**Oasis Academy South Bank**

**Year 11 Mock Revision**

**Chemistry Combined Paper 1: Foundation**

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

**Class: \_\_\_\_\_\_\_\_\_**

**Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Step 1: Knowledge**  Learn each of the quiz questions and answers off by heart. This could be done by:   * turning them into **flash cards** and testing yourself * using **‘look, cover, write, check’** * asking a friend or family member to **quiz** you | | | | |
| **Topic** | **LCWC** | **Quiz 1** | **Quiz 2** | **Quiz 3** |
| The Three States (C.1) |  |  |  |  |
| Elements, compounds (C.2) |  |  |  |  |
| Mixtures (C.3) |  |  |  |  |
| Chromatography (C.4) |  |  |  |  |
| Structure of an atom (C.5) |  |  |  |  |
| The periodic table (C.6) |  |  |  |  |
| Types of bonding (C.7) |  |  |  |  |
| Properties of materials (C.8) |  |  |  |  |
| Describing chemical reactions, reactions of metals and gas tests (C.9) |  |  |  |  |
| Acids and Alkalis (C.10) |  |  |  |  |
| Electrolysis (C.12) |  |  |  |  |
| Endothermic and exothermic reactions (C.14) |  |  |  |  |
| Rates of reaction (C.17) |  |  |  |  |
| Chemical calculations, volumes and concentrations (C.19) |  |  |  |  |
| Metals and alloys (C.23) |  |  |  |  |
| Alkanes and alkenes (C.28) |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Step 2: Exam practice**   * Practice applying your knowledge using the **past exam questions** in each section. * Self-assess these using the **mark schemes** at the back and rewrite your answers. * Assess your **progress** using a ‘red, amber, green’ system (RAG) | | | |
| **Section** | **Completed** | **SA using green pen** |  |
| 1: Knowledge |  |  |  |
| 2. Required Practicals |  |  |  |
| 3. 6 markers |  |  |  |

**Exam practice**

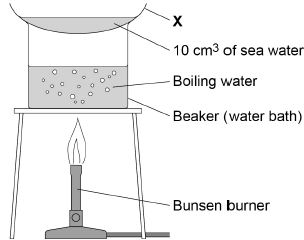
**Section 1: Knowledge**

**Q1.**

A student tested a sea water sample for dissolved solids.

**Figure 1** shows the apparatus.

**Figure 1**

****

(a)  What is apparatus **X** on **Figure 1**?

Tick **one** box.

|  |  |
| --- | --- |
| Boiling tube |  |
| Condenser |  |
| Funnel |  |
| Watch glass |  |

**(1)**

(b)  The student did the test four times.

The student calculated the mass of solid on apparatus **X** after heating.

The table below shows the student’s results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **Mass of solid in grams** | 0.12 | 0.29 | 0.14 | 0.15 |

Calculate the mean mass of solid.

Do not include the anomalous result in your calculation.

Give your answer to 2 significant figures.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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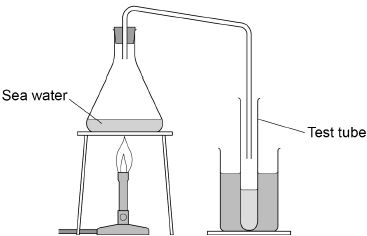
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Mean mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(3)**

The student distilled a sample of sea water in the apparatus shown in **Figure 2**

**Figure 2**

****

(c)  What change of state is happening at the surface of the sea water in **Figure 2**?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(d)  Describe how the water in the test tube in **Figure 2** is different from the sea water.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(e)  Why does producing drinking water from sea water using distillation cost a lot of money?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(f)  River water is filtered then sterilised to make drinking water.

Why are these **two** processes done?

Filtering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sterilising \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

**(Total 9 marks)**

**Q2.**

A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

This is the method used.

1.   Add 10.0 g of marble chips into the flask.

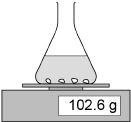
2.   Add 50 cm3 of hydrochloric acid and start a timer.

3.   Record the mass lost from the flask every 10 seconds.

4.   Repeat steps 1 to 3 with different sizes of marble chips.

**Figure 1** shows the apparatus.

**Figure 1**

****

(a)  Draw **one** line from each type of variable to the correct example of the variable.

|  |  |  |
| --- | --- | --- |
| **Type of variable** |  | **Example of variable** |
|  | | |
|  |  | Mass lost from flask |
|  | | |
| Independent |  | Size of flask |
|  | | |
|  |  | Size of marble chips |
|  | | |
| Control |  | Time taken |
|  | | |
|  |  | Volume of acid |

**(2)**

(b)  The equation for the reaction is:

CaCO3(s) + 2HCl(aq) CaCl2(aq) + H2O(l) + CO2(g)

Name the **three** products.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)  Another student suggests putting some cotton wool in the top of the flask.

Suggest why this improves the investigation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(d)  The reaction produces 1.6 g of gas in 30 seconds.

Calculate the mean rate of the reaction in the first 30 seconds.

Use the equation:



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mean rate of reaction = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(e)  What is the unit for the mean rate of reaction calculated in part **(d)**?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| g |  | g/s |  | s |  | s/g |  |

**(1)**

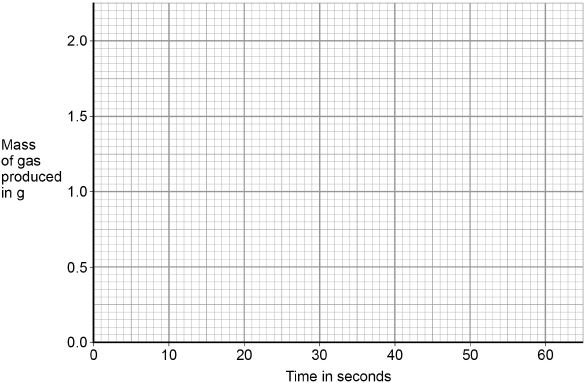
(f)  The table below shows the student’s results.

|  |  |
| --- | --- |
| **Time in seconds** | **Mass of gas produced in g** |
| 0 | 0.0 |
| 10 | 0.8 |
| 20 | 0.6 |
| 30 | 1.6 |
| 40 | 1.8 |
| 50 | 2.0 |
| 60 | 2.0 |

Plot the data from the table above on **Figure 2**

Draw a line of best fit.

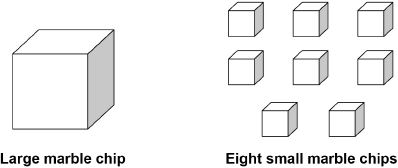
**Figure 2**

****

**(3)**

(g)  **Figure 3** shows a large marble chip and eight small marble chips.

**Figure 3**

****

The large marble chip has the same total volume as the eight small marble chips, but a different surface area.

Why do the eight small marble chips react faster than the large marble chip?

Tick **one** box.

|  |  |
| --- | --- |
| The eight small marble chips have a larger surface area, so less frequent collisions. |  |
| The eight small marble chips have a larger surface area, so more frequent collisions. |  |
| The eight small marble chips have a smaller surface area, so less frequent collisions. |  |
| The eight small marble chips have a smaller surface area, so more frequent collisions. |  |

**(1)**

**(Total 11 marks)**

**Q3.**

An argon atom can be represented as 

(a)  What does the number 40 represent in ?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)  How many protons does this atom of argon have?

Tick **one** box.

|  |  |
| --- | --- |
| 18 |  |
| 22 |  |
| 40 |  |
| 58 |  |

**(1)**

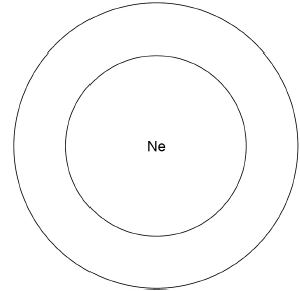
(c)  How many neutrons does this atom of argon have?

Tick **one** box.

|  |  |
| --- | --- |
| 18 |  |
| 22 |  |
| 40 |  |
| 58 |  |

**(1)**

The diagram below shows the energy levels (shells) in a neon atom.



(d)  A neon atom has 10 electrons.

Complete the diagram above to show the electronic structure of a neon atom.

Use **x** to represent an electron.

**(1)**

(e)  The nucleus of a neon atom has a charge.

What is the charge?

Tick **one** box.

|  |  |
| --- | --- |
| Negative |  |
| Neutral |  |
| Positive |  |

**(1)**

(f)  A neon atom has 10 protons, 10 electrons and 10 neutrons.

Explain why there is no overall charge on a neon atom.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(g)  There are two different types of neon atom.

What are these different types of atom called?

Tick **one** box.

|  |  |
| --- | --- |
| Compounds |  |
| Ions |  |
| Isotopes |  |
| Molecules |  |

**(1)**

(h)  Neon is a gas.

The states of matter can be shown by a simple particle model.

Draw **one** line from each state of matter to the correct particle model.

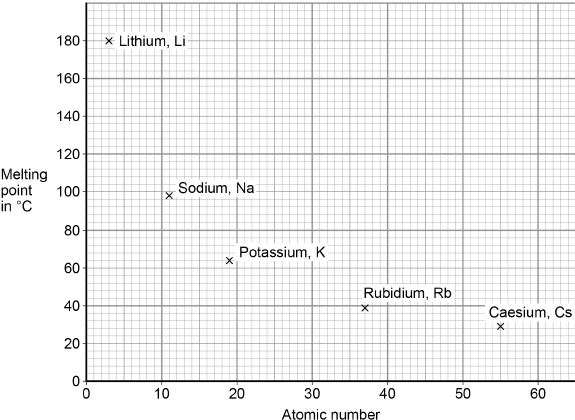
|  |  |  |
| --- | --- | --- |
| **State of matter** |  | **Particle model** |
|  | | |
|  |  |  |
| Gas |  |
|  |  |
|  | | |
|  |  |  |
| Liquid |  |
|  |  |
|  | | |
|  |  |  |
| Solid |  |
|  |  |

**(2)**

**Q4.**

This question is about Group 1 metals.

The graph below shows the melting points of Group 1 metals plotted against their atomic number.



(a)  Describe the trend shown by the melting points of Group 1 metals as the atomic number increases.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)  Determine the atomic number and melting point of caesium.

Use the graph above.

Atomic number of caesium = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Melting point of caesium = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ °C

**(1)**

Lithium is a Group 1 metal.

(c)  A lithium atom can be shown as 

How many electrons does the **outer shell** of a lithium atom contain?

Tick **one** box.

|  |  |
| --- | --- |
| 1 |  |
| 3 |  |
| 4 |  |
| 7 |  |

**(1)**

(d)  Lithium reacts with oxygen to produce lithium oxide.

Draw **one** line from each substance to the correct description of the substance.

|  |  |  |
| --- | --- | --- |
| **Substance** |  | **Description** |
|  | | |
|  |  | compound |
|  | | |
| Lithium oxide |  | element |
|  | | |
|  |  | metal |
|  | | |
| Oxygen |  | mixture |
|  | | |
|  |  | polymer |

**(2)**

(e)  Balance the equation for the reaction of lithium with oxygen.



**(1)**

(f)  What type of bonding is present in lithium oxide?

Tick **one** box.

|  |  |
| --- | --- |
| Covalent |  |
| Ionic |  |
| Metallic |  |

**(1)**

(g)  Calculate the relative formula mass (*M*r) of lithium oxide (Li2O).

Relative atomic masses (*A*r): Li = 7 O = 16

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Relative formula mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

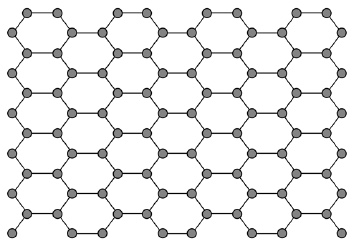
**(Total 9 marks)**

**Q5.**

This question is about structure and bonding.

(a)     **Figure 1** shows part of one layer of graphene.

**Figure 1**

****

Which element is graphene made from?

