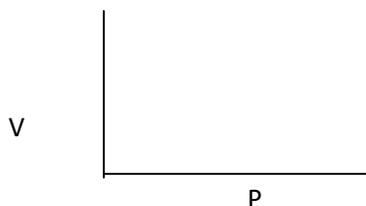


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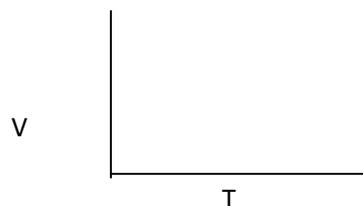
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**Chemistry 20**  
**Summative #2 Review (Gases)**

1. Sketch a graph illustrating Boyle's Law



Sketch a graph illustrating Charles' Law



2. Convert the following using

$$^{\circ}\text{C} = \text{K} - 273.15$$

$$1.00 \text{ atm} = 101.3 \text{ kPa} = 760 \text{ mmHg}$$

$$1.0 \text{ psi} = 6.9 \text{ kPa}$$

250.4 K = \_\_\_\_\_  $^{\circ}\text{C}$     25.25  $^{\circ}\text{C}$  = \_\_\_\_\_ K

222 K = \_\_\_\_\_  $^{\circ}\text{C}$

200 kPa = \_\_\_\_\_ mmHg

300 kPa = \_\_\_\_\_ atm

45.0 psi = \_\_\_\_\_ kPa

3. What is SATP?

The temperature is  $^{\circ}\text{C}$  \_\_\_\_\_ and \_\_\_\_\_ K. The pressure is \_\_\_\_\_ kPa

4. What is STP?

The temperature is  $^{\circ}\text{C}$  \_\_\_\_\_ and \_\_\_\_\_ K. The pressure is \_\_\_\_\_ kPaGAS LAWS - Combined ( $P_1V_1T_2 = P_2V_2T_1$ ) and Ideal ( $PV = nRT$ )

5. A 10.0 L propane tank on a BBQ gas at 25.0 $^{\circ}\text{C}$  has a pressure of 150 kPa if the temperature drops to -25.0 what is the new pressure?
6. A hot air balloon has a volume of 345 L at SATP, what is the new volume when the balloon is at 1000 m above the surface where the pressure is 80.0 kPa and 8.0 $^{\circ}\text{C}$ .
7. A helium balloon at 22.0 $^{\circ}\text{C}$  and 100 kPa has a volume of 5.55 L. Calculate the volume of the balloon after it rises 10 km up into the atmosphere where the temperature is -36.0 $^{\circ}\text{C}$  and the outside air pressure is 28.0 kPa.
8. A 1.00 L container of  $\text{CO}_2(g)$  in Mr. Urlacher's prep room is pressurized to 1100 kPa at 20.0 $^{\circ}\text{C}$ . What volume of gas would fill the room when the pressure in the room is 100 kPa at 20.0 $^{\circ}\text{C}$ ?
9. Freon (CFC) is used in many air conditioners. If 500 mL of freon at 1.50 atm and 24.0 $^{\circ}\text{C}$  is compressed to 250 mL at 3.50 atm what is the final temperature of the gas. (K and  $^{\circ}\text{C}$ )
10. One teaspoon of baking soda produces about 0.13 g of carbon dioxide during baking. What volume of gas is produced in a cake while baking at a temperature of 200 $^{\circ}\text{C}$  and a pressure of 100 kPa?

11. What is the mass of He (g) that fills a hot air balloon with volume of 1100 L and a pressure of 87.00 kPa and a temperature of 10.0°C?
12. What volume would 5.00 g of methane occupy at STP?
13. What volume would 5.00 g of methane occupy at SATP?
14. A BBQ propane tank holds 20 lbs of propane (20 lbs = 9.08 kg). If the tank was opened what volume would the gas take up at SATP?
15. What is the pressure exerted on a compressor when a 5.00 L tank of is filled with 29.6 g of oxygen at 25°C?
16. A 200 L propane tank is used to heat a home. The tank can be filled to a maximum pressure of 800 kPa at 30°C. What mass of gas can be added to the tank.?
17. At a vehicle manufacturing factory a technician adds 0.0794 g of a gas into each headlight bulb. The bulbs contain 10.00 mL of gas at 150 kPa and 25°C. Calculate the molar mass of this gas. What kind of gas is placed in vehicle headlights?
18. A plant uses 9.86 L (17.5 g) of this gas per day at SATP? What is the molar mass of the gas? Identify the gas?
19. A company that produces natural gas creates 1.315 kg of polluting gas per day. The volume of this gas at 100.0 kPa and 20.0°C is 500.0 L. What is the molar mass of the gas and what is its identity.
20. Design an experiment to test one of the gas laws (Boyles, Charles, or Ideal). Assume you have only everyday materials available to you , such as a pump, a pressure guage, a pail with lid, hot plate, scale, measuring tape, measuring cup or graduated cylinder, a balloon, and a thermometer.

