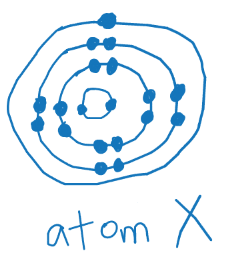
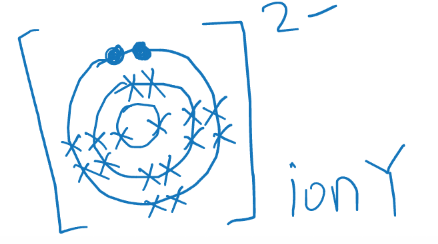
Secondary 3 Express Course

Chemistry

**Worksheet: Chemical Bonding**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( ) Class: \_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_

Structured Questions – Answer all questions in the space provided.

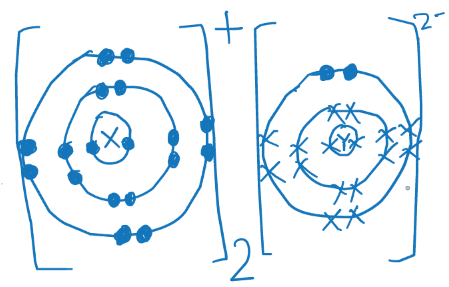
1. Two elements, **X** and **Y**, are bonded together. The electronic configuration of **X** is 2.8.8.1 while the electronic configuration of **Y** is 2.8.6.
2. In the space below, draw a ‘dot-and-cross’ diagram to show the electronic configuration of an atom of **X**.
3. In the space below, draw a ‘dot-and-cross’ diagram to show the electronic configuration of an ion of **Y**.
4. **X** and **Y** are bonded together. Suggest the type of chemical bond between **X** and **Y**.

**Ionic bond**

1. What is the formula of the compound formed by **X** and **Y**?

X2Y

1. In the space below, draw a ‘dot-and-cross’ diagram to show the compound in **(d)**.



1. Read the extract below.

|  |
| --- |
| Ionic compounds are formed between metals and non-metals. Ionic compounds are non-volatile, soluble in water and conducts electricity only in molten and aqueous state. |

1. Complete the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ionic compound** | **Formula of cation** | **Charge of cation** | **Formula of anion** | **Charge of anion** |
| Sodium chloride | Na+ | +1 | Cl- | -1 |
| Magnesium oxide | Mg2+ | +2 | O2- | -2 |
| Ammonium chloride | NH4+ | +1 | Cl- | -1 |
| Potassium bromide | K+ | +1 | Br- | -1 |

1. What does it mean by ‘non-volatile’?

It means that a substance does not readily evaporate into gas.

1. Complete the following table.

|  |  |
| --- | --- |
| **PROPERTIES OF IONIC COMPOUNDS** | |
| **Properties** | **Explanation** |
| High melting and boiling points | A lot of energy is required to break the strong electrostatic forces of attraction that hold the ions in the lattice.  Therefore, a lot of energy is required to melt ionic compounds or cause them to boil.  Note: The melting and boiling points are dependent on the strength of the electrostatic attraction. Hence, the bigger the charge on the ions, the stronger the electrostatic attraction and the higher the melting and boiling points. |
| Excellent conductor of electricity in molten or aqueous state | When ionic compounds are dissolved in water, the dissociated ions are free to conduct electric charge through the solution. Molten ionic compounds also conduct electricity due to the mobile ions. |
| Ionic compounds are hard and brittle. | Ionic crystals are hard because the positive and negative ions are strongly attracted to each other and difficult to separate, however, when pressure is applied to an ionic crystal then ions of like charge may be forced closer to each other. The electrostatic repulsion can be enough to split the crystal, which is why ionic solids also are brittle. |

1. The following table shows the properties of some compounds.

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | **Type of bonding** | **Melting point / oC** | **Boiling point / oC** |
| Iodine | Covalent | 114 | 184 |
| Lead(II) bromide | Ionic | 370 | 914 |
| Methane | Covalent | -182 | -161 |
| Bromine | Covalent | -7 | 59 |
| Silicon dioxide | Covalent | 1610 | 2230 |
| Lithium | Metallic | 180 | 1360 |

1. What is meant by ionic bond, covalent bond and metallic bond?

Ionic bond: the bond formed when the electrons of an atom is transferred to another atom, forming a positively charged cation and a negatively charged anion.

