25 copies

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS 9188/5

PAPER 5

JUNE 2013 SESSION 1 hour 15 minutes

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)** Explain the terms in the ideal gas equation of state.

(ii) One molecule of oxygen was put in a 500 cm^3 container.

Calculate the temperature of the oxygen gas if the molecule is moving at 590 m/s.

(iii) State and explain whether your answer in **(ii)** is reliable or not.

[5]

(b) **Fig. 1.1** shows a circuit with a power supply of e.m.f, E, and negligible internal resistance.

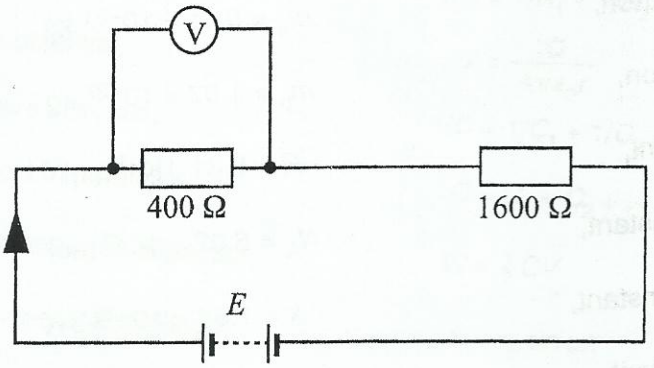

Fig. 1.1

(i) If the resistance of the voltmeter is 2 000 Ω, calculate the magnitude of E when the voltmeter gives a reading of 8 V.

(ii) Suggest **one** assumption made besides that of negligible internal resistance.

[4]

(c) **(i)** State Coulomb's law.

(ii) Compare the electrostatic force and the gravitational force.

(iii) Calculate the force between an electron and a proton 1.0×10^{-10} m apart, in a vacuum.

[5]

(d) (i) State and explain **two** features of a transformer which help minimise energy losses.

(ii) **Fig 1.2** shows the power variation with time for the primary coil of an ideal transformer.

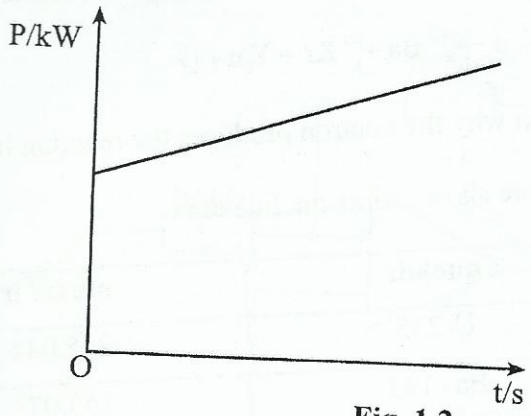

Fig. 1.2

Copy **Fig.1.2** and sketch the power variation for the secondary coil on the same axes.

[5]

(e) (i) Define the term *decay constant*.

(ii) The half-life of radon-220 is 55.7 s and there are 6.0 g of radon-220 initially.

Calculate the number of radon-220 atoms remaining after three and half days.

(iii) State the effects of using, in a hospital, a short half-life source and a long half-life source.

[5]

2 (a) (i) State the difference between nuclear fusion and nuclear fission.

(ii) Describe the significance of binding energy per nucleon to the processes of fission and fusion.

(iii) Find the values of **x** and ***Y*** in the nuclear reaction below.

$$^{235}_{92}\mathrm{U} + ^{1}_{0}\mathrm{n} \rightarrow ^{143}_{56}\mathrm{Ba} + ^{90}_{x}\mathrm{Kr} + \mathbf{Y}^{1}_{0}\mathrm{n} + Q$$

(iv) Explain why the neutron produces the reaction in **(iii)**.

(v) The table shows some nuclide data.

nuclide	mass / u
U-235	235.044
Ba- 143	143.073
Kr- 90	89.080
n	1.009

Use the data to determine the energy Q in **a(iii)** in MeV.

[8]

(b) The reaction in **a(iii)** can be used in the generation of electricity.

(i) Suggest how electricity can be generated from this reaction.

(ii) Give **one** advantage and **one** disadvantage of generating electricity using this reaction.

[4]

3 **(a)** Use energy considerations to distinguish between an **LED** and a **buzzer** as output transducers. [1]

(b) Explain the virtual earth approximation as applied to operational amplifiers. [3]

(c) An electronic thermometer consists of a thermocouple connected to a voltmeter as shown in **Fig. 3.1**.

