**1** Below is a picture showing four metals reacting with an acid.

 

 **a)** How can you tell a reaction is taking place? (1)

 **b)** Put the metals in order of reactivity with the most reactive first. (2)

**2** Below is a list showing the reactivity series of some metals

 most reactive    potassium

         sodium

         calcium

         magnesium

         aluminium

         iron

         nickel

         lead

         copper

         silver

 least reactive    gold

 **a)** Carbon is used to extract iron from its ore but electrolysis is used for aluminium. Draw on the list above where carbon fits into the series. (1)

 **b)** Three metals were reacted with oxygen, water and an acid. The results are shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Metal** | **Reaction with oxygen** | **Reaction with water** | **Reaction with acid** |
| X | Burns to form oxide | Reacts vigorously with cold water | Reacts violently |
| Y | Forms oxide when heated | No reaction | Reacts slowly |
| Z | No reaction | No reaction | No reaction |

 **i)** Using the reactivity series given, what metal could X be? (1)

 **ii)** Using the reactivity series given, what metal could Z be? (1)

 **iii)** Metal Y is lead. What gas is produced when lead reacts with an acid? (1)

 **c)** In the following reactions, decide if the substance in **bold** has been oxidised or reduced:

 **i)** **Magnesium +** oxygen → magnesium oxide (1)

 **ii)** Copper oxide+ **carbon** → copper + carbon dioxide (1)

 **iii)** Magnesium + **copper oxide** **→** magnesium oxide + copper (1)

 **iv)** **Magnesium** + copper oxide → magnesium oxide + copper (1)

 **d)** Magnesium reacts with oxygen to form magnesium oxide (MgO). Write a chemical balanced equation for this reaction. (3)

**3** Decide if the following reactions take place and, if they do, finish the word equation. If no reaction, explain why.

 **a)** Magnesium + iron oxide → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2)

 **b)** Calcium oxide + lead → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2)

 **c)** Potassium + copper oxide →\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2)

 **d)** Which of these reactions will be the most vigorous and why? (3)

**4**

 **a)** Below are statements concerning acids and pH. Put a tick if the statement is correct or a cross if it is wrong. (7)

|  |  |
| --- | --- |
| **Statement** | **True/False** |
| Acids have pH values greater than 7 |  |
| A neutral pH is 8 |  |
| Alkalis are soluble bases |  |
| Acids turn universal indicator green |  |
| Acids react with metals to form oxygen |  |
| Hydrochloric acid reacts to form salts called chlorides |  |
| Acids contain the OH**−** ion |  |

 **b)** Copper sulfate can be made by reacting insoluble copper oxide solid with sulfuric acid. Give the equation for this reaction and the method to obtain dry crystals of blue copper sulfate. (6)

 **c)** When an acid is added to an alkali, a neutralisation reaction occurs.

 **i)** Write the symbol equation, including state symbols, for the neutralisation of hydrochloric acid with potassium hydroxide. (2)

 **ii)** Write the *ionic* equation for this reaction, including state symbols. (3)

**5**

 **a)** What is electrolysis? (1)

 **b)** Ionic compounds contain positive and negative ions. What are the positive and negative ions in sodium chloride (show charges)? (2)

 **c)** What are the products at the anode (+ve) and cathode (−ve) electrodes when the following salts are electrolysed in aqueous solutions? (4)

|  |  |  |
| --- | --- | --- |
|  | **Anode (+ve)** | **Cathode (−ve)** |
| Lead chloride |  |  |
| Potassium sulfate |  |  |

 **d)** Write the half equation for the reaction of copper ions when they are attracted to the cathode. (2)

Total = 50

**Answers**

**1**

 **a)** There is release of a gas – effervescent (1)

 **b)** 2, 3, 4, 1 (all correct = 2, 1 error = 1)

**2**

 **a)** Carbon above iron but below aluminium (1)

 **b)**

 **i)** Na or K (1)

 **ii)** Fe or Pb (1)

 **iii)** Ag or Au (1)

 **c)**

 **i)** Oxidised (1)

 **ii)** Oxidised (1)

 **iii)** Reduced (1)

 **iv)** Oxidised (1)

 **d)** 2Mg + O2 → 2MgO (1 = LHS, 1 = RHS, 1 = balance)

**3**

 **a)** Magnesium oxide + iron (2)

 **b)** No reaction because calcium is above lead. (2)

 **c)** Potassium oxide + copper (2)

 **d)** The reaction of potassium + copper oxide (1) would be the most vigorous. This is because potassium and copper (1) have a large difference in reactivity (1).

**4**

1. (1 mark for each correct answer)

|  |  |
| --- | --- |
| Statement | True/False |
| Acids have pH values greater than 7 | ✕ |
| A neutral pH is 8 | ✕ |
| Alkalis are soluble bases | ✔ |
| Acids turn universal indicator green | ✕ |
| Acids react with metals to form oxygen | ✕ |
| Hydrochloric acid reacts to form salts called chlorides | ✔ |
| Acids contain the OH**−**ion | ✕ |

 **b)**

|  |  |
| --- | --- |
| **Marks** |  |
| 6–5 | At least three different points well expressed |
| 4–3 | A couple of points mentioned |
| 2–1 | Not much detail |

* CuO + H2SO4 → CuSO4 + H2O
* Filter off insoluble CuO.
* CuSO4 is soluble and thus stays in solution.
* Some water should be evaporated off (approximately one-third).
* The solution can be left to slowly evaporate.
* CuSO4 crystals will form.
* Filter, wash, dry crystals.

 **c)**

 **i)** HCl(aq) + KOH(aq) → KCl(aq) + H2O(l) (LHS and RHS = 1, rest = 1)

 **ii)** H+(aq) + OH−(aq) → H2O(l) (LHS = 1, RHS = 1, rest = 1)

**5**

 **a)** Electrolysis is chemical decomposition produced by passing an electric current through a liquid or solution containing ions. (1)

 **b)** Sodium is the positive and chloride is the negative ion. Na+ and Cl−. (2)

 **c)** (1 mark for each correct answer)

|  |  |  |
| --- | --- | --- |
|  | Anode (+ve) | Cathode (−ve) |
| Lead chloride | Chlorine gas | Lead |
| Potassium sulfate | Oxygen | Hydrogen |

 **d)** Cu2+ + 2e− → Cu (2)

Total = 50