ST MARY'S ANGLICAN GIRLS' SCHOOL

YEAR 12 CHEMISTRY *TEST 3 (2009)*

PUT A CROSS (X) THROUGH THE CORRECT ANSWER.

1.	*a*	*b*	*c*	*d*
2.	*a*	*b*	*c*	*d*
3.	*a*	*b*	*c*	*d*
4.	*a*	*b*	*c*	*d*
5.	*a*	*b*	*c*	*d*
6.	*a*	*b*	*c*	*d*
7.	*a*	*b*	*c*	*d*
8.	*a*	*b*	*c*	*d*
9.	*a*	*b*	*c*	*d*
10.	*a*	*b*	*c*	*d*
11.	*a*	*b*	*c*	*d*

PART A */ 11*	
PART B */ 40*	
TOTAL */ 51*	

PART B - Answer all questions in the spaces provided.

1. *For each species listed in the table below*
   a) *Draw the electron dot diagrams showing* ***all*** *valence shell electron pairs.*
   b) *Indicate the shape of the species by either a sketch or a name.*

Species	*Electron Dot Diagram*	*Shape (sketch or name)*
Sulfur dioxide, SO_2		
Sulfate ion, SO_4^{2-}		
Nitrogen trichloride, NCl_3		

(9 marks)

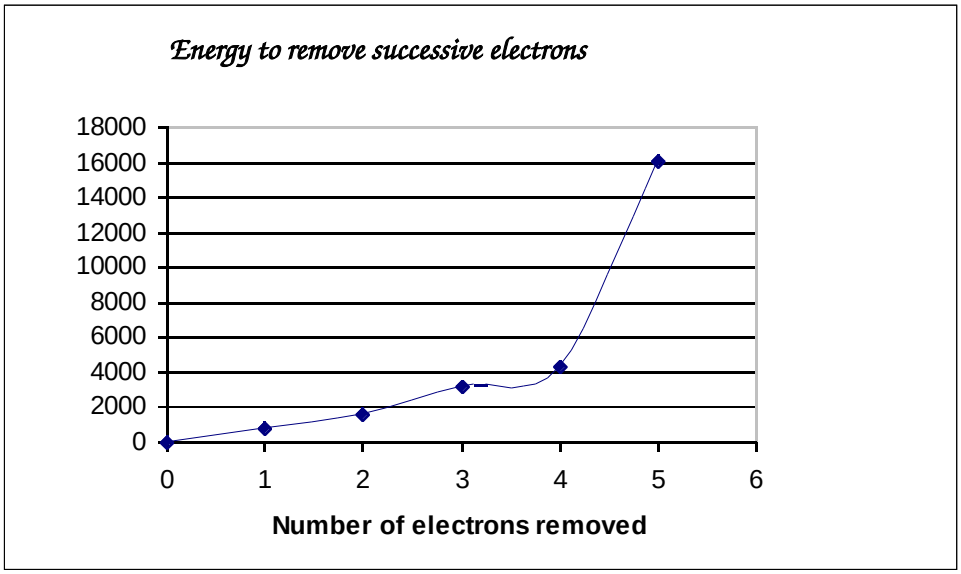
2. *Limestone contains the ionic compound,* $CaCO_3$*. Limestone decomposes when it is heated strongly, forming an ionic compound, CaO and a covalent compound,* CO_2*.*
   a) *State what is meant by ionic bonding.*

   b) *Draw the electron dot diagrams to show the bonding in CaO and* CO_2*.*

(5 marks)

3. *An element from the third row of the periodic table has five successive electrons removed. The energy required is shown on the graph below.*

a)



b) *Give three properties of this type of material.*

(6 marks)

4. a) *Which element would you expect to have the higher first ionisation energy — sodium Na or chlorine Cl? Explain your reasoning.*

b) *Explain why potassium atoms readily form K^+ ions in chemical reactions, while chlorine atoms readily form Cl^- ions.*

(4 marks)

5.

Name a group of elements for which the outermost energy level contains only *s* electrons.	
Name a period of elements for which the outermost energy level contains only *s* and *p* electrons.	
Name a period of elements for which the outermost energy level contains only *s*, *p* and *d* electrons.	
Name a metal that forms complex ions.	
Name an ionic compound made from non-metallic elements.	

