

Please read all the questions VERY carefully before answering. Ask your instructor if you don not understand. No outside paper is allowed. The last page is a periodic table with constants. Total points = $57 + (21 * 3 =) 63 = 120$

SHORT ANSWER. Please write the set-up equation first, then put the raw data with units before calculating. Write the word or phrase that best completes each statement or answers the question.

1) Iron, Fe(s) reacts with oxygen gas, O₂(g) to produce Fe₂O₃ (s). Calculate moles of Fe₂O₃ produced from 2.3 moles of Fe (4 pts.) 1) _____

2) In the reaction between Fe₂O₃ (s) and Al (s) to produce Fe (s) and Al₂O₃ (s), 23.5 g of Fe₂O₃ was reacted with 13.2 g of Al. (a) Show all your calculations to find out the limiting reagent (8 pts.) 2) _____

(b) Calculate the amount (in grams) of the reagent that remained unreacted (6 pts.)

3) Calculate the volume of NH_3 (g) in liters at 729°C and 4.5 atm pressure that is required to react with 2.52 moles of O_2 (g) according to reaction, $4 \text{NH}_3(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$ (8 pts.)

3) _____

4) A ball has a volume of 120.3 cm^3 and it contains 0.25 g of N_2 gas. Calculate the pressure inside the ball at 31°C (6 pts.)

4) _____

5) An inflated balloon has a volume of 6.0 L at 1 atm pressure and at 22°C . Calculate its volume when it ascends to an altitude where the pressure is 0.45 atm and the temperature is -21°C . (5 pts.)

5) _____

6) When nitrogen (N_2) gas is collected by decomposing NH_4NO_2 (s) $\rightarrow \text{N}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{g})$, its volume is 3.27 mL at 19.5°C and 753.0 mm of mercury pressure. Calculate how many grams of NH_4NO_2 was decomposed. Vapor pressure of water at 19.5°C is 17.0 torr. (10 pts.) 6) _____

7) An evacuated flask weighs 134.567 g. When filled with an unknown gas at 735 torr and 31°C , it weighs 137.456 g. If the flask is filled with water at 31°C , it weighs 1067.9 g. If the ideal gas law applies and the density of water at 31°C is 0.997 g/mL, then calculate the molar mass (in grams per mole) of the unknown gas. (10 pts.) 7) _____

MULTIPLE CHOICE. On the scantron, fill up the circle with the same number as the question number. Choose the one alternative that best completes the statement or answers the question (3 pts each).

8) When the equation $__ \text{NO}_2 + __ \text{H}_2\text{O} + __ \text{O}_2 \rightarrow __ \text{HNO}_3$ is balanced, the coefficient of HNO_3 is _____
is
A) 5.
B) 3.
C) 2.
D) 4.
E) none of the above

9) What are the coefficients for the following reaction when it is properly balanced? _____
 $__ \text{O}_2 + __ \text{CH}_4 \rightarrow __ \text{CO}_2 + __ \text{H}_2\text{O}$
A) 2, 1, 3, 1
B) 2, 1, 1, 2
C) 2, 3, 2, 2
D) 1, 3, 2, 1
E) none of the above

10) Which of the following equations is NOT balanced properly? _____
A) $4\text{NH}_3 + 14\text{O}_2 \rightarrow 4\text{NO}_2 + 6\text{H}_2\text{O}$
B) $2\text{Cr} + 6\text{HCl} \rightarrow 2\text{CrCl}_3 + 3\text{H}_2$
C) $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$
D) $\text{Cr}_2(\text{SO}_4)_3 + 6\text{KOH} \rightarrow 2\text{Cr}(\text{OH})_3 + 3\text{K}_2\text{SO}_4$
E) none of the above

11) Which of the following compounds is INSOLUBLE? _____
A) magnesium bromide
B) potassium acetate
C) lithium carbonate
D) aluminum sulfide
E) none of the above

12) All of the following compounds are soluble in water EXCEPT _____
A) NH_4Cl . B) NaCl . C) PbCl_2 . D) CaCl_2 . E) FeCl_3 .

