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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE AND APPLIED SCIENCE**

 **OCT/NOV 2019 EXAMINATIONS**

**COURSE CODE: PHY 407**

**COURSE TITLE: SOLID STATE PHYSICS II**

**CREDIT UNIT: 3**

**TIME ALLOWED: (2½ HRS)**

**INSTRUCTION: *Answer question 1 and any other four questions***

**QUESTION 1**

1. Distinguish between Conductors and Dielectrics **4 marks**
2. Name two examples each of conductors and dielectrics **4 marks**
3. Define crystalline defects **2 marks**
4. State the five major categories of crystalline defects. **5 marks**
5. The molecular weight of a compound is 400, it’s density

is$2×10^{3} kgm^{3}$ and its magnetic susceptibility at $293 K$

is $2.56×10^{-4}$. Calculate the permanent magnetic dipole

moment associated with each molecule.

(take$ε\_{0}=8.854×10^{-12}C^{2}N^{-1}m^{-2}$ and Avogadro’s number = $6.02×10^{23}$) **5 marks**

1. What is dipole moment? **2 marks**

**QUESTION 2**

1. (a) Describe briefly the following: i. Polarisation **3 marks**

ii. Depolarization field **3 marks**

(b) Calculate the individual dipole moment P and average electron displacement of a molecule of carbon tetrachloride given the following data:

 Relative permittivity $ε\_{r}=2.24$

 Density = $1.60gcm^{-3}$

 Molecular weight = 156

 Field = $10^{7} vm^{-1}$

 $ε\_{0}=8.854×10^{-12}C^{2}N^{-1}m^{-2}$

 Avogadro’s number = $6.02×10^{23}$

 **6 marks**

**QUESTION 3**

 (a) Define Dipole relaxation time **2 marks**

 (b) The plates of parallel-plate capacitors are 2 mm apart and 5 m2 in area. The plates are in vacuum. A potential difference of 2000 volts is applied across the capacitor. Calculate the Capacitance of the capacitor and the magnitude of electric field between the plates. (Take$ε\_{0}=8.854×10^{-12}C^{2}N^{-1}m^{-2}$) **5 marks**

(c) A parallel plate air capacitor is made of 0.2m2 tin plates and 1cm apart. It is connected to a 50 V battery. What is the charge on each plate?

(Take $ε\_{0}=8.854×10^{-12}C^{2}N^{-1}m^{-2}$) **5 marks**

**QUESTION 4**

(a) State the fundamental pole-force law. **3 marks**

(b)i. Differentiate between diamagnetic and paramagnetic materials **3 marks**

 ii. List four examples each of diamagnetic and paramagnetic materials. **4 marks**

(c) With the aid of an appropriate expression state Curie-Weiss Law **2 marks**

**QUESTION 5**

 (a) Briefly explain Ferromagnetism **4 marks**

(b) Differentiate between ferromagnetism and antiferromagnetism **4 marks**

(c) State two examples of ferromagnetic and antiferromagnetic materials **2 marks**

(d) Itemise two unusual characteristics of ferromagnetic resonance. **2 marks**

**QUESTION 6**

 (a) Briefly describe Paramagnetism **3 marks**

 (b) Explain Langevin theory of paramagnetism **3 marks**

 (c) Two parallel plates have equal and opposite charges. When the space between the plates is evacuated, the electric field is $3.20×10^{5} Vm^{-1}$, the electric field within the dielectric is $2.50×10^{5} Vm^{-1}$. Calculate the induced charge density on the surface of the dielectric. (Take $ε\_{0}=8.854×10^{-12}C^{2}N^{-1}m^{-2}$) **6 marks**