Mark scheme

Electrolysis and half-equations

Chemistry 0620 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

84

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
4	5	5	6	7	8	11	12	13	13	**84**

Question 1 [4]

1 **(a)** bubbles / fizzing / effervescence [1]

(b) alkali formed [1]

(c) **(i)** chlorine [1]

(ii) indicator bleached / decolourised **allow** yellow [1]

[Total: 4]

Question 2 [5]

2 **(a)** electroplating [1]

(b) **(i)** chromium (1)

(ii) any named chromium salt (1) [2]

(c) to stop corrosion owtte (1)
to look attractive owtte (1) [2]

[Total: 5]

STEM | Exam Builder

Question 3 [5]

3 **(a)** carbon / graphite (1) [1]

(b) bulb lights / fizzing / bubbles (1) [1]
ignore: names of electrodes
allow: solution gets paler / changes colour / green colour fades

(c) copper (1)
negative electrode / cathode (1) [2]

(d) electrolysis (1) [1]

Question 4 [6]

4	clean / sandpaper the metal ring dissolve copper(II) sulfate in water / copper(II) sulfate solution set up circuit / switch on electricity / complete circuit copper rod anode(+ ve electrode) metal ring cathode(– ve electrode) rotate the metal ring / agitate remove the metal ring, wash and dry	**6**

Question 5 [7]

5 **(a)** **(i)** electrolyte → D [1]
allow: (molten) sodium chloride
cathode → C [1]

(ii) graphite [1]

(b) floats on top of the sodium chloride [1]
allow: sodium is on top

(c) chlorine / Cl_2 [1]
allow: Cl
reject: chloride

(d) (anode →) chlorine / Cl_2 [1]
allow: oxygen / O_2
allow: Cl / O
reject: chloride / oxide
(cathode →) hydrogen / H_2 [1]
allow: H

[Total: 7]

STEM | Exam Builder

Question 6 [8]

6(a)	**breakdown** of an ionic **compound** when molten or in aqueous solution (1) (using) electricity / electric current / electrical energy (1)	**2**
6(b)	platinum / graphite	**1**
6(c)	$2H^+ + 2e \rightarrow H_2$	**1**

6(d)	Na^+ H^+ Cl^- OH^- all four (2) 3 or 2 (1)	**2**
6(e)	H^+ and Cl^- are discharged / removed (1) Na^+ and OH^- remain (1)	**2**

Question 7 [11]

7(a)	**M1** breakdown by (the passage of) electricity **M2** of an ionic compound in molten or aqueous (state)	**2**
7(b)(i)	**M1** brown solution **OR** black solid **M2** iodine **M3** hydrogen **M4** copper	**4**

7(b)(ii)	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ **M1** OH^- **AND** e^- **M2** correct equation	**2**
7(c)(i)	copper **OR** anode forms Cu^{2+} which goes into the solution	**1**
7(c)(ii)	copper	**1**
7(c)(iii)	no change	**1**

Question 8 [12]

8(a)	electrolyte	**1**
8(b)(i)	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ balance of charge (1) rest of equation (1)	**2**
8(b)(ii)	(OH^-(aq) ions) lose electrons	**1**
8(c)	fizzing	**1**
8(d)	$2H^+ + 2e^- \rightarrow H_2$ species correct (1) fully correct equation (1)	**2**
8(e)(i)	fizzing (1) green gas (1)	**2**
8(e)(ii)	(litmus turns) blue **and** alkali / base forms (1) Sodium hydroxide / NaOH (forming) (1)	**2**
8(f)	platinum	**1**

STEM | Exam Builder

Question 9 [13]

9(a)	14.01/59 : 60.33/127 : 2.85/1 : 22.81/16 **OR** 0.237 : 0.475 : 2.85 : 1.43	**1**
	$NiI_2H_{12}O_6$	**1**
9(b)(i)	electrons	**1**
9(b)(ii)	(positive and negative) ions	**1**
9(b)(iii)	nickel	**1**
	iodine	**1**
	$Ni^{2+} + 2e^- \rightarrow Ni$ **OR** $2I^- \rightarrow I_2 + 2e^-$	**1**
9(c)(i)	copper formed/copper deposited	**1**
9(c)(ii)	oxygen	**1**
9(c)(iii)	copper removed or copper lost **or** copper forms ions	**1**
9(c)(iv)	any **three** from: (apparatus **A**): solution becomes paler/fades in **A** (apparatus **B**): solution stays the same colour in **B** (explanation): copper ions removed (but not added) copper ions not replaced in **A** **OR** copper ions both removed and added (at the same rate) copper ions are being replaced (continually)	**3**

Question 10 [13]

10(a)(i)	inert / unreactive / does not react with chlorine	**1**
10(a)(ii)	bubbles / fizzing / effervescence	**1**
10(a)(iii)	**M1** increases **M2** (solid) copper deposited	**2**
10a(iv)	**M1** colour fades / becomes pale(r) / becomes colourless / becomes lighter **M2** copper (ions) removed (from solution)	**2**
10(a)(v)	**M1** species oxidised: chloride (ions) / Cl^- **M2** explanation: loss of electrons / increase in oxidation state	**2**
10(b)(i)	**M1** spoon as cathode **M2** (pure)silver as anode **M3** aqueous silver nitrate as electrolyte **M4** $Ag^+ + e^- \rightarrow Ag$	**4**
10(b)(ii)	any one from: • Improves appearance • prevent / resist corrosion / oxidation • antibacterial	**max 1**

STEM | Exam Builder