X15

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS 9188/5

PAPER 5

JUNE 2012 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 10 printed pages and 2 blank pages.

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

1 **(a)** **(i)** Define *strain* and *stress.*

(ii) Use any of the two terms in **a(i)** to explain the term *creep.*

(iii) State **one** characteristic of a good creep-resistant material.

(iv) Explain the causes of deformation of a tungsten filament lamp. [8]

(b) **(i)** State and explain **two** ways by which a body can be charged.

(ii) Use Coulomb's Law to show that the electric field strength, E, at a distance , r, from a point charge, q, is given by

$$E = \frac{q}{4\pi\varepsilon_o r^2}.$$

(iii) Two point charges, q_1 and q_2, are 50.0 cm apart. q_1 is 2.5×10^{-9} C and q_2 is -2.5×10^{-9} C. (See **Fig.1.1**)

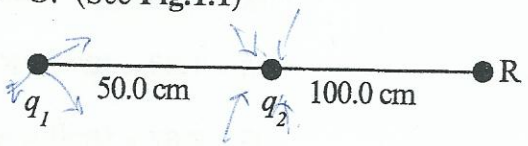

Fig.1.1

Determine the field strength at point R, 100.0 cm from q_2. [8]

(**N.B.** The diagram is not to scale).

(c) **(i)** Distinguish between *emission* and *absorption* line spectra.

(ii) Explain the formation of emission line spectra by gases at low pressure.

E = Stress / Strain

(iii) **Fig.1.2** shows some of the energy levels in a hydrogen atom.

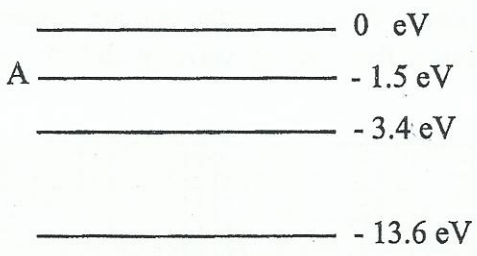

Fig. 1.2

[8]

Calculate the energy in joules which an electron of the hydrogen atom must gain for transition from ground state to energy level A.

2 (a) State Faradays's Law of electromagnetic induction. [1]

(b) A coil of 600 turns of fine wire each of area 500 mm^2 is placed with its plane normal to a magnetic field. The ends of the coil are connected together. The magnitude of the magnetic flux density varies with time as shown in **Fig. 2.1.**

