

GCSE Chemistry

Worksheet: Cells and batteries

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Cells and batteries

NAME _____	CLASS _____	DATE _____
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A battery for a torch is made from four identical cells connected in series, each with a voltage of 1.5 V.

0 1 . 1

Calculate the total voltage of the battery.

.....

.....

.....

Voltage = V

[1 mark]

0 1 . 2

Which factor affects the voltage produced by a simple cell?

Tick (✓) **one** box.

The size of the two metal electrodes

☐

The difference in reactivity between the two metals used as electrodes

☐

The colour of the electrolyte

☐

The length of the connecting wires

☐

[1 mark]

0 2

Cells contain chemicals that react to produce electricity.

0 2 . 1

Which **two** things are needed to make a simple cell?

Tick (✓) **two** boxes.

Two different metals

☐

Two pieces of the same metal

☐

An electrolyte

☐

A catalyst

☐

A thermometer

☐

[2 marks]

0 2 . 2

A battery is made from two or more cells.

How are the cells connected to produce a greater voltage?

.....

.....

.....

[1 mark]

0 2 . 3

A torch battery contains four cells. Each cell has a voltage of 1.5 V.

Calculate the voltage of the battery.

.....

.....

.....

Voltage = V

[1 mark]

0 2 . 4

Alkaline batteries are non-rechargeable.

Why does an alkaline battery eventually stop working?

.....

.....

[1 mark]

0 3

Table 1 gives information about two types of cell that can be used in a games controller.

Table 1

	Alkaline cell	Rechargeable nickel–metal hydride cell
Cost to buy	60p	£3.00
Voltage	1.5 V	1.2 V
Time the controller works before the cell must be replaced or recharged	30 hours	20 hours
Number of times it can be recharged	0	500

0 3 . 1

Explain how a rechargeable cell can be recharged.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Calculate the cost per hour of using the alkaline cell in the games controller.

.....

.....

.....

.....

Cost per hour = p

[2 marks]

0 3 . 3

Evaluate the use of the two types of cell in the games controller.
Use information from Table 1.

.....

.....

.....

.....

.....

.....

[3 marks]

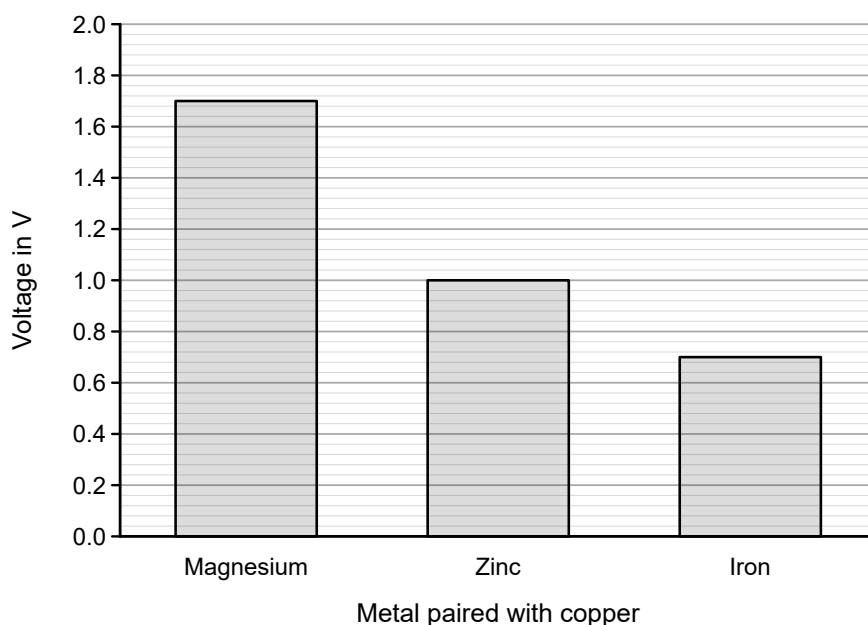
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0 4

A student made three simple cells. Each cell had a copper electrode and an electrode of a second metal, dipped into the same electrolyte. In each cell the second metal was the negative electrode.

Figure 1 shows the voltage of each cell.

Figure 1



0 4 . 1

Use Figure 1 and the reactivity series to describe the relationship between the reactivity of the second metal and the voltage of the cell.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Tin is less reactive than iron but more reactive than copper.
Predict the voltage of a cell made from tin and copper in the same electrolyte.

.....

.....

.....

Voltage = V

[1 mark]

0 4 . 3

Predict the voltage of a cell made with two copper electrodes in the same electrolyte.

.....

.....

.....

Voltage = V

[1 mark]

0 4 . 4

Explain why a cell made from zinc and iron would produce a lower voltage than a cell made from zinc and copper.

.....

.....

.....

.....

[2 marks]

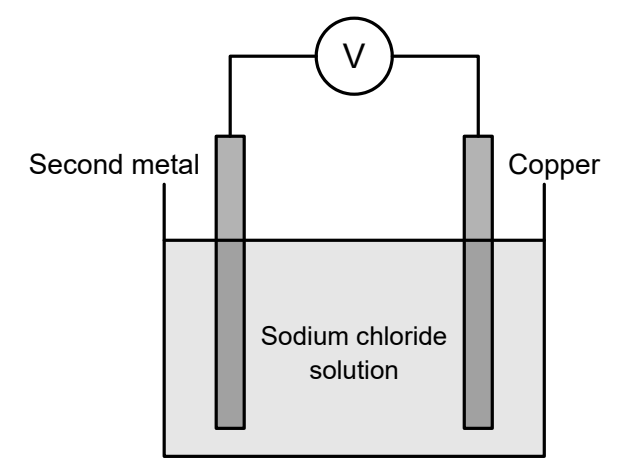
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0 5

A student made simple cells. Each cell had one copper electrode and one electrode made of a second metal. The student used a different second metal for each cell. The electrolyte was sodium chloride solution.

