1. (a) substance brokendown / separates / splits into elements — max 2
by electric current / electricity
ions free to move e.g. when molten / in solution
allow 1 mark for "a substance that conducts electricity"

(b) (i) copper / Cu — 1

(ii) oxygen /O_2 — 1
allow CO_2

(c) tube over electrode — 2
full of $CuSO_4$(aq) / water
allow sulphuric acid / sensible electrolyte
***not** any other liquid / using a syringe*

(d) Cu^{2+} ions removed / less Cu^{2+} — 2
***not** copper sulphate removed*
allow 1 mark for "copper removed / less copper"

[8]

2. (a) electrolytes — 1

(b) oxidation — 1
electrons lost — 1

(c) $2H^+ + 2e^- \rightarrow H_2$ — 2
minus sign on e^- not needed

(d) concentration increases — 1
OH^- discharged from water / water decomposes — 1
H^+ concentration increases / H_2 and O_2 evolved — 1

[8]

3. (a) Gas A = Chlorine / Cl_2 not Cl and Gas B = Hydrogen / H_2 not H — 2
for 1 mark
Solution C = sodium hydroxide/NaOH/spent brine
for 1 mark

(b) (i) 2, 2 — 1

(ii) 2, 2 — 1

(c) water/H_2O/hydrogen oxide not hydrogen hydroxide — 1

(d) ions/positive ions/negative ions/cations/anions — 1
not charged particles/positive particles/negative particles
not H^+ / Cl-/Na^+ / OH-
Allow hydrogen ions etc.
not sulphate ions

[6]

4. (a) Marks awarded for this answer will be determined by the standard of the scientific response as well as the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level. — 6

5/6 There is a clear, balanced and detailed description of the electrolysis of aluminium oxide, with 5-6 points from the **examples** given. The answer shows almost faultless spelling, punctuation and grammar. It is coherent and in an organised, logical sequence. It contains a range of appropriate or relevant specialist terms used accurately.

3/4 There is some description of the electrolysis of aluminium oxide, with 3-4 points from the **examples** given. There are some errors in spelling, punctuation and grammar. The answer has some structure and organisation. The use of specialist terms has been attempted, but not always accurately.

1/2 There is a brief description of the electrolysis of aluminium oxide, with 1-2 points from the **examples** given. The spelling, punctuation and grammar are very weak. The answer is poorly organised with almost no specialist terms and/or their use demonstrating a general lack of understanding of their meaning.

0 No relevant content.

examples of the **chemistry points** made in the response

- the aluminium oxide is dissolved in molten cryolite or aluminium oxide is melted/made liquid
- aluminium ions are attracted to the negative electrode
- at the negative electrode aluminium is formed **or** aluminium ions gain electrons
- oxide ions are attracted to the positive electrode
- oxygen is formed at the positive electrode **or** oxide ions lose electrons
- the oxygen reacts with carbon to make carbon dioxide or
- carbon dioxide formed at positive electrode.

(b) any **two** from the following: 2

- there are delocalised electrons / free electrons / electrons which move around the structure
- the delocalised electrons come from outer shell / energy level.
- the delocalised electrons carry the current / charge

if the candidates use the terms to covalent / ionic / molecules / intermolecular etc. incorrectly in the answer this will limit the mark to a maximum of 1.

[8]