(5 marks)

6. *Ethanol (CH_3CH_2OH) is fully miscible with water. It is also fully miscible with petrol (a mixture of hydrocarbons). Give chemical reasons why ethanol can mix with both water and petrol.*

(3 marks)

7. *The table below shows some physical and chemical properties of the chlorides of some Period 3 elements.*

	$NaCl$	$MgCl_2$	PCl_3	SCl_2
Melting point (°C)	*800*	*710*	*-90*	*-80*
Boiling point (°C)	*1470*	*1420*	*80*	*60*
Electrical conductivity of solid	*Poor*	*Poor*	*Poor*	*Poor*
Electrical conductivity of liquid	*Good*	*Good*	*Poor*	*Poor*
pH of water solution	*7*	*7*	*<7*	*<7*

a) *Explain the large difference in the melting points of $MgCl_2$ and SCl_2.*

b) *Explain the difference in electrical conductivity of solid and liquid $MgCl_2$.*

c) *Would you expect each of these to be an electrical conductor? Explain in each case.*
   i) *a water solution of NaCl*

   ii) *a water solution of PCl_3*

(7 marks)

NAME: _____

PART A *- Answer all questions on the answer sheet.*

1. *As you go down Group II from Be to Ra, which of the options below correctly describes the trends in the characteristics of the elements?*

	Electronegativity	1st Ionisation Energy	Electrical Conductivity
a)	Decreases	Decreases	Increases
b)	Increases	Decreases	Decreases
c)	Decreases	Increases	Increases
d)	Increases	Increases	Decreases

2. An element has the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^5$.
In which group and period of the Periodic Table is the element located?
a) Group III, period 4
b) Group V, period 4
c) Group IV, period 1
d) Group VII, period 3

3. Which one of the following has only dispersion forces between its molecules in the liquid phase?
a) CO_2
b) NH_3
c) C_2H_5OH
d) H_2O

4. Which of the lists below indicate the boiling points of the compounds in either descending order?
a) HI, HBr, HCl
b) NH_3, PH_3, AsH_3
c) CH_4, C_3H_8, C_2H_6
d) C_3H_8, CH_3CH_2COOH, CH_3COCH_3

5. Which of the following best describes the shape and polarity of a molecule whose formula is CF_4 ?
a) tetrahedral, non polar
b) pyramidal, polar
c) pyramidal, non polar
d) tetrahedral, polar

6. Which of the following solids contains discrete molecules?
a) Lead.
b) Calcium oxide.
c) Diamond.
d) Iodine.

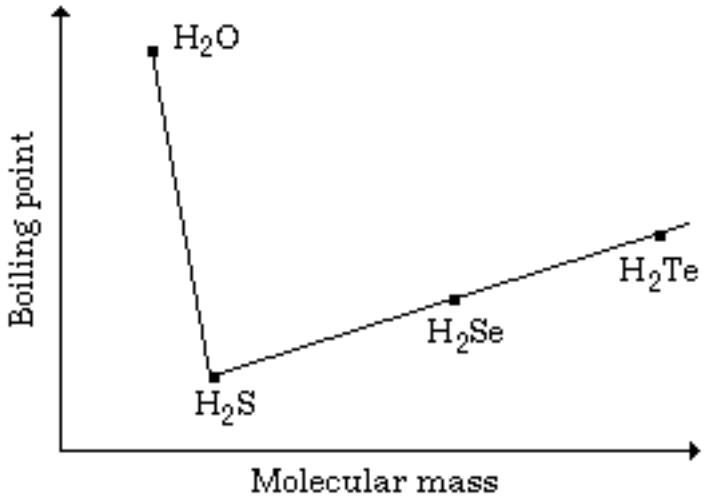
7. When compounds are formed between the following pairs of elements, which ones are most likely to form predominantly covalent bonds?
I Potassium - chlorine.
II Oxygen - carbon.
III Hydrogen - carbon.
IV Caesium - fluorine.
V Chlorine - fluorine.

a) **II**, **III** and **V**.
b) **II** only.
c) **I** and **III**.

d) ***I*** *and* ***IV***.

8. *At room temperature, methane is a gas while carbon tetrachloride is a liquid. This is best explained by which one of the following?*
   a) *There is appreciable hydrogen bonding in carbon tetrachloride, but not in methane.*
   b) *The carbon tetrachloride molecule is polar, while the methane molecule is non-polar.*
   c) *Carbon tetrachloride has an appreciably higher molecular mass than methane.*
   d) *The bonds in carbon tetrachloride are polar covalent.*

9. *The diagram below compares the boiling points of H_2O, H_2S, H_2Se and H_2Te.*



The boiling point of water is much higher than expected because:

a) *water is an ionic compound.*
b) *weak Van der Waal's forces exist between water molecules.*
c) *hydrogen bonding occurs between water molecules.*
d) *water is a liquid.*

