

Name of the Student: _____

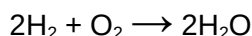
Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

- (a) (i) M1 Positive electrode
- $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

M2 Negative electrode $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$ *Allow multiples, ignore state symbols**If equations both correct but at the wrong electrodes allow 1 mark*1
1*Mark independently**Must be this way round*

1

- (ii) Increase (emf)

If decrease/no change then CE=0/2; if blank then mark on

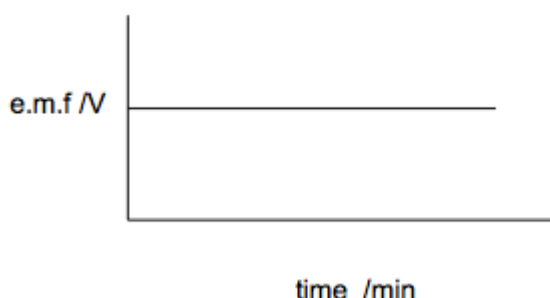
1



Or overall equation moves to the right

Allow $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ will move to the right / oxygen half equation moves to the RHS / $E^\ominus O_2/OH^-$ half cell moves to the right

1



- (b) time / min

Must start at y-axis

1

- (c) (i) Unchanged

1

- (ii) Water is the
- only
- product / fuel cell does not give out pollutants such as
- NO_x
- or
- CO_2
- or
- SO_2
- or C or CO or
- C_xH_y
- or unburnt hydrocarbons

- (d) CO₂ is released because fossil fuels are burned to produce electricity
to generate hydrogen
OR

CO₂ is released when methane reacts with steam to produce hydrogen
Allow CO₂ is released to produce the hydrogen

Q2.

(a) (i) Zn^{2+}

$\text{Zn}^{2+}(\text{aq})$

Apply List

1

(ii) 298 K / 25°C

Ignore pressure

Ignore standard conditions

Ignore state symbols

1

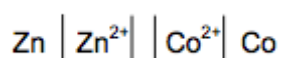
(Solutions at) unit concentration / 1 mol dm⁻³ (of Zn^{2+})

Ignore references to S.H.E

1

(b) Identifying it is the Zn/Zn^{2+} and Co^{2+}/Co half cells

1



Correct order with phase boundaries and salt bridge correct, no Pt

If this is correct it scores M1 and M2

Allow double dashed line for salt bridge

Extra phase boundaries loses M2

Ignore state symbols

1



M3 independent

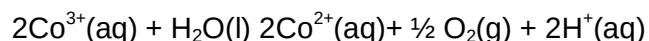
Allow -2e^{-} on LHS

1

(c) Co^{3+}

Mark independently

1



Ignore state symbols

Allow multiples

1

Oxygen / O_2

Allow $\frac{1}{2}\text{O}_2$

1

(d) $E^{\ominus}(\text{O}_2(\text{l})|\text{H}_2\text{O})$ electrode $E^{\ominus}(\text{O}_2(\text{l})|\text{H}_2\text{O})$

OR the $E^{\ominus}(\text{Au}^{+}|\text{Au})$ electrode potential is more positive than the $E^{\ominus}(\text{O}_2|\text{H}_2\text{O})$ electrode

OR The emf (for the reaction of Au and oxygen) is -0.45 V (and therefore not spontaneous)

Mark independently

1

So oxygen is unable to oxidise gold

Ignore references to water

Allow gold cannot reduce oxygen

1

[11]