Question	Answer	Marks	Guidance
1(a)	high melting point / mp / mpt **OR** high boiling point / bp / bpt; poor / non conductor (when liquid and / or solid);	**3**	**I** mpt/bpt above room temp
(b)	(good) conductor when <u>solid</u> (and liquid);	**2**	**A** (good) conductor in any state / both states **I** high melting point/boiling point **R** low melting point/boiling point
(c)	melting point / –7 (°C) is below room temperature / 25 (°C) / RTP ora; boiling point / 59 (°C) is above room temperature / 25 (°C) / RTP ora;	**3**	**I** low melting point / boiling point / conductivity 25 (°C) / room temperature / RTP is in between –7 (°C) and 59 (°C) **OR** 25 (°C) / room temperature / RTP is between mpt and bpt would both score the 2 evidence marks
(d)	high melting point / mp / mpt **OR** high boiling point / bp / bpt; **BOTH** poor / non conductor when solid **and** good conductor when liquid **OR** molten / only conduct when liquid;	**3**	**A** melting point **and** boiling point both above room temp / 25 °C / RTP **I** conducts when aqueous or in solution **I** conducts in liquid due to free electrons

Question	Answer	Marks	Guidance
2(a)(i)	$_3$;	**1**	
1(a)(ii)	$_2O_3$;	**1**	As_2O_5
1(a)(iii)	$_4$;	**1**	
(b)(i)	^{3} ;	**1**	
1(b)(ii)	$^{2+}$;	**1**	
(b)(iii)	$^+$;	**1**	
(c)	M1 2 double bonds, one between each O and the C atom; M2 each O has 8 outer electrons; M3 each C has 8 outer electrons;	**3**	**R** wrong symbols for O for M2 **R** wrong symbols for C for M3 **I** missing symbols **A** any combination of x and o

3 **(a) (i)** $6Li + N_2 = 2Li_3N$
species (1) balancing (1)

(ii) N^3 ion drawn correctly [1]

Charges correct (minimum 1 × Li ion and 1 nitride ion) [1]

(b) 3 × shared pairs between N and 3 × F [1]

only 2 non-bonding electrons on N, 6 non-bonding electrons on each F
(COND on first point) [1]

(ii) Strong attractive forces/strong ionic bonds in lithium nitride [1]

weak (attractive) forces between molecules in NF_3 [1]

[Total: 8]

4 **(a (i)** incomplete combustion **or** limited oxygen / less oxygen / not enough oxygen (1) [1]

(ii) any **two** from:

(forward) reaction is endothermic (1)

high temperature increases yield / favours forward reaction / shifts equilibrium to right (1)

faster reaction (rate) (1) [2]

(iii) any **two** from:

high pressure reduces yield **or** favours LHS (1)

because LHS has smaller volume **or** number of moles / number of molecules (of gas) ORA (1)

(high pressure plant is) expensive / dangerous / explosion / leaks [2]

5 (b hydrogen **and** chlorine / H_2 **and** Cl_2 (1)

sodium hydroxide / NaOH / Na^+OH (1)

$2H^+ + 2e \rightarrow H_2$ / $2H^+ \rightarrow H_2 - 2e$ (1)

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

Hydrogen / H_2 / H / H^+ at cathode **and** chlorine / chloride / Cl_2 / Cl / Cl at anode (1) [5]

5 (c <u>each</u> chlorine 1 bond pair and 3 non-bond pair (1)

oxygen atom 2 non-bond pairs and 2 bond pairs as double bond (1)

carbon atom 4 bond pairs including 2 bond pairs as double bond (1) [3]

[Total: 13]

5 **(a) (i)** any ambiguous formula, e.g. GeH_3-GeH_2-GeH_3 [1]

(ii) Ge_nH_{2n+2} [1]
NOT C instead of Ge

(b) correct formula
COND 4bps around germanium atom [1]
COND 3nbps and 1bp around each chlorine atom [1]

(c) four oxygen atoms around each germanium atom [1]
two germanium atoms around each oxygen atom [1]
tetrahedral [1]

(d) oxidation [1]
COND increase in oxidation number [1]
ACCEPT: electron loss