6CH01/01

Section A

Question Number	Correct Answer	Reject	Mark
1	A		1

Question Number	Correct Answer	Reject	Mark
2	C		1

Question Number	Correct Answer	Reject	Mark
3	C		1

Question Number	Correct Answer	Reject	Mark
4	B		1

Question Number	Correct Answer	Reject	Mark
5	D		1

Question Number	Correct Answer	Reject	Mark
6	B		1

Question Number	Correct Answer	Reject	Mark
7	B		1

Question Number	Correct Answer	Reject	Mark
8	D		1

Question Number	Correct Answer	Reject	Mark
9	A		1

Question Number	Correct Answer	Reject	Mark
10	A		1

Question Number	Correct Answer	Reject	Mark
11	B		1

Question Number	Correct Answer	Reject	Mark
12	A		1

Question Number	Correct Answer	Reject	Mark
13	C		1

Question Number	Correct Answer	Reject	Mark
14	B		1

Question Number	Correct Answer	Reject	Mark
15	A		1

Question Number	Correct Answer	Reject	Mark
16	B		1

Question Number	Correct Answer	Reject	Mark
17	D		1
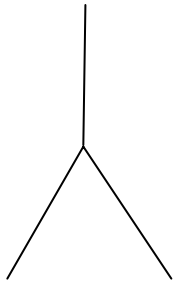
Question Number	Correct Answer	Reject	Mark
18	C		1

Question Number	Correct Answer	Reject	Mark
19	C		1

Question Number	Correct Answer	Reject	Mark
20	D		1

Section B

Question Number	Correct Answer	Reject	Mark
21 (a)(i)	Easier to transport / easier to store / less space / less volume needed for storage / easier to handle / easier to transfer *IGNORE* references to "safety" **Accept** Denser/cheaper to transport OWTTE	Just "cost"	1

Question Number	Correct Answer	Reject	Mark
21 (a)(ii)	**skeletal formula (1)** **Name**: butane **(1)** Stand alone **skeletal formula (1)** **Name**: methylpropane **OR** 2-methylpropane **(1)** *IGNORE* incorrect punctuation [e.g. extra/missing hyphens, etc.] Stand alone *IGNORE* displayed formulae if also given with skeletal formulae if 2 correct displayed formulae are given **max** 1 out of 2 for the structures		4

Question Number	Correct Answer	Reject	Mark
21 (a)(iii)	(Structural) isomers		1

Question Number	Correct Answer	Reject	Mark
21 (b)(i)	$Cl_2 \rightarrow Cl\cdot + Cl\cdot$ / $Cl_2 \rightarrow 2Cl\cdot$ **(1)** (U.V.) light / sunlight **(1)** Must show the dots $\cdot$ *IGNORE* any subsequent propagation steps in (b)(i)	heat alone	2

Question Number	Correct Answer	Reject	Mark
21 (b)(ii)	$C_3H_8 + Cl\cdot \rightarrow C_3H_7\cdot + HCl$ **(1)** $C_3H_7\cdot + Cl_2 \rightarrow C_3H_7Cl + Cl\cdot$ **(1)** Must show the dots $\cdot$		2
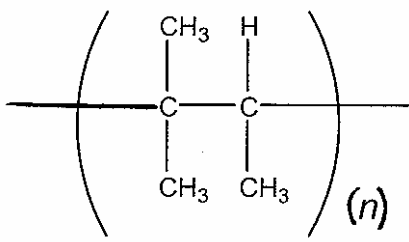
Question Number	Correct Answer	Reject	Mark
21 (b)(iii)	$C_3H_7\cdot + Cl\cdot \rightarrow C_3H_7Cl$ **OR** $Cl\cdot + Cl\cdot \rightarrow Cl_2$ **OR** $C_3H_7\cdot + C_3H_7\cdot \rightarrow C_6H_{14}$ Must show dots in termination step		1

Question Number	Correct Answer	Reject	Mark
21 (c)(i)	Alkene / triene **Accept** Diene Carbon-carbon double bond		1

Question Number	Correct Answer	Reject	Mark
21 (c)(ii)	**From:** Red / brown / orange / yellow or combinations of these colours **To:** colourless *both colours needed*	"clear" instead of colourless	1

Question Number	Correct Answer	Reject	Mark
21 (c)(iii)	Electrophilic **(1)** addition **(1)**		2

Question Number	Correct Answer	Reject	Mark
21 (c)(iv)	**Calculation:** 0.01 mol myrcene reacts with 0.03 mol H_2 **OR** 1 mol myrcene reacts with 3 mol H_2 **(1)** **Structural formula:** $(CH_3)_2CH(CH_2)_3CH(CH_3)CH_2CH_3$ **OR** **(1)** **Accept** Fully displayed formula/skeletal formula Mark calculation and structural formula **independently**.		2

