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ENGR145 HW9

12.43) For forward bias junctions, Electrons are added to the n-type side, and removed from the p-type side. This creates mobile holes on the p-type side and mobile electrons on the n-type side. This allows current to flow across the junction. The opposite is true for reverse bias junctions, where holes are consumed on the p-type side, and so are electrons on the n-type side. This results in little to no current flow across the junction. Rectification is a result of this, as devices can be created that are doped specifically with p-type and n-types on different sides to create an electronic that allows current to flow in only one direction.

12.49) Dielectric 1: $\varepsilon_{r_1} = 2.2$ spacing$_1$ = 2mm $\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$ $\varepsilon_0 = 8.85\times10^{-12}$ F/m

Dielectric 2: $\varepsilon_{r_2} = 3.7$ spacing$_2$ = ?

$\varepsilon_{r_1} \cdot \varepsilon_0 \left(\frac{A}{\ell_1}\right) = \varepsilon_{r_2} \cdot \varepsilon_0 \left(\frac{A}{\ell_2}\right)$ Set capacitance eq. equal $C = \varepsilon \frac{A}{\ell}$, $\varepsilon = \varepsilon_r \cdot \varepsilon_0$

simplifying constants → $\frac{\varepsilon_{r_1}}{\ell_1} = \frac{\varepsilon_{r_2}}{\ell_2}$ $\therefore$ $\ell_2 = \frac{\varepsilon_{r_2} \cdot \ell_1}{\varepsilon_{r_1}}$

$\ell_2 = \frac{3.7 \cdot 2}{2.2} = 3.3636$ mm

17.17) Metals have a high number of free electrons that can transport heat very effectively because of their ability to move through the structure of the metal. This is especially present in high purity metals, as electrons are not easily scattered. Ceramics have a worse thermal conductivity because of their lattices and lack of free electrons. To conduct heat, ceramics rely on photons, which are significantly worse at heat transfer because of how much they are disturbed, or scattered, by imperfections and defects in lattice structures.

19.22) Amorphous polymers are transparent because they do not have a lattice structure to reflect light. The optical properties of a semi-crystalline polymer corresponds to the percent crystallinity possessed it. More lattices and organized, ordered planes will better reflect light, resulting in a translucent, or even opaque, look.

19.14) Zinc Band Gap = 2.58eV $h = 4.13\times10^{-15}$ eV·s

$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E}$ $c = 3\times10^8 \frac{m}{s}$

$\lambda = \frac{(4.13\times10^{-15})(3\times10^8)}{2.58} = 4.802\times10^{-7}$ m $= 0.48$ um

Visible Light (pg. 8) btwn. 0.4um and 0.7um

This wavelength is in the region described to the right of this page.

minimum | bandgap | maximum

$\frac{(4.13\times10^{-15})(3\times10^8)}{7\times10^{-7}\text{ m}} = 1.8$ eV | $\frac{(4.13\times10^{-15})(3\times10^8)}{4\times10^{-7}\text{ m}} = 3.1$ eV

→ Assume wavelength calculated is minimum

$\therefore$ Range 0.48um − 0.7um