1 **(a** **(i)** H_2 on RHS [1]
ignore any other species on RHS
rest of equation fully correct i.e. $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $\underline{H^+}$ removed / escapes / discharged / used up / reduced [1]
(equilibrium) moves to RHS / more water molecules ionise or
dissociate / forward reaction favoured [1]

(iii) oxygen / O_2 [1]
not O

(iv) carbon / graphite / platinum (electrode) [1]

(b) **(i)** to make ammonia / in petroleum processing / balloons / rocket fuel / fuel for cars /
hardening of fats / fuel cells / fuel (unqualified) / making hydrochloric acid [1]

(ii) to sterilise / disinfect it / kill bacteria / bugs / microbes / micro-organisms / germs [1]

(c) **(** (reference to) <u>volume</u> and time / how long it takes [1]

(ii) carry out experiment with different intensities of light / one in light and one in
dark / repeat experiment in reduced light [1]
measure new rate which would be <u>fast**er** or slow**er**</u> depending on light intensity [1]

[Total: 11]

2   (a (i)

aqueous solution	tin Sn	manganese Mn	silver Ag	zinc Zn
tin(II) nitrate		R	NR	R
manganese(II) nitrate	NR		NR	NR
silver(I) nitrate	R			R
zinc nitrate	NR	R	NR	

[1] for each   [3]
ignore anything written in blank space

  (ii) Sn + 2Ag$^+$ → Sn^{2+} + 2Ag   [2]
all species correct [1]
accept equation with Sn^{4+}

 (iii) Mn to Mn^{2+} need both species   [1]
electron loss **or** oxidation number increases   [1]

 (iv) covered with oxide layer   [1]
makes it unreactive **or** protects **or** aluminium oxide unreactive [1]

 (b) (potassium has one valency electron   [1]
or loses one electron
calcium has two valency electrons
or loses two electrons   [1]

  (ii) potassium hydroxide → no reaction   [1]
calcium hydroxide → calcium oxide and water   [1]
ACCEPT metal oxide

 (iii) 2KNO$_3$ → 2KNO$_2$ + O$_2$ [2]
[1] for **formula** of either product

2Ca(NO$_3$)$_2$ → 2CaO + 4NO$_2$ + O$_2$ [2]
[1] for **formulae** of any **TWO** products

[Total: 17]

3. **(a)** dissolved **or** solution in water **[1]**
NOT aqueous **NOT** soluble in water
l liquid <u>and</u> g gas **[1]**

(b) 6 electrons in bond between two nitrogen atoms **[1]**
2 electrons on each nitrogen **[1]**
ignore any coding of electrons with dots **or** crosses

(c) decreases **or** reaction stops **or** rate becomes zero **[1]**

(ii) concentration   **or** number of effective collisions **[1]**
decreases **[1]**
used up **or** less chemical **or** less collisions etc **[1]** only

(iii) greater initial slope **[1]**
same final point **[1]**
as long as new curve touches the original curve near
the top allocate the mark

(iv) greater surface area **[1]**

TOTAL = [10]

4 (a) (i) high densities
high fixed points mp or bp
coloured compounds
hardness
complex ions
ANY three   [3]

   (ii) 13   [1]

(b) (i) manganese chloride   [1]
        water   [1]

    (ii) manganese(III) **and** (IV) oxides   [1]

(c) (i) rate decreases **or** becomes zero   [1]
        do **NOT** accept rate increases then decreases
        COND concentration decreases   [2]
        hydrogen peroxide used up **ONLY** [1]

    (ii) steeper initial gradient   [1]
         double final volume   [1]

    (iii) initial gradient less   [1]
          final volume the same   [1]
          must relate to shape of graph

                                           TOTAL   =14