13) A precipitate is expected to be formed when an aqueous solution of sodium sulfate is added to an aqueous solution of _____
A) barium chloride.
B) potassium chloride.
C) iron(III) chloride.
D) magnesium chloride.
E) none of the above

- 14) What type of a reaction occurs when a silver nitrate solution is mixed with sodium chloride solution? 14) _____
- A) oxidation-reduction
 - B) acid-base neutralization
 - C) precipitation
 - D) gas evolution
 - E) no reaction
- 15) What type of reaction is the generic equation $AB \rightarrow A + B$? 15) _____
- A) decomposition
 - B) synthesis/combination
 - C) single displacement
 - D) double-displacement
 - E) none of the above
- 16) If the theoretical yield of the reaction below corresponds to 99.2 g and the actual yield was 60.9 g, calculate the percent yield. 16) _____
- Given: $\text{Li}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{LiOH}$
- A) 61.4 %
 - B) 71.8 %
 - C) 16.0 %
 - D) 38.0 %
 - E) none of the above
- 17) Starting with 156 g Li_2O and 33.3 g H_2O , decide which reactant is present in limiting quantities. 17) _____
- Given: $\text{Li}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{LiOH}$
- A) lithium oxide
 - B) lithium hydroxide
 - C) water
 - D) insufficient data
 - E) none of the above
- 18) Which of the following types of compounds will NOT undergo a gas evolution reaction when acid is added? 18) _____
- A) carbonates
 - B) bisulfites
 - C) sulfides
 - D) hydroxides
 - E) none of the above
- 19) Which of the following statements about pressure is FALSE? 19) _____
- A) After creating a pressure difference, the atmospheric pressure can push liquid up a straw.
 - B) A deep well dug in the ground must have the pump located at the bottom of well in order to have the water come to the surface.
 - C) Pressure is caused by gas molecules colliding with surfaces.
 - D) The atmosphere has a pressure as the components of air collide with surfaces.
 - E) All of the above statements are true.

- 20) What is the equivalent pressure of 0.905 atm in units of mm Hg? 20) _____
A) 688
B) 0.905
C) 13.3
D) 840
E) none of the above
- 21) If the initial pressure of a system was 1.00 atm and the volume was halved and the temperature was tripled, what is the final pressure? 21) _____
A) 0.667 atm
B) 2.00 atm
C) 1.50 atm
D) 6.00 atm
E) not enough information
- 22) A 3.76 g sample of a noble gas is stored in a 2.00 L vessel at 874 torr and 25°C. What is the noble gas? 22) _____
(R= 0.0821 L atm/ mol K)
A) He
B) Ne
C) Ar
D) Kr
E) not enough information
- 23) The vapor pressure of water at 20.0°C is 17.5 mm Hg. If the pressure of a gas collected over water was measured to be 453.0 mm Hg. What is the pressure of the pure gas? 23) _____
A) 0.596 atm
B) 0.0230 atm
C) 0.619 atm
D) 0.573 atm
E) none of the above
- 24) What is the theoretical yield of waffles if you have 5 cups of flour, 9 eggs and 3 tbs of oil? 24) _____
Given: 2 cups flour + 3 eggs + 1 tbs oil → 4 waffles
A) 10
B) 12
C) 4
D) 6
E) not enough information

TRUE/FALSE. On the scantron, fill up circle "A" for a true answer and "B" for wrong answer (3 pts each).

- 25) Combustion reactions are a subcategory of oxidation-reduction reactions. 25) _____
- 26) A precipitate will form when you mix solutions of potassium chloride and lead nitrate. 26) _____
- 27) A spectator ion is one that does not actively participate in a chemical reaction. 27) _____
- 28) There is a large distance between gas particles as compared to their relative size. 28) _____