AQA A-Level Chemistry

Electrode potentials mark scheme · goes with “Electrode potentials” · whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions

Mark schemes

Electrode potentials · 9 questions

Q1 · June 2023 · Paper 1 · Q8 · [5 marks]

(a) $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$

[1 mark]

(b) $CH_3OH + H_2O \rightarrow CO_2 + 6H^+ + 6e^-$

[1 mark]

(c) 1.23 (V)

[1 mark]

(d) Reactants supplied continuously

Allow fuel continuously supplied

Allow continuous supply of chemicals

[1 mark]

(e) Methanol (is liquid so) can be stored easily or transported easily

More energy can be produced from 1 cm^3 of methanol (liquid) than from 1 cm^3 of hydrogen (gas)

Ignore references to safety and cost

Do not accept no greenhouse gas emissions

[1 mark]

Q2 · June 2023 · Paper 1 · Q2 · [5 marks]

(a) Allow to complete the circuit

Or

Allow ions to move (between half cells)

Allow to maintain electrical neutrality

Do not accept electrons flowing

Potassium/sodium nitrate or any soluble ionic compound that does not react with H^+ or magnesium ions or chloride ions

Allow any soluble ionic compound that does not react with acid or magnesium ions or chloride ions

[2 marks]

(b) No change

[1 mark]

(c) EMF increases

[1 mark]

(d) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Allow $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$

Ignore state symbols

allow multiples

[1 mark]

Q3 · June 2024 · Paper 3 · Q17 · [1 mark]

Answer: **C**

+1.69 V

Q4 · June 2022 · Paper 3 · Q11 · [1 mark]

Answer: **C**

the surface area of the platinum electrode

Q5 · June 2022 · Paper 3 · Q12 · [1 mark]

Answer: **A**

Electrons travel in the external circuit from zinc to lead.

Q6 · June 2024 · Paper 1 · Q6 · [10 marks]

(a) M1 $E^{\ominus}$ V^{3+} ($/V^{2+}$) > $E^{\ominus}$ Zn^{2+} (/ Zn)

OR EMF of reaction between V^{3+} and Zn = (+)0.50 V

M2 $E^{\ominus}$ V^{2+}(/V) < $E^{\ominus}$ Zn^{2+} (/ Zn)

OR EMF of reaction between V^{2+} and Zn = -0.44 V

[2 marks]

(b) Mg

Only

[1 mark]

(c) EMF = (+) 0.78 (V)

Fe(s) l Fe^{2+}(aq) ll VO^{2+}(aq), H^+(aq), V^{3+}(aq) l Pt(s)

Allow Fe(s) l Fe^{2+}*(aq) ll* VO^{2+}*(aq),* V^{3+}*(aq) l Pt(s)*

Ignore state symbols

$Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

Ignore state symbols

[3 marks]

(d) M1 n MnO_4^- = $29.43 \times 10^{-3} \times 0.0200 = 5.89 \times 10^{-4}$ mol

M2 n V^{2+} = $\frac{5.89 \times 10^{-4} \times 5}{3} = 9.81 \times 10^{-4}$ mol

$M2 = \frac{M1 \times 5}{3}$

M3 mass NH_4VO_3 = $9.81 \times 10^{-4} \times 116.9 = 0.1147$ g

M3 = M2 × 116.9

M4 % purity = $\frac{(0.1147 \times 100)}{0.151} = 76.0$ %

$M4 = \frac{M3 \times 100}{0.151}$

Allow 75.9 or 76.2 %

Answer to 3 significant figures

[4 marks]

Q7 · June 2019 · Paper 3 · Q13 · [1 mark]

Answer: **A**

Q8 · June 2025 · Paper 1 · Q6 · [9 marks]

06.1

Negative electrode $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$

Positive electrode $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

award 1 mark if both equations correct but in wrong order

Accept multiples

Ignore state symbols

[2 marks]

06.2

The OH^- ions are produced in one half equation/electrode and used in the other (half equation/electrode).

