ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS 9188/5

PAPER 5

NOVEMBER 2011 SESSION 1 hour 15minutes

Additional materials:
Answer paper
Electronic Calculator and / or Mathematical tables
Ruler (mm)

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **four** questions.

Question 1 is compulsory.
Answer any other **three** from the remaining questions.

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.
All working for numerical answers must be shown.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
You are reminded of the need for good English and clear presentation in your answers.

Candidates are advised to spend 30 minutes on **question 1**.

This question paper consists of 9 printed pages and 3 blank pages.

[Turn over

*Answer **question 1** and **any other 3** from the remaining questions.*

1 (a) (i) By using definitions of pressure and density derive the equation, $p = \rho gh$, with terms having their usual meanings.

(ii) **Fig. 1.1 (a)** shows water in a measuring cylinder. An iron bar of mass, 1.0 kg is then held in the water as shown in **Fig. 1.1 (b).**

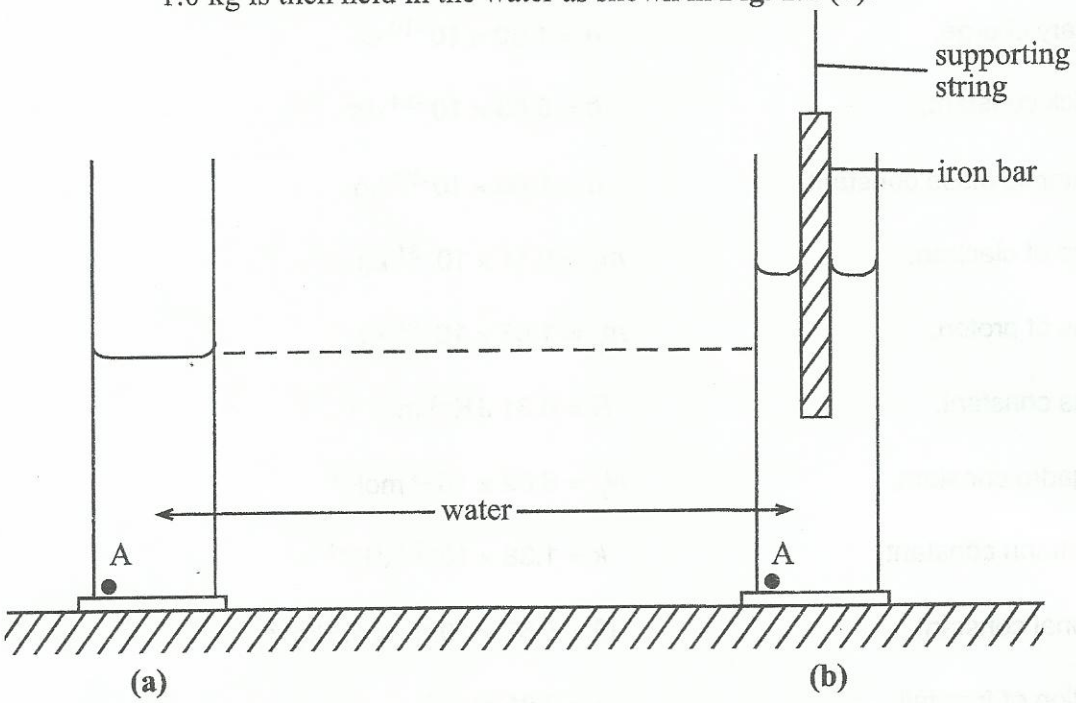

Fig. 1.1

State and explain whether the pressure at point A is different in the two situations.

[6]

(b) **(i)** **Fig. 1.2** shows the output of an alternating current source.

