EXEMPLAR

90172

1

For Supervisor's use only

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1 Chemistry, 2007

90172 Describe atomic structure and bonding

Credits: Three
9.30 am Monday 19 November 2007

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

A metal activity series, solubility rules, a table of ions and a periodic table are provided in Resource Booklet L1–CHEMR.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–7 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	Achievement Criteria				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Describe atomic structure and bonding.	✓	Link principles of atomic structure, bonding and selected properties.	✓	Discuss selected properties in terms of atomic structure and bonding.	–
Overall Level of Performance	M				

You are advised to spend 30 minutes answering the questions in this booklet.

Assessor's use only

QUESTION ONE

Complete the following table.

Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Number	Mass Number
Mg	12	12	12	12	24
Li	3	3	3	3	6
Li	3	4	3	3	7
N^{3-}	7	7	10	7	14
Ca^{2+}	20	20	18	20	40

A

QUESTION TWO

Use the Periodic Table provided to answer the following questions on sulfur.

(a) (i) Write the chemical symbol for the sulfur atom. S

(ii) Write the electron arrangement for the sulfur atom. 2,8,6

(iii) Write the chemical symbol for the sulfide ion. S^{2-}

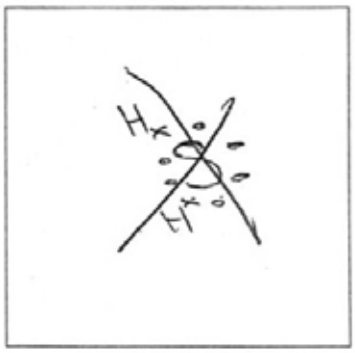
(iv) Write the electron arrangement for the sulfide ion. 2,8,8

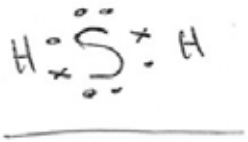
(b) (i) Draw the Lewis structure for the sulfur atom.

A

(ii) Draw the Lewis structure for hydrogen sulfide, H_2S.

Assessor's use only





N

(c) Discuss the electrical conductivity of sulfur and sodium sulfide as solids and as liquids (when heated to molten).
You should include in your answer information on the types of particles in each substance, and the attractive forces between them.

electrical conductivity is the flow of electrons or ions. Sulfur & Sodium Sulfide have different conduction properties ~~because they are bonded differently~~. Sodium Sulfide is an ionic compound & when in a solid state it does not conduct electricity. This is because all the electrons are held together in a tight lattice & therefore there can be no flow. When it is a liquid it does conduct electricity. This is because there is not right lattice & ions are free to move around, this gives a flow of current. Sulfur does not conduct electricity as a solid. this is because its electrons are very shared.

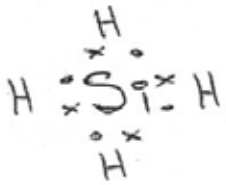
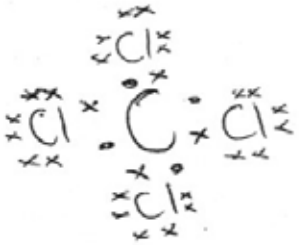
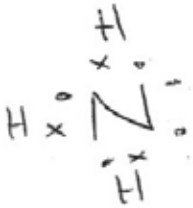
M

M given for full explanation of conductivity of Na_2S in both states. Use of term "electrons" allowed as it is corrected later to "ions".

QUESTION THREE

Assessor's use only

Draw the Lewis structures for the molecules given in the box below.

(a) Silicon hydride, SiH_4 	(b) Tetrachloromethane, CCl_4 
(c) Ammonia, NH_3 	(d) Carbon dioxide, CO_2 

A

QUESTION FOUR

Assessor's use only

Nitrogen and phosphorus can both form ions with a charge of –3. Nitrogen forms the nitride ion, N^{3-}, and phosphorus forms the phosphide ion, P^{3-}.

Explain why both of these elements form ions with the same charge of –3.

This is because of their ~~date~~ electron arrangements. Nitrogen has an electron arrangement of 2,5 & phosphorus has an electron arrangement of 2,8,5. The similarity is in their outer shell of electrons where they both have 5. this number of electrons in the outershell determines the reactivity of the substance & what ions it would form. The two elements form an ion with a charge of -3 because they both need to gain 3 electrons to have a full outer shell. By gaining these 3 there becomes 3 more electrons (negative charge) than positively charged protons. thus giving it an overall charge of -3.

A

Two points needed for **A**.
Has not discussed "stability" of full valence shell.

QUESTION FIVE

Assessor's use only

Fluorine, F_2, is a gas and bromine, Br_2, is a liquid at room temperature.

Discuss the different states of these elements at room temperature.

You should include in your answer information on particle separation, energy, particle motion and the attractive forces between the particles.

Flourine, F_2 and Bromine, Br_2 are both covalently bonded substances. This means that they share electrons to gain a full outer shell. These covalent bonds are quite strong however the inter-molecular bonds between the ~~diff~~ molecules are very weak. This means it does not take much energy to ~~break~~ pull them apart. This is why neither F_2 or Br_2 are a ~~solid~~ at room temp. F_2 is a gas a room temp because it has these very weak intermolecular bonds which are very easy to break. ~~The energy reduced at room temp is enough there is no regular arrangement & every thing is free to move around. Hence F_2 is gas~~ The energy at room temp by heat is enough energy to break these bonds. Therefore the particles have no regular arrangement & they are free to move around. Br_2 is a liquid at room temp which is different to F_2. Br_2 also has these intermolecular bonds. These are weak, however they considerably stronger than F_2 intermolecular bonds. This is because Br is much bigger & heavier atom than F & therefore forms bigger molecules. This means the ~~the~~ inter-molecular attraction also becomes longer & harder to break apart. The energy in room temp is enough ~~break~~ pull these bonds apart but not to the extent that in F_2. This means all the particles still have a regular arrangement unlike in F_2 at room temp & the particles are free to move

Answer continues on next page.

Extra paper for continuation of answers if required.
Clearly number the question.

Assessor's use only

Question number

Plan for Q. 5

F_2 & Br are covalently bonded - weak intermolecular attractions - meaning particles are easily pulled apart hence at room temp either solid.

F_2 - is gas at room temp as intermolecular attractions are weak & present apart - meaning free to move around - gas

Br_2 - liquid @ room temp as of weak intermolecular attractions but still stronger than F_2 attractions this as Br atoms are big & heavy compared to F_2 - therefore more attraction & slightly harder to break apart - liquid at room temp - atoms can move past each other, in no regular arrangement

M