Problem: How can we test \_\_\_\_\_ Law?

Hypothesis:

Variables - M  
R  
C

Materials used (from list above)

Procedure (step by step)

Observation Chart

Analysis formulae to be used

21. At a pressure of 95.0kPa a sample of gas has a volume of 415.0mL. What is the volume of the gas at 110kPa?
22. A sample of oxygen has a volume of 15.0L at 125kPa. What will the volume of the oxygen gas be at a pressure of 75kPa?

23. A sample of gas has a volume of 1.73L at a pressure of 860mmHg. What must the pressure be on this sample for the volume to change to 2.40L?
24. A sample of oxygen has a volume of 315mL at STP. What is the volume of the gas at 35°C?
25. At 23°C, a sample of hydrogen gas has a volume of 29.00L. To what temperature must this gas be heated to change the volume to 64.00L?
26. 27.5L of chlorine gas at 109kPa and 23°C is changed to 84.0kPa and 40.0°C. What is the new volume?
27. A gas sample has a volume of 35.0L at 790mmHg and 22.0°C, What is the volume at STP (745mmHg)?
28. A sample of fluorine gas with a volume of 45.0L at STP is changed to 117kPa and 30.0°C. What is the new volume of the gas?
29. Find the molar mass of the following molecules:
- $\text{NO}_3^-$
  - $\text{CH}_3\text{COOH}$
  - $\text{PbSO}_4$
  - $\text{Al}_2(\text{SO}_4)_3$
  - $(\text{NH}_4)_3\text{PO}_4$

30. Calculate the mass of each of the following:
- 0.705 mol of  $\text{CO}_2$  at STP
  
  - 18.4 mol of  $\text{Ni}(\text{OH})_2$
31. Calculate the number of moles of the following:
- 0.115kg of CuS
  
  - 4046mg of Au at STP
32. Calculate the volume of 28.897g of butane gas  $\text{C}_4\text{H}_{10}$  at  $21.000^\circ\text{C}$  and 134.000kPa?
33. What is the 0.475g of an ideal gas has a volume of 450mL at 175kPa and  $15.0^\circ\text{C}$ . What is its molar mass?
34. Explain how you change Celsius to Kelvin.
35. Explain the difference between SATP and STP.
36. Describe the difference between real and ideal gases
37. Explain the Kinetic Molecular Theory and its applications to this unit.

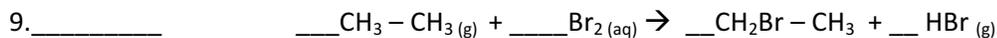
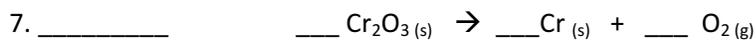
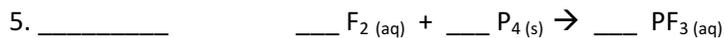
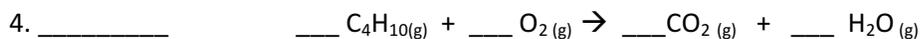
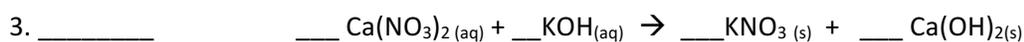
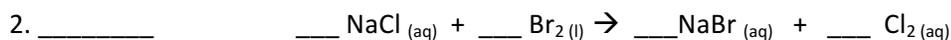
**Chemistry 20**  
**Summative #2 Review (Stoich)**

1. Complete the following table.

Atom	Group	# Valence Electrons	# Valence Orbitals	Lewis Diagram	# Lone Pairs	# Bonding Electrons
Br						
Ga						
Ca						
P						
H						

RXN TYPE

BALANCED CHEMICAL EQUATION



10. Write balanced chemical equations for the following reactions. Include states and reaction type. If you CANNOT balance the reaction you probably did not write the proper chemical formula.

