BOWEN UNIVERSITY, IWO. OSUN STATE. NIGERIA
COLLEGE OF AGRICULTURE, ENGINEERING, AND SCIENCE
PHYSICS PROGRAMME

SECOND SEMESTER EXAMINATION 2022/2023 SESSION

PHY 241: HEAT, ATOMIC AND NUCLEAR PHYSICS
CREDITS: 2C
DATE: WEDNESDAY 21st JUNE, 2023
TIME: 4.00 P.M. – 6. 00P.M.

INSTRUCTION: ANSWER ONLY THREE QUESTIONS

1a. (i) Define the following:

(a) Zeroth law of Thermodynamics; **2Mrks**

(b) Second Law of Thermodynamics; **2Mrks**

(ii) Explain the following as related to thermodynamics

(a) Open System; **2Mrks**

(b) Closed system; and **2Mrks**

(c) Isolated System. **2Mrks**

b. (i) Using a suitable diagram describe the following thermodynamic process

(a) Adiabatic; and **7Mrks**

(b) Isothermal . **7Mrks**

(ii) Show that the relation between P and V for an ideal gas going through an adiabatic in which the gas does work is given as $PV^{\gamma} = constant$.

Where γ = molar capacity ratio $\left(\frac{C_P}{C_V}\right)$, P and V have their usual meaning. **$9\,^1/_2$Mrks**

2a. (i) What do you understand by the following:

(a) Heat transfer **2Mrks**

(b) Heat Engine **2Mrsk**

(c) Heat Pump **2Mrks**

(ii) Explain the following as related to heat transfer and give two examples of each:

(a) Conduction; **6Mrks**

(b) Convection; and **6Mrks**

(c) Radiation. **6Mrks**

b. (i) Explain the term black body and State Lord Kelvin's Postulate as related to the second law of thermodynamics **5Mrks**

(ii) What is the amount of heat transfer between two water columns of different temperatures (40°C and 20°C) separated by a glass wall with an area of 1m by 2m and a thickness of 0.003m, given that the thermal conductivity of the glass is 1.4 W/mK? **$4\,^1/_2$Mrks**

3a. (i) What is thermodynamic equilibrium? $2\frac{1}{2}$Mrks

(ii) Briefly explain the following as related to thermodynamic equilibrium

(a) Mechanical Equilibrium; **4Mrks**

(b) Chemical Equilibrium; and **4Mrks**

(c) Thermal Equilibrium. **4Mrks**

b. (i) Using a situation diagram, describe a Carnot cycle. **12Mrks**

(ii) Determine the efficiency of a Carnot engine with a hot reservoir of 250 degrees Celsius and a cold reservoir of 35 degrees Celsius? **7Mrks**

4a. (i) Explain the following:

(a) Compton Effect and **5Mrks**

(b) Photoelectric Effect **5Mrks**

(ii) Derive the expression for Compton Effect **10Mrks**

b. (i) Give two differences in the properties of hadrons and the Lepton particles **8Mrks**

(ii) In a photoelectric effect experiment the threshold wavelength of light is 380 nm. If the wavelength of incident light is 260 nm, the maximum kinetic energy of emitted electrons will be given E (in eV) $5\frac{1}{2}$Mrks