JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION FOR THE DEGREE OF BARCHELOR IN EDUCATION SCIENCE WITH IT

MAIN

REGULAR

COURSE CODE: **SPB 9107**

COURSE TITLE: **THERMAL PHYSICS**

EXAM VENUE: **STREAM: BACHELOR OF EDUCATION**

DATE: **EXAM SESSION:**

TIME: 2:00HRS

---

1. **<u>Instructions:</u> Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Answer Question 1 (compulsory) and ANY other 2 questions**
3. **Candidates are advised not to write on the question paper.**
4. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

<u>QUESTION 1 (30 MARKS)</u>

a. Define the following terms

I. Thermal equilibrium [2marks]

II. Ideal Gas [2marks]

b. State the **Zeroth law of thermodynamics** [2marks]

c. In a gas thermometer, the pressure needed to fix the volume of 0.20 g of Helium at 0.50 L is 113.3 kPa. What is the temperature? [4marks]

d. When is a system said to be in thermal equilibrium? [2marks]

e. Explain briefly heat transfer between two objects [2marks]

f. The boiling temperature of gold is 3216 °C. Express this temperature into degrees Fahrenheit

[3marks]

g. A spherical air bubble of radius 3.5cm is released 40m below the surface of a pond at 280K. What is its volume when it reaches the surface, which is at 300K assuming it is in thermal equilibrium the whole time? Ignore the size of the bubble compared to other dimensions like 30m.

[5marks]

h. An energy saving stove when burning steadily has an efficiency of 80%. The stove melts 03kg of ice at 0^{o} C in 3minutes.

Calculate; –

i. The power rating of the stove [4marks]

ii. The heat energy wasted by the stove [4marks]

QUESTION 2 (20MARKS)

a. Define **adiabatic expansion** [2marks]

b. At 25°C, two moles of an ideal monatomic gas occupy a volume V. The gas is adiabatically expanded to a volume 4V.

i. Calculate the ratio of final pressure to the initial pressure [4marks]

ii. Change in internal energy [4marks]

iii. Calculate the molar specific heat capacity of the process Change in internal energy

[5marks]

iv. Calculate the molar specific heat capacity of the process [5marks]

QUESTION 3 (20MARKS)

a. An ideal monatomic gas is kept in a container of volume $2.1 \times 10m^3$, temperature 310 K and pressure $5.3 \times 10Pa$.

i. Calculate the number of atoms in the gas. [5mks]

ii. Calculate, in J, the internal energy of the gas. [5mks]

iii. Calculate, in Pa, the new pressure of the gas [5mks]

iv. Explain, in terms of molecular motion, this change in pressure [5mks]

QUESTION 4 (20 MARKS)

a. Using the kinetic theory, explain what is meant by an ideal gas [4marks]

b. Explain why the internal energy of an ideal gas is kinetic energy only [4marks]

c. A fixed mass of an ideal gas has a volume of 850 cm^3 at a pressure of 1.00×10^5 Pa and a temperature of 40.0°C. The gas is heated at constant pressure to a temperature of 80.0°C

i. Calculate the change in volume of the gas [4marks]

ii. Determine the external work done during this process [4marks]

iii. Explain what happens to the molecules of an ideal gas when the temperature of the gas is increased at constant volume [4marks]

QUESTION 5 (20 MARKS)

a. Distinguish between **heat capacity** and **specific heat capacity** [4marks]

b. A burn from steam is more severe than one from water boiling at the same temperature. Give reasons [4marks]

c. An electric kettle with a 4.0 kW heating element has a heat capacity of 400 JK^{-1}. 1.0 kg of water at 30°C is put in the kettle. The kettle is switched on and it is found that 6.5 minutes later, the mass of the water in it is 0.2kg. Ignoring heat losses, determine the specific latent heat of vaporization of the water. [6marks]

d. How much heat is needed to convert 1 kg of ice at -20° C to steam at 100° C? Remember ice and water do not have the same specific heat. [6marks]