New Document 1

Name: __________________________

Class: __________________________

Date: __________________________

Time: 38 minutes

Marks: 37 marks

Comments:
Q1.
This question is about the reactions of acids.

(a) When dilute hydrochloric acid is reacted with sodium hydroxide solution there is a temperature change.

Explain how the temperature changes.
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

(b) Acids produce hydrogen ions in aqueous solutions.

What is the ionic equation for neutralisation reactions?
Tick one box.

\[ \text{H}^+ (\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) \]

\[ \text{H}^+ (\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) \]

\[ 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^- (\text{aq}) \]

\[ \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}^+(\text{aq}) + \text{O}_2^- (\text{aq}) \]

(c) Sulfuric acid reacts with copper carbonate to produce a salt, water and carbon dioxide.

\[ \text{H}_2\text{SO}_4 + \text{CuCO}_3 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O} + \text{CO}_2 \]

What is the name of the salt produced?
________________________________________________________________________________________

(d) A student reacted four metals with water and with a dilute acid to work out the order of reactivity of the metals.

The table below shows some of the observations.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Reaction with water</th>
<th>Reaction with dilute acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Bubbles of gas</td>
<td>X</td>
</tr>
<tr>
<td>Metal</td>
<td>Y</td>
<td>Observation</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Copper</td>
<td>No bubbles of gas</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>Few bubbles of gas</td>
<td>Bubbles of gas</td>
</tr>
<tr>
<td>Zinc</td>
<td>No bubbles of gas</td>
<td>Bubbles of gas</td>
</tr>
</tbody>
</table>

Write the observations for X and Y.

Observation at X __________________________

Observation at Y __________________________

(e) Write the four metals, calcium, copper, magnesium and zinc, in order of reactivity.

Start with the most reactive metal.

__________________________

(f) Some gases given off in reactions can be identified by chemical tests.

Draw one line from each chemical test to the name of the gas.

<table>
<thead>
<tr>
<th>Chemical test</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put in a lighted splint. The gas burns with a pop sound.</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>Put in a glowing splint. The gas relights the splint.</td>
<td>Chlorine</td>
</tr>
<tr>
<td>Put into limewater. The gas turns limewater cloudy.</td>
<td>Hydrogen</td>
</tr>
<tr>
<td></td>
<td>Nitrogen</td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
</tr>
</tbody>
</table>

(g) Acids react with bases to produce salts and water (H₂O).

The electronic structure of a hydrogen atom is 2,1

The electronic structure of an oxygen atom is 2,6

Draw a diagram to show the arrangement of the outer shell electrons in a molecule of water.

(Total 13 marks)
Q2.

This question is about the electrolysis of two compounds.

**Figure 1** shows the electrolysis of molten lead bromide.

(a) The electrolyte contains lead ions \((\text{Pb}^{2+})\) and bromide ions \((\text{Br}^-)\).

Complete the sentences.

Use words from the box.

<table>
<thead>
<tr>
<th>atoms</th>
<th>bromide</th>
<th>bromine</th>
<th>ions</th>
</tr>
</thead>
<tbody>
<tr>
<td>lead</td>
<td>molecules</td>
<td>oxygen</td>
<td></td>
</tr>
</tbody>
</table>

At the positive electrode the gas produced is __________________________

At the negative electrode lead ________________________________

gain electrons and ________________________ .

(b) A student measured the volumes of each gas produced during the electrolysis of water.

The table below shows the student’s results.

<table>
<thead>
<tr>
<th>Time in minutes</th>
<th>Volume of gas produced in cm(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hydrogen</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>11.2</td>
</tr>
<tr>
<td>4</td>
<td>20.1</td>
</tr>
<tr>
<td>6</td>
<td>32.5</td>
</tr>
<tr>
<td>8</td>
<td>40.0</td>
</tr>
</tbody>
</table>
The student plotted a graph of the results for oxygen. Figure 2 shows the graph. The student did not put a scale on the $y$ axis.

