Ch 11/11C

Chemical Bonding Review
Exercise Set 2

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Name: ANSWERS

Date: ______________

1. What explains the fact that at room temperature F_2 is a gas while I_2 is a solid?

   F_2 and I_2 are non-polar molecules so the only way they can form condensed states is through London Forces. I_2 has more e^-s and thus stronger London Forces. /1

2. Write the number of valence electrons possessed by each of the following species:

   a) Ge 4 b) Y 3 c) W^{4+} 2 d) Sn^{2+} 2 e) Bi 5 0.5 ea to a maximum of 2 /2

3. Which substance has a lower melting temperature: $CaBr_2$ (s) or SrI_2 (s)? Explain why.

   SrI_2. This is because the ions are larger and further apart so their ionic bonds are weaker and take less energy to break. /1

4. Write the valence for each: a) S 2 b) B 3 c) Ca 2 d) Xe 0 e) Ga 3 f) Bi 3 /3

   0.5 ea

5. Write the number of open and closed shells for each of the species given below.

   a) At^{3+} 1, 5 b) Ba 1, 5 c) I^{5+} 1, 4 d) V^+ 1, 3 /2

   0.5 0.5 0.5 0.5

6. Although oxygen and fluorine molecules are roughly the same size, each oxygen atom shares four electrons with its neighbour while each fluorine atom shares only two electrons with its neighbour. Which bond should be stronger? Explain.

   The O_2 bond. This is because the more electrons shared between two atoms, the stronger the bond. /1

7. Which types of bonds or forces increase in strength going down a group in the periodic table? ***(I only want you to consider bonds/forces between atoms or molecules of the same element)***

   London forces /1

8. Which types of bonds or forces decrease in strength going down a family in the periodic table? ***(Again, only in terms of bonds/forces between atoms or molecules of the same element)***

   Covalent and metallic bonds /1

9. Provide brief explanations for the following facts:

   a) the melting temperatures of the noble gases increase going down the periodic table.

   Stronger London forces ∴ stronger intermolecular force to overcome. /1

   b) the reactivity of the alkali metals increases going down the periodic table.

   Valence e^-s under less and less nuclear pull ∴ easier to give 'em up. /1

   c) the reactivity of the noble gases increases going down the periodic table.

   Valence e^-s under less and less nuclear pull ∴ easier to get to share. /1

   d) the melting temperature of the alkali metals decreases going down the periodic table.

   Metallic bonds weaken as atom size increases. /1

   e) the reactivity of the halogens decreases going down the periodic table.

   As with all non-metals, reactivity corresponds to electronegativity /1

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10. Define "allotrope". Name the allotropes of carbon. (Bonus marks possible if they are well drawn and explained!)

See notes (bonding lesson 7)

/1

11. *If* a noble gas *could* form a +1 cation, which noble gas would do so most easily? Why?

Radon. Of all the noble gases, it has the weakest hold on its valence e^-'s /1

12. Molecule "M" has closed outer shells as a result of pure covalent bonding within its structure. What type of bond would attract molecules of "M" to each other?

Since it seems the molecule is non-polar, they must attract by London forces. /1

13. Briefly explain the difference between ionic bonding, covalent bonding and metallic bonding.

Ionic : e^- transfer (no sharing)

Covalent : e^- sharing between two atoms (1:1) /1

Metallic : e^- shared with all neighbouring atoms (not 1:1).

14. Use your periodic table (or the one in Hebden, p 200), to classify each of the bonds as covalent, polar covalent, or ionic. Then predict the formula of the compound based on the valence each type of atom.

a) Ba and Br

$\Delta\chi = 1.8$ ∴ Ionic

$BaBr_2$

b) Mg and P

$\Delta\chi = 0.9$ ∴ Polar covalent

Mg_3P_2

c) Si and N

$\Delta\chi = 1.2$ ∴ Polar covalent

Si_3N_4

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d) As and F

$\Delta\chi = 1.9$ ∴ Ionic

AsF_3

e) Ga and Se

$\Delta\chi = 0.8$ ∴ Polar covalent

Ga_2Se_3

f) B and Te

$\Delta\chi = 0.1$ ∴ Covalent

B_2Te_3

15. For each pair of compounds, state which should have the higher boiling points. Why?

a) BCl_3 **vs.** BCl_2F

non-polar

polar

1

BCl_2F by dipole-dipole forces.

(The London forces in BCl_3 are much weaker)

b) NH_3 **vs.** SbH_3

virtually non-polar

v. polar

NH_3 due to hydrogen bonding.

1

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c) $CH_3CH_2CH_3$ ***vs.*** $CH_3CH_2CH_2CH_2CH_2CH_3$

1

hexane has more e^-'s ∴ greater London forces

d) $CH_3CH_2CH_3$ **vs.** CH_3OH

1

methanol due to hydrogen bonding

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