KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SPECIAL EXAMINATION

SECOND YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE), BACHELOR OF SCIENCE

FIRST SEMESTER 2021/2022

(JULY, 2022)

PHYS 221: INTRODUCTORY PHYSICS OF MATERIALS

STREAM: Y2 S1 **TIME: 2 HOURS**

DAY: THURSDAY, 3:00 PM – 5:00 PM **DATE: 28/07/2022**

INSTRUCTIONS:

1. ***Do not write anything on this question paper.***
2. ***Answer Question ONE (Compulsory) and any other TWO questions.***

QUESTION ONE (30 marks)

a.) give the definition of the following terms

i) Lattice (1 mark)

ii) Packing factor (1 mark)

iii) Amorphous solids (1 mark)

iv) Crystal structure (1 mark)

v) Miller indices (1 mark)

b.)

i) Briefly outline the three conditions for formation of crystals(3 marks)

ii) Give the difference between oblique and square lattice?(1 mark)

iii) In a crystal structure, explain 'the co-ordination number' for SCC (2 marks)

c.)

i) Give the general equation of state for an ideal gas (1 mark)

ii) What assumptions apply for the ideal gas (3 marks)

iii) State two modifications made in order to come up with the Van Der Waals equation of state (2 marks)

d.)

i) What do you understand by 'surface tension' ? (1 mark)

ii) Show that surface energy per unit area of a surface is numerically equal to the surface tension (4 marks)

e.)

i) Distinguish between turbulent and streamline flow of fluids (2 marks)

ii) What is a viscous drag? Hence derive the equation of continuity (4 marks)

e.) Describe any two physical consequences of Bernoulli's effect (2 marks)

QUESTION TWO

a.) Briefly describe five types of Bravais lattice in a two dimensional approach

(10 marks)

b.) Suppose in a crystal the lattice plane cults intercepts of 2A, 3b, 6C along the graphical lattice axes, calculate the miller indices (5 marks)

c.) Calculate the glancing angle on a cube (1,0,0) of a rock salt crystal where a=2.814 A^0 correspond to second diffraction maximum for x-rays of wavelength 0.701 A^0 (5 marks)

QUESTION THREE

a.)

i) Using the 1st law of thermodynamics, derive the relationship between specific heat capacity at constant volume C_V and at constant pressure, C_P (8 marks)

ii) Given that the ratio $\frac{C_P}{C_V} = \gamma$, for an ideal gas, show that

$$PV^{\gamma} = constant$$ (8 marks)

b.) Using the definition of equation of state for an ideal gas, derive Van Der Waals' equation (4 marks)

QUESTION FOUR

a.)

i) Derive Bernoulli's, equation for fluid flow energies (10 marks)

ii) In reference to liquid contained in a tank with a tap opening near the bottom, show that velocity of efflux at the opening is given by

$$v = \sqrt{2gh}$$ (5 marks)

b.) Derive the Poiseuilles' equation for a volume of liquid flowing through a hollow pipe (5 marks)

QUESTION FIVE

a.)

i) State the condition necessary for a body to attain terminal velocity (1 mark)

ii) Using the above condition, drive stokes, equation hence stokes' law for terminal velocity (8 marks)

c) A horizontal pipe of unknown form has water flowing through it such that the velocity of flow is 40 cm/s at a point where pressure is 2cm/Hg column. What is the pressure at a point where velocity of flow is 60cm/s (g=980 cm^2) and density of water is 1 g/ cm^3 (6 marks)

b.) show that the weight of a liquid in a capillary tube is given by

$W = \pi^2(h + \frac{r}{3})\rho g$ (5 marks)