Assessment Schedule – 2005

Chemistry: Describe and use thermochemical principles (90699)

Evidence Statement

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	$\Delta_r H = -111$ kJ mol^{-1} (or kJ)	Correct answer. No units required		
1(b) (i)	$\Delta_r H = \Sigma E_{\text{bonds broken}} - \Sigma E_{\text{bonds made}}$ $-41.2 = E_{CO} + (2 \times 463) - (2 \times 743) - 436$ $E_{CO} = -41.2 - 926 + 436 + 1486$ $= 954.8$ or 955 kJ mol^{-1} Accept answer with 3 significant figures. **OR** a valid process which uses bond energies to obtain correct answer Eg $\Delta_r H = \Sigma E_{\text{bonds broken}}$ (positive values) $+ \Sigma E_{\text{bonds formed}}$ (negative values)	Correct process for calculation. / evidence of correct usage of three ratios in calculation. eg $2 \times 463 - 743 \times 2 - 436$	Correct mathematical calculation with one math error.	Answer calculated correctly with correct unit.
1(b) (ii)	Relates enthalpy change to bond breaking.	Bond breaking **:** absorbs energy / endothermic.		
1(b) (iii)	The double bond is stronger than the single bond as it involves the sharing of two electron pairs rather than one as occurs in the single C–O bond.	More (less) energy : required to break : double (single) bonds.	Explanation links higher bond enthalpy to nature of bond and energy required to break bonds. one electron pair : C-O **OR** two electron pairs : C=O	
2(a)	$Ba(s) + N_2(g) + 3O_2(g) \rightarrow Ba(NO_3)_2(s)$	Correct equation, including states.		
2(b)	$\Delta_r H^\circ = \Sigma \Delta_f H_{\text{products}} - \Sigma \Delta_f H_{\text{reactants}}$ $= (5 \times -1676 + 3 \times -554) - 3 \times (-992)$ $= -7066$ kJ mol^{-1} or -7070 kJ mol^{-1} Accept answer with 3 or 4 significant figures.	Correct process for calculation / evidence of correct usage of three ratios in calculation. eg $(5 \times -1676 + 3 \times -554) - 3 \times (-992)$	Answer calculated correctly : kJ / kJ mol^{-1}	
2(c) (i) 2(c) (ii)	n(jelly-baby) = 4.56 g / 342 g mol^{-1} = 0.0133 mol E released = 0.0133×2192 kJ = 29.2 kJ **OR** $\Delta_r H = -29.2$ kJ $n(SrCl_2)$ vaporised = 29.2 kJ / 343 kJ mol^{-1} = 0.0851 mol $m(SrCl_2) = 0.0851$ mol $\times$ 159 g mol^{-1} = 13.5 g Allow follow-on if answer used from (i) is not 29.2 kJ. **Accept** 0.0132 mol jelly-baby 28.8 kJ 0.0841 mol $SrCl_2$ 13.4 g $SrCl_2$	Moles and energy (for the moles stated) calculated correctly. Sign can be positive or negative.	Three correct steps with one error eg input error, calculation error or transcription error.	Four correct steps with correct answers, correct sign and units.
3(a)	Hydrogen bonds involve the attraction between the H bonded to an O, N or F atom in one molecule and the non-bonding electrons on O, N or F in another molecule. Diagram may be included, but must indicate the Hydrogen bond with correct indication of polarity.	H is bonded: highly electronegative element: Intermolecular force.		

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
3(b)	• Propanoic acid has lower melting point than butanoic acid because same intermolecular forces (both acids) but Propanoic acid has a smaller mass / less electrons than butanoic acid hence temporary dipoles are weaker. • Ethyl ethanoate has a lower melting point because it cannot form hydrogen bonds between molecules, so intermolecular forces are weaker than for the two acids.	Differences in melting point linked to differences in nature / strength of intermolecular forces. Temporary dipoles / hydrogen bonding / intermolecular forces: any two appropriate molecules Eg butanoic acid has a higher melting point as it has stronger intermolecular forces than ethyl ethanoate.	Discussion of intermolecular forces and relationship to melting point, mostly correct. Temporary dipoles c/f H bonding : melting point **AND** butanoic/propanoic acid : ethyl ethanoate discussed **OR** butanoic:propanoic acid discussed.	Comprehensive discussion of different inter-molecular forces correctly linked to the variation in melting point for all 3 substances Temporary dipoles c/f H bonding: melting point **AND** butanoic : propanoic acid : ethyl ethanoate discussed.

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
FIVE opportunities answered at Achievement level or higher. 5 × A	SIX opportunities answered with at least three at Merit level or higher. 3 × M *plus* 3 × A	SEVEN opportunities answered with at least TWO at Excellence level and TWO at Merit level. 2 × E *plus* 2 × M *plus* 3 × A