Unit Test: Atomic Structure and Properties

SCH4U 2004 – 2005 Name:

K / U: 10 **A /MC: 23** **C : 7**

1. A substance is a brittle crystal that conducts electricity in molten liquid state only. Which type of substance is it?

a. metallic crystal
b. ionic crystal
c. covalent crystal
d. molecular crystal
e. frozen gas

2. Which shape and bond angle are predicted by VSEPR theory for H_2O?

a. linear, 180°
b. bent, 120°
c. bent, less than 120°
d. bent, 109.5°
e. bent, less than 109.5°

3. Which of the molecules, CO_2, H_2O, NH_3, and BF_3, will be polar?

a. CO_2, NH_3 and BF_3
b. H_2O and NH_3
c. H_2O and BF_3
d. CO_2, H_2O and NH_3
e. CO_2 and BF_3

4. Which forces exist between ammonia, NH_3, particles?

I. Van der Waals
II. metallic bonding
III. hydrogen bonding
IV. dipole

a. I only
b. I and IV only
c. I and II only
d. I, III and IV only
e. I, II and III only

5. Why are diamonds so hard?

a. because they are made of carbon
b. because they are made of a three dimensional array of particles
c. because it is able to conduct electricity
d. because there are covalent bonds between particles
e. none of the above

6. (i) Draw the Lewis structures for carbon monoxide, CO, carbon dioxide, CO_2, and the carbonate ion, CO_3^{-2}. 4

(ii) Identify the species with the longest carbon – oxygen bond and explain your answer. 2

A / MC (23)

1. Classify each of the **solids** listed below as either a **network** crystal, a **metallic** crystal, a **molecular** crystal or an **ionic** crystal. 5

MgO	CH_4	$C_{(graphite)}$	Ag	CH_3OH
_____	_____	_____	_____	_____

Which of these solids would you expect to: (1 each)

a. Dissolve in water?

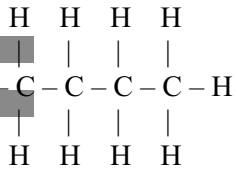
b. Conduct an electric current?

c. Be held together only by London-dispersion forces?

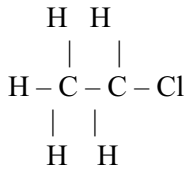
d. Be held together by hydrogen - bonds?

e. Which one will have the highest melting point?

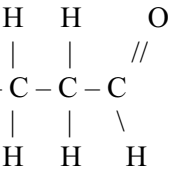
2. Use the following structures of butane, chloroethane, propanal and propan-1-ol to answer the questions below the structures:



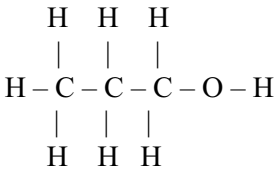
Butane



Chloroethane



Propanal



Propanol

Identify:

i. Which will be insoluble in water and give your reasoning. 2

ii. Which will be soluble in water and give your reasoning. 2

iii. Arrange the compounds in increasing boiling point, justify your choice. 3

3. Consider the following properties of three substances:

Substance	Boiling Point (K)	Electrical Conductivity of	
		solid	liquid
I	1770	poor	good
II	1220	good	good
III	2630	poor	poor

a. Which of the above substances is likely to be a metal? Justify your answer by showing how the structure of metal would account for the properties given. 3

b. Which of the above substances is likely to be an ionic solid? Justify your answer by showing how the structure of an ionic solid would account for the properties given. 3

C (7)

1. Explain why phosphorus can form compounds such as PH_5, which clearly has more than an octet of electrons around the phosphorus atom. 2

2. What is the underlying principle behind VSEPR theory. 2

3. Explain what is meant by resonance, resonance hybrid, and delocalisation. Explain using CO_3^{-2} 3

4. Explain the bond angles in PH_3, PH_2^{-1}, PH_4^{+1}. 3

5. Explain the variation in the (i) ionic radius of Al^{+3} and N^{-3} 2

   (ii) atomic radius of Ca and Ca^{+2} 2

6. State the full electron configuration of: 4

   Fe^{+2}

   S^{-2}

   Cr^{+2}

   Br^{-1}