

GRADE 10 CHEMISTRY

PRACTICE EXERCISE 2

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(b) Copper is refined by the electrolysis of aqueous copper(II) sulphate using copper electrodes. Describe the change that occurs at the electrodes.

(i) cathode (pure copper)
.....[1]

(ii) anode (impure copper)
.....[1]

(iii) Write an ionic equation for the reaction at the cathode.
.....[1]

(iv) If carbon electrodes are used, a colourless gas is given off at the anode and the electrolyte changes from a blue to a colourless solution.

The colourless gas is

The solution changes into [2]

(c) Electrolysis and cells both involve chemical reactions and electricity.

What is the essential difference between them?

.....
.....[2]

(d) Copper is an unreactive metal. Its compounds are easily reduced to the metal or decomposed to simpler compounds. Complete the following equations.

(i) $\dots\text{CuO} + \dots \rightarrow \dots\text{Cu} + \dots$

(ii) Copper(II) hydroxide $\xrightarrow{\text{(heat)}}$ +

(iii) $\text{Cu}(\text{NO}_3)_2 \xrightarrow{\text{(heat)}}$ + +

[4]

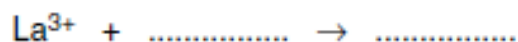
The first three elements in Period 6 of the Periodic Table of the Elements are caesium, barium and lanthanum.

- (a) How many **more** protons, electrons and neutrons are there in one atom of lanthanum than in one atom of caesium. Use your copy of the Periodic Table of the Elements to help you.

number of protons
number of electrons
number of neutrons [3]

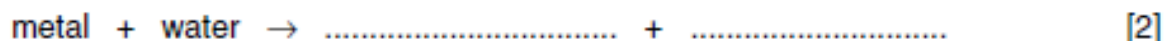
- (b) All three metals can be obtained by the electrolysis of a molten halide. The electrolysis of the aqueous halides does not produce the metal.

- (i) Complete the equation for the reduction of lanthanum ions at the negative electrode (cathode).



- (ii) Name the **three** products formed by the electrolysis of aqueous caesium bromide.
.....
.....[4]

- (c) All three metals react with cold water. Complete the word equation for these reactions.



(a) Copper has the structure of a typical metal. It has a lattice of positive ions and a “sea” of mobile electrons. The lattice can accommodate ions of a different metal.

Give a **different** use of copper that depends on each of the following.

(i) the ability of the ions in the lattice to move past each other

..... [1]

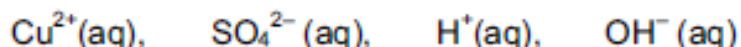
(ii) the presence of mobile electrons

..... [1]

(iii) the ability to accommodate ions of a different metal in the lattice

..... [1]

(b) Aqueous copper(II) sulphate solution can be electrolysed using carbon electrodes. The ions present in the solution are as follows.



(i) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

(ii) A colourless gas was given off at the positive electrode (anode) and the solution changes from blue to colourless.

Explain these observations.

.....
..... [2]

(c) Aqueous copper(II) sulphate can be electrolysed using copper electrodes. The reaction at the negative electrode is the same but the positive electrode becomes smaller and the solution remains blue.

(i) Write a word equation for the reaction at the positive electrode.

..... [1]

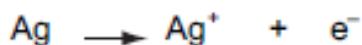
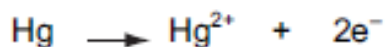
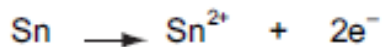
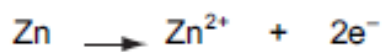
(ii) Explain why the colour of the solution does not change.

.....
..... [2]

(iii) What is the large scale use of this electrolysis?

..... [1]

4 In the following list of ionic equations, the metals are in order of reactivity.



reactivity of metals increases

(a) (i) In the space at the top of the series, write an ionic equation that includes a more reactive metal. [1]

(ii) Define *oxidation* in terms of electron transfer.

 <hr/> 	[1]
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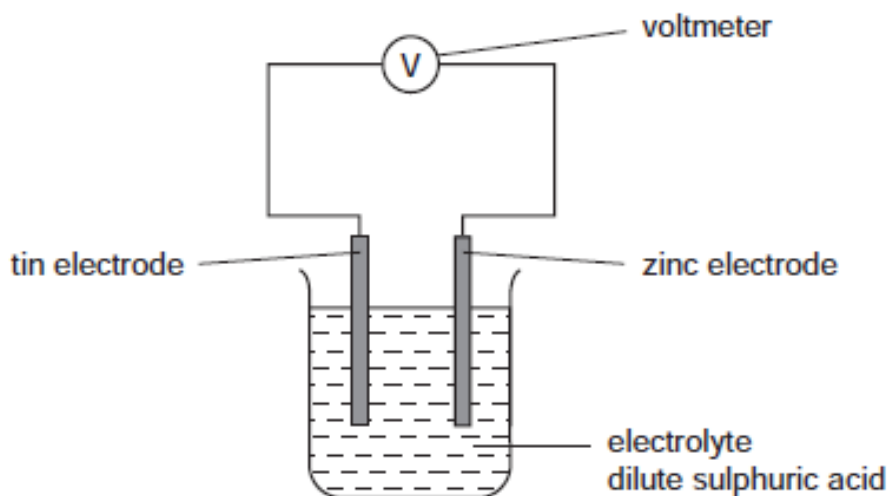
(iii) Explain why the positive ions are likely to be oxidising agents.

