AS LEVEL CHEMISTRY

1.2.2 BONDING AND STRUCTURE

1.3.1 PERIODICITY

TEST

Answer all questions

Max 59 marks

Name ……..
Mark ……../59 ……....% Grade ……

1. Sodium reacts with oxygen to form sodium oxide, Na_2O, which is an ionic compound.

(i) Write the equation for the reaction of sodium with oxygen to form sodium oxide.

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[1]

(ii) State what is meant by the term *ionic bond*.

.....

.....

[1]

(iii) Draw a '*dot-and-cross*' diagram to show the bonding in Na_2O.

Show **outer** electrons only.

[2]

[Total 4 marks]

2. Sodium reacts with chlorine forming the ionic compound sodium chloride, NaC*l*.

(i) Write an equation, including state symbols, for this reaction.

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[2]

(ii) Describe the structure of sodium chloride in the solid state. You may find it useful to draw a diagram.

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[2]

[Total 4 marks]

3. Sodium, Na, is a metallic element.

Explain, with the aid of a labelled diagram, what is meant by the term *metallic bonding*.

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[Total 3 marks]

4. Water and carbon dioxide both consist of covalent molecules.

State what is meant by a *covalent* bond.

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[Total 2 marks]

5. Draw '*dot-and-cross*' diagrams for a molecule of water and a molecule of carbon dioxide. Show outer electron shells only.

water	carbon dioxide

[Total 3 marks]

6. The nitrate ion, NO_3^-, in $Ca(NO_3)_2$ contains both covalent and dative covalent bonds.

(i) What is the difference between a covalent bond and a dative covalent bond?

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[1]

(ii) Calcium nitrate decomposes on heating to form calcium oxide, oxygen and nitrogen(IV) oxide, NO_2.

Construct a balanced equation for this reaction.

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[1]

[Total 2 marks]

7. '*Dot-and-cross*' diagrams can be used to predict the shape of covalent molecules.

Fluorine has a covalent oxide called difluorine oxide, F_2O. The oxygen atom is covalently bonded to each fluorine atom.

(i) Draw a '*dot-and-cross*' diagram of a molecule of F_2O.
Show outer electron shells only.

[2]

(ii) Predict the bond angle in an F_2O molecule. Explain your answer.

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[3]

[Total 5 marks]

8. This question is about the simple molecular compounds water, ammonia and sulphur dioxide.

Pairs of electrons in molecules may be present as *bonding pairs* or as *lone pairs*.

(i) Complete the table below for water, ammonia and sulphur dioxide.

molecule	H_2O	NH_3	SO_2
number of bonding pairs of electrons			4 (2 double bonds)
number of lone pairs of electrons around central atom			1

[2]

(ii) Use your answers to (a)(i) to help you draw the shape of a molecule of NH_3 and of SO_2. Clearly show values of the bond angles in your diagrams.

molecule	NH_3	SO_2
shape of molecule with bond angles		

[4]

[Total 6 marks]

9. An understanding of electronegativity helps to explain why some covalent bonds are polar.

(i) Define the term *electronegativity*.

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[2]

(ii) Water and carbon dioxide both have polar bonds. Explain why water has polar molecules but carbon dioxide has non-polar molecules.

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[2]

[Total 4 marks]

10. In this question, one mark is available for the quality of written communication.

Describe the intermolecular bonding in CH_4 and in H_2O.

Use clear diagrams in your answer.

[Total 6 marks]

11. Describe and explain the density of ice compared with water.

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[Total 2 marks]

12. In this question, one mark is available for the quality of spelling, punctuation and grammar.

Many physical properties can be explained in terms of bonding and structure. The table below show some properties of elements in Period 2 of the Periodic Table.

element	Li	C (graphite)	N
electrical conductivity of solid	good	good	poor
boiling point / °C	1342	4000	–196

Explain these properties in terms of bonding and structure.

[11]

Quality of Written Communication [1]

[Total 12 marks]

13. This question refers to the elements in the first four periods of the Periodic Table.

							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

Identify an element from the first four periods that fits each of the following descriptions.

(i) The element that forms a 2– ion with the same electronic configuration as Ar.

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[1]

(ii) The element that forms a 3+ ion with ten electrons.

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[1]

(iii) An element that forms a compound with fluorine with trigonal planar molecules.

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[1]

(iv) The element that forms a chloride XCl_2 with a molar mass of 111.1 g mol^{-1}.

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[1]

(v) The element with the largest atomic radius.

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[1]

(vi) The element with the smallest first ionisation energy.

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[1]

[Total 6 marks]