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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**

**JULY 2018 EXAMINATIONS**

**COURSE CODE: PHY 407**

**COURSE TITLE: SOLID STATE PHYSICS II**

**CREDIT UNIT 3**

**TIME ALLOWED (3 HRS)**

**INSTRUCTION: *Answer question one (1) and any other four (4) questions***

**QUESTION 1**

1. (a). Briefly explain the importance of solid state physics (5marks)

(b). Write a short note on (i). Conductors (2 marks)

(ii). Insulators or dielectrics (2marks)

(c). Mention four properties of a dielectric (6marks)

(d). Define dipole moment (3marks)

(e). Define the following:

(i). Electric susceptibility (2marks)

(ii). Polarisability (2marks)

**QUESTION 2**

(a). What is dipole relaxation time? (4marks)

(b). Define the dielectric ɛ constant for isotropic or cubic medium (4marks)

(c). If the field is not too large, give the formula for the induced dipole moment pi

(4marks)

**QUESTION 3**

(a). A parallel air capacitor is made of 0.2m square tin plates and 1cm apart. It is

connected to a 50V battery. What is the charge on each plate?

Take ɛo = 8.85 x 10-12 F/m. (5marks)

(b). The plates of a parallel plate capacitor are 2mm apart and 5m2 in area. The plates are

in a vacuum. A potential difference of 2000 volts is applied across the capacitor.

Calculate the magnitude of the electric field between the plates (4marks)

(c). Define polarization of a crystal (3marks)

**QUESTION 4**

(a). Define magnetic susceptibility per unit volume, describing its terms (4marks)

(b). Explain why the magnetic susceptibility of diamagnetic materials will always be less

than zero (4marks)

(c). Explain all the symbols in Langevin expression (4marks)

**QUESTION 5**

(a). Define paramagnetism (3marks)

(b). In paramagnetism, mention where positive susceptibility can be found and give one

example of each (4marks)

(c). Mention five examples of Paramagnetic materials (5marks)

**QUESTION 6**

(a). Differentiate between diamagnetism and paramagnetism (4marks)

(b). List five materials that are diamagnetic (5marks)

(c). At thermal equilibrium, give the expression for magnetization,

stating its terms (3marks)