 	[1]
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(iv) Which positive ion(s) can oxidise mercury metal (Hg)?

 	[1]
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(b) The following diagram shows a simple cell.



- (i) Predict how the voltage of the cell would change if the tin electrode was replaced with a silver one.

[1]

- (ii) Which electrode would go into the solution as positive ions? Give a reason for your choice.

[1]

- (iii) State how you can predict the direction of the electron flow in cells of this type.

[1]

(c) The major ore of strontium is its carbonate, SrCO_3 . Strontium is extracted by the electrolysis of its molten chloride.

(i) Name the reagent that will react with the carbonate to form the chloride.

..... [1]

(ii) The electrolysis of molten strontium chloride produces strontium metal and chlorine. Write ionic equations for the reactions at the electrodes.

negative electrode (cathode)

positive electrode (anode) [2]

(iii) One of the products of the electrolysis of concentrated aqueous strontium chloride is chlorine. Name the other two.

..... [2]

(d) Both metals react with water.

(i) Write a word equation for the reaction of zinc and water and state the reaction conditions.

word equation

conditions

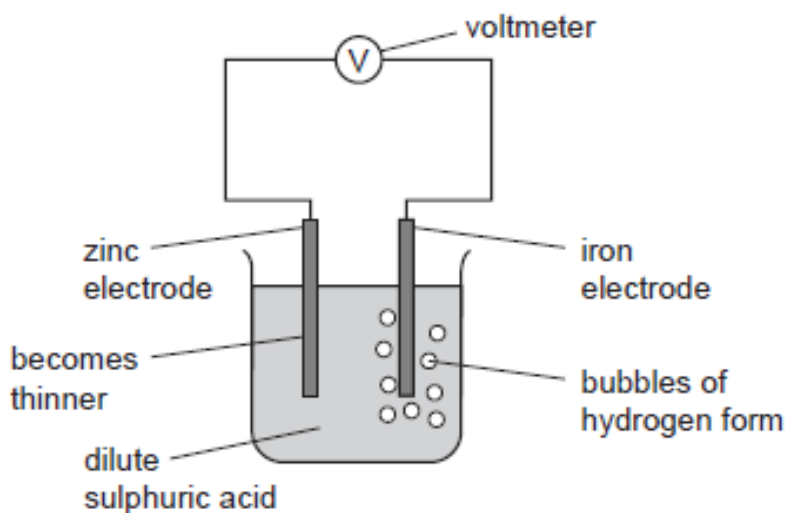
(ii) Write an equation for the reaction of strontium with water and give the reaction condition.

equation

condition

(c) Cell reactions are both exothermic and redox. They produce electrical energy as well as heat energy.

(i) The diagram shows a simple cell.



Which substance in this cell is the reductant and which ion is the oxidant?

reductant

oxidant [2]

(ii) How could the voltage of this cell be increased?

..... [1]

(iii) What is the important large scale use, relating to iron and steel, of this type of cell reaction?

..... [1]

(b) Impure copper is extracted from the ore. This copper is refined by electrolysis.

(i) Name;
the material used for the positive electrode (anode),

.....

the material used for the negative electrode (cathode),

.....

a suitable electrolyte.

.....

[3]

(ii) Write an ionic equation for the reaction at the negative electrode.

.....

[1]

(iii) One use of this pure copper is electrical conductors, another is to make alloys.
Name the metal that is alloyed with copper to make brass.

.....

[1]

(c) The remaining zinc oxide reacts with sulphuric acid to give aqueous zinc sulphate. This is electrolysed with inert electrodes (the electrolysis is the same as that of copper(II) sulphate with inert electrodes).

ions present: $\text{Zn}^{2+}(\text{aq})$ $\text{SO}_4^{2-}(\text{aq})$ $\text{H}^+(\text{aq})$ $\text{OH}^-(\text{aq})$

(i) Zinc forms at the negative electrode (cathode). Write the equation for this reaction.

..... [1]

(ii) Write the equation for the reaction at the positive electrode (anode).

