PRACTICE SET 5

Passage II: Four Industrial Chemicals

5 questions (8–12) · suggested time 8 minutes

1. Read the passage and answer all 5 questions on your own. No notes, no calculator.
2. Check your answers with the key on the last page.
3. Watch the walkthrough video to see how each question is broken down.

Passage II

Four chemicals produced in large quantities in the United States are H_2SO_4, NH_3, N_2, and O_2. The latter three are gases, and H_2SO_4 is produced by gaseous reactions. The preparation of H_2SO_4 involves the following Reactions (I–III).

$$S(s) + O_2(g) \rightarrow SO_2(g) \qquad \Delta H = -296.8 \text{ kJ/mol}$$

Reaction I

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H = -197.8 \text{ kJ/mol}$$

Reaction II

$$SO_3(g) + H_2O(l) \rightarrow H_2SO_4(aq) \qquad \Delta H = -132.6 \text{ kJ/mol}$$

Reaction III

NH_3 is prepared commercially by the reaction of N_2 with H_2 (Reaction IV). NH_3 has a tendency to form coordination compounds, such as $[Co(NH_3)_6]Cl_3$, in which NH_3 forms covalent bonds with a transition metal ion.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ/mol}$$

Reaction IV

N_2 and O_2 are both prepared by the fractional distillation of air. Air samples are first condensed to the liquid state and then passed through a distilling column. The N_2 separates first, and then the O_2 is obtained.

8 The ability of NH_3 to form coordination compounds with transition metal ions can best be accounted for by the fact that NH_3:

- (A) acts as an electron pair donor.
- (B) is capable of hydrogen bonding.
- (C) is a weak base in aqueous solution.
- (D) contains N with a −3 oxidation number.

9 N_2 has a lower boiling point than O_2. Which of the following statements best accounts for this difference?

- (A) N_2 is less reactive than is O_2.
- (B) N_2 is less electronegative than is O_2.
- (C) N_2 has a lower molecular weight than does O_2.
- (D) N_2 contains a triple bond, and O_2 contains a double bond.

10 When Reaction IV is in a state of equilibrium, which of the following changes will cause more NH_3 to form?

- (A) Addition of H_2
- (B) A decrease in pressure
- (C) An increase in temperature
- (D) Addition of a catalyst

11 In the fractional distillation of air, the N_2 separates before the O_2 because N_2:

- (A) is less reactive than O_2.
- (B) is less electronegative than O_2.
- (C) has a triple bond and O_2 has a double bond.
- (D) has a lower boiling point than O_2.

12 If 36 g of S and 32 g of O_2 were used in Reaction I, which of the following would be the limiting reagent?

- (A) S
- (B) O_2
- (C) SO_2
- (D) There would not be a limiting reagent.

Finished all 5 questions?

Only check the key once you've committed to an answer for every question.

YOUR ANSWERS

8	9	10	11	12	Score / 5

Q	ANSWER	
8	A	acts as an electron pair donor.
9	C	N_2 has a lower molecular weight than does O_2.
10	A	Addition of H_2
11	D	has a lower boiling point than O_2.
12	B	O_2

NOW WATCH THE WALKTHROUGH

Breaking Down AAMC Passage-Based Questions (Chemistry Passage Part 2)

Every question broken down step by step: where the information is in the passage, and why each wrong option is wrong.