

Name: \_\_\_\_\_

Period: \_\_\_\_\_

Seat#: \_\_\_\_\_

**Directions:** Any worksheet that is labeled with an \* means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website...and the entire internet! See me if you need help finding practice on a topic you are struggling with.

- **Show work for ANY math problem and include ALL units.**
- **Some answers provided at the end of the question. The answers are underlined.**
- **The column on the right is so you can practice quickly identifying which gas law is being used. Read the question and write in which law would be used.**

- 1) 0.190 g of a gas occupies 250.0 mL at STP. What is its molar mass? What gas is it? Hint - calculate molar mass of the gas.
- 2) 1.089 g of a gas occupies 4.50 L at 20.5 °C and 0.890 atm. What is its molar mass?
- 3) 1.09 g of H<sub>2</sub> is contained in a 2.00 L container at 20.0 °C. What is the pressure in this container in mmHg?
- 4) 2.00 liters of hydrogen, originally at 25.0 °C and 750.0 mm of mercury, are heated until a volume of 20.0 L and a pressure of 3.50 atm is reached. What is the new temp?
- 5) 20.83g of a gas occupies 4.167 L at 79.97 kPa at 30.0 °C. What is its molecular weight?
- 6) 3.50 liters of a gas at 727.0 K will occupy how many liters at 153.0 K?
- 7) 300 mL of O<sub>2</sub> are collected at a pressure of 645 mm of mercury. What volume will this gas have at one atmosphere pressure?
- 8) 4.00 L of a gas are under a pressure of 6.00 atm. What's the volume at 2.00 atm?
- 9) 400.0 mL of a gas are under a pressure of 800.0 torr. What would the volume of the gas be at a pressure of 1000.0 torr?
- 10) 500.0 liters of a gas are prepared at 700.0 mm Hg and 200.0 °C. The gas is placed into a tank under high pressure. When the tank cools to 20.0 °C, the pressure of the gas is 30.0 atm. What is the volume of the gas? 9.51 L
- 11) 500.0 mL of a gas is collected at 745.0 mmHg. What will the vol. be at standard pressure?
- 12) 500.0mL of gas was collected at 20.0 °C and 720.0mmHg. What's the volume at STP?
- 13) 600.0 mL of a gas is at a pressure of 8.00 atm. What's the volume at 2.00 atm?
- 14) 600.0 mL of air is at 20.0 °C. What is the volume at 60.0 °C? 682 mL
- 15) 73.0 mL of nitrogen at STP is heated to 80.0 °C and the volume increase to 4.53 L. What is the new pressure?
- 16) 96.0 g of a gas is 48.0 L at 700.0 mmHg and 20.0 °C. What's the molecular weight?
- 17) A 1.5 liter flask is filled with nitrogen at a pressure of 12 atmospheres. What size flask would be required to hold this gas at a pressure of 2.0 atmospheres?
- 18) A 12.0 g sample of gas occupies 19.2 L at STP. What is the molecular weight of the gas?
- 19) A 30.0 L sample of nitrogen inside a rigid, metal container at 20.0 °C is placed inside an oven whose temperature is 50.0 °C. The pressure inside the container at 20.0 °C was at 3.00 atm. What is the pressure of the nitrogen after its temp is increased?
- 20) 30.6g sample of gas occupies 22.4L at STP. What's the molecular weight of the gas?

