

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Mark Schemes

Q1.

- (a) Solar cells do not supply electrical energy all the time

1

Rechargeable cells can store electrical energy for use when the solar cells are not working

1

- (b) Prevent pollution of the environment by toxic or dangerous substances / recycling of valuable components

Do not allow 'will not use up landfill sites'.

1

[3]

Q2.

- (a) To remove the oxide layer on the aluminium

Do not allow 'cleaning' or 'removal of grease'.

Do not allow 'removal of impurities' without qualification.

1

- (b) An appropriate method for delivering H_2 gas over a Pt electrode

Need H_2 gas and Pt electrode labelled (allow gas delivered directly below the electrode).

1

The Pt electrode must clearly be in contact with a solution of a named acid.

Ignore any concentration or pressure values.

Ignore absence of bubbles.

Allow if electrode is below outer acid level.

1

- (c) The carbonate ion reacts with the acid (in the SHE) / reaction between carbonate and Al^{3+}

Lose this mark if aluminium carbonate formed but mark on.

1

Reaction given (either equation or products specified)

OR H^+ / Al^{3+} concentrations change / cell e.m.f. altered

1

[5]

Q3.

- (a) Diagram of an $\text{Fe}^{3+} / \text{Fe}^{2+}$ electrode that includes the following parts labelled:
Solution containing Fe^{2+} and Fe^{3+} ions

1

Platinum electrode connected to one terminal of a voltmeter

Must be in the solution of iron ions (one type will suffice)

1

Salt bridge

Do not allow incorrect material for salt bridge and salt bridge must be in the solution (ie it must be shown crossing a meniscus)

1

298 K and 100 kPa / 1 bar

1

all solutions unit / 1 mol dm⁻³ concentration

Allow zero current / high resistance voltmeter as alternative to M4 or M5

Ignore hydrogen electrode even if incorrect

1

- (b) $\text{Cu}^{2+} + \text{Fe} \rightarrow \text{Cu} + \text{Fe}^{2+}$

Ignore state symbols

1

$\text{Fe} | \text{Fe}^{2+} || \text{Cu}^{2+} | \text{Cu}$ correct order

Allow $\text{Cu} | \text{Cu}^{2+} || \text{Fe}^{2+} | \text{Fe}$

1

Phase boundaries and salt bridge correct, no Pt

Allow single / double dashed line for salt bridge

Penalise phase boundary at either electrode end

Can only score M3 if M2 correct

1

Copper electrode

Allow any reference to copper

1

- (c) $E^\ominus \text{Au}^+ (/ \text{Au}) > E^\ominus \text{O}_2 (/ \text{H}_2\text{O})$

Allow $E_{\text{cell}} / \text{e.m.f.} = 0.45 \text{ V}$

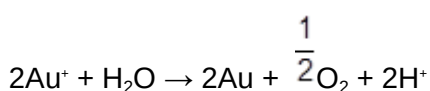
Allow $1.68 > 1.23$

1

So Au^+ ions will oxidise water / water reduces Au^+

QoL

1



Allow multiples

1

- (d) $E^\ominus \text{Ag}^+ (/ \text{Ag}) > E^\ominus \text{Fe}^{2+} (/ \text{Fe})$

Allow $E_{\text{cell}} / \text{e.m.f.} = 1.24$

Allow $0.80 > -0.44$

1

And $E^\ominus \text{Ag}^+ / \text{Ag} > E^\ominus \text{Fe}^{3+} / \text{Fe}^{2+}$

Allow $E_{\text{cell}} / \text{e.m.f.} = 0.03$

Allow $0.80 > 0.77$

1

So silver ions will oxidise iron (to iron(II) ions) and then oxidise Fe(II) ions (further to Fe(III) ions producing silver metal)

Allow Ag^+ ions will oxidise iron to iron(III)

1

[15]