

Grade 10 Chemistry Start Diagnostic

Quantitative, reaction, and model readiness

Name: _____

Date: _____

This internal diagnostic is a starting-point check for instructional planning. It is not a grade, proficiency, placement, or release claim. Work independently; a basic calculator is optional. Treat every data card as a fictional paper model unless a prompt says otherwise.

Directions. Select the best answer where choices are given. Show units and reasoning for calculations. The 12 items total 20 points.

1. A fictional lab card reports: "The balance reading changed from 3.00 g to 2.84 g, and bubbles appeared." Which statement is an *inference*, rather than a direct observation? [1 pts]

A. The balance reading changed. B. Bubbles appeared.
C. A chemical reaction occurred. D. The final mass was 2.84 g.

2. Which coefficient set correctly 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

3. Use $C = 12.01$ g/mol and $O = 16.00$ g/mol. Calculate the molar mass of CO_2 . [2 pts]

4. A sample contains 18.0 g of water. Using $M_{\text{H}_2\text{O}} = 18.0$ g/mol, calculate the amount of water in moles. [2 pts]

5. Hydrogen reacts according to $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. If 0.60 mol of H_2 reacts completely with excess oxygen, determine both: (a) moles of O_2 required and (b) moles of H_2O predicted. [2 pts]
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6. A mixture begins with 0.40 mol of H_2 and 0.30 mol of O_2 . For the same balanced equation, identify the limiting reactant and calculate the moles of excess reactant remaining after reaction. [2 pts]
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7. A fictional reaction card lists $\Delta H = -50 \text{ kJ}$ for the reaction as written. Is the reaction endothermic or exothermic? Briefly connect your answer to the sign of ΔH . [1 pts]
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8. A student changes only the concentration of reactant A in a controlled paper-model trial. Interpret the table. [2 pts]

Trial	[A] (M)	Initial rate (arbitrary units)
1	0.10	3.0
2	0.20	6.0

By what factor did the initial rate change? State one careful conclusion this two-trial card supports, and one conclusion it does *not* establish.

9. A reaction system has $Q = 0.25$ and $K = 1.0$ at the stated temperature. Which direction is favored as the system moves toward equilibrium? [1 pts]

A. Toward reactants, because $Q < K$
B. Toward products, because $Q < K$
C. Neither direction, because $Q = K$
D. The direction cannot be related to Q and K

10. A solution has $\text{pH} = 3.00$. Calculate $[\text{H}_3\text{O}^+]$. [2 pts]

11. A fictional galvanic-cell card gives $E^\circ_{\text{cathode}} = +0.34 \text{ V}$ and $E^\circ_{\text{anode}} = -0.76 \text{ V}$. Calculate E°_{cell} . Then state the direction of electron flow in the external circuit. [2 pts]

12. A poster claims: "Because our calculated cell potential is positive, this battery product is safe and will last a long time." Identify one unsupported part of this claim and explain what the calculated cell potential can support instead. [2 pts]

For instructor use: use the companion item map to select a targeted Grade 10 reteach path. Do not use this single check as a placement or release decision.