M1. D

[1]

M2. A

[1]

M3. A

[1]

M4. (a) Gains electrons (or removes electrons)

1

(b) (i) +4

1

+6

1

(ii) $Br_2 + 2e^- \rightarrow 2Br^-$

1

(iii) $SO_2 + 2H_2O \rightarrow 4H^+ + SO_4^{2-} + 2e^-$

1

(iv) $Br_2 + SO_2 + 2H_2O \rightarrow 2Br^- + 4H^+ + SO_4^{2-}$

1

(c) $Cl_2 + H_2O \rightarrow H^+ + Cl^- + HOCl$
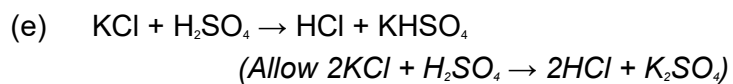
1

Chloride: –1

1

Chlorate(I): +1

1

(d) Chloride ions cannot reduce sulphuric acid

(Or chloride ions are weak reducing agents
Or sulphuric acid is not a strong enough oxidising agent
Or sulphuric acid is a weaker oxidising agent than chlorine)

1

(e) $KCl + H_2SO_4 \rightarrow HCl + KHSO_4$
     (Allow $2KCl + H_2SO_4 \rightarrow 2HCl + K_2SO_4$)

1

(f) (i) Bromine

1

  (ii) Sulphur dioxide

1

[13]

M5. D

[1]

M6. (a) (i) HgO

1

  (ii) $Hg^{2+} + 2e^- \rightarrow Hg$

1

  (iii) $2H_2O + SO_2 \rightarrow H_2SO_4 + 2e^-$ etc

1

  (iv) $Cl_2 + 2e^- \rightarrow 2Cl^-$
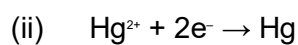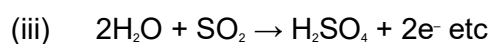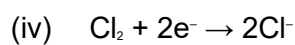
1

 (b) (i) Vanadium species: VO_2^+

1

    Oxidation state: 5

1

    Half-equation: $V^{2+} + 2H_2O \rightarrow VO_2^+ + 4H^+ + 3e^-$
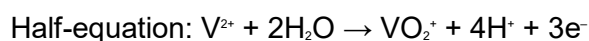
       (ii)   Cell e.m.f 0.06 V

              Change in e.m.f , Increases

              More Fe^{3+} ions to accept electrons

              Fe^{3+}/Fe^{2+} electrode becomes more positive

(c)   (i) $2H_2 \rightarrow 4H^+ + 4e^-$

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

            Overall equation $2H_2 + O_2 \rightarrow 2H_2O$

       (ii)   Unchanged

(d)   Economic disadvantage; Use of CH_4 or cost of producing or high temp

       Environmental disadvantage; Makes CO_2

(e)   Cost of manufacture of solar cells

[17]

M7.   (a)   Accepts electrons

(b)   Charge on the ion (or element or atom)

(c)   +4

+5

−3

(d)   (i) $Cu^- \rightarrow Cu^{2+} + 2e^-$

(ii) $NO_3^- + 4H^+\ 3e^- \rightarrow NO_2\ H_2O$

(iii) $3Cu + 2NO_3^- + 8H^+ \rightarrow 3Cu^{2+} + 2NO + 4H_2O$

[8]

M8.B

[1]

M9.A

[1]

M10.   (a)   removal/loss of electrons

(b) no change

1

equal number of gaseous moles on either side

1

both sides affected equally

1

increases

1

equilibrium moves to lower the temperature/oppose the change

1

endothermic reaction favoured /forward reaction is endothermic

1

(c) (i) +2

1

+5

1

(ii) $NO_3^- + 4H^+ + 3e^- \rightarrow NO + 2H_2O$

1

(iii) $Ag \rightarrow Ag^+ + e^-$

1

(iv) $NO_3^- + 4H^+ + 3Ag \rightarrow NO + 2H_2O + 3Ag^+$

1

[12]