[1 mark]

06.3

M1 electrons released at the negative electrode

M2 (electrons) pass through the motor/external circuit to the positive electrode

Allow

M1 Hydrogen releases electrons/is oxidised

M2 (electrons) pass through the motor/external circuit to oxygen (which is reduced)

[2 marks]

06.4

carbon dioxide/CO_2 (in the air would react with the electrolyte)

[1 mark]

06.5

Occupies less volume

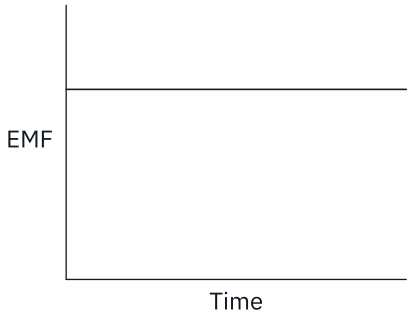
Allow minimises chance of escape

Ignore cost/safety/transport

[1 mark]

06.6

C



[1 mark]

06.7

same overall reaction/equation

[1 mark]

Q9 · June 2025 · Paper 3 · Q3 · [11 marks]

03.1

M1 mistake the concentration of H_2SO_4 OR $[H^+] \neq 1$ mol dm^{-3}

change use 0.5 mol dm^{-3} H_2SO_4 OR 1 mol dm^{-3} HCl / HNO_3

M2 mistake NaOH / wrong substance on filter paper/salt bridge

change use KNO_3

M3 mistake Fe / wrong electrode/metal (on RHS)

change Pt

ALLOW 1 mark for 3 mistakes if no other mark

It must be clear that it is the concentration that is wrong, not the identity of the acid

ALLOW 1 mol dm^{-3} H^+ for the change

ALLOW if NaOH not mentioned e.g. salt bridge would react with H_2SO_4

ALLOW suitable alternative (name or formula)

e.g. KCl

ALLOW graphite OR different named unreactive metal e.g. Au, Ag (NOT Cu)

[3 marks]

03.2

High resistance

[1 mark]

03.3

$2Fe^{3+} + H_2 \rightarrow 2Fe^{2+} + 2H^+$

ALLOW multiples/fractions

IGNORE state symbols

NOT ⇌

[1 mark]

03.4

M1 Cu is the brown (solid)

M2 Fe^{2+} is the (pale) green (solution)

M3 because $E^{\ominus}$ Fe^{2+}/Fe more negative than $E^{\ominus}$ Cu^{2+}/Cu OR because $E^{\ominus}$ Cu^{2+}/Cu more positive than $E^{\ominus}$ Fe^{2+}/Fe

M4 $Cu^{2+} + Fe \rightarrow Cu + Fe^{2+}$

M5 Fe(s) | Fe^{2+}(aq) || Cu^{2+}(aq) | Cu(s)

(State symbols required)

M6 (+)0.78 (V)

IGNORE Fe^{3+} is brown

ALLOW reference to +ve EMF of the correct cell/reaction

ALLOW $E^{\ominus}$ Fe^{2+}/Fe < $E^{\ominus}$ Cu^{2+}/Cu OR

$E^{\ominus}$ Cu^{2+}/Cu > $E^{\ominus}$ Fe^{2+}/Fe

References to the half-cells / half-equations must refer to both Fe and Fe^{2+} (in either order)

AND to Cu and Cu^{2+} (in either order) to identify the half-equations.

IGNORE $E^{\ominus}$ Fe^{2+}/Fe greater than or less than

$E^{\ominus}$ Cu^{2+}/Cu

IGNORE state symbols

NOT ⇌

M5 ECF from M4 where clear which two half equations are being used; but LHS and RHS of cell representation must match direction of reaction in M4 for incorrect half equations

ALLOW Cu(s) | Cu^{2+}(aq) || Fe^{2+}(aq) | Fe(s) only

if Fe^{2+} + Cu → Fe + Cu^{2+} in M4

M6 ECF from M4 or M5 where clear which two half equations are being used

NOT negative EMF

[6 marks]

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