Assessment schedule: practice paper 2026

AS 91166 Demonstrate understanding of chemical reactivity · Vertex Academy practice paper, not an NZQA paper

QUESTION ONE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$ B: powder C: 2.0 mol L^{-1} acid D: 30 °C	Balanced equation AND the effect of all three changes stated correctly.		
(b)	alternative pathway, lower activation energy more collisions have enough energy catalyst not used up	Describes an alternative pathway with lower activation energy, so more collisions are successful.		
(c)	B: powder, larger surface area more frequent collisions C: higher concentration more frequent collisions	States that B or C has more collisions.	Explains both B and C in terms of more frequent collisions, giving more successful collisions per second.	
(d)	higher temperature collide more often larger proportion with energy ≥ activation energy rate × 1.9	States that particles have more energy or move faster at a higher temperature.	Explains both effects: more frequent collisions AND more collisions with energy equal to or greater than the activation energy.	Discusses both effects AND justifies that the larger proportion of collisions with enough energy is the main reason the rate nearly doubled.

QUESTION TWO

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$K_c = [HI]^2 \div ([H_2][I_2])$	Correct Kc expression.		

(b)	$K_c = 0.140^2 \div (0.0200 \times 0.0200)$ $K_c = 0.0196 \div 0.000400$ $K_c = 49.0$	$K_c = 49.0$ AND states that the equilibrium favours the products (HI).		
(c)	2 gas molecules ⇌ 1 gas molecule higher pressure less NO_2	States that the equilibrium shifts to the right, OR that more N_2O_4 forms.	Explains that higher pressure favours the side with fewer gas molecules (1 rather than 2), so the mixture becomes paler.	
(d)	forward exothermic heating $K_c = [N_2O_4] \div [NO_2]^2$ catalyst	States that the mixture becomes darker brown, OR that the equilibrium shifts to the left.	Explains the shift to the left using the endothermic reverse reaction, linked to the colour change.	Discusses the shift, the colour AND the decrease in Kc with a reason, AND contrasts this with a catalyst, which changes neither the position nor Kc.

QUESTION THREE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$[H_3O^+] = 0.0250$ mol L^{-1} $pH = -\log(0.0250)$ $pH = 1.60$	pH = 1.60.		
(b)	$[H_3O^+] = 10^{-11.20} = 6.31 \times 10^{-12}$ mol L^{-1} $[OH^-] = 1.00 \times 10^{-14} \div 6.31 \times 10^{-12}$ $[OH^-] = 1.58 \times 10^{-3}$ mol L^{-1}	$[H_3O^+] = 6.31 \times 10^{-12}$ mol L^{-1} AND $[OH^-] = 1.58 \times 10^{-3}$ mol L^{-1}.		
(c)	$HCl + H_2O \rightarrow H_3O^+ + Cl^-$ $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$ $[H_3O^+] = 1.32 \times 10^{-3}$ mol L^{-1}	One correct equation, OR states that HCl is a strong acid and ethanoic acid is a weak acid.	Explains with both equations: complete dissociation of HCl and partial dissociation of ethanoic acid, so $[H_3O^+]$ is higher in HCl.	

(d)	$NaOH \rightarrow Na^+ + OH^-$ $[H_3O^+] = 1.00 \times 10^{-14} \div 0.0500 = 2.00 \times 10^{-13}$ $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ NaOH: many ions NH_3: few ions	pH of NaOH = 12.7, OR a correct equation for ammonia reacting with water.	pH = 12.7 AND explains that ammonia has a lower pH because it only partly reacts with water.	pH = 12.7 AND discusses both pH and conductivity, linking complete dissociation of NaOH and partial reaction of NH_3 to the concentrations of OH^- and of ions.

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 8, Achieved 9 to 13, Merit 14 to 18, Excellence 19 to 24 (the 2025 exam's cut scores).