

SOME (NOT ALL) Practice Problems for Chapter 4 and 5 – Updated Oct 11, 2010

1. What is the oxidation number of each sulfur atom in the compound, $\text{Rb}_2\text{S}_2\text{O}_4$?

- a. -2
- b. +1
- ! c. +3
- d. +5
- e. +6

2. What is the oxidation number of each sulfur atom in the $\text{S}_2\text{O}_8^{2-}$ ion?

- a. -2
- b. +1
- c. +3
- d. +5
- ! e. +7

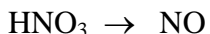
3. The CrO_4^{2-} ion was involved in a chemical reaction during which it was transformed into Cr^{3+} ions. What is the change in oxidation number of the chromium atom?

- a. increase by 5 units
- b. decrease by 5 units
- c. increase by 1 unit
- ! d. decrease by 3 units
- e. decrease by 4 units

4. Which one of the following processes represents an oxidation?

- a. $\text{Ba}^{2+}(aq) + \text{CrO}_4^{2-}(aq) \rightarrow \text{BaCrO}_4(s)$
- b. $2 \text{H}^+(aq) + \text{CO}_3^{2-}(aq) \rightarrow \text{H}_2\text{O}(l) + \text{CO}_2(g)$
- c. $\text{Fe}^{3+}(aq) \rightarrow \text{Fe}^{2+}(aq)$
- ! d. $\text{MnO}_2(s) \rightarrow \text{MnO}_4^-(aq)$
- e. $2 \text{CrO}_4^{2-}(aq) + 2 \text{H}^+(aq) \rightarrow \text{Cr}_2\text{O}_7^{2-}(aq) + \text{H}_2\text{O}(l)$

5. What is the change in oxidation number of each nitrogen atom in the process,



- a. +3
- b. -6
- c. -1
- ! d. -3
- e. +5

6. The sulfite ion(SO_3^{2-}) was involved in a chemical reaction in which it underwent oxidation. Based on the change in oxidation numbers, which one of the products listed below is a possible oxidation product of the sulfite ion?

- a. $\text{S}_2\text{O}_3^{2-}(\text{aq})$
- b. $\text{SO}_2(\text{g})$
- c. $\text{S}^{2-}(\text{aq})$
- d. $\text{S}(\text{s})$
- ! e. $\text{SO}_4^{2-}(\text{aq})$

7. In the reaction, $\text{C}_4\text{H}_{10}(\text{l}) + \text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{H}^+(\text{aq}) \rightarrow \text{H}_6\text{C}_4\text{O}_4(\text{s}) + \text{Cr}^{3+}(\text{aq}) + \text{H}_2\text{O}(\text{l})$

the change in the oxidation number of the chromium atom is

- a. -6
- ! b. -3
- c. +3
- d. +5
- e. +8

8. Which one of the following compounds produces 4 ions by dissociation (ionization) when dissolved in water?

- a. NaCl
- b. $\text{Mg}(\text{OH})_2$
- ! b. $\text{Al}(\text{NO}_3)_3$
- d. NaBrO_3
- e. Na_2SO_4

9. In the reaction, $\text{K}_2\text{SO}_4(\text{aq}) + \text{Ba}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2 \text{KNO}_3(\text{aq})$, which ions are the spectator ions?

- a. Ba^{2+} and SO_4^{2-}
- b. Ba^{2+} and K^+
- c. Ba^{2+} and NO_3^-
- d. K^+ and SO_4^{2-}
- ! e. K^+ and NO_3^-

10. Which one of the following compounds is insoluble in water?

- a. KNO_3
- b. $\text{Pb}(\text{NO}_3)_2$
- c. Na_2SO_4
- ! d. PbSO_4
- e. MgCl_2

11. According to the Arrhenius theory of Acids and Bases, acids are substances which

- a. exhibit a sour taste
- b. react with all metals to release hydrogen gas
- c. react with all metals to release carbon dioxide gas
- ! d. release hydrogen ions when dissolved in water to form a solution

12. Which one of the following bases is NOT a known strong base?

- a. $\text{Ca}(\text{OH})_2(aq)$
- b. $\text{Ba}(\text{OH})_2(aq)$
- c. $\text{KOH}(aq)$
- d. $\text{NaOH}(aq)$
- ! e. $\text{NH}_3(aq)$

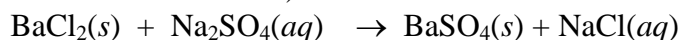
13. 66.7 mL of 18.0 molar sulfuric acid solution was dissolved in enough water to make 500 mL of solution. The molarity of the diluted mixture is

- ! a. 2.40 molar
- b. 0.135 molar
- c. 36.0 molar
- d. 9.00 molar
- e. 0.00741 molar

14. Sodium acetate, $\text{NaC}_2\text{H}_3\text{O}_2$, has a formula weight of 82.034. What is the molar concentration of a solution prepared by dissolving 4.10 grams of sodium acetate in enough water to prepare 250 mL of the solution?

