ALL SAINTS' COLLEGE

Year 12 Chemistry

Test #1 (Atomic Structure & Bonding)

Weighting: 2% **Time: 50 minutes**

Name: _____ Mark = _____ / 46

Part One: Multiple Choice Section **9 marks**

Answer by placing a cross through, or a circle around, the letter of the most correct answer.

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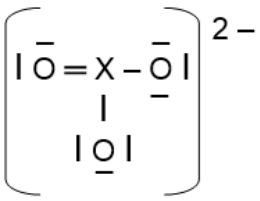
1. The full symbol for a particular ion of arsenic-71 is $^{71}_{33}As^{3+}$.

   Which of the following best describes the composition of this ion?

   A. 33 protons, 38 neutrons and 30 electrons.
   B. 33 protons, 38 neutrons and 33 electrons.
   C. 33 protons, 71 neutrons and 30 electrons.
   D. 38 protons, 33 neutrons and 38 electrons.

2. Consider the Lewis structure for a polyatomic anion of element X:



   Element X is likely to be in:

   A. group 14
   B. group 15
   C. group 16
   D. group 17

3. Which of the following combinations of elements are listed in **increasing** order of electronegativity?

   A. phosphorous, nitrogen, oxygen, sodium, magnesium
   B. sodium, phosphorous, oxygen, nitrogen, fluorine
   C. sodium, phosphorous, nitrogen, oxygen, fluorine
   D. sodium, magnesium, oxygen, nitrogen, fluorine

4. Which of the following correctly identifies the shapes of the following molecules?

	SiH_4	PH_3	H_2S	$HC\ell$
A.	planar	pyramidal	linear	linear
B.	tetrahedral	trigonal planar	linear	bent
C.	pyramidal	trigonal planar	bent	linear
D.	tetrahedral	pyramidal	bent	linear

5. Which of the substances listed below have both a trigonal planar shape and a dipole?

I NH_3

II H_2CO

III SO_3

IV $PC\ell_3$

V $COC\ell_2$

A. I and IV only

B. II and III only

C. II and V only

D. II, III and V only

6. The molecules hydrogen sulfide (H_2S), methanamine (CH_3NH_2), and oxygen (O_2), have similar molar mass. Which of the following lists the gases in **ascending** order of boiling point?

A. H_2S, O_2, CH_3NH_2

B. O_2, H_2S, CH_3NH_2

C. O_2, CH_3NH_2, H_2S

D. CH_3NH_2, H_2S, O_2

7. Which of the following statements is **incorrect** for an ionic substance?

A. The substance will have a high melting point because of the strong electrostatic attraction between oppositely charged ions.

B. When heated sufficiently charged particles can move and allow the passage of an electric current through the substance.

C. When dissolved in water the ionic lattice breaks up and makes electrons available to allow the passage of an electric current through the solution.

D. When the ions in the lattice are forced to move, electrostatic repulsion tends to make the solid shatter.

8. A covalent bond is best described as:

A. a bond between two non-metallic elements.

B. the sharing of electrons between two atoms.

C. the attraction between the nuclei of adjacent atoms and their shared electrons.

D. either a polar or non-polar bond.

9. The table below gives four consecutive ionisation energies (in MJ mol^{-1}) for an element in the third period of the Periodic Table.

1^{st}	2^{nd}	3^{rd}	4^{th}
0.425	3.058	4.418	5.883

The ground state electron configuration for atoms of this element is:

A. 2,1

B. 2,8,1

C. 2,8,4

D. 2,8,8,1

End of Part One

Part Two: Short Answer Section **37 marks**

Write all answers in the spaces provided.

Question 10 **(5 marks)**

Consider the elements chlorine, magnesium, neon and phosphorus.

(a) Rank the elements in **increasing** order of first ionisation energy.

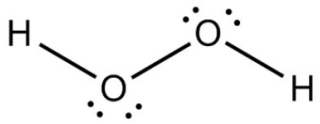
(1 mark)

(b) Explain your reasoning for your ranking in (a) above.
Note that simply stating a trend is not an explanation.