- 21) A 40.0 g gas sample occupies 11.2 L at STP. Find the molecular weight of this gas.
- 22) A 40.0 L tank of ammonia has a pressure of 8.00 atm. Calculate the volume of the ammonia if its pressure is changed to 12.0 atm while its temp remains constant.
- 23) A 600.0 mL sample of nitrogen is warmed from 77.0 °C to 86.0 °C. Find its new volume if the pressure remains constant.
- 24) A balloon has a volume of 2500.0 mL on a day when the temperature is 30.0 °C. If the temperature at night falls to 10.0 °C, what will be the volume of the balloon if the pressure remains constant?
- 25) A container of oxygen has a volume of 30.0 mL and a pressure of 4.00 atm. If the pressure of the oxygen gas is reduced to 2.00 atm and the temperature is kept constant, what is the new volume of the oxygen gas?
- 26) A gas balloon has a volume of 106.0 L when the temp is 45.0 °C and the pressure is 740.0 mmHg. What will its volume be at 20.0 °C and 780 .0 mm of mercury pressure?
- 27) A gas has a pressure of 0.370 atm at 50.0 °C. What is the pressure at standard temperature? 0.313 atm
- 28) A gas has a pressure of 699.0 mmHg at 40.0 °C. What is the temp at standard pressure?
- 29) A gas has a temperature of 14 °C, and a volume of 4.5 liters. If the temp is raised to 29 °C and the pressure is not changed, what is the new volume of the gas? 4.74 L
- 30) A gas has a volume of 800.0 mL at minus 23.00 °C and 300.0 torr. What would the volume of the gas be at 227.0 °C and 600.0 torr of pressure? 800.0 mL
- 31) A gas is heated from 263.0 K to 298.0 K and the volume is increased from 24.0 liters to 35.0 liters by moving a large piston within a cylinder. If the original pressure was 1.00 atm, what would the final pressure be?
- 32) A gas occupies 1.00 L at standard temperature. What is the volume at 333.0 °C?
- 33) A gas occupies 1.56 L at 1.00 atm. What will be the volume of this gas if the pressure becomes 3.00 atm? 0.520 L
- 34) A gas fills 11.2 L at 0.860 atm. What's the pressure if the vol. becomes 15.0 L? 0.642 atm
- 35) A gas occupies 12.3 liters at a pressure of 40.0 mm Hg. What is the volume when the pressure is increased to 60.0 mm Hg? 8.20 L
- 36) A gas occupies 25.3 mL at a pressure of 790.5 mm Hg. Determine the volume if the pressure is reduced to 0.804 atm.
- 37) A gas occupies 4.31 liters at a pressure of 0.755 atm. Determine the volume if the pressure is increased to 1.25 atm.
- 38) A gas occupies 900.0 mL at 27.0 °C. What is the volume at 132.0 °C? 1215 mL
- 39) A gas occupies a volume of 34.2 mL at a temperature of 15.0 °C and a pressure of 800.0 torr. What will be the volume of this gas at standard conditions?
- 40) A gas sample occupies 3.25 liters at 24.5 °C and 1825 mm Hg. Determine the temperature at which the gas will occupy 4250 mL at 1.50 atm.
- 41) A gas syringe contains 42.3 milliliters of a gas at 98.15 °C. Determine the volume that the gas will occupy if the temperature is decreased to -18.50 °C.
- 42) A gas syringe contains 56.05 milliliters of a gas at 315.1 K. Determine the volume that the gas will occupy if the temperature is increased to 380.5 K
- 43) A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas? 30.5 L
- 44) A man heats a balloon in the oven. If the balloon initially has a volume of 0.4L and a temp of 20.0°C, what will the volume of the balloon be after he heats it to 250.0°C? 0.71 L
- 45) A sample of argon gas at STP occupies 56.2 liters. Determine the number of moles of argon and the mass in the sample.