- ! a. 0.200 molar
- b. 1.025 molar
- c. 1.345 molar
- d. 5.00 molar
- e. 16.4 molar

15. How many mL of 0.200 molar $\text{Na}_2\text{SO}_4(aq)$ solution are required to completely react with 3.23 grams of BaCl_2 (formula weight = 208.2) to form products as shown below? (Reaction is NOT balanced)



- a. 0.0155 ml
- b. 0.0776 ml
- c. 15.5 ml
- d. 31.0 ml
- ! e. 77.6 ml

16) What volume of 0.305 M aqueous solution of AgNO₃ is required to react exactly with 155.0 mL of 0.274 M aqueous solution of Na₂SO₄ solution? Hint: you will want to write a balanced reaction.

- A) 581 mL
- B) 173 mL
- C) 345 mL
- D) 139 mL
- E) 278 mL

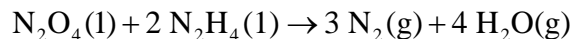
Answer: E

17) Determine the concentration of a solution prepared by diluting 25.0 mL of a concentrated 0.188 M Ca(NO₃)₂ solution to 150.0 mL.

- A) 1.13 M
- B) 0.0887 M
- C) 0.0313 M
- D) 0.0199 M
- E) 0.0501 M

Answer: C

18) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N₂O₄ and 45.0 g N₂H₄.



- A) LR = N₂H₄, 59.0 g N₂ formed
- B) LR = N₂O₄, 105 g N₂ formed
- C) LR = N₂O₄, 45.7 g N₂ formed
- D) LR = N₂H₄, 13.3 g N₂ formed
- E) No LR, 45.0 g N₂ formed

Answer: C

19) What pressure (in atm) will 0.44 moles of CO₂ exert in a 2.6 L container at 25°C?

- A) 0.35 atm
- B) 4.1 atm
- C) 4.7 atm
- D) 8.6 atm
- E) 3.6 atm

Answer: B

20) How many moles of CO are contained in a 5.00 L tank at 155°C and 2.80 atm?

- A) 0.399 moles
- B) 1.10 moles
- C) 2.51 moles
- D) 0.455 moles
- E) 0.289 moles

21) What temperature must a balloon, initially at 25 °C and 2.00 L, be heated to in order to have a volume of 6.00 L?

- A) 993 K
- B) 403 K
- C) 75 K
- D) 655 K
- E) 894 K

22) A large balloon is initially filled to a volume of 25.0 L at 353 K and a pressure of 2575 mm Hg. What volume of gas will the balloon contain at 1.35 atm and 253 K?

- A) 22.2 L
- B) 87.5 L
- C) 11.4 L
- D) 45.0 L
- E) 58.6 L

Answer: D

23) Which of the following samples will have the greatest average speed at 355 K?

- A) Ne
- B) C₂H₄
- C) Cl₂
- D) CH₄
- E) All of these samples will have the same average speed at the same T.

Answer: D

24) A 0.334 g sample of an unknown halogen occupies 109 mL at 398 K and 1.41 atm. What is the identity of the halogen?

- A) Br₂
- B) F₂
- C) Cl₂
- D) I₂
- E) Ge

Answer: C

25) A mixture of 0.220 moles CO, 0.350 moles H₂ and 0.640 moles He has a total pressure of 2.95 atm. What is the partial pressure of H₂?

- A) 1.17 atm
- B) 0.853 atm
- C) 1.03 atm
- D) 0.969 atm
- E) 0.649 atm

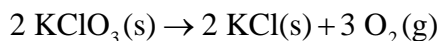
Answer: B

26) A mixture of 10.0 g of Ne and 10.0 g Ar have a total pressure of 1.6 atm. What is the partial pressure of Ne?

- A) 1.1 atm
- B) 0.80 atm
- C) 0.54 atm
- D) 0.40 atm
- E) 1.3 atm

Answer: A

27) Determine the volume of O₂ (at STP) formed when 50.0 g of KClO₃ decomposes according to the following reaction. The molar mass for KClO₃ is 122.55 g/mol.



- A) 9.14 L
- B) 8.22 L
- C) 12.3 L
- D) 13.7 L
- E) 14.6 L

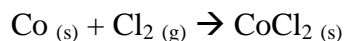
Answer: D

28. a) 760 mmHg equals how many atm? _____

b) The combined gas law is a combination of what two laws? _____ &

c) The oxidation number of Mn in KMnO₄ is _____

d) In the following equation, which is the oxidizing agent?



e) True or False. All molecules of a particular gas (e.g., O_2) travel at exactly the same speed when T, P and V are held constant

f). What is the difference between a barometer and manometer? (4 points)

29. It takes 44 seconds for a sample of $N_2(g)$ to effuse through a tiny orifice. Determine the molecular mass of the gas whose effusion time under exactly the same conditions is 75 seconds. (4 points)

30. How can differentiate between a ppt reaction, an acid base reaction, and a REDOX, just by looking at the balance chemical equation. List all 'tell tale' signs for each!