

- Please explain following noun: (15%)
  - Schottky defect
  - Frankel defect
  - Burgers vector
  - Eutectic reaction
  - Peritectic reaction
- Copper( ion radius=0.125nm) and nickel (ion radius= 0.128nm) form a solid solution in all properties. Predict this result using the Hume-Rothery rules (15%)
- Calculate the theoretical density of CsCl. (20%)  
( atomic weight of Cs and Cl are 132.9g/mol and 35.45g/mol,  $r(\text{Cs}^+)=0.167\text{nm}$  and  $r(\text{Cl}^-)=0.181\text{nm}$ , Avogadro's number  $=6.023 \times 10^{23}$  atom/mol)
- Explain or define the following terms. (20%)
  - Skin effect
  - Fluorescence (螢光)
  - No Center of Symmetry
  - Loss Tangent
- A typical 1 MHz quartz crystal has the following properties:  $f_s = 1$  MHz,  $f_a = 1.0025$  MHz,  $C_o = 5$  pF,  $R = 20 \Omega$  What are  $C$  and  $L$  in the equivalent circuit of the quartz? What is the quality factor of the crystal, given that  $Q = \frac{1}{2\pi f_s RC}$ ? (15%)
- When the dielectric fills the whole space between the plates of a capacitor, the net field within the dielectric is the same as before,  $E = V/d$ . Explain what happens when a dielectric slab of thickness  $t \ll d$  is inserted in the middle of the space between the plates, as shown in Fig. 1. What is the field inside the dielectric? (15%)

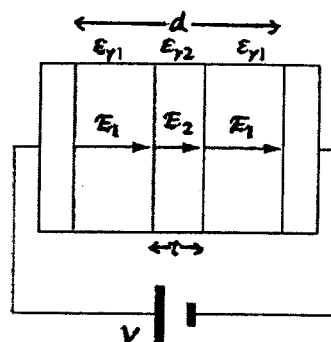


Fig. 1