Assessment schedule: practice paper 2026

AS 91390 Demonstrate understanding of thermochemical principles and the properties of particles and substances · Vertex Academy practice paper, not an NZQA paper

QUESTION ONE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	Fe (26 e^-): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$ Fe^{3+} (23 e^-): $4s^2$ and one 3d removed Br^- (36 e^-): $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6$	All three electron configurations correct.		
(b)	PCl_5: 5 regions, 0 lone pairs SF_4: 5 regions, 1 lone pair XeF_4: 6 regions, 2 lone pairs	All three shapes named correctly.		
(c)	across Period 3: nuclear charge increases, same energy level, similar shielding stronger attraction to outer electrons K: outer electron in level 4, further out, more shielding weaker attraction	States that ionisation energy increases across the period, OR that potassium's is lower than sodium's.	Explains the trend across the period (increasing nuclear charge, same energy level, similar shielding) AND why potassium is lower than sodium (further from the nucleus, more shielding).	
(d)	SF_4: 5 regions, 1 lone pair XeF_4: 6 regions, 2 lone pairs opposite S–F and Xe–F bonds polar SF_4 not symmetrical XeF_4 symmetrical	Correct shape of one molecule. States that the bonds are polar.	Explains one shape from the number of regions of electron density and lone pairs, OR explains the polarity of one molecule.	Justifies both shapes (five regions with one lone pair; six regions with two lone pairs opposite each other) AND both polarities, linking bond polarity to symmetry.

QUESTION TWO

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)

(a)	propane ethanal ethanol	Intermolecular forces correct for all three substances.		
(b)	(i) liquid to gas (ii) 3 mol gas to 2 mol gas (iii) ordered lattice to ions free in solution	All three correct, each with a reason.		
(c)	similar molar mass propane: temporary only ethanal: + permanent dipoles ethanol: + hydrogen bonds	Links a higher boiling point to stronger intermolecular forces for one substance.	Explains the order of all three, linking the similar molar masses to similar temporary dipole attractions and the extra permanent dipoles (ethanal) and hydrogen bonds (ethanol) to more energy needed.	
(d)	endothermic solid lattice to free ions system increase > surroundings decrease at 25 °C total entropy increases	States that the entropy of the system increases as the solid dissolves.	Explains the increase in entropy of the system (lattice to free ions) AND the decrease in entropy of the surroundings (heat absorbed).	Discusses both entropy changes AND justifies spontaneity: the increase in the entropy of the system outweighs the decrease in the surroundings, so the total entropy increases.

QUESTION THREE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$q = 50.0 \times 4.18 \times 10.2 = 2132$ J $n = 2.00 \div 40.0 = 0.0500$ mol $\Delta solH = -2.132 \div 0.0500 = -42.6$ kJ mol^{-1}	$\Delta solH = -42.6$ kJ mol^{-1}, with the negative sign.		
(b)	$2C(s) + 3H_2(g) + \frac{1}{2}O_2(g) \rightarrow C_2H_5OH(l)$ $\Delta fH^\circ = -277$ kJ mol^{-1}	Correct equation with states AND the enthalpy value.		

(c)	$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ products: 2(−394) + 3(−286) = −1646 reactants: −277 + 0 = −277 $\Delta cH° = -1646 - (-277) = -1369$ kJ mol^{-1}	Correct balanced equation, OR the correct total for the products (−1646 kJ).	$\Delta cH°$ = −1369 kJ mol^{-1}, from a correct method.	
(d)	q = 200 × 4.18 × 21.5 = 17 974 J n = 1.15 ÷ 46.0 = 0.0250 mol $\Delta cH = -17.97 \div 0.0250 = -719$ kJ mol^{-1} heat lost to air and can incomplete combustion, evaporation	q = 18.0 kJ (17 974 J), OR n = 0.0250 mol.	ΔcH = −719 kJ mol^{-1}, with the negative sign.	$\Delta cH = -719$ kJ mol^{-1} AND discusses at least two reasons it is less negative than −1369 kJ mol^{-1} (heat lost, incomplete combustion, evaporation), linking each to the energy measured.

Judgement for each question

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a.	2a, or 1m.	3a, or 1a and 1m.	4a, or 2a and 1m.	2m, or 1e.	2a and 2m, or 1m and 1e.	1e and 1m, with a minor error or omission elsewhere.	2a, 1m and 1e: every part correct.

Grade score out of 24 (each question's grade: N0 = 0 to E8 = 8): Not Achieved 0 to 7, Achieved 8 to 13, Merit 14 to 18, Excellence 19 to 24 (the 2025 exam's cut scores).