Tick **one** box.

|  |  |
| --- | --- |
| Carbon |  |
| Copper |  |
| Hydrogen |  |
| Sodium |  |

**(1)**

(b)     Each atom in graphene has one delocalised electron.

Complete the sentence.

Choose the answer from the box.

|  |  |
| --- | --- |
| **act as a lubricant** | **be used as a fuel** |
| **conduct electricity** | **dissolve in water** |

Delocalised electrons allow graphene to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(c)     Which structure is a fullerene?

Tick **one** box.

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |

**(1)**

**Figure 2** shows part of a large hydrocarbon molecule.

**Figure 2**

****

(d)     Which **two** elements are in all hydrocarbons?

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(e)     Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **an atom** | **a metal** | **a polymer** | **a salt** |

The large molecule represented in **Figure 2** is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(f)      Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **attract** | **bond** | **slide** | **vibrate** |

Metals can be stretched into wires

because the layers of atoms can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**Q6.**

This question is about electrolysis.

(a)     How many different elements are in the formula AgNO3?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2 |  | 3 |  | 5 |  | 6 |  |

**(1)**

(b)     How many atoms are in the formula AgNO3?

Tick **one** box.

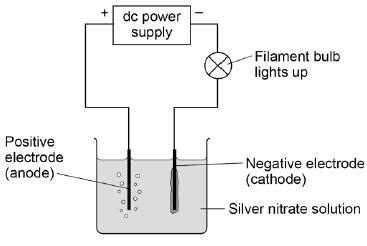
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2 |  | 3 |  | 5 |  | 6 |  |

**(1)**

An electric current is passed through silver nitrate solution.

**Figure 1** shows the apparatus.

**Figure 1**

****

The solution contains four ions:

•        Ag+

•        H+

•        NO3–

•        OH–

(c)     Where do the H+ and OH– ions come from?

Tick **one** box.

|  |  |
| --- | --- |
| Air |  |
| Electrodes |  |
| Silver nitrate |  |
| Water |  |

**(1)**

(d)     Ag+ ions and H+ ions are attracted to the negative electrode (cathode).

Give a reason why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(e)     Silver is produced at the negative electrode (cathode) and not hydrogen.

What does this tell you about the reactivity of silver?

Tick **one** box.

|  |  |
| --- | --- |
| Silver is less reactive than hydrogen |  |
| Silver is less reactive than oxygen |  |
| Silver is more reactive than nitrate |  |
| Silver is more reactive than water |  |

**(1)**

(f)      The hydroxide ion (OH–) is attracted to the positive electrode (anode).

The equation shows what happens at the positive electrode (anode).

4OH– → 2H2O + O2 + 4e–

Name the gas produced at the positive electrode (anode).

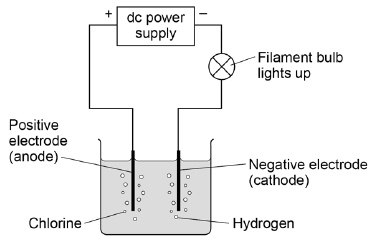
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**(1)**

(g)     An electric current is passed through sodium chloride solution.

**Figure 2** shows the apparatus.

**Figure 2**

****

After passing an electric current through sodium chloride solution one product is sodium hydroxide (NaOH) solution.

The presence of sodium hydroxide can be shown by adding an indicator.

Name an indicator.

Give the colour of the indicator in sodium hydroxide solution.

Indicator \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Colour \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

**(Total 8 marks)**

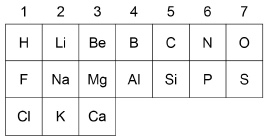
**Q7.**

This question is about the periodic table.

In 1864 John Newlands suggested an arrangement of elements.

**Figure 1** shows the arrangement Newlands suggested.

**Figure 1**

****

(a)     Give **two** differences between column 1 in **Figure 1** and Group 1 in the modern periodic table.

Use the periodic table to help you.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     In 1869 Mendeleev produced his periodic table.

Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **insoluble** | **magnetic** | **undiscovered** | **unreactive** |

Mendeleev left gaps in his periodic table for elements that were

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(c)     How are the elements ordered in the modern periodic table?

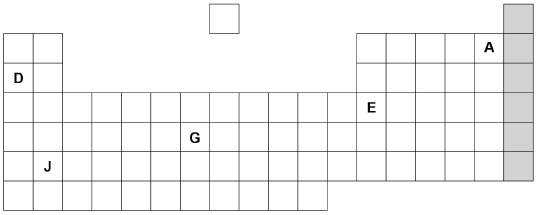
Tick **one** box.

|  |  |
| --- | --- |
| Atomic mass |  |
| Atomic number |  |
| Melting point |  |
| Reactivity |  |

**(1)**

**Figure 2** shows part of the modern periodic table.

**Figure 2**

****

(d)     Complete the sentences about the elements in **Figure 2**.

Choose the answers from the box.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **A** | **D** | **E** | **G** | **J** |

Sodium is an alkali metal and is represented by the letter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

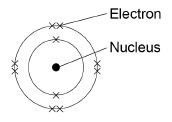
An element in group 3 is represented by the letter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A gaseous non-metal element is represented by the letter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**(3)**

(e)     **Figure 3** shows the electronic structure of an atom.

**Figure 3**

****

This element is in the shaded group on **Figure 2**.

Why is this element unreactive?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(f)      Name the group of elements in the shaded column on **Figure 2**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

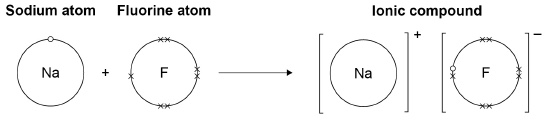
**(1)**

**Q8.**

A sodium atom and a fluorine atom react together to form an ionic compound.

**Figure 1** shows the electron arrangements in the atoms and the ionic compound.

Only the outer shell electrons are shown.

****

(a)     What is the name of the ionic compound shown in **Figure 1**?

Tick **one** box.

|  |  |
| --- | --- |
| Sodium fluorate |  |
| Sodium fluoride |  |
| Sodium fluorine |  |

**(1)**

(b)     What type of force acts between the ions in an ionic compound?

Tick **one** box.

|  |  |
| --- | --- |
| Electrostatic |  |
| Frictional |  |
| Gravitational |  |
| Magnetic |  |

**(1)**

(c)     What are **two** properties of ionic compounds?

Tick **two** boxes.

|  |  |
| --- | --- |
| Conducts electricity when molten |  |
| High melting point |  |
| Low boiling point |  |
| Small molecules |  |
| Weak bonds between particles |  |

**(2)**

(d)     Describe what happens when a sodium atom reacts with a fluorine atom to form an ionic compound.

Use **Figure 1**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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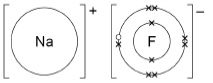
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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(4)**

(e)     **Figure 2** shows the structure of the ionic compound formed in the reaction.

**Figure 2**

****

Suggest **one** limitation of using **Figure 2** to show the structure of this compound.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

**(Total 9 marks)**

**Q9.**

The pH scale is a measure of the acidity or alkalinity of a solution.

(a)     Draw one line from each solution to the pH value of the solution.

|  |  |  |
| --- | --- | --- |
| **Solution** |  | **pH value of the solution** |

|  |  |  |
| --- | --- | --- |
|  |  | 5 |
|  |  |  |
| Acid |  | 7 |
|  |  |  |
|  |  | 9 |
|  |  |  |
| Neutral |  | 11 |
|  |  |  |
|  |  | 13 |

**(2)**

(b)     Which ion in aqueous solution causes acidity?

Tick **one** box.

|  |  |
| --- | --- |
| H+ |  |
| Na+ |  |
| O2− |  |
| OH− |  |

**(1)**

(c)     When sulfuric acid is added to sodium hydroxide a reaction occurs to produce two products.

The equation is:

             H2SO4  +  2NaOH     Na2SO4  +  2H2O

How many elements are in the formula H2SO4?

Tick **one** box.

|  |  |
| --- | --- |
| 3 |  |
| 4 |  |
| 6 |  |
| 7 |  |

**(1)**

(d)     What is this type of reaction?

Tick **one** box.

|  |  |
| --- | --- |
| Decomposition |  |
| Displacement |  |
| Neutralisation |  |
| Reduction |  |

**(1)**

(e)     Name the salt produced.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(f)     Describe how an indicator can be used to show when all the sodium hydroxide has reacted with sulfuric acid.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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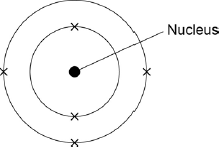
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**(3)**

**(Total 9 marks)**

**Q10.**

The figure below shows an atom of boron.



(a)     When the mass of the boron atom is calculated, the mass of the electrons is ignored.

Why is the mass of the electrons ignored?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     How many electrons are there in the boron atom?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     What is the electrical charge on the nucleus of the boron atom?

Tick **one** box.

|  |  |
| --- | --- |
| +1 |  |
| +5 |  |
| +6 |  |
| +11 |  |

**(1)**

(d)     The mass number of boron is 11.

Use the figure above to calculate the number of neutrons in the nucleus of the boron atom.

Explain how you worked out the answer.

Number of neutrons = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explanation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(e)     Phosphorus has a mass number of 31 and has 16 neutrons.

What percentage of the mass number of phosphorus is the number of neutrons?

Give your answer to two significant figures.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Percentage = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

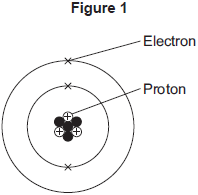
**(2)**

**(Total 8 marks)**

**Q11.**

There are eight elements in the second row (lithium to neon) of the periodic table.

(a)     **Figure 1** shows a lithium atom.



(i)      What is the mass number of the lithium atom in **Figure 1**?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| 3 |  |
| 4 |  |
| 7 |  |

**(1)**

(ii)     What is the charge of an electron?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| –1 |  |
| 0 |  |
| +1 |  |

**(1)**

(iii)    Protons are in the nucleus.

Which other sub-atomic particles are in the nucleus?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| ions |  |
| molecules |  |
| neutrons |  |

**(1)**

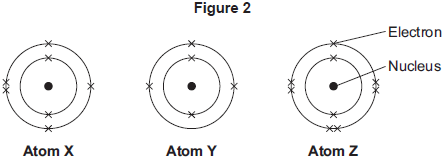
(b)     What is **always** different for atoms of different elements?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| number of neutrons |  |
| number of protons |  |
| number of shells |  |

**(1)**

(c)     **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

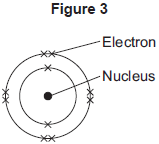


Which atom is from an element in Group 3 of the periodic table?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| **Atom X** |  |
| **Atom Y** |  |
| **Atom Z** |  |

**(1)**

(d)     **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.



(i)      Give the chemical symbol of this element.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Why is this element unreactive?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

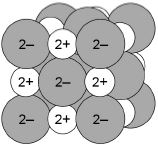
**(1)**

**Q12.**

This question is about structure and bonding.

(a)  **Figure 1** shows part of the structure of calcium oxide (CaO).

**Figure 1**

****

What type of bonding is present in calcium oxide?

Tick **one** box.

|  |  |
| --- | --- |
| Covalent |  |
| Ionic |  |
| Macromolecular |  |
| Metallic |  |

**(1)**

(b)  **Figure 2** shows a particle of methane (CH4).

****

What type of particle is present in **Figure 2**?

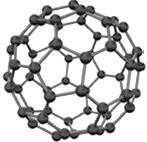
Tick **one** box.

|  |  |
| --- | --- |
| An ion |  |
| A lattice |  |
| A molecule |  |
| A polymer |  |

**(1)**

(c)  **Figure 3** shows the structure of C60

**Figure 3**

****

Complete the sentence.

Choose the answer from the box.

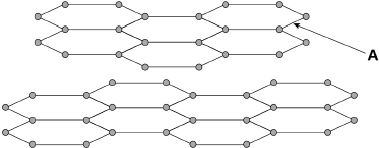
|  |  |  |  |
| --- | --- | --- | --- |
| **diatomic** | **giant ionic** | **a fullerene** | **giant metallic** |

The structure of C60 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

**Figure 4** shows the structure of graphite.

**Figure 4**

****

(d)  What type of bond is labelled **A** in **Figure 4**?

