KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
Resit/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPH 115

COURSE TITLE: HEAT AND PROPERTIES OF MATTER

DURATION: 2 HOURS

DATE: 27/09/2021   **TIME: 2:00-4:00PM**

<u>INSTRUCTIONS TO CANDIDATES</u>
- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **4** printed pages. Please Turn Over

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Question One (30 Marks)

a) State Zeroth law of thermodynamics. (1 mark)

b) What is seebeck effect in a thermometer? (1 mark)

c) Explain the following terms as used in heat;

    I.   Diathermic wall. (1 mark)

    II.   Adiabatic wall. (1 mark)

d) What is seebeck effect in a thermometer? (1 mark)

e) What is thermal equilibrium? (2marks)

f) Differentiate between calorimetry and thermometry. (2 marks)

g) When the temperature of the gas is raised, state the changes that are likely to happen to it. (2 marks)

h) State provost's theory of heat exchange. (2 marks)

i) State Pascal principal of transmission of pressure and name its practical applications. (2 marks)

j) There is a change in length, area and volume when a solid is heated. Which factors does these changes depend on? (3 marks)

k) Convert $-100^{\circ}C$ into Fahrenheit scale. (3 marks)

l) Explain the concept of temperature. (3 marks)

m) An Oxygen cylinder has temperature and pressure of $-20^{\circ}C$ and 2.5 atmospheres respectively. Find its pressure when its temperature is raised to $-105^{\circ}C$. (3 marks)

n) Name any three application of convection in liquids. (3 marks)

Question Two (20 Marks)

a) What is linear expansivity of a solid? (1 mark)

b) An Aero plane gets lifted into air from the runway. Explain. (2 marks)

c) Name any three types of thermometers. (3 marks)

d) How much heat is needed to bring 10g of water from 50°C to boiling point? (Specific heat capacity of water = 4200 $Jkg^{-1}{}^{\circ}C^{-1}$)? (4 marks)

e) A piece of iron of mass 0.20kg is heated to 64°C and then dropped gently into 0.15kg of water at 16°C. If the temperature of the mixture is 22°C, what is the specific heat capacity of iron? Take specific heat capacity of water to be 4.2J/Kg/K. (5 marks)

f) The power of a thermocouple is given by $P = (\frac{1}{2} + 0.2t)J/s$. Find the electromotive force of the thermometer. (5 marks)

Question Three (20 Marks)

a) State provost's theory of heat exchange. (2 marks)

b) A platinum resistance thermometer reads $5.5 \times 10^{-4} K\Omega$ an $8.02 \times 10^{-4} K\Omega$ in melting ice and pure steam respectively. Find the temperature when the thermometer reads 0.2Ω. (3 marks)

c) Name the systems that have measurable properties that vary with temperature. (3 marks)

o) Describe thermocouple thermometer. (4 marks)

p) The normal boiling point of liquid oxygen is -182.97°C, what is this temperature on the Kelvin and Fahrenheit scales? (4 marks)

q) A metal container of heat capacity 200J °C⁻¹ is heated from 15°C to 45°C. What is the quantity of heat required to do so? (4 marks)

Question Four (20 Marks)

a) Why is alcohol thermometer preferred over other types of thermometers for use in temperate regions? (1 mark)

b) Explain the following terms as used in quantity of heat;

   I)   Heat capacity. (1 mark)
   II) Specific latent heat of vaporization. (1 mark)

c) Explain the statement "the specific latent heat of fusion of ice 3.3 x 10^{-5} Jkg^{-1}". (2 marks)

d) An iron rail is 20m long. How much will it expand when heated from $10°C$ to $50°C$ (linear expansivity of iron $= 1.2 \times 10^{-5} C^{-1}$) (3 marks)

e) The volume of a small piece of metal is 5cm^3 at $20°C$ and 5.014cm^3 at $100°C$. Determine its cubic expansivity. (5 marks)

f) Name any three applications of thermal expansions. (3 marks)

g) The lengths of the mercury column of a mercury thermometer are 1.06cm and 20.86cm respectively at the standard fixed points. What is the temperature of body, which produces 7.0cm of this mercury column? (4 marks)

Question Five (20 Marks)

a) What is steady flow of a fluid? (1 mark)

b) State Pascal principal of transmission of pressure and name its practical applications. (2 marks)

c) A pipeline 0.2m in diameter, flowing full of water has a constriction of diameter 0.1m. If the velocity in the 0.2m portion is 2.0m/s find the velocity of the water in the constriction and the discharge rate in cubic meters per second. (5 marks)

d) A hydraulic press where the area of the small piston is 0.001m^2 while the area of the large piston is 0.1m^2. Calculate the weight of the load that can be lifted by the large piston when an effort of 80N is applied to the small piston. (4 marks)

e) Find the pressure on a diver working at the depth of 10m in the sea on a day when the barometer stands at 750mmHg. (Density of sea water and mercury is 1050kgm^{-3} and 13,600kgm^{-3} respectively). Express your answer in (5 marks)

I. mmHg

II. Nm^{-2} (3 marks)