**Y11 Chemistry 1 PPE Higher Topic list**

**The topics below will be assessed in your next PPE**

**Atomic structure and the periodic table**

* Group 7

**Bonding**

* Ionic bonding
* Metallic bonding
* Metals and alloys

**Chemical changes**

* Strong and weak acids
* pH scale and neutralisation
* electrolysis- aluminium oxide

**Energy transfer**

* RPA- metals and acid
* Bond energy

**Exam Practice**

The following pages contain past exam questions that should attempt.

The grade for each question is indicated by:



Remember: to get Grade 7, 8 or 9 you still have to be able to answer the 4-5 questions!

**Q1.**

The halogens are in Group 7 of the periodic table.

(a)     Why, in terms of electrons, are the halogens in Group 7?

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**(1)**

(b)     Sea water contains bromide ions (Br-).  
The bromide ions can be changed to bromine by bubbling chlorine gas into sea water.  
Chlorine is able to displace bromine from sea water because chlorine is more reactive than bromine.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 2Br-(aq) | + | Cl2(g) | → | Br2(g) | + | 2Cl-(aq) |

Explain, in terms of electrons, why chlorine is more reactive than bromine.

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**(3)**

**(Total 4 marks)**

**Q2.**

This question is about magnesium and magnesium chloride.

(a)     Magnesium chloride contains magnesium ions (Mg2+) and chloride ions (Cl⁻).

Describe, in terms of electrons, what happens when a magnesium atom reacts with chlorine atoms to produce magnesium chloride.

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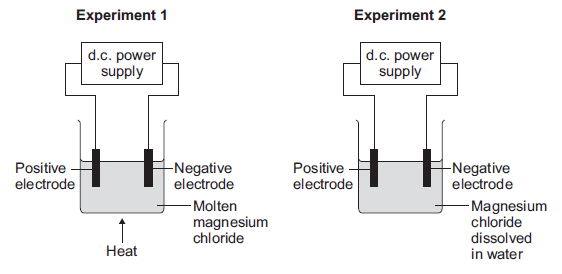
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**(4)**

(b)     Magnesium chloride can be electrolysed.

The diagram below shows two experiments for electrolysing magnesium chloride.



(i)      Explain why magnesium chloride must be molten or dissolved in water to be electrolysed.

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**(2)**

(c)     Magnesium is a metal.

Explain why metals can be bent and shaped.

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**(2)**

**(Total 14 marks)**

**Q3.**

This question is about different substances and their structures.

(a)     Draw **one** line from each statement to the diagram which shows the structure.

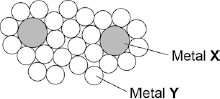
**Statement**                                                 **Structure**

****

**(4)**

(b)     **Figure 2** shows the structure of an alloy.

**Figure 2**

****

Explain why this alloy is harder than the pure metal **Y**.

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

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**(2)**

(c)     What percentage of the atoms in the alloys are atoms of **X**?

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**(2)**

(d)     What type of substance is an alloy?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| Compound |  |
| Element |  |
| Mixture |  |

**(1)**

**(Total 11 marks)**

**Q4.**

The table shows some information about acids and alkalis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name of acid  or alkali** | **Type** | **Ions produced in  solution** | | **pH** | **Effect on Universal  Indicator** |
| Hydrochloric acid | Strong acid | H+ | Cl– | 1 | Goes red |
| Sodium hydroxide | Strong alkali | Na+ | OH– | 13 | Goes purple |

Use the information in the table to help you answer parts **(a)** and **(b)**.

(a)     Draw a ring around the correct answer to complete each sentence.

(i)     Hydrochloric acid is acidic.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Cl- |  |
|  | This is because it contains | H+ | ions |
|  |  | OH- |  |

**(1)**

(ii)    Sodium hydroxide solution is alkaline.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | H+ |  |
|  | This is because it contains | Na+ | ions |
|  |  | OH- |  |

**(1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | higher than |  |
|  | (iii) | The pH of acids is | lower than | the pH of alkalis. |
|  |  |  | the same as |  |

**(1)**

(b)     Ethanoic acid is a weak acid.

Universal Indicator can be used to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration.

Explain how.

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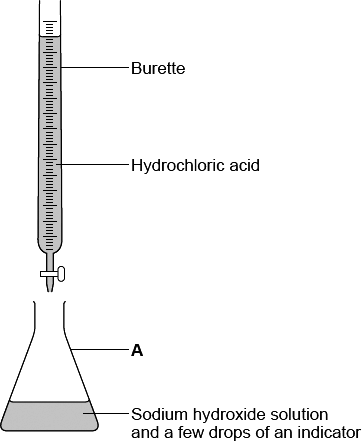
**(2)**

(c)     Draw a ring around the correct answer to complete this sentence.

|  |  |  |
| --- | --- | --- |
|  | completely |  |
| Strong acids and strong alkalis are | not | ionised in water. |
|  | partially |  |

**(1)**

(d)    The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25.0 cm3 of sodium hydroxide solution.



(i)      Which **one** of the following is the correct name for **A**?