(4 marks)

Question 11 **(4 marks)**

The Lewis structure for hydrogen peroxide, H_2O_2, is shown to the right. The O-O bond can be described as non-polar whereas the O-H bond can be described as polar. Explain the meaning of the terms polar and non-polar in relation to covalent bonds. In your response explain why there is a difference in polarity of the O-O and O-H bonds.



Question 12 **(9 marks)**

Complete the table given below by:

- drawing Lewis structures, representing all valence shell electron pairs as : or as –
- naming or drawing the molecular shapes
- identifying the molecules as either polar or non-polar

Formula	*Lewis structure*	*Molecular shape*	*Polar/non-polar*
$CH_2C\ell_2$			
PBr_3			
N_2O (NNO)			

Question 13 **(3 marks)**

Consider the following information:

- element X is a silvery-grey solid at room temperature. It melts at 660°C and is a good thermal and electrical conductor
- element Y is a red liquid at room temperature and a non-conductor of electricity in any state
- element X and Y combine to form a compound that has a low melting point (98°C) and, when molten, is a non-conductor of electricity

(a) Classify the compound of X and Y as ionic, metallic, molecular or covalent network.

(1 mark)

(b) Provide supporting reasons for your classification in (a) above.

(2 marks)

Question 14 **(4 marks)**

(a) Explain what is meant by the term 'hydrogen bond'.

(2 marks)

(b) Consider the substances listed below. Draw a circle around those that could possibly form a hydrogen bond with water.

hydrogen fluoride phosphine (PH_3) ammonia

trichloromethane ($CHC\ell_3$) methanal (CH_2O)

(2 marks)

Question 15 **(6 marks)**

Consider the following substances and their melting points.

HBr – 86^{0}C Br_2 5^{0}C CBr_4 90^{0}C

Explain the difference in melting points for the each of the following pairs of substances:

(a) Br_2 and CBr_4

(3 marks)

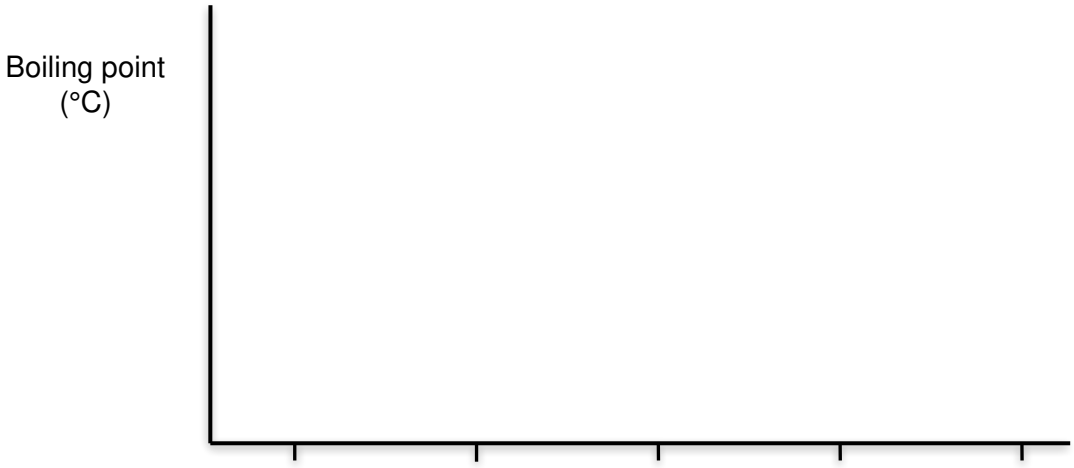
(b) HBr and Br_2

(3 marks)

Question 16 **(6 marks)**

Consider the hydrides of the group 15 elements.

(a) On the axes below sketch a qualitative graph for the boiling points of the hydrides in this group.



(2 marks)

(b) Account for the shape of your graph.

(4 marks)

End of Test