in a d.c. motor. [3]

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11 A thin metal filament J and a metal plate K are sealed inside an evacuated glass vessel. The electrical connections pass through the glass to external components as shown in Fig. 11.1.

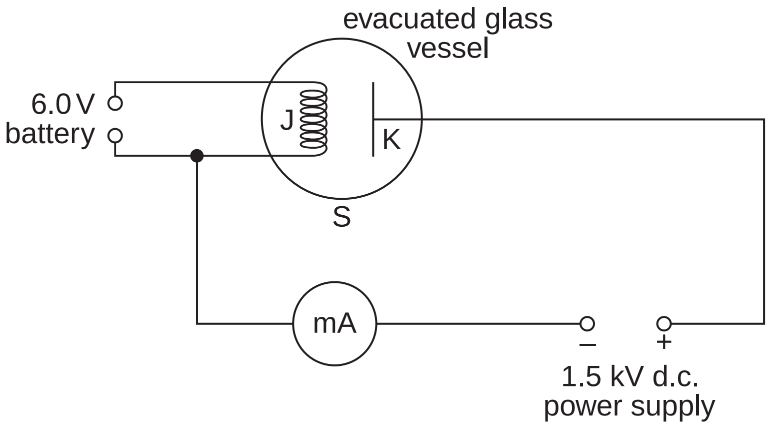

Fig. 11.1

(a) A 6.0 V battery is connected to J and the filament becomes white hot. The current from the battery is 1.6 A. Calculate the power supplied by the battery. [2]

(b) A milliammeter and a 1.5 kV d.c. power supply are connected in series between K and J. The positive terminal of the power supply is connected to K.

(i) The milliammeter registers a small current. Explain the presence of a current in this circuit despite the gap between J and K. [3]

(ii) State why the glass vessel must be evacuated. [1]

(iii) One pole of a bar magnet is brought close to the side S of the glass vessel and the current registered by the milliammeter decreases. Explain why this happens. [2]

(iv) The terminals of the 1.5 kV d.c. power supply are reversed. Explain how this affects the current in the milliammeter. [2]

Question 11 is continued on page 13.

(c) Fig. 11.2 shows two terminals M and N of a potential divider (potentiometer) connected to a 6.0V battery. N is also connected to one of the two Y-input terminals of a cathode-ray oscilloscope. The other Y-input terminal is connected to the sliding contact of the potential divider (potentiometer).

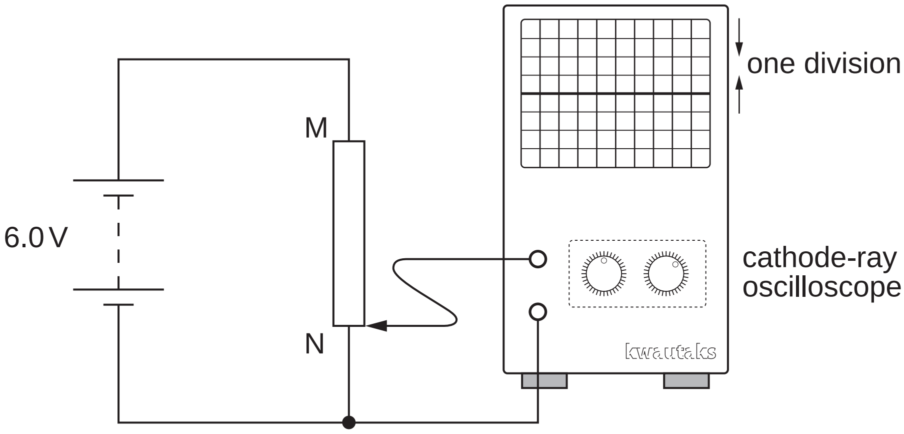

Fig. 11.2

The sliding contact is at N and the trace on the oscilloscope is a horizontal line passing through the centre of the screen.

(i) The timebase setting is 1.0 ms / div. Explain why the trace is a horizontal line. [1]

(ii) The Y-gain setting is 2.0V / div. The sliding contact is moved at a slow, uniform rate from N to M. Describe in detail what happens to the trace on the screen. [3]

(iii) The Y-gain setting is now changed to 1.0V / div and the trace disappears from the screen. State why this happens. [1]

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