Tick **one** box.

|  |  |
| --- | --- |
| covalent |  |
| double |  |
| ionic |  |
| metallic |  |

**(1)**

(e)  In graphite, each carbon atom forms bonds with other carbon atoms as shown in **Figure 4**

How many electrons does **one** carbon atom use to form **one** bond?

Tick **one** box.

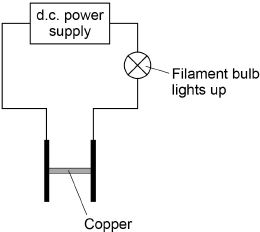
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1** |  | **2** |  | **3** |  | **4** |  |

**(1)**

An electric current is passed through copper.

**Figure 5** shows the apparatus used.

**Figure 5**

****

(f)  Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **gas** | **liquid** | **solid** | **solution** |

**Figure 5** shows that copper conducts electricity as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(g)  Complete the sentence.

Choose the answer from the box.

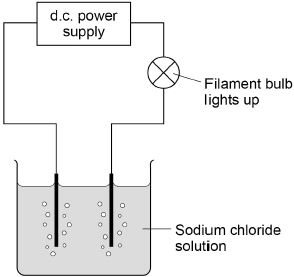
|  |  |  |  |
| --- | --- | --- | --- |
| **atoms** | **electrons** | **ions** | **molecules** |

Copper conducts electricity because of the movement of delocalised \_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(h)  **Figure 6** shows the apparatus used to investigate the effect of electricity on sodium chloride solution.

**Figure 6**

****

Complete the sentence.

Choose the answer from the box.

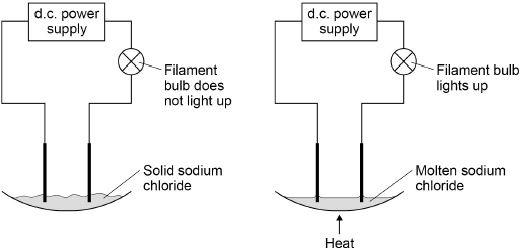
|  |  |  |
| --- | --- | --- |
| **dissolved** | **gaseous** | **molten** |

**Figure 6** shows that sodium chloride conducts electricity when \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(i)   Sodium chloride is made up of ions.

**Figure 7** shows the apparatus used to investigate the effect of electricity on solid sodium chloride and molten sodium chloride.

****

The table below shows the results.

|  |  |  |
| --- | --- | --- |
|  | **Solid sodium chloride** | **Molten sodium chloride** |
| **Observation** | The filament bulb does not light up | The filament bulb lights up |
| **Deduction** | Does not conduct electricity | Does conduct electricity |

Draw **one** line from each statement to the correct reason.

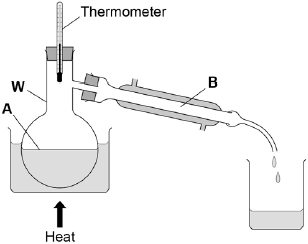
|  |  |  |
| --- | --- | --- |
| **Statement** |  | **Reason** |
|  | | |
|  |  | The ions are fixed. |
| Solid sodium chloride does |  |  |
| not conduct electricity. |  | The ions are mobile. |
|  | | |
| Molten sodium chloride |  | The ions are neutral. |
| conducts electricity. |  |  |
|  |  | The ions are vibrating. |

**(2)**

**(Total 10 marks)**

**Q13.**

The apparatus in the figure below is used to separate a mixture of liquids in a fuel.



(a)     What is apparatus **W** on above the figure above?

Tick **one** box.

|  |  |
| --- | --- |
| Beaker |  |
| Boiling Tube |  |
| Flask |  |
| Jug |  |

**(1)**

(b)     What is the name of this method of separation?

Tick **one** box.

|  |  |
| --- | --- |
| Crystallisation |  |
| Electrolysis |  |
| Filtration |  |
| Distillation |  |

**(1)**

(c)     Name the changes of state taking place at **A** and **B** in the figure above.

Use words from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **boiling** | **condensing** | **freezing** | **melting** |

Change of state at **A**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Change of state at **B**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(d)     **Table 1** shows the boiling points of the hydrocarbons in the fuel.

**Table 1**

|  |  |
| --- | --- |
| **Hydrocarbon** | **Boiling point in °C** |
| Pentane | 36 |
| Hexane | 69 |
| Heptane | 98 |
| Octane | 125 |

Which hydrocarbon will be the last to collect in the beaker?

Tick **one** box.

|  |  |
| --- | --- |
| Pentane |  |
| Hexane |  |
| Heptane |  |
| Octane |  |

**(1)**

(e)     The fuel is a mixture of liquids that has been designed as a useful product.

What name is given to this type of mixture?

Tick **one** box.

|  |  |
| --- | --- |
| Catalyst |  |
| Formulation |  |
| Polymer |  |
| Solvent |  |

**(1)**

(f)     Describe how this fuel is different from crude oil.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(g)     A student measured the melting point of a solid hydrocarbon four times.

The student’s results are in **Table 2**.

**Table 2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Trial 1** | **Trial 2** | **Trial 3** | **Trial 4** |
| Melting point in °C | 35 | 48 | 37 | 37 |

Calculate the mean melting point of the hydrocarbon, leaving out any anomalous result.

Give your answer to two significant figures.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mean melting point = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ °C

**(2)**

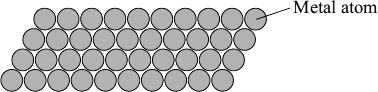
**(Total 10 marks)**

**Q14.**

Metal is bent and shaped to make a car body.



The diagram below represents how atoms are arranged in a metal.



Which **two** statements in the table best explain why the metal can be bent and shaped?

Tick () the **two** statements.

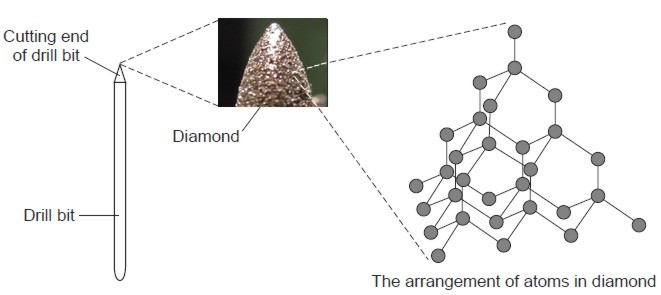
|  |  |
| --- | --- |
| **Statement** | **Tick ()** |
| The atoms are in layers. |  |
| The metal is shiny. |  |
| The atoms can slide over each other. |  |
| All the atoms are linked by strong covalent bonds. |  |

**(2)**

**(Total 2 marks)**

**Q15.**

A drill bit is used to cut holes through materials. The cutting end of this drill bit is covered with very small diamonds.



By Wanderlinse [CC By 2.0], via Flickr

Draw a ring around the correct word in each box.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | carbon |  |
| (a) | Diamond is made from | nitrogen | atoms. |
|  |  | oxygen |  |

**(1)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | none |  |
| (b) | Diamond has a giant structure in which | some | of the atoms are joined together. |
|  |  | all |  |

**(1)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | covalent |  |
| (c) | The atoms in diamond are joined together by | ionic | bonds. |
|  |  | metallic |  |

**(1)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | two |  |
| (d) | In diamond each atom is joined to | three | other atoms. |
|  |  | four |  |

**(1)**

|  |  |  |
| --- | --- | --- |
|  |  | hard. |
| (e) | Diamond is suitable for the cutting end of a drill bit because it is | shiny. |
|  |  | soft |

**(1)**

**(Total 5 marks)**

**Q16.**

This label was on a container of graphite lubricant.

|  |
| --- |
| ***Super G* Graphite Lubricant**  ***Super G*** forms a thin anti-friction film on metal surfaces. It provides good lubrication when metal parts rub against each other. |

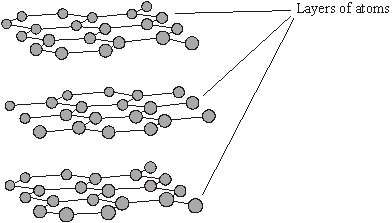
(a)     Give **one** reason why a lubricant is used when metal parts rub against each other.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The diagram shows the arrangement of atoms in graphite.



(i)      Draw a ring around the type of atoms in graphite.

**aluminium**                      **carbon**                       **silicon**

**(1)**

(ii)     Graphite is a good lubricant because it is slippery. Use the diagram to explain why graphite is slippery.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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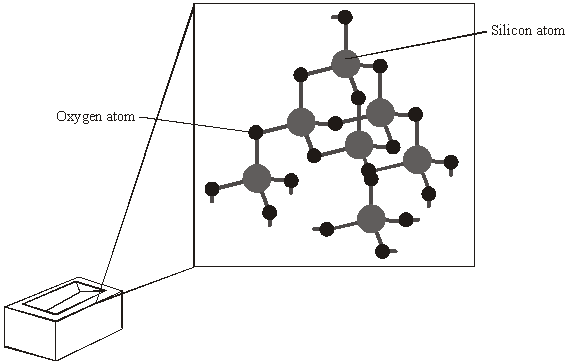
**(2)**

**(Total 4 marks)**

**Q17.**

Bricks made from silica (silicon dioxide) are used to line furnaces that operate at high temperatures.

Part of the structure of silica is shown in the diagram.



          Use words from the box to complete the sentences.

|  |
| --- |
| **covalent          giant          low          small**    **four          high          six          weak** |

One reason for using silica to make bricks for high-temperature furnaces is that silica has

a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ melting point.

Silica has this property because it is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ structure in which each

silicon atom is joined to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ oxygen atoms by

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds.

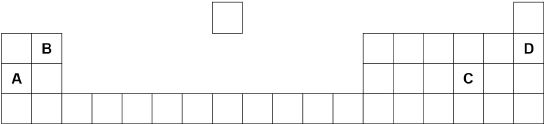
**(Total 4 marks)**

**Q18.**

This question is about the elements in Group 2 of the periodic table.

(a)  **Figure 1** shows the positions of four elements, **A**, **B**, **C**, and **D**, in the periodic table.

**Figure 1**

****

Which element is in Group 2?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **A** |  | **B** |  | **C** |  | **D** |  |

**(1)**

Group 2 metal carbonates break down when heated to produce a metal oxide and a gas.

metal carbonate ⟶ metal oxide + gas

(b)  Name the two products when calcium carbonate (CaCO3) is heated.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)  What type of reaction happens when a compound breaks down?

Tick **one** box.

|  |  |
| --- | --- |
| burning |  |
| decomposition |  |
| neutralisation |  |
| reduction |  |

**(1)**

(d)  The metal carbonate takes in energy from the surroundings to break down.

What type of reaction takes in energy from the surroundings?

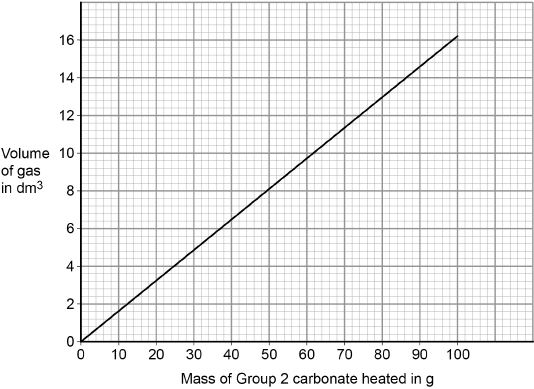
Tick **one** box.

|  |  |
| --- | --- |
| combustion |  |
| electrolysis |  |
| endothermic |  |
| exothermic |  |

**(1)**

(e)  **Figure 2** shows the volume of gas produced when a Group 2 metal carbonate is heated.

**Figure 2**

****

The student collected 5.2 dm3 of gas.

What mass of the Group 2 metal carbonate is heated?

Mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(1)**

(f)  Calculate the mass of the Group 2 carbonate needed to produce 24 dm3 of gas.

Use your answer from part **(e)** to help you.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(2)**

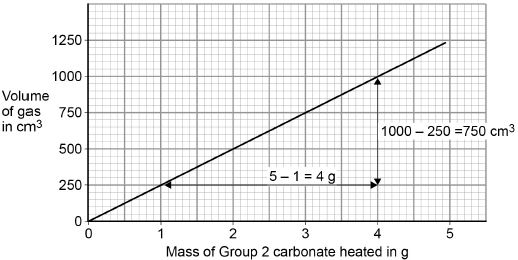
(g)  A student heated different masses of a Group 2 carbonate. The student measured the volume of gas produced.

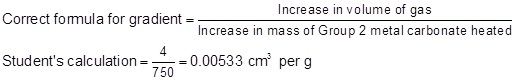
**Figure 3** shows a graph of the student’s results.

The student calculates the gradient of the line in **Figure 3**

The student makes **two** mistakes.

**Figure 3**

****



Identify the **two** mistakes the student makes.

Calculate the correct gradient of the line.

Mistake 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mistake 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calculation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Gradient = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3 per g

**(4)**

(h)  A student repeated the experiment with a different Group 2 metal carbonate (**X**CO3).

The relative formula mass (*M*r) of **X**CO3 is 84

Relative atomic masses (*A*r):  C = 12  O = 16

Calculate the relative atomic mass (*A*r) of **X**.

Name metal **X**.

Use the periodic table.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Relative atomic mass (*A*r) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Metal **X** is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(4)**

**(Total 16 marks)**

**Q19.**

A teacher extracted copper from copper oxide.

This is the method used.

1.   Mix 1.30 g of zinc and 1.59 g of copper oxide.

2.   Heat the mixture strongly.

3.   When the mixture starts to glow, stop heating.

4.   Let the glow spread through the mixture.

5.   Leave the mixture to cool.

(a)  This reaction is exothermic.

Which part of the method shows the reaction is exothermic?

Tick **one** box.

|  |  |
| --- | --- |
| Mix zinc and copper oxide |  |
| Heat the mixture |  |
| Let the glow spread |  |
| Leave to cool |  |

**(1)**

The equation for the reaction between zinc and copper oxide is:



(b)  1.30 g of zinc fully reacted with 1.59 g of copper oxide to produce 1.62 g of zinc oxide.

What mass of copper was produced?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Mass of copper produced = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(1)**

(c)  What is the physical state of zinc oxide in the reaction?

Tick **one** box.

|  |  |
| --- | --- |
| Aqueous |  |
| Gas |  |
| Liquid |  |
| Solid |  |

**(1)**

(d)  Which substance has been oxidised in the reaction?

Tick **one** box.

|  |  |
| --- | --- |
| Copper |  |
| Copper oxide |  |
| Zinc |  |
| Zinc oxide |  |

**(1)**

(e)  What type of reaction takes place when zinc reacts with copper oxide?

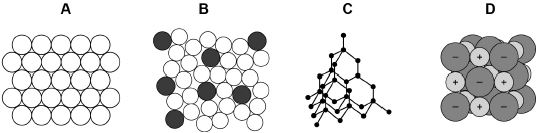
Tick **one** box.

|  |  |
| --- | --- |
| Combustion |  |
| Crystallisation |  |
| Displacement |  |
| Neutralisation oxide |  |

**(1)**

Copper is a metal.

(f)  Which structure represents the arrangement of atoms in pure copper?



Tick **one** box.

|  |  |
| --- | --- |
| **A** |  |
| **B** |  |
| **C** |  |
| **D** |  |

**(1)**

(g)  Copper is used in electrical wiring.

Give **one** reason why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(h)  In the UK, 40% of the copper we use is recycled copper.

The other 60% is copper obtained by mining.

What is the simplest ratio of recycled copper to copper obtained by mining?

Tick **one** box.

|  |  |
| --- | --- |
| 2 : 3 |  |
| 2 : 5 |  |
| 4 : 10 |  |
| 6 : 4 |  |

**(1)**

(i)   What are **two** advantages of recycling copper?

Tick **two** boxes.

|  |  |
| --- | --- |
| Conserves copper ores |  |
| Increase in greenhouse gases |  |
| Less energy used |  |
| More jobs for miners |  |
| More space used at landfill |  |

**(2)**

**(Total 10 marks)**

**Q20.**

This question is about compounds of oxygen.

The reaction between carbon and oxygen is exothermic.

(a)     What does exothermic reaction mean?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(b)     Which is the correct reaction profile (energy level diagram) for an exothermic reaction?

Tick **one** box.

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |

**(1)**

(c)     The percentage by mass of oxygen in carbon dioxide (CO2) is calculated by the equation:



Relative atomic masses (*A*r):      C = 12      O = 16

Calculate the percentage by mass of oxygen in carbon dioxide (CO2).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Percentage by mass of oxygen = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ %

**(3)**

Hydrogen peroxide decomposes to produce water and oxygen.

(d)     Balance the chemical equation.

\_\_\_\_ H2O2 → \_\_\_\_H2O + O2

**(1)**

(e)     6.8 g of hydrogen peroxide decomposes to produce 3.6 g of water.

Calculate the mass of oxygen produced when 68 g of hydrogen peroxide decomposes.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Mass of oxygen = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(2)**

**(Total 8 marks)**

**Q21.**

This question is about carbon and gases in the air.

(a)     Carbon atoms have protons, neutrons and electrons.

Complete the table by writing the relative mass of a neutron and an electron.

|  |  |
| --- | --- |
| **Name of particle** | **Relative mass** |
| proton | 1 |
| neutron |  |
| electron |  |

**(2)**

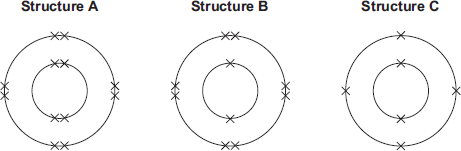
(b)     What is the total number of protons and neutrons in an atom called?

|  |  |
| --- | --- |
| Tick () **one** box. | |
| The atomic number |  |
| The mass number |  |
| One mole of the atom |  |

**(1)**

(c)     An atom of carbon has six electrons.

Which structure, **A, B** or **C**, represents the electronic structure of the carbon atom?



|  |  |
| --- | --- |
| The carbon atom is structure |  |

**(1)**

(d)     Carbon reacts with oxygen to produce carbon dioxide (CO2).

(i)      How many different elements are in one molecule of carbon dioxide?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     What is the total number of atoms in one molecule of carbon dioxide?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(e)     Sometimes carbon reacts with oxygen to produce carbon monoxide (CO).

(i)      Calculate the relative formula mass (*M*r) of carbon monoxide.

Relative atomic masses (*A*r): C = 12; O = 16

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Mr* of carbon monoxide = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Calculate the percentage by mass of carbon in carbon monoxide.

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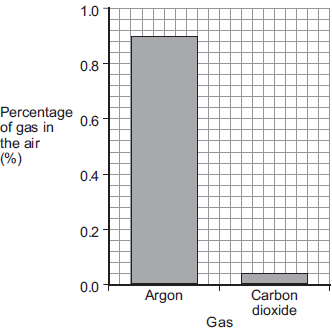
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Percentage by mass of carbon in carbon monoxide = \_\_\_\_\_%

**(1)**

(f)     Carbon dioxide is one of the gases in the air.

(i)      The graph shows the percentage of argon and the percentage of carbon dioxide in the air.



What is the percentage of argon in the air?

Percentage of argon = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ %

**(1)**

(ii)     An instrumental method is used to measure the amount of carbon dioxide in the air.

Give **one** reason for using an instrumental method.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

**(Total 10 marks)**

**Q22.**

Calcium oxide (quicklime) is made by heating calcium carbonate (limestone).

calcium carbonate   →   calcium oxide   +   carbon dioxide  
          100 g                               ?                          44 g

(a)     44 grams of carbon dioxide is produced when 100 grams of calcium carbonate is heated.

          Calculate the mass of calcium oxide produced when 100 grams of calcium carbonate is heated.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

mass \_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(1)**

(b)     What mass of carbon dioxide could be made from 100 tonnes of calcium carbonate?

mass \_\_\_\_\_\_\_\_\_\_\_\_ tonnes

**(1)**

**(Total 2 marks)**

**Section 2: Required Practicals**

**Q23.**

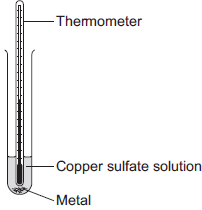
A student investigated displacement reactions of metals.

The student added different metals to copper sulfate solution and measured the temperature change.

The more reactive the metal is compared with copper, the bigger the temperature change.

The apparatus the student used is shown in **Figure 1**.

**Figure 1**

****

(a)     State **three** variables that the student must control to make his investigation a fair test.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

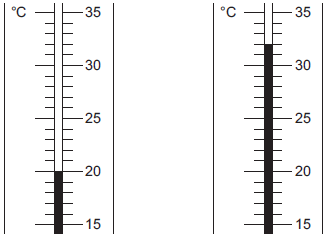
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(b)     **Figure 2** shows the thermometer in one experiment before and after the student added a metal to the copper sulfate solution.

**Figure 2**

|  |  |
| --- | --- |
| **Before adding metal** | **After adding metal** |

****

Use **Figure 2** to complete **Table 1**.

**Table 1**

|  |  |
| --- | --- |
| Temperature before adding metal in °C | \_\_\_\_\_\_\_\_ |
| Temperature after adding metal in °C | \_\_\_\_\_\_\_\_ |
| Change in temperature in °C | \_\_\_\_\_\_\_\_ |

**(3)**

(c)     The student repeated the experiment three times with each metal.

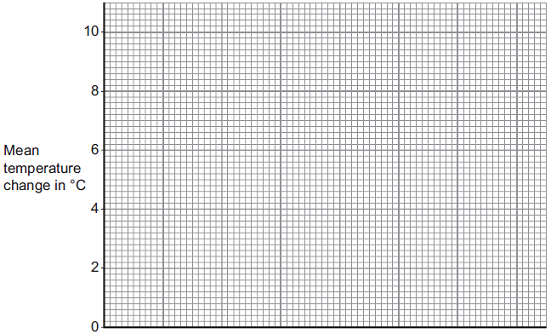
**Table 2** shows the mean temperature change for each metal.

**Table 2**

|  |  |
| --- | --- |
| **Metal** | **Mean temperature change in °C** |
| Cobalt | 4.5 |
| Gold | 0.0 |
| Magnesium | 10.0 |
| Nickel | 3.0 |
| Silver | 0.0 |
| Tin | 1.5 |

(i)      On **Figure 3**, draw a bar chart to show the results.

**Figure 3**

****

**(3)**

(ii)     Why is a line graph **not** a suitable way of showing the results?

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**(1)**

(iii)    Use the results to work out which metal is the most reactive.

Give a reason for your answer.

Most reactive metal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reason \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(iv)    Explain why there was no temperature change when silver metal was added to the copper sulfate solution.

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**(2)**

(v)     It is **not** possible to put all six metals in order of reactivity using these results.

Suggest how you could change the experiment to be able to put all six metals into order of reactivity.

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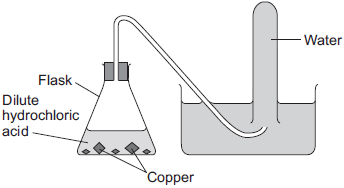
**(2)**

**Q24.**

A student was trying to produce hydrogen gas.

**Figure 1** shows the apparatus she used.

**Figure 1**

****

(a)     No gas was produced.

The student’s teacher said that this was because the substances in the flask did **not** react.

(i)      Suggest why the substances in the flask did **not** react.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     Which two substances could the student have put in the flask to produce hydrogen safely?

Tick (✓) **one** box.