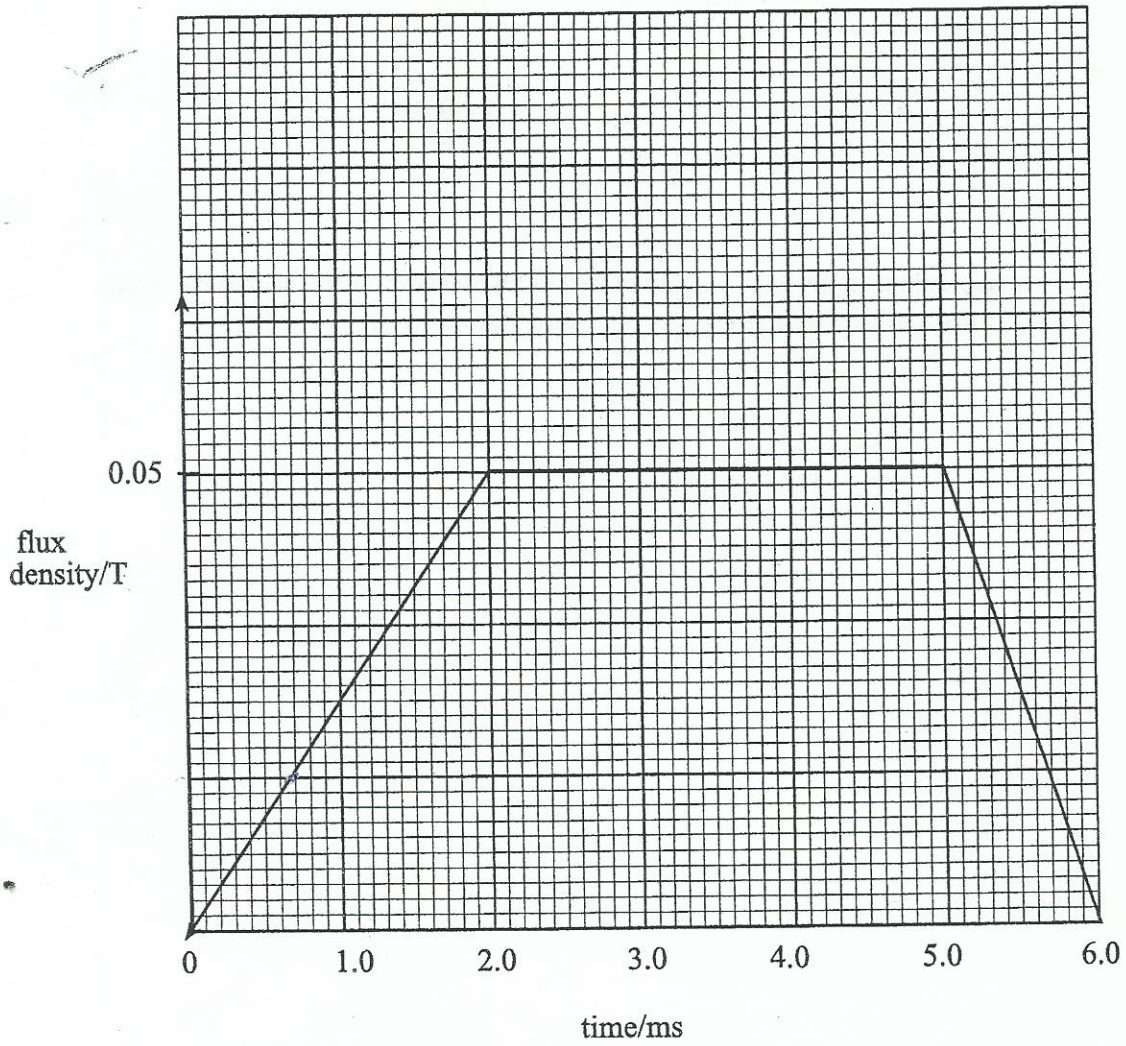

Fig. 2.1

(i) Calculate the maximum flux linking one turn of the coil.

(ii) Determine the *emf* induced in the coil during the first 2.0 ms.

(iii) Sketch a graph to show how the induced *emf* varies with time over the 6.0 ms.

(iv) State **three** ways of increasing the magnitude of the induced e.m.f peak. [11]

3 (a) State any **two** physical properties that vary with temperature. [2]

(b) A physical quantity, x, varies with temperature as shown in **Fig. 3.1.**

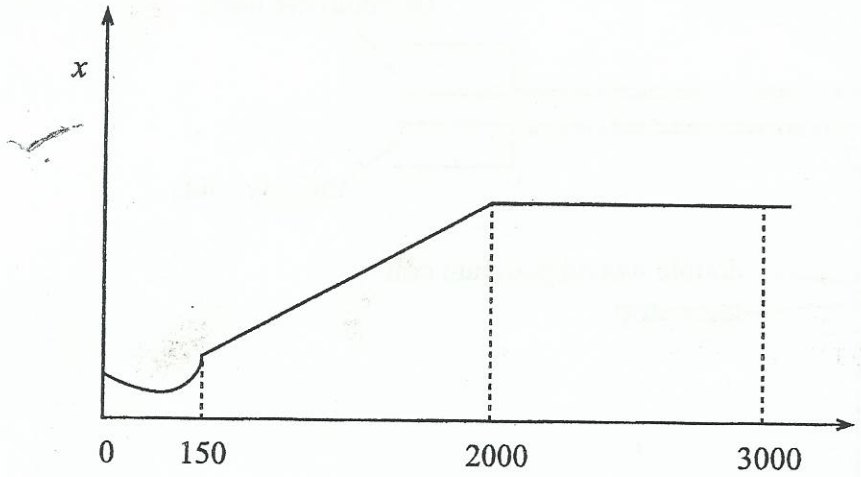

Fig. 3.1

(i) From the graph, determine the range the quantity can be used as a thermometer.

(ii) Explain your answer in **(b) (i).**

(iii) Give **two** practical uses of such a thermometer.

[4]

(c) **Fig. 3.2** shows a platinum resistance thermometer.

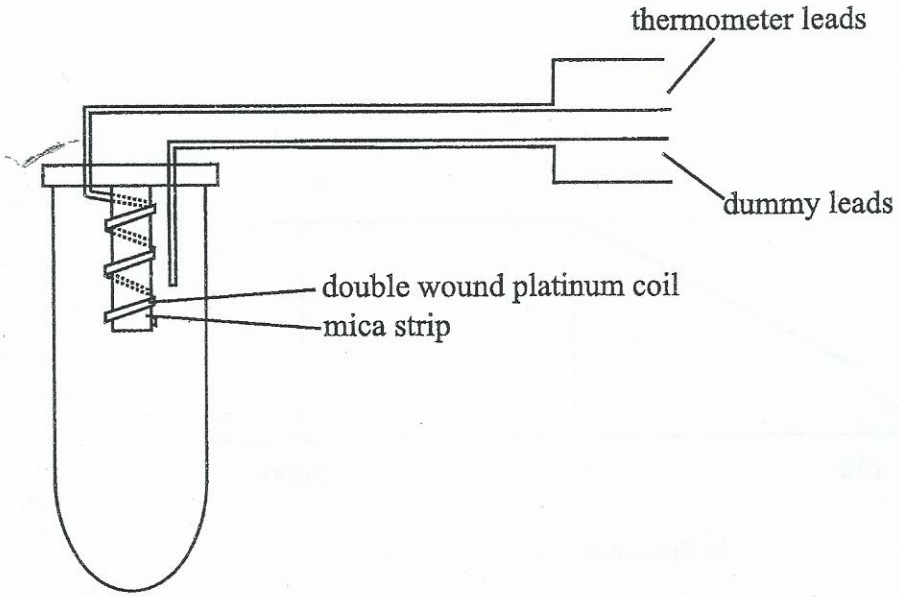

Fig. 3.2

(i) Explain the following features of the thermometer:

1. the coil is double wound

2. presence of dummy leads

(ii) Give two advantages of the platinum resistance thermometer over a thermocouple one.