Covalent bond: the bond formed when 2 or more atoms are joined together by sharing electrons to form molecules.

Metallic bond: the bond between metal atoms, formed by electrostatic forces of attraction between delocalised electons amongst a lattice of positive ions.

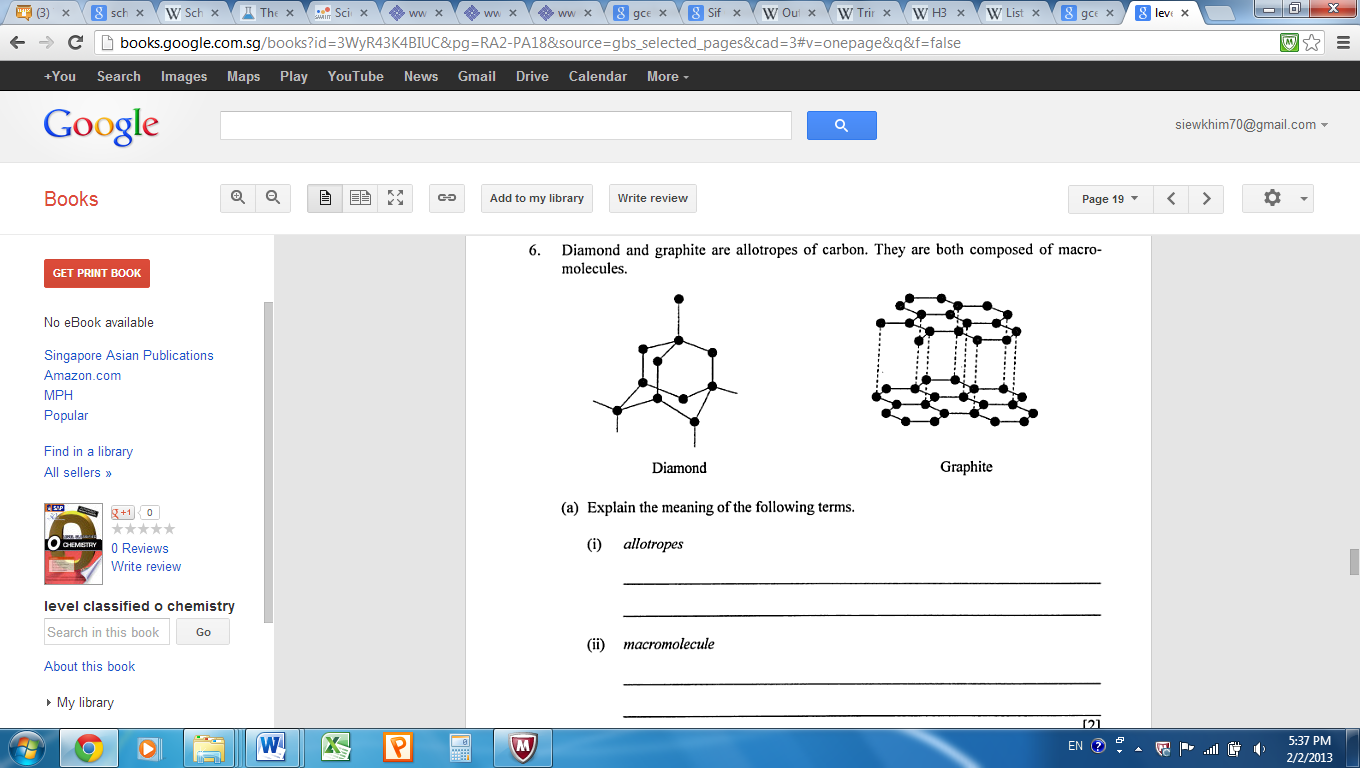
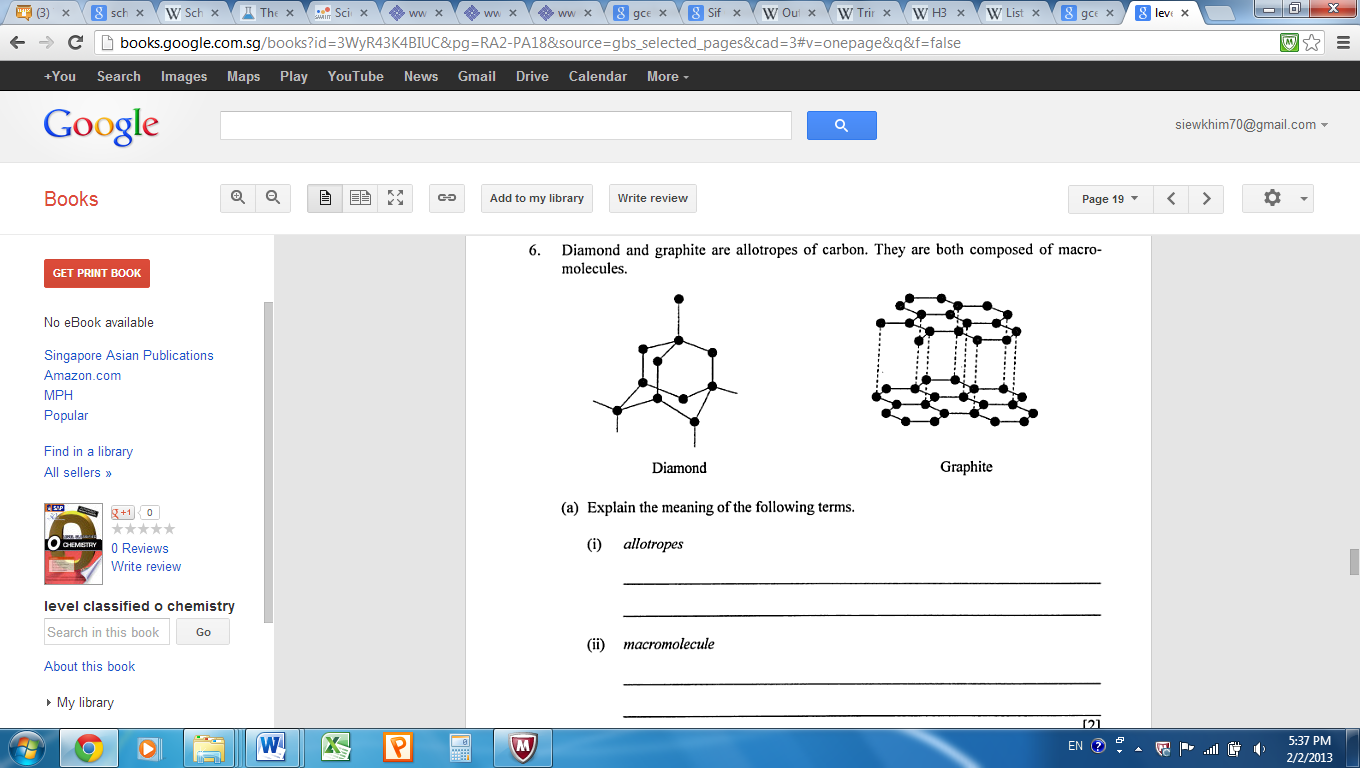
1. Complete the following table. Use the substance named in the table above only.