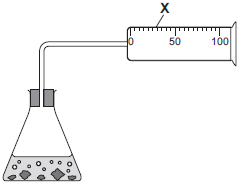
|  |  |
| --- | --- |
| Gold and dilute hydrochloric acid |  |
| Potassium and dilute hydrochloric acid |  |
| Zinc and dilute hydrochloric acid |  |

**(1)**

(b)     Another student did produce hydrogen from two substances.

**Figure 2** shows the apparatus the student used to collect and measure the volume of the hydrogen gas.

**Figure 2**

****

Give the name of the apparatus labelled **X**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     The student did the experiment four times. Her results are shown in the table below.

|  |  |
| --- | --- |
| **Experiment** | **Volume of hydrogen collected in one minute in cm3** |
| 1 | 49 |
| 2 | 50 |
| 3 | 35 |
| 4 | 48 |

(i)      One of the results is anomalous.

Which result is anomalous? Write your answer in the box.    

Give a reason for your choice.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     Calculate the mean volume of hydrogen collected in one minute.

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Mean volume = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3

**(2)**

(iii)    Give a reason why the experiment should be repeated several times.

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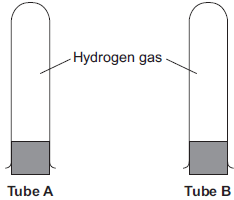
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**(1)**

(d)     A teacher collected two tubes full of hydrogen gas, as shown in **Figure 3**.

**Figure 3**

****

She tested tube **A** with a lighted splint as soon as she took the bung out.

She tested tube **B** with a lighted splint a few seconds after taking the bung out.

(i)      Suggest why tube **B** gave a much louder pop than tube **A**.

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**(1)**

(ii)     Complete and balance the chemical equation for the reaction that takes place when the hydrogen reacts in this test.

H2    +    O2 

**(2)**

**(Total 11 marks)**

**Q25.**

The label shows the ingredients in a drink called Cola.

|  |
| --- |
| **Cola** |
| Ingredients: |
| Carbonated water  Sugar  Colouring  Phosphoric acid  Flavouring  Caffeine |

(a)     (i)      The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

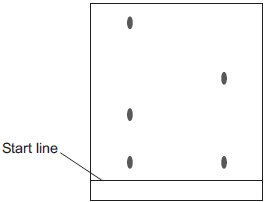
(ii)     Which ion causes the pH to be 2.9?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in the figure below shows the student’s results.

   
                      Cola            Fruit drink

(i)      Complete the sentence.

The start line should be drawn with a ruler and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

Give a reason for your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     Suggest **three** conclusions you can make from the student’s results.

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**(3)**

(c)     Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(d)     Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

(i)      Only **one** of the questions in the table **can** be answered by science alone.

Tick () **one** question.

|  |  |
| --- | --- |
| **Question** | **Tick** () |
| Should caffeine be an ingredient in drinks? |  |
| Is there caffeine in a certain brand of drink? |  |
| How much caffeine should people drink? |  |

**(1)**

(ii)     Give **two** reasons why the other questions **cannot** be answered by science alone.

Reason 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Reason 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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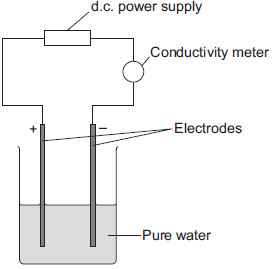
**(2)**

**(Total 11 marks)**

**Q26.**

A student investigated the conductivity of different concentrations of sodium chloride solution.  
The student set the apparatus up as shown in **Figure 1**.

**Figure 1**

****

The student measured the conductivity of the pure water with a conductivity meter.

The reading on the conductivity meter was zero.

(a)     The student:

•        added sodium chloride solution one drop at a time   
•        stirred the solution   
•        recorded the reading on the conductivity meter.

The student’s results are shown in the table below.

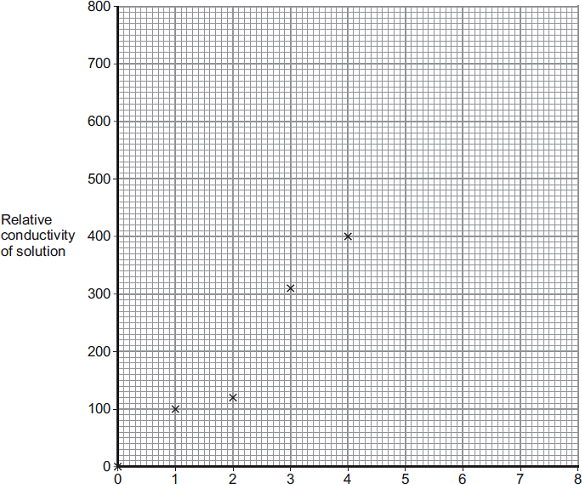
|  |  |
| --- | --- |
| **Number of drops of sodium chloride solution added** | **Relative conductivity of solution** |
| 0 | 0 |
| 1 | 100 |
| 2 | 120 |
| 3 | 310 |
| 4 | 400 |
| 5 | 510 |
| 6 | 590 |
| 7 | 710 |
| 8 | 800 |

(i)      The student plotted the results on the grid shown in **Figure 2**.

Plot the four remaining results.

Draw a line of best fit, ignoring the anomalous result.

**Figure 2**

****                            Number of drops of sodium chloride added

**(3)**

(ii)     One of the points is anomalous.

Suggest **one** error that the student may have made to cause the anomalous result.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(iii)    The student wanted to compare the conductivity of sodium chloride solution with the conductivity of potassium chloride solution.

State **one** variable he should keep constant when measuring the conductivity of the two solutions.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     (i)      Explain, in terms of bonding, why pure water does **not** conduct electricity.

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**(2)**

(ii)     Explain why sodium chloride solution conducts electricity.

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**(2)**

(iii)    After he had added sodium chloride solution, the student noticed bubbles of gas at the negative electrode.

Complete the sentence.

The gas produced at the negative electrode is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

**(Total 10 marks)**

**Q27.**

Some students investigated the change in temperature as sodium hydroxide solution is added to dilute sulfuric acid.

This is the method used.

1.     Put 25 cm3 of dilute sulfuric acid into a polystyrene cup.

2.     Measure the initial temperature of the dilute sulfuric acid.

3.     Add 4 cm3 of sodium hydroxide solution to the dilute sulfuric acid.

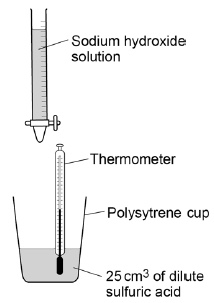
4.     Stir the mixture.

5.     Measure the highest temperature of the mixture.

6.     Repeat steps 3‒5 until 40 cm3 of sodium hydroxide solution have been added.

**Figure 1** shows the apparatus the student used.

**Figure 1**

****

(a)     The volume of sodium hydroxide solution is a variable.

Which **two** words can be used to describe this type of variable?

Tick **two** boxes.

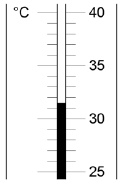
|  |  |
| --- | --- |
| Categoric |  |
| Continuous |  |
| Control |  |
| Dependent |  |
| Independent |  |

**(2)**

(b)     The dilute sulfuric acid has an initial temperature of 24.0 °C

**Figure 2** shows the highest temperature.

**Figure 2**

****

Calculate the change in temperature.

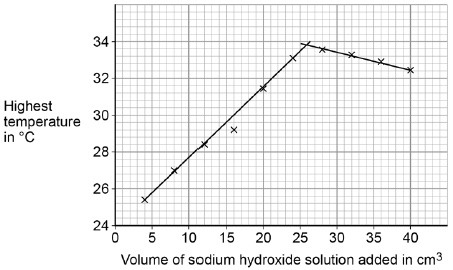
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Temperature = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ °C

**(2)**

**Figure 3** shows the students’ results.

**Figure 3**

****

(c)     Determine the volume of sodium hydroxide solution that gives the highest temperature change.

Use **Figure 3** to help you answer this question.

Volume = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3

**(1)**

(d)     In **Figure 3** the temperature when 16 cm3 of sodium hydroxide solution is added is anomalous.

Suggest **one** error that could have been made in the method which would cause this anomalous result.

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**(1)**

(e)     The sodium hydroxide solution in this investigation contains 80 grams per dm3

The students use 40 cm3 of sodium hydroxide solution.

Calculate the mass of sodium hydroxide in 40 cm3

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Mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

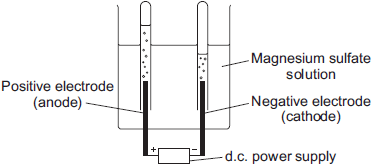
**(3)**

**(Total 9 marks)**

**Q28.**

**Diagram 1** shows the apparatus used to electrolyse magnesium sulfate solution.

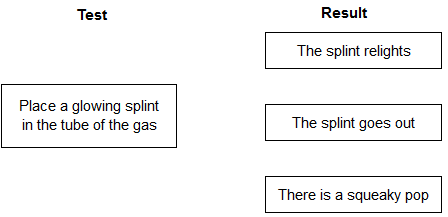
**Diagram 1**

****

Gases were given off at both electrodes.

(a)     The gas collected at the anode was oxygen.

Draw **one** line from the test for oxygen to the correct result.



**(1)**

(b)     (i)      The gas collected at the cathode was hydrogen.

Describe how to test the gas to show that it is hydrogen.

Test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Result \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(ii)     Why is hydrogen, and **not** magnesium, produced at the cathode?

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**(1)**

(c)     A student wanted to use electrolysis to silver plate a metal spoon.

(i)      Give **one** reason why metal spoons are sometimes silver plated.

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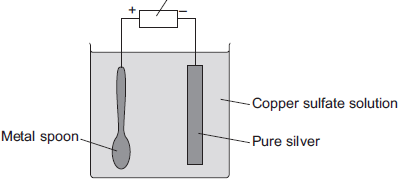
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**(1)**

(ii)     **Diagram 2** shows the apparatus the student used. The student did **not** set the apparatus up correctly.

**Diagram 2**

d.c. power  
supply



The student found that the metal spoon eroded and a thin layer of copper formed on the pure silver electrode.

Suggest **two** changes that the student must make to his apparatus to be able to silver plate the metal spoon. Give a reason for each change.

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**(4)**

(iii)    Why is it difficult to electroplate plastic spoons?

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**(1)**

**(Total 10 marks)**

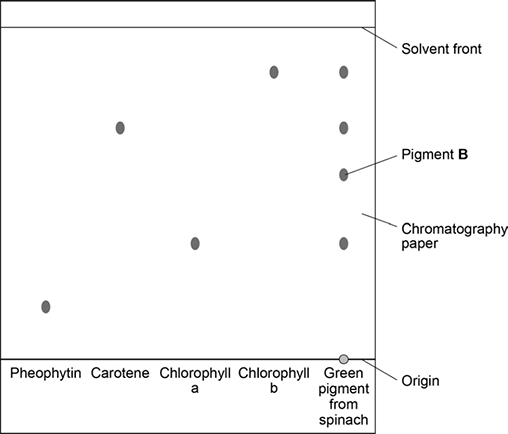
**Q29.**

A student used paper chromatography to identify the pigments in spinach leaves.

She used propanone as a solvent.

**Figure 1** shows the student’s results.

**Figure 1**

****

(a)     Name the mobile phase and the stationary phase in the student’s experiment.

Mobile phase \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Stationary phase \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     What does **Figure 1** tell you about the green pigment from spinach?

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**(3)**

(c)     Write the equation that links distance moved by solvent, distance moved by solute and Rf value.

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**(1)**

(d)     Use **Figure 1** to calculate the Rf value for pigment **B**.

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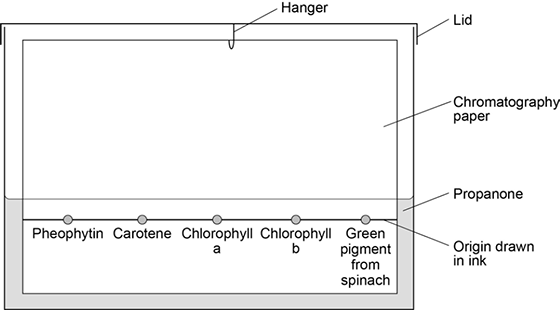
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  Rf value = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(e)     Another student set up the apparatus shown in **Figure 2**.

