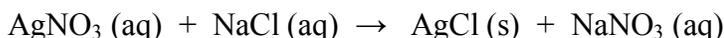


PART 1. MULTIPLE CHOICE and FILL IN THE BLANK. Circle the best answer or fill in the blank. **CAUTION:** Some questions may appear similar to homework questions but are probably not exactly the same.

1. The following reaction is an example of a _____ reaction. (2 pts.)



- a. single replacement
- *b. double replacement**
- c. combination
- d. decomposition
- e. endothermic

2. Which of the following is an example of a chemical change? (2 pts)

- a. boiling water
- b. dissolving salt in water
- *c. rusting of iron**
- d. evaporation of water
- e. freezing of water

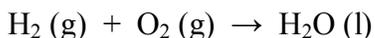
3. A reaction that absorbs heat is _____. (2 pts)

- a. an exothermic reaction.
- *b. an endothermic reaction.**
- c. an oxidation reaction.
- d. a double replacement reaction.
- e. a single replacement reaction.

4. The _____ is the minimum energy needed for a chemical reaction to begin. (2 pts)

- a. reaction energy
- *b. activation energy**
- c. energy of reactants
- d. energy of products
- e. heat of reaction

5. The reaction shown below is exothermic, therefore, the energy level of the reactants is _____. (2 pts)



- a. lower than that of the products.
- *b. higher than that of the products.**
- c. the same as that of the products.
- d. possibly lower, possibly higher than that of the products.
- e. higher than the activation energy of the reaction.

6. A catalyst _____. (2 pts)
- slows down a reaction by increasing the activation energy.
 - speeds up a reaction by changing the heat of the reaction.
 - speeds up a reaction by lowering the activation energy.
 - speeds up a reaction by increasing the activation energy.
 - slows down an reaction lowering the activation energy.
7. The following reaction is an example of a _____ reaction. (2 pts.)



- single replacement
- double replacement
- combination
- decomposition
- endothermic

8. Which of the following will increase the rate of reaction? (2 pts.)

- increasing the temperature
- increasing the amount of the reactants
- adding a catalyst
- all of the above
- none of the above

9. According to kinetic molecular theory of gases, particles of a gas (2 pts.)

- move slowly.
- lose their valence electrons.
- are very large particles.
- are very far apart.
- decrease kinetic energy as temperature increases.

10. Boyles Law says that as the volume of a gas is increased, the pressure of the gas _____. (2 pts.)

- decreases
- increases
- stays the same

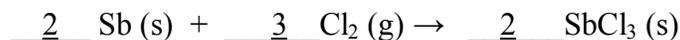
11. Charles' Law says that as the temperature increases, the volume of the gas _____. (2 pts)

- decreases
- increases
- stays the same

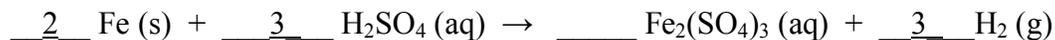
12. Which of the following is NOT a potential use for a hyperbaric chamber? (2 pts.)

- counteracting carbon monoxide poisoning.
- treatment for burns and infections.
- treating divers with the bends.
- increasing the rate at which a broken bone heals.
- treating some cancers.

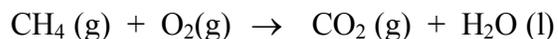
13. Balance the following reaction: (3 pts)



14. Balance the following reaction. (3 pts)



15. In this reaction, methane gas (CH₄) is burned. What is the substance reduced? (2 pts.)



- a. C
- *b. O**
- c. CO₂
- d. H₂O
- e. H

16. For gases, what is STP? (2 pts)

- *(a) 1 atm and 0°C**
- (b) 760 Torr and 25°C
- (c) 1 Pa and 25°C
- (d) 760 atm and 0°C
- (e) 760 atm and 25°C

17. The loss of electrons is _____. (2 pts)

- a. reduction
- *b. oxidation**
- c. combination
- d. exothermic
- e. catalytic conversion

18. What is the oxidation charge of oxygen in CO₂? (1 pt)

- a. +1
- b. +2
- c. -1
- *d. -2**
- e. 0
- f. it doesn't have one.

19. What is the oxidation charge of carbon in CO₂? (1 pt)

- a. +2
- *b. +4**
- c. -2
- d. -4
- e. 0
- f. it doesn't have one.

PART 2. PROBLEMS. Show all units. Show all answers to correct significant figures. SHOW WORK for Partial Credit.

20. How many CO₂ molecules are in 5.0 moles of CO₂ molecules? (4 pts)

$$5.0 \text{ moles CO}_2 \left(\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mole}} \right) = 3.0 \times 10^{24} \text{ CO}_2 \text{ molecules}$$

21. What is the molar mass of CO₂? (4 pts)

$$44.0098 \text{ g/mole}$$

22. How many moles of CO₂ are in 10.0 g of CO₂? (5 pts)

$$10.0 \text{ g CO}_2 \left(\frac{1 \text{ mole}}{44.0098 \text{ g}} \right) = 0.227 \text{ moles}$$

23. How many moles of carbon are in 3.0 moles of C₆H₁₂O₆ (glucose)? (3 pts)

$$3.0 \text{ moles C}_6\text{H}_{12}\text{O}_6 \left(\frac{6 \text{ moles C}}{1 \text{ mole C}_6\text{H}_{12}\text{O}_6} \right) = 18 \text{ moles C}$$

