

# **Chelmsford County High School for Girls**

## **Chemistry bridging work GCSE → Sixth form**

**Name** \_\_\_\_\_

**Please complete this paper and bring it to your  
first chemistry lesson in September.**

**You may use a periodic table, notes and  
textbooks to aid you.**

**You will find some of these questions will be  
challenging; however, you should be able to  
make an attempt on them.**

1. This question is about different models of bonding and molecular shapes.

Magnesium sulfide shows ionic bonding.

(i) What is meant by the term *ionic bonding*?

.....  
.....

[1]

(ii) Draw a '*dot-and-cross*' diagram to show the bonding in magnesium sulfide. Show outer electron shells only.

[2]

[Total 3 marks]

2. The third period of the Periodic Table features the elements magnesium and chlorine. The table below shows the melting points of these elements.

element	melting point / °C
magnesium	650
chlorine	-101

Describe the structure and bonding shown by these elements. Use your answer to explain the difference in melting points.



*In your answer, you should use appropriate technical terms spelt correctly.*

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 6 marks]

3. One form of naturally occurring carbon is graphite.

The table below lists some properties of graphite.

<b>electrical conductivity</b>	good conductor
<b>hardness</b>	soft
<b>melting point</b>	very high

- Describe the bonding and structure in graphite.
- Explain, in terms of bonding and structure, the properties of graphite shown above.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 5 marks]

4. Chemists have developed models for bonding and structure which are used to explain different properties.

Ammonia,  $\text{NH}_3$ , is a covalent compound.

- (i) Explain what is meant by a *covalent bond*.

.....

[1]

- (ii) Draw a '*dot-and-cross*' diagram to show the bonding in  $\text{NH}_3$ .

Show **outer** electrons only.

[1]

[Total 2 marks]

5. Chemists have developed models for bonding and structure. These models are used to explain different properties of metals and non-metals.

- (i) Draw a labelled diagram to show the currently accepted model for *metallic bonding*.

[2]

- (ii) What feature of this model allows metals to conduct electricity?

.....

.....

[1]

[Total 3 marks]

6. Rubidium forms an ionic compound with silver and iodine. This compound has a potential use in miniaturised batteries because of its high electrical conductivity.

The empirical formula of this ionic compound can be calculated from its percentage composition by mass: Rb, 7.42%; Ag, 37.48%; I, 55.10%.

- (i) Define the term *empirical formula*.

.....  
.....  
.....

[1]

- (ii) Calculate the empirical formula of the compound.

[2]

[Total 3 marks]

7. A student carries out experiments using acids, bases and salts.

Calcium nitrate,  $\text{Ca}(\text{NO}_3)_2$ , is an example of a salt.

The student prepares a solution of calcium nitrate by reacting dilute nitric acid,  $\text{HNO}_3$ , with the base calcium hydroxide,  $\text{Ca}(\text{OH})_2$ .

(i) Why is calcium nitrate an example of a salt?

.....  
.....

[1]

(ii) Write the equation for the reaction between dilute nitric acid and calcium hydroxide. Include state symbols.

.....

[2]

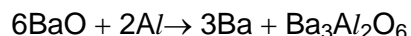
(iii) Explain how the hydroxide ion in aqueous calcium hydroxide acts as a base when it neutralises dilute nitric acid.

.....  
.....  
.....

[1]

[Total 4 marks]

8. Barium metal can be extracted from barium oxide,  $\text{BaO}$ , by reduction with aluminium.



Calculate the mass of barium metal that could be produced from reduction of 500 g of barium oxide using this method.

answer = ..... g

[Total 4 marks]

9. Chemists use the Periodic Table to predict the behaviour of elements.

Early attempts at developing a Periodic Table arranged elements in order of increasing atomic mass.

(i) State which two elements from the **first twenty** elements of the modern Periodic Table are not arranged in order of increasing atomic mass.

.....

[1]

(ii) Why does the modern Periodic Table **not** arrange some elements, such as those in (i), in order of increasing atomic mass?

.....  
.....  
.....

[1]

[Total 2 marks]

10. Sodium reacts with excess oxygen to form sodium peroxide,  $\text{Na}_2\text{O}_2$ .

$\text{Na}_2\text{O}_2$  is used in laundry bleaches. When added to water a reaction takes place forming an alkaline solution and hydrogen peroxide,  $\text{H}_2\text{O}_2$ .

(i) Construct a balanced equation for the formation of sodium peroxide from sodium.

.....

[1]

(ii) Construct a balanced equation for the reaction of sodium peroxide with water.

.....

[1]

(iii) Draw a 'dot-and-cross' diagram for a molecule of  $\text{H}_2\text{O}_2$ . Show outer electrons only.

[2]

[Total 4 marks]



11. Magnesium and strontium are in Group 2 of the Periodic Table.

- (i) When reacted with oxygen, magnesium forms a white powder called magnesium oxide.

Write the equation for the reaction of magnesium with oxygen.

.....

[1]

- (ii) Magnesium reacts with dilute acids.

Describe what you would expect to **see** when magnesium ribbon is added to an excess of dilute hydrochloric acid.

.....

.....

[2]

- (iii) Strontium reacts in a similar way to magnesium.

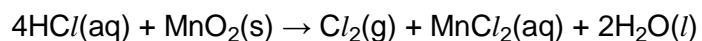
Describe **one** difference you might observe if strontium, instead of magnesium, was reacted with dilute hydrochloric acid.

.....

[1]

[Total 4 marks]

12. Chlorine can be prepared by reacting concentrated hydrochloric acid with manganese(IV) oxide.



- (a) A student reacted  $50.0 \text{ cm}^3$  of  $12.0 \text{ mol dm}^{-3}$  hydrochloric acid with an excess of manganese(IV) oxide.
- (i) Calculate how many moles of  $\text{HCl}$  were reacted.

answer = ..... mol

[1]

- (ii) Calculate the volume of  $\text{Cl}_2(\text{g})$  produced, in  $\text{dm}^3$ .  
Under the experimental conditions, one mole of  $\text{Cl}_2(\text{g})$  occupies  $24.0 \text{ dm}^3$ .

answer = .....  $\text{dm}^3$

[2]

[Total 3 marks]

13. Magnesium exists naturally as a mixture of its isotopes,  $^{24}\text{Mg}$ ,  $^{25}\text{Mg}$  and  $^{26}\text{Mg}$ .

- (i) Complete the table below to show the composition of the  $^{25}\text{Mg}$  and  $^{26}\text{Mg}$  isotopes.

	protons	neutrons	electrons
$^{25}\text{Mg}$			
$^{26}\text{Mg}$			

[2]

- (ii) Complete the electronic configuration of an atom of  $^{24}\text{Mg}$ .

.....

[1]

- (iii) Results from a sample of magnesium are shown below.

isotope	$^{24}\text{Mg}$	$^{25}\text{Mg}$	$^{26}\text{Mg}$
relative isotopic mass	24.00	25.00	26.00
% abundance	78.60	10.11	11.29

The relative atomic mass of Magnesium is 24.33 to two decimal places.

Use the data in the table to show how this value was calculated.

[2]

[Total 5 marks]

14. At room temperature, **X** is a liquid which does **not** conduct electricity. What does this information suggest about the bonding and structure in **X**?

.....

.....

.....

[Total 2 marks]