Question Number	Correct Answer	Reject	Mark
21 (d)	 repeat unit **(1)** continuation bonds shown (but these bonds do not have to cut through the brackets) **(1)** *n* **not essential** *IGNORE* the position of "*n*" relative to the repeat unit (e.g. can be written as a superscript)		2

Question Number	Correct Answer	Reject	Mark
22 (a)(i)	*(see table below)*		3

Energy change	Letter	$\Delta H/\text{kJ mol}^{-1}$
Lattice energy for sodium chloride	E	-775
Enthalpy change of atomization of sodium	C	+109
Enthalpy change of atomization of chlorine	A	+121
First ionization energy of sodium	B	+494
First electron affinity of chlorine	F	
Enthalpy change of formation of sodium chloride	D	-411

6 correct letters **(3)**
5 or 4 correct letters **(2)**
3 or 2 correct letters **(1)**
1 or 0 correct letters **(0)**

Question Number	Correct Answer	Reject	Mark
22 (a)(ii)	Expression such as: D = C + B + A + F + E - 411 = + 109 + 494 + 121 + F + (- 775) F = - 411 - 109 - 494 - 121 + 775 (1) Answer: F = −360 (kJ mol^{-1}) **(1)** *Check empty box in 22(a)(i), as answer may be written there.* Answer must follow from working Correct answer only **(2)** Correct answer with some consistent working **(2)**		2

Question Number	Correct Answer	Reject	Mark
22 (b)(i)	(Bonding in NaCl) 100% ionic **OR** almost completely ionic **OR** no covalent character/(very) little covalent character	'Molecule' **(0)**	1

Question Number	Correct Answer	Reject	Mark
22 (b)(ii) QWC	AgI has (a degree of) covalent character **(1)** due to polarization or distortion (of the anion) **(1)**		2

Question Number	Correct Answer	Reject	Mark
22 (c) QWC	Any **two** of the following: • (outermost) electron further from the nucleus/atoms get bigger/more shells • (outermost) electron more shielded (by inner shells of e⁻) • (force of) attraction between nucleus and (outermost) electron decreases (down the Group) **OR** (outermost) electron held less strongly (down the Group) **OR** (outermost) electron becomes easier to remove (down the Group) *IGNORE* any references to(effective) nuclear charge or more protons.	"**ions**" get bigger (down Group)	2

Question Number	Correct Answer	Reject	Mark
23 (a)			3

element	structure	bonding
sodium	**Giant**	**metallic**
silicon	**Giant (atomic)/ macromolecular/ giant molecular**	**covalent**
sulfur	**simple / small molecules** **OR** **(simple) molecular** **OR** **S$_8$ molecules**	**covalent or van der Waals' forces/ London forces/ intermolecular forces/dispersion forces/induced-dipole forces**

IGNORE the word "lattice" **OR** "crystalline"

6 boxes correct (3)
5,4 boxes correct (2)
3,2 boxes correct (1)
1,0 boxes correct (0)

Question Number	Correct Answer	Reject	Mark
23 (b)	Si : covalent bonds / many bonds/ strong bonds (between atoms) (1) S : weak forces /van der Waals' forces/London forces/dispersion forces/intermolecular forces/induced-dipole forces (1) (need to be overcome)	any reference to **intermolecular forces in Si** suggestion that covalent bonds are broken	2

Question Number	Correct Answer	Reject	Mark
23 (c) QWC	Cations/ions decrease in size (from Na^+ to Al^{3+}) **OR** charge increases/charge density on (cat)ions increases/ "**effective nuclear charge**" increases (from Na^+ to Al^{3+}) (1) more e^- (per atom in 'sea' of delocalized electrons) / more delocalized electrons **OR** (force of) attraction between (cat)ions/nucleus and (delocalised) electrons increases (from Na to Al) (1) *IGNORE* "nuclear charge increases"/ "increasing no. of protons"	**atoms** decrease in size any mention of "molecules"/ "covalent bonds"/ "van der Waals' forces"/ "ionic bonds" **(0)** overall	2

Question Number	Correct Answer	Reject	Mark
23 (d)(i) QWC	• Add MgO to acid/react MgO with acid/dissolve MgO in acid **(1)** *[NOTE:* mention of heating not required. **IGNORE** water bath/reflux] • Filter **(1)** • **Heat/boil** filtrate /$MgSO_4$ solution (until volume reduced by half) **(1)** • Leave to cool/leave to crystallise/evaporate slowly/leave to evaporate **(1)** (decant / filter / pick out crystals, then) Leave to dry/pat dry/dry between filter papers/put in an oven/put in a desiccator/dry the crystals **(1)** *IGNORE* any washing of crystals immediately prior to drying them	Just "**warm**" the filtrate/$MgSO_4$ solution Use of a **desiccant** (added to crystals)	5