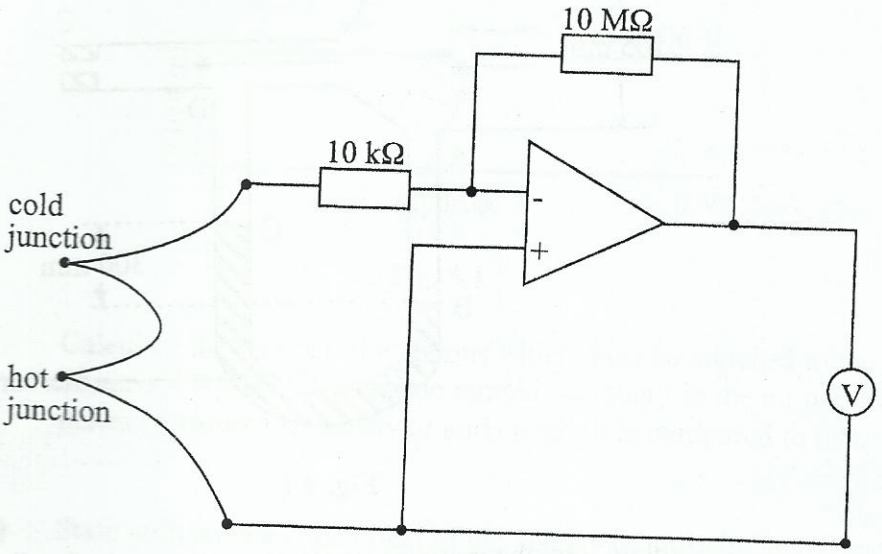

Fig. 3.1

The voltmeter reads 3.20 V and 0.00 V at the steam point and ice point respectively.

(i) Determine the

1. input voltage at the steam point,
2. voltmeter reading at 130°C. [5]

(ii) Comment on the use of the op-amp as a comparator in **Fig. 3.1** against its use in the same set-up as a voltage follower. [3]

4 **(a)** State the equation of continuity, with terms explained, for the flow of an ideal fluid. [2]

(b) **(i)** **Fig. 4.1** shows a U-tube manometer connected to two different parts of a pipe with flowing water.

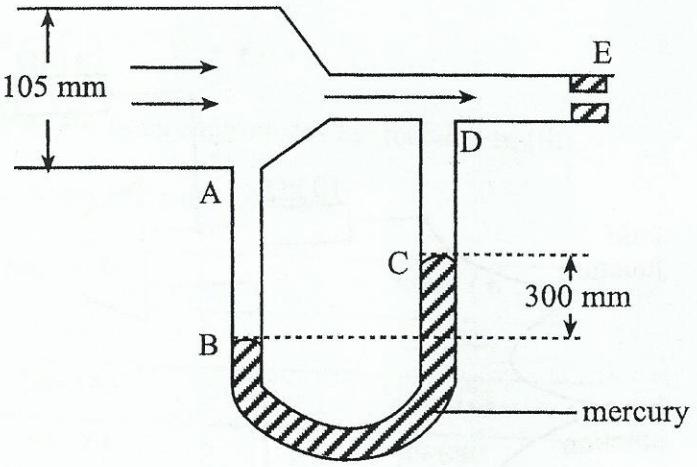

Fig. 4.1

1. Explain why the mercury levels are as shown in the diagram.

2. The speed of water in the wider part is 10 m/s and the densities of water and mercury are 1000 kgm^{-3} and 13 600 kgm^{-3} respectively.

If the water is assumed to behave ideally, determine the diameter of the narrow part. [8]

(ii) The end **E** of the tube in **Fig. 4.1** can be adjusted to further reduce the cross-sectional area at this part.

Suggest and explain **one** advantage of such a system for irrigation purposes. [2]

5 (a) Explain the term *Quantisation of charge*. [1]

(b) (i) Describe how the radius of an oil drop is determined in Millikan's oil drop experiment.

(ii) **Fig. 5.1** shows a diagram of Millikan's oil drop experiment.

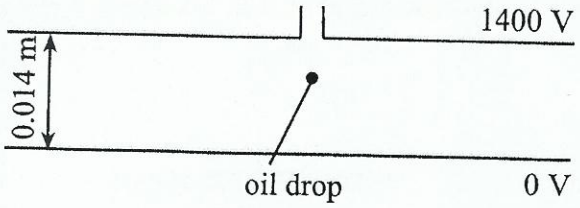

Fig. 5.1

Calculate the number of electrons which must be attached to the oil drop of mass 4.9×10^{-15} kg for it to remain stationary in the air between the plates (Assume the density of air is negligible compared to oil).

(iii) State with a reason the effect of the density of air being significant.

[9]

(c) The following charges on various oil drops were found by the Millikan experiment:

26.4×10^{-19}C; 4.4×10^{-19} C; 13.2×10^{-19} C; 11.0×10^{-19} C

Deduce the value of the charge of an electron. [2]