Assessment schedule: practice paper 2026

AS 91164 Demonstrate understanding of bonding, structure, properties and energy changes · Vertex Academy practice paper, not an NZQA paper

QUESTION ONE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	CH_4: 4 bonding regions, 0 lone pairs NH_3: 3 bonding regions, 1 lone pair CO_2: 2 regions (double bonds), 0 lone pairs	All three shapes named correctly, with bond angles.		
(b)	NH_3: 5 + 3 = 8 electrons CO_2: 4 + 12 = 16 electrons 2 lone pairs on each O, none on C	Both Lewis structures described correctly, with bonds and lone pairs.		
(c)	N–H and C=O bonds are both polar NH_3 trigonal pyramidal, not symmetrical CO_2 linear, symmetrical	Identifies the N–H and C=O bonds as polar, OR states that NH_3 is polar and CO_2 is non-polar.	Explains the polarity of both molecules by linking bond polarity to shape (whether the bond dipoles cancel).	
(d)	NH_3: 4 regions, 1 lone pair BF_3: 3 regions, 0 lone pairs N–H and B–F bonds are polar NH_3 not symmetrical BF_3 symmetrical	Correct shape for one molecule. Identifies the bonds in both molecules as polar.	Explains one shape from the number of regions of electron density and lone pairs, OR explains the polarity of one molecule from its bonds and shape.	Justifies both shapes (four regions with one lone pair, three regions with none) AND both polarities, linking bond polarity to symmetry.

QUESTION TWO

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

(a)	copper sodium chloride silicon dioxide iodine	Type of solid, particles and attractive forces correct for at least three of the four solids.		
(b)	delocalised electrons free to move metallic bonding is non-directional layers of cations slide	Describes delocalised electrons that are free to move (conduction) AND layers of cations that can slide without the bonding breaking (ductility).		
(c)	charged particles: Na^+ and Cl^- ions, no free electrons solid: ions fixed in the lattice by ionic bonds molten or dissolved: ions free to move	States that the charged particles in sodium chloride are ions.	Explains that the ions are held in fixed positions in the solid lattice, AND are free to move and carry charge when molten or dissolved.	
(d)	iodine: I_2 molecules I_2 non-polar water polar, hydrogen bonded SiO_2: covalent network solvent attractions too weak to break covalent bonds	Iodine: weak intermolecular forces between molecules. Silicon dioxide: strong covalent bonds in a network. I_2 is non-polar.	Explains the low melting point of iodine OR the high melting point of silicon dioxide from the forces overcome, OR explains why iodine dissolves in cyclohexane.	Compares the melting points of both, linking particles to the strength of the forces overcome, AND justifies the solubility of both substances in water and in cyclohexane.

QUESTION THREE

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

(a)	butane burning ammonium nitrate dissolving	Both processes classified correctly, with the sign of ΔrH and the temperature change.		
(b)	n = 25.0 ÷ 58.0 = 0.431 mol energy = 0.431 × 2877 energy released = 1240 kJ	n = 0.431 mol AND energy released = 1240 kJ (1.24 × 10^3 kJ).		
(c)	broken: 945 + 3 × 436 = 2253 kJ formed: 6 × 391 = 2346 kJ ΔrH = 2253 − 2346 = −93 kJ mol^{-1}	Correct total for bonds broken (2253 kJ) OR bonds formed (2346 kJ).	ΔrH = −93 kJ mol^{-1} AND explains the negative sign: more energy is released making bonds than is absorbed breaking them.	
(d)	broken: 4 × 414 + 2 × 498 = 2652 kJ formed: 2 × 804 + 4 × 463 = 3460 kJ ΔrH = 2652 − 3460 = −808 kJ mol^{-1} n = 8.00 ÷ 16.0 = 0.500 mol average bond enthalpies; liquid water releases extra energy on condensing	Correct total for bonds broken (2652 kJ) OR bonds formed (3460 kJ).	ΔrH = −808 kJ mol^{-1}, OR energy released for 8.00 g calculated correctly from their ΔrH.	ΔrH = −808 kJ mol^{-1} AND 404 kJ released, AND discusses both reasons for the difference (average bond enthalpies; condensing water vapour to liquid releases more energy).

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).