..... [2]

(iii) The electrolyte changes from aqueous zinc sulphate to

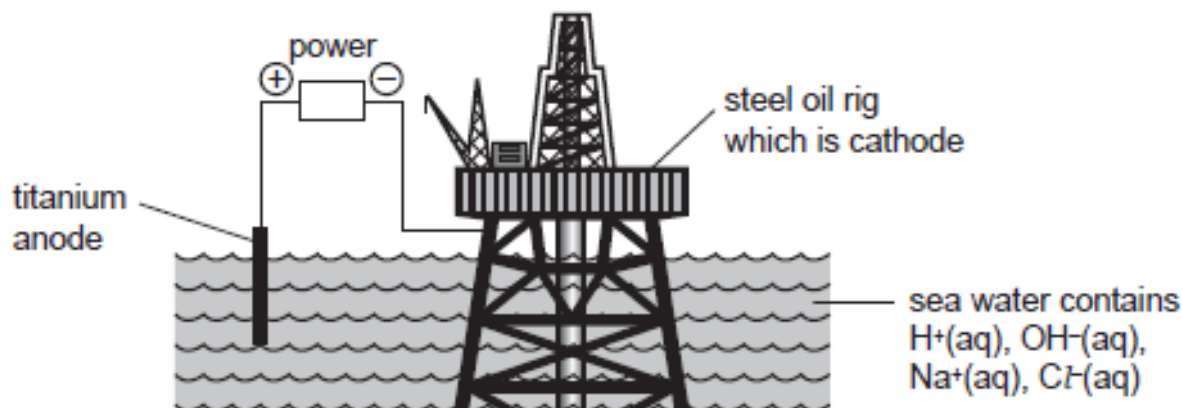
..... [1]

(d) Give two uses of zinc.

1.

2. [2]

(b) Titanium is very resistant to corrosion. One of its uses is as an electrode in the cathodic protection of large steel structures from rusting.



(i) Define oxidation in terms of electron transfer.

..... [1]

(ii) The steel oil rig is the cathode. Name the gas formed at this electrode.

..... [1]

(iii) Name the **two** gases formed at the titanium anode.

..... and [2]

(iv) Explain why the oil rig does not rust.

.....
..... [2]

(v) Another way of protecting steel from corrosion is sacrificial protection. Give **two** differences between sacrificial protection and cathodic protection.

.....
..... [2]

The electrolysis of concentrated aqueous sodium chloride produces three commercially important chemicals hydrogen, chlorine and sodium hydroxide.

(a) The ions present are $\text{Na}^+(\text{aq})$, $\text{H}^+(\text{aq})$, $\text{Cl}^-(\text{aq})$ and $\text{OH}^-(\text{aq})$.

(i) Complete the ionic equation for the reaction at the negative electrode (cathode).



(ii) Complete the ionic equation for the reaction at the positive electrode (anode).



(iii) Explain why the solution changes from sodium chloride to sodium hydroxide.

..... [1]

(b) (i) Why does the water supply industry use chlorine?

..... [1]

(ii) Name an important chemical that is made from hydrogen.

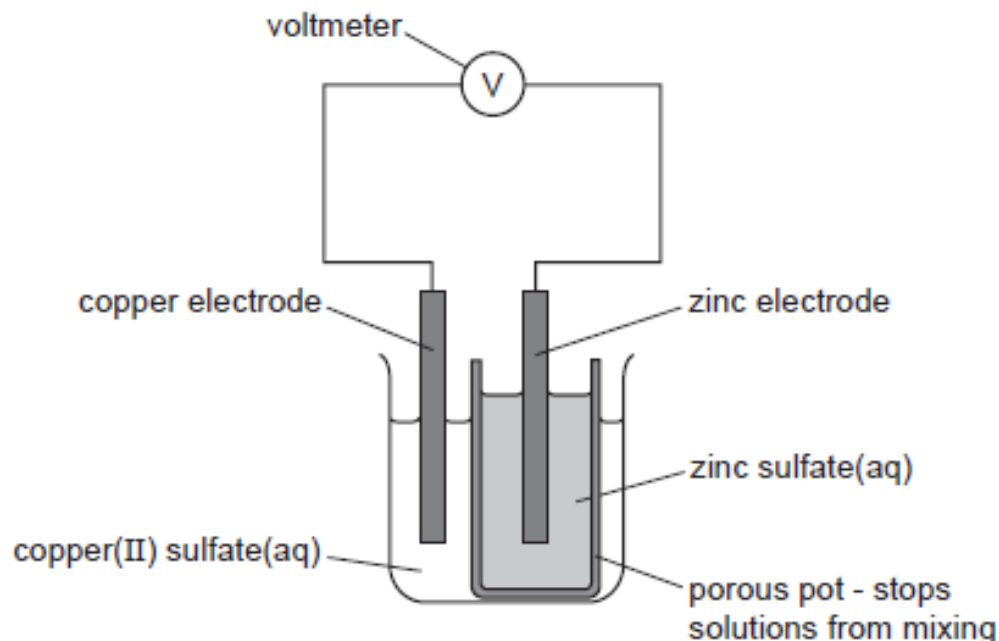
..... [1]

(iii) How is sodium hydroxide used to make soap?

..... [2]

[Total: 7]

- (c) Zinc electrodes have been used in cells for many years, one of the first was the Daniel cell in 1831.



- (i) Give an explanation for the following in terms of atoms and ions.

observation at zinc electrode – *the electrode becomes smaller*

explanation

..... [1]

observation at copper electrode – *the electrode becomes bigger*

explanation

..... [1]

- (ii) When a current flows, charged particles move around the circuit.

What type of particle moves through the electrolytes?

..... [1]

Which particle moves through the wires and the voltmeter?

..... [1]