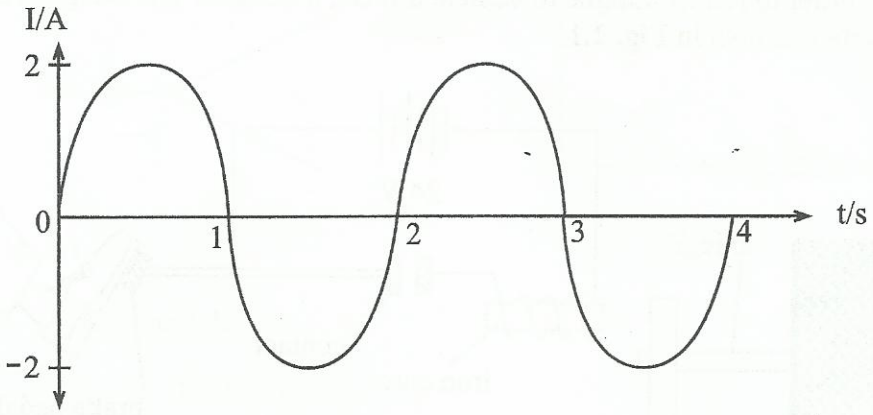

Fig. 1.2

1. State what is meant by *root mean square value* of alternating current.

2. Determine the average value of the current over the two cycles shown in **Fig. 1.2**.

(ii) When an alternating current source is connected to a hospital lamp, in an intensive care unit, the lamp lights with the same brightness as it does when connected across a 24 V battery.

Find the

1. root mean square voltage of the alternating current supply.

2. peak voltage of the alternating current supply.

(iii) Zimbabwe Electricity Supply Authority (ZESA) supplies electrical energy to a distant farm through power lines which have a total resistance of 5 Ω.

1. Explain why an input potential difference of 100 kV r.m.s. would be preferred to that of 10 kV r.m.s.

2. Calculate, in each case, the output voltage when the power input is 20 MW.

[12]

(c) **(i)** State what is meant by *a photon*.

(ii) Explain how the photoelectric effect demonstrates the quantum nature of electromagnetic radiation. [6]

2 **(a)** State Lenz's *law of electromagnetic induction.* [1]

(b) In order to reduce fatigue to vehicle drivers, a designer has designed a braking system shown in **Fig. 2.1**.

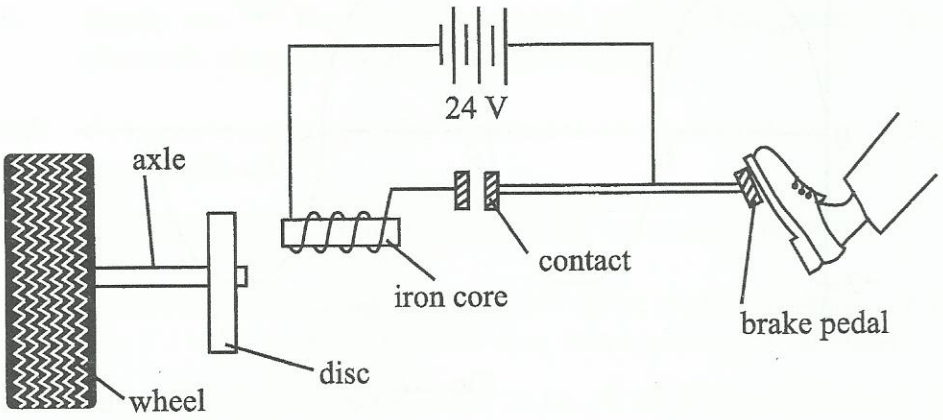

Fig. 2.1

(i) Recommend a suitable material for the disc and give a reason for your choice.

(ii) Describe and explain how the braking is achieved.

(iii) State how the strength of the electromagnet can be increased.

[11]

3 **(a)** Draw a circuit symbol for a galvanometer. [1]

(b) Using a standard cell with e.m.f. of 1.0186 V, explain how you would find the e.m.f. E_1 of a torch cell using a potentiometer. [3]

(c) **Fig. 3.1** shows current flowing through a junction. **Fig. 3.2** shows a closed loop.

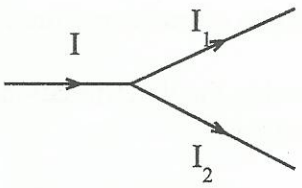

Fig. 3.1

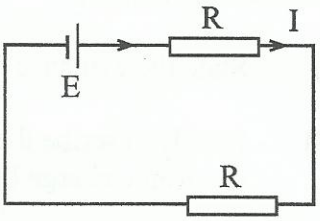

Fig. 3.2

(i) Explain why

1. $I = I_1 + I_2$,

2. $E = \Sigma IR$.

(ii) Use the concepts in **(i)** to find current I_1 and I_2 in **Fig. 3.3**.

