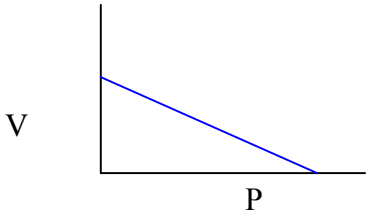
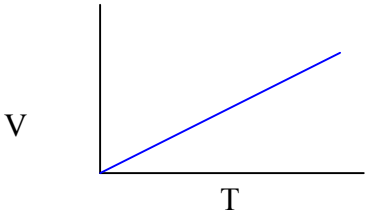
Name: _____ Date:_____

# Chemistry 20 - GASES
# Midterm Review KEY

1. Sketch a graph illustrating Boyle's Law




Sketch a graph illustrating Charles' Law




2. Convert the following using $^{o}C = K - 273.15$
1.00 atm = 101.3 kPa = 760 mmHg 1.0 psi = 6.9 kPa

250.4 K = ___-22.8_C 25.25 $^{o}$C = __298.40_K 222 K = ___-51__$^{o}$C
200 kPa = ___1.50 x 10^3 mmHg 300kPa = _2.96__atm 45.0 psi = _311___kpa

3. What is SATP?
The temperature is $^{o}$C ____25__ and ___298.15_K. The pressure is ____100.000__ kPa
4. What is STP?
The temperature is $^{o}$C __0____ and ____273.15__K. The pressure is __101.325_ kPa

GAS 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$^{o}$C has a pressure of 150 kPa if the temperature drops to –25.0 what is the new pressure?

$P_2 = (P_1V_1T_2)/(V_2T_1) = (150kPa \times 10.0L \times 248K)/(10L \times 298K) = 125kPa$

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$^{o}$C.

$V_2 = (P_1V_1T_2)/(P_2T_1) = (100kPa \times 345L \times 281.15K)/(80kPa \times 298.15K) = 4.1 \times 10^2 L$

7. A helium balloon at 22.0$^{o}$C aand 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$^{o}$C and the outside air pressure is 28.0 kPa.

$V_2 = (P_1V_1T_2)/(P_2T_1) = (100kPa \times 5.55L \times 237.15K)/(28kPa \times 298.15K) = 15.9L$

8. A 1.00 L container of $CO_{2\,(g)}$ in Mr. Urlacher's prep room is pressurized to 1100 kPa at 20.0$^{o}$C. What volume of gas would fill the room when the pressure in the room is 100 kPa at 20.0$^{o}$C?

$V_2 = (P_1V_1)/(P_2) = (1100kPa \times 1.00L)/(100kPa) = 11.0L$

9. Freon (CFC) is used in many air conditioners. If 500 mL of freon at 1.50 atm and 24.0$^{o}$C is compressed to 250 mL at 3.50 atm what is the final temperature of the gas. (K and $^{o}$C)

$T_2 = (P_2V_2T_1)/(P_1V_1) = (354.55kPa \times 0.250L \times 297.15)/(151.95kPa \times 0.500L) = 347K = 73.7^{o}C$

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$^{o}$C and a pressure of 100 kPa?

$V = (nRT)/(P) = (0.002953\ldots mol \times 8.314 \times 473K)/100kPa = 0.12L$

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?

m=(MPV)/(RT)=(4.00x87.00x1100)/(8.314x283.2)=163g

12. What volume would 5.00 g of methane occupy at STP?

V=(mRT)/(MP) = (5.00g x 8.314 x 273.15K)/(16.05g/mol x 101.325kPa) = 6.98L

13. What volume would 5.00 g of methane occupy at SATP

V=(mRT)/(MP) = (5.00g x 8.314 x 298.15K)/(16.05g/mol x 100.000kPa) = 7.72L

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?

V=(mRT)/(MP) = (9080g x 8.314 x 298.15K)/(44.11g/mol x 100.000kPa) = 5103 L

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?

P=(mRT)/(MV)=(29.6g*8.314(L*kPa)/(K*mol)298.15K)/(5.00L*32.00g/mol)=458 kPa

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.?

m=(MPV)/(RT)=(44.11x800x200)/(8.314x303.2)=2.80 x $10^3$g

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?

M=(mRT)/(PV) = (0.0794g x 8.314 x 298K)/(150kPa x 0.01000L) = 131.15g/mol = Xenon

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?

M=(mRT)/(PV)=(17.5x8.314x298.15)/(100.000x9.86)=44.00 g/mol (propane)

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.

M=(mRT)/(PV) = (1315g x 8.314 x 293K)/(100.0kPa x 500.0L) = 64.07g/mol

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