Figure 2 shows the apparatus.

Figure 2



0 5 . 1

Table 2

Second metal	Voltage in V
Copper	0.0
Iron	0.6
Magnesium	2.0
Tin	0.3
Zinc	1.0

Table 2 shows the results.

Explain why the voltage was zero when both electrodes were copper.

.....

.....

[1 mark]

0 5 . 2

Use the results to put the five metals in order of reactivity.
Start with the most reactive.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Nickel is more reactive than tin but less reactive than iron.
Predict the voltage of a cell made with nickel and copper electrodes.

.....

.....

.....

Voltage = V

[1 mark]

0 5 . 4

Give **one** variable the student should keep the same.

.....

.....

[1 mark]

0 6

A student plans to investigate how the metal used for one electrode affects the voltage of a simple cell. The other electrode will always be copper, and the electrolyte will be copper sulfate solution.

0 6 . 1

Identify the independent variable and the dependent variable.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Give **two** variables the student should control.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Suggest why the student should clean the surface of each metal electrode with sandpaper before use.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Cells and batteries · 30 marks

Question 1 (2 marks)

01.1 [1 mark]

Answer: 6.0 V

- 6(.0) (V) (1)
-

01.2 [1 mark]

Correct: The difference in reactivity between the two metals used as electrodes

Question 2 (5 marks)

02.1 [2 marks]

Correct: Two different metals; An electrolyte

02.2 [1 mark]

Answer: In series

- in series (1)
-

02.3 [1 mark]

Answer: 6.0 V

- 6(.0) (V) (1)
-

02.4 [1 mark]

Answer: One of the reactants is used up, so the chemical reactions stop.

- one of the reactants has been used up (so the chemical reactions stop) (1)
-

Question 3 (7 marks)

03.1 [2 marks]

Answer: An external electric current is supplied, which reverses the chemical reactions.

- an external electrical current is supplied (from a charger) (1)
- the chemical reactions are reversed (1)

03.2 [2 marks]

Answer: 2p per hour

- $60 \div 30$ (1)
- 2 (p per hour) (1)

03.3 [3 marks]

Answer: The rechargeable cell costs more to buy but can be used 500 times, so it is much cheaper per hour and less waste is produced; the alkaline cell has a higher voltage and lasts longer between changes. The rechargeable cell is the better choice.

- the rechargeable cell costs more to buy but can be recharged 500 times, so it is much cheaper per hour of use (1)
- fewer rechargeable cells are thrown away, so less waste (1)
- the alkaline cell has a higher voltage / lasts longer before it needs replacing (1)
- the rechargeable cell needs a charger and electricity to recharge it (1)
- justified conclusion, e.g. the rechargeable cell is better because it can be reused many times (1)

Any 3 of the points above.

Notes: Maximum 2 marks if there is no conclusion.

Question 4 (6 marks)

04.1 [2 marks]

Answer: The more reactive the second metal (magnesium > zinc > iron), the higher the voltage, because its difference in reactivity from copper is bigger.

- the more reactive the second metal, the higher the voltage (magnesium highest, iron lowest) (1)
- the bigger the difference in reactivity between the second metal and copper, the bigger the voltage (1)

04.2 [1 mark]

Answer: Any value above 0 V and below 0.7 V, e.g. 0.4 V

- any value greater than 0 and less than 0.7 (V) (1)

04.3 [1 mark]

Answer: 0 V

- 0 (V) (1)

04.4 [2 marks]

Answer: Zinc and iron are much closer together in reactivity than zinc and copper, and the smaller the difference in reactivity, the smaller the voltage.

- zinc and iron are closer in reactivity than zinc and copper / the difference in reactivity is smaller (1)
 - the smaller the difference in reactivity between the two metals, the smaller the voltage (1)
-

Question 5 (5 marks)

05.1 [1 mark]

Answer: The electrodes are the same metal, so there is no difference in reactivity.

- both electrodes are the same metal / there is no difference in reactivity between the electrodes (1)

05.2 [2 marks]

Answer: magnesium, zinc, iron, tin, copper

- magnesium first and copper last (1)
- zinc, iron, tin in that order in between (1)

05.3 [1 mark]

Answer: Any value between 0.3 V and 0.6 V, e.g. 0.45 V

- any value greater than 0.3 V and less than 0.6 V (1)

05.4 [1 mark]

Answer: The concentration of the sodium chloride solution.

- concentration / type of electrolyte / size (area) of the electrodes / distance between the electrodes / temperature (1)
-

Question 6 (5 marks)

06.1 [2 marks]

Answer: Independent: the metal used for the other electrode; dependent: the voltage of the cell.

- independent variable: the metal used for the (non-copper) electrode (1)
 - dependent variable: the voltage (potential difference) of the cell (1)
-

06.2 [2 marks]

Answer: Concentration of copper sulfate solution; size (area) of the electrodes.

- concentration of the copper sulfate solution (1)
- size (surface area) of the electrodes (1)
- distance between the electrodes (1)
- temperature (1)

Any 2 of the points above.

06.3 [1 mark]

Answer: To remove any oxide layer or dirt, which could otherwise affect the voltage.

- to remove any oxide layer / dirt / grease from the surface, which could otherwise affect the reaction and the voltage measured (1)
-