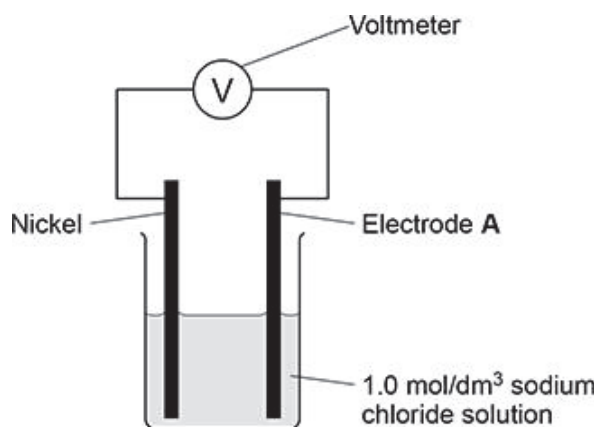


All questions are for separate science students only

Q1.

A student investigated the voltage produced by different pairs of metal electrodes in a chemical cell.

The figure below shows the apparatus.



This is the method used.

1. Place a nickel electrode and an electrode made from a different metal (electrode **A**) in 1.0 mol/dm^3 sodium chloride solution.
2. Measure the voltage produced.
3. Repeat using different metals for electrode **A**.

The table below shows the results.

Electrode A	Symbol of metal	Voltage in volts
Copper	Cu	-0.59
Magnesium	Mg	2.12
Nickel	Ni	0.00
Silver	Ag	-1.05
Zinc	Zn	0.51

4
1
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- (a) Write the symbols of the five metals in the above table in order of reactivity.

Justify your answer. (chemistry only)

Most reactive Mg Zn Ni Cu Ag Least reactive

Justification The higher the (positive) voltage,
the more reactive the metal.

(3)

- (b) The **voltage** produced by a chemical cell depends on the **concentration** of the electrolyte solution.

Plan an experiment to investigate **how the voltage produced by a chemical cell varies with the concentration** of the electrolyte solution. **(chemistry only)**

The following substances are available:

- the **metal electrodes** in the table above
- **1.0 mol/dm³ sodium chloride** solution
- **pure water.**

Set up the chemical cell with the given 1.0 mol dm⁻³ NaCl solution as the electrolyte. Use 2 different metals as electrodes. Measure the voltage.

Repeat at different concentrations of electrolyte solution, by diluting the NaCl solution with pure water.

Using measured volumes of NaCl solution and water. Measured with a measuring cylinder. Use the same 2 metals each time, same volumes.

(6)

- (c) Describe how a hydrogen fuel cell produces a potential difference. **(chemistry only)**

Hydrogen is oxidised (electrochemically) (loses electrons) to produce water, H₂O

(2)

(Total 11 marks)