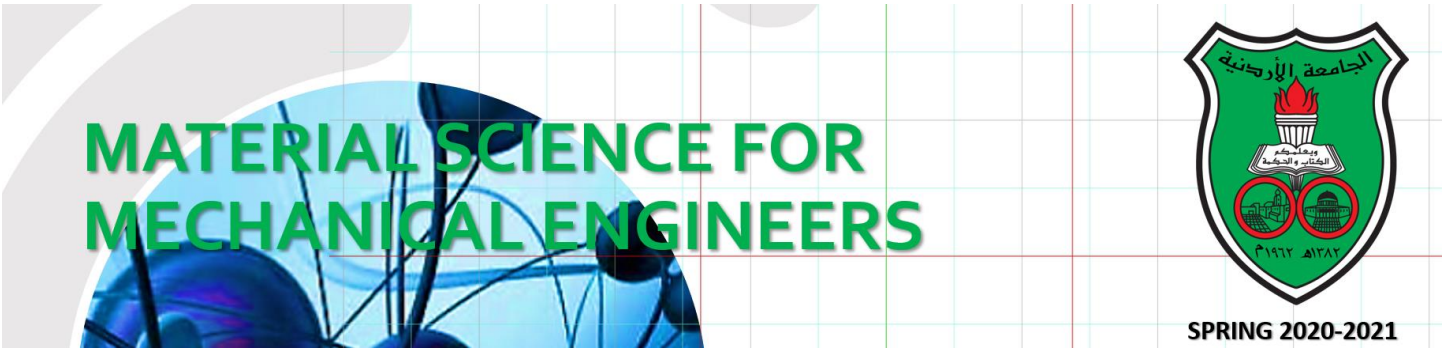

Midterm exam

Due Date: 11/04/2021

Submitted by:

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Problem 1

Because different compositions and processing for materials give materials different propeties and performance

Processing → Structure → Properties → Performan

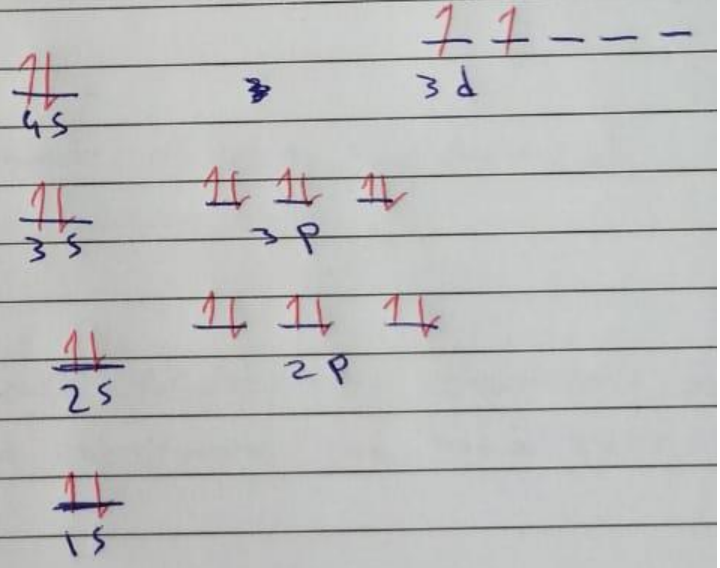
Problem 2

electron configuration : $[Ar]_{18}\ 4s^2\ 3d^2$

$Z = 18 + 2 + 2 = 22$

① the element is **Ti**

②



Problem 3

1- Primary interatomic bonds have much higher bond energy than secondary ones

2- In Primary interatomic bonds, there is a tendency of the atoms to assume stable electron structures

3- Primary interatomic bonde affect the chemical behavior of elements and compounds

4- All primary bonds are related to electrons, and how electrons are shared determines the bond type.

Problem 4

$$X_{Cu} = 1.9$$
$$X_{Ag} = 1.9$$

$$\% IC = \left\{ 1 - \exp\left[-0.25 \left(X_A - X_B \right)^2 \right] \right\} \times 100$$

$$= \left\{ 1 - \exp[0] \right\} \times 100$$

$$\% IC = 0 \%$$

→ Ionic character in this bond = 0%
because the two atoms have the same electronegativity value, so the will share electrons equally.

Problem 5

Self-diffusion is a (vacancy diffusion), so the activation energy is a function of Vacancies number, when vacancies number is high activation energy will be lower and vise-versa. metals form high number of vacancies when the temperature is raised to near melting one. So self-diffusion will be easier in them.

Problem 6 $T = 927\,^{\circ}C = 1200\,^{\circ}K$

①

$C_x = 0.40\%$ at

$x = 0.5 \times 10^{-3}\ m$

$C_s = 0.93\ \%$

$C_o = 0.18\ \%$

$D = 1.42 \times 10^{-11}\ m^2/s$

$$\frac{C_x - C_o}{C_s - C_o} = 1 - \text{erf}\left(\frac{x}{2\sqrt{Dt}}\right)$$

$$\frac{0.4 - 0.18}{0.93 - 0.18} = 1 - \text{erf}\left[\frac{0.5 \times 10^{-3}\ m}{2\sqrt{1.42 \times 10^{-11}\ m^2/s\ (t)}}\right]$$

$$0.707 = \text{erf}\left(\frac{66.3\ s^{1/2}}{\sqrt{t}}\right)$$

z	erf (z)
0.70	0.6778
z	0.707
0.75	0.7112

$$\frac{z - 0.70}{0.75 - 0.7} = \frac{0.707 - 0.6778}{0.7112 - 0.6778}$$

$z = 0.744$

$$z = \frac{66.3\ s^{1/2}}{\sqrt{t}} \rightarrow t = \left(\frac{66.3\ s^{1/2}}{0.744}\right)^2 = 7.9411 \times 10^3\ s$$

$= 2.206\ h$

② ~~x^2/t = constant~~

② $t = 723\ h = 2.6 \times 10^6\ s$

$$\frac{C_x - C_o}{C_s - C_o} = 1 - \text{erf}\left(\frac{x}{2\sqrt{Dt}}\right)$$

$$\frac{C_x - 0.18}{0.93 - 0.18} = 1 - \text{erf}\left(\frac{0.7 \times 10^{-3}\ m}{2\sqrt{1.42 \times 10^{-11}\ m^2/s\ \ 2.6 \times 10^6\ s}}\right)$$

$$= 1 - \text{erf}(0.576)$$

$$\frac{C_x - 0.18}{0.93 - 0.18} = 1 - 0.58 = 0.42$$

$$C_x - 0.18 = (0.42)(0.93 - 0.18)$$

$$C_x - 0.18 = 0.315$$

$$C_x = 0.495\ \%\ at$$