A. *zinc is added to aqueous tin (II) chloride to form zinc chloride and tin.*

B. *Propane is burned in a barbeque using oxygen and making carbon dioxide and water vapor.*

C. *When heated copper (II) sulfate pentahydrate form copper (II) sulfate and water*

D. *acetic acid is added to a solution of barium hydroxide to produce barium acetate and water (write water as HOH <sub>(l)</sub> it is easier to balance with hydroxide)*

E. *A solution of lead (II) nitrate is added to a solution of sodium chloride*

F. *2,2 dimethyl decane<sub>(l)</sub> is burned.*

G. *Al<sub>(s)</sub> is added to excess copper (II) nitrate solution.*

H. *3 hexyne<sub>(l)</sub> is added to excess fluorine<sub>(aq)</sub>. The product is a liquid .*

I. *butanoic acid <sub>(l)</sub> is added to ethanol to form a solid ester*

J. *When hydrogen is added to an open flame it produces a "pop" sound.*

11. What is the limiting and excess reagent in a chemical reactions?
12. 10.0 g of lithium is added to 10.0 g of nitrogen what mass of product will be produced? Which substance is the limiting reagent? Which substance is in excess?
13. 20.0 mL of 0.250 mol/L  $\text{Ba}(\text{OH})_2$  (s) is added to 50.0 mL of 0.222 mol/L  $\text{Ga}(\text{CH}_3\text{COO})_3$  (aq). Which substance is the limiting reagent? Which substance is in excess?
14. What mass of lead (II) nitrate is required to react with excess potassium iodide to produce 4.26 g of lead (II) iodide?
15. What is the concentration of 25.0 mL of  $\text{NaOH}$  (aq) used to neutralize an acid spill when 18.25 mL of 0.100 mol/L  $\text{HCl}$  (aq)?
16. What volume of hydrogen gas is produced at SATP when a 1.68 g of magnesium is totally dissolved in excess nitric acid?
17. Sulphur is burned by reacting with oxygen to form a dangerous gas  $\text{SO}_2$  (g).

**In a combustion furnace 2.20 kg of sulfur is burned. What volume of oxygen is required at 560 kPa and 450°C?**

18. What is the concentration of 30.0 mL  $\text{Na}_2\text{CO}_3$  when it is neutralized by 250 mL of 0.100 mol/L  $\text{H}_3\text{BO}_3$  (aq) ?
19. A 50.0 g candle ( $\text{C}_{25}\text{H}_{52}$  (s)) is burned until there are 16.0 g left. What volume of carbon dioxide is produced at 18.2°C and 99.5 kPa?

20. 3.00 g of benzoic acid are added to excess methanol. What mass of ester will be created?

21. Calculate the concentration of hydrochloric acid using bromothymol blue as an indicator

<i>Titration of 25.0 mL of HCl<sub>(aq)</sub> with 0.465 mol/L Na<sub>2</sub>CO<sub>3(aq)</sub></i>				
<u>TRIAL</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Final buret reading (mL)</u>	<b>18.4</b>	<b>33.6</b>	<b>48.7</b>	<b>37.0</b>
<u>Initial buret reading (mL)</u>	<b>0.1</b>	<b>18.4</b>	<b>33.6</b>	<b>22.0</b>
<u>Volume of Na<sub>2</sub>CO<sub>3(aq)</sub> added (mL)</u>				
<u>Color at endpoint</u>	<u>blue</u>	<u>green</u>	<u>green</u>	<u>green</u>

22. The number of moles of ethane, C<sub>2</sub>H<sub>6</sub>, that can react with 9 moles of oxygen, O<sub>2</sub>, according to the equation  $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2 \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$  is:

23. How many grams of copper(II)chloride is needed to react with 19.0g of iron, according to the following equation:  $3\text{CuCl}_2 + 2\text{Fe} \rightarrow 3\text{Cu} + 2\text{FeCl}_3$

24. How many grams of ammonia is produced when 12.0g of nitrogen gas is reacted according to the following equation:  $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$

25. Given the following BALANCED equation:  $4\text{NH}_3 + 5\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{NO}$

If 2.30moles of ammonia (NH<sub>3</sub>) are consumed, how many moles of NO are produced?