On the graph in Figure 2:

- complete the scale for the $y$ axis
- plot the results for hydrogen
- include a line of best fit.

(c) Use the graph to calculate the mean volume of oxygen produced per second.
Q3.
Iron is extracted from iron oxide in the blast furnace.

(a) The equation for one of the reactions in the blast furnace is:

\[ \text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2 \]

(i) Complete the word equation for this reaction.

iron oxide + carbon monoxide \[\rightarrow\] ___________ + ___________

(ii) Oxygen is removed from iron oxide in the blast furnace.

Draw a ring around the correct answer to complete the sentence.

The iron oxide is

- neutralised.
- oxidised.
- reduced.

(b) The diagrams represent pure iron and iron from the blast furnace.

Pure iron \hspace{2cm} \text{Iron from the blast furnace}

(i) Draw one line from each statement to the correct explanation.
Q4.

Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in Figure 1.

Figure 1
(a) Draw a ring around the correct answer to complete each sentence.

(i) Copper ores contain enough copper to make extraction of the metal [ ]
    - carbon neutral.
    - economical.
    - reversible.

(ii) Using plants to extract metals is called [ ]
    - photosynthesis.
    - phytomining.
    - polymerisation.

(iii) Copper oxide reacts with carbon to produce copper and [ ]
    - carbon dioxide.
    - oxygen.
    - sulfur dioxide.

(b) Copper is produced from copper sulfate solution by displacement using iron or by electrolysis.

(i) Complete the word equation.
    copper sulfate + iron → [ ]

(ii) Figure 2 shows the electrolysis of copper sulfate solution.

**Figure 2**
Why do copper ions go to the negative electrode?

______________________________________________________________

______________________________________________________________

(1)

(c) Suggest two reasons why copper should not be disposed of in landfill sites.

______________________________________________________________

______________________________________________________________

______________________________________________________________

(2)

(Total 8 marks)
Q1.

(a) it goes up / increases

because the reaction is exothermic or transfers energy to the surroundings

allow gives out thermal / heat energy

(b) \[H^+ (aq) + OH^- (aq) \rightarrow H_2O(l)\]

(c) copper sulfate

(d) X bubbles of gas

Y no bubbles of gas

(e) calcium > magnesium > zinc > copper

if not all correct allow 1 mark for at least two metals in the correct position

(f) Chemical test

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Put in a lighted splint. The gas burns with a pop sound.

Put in a glowing splint. The gas relights the splint.

Put into limewater. The gas turns limewater cloudy

extra lines from a test negate the mark

(g)

two pairs of shared electrons

oxygen has four other electrons not bonded
Q2.
(a) bromine ions atoms 1
(b) correct scale on y axis points correctly plotted using the scale ± ½ small square best-fit line drawn 1
(c) value for oxygen divided by corresponding time × 60 = 0.05 (cm³ / s) allow 0.05 with no working shown for 3 marks 1

Q3.
(a) (i) iron either order carbon dioxide 1
(ii) reduced 1
(b) (i) Statement Explanation
Pure iron is an element because .......

Iron from the blast furnace is a mixture because .......

each correct line gains 1 mark
extra lines from statement negate the mark

(ii) the layers / rows are distorted / disrupted or it doesn't occur in layers or the atoms are different

so cannot slide over one another or slide less easily

Q4.

(a) (i) economical

(ii) phytomining

(iii) carbon dioxide

(b) (i) copper / Cu

iron sulfate / FeSO₄

(ii) copper / ions have a positive charge

\[ \text{it} = \text{copper ions} \]

allow copper ions have a different charge

accept copper / ions are free to move

accept to gain electrons

accept copper / ions are attracted to the negative electrode or opposite charges attract

(c) any two from:

ignore not biodegradable or does not decay
• copper ores are limited / running out
  
  allow copper is running out
• copper can be recycled
• copper can be reused
• copper is expensive
• landfill sites are filling up
• copper compounds are toxic
  
  allow copper is toxic