**Figure 2**

****

This student did not set up the apparatus correctly.

Identify the errors the student made.

Explain how the errors she made would affect her results.

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**(4)**

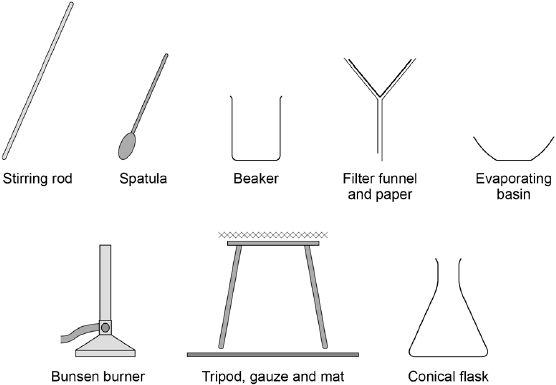
**(Total 13 marks)**

**Section 3: 6 Mark Questions**

**Q30.**

This question is about making copper salts.

The figure below shows the apparatus given to a student.



Outline a safe plan the student could use to make pure, dry, crystals of the soluble salt copper sulfate from the insoluble metal oxide and dilute acid.

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**(Total 6 marks)**

**Q31.**

Magnesium is added to dilute hydrochloric acid.

An exothermic reaction takes place.

Magnesium chloride solution and hydrogen gas are produced.

The equation for the reaction is:

Mg (s) + 2HCl (aq) → MgCl2 (aq) + H2 (g)

(a)     Describe the test for hydrogen gas.

Give the result of the test if hydrogen gas is present.

Test \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Result \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     A student investigates how the mass of magnesium used affects the temperature change during the reaction.

Plan a method the student could use.

You should include:

•        the apparatus needed

•        the measurements to be taken.

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**(6)**

**(Total 8 marks)**

**Q32.**

John Newlands arranged the known elements into a table in order of atomic weight.

**Figure 1** shows part of Newlands’ table.

**Figure 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Group** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|  | H | Li | Be | B | C | N | O |
|  | F | Na | Mg | Al | Si | P | S |
|  | Cl | K | Ca |  |  |  |  |

(a)     What are the names of the elements in Group 5 of Newlands’ table?

Tick **one** box.

|  |  |
| --- | --- |
| Calcium and sulfur |  |
| Carbon and silicon |  |
| Chlorine and silver |  |
| Chromium and tin |  |

**(1)**

(b)     In what order is the modern periodic table arranged?

Tick **one** box.

|  |  |
| --- | --- |
| Atomic mass |  |
| Atomic number |  |
| Atomic size |  |
| Atomic weight |  |

**(1)**

(c)     Give **two** differences between Group 1 of Newlands’ table and Group 1 of the periodic table.

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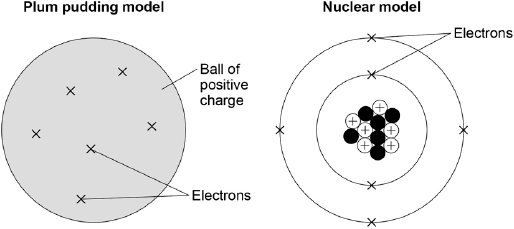
**(2)**

(d)     In 1864, atoms were thought to be particles that could not be divided up into smaller particles.

By 1898, the electron had been discovered and the plum pudding model of an atom was proposed.

**Figure 2** shows the plum pudding model of an atom of carbon and the nuclear model of an atom of carbon.

**Figure 2**

****

Compare the position of the subatomic particles in the plum pudding model with the nuclear model.

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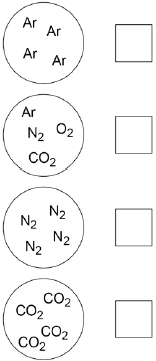
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**(4)**

(e)     Models are used to show the differences between elements, compounds and mixtures.

Which circle shows a model of a mixture?

Tick **one** box.



**(1)**

(f)     **Figure 3** shows a model of carbon dioxide.

**Figure 3**

****

What does each line between the atoms in **Figure 3** represent?

Tick **one** box.

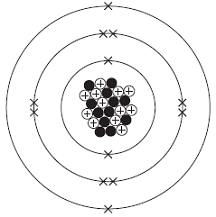
|  |  |
| --- | --- |
| Covalent bond |  |
| Intermolecular force |  |
| Ionic bond |  |
| Metallic bond |  |

**(1)**

**(Total 10 marks)**

**Q33.**

The diagram represents a magnesium atom.



(a)     Use words from the box to answer these questions.

|  |  |  |  |
| --- | --- | --- | --- |
| **electron** | **neutron** | **nucleus** | **proton** |

(i)      What is the name of the central part of the atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     What is the name of the particle with no charge? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(iii)    What is the name of the particle with a negative charge? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     Use the diagram above to help you answer these questions.

(i)      Draw a ring around the atomic (proton) number of this magnesium atom.

|  |  |  |
| --- | --- | --- |
| **12** | **24** | **36** |

**(1)**

(ii)     Draw a ring around the mass number of this magnesium atom.

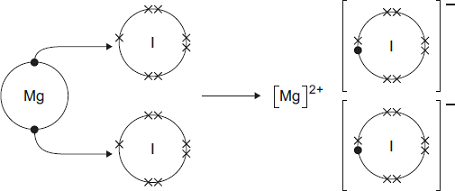
|  |  |  |
| --- | --- | --- |
| **12** | **24** | **36** |

**(1)**

(c)     The diagram shows how magnesium and iodine atoms form magnesium iodide.

Only the outer electrons are shown.

The dots (●) and crosses (×) are used to represent electrons.



**Use the diagram** to help you to answer this question.

Describe, as fully as you can, what happens when magnesium reacts with iodine to make magnesium iodide.

To gain full marks you should use the words atom, electron and ion in your answer.

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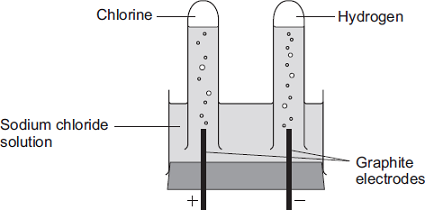
**(4)**

**(Total 9 marks)**

**Q34.**

The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.



(a)     One of the products of the electrolysis of sodium chloride solution is hydrogen.

(i)      Why do hydrogen ions move to the negative electrode?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     How does a hydrogen ion change into a hydrogen atom?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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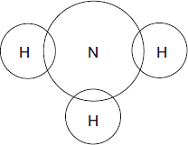
**(1)**

(b)     Hydrogen is used to make ammonia (NH3).

Complete the diagram to show the bonding in ammonia.

Use dots (●) and crosses (x) to show electrons.

Show only outer shell electrons.



**(2)**

(c)     The table shows the ions in sodium chloride solution.

|  |  |
| --- | --- |
| **Positive ions** | **Negative ions** |
| hydrogen | chloride |
| sodium | hydroxide |

In industry, some of the waste from the electrolysis of sodium chloride solution is alkaline and has to be neutralised.

(i)      Which ion makes the waste alkaline?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(d)     *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

|  |  |  |
| --- | --- | --- |
|  | **Mercury cell** | **Membrane cell** |
| **Cost of construction** | Expensive | Relatively cheap |
| **Additional substances used** | Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste | Membrane, which is made of a polymer. The membrane must be replaced every 3 years. |
| **Amount of electricity used for each tonne of chlorine produced in kWh** | 3400 | 2950 |
| **Quality of chlorine produced** | Pure | Needs to be liquefied and distilled to make it pure. |
| **Quality of sodium hydroxide solution produced** | 50% concentration. Steam is used to concentrate the sodium hydroxide solution produced. | 30% concentration. Steam is used to concentrate the sodium hydroxide solution produced. |

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

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**(6)**

**(Total 12 marks)**

**Q35.**

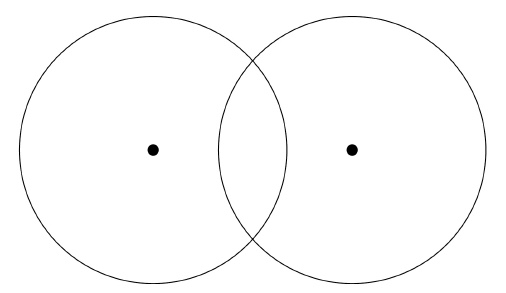
This question is about structure and bonding.

(a)     Oxygen is in Group 6.

The diagram shows the outer shells in an oxygen molecule.

Complete the dot and cross diagram.

You should show only the electrons in the outer shell.



**(2)**

(b)     Oxygen forms many compounds.

Which **two** compounds of oxygen are small molecules?

Tick **two** boxes.

|  |  |
| --- | --- |
| Carbon dioxide |  |
| Magnesium oxide |  |
| Potassium oxide |  |
| Silicon dioxide |  |
| Water |  |

**(2)**

(c)     Explain why metals conduct electricity.

Refer to structure and bonding in your answer.

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**(4)**

**(Total 8 marks**

**Section 1: Knowledge Mark Scheme**

**Q1.**

(a)  watch glass

**1**

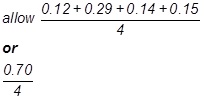
(b)  identify 0.29 as anomaly

**1**

****

**or**

****



**1**

(=) 0.14 (g)

*allow 0.18 (g) if first marking point not awarded*

**1**

*an answer of 0.14 (g) scores* ***3*** *marks*

(c)  evaporating

**or**

vaporisation

*allow from liquid to vapour / gas*

*do* ***not*** *accept boiling*

**1**

(d)  pure

**or**

no salt

*allow converse answers relating to seawater*

*allow not a mixture*

*allow desalinated*

*do* ***not*** *accept less salt*

*do* ***not*** *accept filtered*

**1**

(e)  uses (a lot of) energy

*allow needs heating*

*allow needs electricity*

*allow needs fuel* ***or*** *any suitable fuel*

*ignore references to equipment*

*ignore references to time*

**1**

(f)  filtering removes particles

*allow solids* ***or*** *suitable named solids*

**1**

sterilising kills bacteria / microbes

*allow destroys viruses*

*allow kills viruses*

**1**

**[9]**

**Q2.**

(a)  lines from:

•   independent to size of marble chips

**1**

•   control to volume of acid

**1**

*ignore arrowheads*

*do* ***not*** *accept if more than one line from one box*

(b)  calcium chloride

carbon dioxide

*do* ***not*** *accept carbon oxide*

water

*do* ***not*** *accept hydrogen oxide*

**2**

*all three needed for* ***2*** *marks*

*allow* ***1*** *mark if two correct*

(c)  stops loss of acid

*allow stops loss of water / liquid*

*allow to ensure that only the gas escapes*

*do* ***not*** *accept stops acid evaporating*

*do* ***not*** *accept stops gas / CO2 / water vapour escaping*

**1**

(d)  0.053

*allow 0.05*

*allow 0.053333…*

*do* ***not*** *accept 0.052*

*ignore units*

**1**

(e)  g/s

**1**

(f)  all points correctly plotted

*allow* ***1*** *mark for 5 points correctly plotted*

*allow ± ½ a small square*

**2**

line of best fit

*should be a curve nearer to (10,0.8) than the anomaly (20, 0.6) and through all other points*

*if plotting incorrect allow 1 mark for appropriate line of best fit through student’s points*

**1**

(g)  the eight small marble chips have a larger surface area, so more frequent collisions

**1**

**[11]**

**Q3.**

(a)  the mass number

**or**

number of protons **and** neutrons

*ignore (relative) atomic mass*

**1**

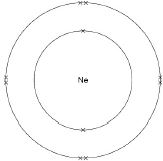
(b)  18

**1**

(c)  22

**1**

(d)



