Name:_____ Period:_____ Date:_____

CHAPTER 10 NOTES
10.3: The Gas Laws

1. Define **gas laws:**

2. **What units** do the following measurements need to be in to describe gases?

    a. Temperature –
    b. Volume –
    c. Pressure -

Boyle's Law

3. Looking at the data table on page 314, describe the relationship between pressure and volume (include whether this is a direct or indirect proportionality).

4. Use the kinetic-molecular theory to explain what Boyle saw when he experimented with the relationship between pressure and volume.

5. Define Boyle's Law in words.

6. Write the equation for Boyle's Law (use the one that compares changing conditions for a gas at the bottom of page 314).

7. Think of a situation in "real life" that exemplifies Boyle's Law and explain it below.

8. **Example Problem:** A balloon filled with helium gas has a volume of 500 mL at a pressure of 1 atm. The balloon is released and reaches an altitude of 6.5 km, where the pressure is 0.5 atm. Assuming that the temperature has remained the same, what volume does the gas occupy at this height?

Charles's Law

9. Looking at the data table on page 317, describe the relationship between temperature and volume (include whether this is a direct or indirect proportionality).

10. Explain (or draw) how a hot air balloon is a good example of this relationship.

11.

    a. What is absolute zero?

    b. Why is it REALLY IMPORTANT that all temperature values are in KELVIN when describing gas laws?

    c. How do you convert between Kelvin and Celsius?

12. Define Charles's Law in words.

13. Write the equation for Charles's Law (use the one that compares changing conditions for a gas at the bottom of page 318).

14. **Example Problem:** A helium-filled balloon has a volume of 2.75 L at 20 °C. The volume of the balloon decreases to 2.46 L after it is placed outside on a cold day. What is the outside temperature?

Gay-Lussac's Law

15. Knowing both Boyle and Charles's Laws, describe the relationship between pressure and temperature (include whether this is a direct or indirect proportionality).

16. Think of a situation in "real life" that exemplifies Gay-Lussac's Law and explain it below.

17. Define Gay-Lussac's Law in words.

18. Write the equation for Gay-Lussac's Law (use the one that compares changing conditions for a gas at the top of page 320).

19. **Example Problem:** A sample of helium gas has a pressure of 1.20 atm at 22 ˚C. At what Celsius temperature will the helium reach a pressure of 2.00 atm?

The Combined Gas Law

20. Define "the combined gas law":

21. Write the equation for Combined Gas Law (use the one that compares changing conditions for a gas at the top-middle of page 321).

22. Explain how each of the individual gas laws can be obtained from the combined gas law.

23. **Example Problem:** The volume of a gas is 27.5 mL at 22.0 ˚C and 0.974 atm. What will the volume be at 15.0 ˚C and 0.993 atm?

Law of Partial Pressures

24. Describe what John Dalton found when he studied gas mixtures.

25. Define "partial pressure":

26. Describe Dalton's law of partial pressures **in words and in an equation**:

27. How does the kinetic-molecular theory support the law of partial pressures?

28. When water displacement is used to collect gases, **what equation** describes how Dalton's law of partial pressures applies?

29. **Example Problem:** Helium gas is collected over water at 25 ˚C. What is the partial pressure of helium, given that barometric pressure is 750.0 mm Hg?

10.3 Section Review

1. State Boyle's law, Charles's law, and the combined gas law in mathematical terms.

2. A sample if helium gas has a volume of 200.0 mL at 0.960 atm. What pressure, in atm, is needed to reduce the volume at constant temperature to 50.0 mL?

3. A certain quantity of gas has a volume of 0.750 L at 298 K. At what temperature, in degrees Celsius, would this quantity of gas be reduced to 0.500 L, assuming constant pressure?

4. An aerosol can contains gases under a pressure of 4.50 atm at 20.0 °C. If the can is left on a hot, sand beach, the pressure of the gases increases to 4.80 atm. What is the Celsius temperature on the beach?

5. Discuss the significance of the absolute-zero temperature?

6. A certain mass of oxygen was collected over water when potassium chlorate was decomposed by heating. The volume of oxygen sample collected was 720. mL at 25.0 °C and a barometric pressure of 755 torr. What would the volume of the oxygen be at STP? (Hint: First calculate the partial pressure of the oxygen, using Appendix Table A-8. Then use the combined gas law.)