Jan 16th , 2015

MSE-2001E: Quiz – Chapter 2

Name _____ **(Total 20 points)**

1. (10 points) Fill in the blanks or circle the right answer.

(1) The equilibrium interatomic distance (= bond length) is obtained when the attractive and repulsive forces balance out to make the net force zero and the energy of the bond is ___**minimum**_____.

(2) Directional sharing of electrons occurs in _____**covalent**_____ bond.

(3) A type of secondary bond in which a temporary dipole induces another dipole in an adjacent atom is referred to as a _____ **van der Waals bond**_____.

(4) A measure of the stiffness of a material in extensional deformation is referred to as the __**elastic modulus (= Young's modulus)**__.

(5) How many neutrons are there in an atom of the isotope ^{60}Co? [The atomic number is 27].

The atomic number is 27 and hence has that many protons – Mass number is the number of protons plus neutrons, therefore ^{60}Co has 33 neutrons.

(6) Melting of a crystalline material is an **[endothermic /** exothermic] process.

(7) The electron configuration of iron (^{26}Fe) is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$. The magnetic properties of iron originate from the unfilled 3d subshell [**true** / false].

(8) Fluids that have long-range orientational order are called [Crystalline Liquids/liquid mixed with crystals/**Liquid Crystals**].

(9) NaCl is an example of [covalent bonding/van der Walls bonding/**ionic bonding**/co-ordination bonding].

(10) How did we know that there are specific number of energy levels, say for H_2?

With the use of spectral data obtained from atomic spectra.

2. **(**10 points) The electronegativity (EN) of potassium (^{19}K) is 0.82 and that of chlorine (^{17}Cl) is 3.16.

(1) Show the electron configuration of potassium in different sub-shells. What will be the valence and charge of the potassium ion?

K has electron configuration of $\mathbf{1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1}$, with the valence electron of 1 in 4s. Therefore, it has a high tendency of donating the sole electron in 4s, changing into a **cation $\mathbf{K^+}$**.

(2) When K atoms bond to chlorine (^{17}Cl) atoms, what type of interatomic bonding would be dominant? Why?

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Ionic bonding, because $\Delta EN = 3.16-0.82 = 2.34$, which is higher than **1.7**. The big difference in the electronegativity implies that the K atom will donate an electron and become K^+, while the chlorine atom will accept an electron and become Cl^-. Eventually, **the Coulomb force (or charge interaction) between the K^+ and Cl^- ions** will result in an **ionic bonding**, leading to an ionic compound KCl.