



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPH 115

COURSE TITLE: HEAT AND PROPERTIES OF MATTER

DURATION: 2 HOURS

DATE: ¹⁴05/05/2021

TIME: 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES

- 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



KIBU observes ZERO tolerance to examination cheating

Question One (30 Marks)

- a) State Charles' law of gases. (1 mark)
- b) What is streamline flow of a fluid? (1 mark)
- c) What is seebeck effect in a thermometer? (1 mark)
- d) Explain the following terms as used in heat;
- I. Diathermic wall. (1 mark)
 - II. Adiabatic wall. (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) Write down the gas equation and explain all the variables in the equation. (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 $5.5 \times 10^{-4} K\Omega$ and $8.02 \times 10^{-4} K\Omega$ in melting ice and pure steam respectively. Find the temperature when the thermometer reads 0.2Ω . (3 marks)
- c) Name any five properties of a radiation. (5 marks)
- d) A thin square steel plate 10 cm on a side is heated in a blacksmith forge to a temperature of 800°C. If the emissivity is unity, calculate the total rate of radiation of energy? (5 marks)
- e) Name any five properties of thermometric substance. (5 marks)

Question Four (20 Marks)

- a) Explain the following terms as uses in thermometers;
- I. Upper fixed point. (1 mark)
 - II. Lower fixed point. (1 mark)
- b) What is thermal equilibrium? (2marks)
- c) The pressure of the hydrogen gas in a constant volume hydrogen thermometer is 12mmHg and 54mmHg respectively in pure melting ice and steam. Find the thermometer reading when the temperature is 80°C. (3 marks)

d) Explain the concept of heat. (3 marks)

e) Show that $t_F = \left[\frac{9}{5}t_C + 32 \right]^\circ F$

where symbols have their usual meanings. (10 marks)

Question Five (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 $3.3 \times 10^5 \text{ Jkg}^{-1}$ ”. (2 marks)

d) An iron rail is 20m long. How much will it expand when heated from $10^\circ C$ to $50^\circ C$ (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 $20^\circ C$ and 5.014cm^3 at $100^\circ C$. 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)