

Grade 10 Chemistry Midyear Exam

Units 1–5: quantitative reasoning through acids and bases

Name: _____

Date: _____

Time: 60 minutes. Calculator permitted. Show units and reasoning. All data cards are fictional paper models; use stated evidence only. Total: 30 points.

1. Which coefficient set balances $\text{Al} + \text{O}_2 \rightarrow \text{Al}_2\text{O}_3$? [1 pts]

A. 2,3,1

B. 4,3,2

C. 2,1,1

D. 1,1,1

2. Calculate moles in 22.0 g CO_2 , $M = 44.01 \text{ g/mol}$. [2 pts]

3. A compound is 40.0% C, 6.7% H, 53.3% O. Determine empirical formula. [3 pts]

4. Use $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. With 0.80 mol H_2 and 0.30 mol O_2 , identify limiting reactant and predicted water. [3 pts]

5. A 100.0 g water sample warms 20.0°C to 25.0°C . Use $c = 4.184 \text{ J/(g}^\circ\text{C)}$ to calculate q_{water} and q_{rxn} for an insulated cup. [3 pts]

6. Use Hess cards: $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$, -394 kJ ; $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2$, -283 kJ . Find ΔH for $\text{C} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}$.
[3 pts]

7. A concentration-time graph is steep then less steep. Draw a small labeled sketch and explain the rate trend using collision theory. [3 pts]

8. In a controlled rate table with all other conditions held constant, $[\text{A}]$ doubles from 0.10 M to 0.20 M while initial rate doubles 2.0 to 4.0 units/s. State supported conclusion and one conclusion not established.
[2 pts]

9. For $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$, write K_c ; then predict shift if $Q < K$. [3 pts]

10. A diagram shows equal forward/reverse arrows at equilibrium. Draw particle-level labels showing dynamic exchange, then state why equal concentrations are not required. [2 pts]

11. pH is 3.00. Calculate $[\text{H}_3\text{O}^+]$; then explain why pH alone does not prove a solution is safe to drink.
[3 pts]

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12. A student claims an 82.5% yield proves atoms disappeared and a positive cell potential proves a product safe. Correct both claims using conservation and evidence limits. [2 pts]
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