10. *A water molecule is polar because:*

a) *hydrogen and oxygen have the same electronegativity.*
b) *the molecule is linear with a net dipole.*
c) *oxygen has a higher electronegativity than hydrogen and it is non-linear.*
d) *the hydrogen atoms acquire a slight negative charge while the oxygen atom acquires a slight positive charge.*

11. *Which of the following molecules possesses a molecular dipole?*

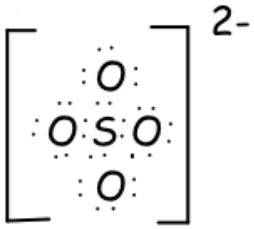
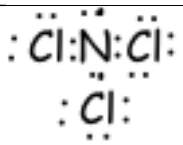
I F_2O
II BeF_2
III BF_3
IV NF_3
V CF_4

a) ***II, III*** *and* ***V****.*
b) ***I*** *only.*
c) ***IV*** *only.*
d) ***I*** *and* ***IV****.*

ANSWERS

1.	a	b	c	d
2.	a	b	c	d
3.	a	b	c	d
4.	a	b	c	d
5.	a	b	c	d
6.	a	b	c	d
7.	a	b	c	d
8.	a	b	C	d
9.	a	b	c	d
10.	a	b	c	d
11.	a	b	c	d

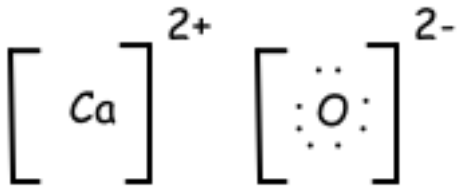
1.

Species	Electron Dot Diagram	Shape (sketch or name)
Sulfur dioxide, SO_2		Bent
Sulfate ion, SO_4^{2-}		Tetrahedral
Nitrogen trichloride, NCl_3		Pyramidal

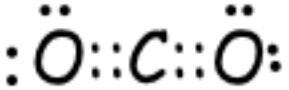
Diagrams = 2 and shape =1 mark *(9 marks)*

2. a) *It is the electrostatic attraction between oppositely charged ions.* [1]

b)



[2] &



[2]

(5 marks)

3. a) *Covalent.*
In the form of a covalent network.
This element loses 4 e⁻ relatively easily and the 5th is removed from the non-valence shell. Element is non-metal Si.
Covalent bonding is the attraction between adjacent nuclei for the shared e⁻'s between them. *[4]*

b) *High m.pt and b.pt*
Non-conductors of electricity
Hard
Brittle *[1 for 1 or 2 props]* *[2 for 3 props]*

(6 marks)

4. a) *Cl has more protons so there is a greater attraction for e- which causes the atom to be smaller and there is a shorter distance between the nucleus and e-. For these 2 reasons it takes more energy to remove an e-.* *[2]*

K has a low ionisation E and electronegativity so will easily lose an e- but Cl has high electronegativity and ionisation E so is more likely to gain an e-. *[2]*

(4 marks)

5.

Name a group of elements for which the outermost energy level contains only *s* electrons.	**I or II**
Name a period of elements for which the outermost energy level contains only *s* and *p* electrons.	Period 2
Name a period of elements for which the outermost energy level contains only *s*, *p* and *d* electrons.	Period 3
Name a metal that forms complex ions.	Iron, copper, etc
Name an ionic compound made from non-metallic elements.	NH_4Cl

(5 marks)

6. *Ethanol (CH_3CH_2OH) has non-polar hydrocarbon end and a polar H-bonded end.* *[1]* *The non-polar end has enough attraction to petrol to break the petrol-petrol forces (dispersion) and dissolve in the petrol.* *[1]* *It also has H-bonding attractions to water and can break the water-water H-bonds and is fully miscible with water.* *[1]*

(3 marks)

7.

a) $MgCl_2$ is ionic and has many strong ionic bonds between Mg^{2+} and Cl^- ions that need a lot of energy to break. [1] Whereas SCl_2 is a CM compound with dipole-dipole forces between molecules that require less energy to break. [1]

b) Solid $MgCl_2$ has ions but these charged particles fixed in place and cannot carry charge. [1] Liquid form now allows the ions Mg^{2+} and Cl^- to move and carry the charge. [1]

c) i) Yes. [1/2]

$NaCl \rightarrow Na^+ + Cl^-$

The solution has mobile charged particles, $Na^+ + Cl^-$, ions to carry the charge. [1]

ii) No. [1/2] As dissolves PCl_3 in water (which it will do to a small degree because it is a polar molecule) it will not form ions and not conduct electricity. [1]

(7 marks)