24. What is the molar mass of glucose (C₆H₁₂O₆)? (3 pts)

$$180.15768 \text{ g/mole}$$

25. The barometric pressure today is 765.8 mm Hg. What is this pressure in atm? (4 pts)

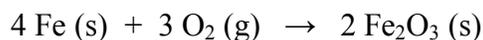
$$765.8 \text{ mm Hg} \left(\frac{1 \text{ atm}}{760 \text{ mm Hg}} \right) = 1.008 \text{ atm}$$

26. How many moles of O_2 gas are needed to react with 10.0 moles of Fe in the following reaction? (4 pts)



$$10.0 \text{ mole Fe} \left(\frac{3 \text{ mole O}_2}{4 \text{ mole Fe}} \right) = 7.50 \text{ moles O}_2$$

27. If 10.0 moles of iron react in the following reaction, how many moles of iron (III) oxide will be produced? (4 pts)



$$10.0 \text{ mole Fe} \left(\frac{2 \text{ mole Fe}_2\text{O}_3}{4 \text{ mole Fe}} \right) = 5.00 \text{ mole Fe}_2\text{O}_3$$

28. If 10.0 g of iron react in the following reaction, how many grams of iron (III) oxide will be produced? (8 pts)



$$10.0 \text{ g Fe} \left(\frac{1 \text{ mole Fe}}{55.845 \text{ g}} \right) \left(\frac{2 \text{ mole Fe}_2\text{O}_3}{4 \text{ mole Fe}} \right) \left(\frac{159.6882 \text{ g}}{1 \text{ mole Fe}_2\text{O}_3} \right) = 14.3 \text{ g Fe}_2\text{O}_3$$

29. The volume of air in a person's lungs is 615 mL at a pressure of 760 Torr. Inhalation occurs as the pressure in the lungs drops to 752 Torr. To what volume did the lungs expand? (6 pts)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \Rightarrow \quad P_1 V_1 = P_2 V_2 \quad \Rightarrow$$

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(615 \text{ mL})(760 \text{ Torr})}{752 \text{ Torr}} = 622 = 620 \text{ mL}$$

30. A 100.0 mL bubble of hot gases at 225°C and 1.80 atm escapes from an active volcano. What is the new volume of the bubble outside the volcano where the temperature is -25°C and the pressure is 0.80 atm? (8 pts)

$$\begin{array}{ll} V_1 = 100.0 \text{ mL} & V_2 = ? \\ T_1 = 225^\circ\text{C} = 498 \text{ K} & T_2 = -25^\circ\text{C} = 248 \text{ K} \\ P_1 = 1.80 \text{ atm} & P_2 = 0.80 \text{ atm} \end{array}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow \text{solve for } V_2 \Rightarrow \frac{P_1 V_1 T_2}{T_1} = \frac{P_2 V_2 * T_2}{T_2} \Rightarrow \frac{P_1 V_1 T_2}{T_1} = \frac{P_2 V_2}{T_1} \Rightarrow \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{P_2 V_2}{P_2}$$

$$\Rightarrow \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{V_2}{1} = \frac{(1.80 \text{ atm})(100.0 \text{ mL})(248 \text{ K})}{(498 \text{ K})(0.80 \text{ atm})} = 112.048 \text{ mL} = 110 \text{ mL}$$

31. How many moles of helium does a 2.0 liter helium balloon contain? (4 pts)

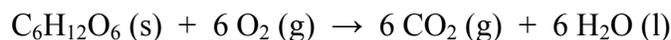
$$2.0 \text{ L} \left(\frac{1 \text{ mole}}{22.4 \text{ L}} \right) = 0.089 \text{ moles He}$$

32. If the total pressure of air is 760.0 mm Hg, the partial pressure of nitrogen is 594.0 mm Hg, the partial pressure of carbon dioxide is 0.3 mm Hg, and the partial pressure of water vapor is 5.7 mm Hg; what is the partial pressure of oxygen, assuming the only gases in this sample of air are nitrogen, carbon dioxide, water vapor, and oxygen? (4 pts)

$$P_{\text{total}} = P_{\text{N}_2} + P_{\text{CO}_2} + P_{\text{H}_2\text{O}} + P_{\text{O}_2} \Rightarrow P_{\text{O}_2} = P_{\text{total}} - P_{\text{N}_2} - P_{\text{CO}_2} - P_{\text{H}_2\text{O}}$$

$$P_{\text{O}_2} = 760.0 \text{ mmHg} - 594.0 \text{ mmHg} - 0.3 \text{ mmHg} - 5.7 \text{ mmHg} = 160.0 \text{ mmHg}$$

33. Glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, is metabolized in living systems according to the reaction



How many grams of glucose react when 2.5 L CO_2 are produced at STP? (4 pts.)

$$2.5 \text{ L CO}_2 \left(\frac{1 \text{ mole CO}_2}{22.4 \text{ L}} \right) \left(\frac{1 \text{ mole C}_6\text{H}_{12}\text{O}_6}{6 \text{ mole CO}_2} \right) \left(\frac{180.15768 \text{ g}}{1 \text{ mole C}_6\text{H}_{12}\text{O}_6} \right) = 3.4 \text{ g C}_6\text{H}_{12}\text{O}_6$$