|  |  |
| --- | --- |
| **Description** | **Substance(s)** |
| Not in solid state in room temperature and pressure. | Bromine |
| In liquid state over the largest temperature range. | Lithium |
| Non-metallic elements | Iodine, Bromine |
| Two substances that conducts electricity when molten. | Lead(II) Bromide, Lithium |

1. Account for the high melting and boiling point of silicon dioxide.

Silicon dioxide has a giant covalent structure with a network of covalent bonds, where each silicon atom is covalently bonded to four oxygen atoms, forming a tetrahedral structure. Very strong silicon-oxygen covalent bonds have to be broken throughout the structure before melting or boiling occurs

1. Below shows the structure of two *macromolecules*.

**Macromolecule A Macromolecule B**

1. The two *macromolecules* are *allotrope*s of carbon. What are meant by ‘macromolecule’ and ‘allotrope’?

A macromolecule is a molecule containing a large number of atoms.

Allotropes are different forms of the same element, where the atoms combine in different ways to form different physical structures.

1. Identify the two macromolecules shown above.

Diamond, Graphite

1. Complete the following table.

|  |  |
| --- | --- |
| **PROPERTIES OF MACROMOLECULE B** | |
| **Properties** | **Explanation** |
| Can conduct electricity | Each carbon atom uses only 3 out of 4 electrons for bonding, leaving 1 free electron each to conduct electricity. The delocalised electrons are free to move and are able to conduct electricity. |
| Soft | The weak van der waals’ forces between the layers enable the layers to slide over each other. |