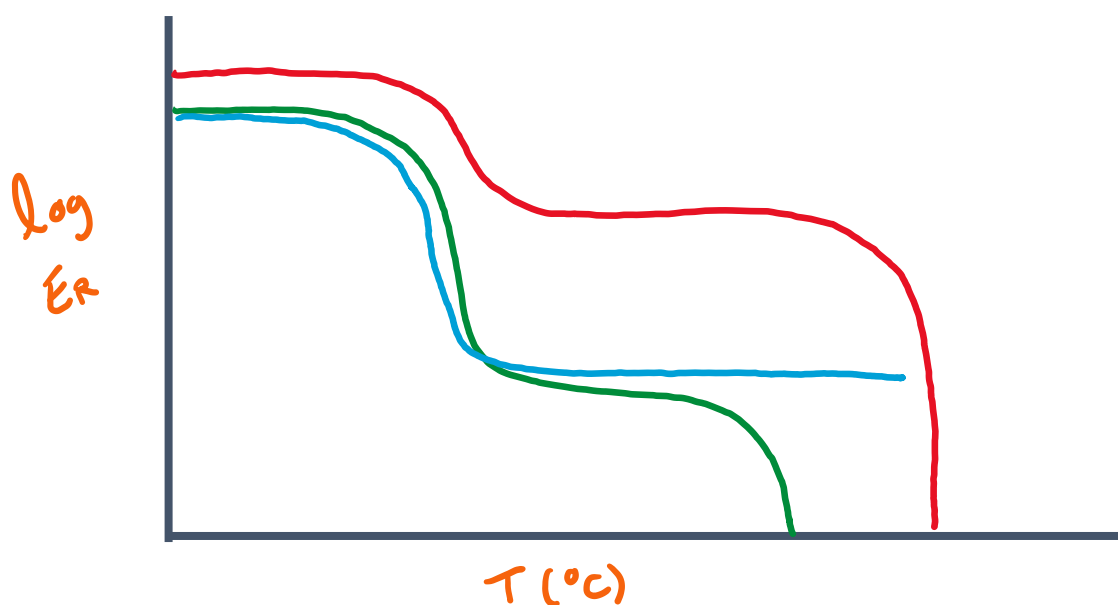


APS110 Problem Set #2**Due – December 2nd**

Please submit all answers to the questions (this can be on the file itself, written electronically or by hand, or photocopies/scans of your work) in as neat of a fashion as possible, and a single file if possible.

A late penalty of 20% per day will be applied to late submissions.

- The curve below shows the relaxation modulus vs. temperature behaviour for different structures of PVC. Match each of the curves to one of the options given below, and justify your reasoning [6]
 - 100% crystalline PVC
 - 100% amorphous PVC
 - Highly crosslinked PVC



- Provide the electron configuration for the following elements or ions. [2]
 - Br (Bromine)
 - Ca²⁺ (Calcium)

3. How does the electron structure of an isolated atom differ from that of a solid material? Draw a figure to assist in explaining this. [4]
4. A semiconductor with a hole concentration of $7.0 \times 10^{17} \text{ (1/m}^3\text{)}$ has a measured conductivity of $5.93 \times 10^{-3} \text{ (1/\Omega m}^3\text{)}$ at room temperature. [6]
 - a. What is the electron concentration given an electron mobility of $0.14 \text{ (m}^2\text{/Vs)}$ and a hole mobility of $0.05 \text{ (m}^2\text{/Vs)}$. [3]
 - b. Based on the above calculation, would you say that this semiconductor is intrinsic, n-type extrinsic, or p-type extrinsic? Justify your answer with some values above. [2]
 - c. Why is it important to report the temperature at which the conductivity is measured? [1]

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- Calculate the standard formation enthalpy for calcium carbide (CaC_2) reacting with water to form acetylene (C_2H_2) and calcium hydroxide ($\text{Ca}(\text{OH})_2$). You can find the necessary values in the TopHat text at the end of Chapter 10 [3]
- Solid iron and oxygen gas can be reacted together to form iron (III) oxide (Fe_2O_3).
 - Calculate the standard enthalpy of formation for this reaction based on the values in the TopHat text [2]
 - If the standard Gibbs energy of formation for this reaction is -740 kJ/mol, what is the standard entropy of formation at this temperature? Is this a spontaneous process? [3]