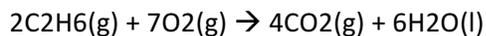
26. Consider the following BALANCED equation:



Assuming that there is an excess of carbon dioxide, what is the mass of sodium hydroxide that is needed to produce 22.0g of sodium carbonate?

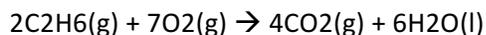
27. When the reaction  $\text{Al}_2(\text{SO}_4)_3 + \text{CaCl}_2 \rightarrow \text{AlCl}_3 + \text{CaSO}_4$  is balanced, using simplest whole numbers, the quantity of calcium chloride used is

28. Consider the following BALANCED equation:



What volume of  $\text{C}_2\text{H}_6$  at STP is required to produce 8.0g of water?

29. Consider the following BALANCED equation:



What mass of oxygen is required to react completely with 16.2L of  $\text{C}_2\text{H}_6$  at STP?

30. 20g of cadmium reacts with 0.790g of sulphur to produce cadmium sulphide as shown by  $\text{Cd}(\text{s}) + \text{S}(\text{s}) \rightarrow \text{CdS}(\text{s})$  What is the limiting reagent?

31. Consider the BALANCED equation:



If 29.4g of potassium chlorate were to react with 7.2g of sulphur, what is the mass of potassium chloride that is formed?

*The following 3 questions (32-34) refer to the info below.*

**30.0g of potassium is reacted with 12.0g of nitrogen, according to the following BALANCED equation:  $6\text{K} + \text{N}_2 \rightarrow 2\text{K}_3\text{N}$**

32. Which chemical is the limiting reagent?

33. How much excess is there for the other chemical?

34. How many grams of potassium nitride can be produced?

The following 3 questions (35-37) refer to the info below.

**20.0g of potassium is reacted with 11.0g of nitrogen, according to the following BALANCED equation:  $6K + N_2 \rightarrow 2K_3N$**

35. Which chemical is the limiting reagent?
36. How much excess is there for the other chemical?
37. How many grams of potassium nitride can be produced?

Use the following reaction for questions 38-41



38. What mass of H<sub>2</sub>O is produced when 22.7g of CH<sub>3</sub>NO<sub>2</sub> is burned?
39. What combined volume of gas at STP is produced if 3.36g of CH<sub>3</sub>NO<sub>2</sub> is burned?
40. What volume of O<sub>2</sub> at STP is required to produce 2.78g of CO<sub>2</sub>?
41. What mass of N<sub>2</sub> is produced when 0.490g of CO<sub>2</sub> is produced?

Use the following reaction for questions 41-42

**A 8.79mL sample of H<sub>3</sub>PO<sub>4</sub> is titrated with 97.8mL of 0.789M of NaOH.**



42. What is the molar concentration of pure H<sub>3</sub>PO<sub>4</sub>?
43. Calculate the density of pure H<sub>3</sub>PO<sub>4</sub>?

Use the following information for questions 44-454:

Before analyzing a fertilizer sample containing  $\text{NH}_4\text{NO}_3$ , a chemist makes a test solution by dissolving 66.3g of pure  $\text{NH}_4\text{NO}_3$  and diluting it to 150.0mL. If the chemist wishes to carry out the titration reaction

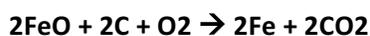


Such that the reaction requires 43.0mL of NaOH when 19.5mL of solution is titrated,

44. What is the molarity of the NaOH she should use?

45. What volume of  $\text{NH}_3$  at STP would be produced?

Use the following reaction for question 46-49



46. A 13.4g FeO sample has a 56.0% yield. What mass of Fe can the sample produce?

47. A 33.9g FeO sample produces 85.8g of Fe. What is the % yield of FeO?

48. A 460.4g FeO pure sample produces 324.8g of Fe. What is the % yield of the reaction?

49. What mass of FeO with a yield of 56.8% is needed to make 34.9g of solid iron?