- 46) A sample of gas has a volume of 12.0 L and a pressure of 1.00 atm. If the pressure of gas is increased to 2.00 atm, what is the new volume of the gas?
- 47) A sample of gas fills 50.0 L at 15.0 °C and 640.0 mmHg. What is the volume at STP?
- 48) A tank of helium has a volume of 50.0 L and is at 2000.0 psi. This gas is allowed to flow into a blimp until the pressure in the tank drops to 40.00 psi. and the pressure in the blimp is 30.00 psi. What will be the volume of the blimp?
- 49) At 210.0 °C a gas has a volume of 8.00 L. What is the volume of this gas at -23.0 °C?
- 50) At 225.0°C a gas has a vol. of 400.0mL. What is the volume of the gas at 127.0 °C?
- 51) At 27.00 °C a gas has a volume of 6.00 L. What will the volume be at 150.0 °C?
- 52) At a pressure of 780.0 mm Hg and 24.2 °C, a certain gas has a volume of 350.0 mL. What will be the volume of this gas under STP
- 53) At conditions of 785.0 torr and 15.0 °C, a gas occupies a volume of 45.5 mL. What will be the volume of the same gas at 745.0 torr and 30.0 °C?
- 54) At STP 0.250 L of an unknown gas has a mass of 1.00 g. Calculate its molar mass.
- 55) At STP 150.0 mL of an unknown gas has a mass of 0.250g. Calculate its molar mass.
- 56) At STP 3.00 liters of an unknown gas has a mass of 9.50 g. Calculate its molar mass.
- 57) At what pressure would 0.150 mole of nitrogen gas at 23.0 °C occupy 8.90 L?
- 58) At what temperature will 0.654 moles of neon gas occupy 12.30 liters at 1.95 atm?
- 59) Atmospheric pressure on the peak of Mt. Everest can be as low as 150 mm Hg, which is why climbers need to bring oxygen tanks for the last part of the climb. If the climbers carry 10.0 liter tanks with an internal gas pressure of  $3.04 \times 10^4$  mm Hg, what will be the volume of the gas when it is released from the tanks?  $2.0 \times 10^3$  L
- 60) Boyle's Law deals with which variables?
- 61) Calculate decrease in temp when 2.00 L at 20.0 °C is compressed to 1.00 L. 146.5 K
- 62) Calculate the final pressure inside a scuba tank after it cools from  $1.00 \times 10^3$  °C to 25.0 °C. The initial pressure in the tank is 130.0 atm.
- 63) Calculate the molecular weight of a gas if 35.44 g of the gas stored in a 7.50 L tank exerts a pressure of 60.0 atm at a constant temperature of 35.5 °C
- 64) Calculate the volume 3.00 moles of a gas will occupy at 24.0 °C and 762.4 mm Hg.
- 65) CO<sub>2</sub> is usually formed when gasoline is burned. If 30.0 L of CO<sub>2</sub> is produced at a temperature of  $1.00 \times 10^3$  °C and allowed to reach room temperature (25.0 °C) without any pressure changes, what is the new volume of the carbon dioxide?
- 66) Charles' Law deals with which variables?
- 67) Convert 273.15 mL at 166.0 mm of Hg to its new volume at standard pressure.
- 68) Convert 338 L at 63.0 atm to its new volume at standard pressure.
- 69) Convert 350.0 mL at 740.0 mm of Hg to its new volume at standard pressure.
- 70) Convert 77.0 L at 18.0 mm of Hg to its new volume at standard pressure.
- 71) Determine the number of grams of carbon dioxide in a 450.6 mL tank at 1.80 atm and minus 50.5 °C. Determine the number of grams of oxygen that the same container will contain under the same temperature and pressure.
- 72) Determine the number of moles of Krypton contained in a 3.25 liter gas tank at 5.80 atm and 25.5 °C. If the gas is Oxygen instead of Krypton, will the answer be the same? Why or why not?
- 73) Determine the pressure change when a constant volume of gas at 1.00 atm is heated from 20.0 °C to 30.0 °C. 1.03 atm
- 74) Determine the volume of occupied by 2.34 grams of carbon dioxide gas at STP.