Question Number	Correct Answer	Reject	Mark
23 (d)(ii)	Rinse with (plenty of) water /use a damp cloth or damp (paper) towel / add a (named) weak alkali (e.g. solid or aqueous sodium hydrogencarbonate)	Any named strong alkali/just "strong alkali"	1

Question Number	Correct Answer	Reject	Mark
23 (e)(i)	**Insoluble strontium sulfate/insoluble $SrSO_4$** (forms on the strontium carbonate)		1

Question Number	Correct Answer	Reject	Mark
23 (e)(ii)	$Sr^{2+}(aq) + SO_4^{2-}(aq) \rightarrow SrSO_4(s)$ species **(1)** state symbols **(1)** **2nd mark is cq on first mark** $Sr^{2+}(aq) + 2Cl^-(aq) + 2Na^+(aq)$ $+ SO_4^{2-}(aq) \rightarrow SrSO_4(s) + 2Cl^-(aq) +$ $2Na^+(aq)$ scores **(1)** $SrCl_2(aq) + Na_2SO_4(aq) \rightarrow SrSO_4(s) +$ $2NaCl(aq)$ scores **(1)**		2

Question Number	Correct Answer	Reject	Mark
24 (a)(i)	$\dfrac{2.90}{58} = 0.05(00)$ (mol) correct answer only **(1)**		1
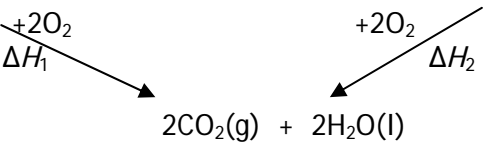
Question Number	Correct Answer	Reject	Mark
24 (a)(ii)	$200 \times 4.18 \times$ **58.2** = 48655 (J) **OR** 48.655 kJ **(1)** for correct ΔT **(1)** *IGNORE* sf *IGNORE* signs at this stage		2

Question Number	Correct Answer	Reject	Mark
24 (a)(iii)	$- \dfrac{48655}{0.0500} = -973\,100$ (J mol^{-1}) $= -973$ kJ mol^{-1} (3 s.f.) / -973000 J mol^{-1} (3 s.f.) answer **(1)** sign and units **(1)** [Do not award sign and units mark **if units given are just** "kJ" or **just** "J"] **three sig figs (1)** *CQ on (a)(i) & (ii)*		3

Question Number	Correct Answer	Reject	Mark
24 (b)(i)	Heat loss/energy loss **Accept** Incomplete combustion OWTTE *IGNORE* "experimental error"/ "departure from standard conditions"	Anything related to "average values" **(0)**	1

Question Number	Correct Answer	Reject	Mark
24 (b)(ii)	**Difference**: less exothermic / less negative *IGNORE* "higher" **if** written **with** less exothermic/less negative **Accept just** "lower"/ "less" (1) **Justification**: energy taken in to form gas/energy required to form gas/energy needed to form gas/takes heat in to form gas/heat required to form gas **Or reverse argument** (1) *Mark these two points independently*	**Just** "higher" **(0)** **Just** "$H_2O(g)$ is not water's standard state"	2

Question Number	Correct Answer	Reject	Mark
24 (c)(i)	Enthalpy / energy / heat (energy) change (when) one mole of a substance/one mole of a compound (1) is formed from its elements (in their most stable states) (1) 298K / 25°C / a stated temperature <u>AND</u> 1 atm pressure/100 kPa (1) *IGNORE* any references to concentration	"energy required" **OR** "energy released" "one mole of **product(s)**" is formed from its **reactants** room temperature/rtp	3

Question Number	Correct Answer	Reject	Mark

24 (c)(ii)	Cycle or formula expression
	
	$+2O_2$ $+2O_2$
	ΔH_1 ΔH_2
	
	     $2CO_2(g)$ + $2H_2O(l)$
	
	$\Delta H^{\theta}_{f} = \Delta H_1 - \Delta H_2$
	
	$= (2 \times -394) + (2 \times -286) - (-870)$
	
	$= \textbf{−490}$ (kJ mol^{-1})
	
	  • correct expression or cycle **(1)**
	  • evidence for doubling **both** ΔH^{θ}_{c} [C] **and** ΔH^{θ}_{c} [H$_2$] **(1)**
	  • answer **(1)**
	
	Correct answer with no working scores full marks
			3