Uganda Martyrs University

FACULTY OF EDUCATION
BACHELOR OF EDUCATION (PRIMARY) YEAR TWO
SEMESTER ONE EXAMINATIONS, 2021/22
PHYSICAL SCIENCE EDUCATION

PAPER TWO: THERMAL PROPERTIES OF MATTER, MATERIALS AND STRUCTURES

DATE: Wed 11/01/2023 **3hrs** **Time: 2.00-5.00 PM**

Instructions:

- **Do not write anything on this question paper.**
- **Attempt FOUR questions.**
- **Begin each selected question on a new page in the answer booklet.**
- **Follow instructions on this question paper and answer booklet carefully.**
- **Each question carries a total of 25 marks.**

These values might be of use to you:

i. Latent heat of fusion of lead = 2.45×10^4 J/kg, c of lead = 128 J/kg ^{O}C and Specific heat capacity of Iron (c) = 448 J/kg ^{O}C
ii. Latent heat of fusion of ice = 334J/g, Latent heat of vaporization of water = 2257J/g
iii. Specific heat capacity of water = 4.186 J/g ^{O}C

QUESTIONS

1. a. Define i. Latent heat of fusion
ii. Latent heat of vaporization
iii. Heat capacity
iv. Specific heat capacity **10mks.**

b. i. The specific heat capacity of water is higher than that of air. Explain this observation. **5mks**

ii. Determine the final temperature of the Lead – Iron system, if 100g of molten lead at its melting point of 327.3^{O}C is poured into a 200g casting form made of iron and initially at 25^{O}C. (Assume **no** energy is lost to the environment) **10mks**

2. a. What is meant by: i. Heat? **2mks**
ii. Thermo-equilibrium? **2mks**

b. i. Explain three reasons why Mercury is preferred to Alcohol as thermometric liquids. **6mks**

ii Describe the process of identifying the upper and lower fixed points during calibrating (putting a standard scale on) a thermometer. **8mks**

iii. Explain the working of the maximum and minimum thermometer **7mks**

3. a. Define the following:

i. Temperature,

ii. Kinetic Energy **4mks**

b. i. The average maximum and minimum temperatures recorded on a certain day were 90°F and 5°F respectively. Express these temperatures in the Celsius and Kevin scales.

6mks

ii. An Iron plate is 3cm thick, with a cross-sectional area of 2550cm^2, and its one side is 150°C hot while the other side is 130^{0}C hot. Given that the thermal conductivity, k, for Iron is 80 Wm^{-1}K^{-1}, find the amount of heat passing through the plate per second.

8mks

c. A 60g sample of copper at 26 ^{O}C absorbs 1200J of thermal energy.
Determine the final temperature of copper **7mks**

4. a. i. State the Pressure Law **3mks**

ii. The pressure of a mass of gas at constant volume at a temperature of 120°C is 600mmHg. Calculate the pressure of the same amount of gas if the temperature falls to a third.

10mks

b. Describe an experiment that can be used to verify the pressure law. **12mks**

5. a. Derive the equation of state. **10mks**

b. A 2 liters bulb contains a certain amount of gas at 110^{0}C and exerts a pressure of 151987.5Nm^{-2}, what pressure would be developed if the same amount of gas is contained in a 3 liters vessel at a temperature of 90°C? **15mks**

6. a. Differentiate between the following structures

i. a Ring beam and a Column

ii. a Strut and a tie **10mks**

b. Describe an experiment you would carry out to illustrate the terms; *compression* and *tension* in a beam. **15mks**

7. a. State and briefly explain Charles' law **5mks**

b. i. The volume of a fixed mass of a gas is 350cm^3 at a temperature of 35°C. What will its volume be at a temperature of 45°C assuming the pressure remains the same?

10mks

ii. If the volume of gas x at constant pressure is doubled when its temperature is increased from zero, determine its final temperature **10mks**

8. a. Define the terms:

i. Conduction

ii. Convection

iii. Radiation **6mks**

were 90°F

b. A cup of hot tea stands on a table and after some time it gets cold. Describe the various ways in which the tea in the cup can cool down. **9mks**

c. Explain how the thermos flask is designed in order to prevent heat loss through conduction, convection and radiation **10mks**

END