- 75) Divers get “the bends” if they come up too fast because gas in their blood expands, forming bubbles in their blood. If a diver has 0.05 L of gas in his blood at 250 atm, then rises instantaneously to a depth where his blood has a pressure of 50.0 atm, what will the volume of gas in his blood be? Do you think this will harm the diver?  $V = 0.25 L$ , yes
- 76) Find the volume of 2.40 mol of gas whose temp is 50.0 °C and pressure is 2.00 atm.
- 77) Given 300.0 mL of a gas at 17.0 °C. What is its volume at 10.0 °C?
- 78) How hot will a 2.30 L balloon have to get to expand to a volume of 400.0 L? Assume that the initial temperature of the balloon is 25.0 °C. 51,800K
- 79) How many cubic feet of air at standard conditions (1.00 atm.) are required to inflate a bicycle tire of 0.50 cu. ft. to a pressure of 3.00 atmospheres?
- 80) How many moles of a gas would be present in a gas trapped within a 37.0 liter vessel at 80.00 °C at a pressure of 2.50 atm?
- 81) How many moles of gas are contained in 890.0 mL at 21.0 °C and 750.0 mm Hg?
- 82) How many moles of gas are contained in a 50.0 L cylinder at a pressure of 100.0 atm and a temperature of 35.0 °C?
- 83) How many moles of gas would be present in a gas trapped within a 100.0 mL vessel at 25.0 °C at a pressure of 2.50 atmospheres?
- 84) How much will the volume of 75.0 mL of neon change if the pressure is lowered from 50.0 torr to 8.00 torr?
- 85) I have an unknown volume of gas at a pressure of 0.5 atm and a temperature of 325 K. If I raise the pressure to 1.2 atm, decrease the temperature to 320 K, and measure the final volume to be 48 liters, what was the initial volume of the gas? 117 L
- 86) I have an unknown volume of gas held at a temperature of 115 K in a container with a pressure of 60 atm. If by increasing the temperature to 225 K and decreasing the pressure to 30 atm causes the volume of the gas to be 29 liters, how many liters of gas did I start with? 7.41
- 87) I have made a thermometer, which measures temperature by the compressing and expanding of gas in a piston. I have measured that at 100.0° C the volume of the piston is 20.0 L. What is the temperature outside if the piston has a volume of 15.0 L? What would be appropriate clothing for the weather? The temperature is 279.6 K, which corresponds to 6.6° C. A jacket would be appropriate clothing for this weather.
- 88) If 10.0 liters of oxygen at STP are heated to 512 °C, what will be the new volume of gas if the pressure is also increased to 1520.0 mm of mercury?
- 89) If 15.0 liters of neon at 25.0 °C is allowed to expand to 45.0 liters, what must the new temperature be to maintain constant pressure?
- 90) If 540.0 mL of nitrogen at 0.00 °C is heated to a temperature of 100.0 °C what will be the new volume of the gas?
- 91) If 9.006 grams of a gas are enclosed in a 50.00 liter vessel at 273.15 K and 2.000 atmospheres of pressure, what is the molar mass of the gas? What gas is this?
- 92) If a gas at 25.0 °C occupies 3.60 liters at a pressure of 1.00 atm, what will be its volume at a pressure of 2.50 atm? 1.44 L
- 93) If a gas is cooled from 323.0 K to 273.15 K and the volume is kept constant what final pressure would result if the original pressure was 750.0 mm Hg?
- 94) If a gas is heated from 298.0 K to 398.0 K and the pressure is increased from  $2.230 \times 10^3$  mm Hg to  $4.560 \times 10^3$  mm Hg what final volume would result if the volume is allowed to change from an initial volume of 60.0 liters?
- 95) If I contain 3.00 moles of gas in a container with a volume of 60 liters and at a temperature of 400 K, what is the pressure inside the container? 1.64 atm
- 96) If I have 0.275 moles of gas at a temperature of 75 K and a pressure of 1.75 atmospheres, what is the volume of the gas? 0.97 L

- 97) If I have 1.900 moles of gas held at a pressure of 5 atm and in a container with a volume of 50 liters, what is the temperature of the gas? 1603 K
- 98) If I have 17 liters of gas at a temperature of 67 °C and a pressure of 88.89 atm, what will be the pressure of the gas if I raise the temperature to 94 °C and decrease the volume to 12 liters? 136 atm
- 99) If I have 17 moles of gas at a temperature of 67 °C, and a volume of 88.9 liters, what is the pressure of the gas? 5.34 atm
- 100) If I have 2.40 moles of gas held at a temperature of 97 °C and in a container with a volume of 45 liters, what is the pressure of the gas? 1.62 atm
- 101) If I have 2.9 L of gas at a pressure of 5 atm and a temperature of 50 °C, what will be the temperature of the gas if I decrease the volume of the gas to 2.4 L and decrease the pressure to 3 atm? 160 K
- 102) If I have 21 liters of gas held at a pressure of 78 atm and a temperature of 900 K, what will be the volume of the gas if I decrease the pressure to 45 atm and decrease the temperature to 750 K? 30.3 L
- 103) If I have 21.0 moles of gas held at a pressure of 78 atm and a temperature of 900 K, what is the volume of the gas? 19.9 L
- 104) If I have 4 moles of a gas at 5.60 atm and a volume of 12 liters, what is the temp? 205 K
- 105) If I have 7.70 moles of gas at a pressure of 0.09 atm and at a temperature of 56 °C, what is the volume of the container that the gas is in? 2310 L
- 106) If I have 72 liters of gas held at a pressure of 3.40 atm and a temperature of 225 K, how many moles of gas do I have? 13.3 moles
- 107) If I have an unknown quantity of gas at a pressure of 0.50 atm, a volume of 25 liters, and a temperature of 300 K, how many moles of gas do I have? 0.51 moles
- 108) If I have an unknown quantity of gas at a pressure of 1.20 atm, a volume of 31 liters, and a temperature of 87 °C, how many moles of gas do I have? 1.26 moles
- 109) If I have an unknown quantity of gas held at 1195 K in a container with a volume of 25 liters and a pressure of 560 atm, how many moles of gas do I have? 143 moles
- 110) If the Kelvin temp of a gas is doubled, the volume of the gas will increase by...
- 111) If the number of moles of a gas are doubled at the same temperature and pressure, will the volume increase or decrease?
- 112) If the pressure on a gas is decreased by one-half, how large will the volume change be?
- 113) Part of the reason that conventional explosives cause so much damage is that their detonation produces a strong shock wave that can knock things down. While using explosives to knock down a building, the shock wave can be so strong that 12 liters of gas will reach a pressure of  $3.8 \times 10^4$  mm Hg. When the shock wave passes and the gas returns to a pressure of 760 mm Hg, what will the volume of that gas be? 600 L
- 114) Solve Boyle's Law equation for  $V_2$ .
- 115) Solve the Charles' Law equation for  $V_2$ .
- 116) Some students believe that teachers are full of hot air. If I inhale 2.2 liters of gas at a temperature of 18.0°C and it heats to a temperature of 38.0°C in my lungs, what is the new volume of the gas? 2.35 L
- 117) Submarines need to be extremely strong to withstand the extremely high pressure of water pushing down on them. An experimental research submarine with a volume of 15,000 liters has an internal pressure of 1.2 atm. If the pressure of the ocean breaks the submarine forming a bubble with a pressure of 250 atm pushing on it, how big will that bubble be? 72 L
- 118) The highest pressure ever produced in a laboratory setting was about  $2.0 \times 10^6$  atm. If we have a  $1.0 \times 10^{-5}$  liter sample of a gas at that pressure, then release the pressure until it is equal to 0.275 atm, what would the new volume of that gas be? 72.7 L