[6]

4 (a) Define *electric field strength.* [1]

(b) **Fig. 4.1** shows an electron getting into a uniform electric field, *E,* between two parallel plates of length, 200 cm.

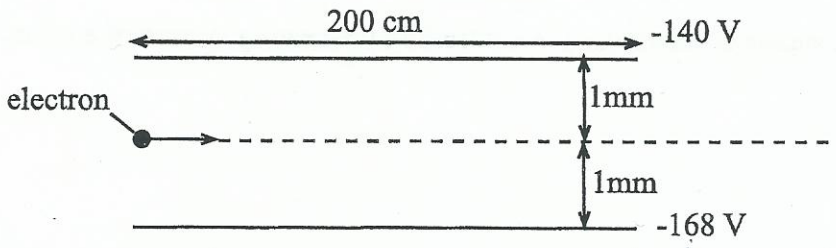

Fig. 4.1.

(i) Determine the magnitude of the electric field strength, *E.*

(ii) Calculate the electric force on the electron.

(iii) On a sketch diagram, label all the forces acting on the electron.

(iv) Deduce whether the electron will leave the field or not. Hence complete the path of the electron.

[11]

5 (a) (i) Describe the effect of negative feedback on the gain of an operational amplifier.

(ii) Explain the virtual earth principle.

[3]

(b) Fig. 5.1 shows a circuit used in controlling the heating system of a room.

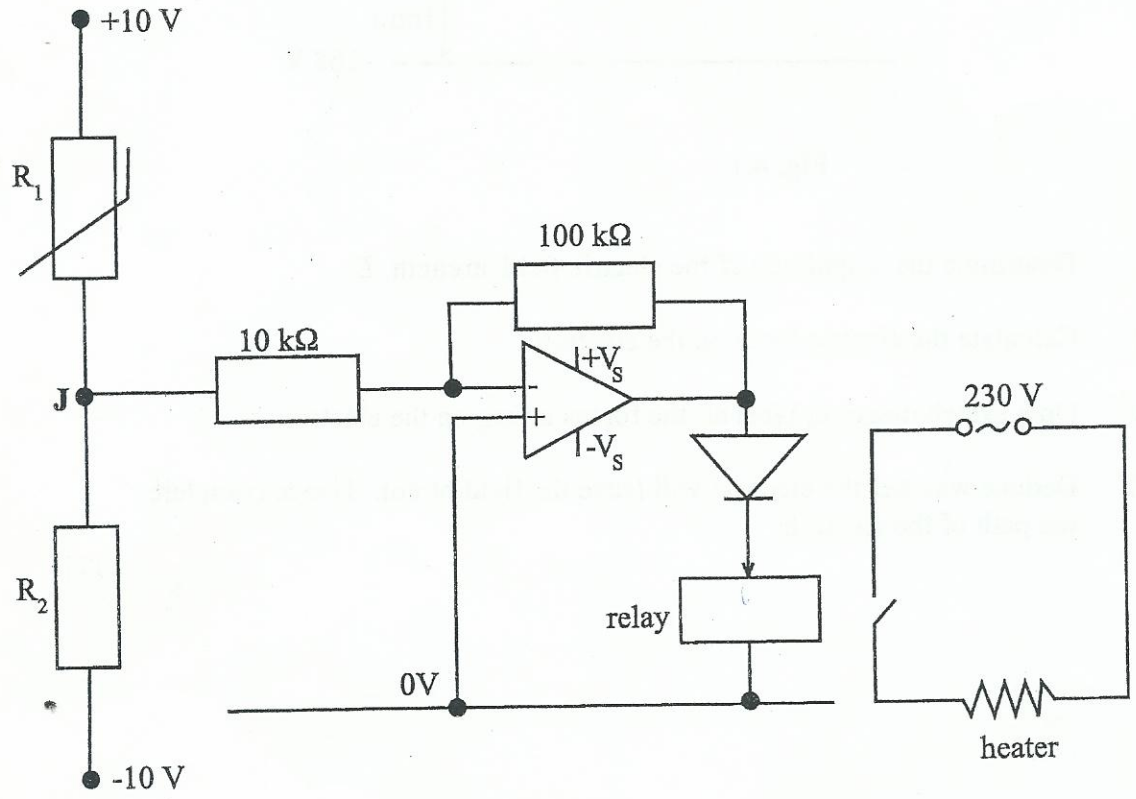

Fig. 5.1

(i) Calculate the gain of the op - amp.

(ii) Explain how this heating system operates.

(iii) For the relay to operate, the voltage across it must be 5.0 V. Given that R_1 is 2.0 MΩ, deduce the value of R_2.

[9]