*ignore pairing of electrons*

**1**

(e)  positive

**1**

(f)  equal number of protons **and** electrons

*do* ***not*** *accept equal number of protons, electrons and neutrons*

**1**

(therefore) the positive cancels out the negative charge

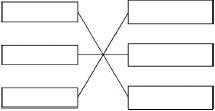
*allow (therefore) equal number of positives and negatives*

**1**

(g)  isotopes

**1**

(h)



**2**

**[10]**

**Q4.**

(a)  melting points decrease (as the atomic number increases)

*allow negative correlation*

**1**

(b)  55

**and**

29 (°C)

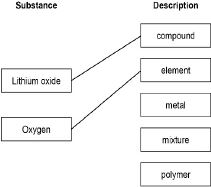
*allow values in range 28−32 (°C)*

**1**

(c)  1

**1**

(d)



**1**

**1**

(e)  4 Li + O2 ⟶ 2 Li2O

*allow correct multiples*

**1**

(f)  ionic

**1**

(g)  (*M*r) = (2 × 7) + 16

**1**

= 30

**1**

*an answer of 30 scores* ***2*** *marks*

**[9]**

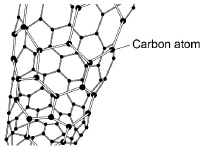
**Q5.**

(a)     carbon

**1**

(b)     conduct electricity

**1**

(c)     

**1**

(d)     carbon

hydrogen

*either order*

**2**

(e)     a polymer

**1**

(f)      slide

**1**

**[7]**

**Q6.**

(a)     3

**1**

(b)     5

**1**

(c)     water

**1**

(d)     opposite charges attract

**1**

(e)     silver is less reactive than hydrogen

**1**

(f)      oxygen

**1**

(g)     universal indicator

*allow other indicators*

**1**

blue / purple

**1**

**[8]**

**Q7.**

(a)     any **two** from:

•        hydrogen is in group 1 on Newlands table

•        fluorine / chlorine / halogens are in group 1 on Newlands table

•        alkali metals are in group 2 on Newlands table

*allow converse arguments relating to modern table*

*allow lithium / sodium / potassium for alkali metals*

**2**

(b)     undiscovered

**1**

(c)     atomic number

**1**

(d)     **D**

**1**

**E**

**1**

**A**

**1**

*must be in this order*

(e)     has a complete outer shell of electrons

*allow because has a stable arrangement of electrons*

**1**

(f)      noble gases

**1**

**[9]**

**Q8.**

(a)     sodium fluoride

**1**

(b)     electrostatic

**1**

(c)     conducts electricity when molten

**1**

high melting point

**1**

(d)     any **four** from:

•        sodium loses electron(s)

•        fluorine gains electron(s)

•        reference to one electron being transferred

•        (forming) positive sodium ion and negative fluoride ion

•        ions have complete outer shells

•        oppositely charged ions are attracted towards each other

**4**

(e)     the diagram only shows a two-dimensional representation

**or**

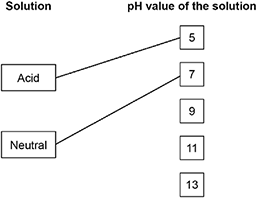
the diagram is not three-dimensional

**1**

**[9]**

**Q9.**

(a)



*extra lines from solution negate the mark*

**2**

(b)     H+

**1**

(c)     3

**1**

(d)     Neutralisation

**1**

(e)     sodium sulfate

**1**

(f)     Add indicator to sodium hydroxide solution

*allow add indicator to sulfuric acid*

**1**

Add sulfuric acid (gradually)

*allow add sodium hydroxide solution (gradually)*

**1**

*allow pH probe*

until indicator just changes (colour)

**or** until universal indicator turns green or shows pH7

**1**

**[9]**

**Q10.**

(a)     because the mass of an electron is very small

*do not accept has no mass*

**1**

(b)     5 / five

**1**

(c)     +5

**1**

(d)     6

**1**

(because) mass number = no. protons + no. electrons

*allow atomic number = 5*

**1**

(so the number of) neutrons = 11 – 5

*allow mass number – number of protons*

**1**

(e)     (16 / 31) × 100 = 51.6

**1**

= 52

*incorrect sig. figs max* ***1*** *mark*

**1**

**[8]**

**Q11.**

(a)     (i)      7

**1**

(ii)     –1

**1**

(iii)     neutrons

**1**

(b)    number of protons

**1**

(c)    atom **Y**

**1**

(d)     (i)      Ne

*allow neon*

**1**

(ii)     has a full outer shell

*allow in Group 0*

*allow a noble gas*

**or**

full outer energy level

*allow the shells are full*

**or**

has 8 electrons in its outer shell

*ignore in Group 8*

**1**

**[7]**

**Q12.**

(a)  ionic

**1**

(b)  a molecule

**1**

(c)  a fullerene

**1**

(d)  covalent

**1**

(e)  1

**1**

(f)  solid

**1**

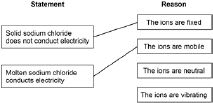
(g)  electron

**1**

(h)  dissolved

**1**

(i)



*do* ***not*** *accept if more than 1 line from 1 box*

**1**

**1**

**[10]**

**Q13.**

(a)     Flask

**1**

(b)     Fractional distillation

**1**

(c)     **A** – boiling

*in this order*

**1**

**B** – condensing

**1**

(d)     Pentane

**1**

(e)     Formulation

**1**

(f)     the fuel is a pure compound

**1**

and crude oil is a mixture

**or**

the fuel is made up of four hydrocarbons

*allow crude oil contains a large number of compounds and the fuel contains four*

and crude oil could have many more

**1**

(g)     (35 + 37 + 37 / 3) = 36.33

**1**

36

**1**

*allow (35 + 48 + 37 + 37 / 4 =) 39(.25) for* ***1*** *mark*

**[10]**

**Q14.**

the atoms are in layers

**1**

the atoms can slide over each other

**1**

**[2]**

**Q15.**

(a)     carbon

**1**

(b)     all

**1**

(c)     covalent

**1**

(d)     four

**1**

(e)     hard

**1**

**[5]**

**Q16.**

(a)     reduce wear of metal ie don’t get damaged

***or*** *other sensible answer*

**or**

          stop / reduce friction

*accept stop metal heating up*

*accept move more smoothly*

*ignore make it slippery / rub more smoothly*

**or**

          prevent seizing

*accept can move freely*

**1**

(b)     (i)      carbon

**1**

(ii)     layers (of atoms)

**1**

         can slide / slip over each other

*allow slip off*

**or**

         weak forces of attraction / weak bonds (between layers)

*allow no bonds*

*accept there are weak forces of attraction for****1*** *mark even when there is no reference to layers*

*accept atoms slide over each other (for* ***1*** *mark)*

*an answer which* ***only*** *states there are weak bonds would gain* ***0*** *mark when there is no reference to layers*

*weak covalent bonds =* ***0*** *marks*

**1**

**[4]**

**Q17.**

high

**1**

          giant

*allow covalent*

**1**

          four

**1**

          covalent

**1**

**[4]**

**Q18.**

(a)  B

**1**

(b)  calcium oxide **or** CaO

**1**

carbon dioxide **or** CO2

**1**

*either order*

(c)  decomposition

**1**

(d)  endothermic

**1**

(e)  32 (g)

*allow 31−33 (g)*

**1**

(f)  

**1**

148 (g)

*allow a range 143−153 (g)*

**or**

uses graph e.g. 12 dm3 gives 74 (g) (1)

(then factors up so that 24 dm3 gives) 148 (g) (1)

*allow a range 143−153 (g)*

**1**

*an answer of 148 (g) scores* ***2*** *marks*

*allow ecf from part* ***(e)***

(g)  (mistakes)

increase in mass = 3 (not 4)

*allow mistakes in either order*

**1**

inserted numbers inversely into formula

*allow numbers wrong way round*

**1**

(calculation)

*an answer of 250 scores the* ***2*** *calculation marks*

**1**

****



250 (cm3 per g)

*if no calculation marks awarded*

**

***or*** *0.004 for* ***1*** *mark*

**1**

(h)  3 × 16 or 48

**1**

(48) + 12 or 60

*allow their mass of oxygen + 12*

**1**

84 − (60) **or** 24

*allow 84 − their mass of carbonate*

**1**

magnesium **or** Mg

*magnesium* ***or*** *Mg without working scores this mark*

**1**

*an answer of 24 scores the* ***3*** *calculation marks*

**[16]**

**Q19.**

(a)  let the glow spread

**1**

(b)  1.27 (g)

**1**

(c)  solid

**1**

(d)  zinc

**1**

(e)  displacement

**1**

(f)  A

**1**

(g)  any **one** from:

•   (good electrical) conductor

•   can be bent easily

*ignore malleability*

•   does not corrode

*ignore does not rust*

**1**

*allow is ductile*

(h)  2 : 3

**1**

(i)   conserves copper ores

**1**

less energy used

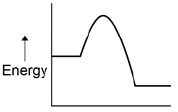
**1**

**[10]**

**Q20.**

(a)     (a reaction that) transfers energy to the surroundings

**1**

(b)     

**1**

(c)     2 × 16 (= 32)

**1**

(*M*r =) 44

**1**

72.7 (%)

**1**

(d)     2      2

*allow multiples*

**1**

(e)     3.2 g of O2 produced from 6.8 g of H2O2

**1**

32 (g)

**1**

**[8]**

**Q21.**

(a)     1

*must be in this order*

**1**

very small

*accept negligible, 1 / 2000*

*allow zero*

**1**

(b)     The mass number

**1**

(c)     C

**1**

(d)     (i)      2

**1**

(ii)     3

**1**

(e)     (i)      28

**1**

(ii)     42.9

*accept ecf from (e)(i)*

*accept 42 - 43*

**1**

(f)    (i)      0.9

**1**

(ii)     any **one** from:

•        accurate

•        sensitive

•        rapid

•        small sample.

**1**

**[10]**

**Q22.**

(a)     56g

*for 1 mark*

**1**

(b)     44 tonnes

*for 1 mark*

**1**

**[2]**

**Section 2: Required Practicals Mark Scheme**

**Q23.**

(a)     any **three** from:

•        concentration of (salt) solution

•        volume of (salt) solution

*ignore amount of solution*

•        **initial** temperature (of the solution)

*ignore room temperature*

•        surface area / form of metal

•        moles of metal

*allow mass / amount*

*ignore time*

*ignore size of tube*

**3**

(b)     20

**1**

32

**1**

12

*allow ecf*

**1**

(c)     (i)      four bars of correct height

*tolerance is + / - half square*

*3 correct for* ***1*** *mark*

**2**

bars labelled

**1**

(ii)     *one variable* is non-continuous / categoric

*accept qualitative or discrete*

*accept no values between the metals*

**1**

(iii)    magnesium

**1**

because biggest temperature change

*accept gives out most energy*

*ignore rate of reaction*

*dependent on first mark*

**1**

(iv)    does not react / silver cannot displace copper

**1**

because silver not more reactive (than copper) **or** silver below copper in reactivity series

*do* ***not*** *accept silver is less reactive than copper sulfate*

**1**

(v)     replace the copper sulfate

*could be implied*

**1**

with any compound of a named metal less reactive than copper

*allow students to score even if use an insoluble salt*

**1**

**[16]**

**Q24.**

(a)     (i)      copper is less reactive than hydrogen **or** copper is unreactive

**1**

(ii)     Zinc and dilute hydrochloric acid

**1**

(b)     (gas) syringe

**1**

(c)     (i)      35

*allow 3*

**1**

because not close to others

*accept it is much lower than the others*

*ignore references to trends or patterns*

*dependent on the first mark*

**1**

(ii)     (49 + 50 + 48) / 3

= 49

*correct answer with or without working gains* ***2*** *marks*

**1**

*allow ecf from anomaly identified in (i) for* ***2*** *marks:*

*•      Exp 1 anomalous gives 43.3*

*•      Exp. 2 anomalous gives 44*

*•      Exp. 4 anomalous gives 44.7*

*answer of 45.5 or 46 (anomaly not excluded) gains* ***1*** *mark*

*correct working* ***excluding anomaly*** *but with wrong answer gains* ***1*** *mark*

