P510/1
Physics
Paper 1
Jan 2020
1 ½ Hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

Physics

Paper 1

1 Hour 30 Minutes

INSTRUCTIONS TO CANDIDATES

- *Answer any 3 questions.*
- *Any additional question(s) answered will not be marked.*

Assume where necessary

- *Universal gravitational constant, G* = $6.67 \times 10^{-11}\ Nm^3\ Kg^{-2}$
- *Stefan's — Boltzmann's constant, σ* = $5.67 \times 10^{-8}\ Wm^{-2}K^{-4}$
- *Speed of light in vacuum, C* = $3.0 \times 10^{8} ms^{-1}$
- *Specific heat capacity of water* = $4200 Jkg^{-1}k^{-1}$
- *Radius of earth* = $6.4 \times 10^{6} m$
- *Radius of sun* = $7x10^{8} m$
- *Radius of earth's orbit about the sun* = $1.5 \times 10^{11} m$
- *Planck's constant, h* = $6.6 \times 10^{-34} Js$
- *Charge of mass ratio* e/m = $8.31 Jmol^{-1}K^{-1}$
- *Gas constant, R* = $8.31\ Jmol^{-1}K^{-l}$
- *Electron mass* = $9.11 \times 10^{-31}\ Kg$
- *Electron charge, e* = $1.6 \times 10^{-19} C$
- *Density of water* = $1000\ Kgm^{-3}$
- *Density of Mercury* = $13600\ Kg\ m^{-3}$
- *Density of oil* = $900 Kgm^{-3}$
- *Viscosity of air* = $1.8 \times 10^{-5} Ns^{-1}m^{-1}$
- *Avogadro's number, NA* = $6.02 \times 10^{23}\ mol^{-1}$
- *Acceleration due to gravity, g* = $9.81\ ms^{-2}$

1. (a) (i) What is meant by **conduction of heat**? (1)

(ii) State **four** factors that determine the rate of heat flow through a solid. (2)

(iii) Describe with the aid of a labeled diagram, the experiment to determine the thermal conductivity of a piece of glass. (6)

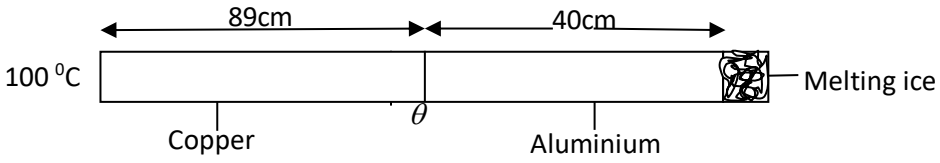
(b) (i) What is **a black body**? (1)

(ii) Sketch a graph to show the variation of intensity against wave length for radiation emitted by a black body for two different temperatures. (2).

(iii) Explain the appearance of a metal ball placed in a dark room when its temperature is progressively increased from room temperature to just below melting.
(3).

(c) (i) State **Stefan's law**. (1)

(ii) A uniform composite metal of diameter 4.0cm is made of copper off length 89cm and aluminium off length 40cm joined end to end.



One end is maintained at 100^{o}C and the other end is kept in melting ice. The sides of the metal are well lagged and the ice melts at a rate of 5.36gmin^{-1}. Calculate the thermal conductivity of copper. (4)

2. (a) Define the following;

(i) **Fundamental interval**. (1)

(ii) **Thermometric property**. (1)

(b) (i) State **two** advantages of the constant –volume gas thermometer. (2)

(ii) Explain why two thermometers may give different values for the same unknown temperature (2).

(c) (i) With the aid of labeled diagram, describe an experiment to determine the specific latent heat of vaporization of water using electrical method. (6).

(ii) Explain using molecular theory cooling, by evaporation. (3)

(d) An aluminium container of mass 100g contains 200g of ice at -20^0C. Heat is supplied to the system at the rate of 4.20W. Find the temperature of the system after 4 minutes. (5).

3. (a) Define the following terms as applied to heat
   (i) specific heat capacity (01 mark)
   (ii) internal energy of a substance (01 mark)

   (b) (i) Describe an experiment to determine the specific heat capacity of a liquid using the continuous flow method (05 marks)
   (ii) Outline the advantages the continuous flow method has over the method of mixtures when determining specific heat capacity of a liquid. (03 marks)

   (c) State Newton's law of cooling (01 mark)

   (d) In an experiment to determine the specific heat capacity of aluminium a cylindrical 1kg block of aluminium, suspended in a room at 20°C was heated electrically by a 17.3W immersion heater inserted into a hole in the centre of the block. The temperature of the block at first rose steadily and at 25°C, Its rate of rise was 10K in 10 minutes, then more slowly, finally stabilizing at 85°C.
   Calculate
   (i) the rate of heat loss from the block at 25°C (04 marks)
   (ii) the specific heat capacity of aluminium (03 marks)

   (e) Explain why temperature remains constant during change of phase from solid to liquid (02 marks)

4. (a) Explain why specific latent heat of vaporization has a greater value than that of fusion. (3marks)

(b) Water flows at a steady rate $6.0gs^{-1}$, through a continuous flow calorimeter when the p.d. across the coil is 11.0**V** and the current is 5.0**A**. The difference between the inflow and outflow temperature is 2.0**K**. When flow rate changes to $2.0gs^{-1}$, the current supplied is adjusted to 3.1**A** to produce the same temperature rise. Calculate the;

(i) new p.d. across the heating coil . (2marks)

(ii) Specific heat capacity of water . (4marks)

(c) (i) State Wien's displacement law. (1mark)

(ii) The energy intensity received by a spherical planet from a star is $1.4x10^{3}Wm^{-2}$. The star which emits black body radiation is of radius $7.0x10^{5}$km and is $14.7x10^{7}$km from the planet. Calculate the surface temperature of the star. (5marks)

(d) Explain why the Centre of a fire looks white. (3marks)