- 119) The pressure of a gas is reduced from 1200.0 mm Hg to 850.0 mm Hg as the volume of its container is increased by moving a piston from 85.0 mL to 350.0 mL. What would the final temperature be if the original temperature was 90.0 °C?
- 120) The temperature of a 4.00 L sample of gas is changed from 10.0 °C to 20.0 °C. What will the volume of this gas be at the new temperature if the pressure is held constant?
- 121) The temperature of a sample of gas in a steel container at 30.0 kPa is increased from -100.0 °C to  $1.00 \times 10^3$  °C. What is the final pressure inside the tank?
- 122) The volume of a gas originally at standard temperature and pressure was recorded as 488.8 mL. What volume would the same gas occupy when subjected to a pressure of 100.0 atm and temperature of minus 245.0 °C?
- 123) To what pressure must a gas be compressed in order to get into a 3.00 ft<sup>3</sup> tank the entire weight of a gas that occupies 400.0 cu. ft. at standard pressure? 133 atm
- 124) Two hundred liters of helium at 2.00 atm and 28.0 °C is placed into a tank with an internal pressure of 600.0 kPa. Find the volume of the helium after it is compressed into the tank when the temperature of the tank remains 28.0 °C.
- 125) What change in volume results if 60.0 mL of gas is cooled from 33.0 °C to 5.00 °C?
- 126) What is the final volume of a 400.0 mL gas sample that is subjected to a temperature change from 22.0 °C to 30.0 °C and a pressure change from 760.0 mm Hg to 360.0 mm Hg? 867.3 mL
- 127) What is the value of and units on R? What is R called?
- 128) What is the volume at STP of 720.0 mL of a gas collected at 20.0 °C and 3.00 atm?
- 129) What is the volume of gas at 2.00 atm and 200.0 K if its original volume was 300.0 L at 0.250 atm and 400.0 K.
- 130) What pressure is required to compress 196.0 liters of air at 1.00 atmosphere into a cylinder whose volume is 26.0 liters?
- 131) What volume change occurs to a 400.0 mL gas sample as the temperature increases from 22.0 °C to 30.0 °C?
- 132) What volume will 1.27 moles of helium gas occupy at STP?
- 133) What volume will 20.0 g of Argon occupy at STP?
- 134) What volume would 32.0 g of NO<sub>2</sub> gas occupy at 3.12 atm and 18.0 °C?
- 135) When 50.0 liters of oxygen at 20.0 °C is compressed to 5.00 liters, what must the new temperature be to maintain constant pressure?
- 136) When the pressure on a gas increases, will the volume increase or decrease?
- 137) When the temperature of a gas decreases, does the volume increase or decrease?
- 138) Write the combined gas law in equation form. Solve the combined gas law for V<sub>2</sub>.
- 139) You are now wearing scuba gear and swimming under water at a depth of 66.0 ft. You are breathing air at 3.00 atm and your lung volume is 10.0 L. Your scuba gauge indicates that your air supply is low so, to conserve air, you make a terrible and fatal mistake: you hold your breath while you surface. What happens to your lungs? Why?