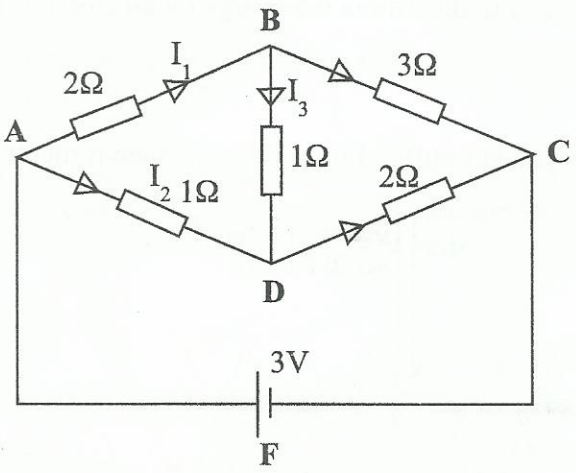

Fig. 3.3

[8]

4 **(a)** Millikan's oil drop experiment was a major success in the determination of the electron charge.

(i) State the evidence provided by the results of this experiment.

(ii) Briefly describe the principles involved in the determination of the electronic charge by Millikan's experiment.

(iii) To improve accuracy in the experiment, Millikan used a heat jacket and a less volatile oil.

Explain how each of these improved the accuracy of the results.

(iv) A student investigating the magnitude of the electronic charge, based on non-S.I units, obtained the following data of charge on oil drops:

26.08; 22.82; 9.77; 26.08;16.30; 22.82; 19.56; 9.78; 16.30; 26.08; 9.78; 16.30; 19.56; 9.79

Use these results to determine the charge on an electron according to the student.

[10]

(b) **Fig. 4.1** shows a simplified form of a mass spectrometer.

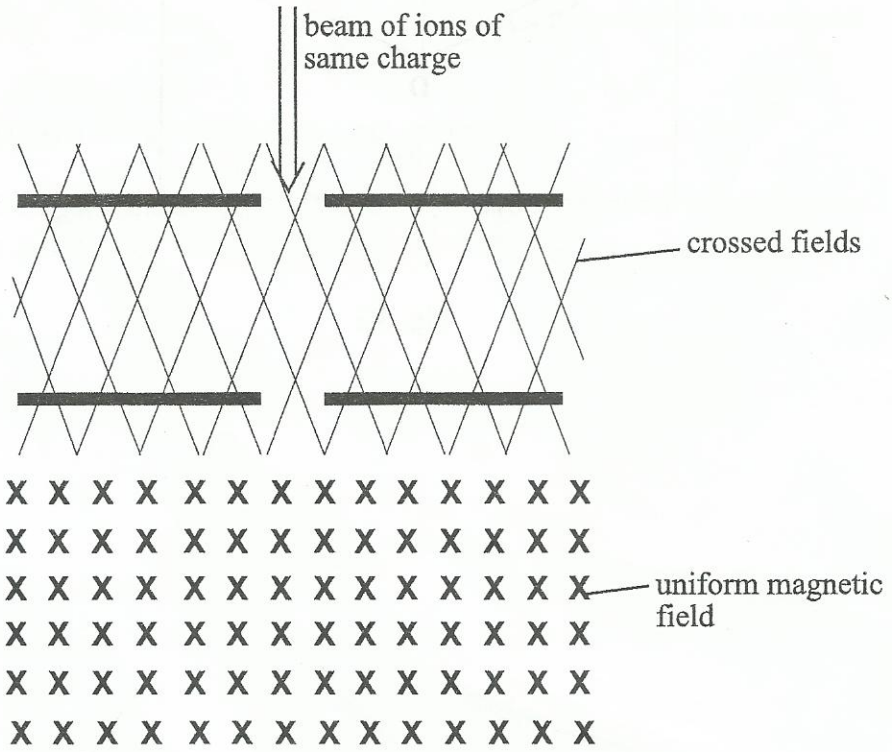

Fig. 4.1

Suggest

(i) the use of the crossed fields,

(ii) how the separation of ions of different masses is achieved. [2]

5 **(a)** **(i)** Define *heat capacity*.

(ii) State how the processes of melting and boiling differ from evaporation.

(iii) Explain the

1. cooling effect associated with evaporation,

2. reason why water is used as a coolant in engines. [5]

(b) Give the first law of thermodynamics and the principle upon which it is based. [2]

(c) **(i)** Determine the amount of heat needed to convert

1. 5 kg of ice to water at 0°C

2. 5 kg of water to vapour at 100°C

$$\begin{bmatrix}\text{Specific latent heat of fusion of water} = 336\ \text{kJ/kg} \\ \text{Specific latent heat of vaporisation of water} = 2.0 \times 10^6\ \text{J/kg}\end{bmatrix}$$

(ii) Comment on your answers to **(c)(i)**. [5]