Draw a ring around your answer.

|  |  |  |
| --- | --- | --- |
| **beaker** | **conical flask** | **pipette** |

**(1)**

(ii)      Use the correct word from the box to complete the sentence.

|  |  |  |
| --- | --- | --- |
| **distillation** | **filtration** | **titration** |

The method used to find the volume of acid that reacts with a known volume

of alkali is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(iii)     Suggest **one** way to make the results more reliable.

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

**(1)**

**(Total 9 marks)**

**Q5.**

Sodium hydroxide neutralises sulfuric acid.

The equation for the reaction is:

                 2NaOH + H2SO4  →  Na2SO4 + 2H2O

(a)     Sulfuric acid is a strong acid.

What is meant by a strong acid?

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**(2)**

(b)     Write the ionic equation for this neutralisation reaction. Include state symbols.

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**(2)**

(c)     A student used a pipette to add 25.0 cm3 of sodium hydroxide of unknown concentration to a conical flask.

The student carried out a titration to find out the volume of 0.100 mol / dm3 sulfuric acid needed to neutralise the sodium hydroxide.

Describe how the student would complete the titration.

You should name a suitable indicator and give the colour change that would be seen.

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**(4)**

(d)     The student carried out five titrations. Her results are shown in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Titration 1 | Titration 2 | Titration 3 | Titration 4 | Titration 5 |
| Volume of 0.100 mol / dm3 sulfuric acid in cm3 | 27.40 | 28.15 | 27.05 | 27.15 | 27.15 |

Concordant results are within 0.10 cm3 of each other.

Use the student’s concordant results to work out the mean volume of 0.100 mol / dm3 sulfuric acid added.

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

**(2)**

(e)     The equation for the reaction is:

                               2NaOH + H2SO4  →  Na2SO4 + 2H2O

Calculate the concentration of the sodium hydroxide.

Give your answer to three significant figures.

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Concentration = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mol / dm3

**(4)**

(f)     The student did another experiment using 20 cm3 of sodium hydroxide solution with a concentration of 0.18 mol / dm3.

Relative formula mass (*M*r) of NaOH = 40

Calculate the mass of sodium hydroxide in 20 cm3 of this solution.

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

**(2)**

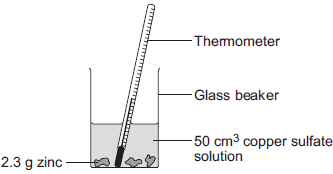
**(Total 16 marks)**

**Q6.**

A student investigated the temperature change when zinc reacts with copper sulfate solution.

The student used a different concentration of copper sulfate solution for each experiment.

The student used the apparatus shown below.



The student:

•        measured 50 cm3 copper sulfate solution into a glass beaker

•        measured the temperature of the copper sulfate solution

•        added 2.3 g zinc

•        measured the highest temperature

•        repeated the experiment using copper sulfate solution with different concentrations.

The equation for the reaction is:

Zn(s)     +                 CuSO4(aq)                    Cu(s)       +              ZnSO4(aq)

zinc       +      copper sulfate solution        copper      +    zinc sulfate solution

(a)     The thermometer reading changes during the reaction.

Give **one** other change the student could **see** during the reaction.

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**(1)**

(b)     Suggest **one** improvement the student could make to the apparatus.

Give a reason why this improves the investigation.

Improvement \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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**(2)**

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

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

|  |  |  |
| --- | --- | --- |
| **Experiment number** | **Concentration of copper sulfate in moles per dm3** | **Increase in temperature in °C** |
| 1 | 0.1 | 5 |
| 2 | 0.2 | 10 |
| 3 | 0.3 | 12 |
| 4 | 0.4 | 20 |
| 5 | 0.5 | 25 |
| 6 | 0.6 | 30 |
| 7 | 0.7 | 35 |
| 8 | 0.8 | 35 |
| 9 | 0.9 | 35 |
| 10 | 1.0 | 35 |

Describe **and** explain the trends shown in the student’s results.

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**(6)**

**(Total 9 marks)**

**Q7.**

Cells contain chemicals which react to produce electricity.

(a)     Why can a rechargeable cell be recharged?

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**(1)**

(b)     Give **two** factors that affect the voltage produced by a cell.

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

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

**(2)**

(c)     Balance the half-equation for the reaction occurring at an electrode in one type of hydrogen fuel cell.

H2   +  OH−  ⟶  H2O   +  e−

**(1)**

(d)     Why is the fuel cell in Question (c) described as an alkaline fuel cell?

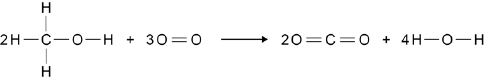
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**(1)**

(e)     Another type of fuel cell uses methanol instead of hydrogen.

The diagram represents the reaction in this fuel cell.



The table shows the bond energies for the reaction.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **C–H** | **C–O** | **O–H** | **O=O** | **C=O** |
| Bond energy in kJ / mol | 412 | 360 | 464 | 498 | 805 |

Calculate the overall energy change for the reaction.

Use the diagram and the table above.

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

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Overall energy change = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kJ / mol

**(3)**

**(Total 8 marks)**