

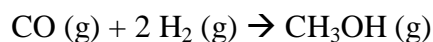
Part I (60pts). 15 multiple-choice questions worth 4 points each. Choose the **best** answer from the options given, and **record your final answer on your scantron.**

- What is the process in which molecules undergo a phase change directly from the solid phase to the gas phase?
A. sublimation B. deposition C. freezing D. condensation E. melting
- Which of the following is a weak acid?
A. HF B. HBr C. HCl D. HNO₃ E. H₂SO₄
- Which is the net ionic equation for the reaction between aqueous solutions of LiOH and HBr?
A. $\text{Li}^+(aq) + \text{OH}^-(aq) + \text{H}^+(aq) + \text{Br}^-(aq) \rightarrow \text{H}_2\text{O}(l) + \text{LiBr}(aq)$
B. $\text{H}^+(aq) + \text{OH}^-(aq) \rightarrow \text{H}_2\text{O}(l)$
C. $\text{LiOH}(aq) \rightarrow \text{Li}^+(aq) + \text{OH}^-(aq)$
D. $\text{HBr}(aq) \rightarrow \text{H}^+(aq) + \text{Br}^-(aq)$
E. $\text{Li}^+(aq) + \text{Br}^-(aq) \rightarrow \text{LiBr}(aq)$
- If aqueous solutions of ammonium sulfide and copper(II) nitrate are mixed, which insoluble precipitate is formed?
A. Cu₂S B. NH₄NO₃ C. CuSO₄ D. CuS E. NH₄(NO₃)₂
- If aqueous solutions of Na₂CO₃ and BaCl₂ are mixed, which insoluble precipitate is formed?
A. Ba₂CO₃ B. BaCO₃ C. NaCl₂ D. BaO E. NaCl
- Based on the solubility rules, which of these processes will occur if solutions of CuSO₄(aq) and BaCl₂(aq) are mixed?
A. No precipitate will form.
B. CuCl₂ will precipitate; Ba²⁺ and SO₄²⁻ are spectator ions.
C. CuSO₄ will precipitate; Ba²⁺ and Cl⁻ are spectator ions.
D. BaCl₂ will precipitate; Cu²⁺ and SO₄²⁻ are spectator ions.
E. BaSO₄ will precipitate; Cu²⁺ and Cl⁻ are spectator ions.
- Based on the solubility rules, which one of these compounds is *soluble* in water?
A. Ag₂S B. Na₂S C. Ag₂CO₃ D. Hg₂Cl₂ E. BaCO₃
- The location that indicates conditions under which two phases can exist in equilibrium is called the
A. transition state. B. phase diagram. C. phase boundary. D. critical point. E. triple point.
- What is the net ionic equation if sodium sulfate is mixed with barium hydroxide?
A. $\text{Ba}^{2+}(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{BaSO}_4(s)$
B. $2\text{Ba}^+(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{Ba}_2\text{SO}_4(s)$
C. $\text{Na}^+(aq) + \text{OH}^-(aq) \rightarrow \text{NaOH}(s)$
D. $\text{Ba}^{2+}(aq) + 2\text{OH}^-(aq) \rightarrow \text{Ba}(\text{OH})_2(s)$
E. $2\text{Na}^+(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{Na}_2\text{SO}_4(s)$
- Which of the following gases effuses most rapidly?
A. N₂ B. O₂ C. HCl D. NH₃ E. CO
- What name is given to the phenomenon where a thin film of water contracts and adheres to the wall of a glass cylinder?
A. Cohesion B. Polarity C. Surface tension D. Capillary action E. Adhesion

12. Based on the solubility rules, which one of these compounds is *insoluble* in water?
 A. AgBr B. NaCl C. ZnCl₂ D. MgBr₂ E. FeCl₂
13. The distinguishing characteristic of all electrolyte solutions is that they
 A. contain molecules. D. conduct heat.
 B. react with other solutions. E. always contain acids.
 C. conduct electricity.
14. Based on the solubility rules, which one of these compounds is *soluble* in water?
 A. PbSO₄ B. CaSO₄ C. K₂SO₄ D. BaSO₄ E. Ag₂SO₄
15. Which chemical equation describes an *acid–base neutralization reaction*?
 A. $\text{LiOH}(aq) + \text{HNO}_3(aq) \rightarrow \text{LiNO}_3(aq) + \text{H}_2\text{O}(l)$
 B. $2\text{Al}(s) + 3\text{H}_2\text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(aq) + 3\text{H}_2(g)$
 C. $2\text{KBr}(aq) + \text{Cl}_2(g) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)$
 D. $2\text{SO}_2(g) + 2\text{H}_2\text{O}(l) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{SO}_4(aq)$
 E. $\text{CaBr}_2(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{CaSO}_4(s) + 2\text{HBr}(g)$

Part 2 (40pts). Calculations: Clearly (and legibly) show all work on the blank space on the scantron answer sheet for full credit. Do not wait until the end of the test to transfer your answers.

- (10 pts) A sample of gas has an initial volume of 5.65 L at a pressure of 735 mmHg. If the volume of the gas is increased of 9.45 L, what is its new pressure in mmHg?
- (10 pts) A chemist wants to make 5.50 L of a 0.300 M CaCl₂ solution? What mass in grams should the chemist use? (MM of CaCl₂ = 110.98 g/mol)
- (10 pts) Methanol gas can be synthesized by the reaction below. What volume of methanol gas is produced if 2.5L of CO is reacted with 3.5 L of H₂ at constant pressure and temperature?



- (10 pts) Oxygen gas reacts with powdered aluminum to make aluminum oxide according to the balanced reaction below. What mass of aluminum oxide is produced if 2.75 L of O₂ at 1.00 atm and 298K is reacted with excess aluminum? (MM of Al₂O₃ = 101.96 g/mol)