**1**

(iii)    so that a mean can be calculated

*accept improves accuracy of the mean* ***or*** *so anomalies can be identified / discarded* ***or*** *to reduce effect of random errors*

*ignore makes it a fair test*

*ignore reliability, validity, repeatability, reproducibility*

**1**

(d)     (i)      idea of mixing with oxygen / air, letting air / oxygen in

*accept converse*

**1**

(ii)     H2O

*do not accept incorrect additional products*

**1**

balancing 2 … (1) … 2

*allow fractions or multiples*

*dependent on first mark*

**1**

**[11]**

**Q25.**

(a)     (i)      (phosphoric) acid

*allow phosphoric*

**1**

(ii)     H+ / hydrogen (ion)

*if ion symbol given, charge must be correct*

**1**

(b)     (i)      pencil

**1**

so it will not run / smudge / *dissolve*

*ignore pencil will not interfere with / affect the results*

**or**

because ink would run / smudge / *dissolve*

*ignore ink will interfere with / affect the results*

**1**

(ii)     any **three** from:

*reference to spots / dots = max* ***2***

*allow colouring for colour*

•        *3* colours in Cola

*allow more colours in cola* ***or*** *fewer colours in fruit drink*

•        *2* colours in Fruit drink

•        one of the colours is the same

•        two of the colours in Cola are different

•        one of the colours in Fruit drink is different

*allow some of the colours in the drinks are different*

•        *one of the colours in Cola is the most soluble*

*accept one of the colours in Cola has the highest Rf value*

**3**

(c)     different substances travel at different speeds **or** have different retention times

*accept different attraction to solid*

*ignore properties of compounds*

**1**

(d)     (i)      Is there caffeine in a certain brand of drink?

**1**

(ii)     any **two** from:

•        cannot be done by experiment

•        based on opinion / *lifestyle choice*

•        ethical, *social* or economic issue

*accept caffeine has different effects on different people*

**2**

**[11]**

**Q26.**

(a)     (i)      points correctly plotted ( ± ½ small square)

*four points =* ***2*** *marks*

*three points =* ***1*** *mark*

**Max 2**

straight line of best fit using full range of points from 0,0

**1**

(ii)     any **one** from:

*must explain why the point is below the line*

•        the solution may not have been properly stirred

•        the electrodes may have been a larger distance apart

•        the drop of sodium chloride may have been a smaller volume / smaller

*allow not enough sodium chloride added*

*allow smaller amount of sodium chloride*

*do* ***not*** *allow too few drops added*

*ignore the student may have misread the conductivity meter*

**1**

(iii)    any **one** from:

•        the volume of pure water

*allow amount*

•        the concentration (of the solutions added)

•        the volume (of the drops) of solution added

*ignore number of drops*

•        the distance between the electrodes

•        the same electrodes **or** electrodes made of the same material

•        same depth **or** surface area of electrodes in the water

•        constant power supply

*ignore current*

•        stirred

**1**

(b)     (i)      because (pure) water is covalent / molecular (simple) **or** contains molecules

**1**

therefore (pure) water has no free / mobile electrons **or** ions

*molecules do not have a charge* ***or*** *molecules do not contain ions gains* ***2*** *marks*

**1**

(ii)     because there are ions in sodium chloride

*allow Na+ and / or Cl–(ions)* ***or*** *ionic bonding.*

*Ignore particles other than ions for MP1.*

**1**

which can move **or** carry the current / charge

*MP2 must be linked to ions only.*

**1**

(iii)    Hydrogen

*allow H2 / H*

**1**

**[10]**

**Q27.**

(a)     continuous

**1**

independent

**1**

(b)     31.5 – 24.0

**1**

7.5 (°C)

*an answer of 7.5 (°C) scores* ***2*** *marks*

**1**

(c)     25.5 – 26(.0) cm3

**1**

(d)     did not stir

**or**

did not wait long enough for the highest temperature to be reached

**1**

(e)     

**1**

× 80

**1**

3.2 (g)

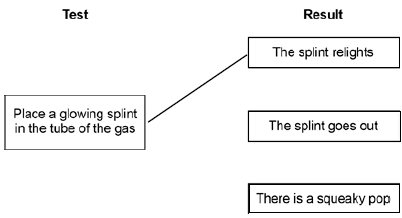
*an answer of 3.2 (g) scores* ***3*** *marks*

**1**

**[9]**

**Q28.**

(a)



*more than one line from test negates the mark*

**1**

(b)     (i)      place a lighted splint at the mouth of the tube

**1**

there is a squeaky pop

*dependent on correct test*

**1**

(ii)     hydrogen is less reactive than magnesium

*accept converse*

*accept magnesium is too reactive*

**1**

(c)     (i)      any **one** from:

•        to improve appearance or make it look nice

•        to prevent corrosion

•        to make it more durable

•        cheaper than solid silver

**1**

(ii)     solution must be silver nitrate **or** contain silver ions

**1**

otherwise copper will be deposited **or** silver will not be deposited

**1**

spoon must be the negative electrode / cathode

**1**

because silver ions have a positive charge **or** go to negative electrode **or** are discharged at the negative electrode.

**1**

(iii)    because (plastic is an) insulator **or** does not conduct electricity

*accept does not contain mobile electrons*

**1**

**[10]**

**Q29.**

(a)     **mobile phase** propanone

**1**

**stationary phase** paper

**1**

(b)     any **three** from:

•        contains chlorophyll a, b and carotene

•        contains Pigment B

•        does not contain pheophytin

•        contains (at least) one unknown substance

•        contains five substances

•        contains a substance that does not dissolve in the solvent

**3**

(c)    

**1**

(d)     both measurements correct

*solvent front = 9.0 cm and pigment B distance = 5.0 cm*

**1**

Rf = 5.0 / 9.0

**1**

= 0.56

*allow ecf from incorrect measurements*

**1**

(e)     origin line drawn in ink

**1**

so it will run **or** dissolve in the solvent **or** split up

**1**

spots under solvent **or** solvent above spots / origin line

**1**

so they will mix with solvent **or** wash off paper **or** colour the solvent **or** dissolve in the solvent

**1**

**[13]**

**Section 3: 6 Mark Questions Mark Scheme**

**Q30.**

**Level 3 (5–6 marks):**

A coherent method is described with relevant detail, which demonstrates a broad  
understanding of the relevant scientific techniques, procedures and safety precautions. The  
steps in the method are logically ordered with the dependent and control variables correctly identified. The method would lead to the production of valid results.

**Level 2 (3–4 marks):**

The bulk of a method is described with mostly relevant detail, which demonstrates a  
reasonable understanding of the relevant scientific techniques, procedures and safety precautions. The method may not be in a completely logical sequence and may be missing  
some detail.

**Level 1 (1–2 marks):**

Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques, procedures and safety precautions. The response may lack a logical structure and would not lead to the production of valid results.

**0 marks:**

No relevant content

**Indicative content**

Named chemicals

•        copper oxide

•        sulfuric acid

•        copper sulfate

Correct use of apparatus

•        stirring rod

•        spatula

•        beaker

•        filter funnel and filter paper

•        evaporating basin

•        Bunsen burner

•        tripod and gauze

•        bench mat

•        conical flask

Method

•        add (excess) copper oxide to sulfuric acid

•        heat the mixture

•        filter the mixture

•        method to evaporate some of the water from the filtrate eg using a water bath or evaporating to half volume

•        leave solution (to cool and) to form crystals

•        remove and dry crystals

Safety

•        wearing of safety glasses / goggles

•        care with use of sulfuric acid as corrosive

•        warming not boiling mixture of copper oxide and sulfuric acid

•        hold beaker containing warm mixture with tongs whilst filtering

**[6]**

**Q31.**

(a)     **(test)**

burning splint (held at open end of test tube)

**1**

**(result)**

a (squeaky) pop

**1**

(b)

|  |  |
| --- | --- |
| **Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5-6 |
| **Level 2:** The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced. | 3-4 |
| **Level 1:** The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1-2 |
| No relevant content | 0 |
| **Indicative content**  •   measure volume of hydrochloric acid  •   in a measuring cylinder  •   pour hydrochloric acid into suitable container  •   measure temperature of hydrochloric acid  •   using a thermometer  •   measure mass of magnesium  •   using a balance  •   add magnesium to hydrochloric acid  •   stir  •   measure maximum temperature reached  •   record maximum temperature reached  •   calculate the change / rise in temperature  •   repeat procedure for same mass of magnesium  •   find mean temperature rise  •   repeat with different masses of magnesium |  |

**6**

**[8]**

**Q32.**

(a)     Carbon and silicon

**1**

(b)     Atomic number

**1**

(c)     Hydrogen / fluorine / chlorine are not in Group 1 of the periodic table

**or**

Hydrogen and fluorine / chlorine are not in the same group of the periodic table

**1**

Lithium / sodium / potassium are in Group 1 of the periodic table

**1**

(d)     plum pudding model has a single ball of positive charge and nuclear model has positive charges in the centre / nucleus

**1**

plum pudding model has electrons in random positions and nuclear model has electrons  
in fixed positions

**1**

plum pudding model has no nucleus and the nuclear model has a nucleus

**1**

plum pudding model has no neutrons and the nuclear model has neutrons in the nucleus

**1**

(e)



**1**

(f)     Covalent bond

**1**

**[10]**

**Q33.**

(a)     (i)      nucleus

**1**

(ii)     neutron

**1**

(iii)    electron

**1**

(b)     (i)      12

**1**

(ii)     24

**1**

(c)     any **four** from:

*sharing / covalent / metallic = max* ***3***

•         magnesium (atom) reacts with **two** iodine (atoms)

•         magnesium (atom) loses electrons

•         **2** electrons (from each atom)

•         Iodine (atom) gains electron(s)

•         **1** electron or an electron (to each atom)

•         iodide ion formed

*allow iodine ion*

•         iodide has negative charge / is a negative ion / particle

*allow iodine  
ignore I2–*

•         magnesium ion formed

•         magnesium has positive charge

•         oppositely charged ions attract

•         a giant structure / lattice is formed

*allow* ***1*** *mark for unqualified reference to ion formation or ionic bonding*

**4**

**[9]**

**Q34.**

(a)     (i)      because they are positively charged

*accept they are positive / H+*

*accept oppositely charged* ***or*** *opposites attract*

ignore they are attracted

**1**

(ii)     gains one / an electron

*accept H+  + e– → H or multiples*

*allow gains electrons*

**1**

(b)     3 bonding pairs

**1**

1 lone pair

*accept 2 non-bonding electrons on outer shell of nitrogen*

**1**

(c)     (i)      hydroxide / OH–

*do* ***not*** *accept sodium hydroxide*

**1**

(ii)     H+ + OH– → H2O

*ignore state symbols*

*ignore word equation*

**1**

(d)     Marks awarded for this answer will be determined by the Quality of   
Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Reference material.

**0 marks**No relevant content.

**Level 1 (1-2 marks)**There are basic descriptions of advantages or disadvantages of the electrolysis cells.

**Level 2 (3-4 marks)**There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.

**Level 3 (5-6 marks)**There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.

**Examples of chemistry points made in the response:**

Accept converse where appropriate.

•        mercury cell is more expensive to construct

•         mercury is recycled but membranes must be replaced

•         mercury is toxic but membrane / polymer is not

•         removing traces of mercury from waste is expensive

•         mercury cell uses more electricity

•         mercury cell produces chlorine that is purer

•         mercury cell produces higher concentration / better quality of sodium hydroxide (solution)

**6**

**[12]**

**Q35.**

(a)     4 electrons shared

**1**

each atom has 4 unshared electrons outside the bond

**1**

(b)     carbon dioxide

**1**

water

**1**

(c)     giant structure of atoms

**1**

delocalised electrons

**1**

(delocalised electrons) are free to move

**1**

through the whole structure

**1**