Take-Home Quiz
Topic 11: Gases

Objective:

This is to assess your comprehension of the material we have covered so far and to help prepare you for the exam.

Instructions and Notes:

- Most of the quiz problems are from or adapted from "Exercises" at the end of the chapters in the Chemistry: Atoms First 2e Online Textbook (OpenStax)
- You must *CLEARLY LABEL* all problems and *SHOW ALL WORK* neatly and legibly to receive credit. If the problems do not require calculations/work then you must explain how you got the answer. (can be a few words up to a few sentences or even a few arrows)
- If the problem requires calculations, the answers should be highlighted or boxed.
- Book sections covered: 8.1, 8.2

Submission:

The quiz is usually due ~1 week after we start this section (see our due date schedule). Summer session is due sooner. This should be scanned as a single PDF and submitted online through Canvas. The file cannot be larger than 20 Mb (20,000 kB).

Helpful Tips:

- Start as soon as we're done with the lecture.
- Refer to the lecture and/or videos (if available).
- Use the corresponding chapter in the book to help you through difficult problems/concepts.
- There are answers and solutions available to the odd numbered problems (book number not quiz number) on the OpenStax website under "Student Resources". It is not advised to rely on the solutions because you will not have access to the solutions during the exam. Only use the solutions as a last resort. Struggling is good and that is when you are learning the most!
- Work together with your classmates.
- Go to tutoring in the ASTC or MESA, ask your classmates in our Discord room, watch YouTube Videos, come to office hours, etc.
- To ensure your mastery of the material, do the quiz multiple times.

8.1 Gas Pressure

1) (From Chapter 8.1 #1) Why are sharp knives more effective than dull knives? (Hint: Think about the definition of pressure.)

2) (From Chapter 8.1 #3) Why should you roll or belly-crawl rather than walk across a thinly-frozen pond?

3) (From Chapter 8.1 #5) A typical barometric pressure in Denver, Colorado, is 615 mm Hg. What is this pressure in atmospheres and kilopascals?

4) (From Chapter 8.1 #7) Canadian tire pressure gauges are marked in units of kilopascals. What reading on such a gauge corresponds to 32 psi?

5) (From Chapter 8.1 #9) The pressure of the atmosphere on the surface of the planet Venus is about 88.8 atm. Compare that pressure in psi to the normal pressure on earth at sea level in psi.

6) (From Chapter 8.1 #11) Consider this scenario and answer the following questions: On a mid-August day in the northeastern United States, the following information appeared in the local newspaper: atmospheric pressure at sea level 29.97 in. Hg, 1013.9 mbar. (a) What was the pressure in kPa? (b) The pressure near the seacoast in the northeastern United States is usually reported near 30.0 in. Hg. During a hurricane, the pressure may fall to near 28.0 in. Hg. Calculate the drop in pressure in torr.

8.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law

7) (From Chapter 8.2 #18) Sometimes leaving a bicycle in the sun on a hot day will cause a blowout. Why?

8) (From Chapter 8.2 #19) Explain how the volume of the bubbles exhausted by a scuba diver (Figure 8.16) change as they rise to the surface, assuming that they remain intact.

9) (From Chapter 8.2 #20) One way to state Boyle's law is "All other things being equal, the pressure of a gas is inversely proportional to its volume." (a) What is the meaning of the term "inversely proportional?" (b) What are the "other things" that must be equal?

10) (From Chapter 8.2 #21) An alternate way to state Avogadro's law is "All other things being equal, the number of molecules in a gas is directly proportional to the volume of the gas." (a) What is the meaning of the term "directly proportional?" (b) What are the "other things" that must be equal?

11) (From Chapter 8.2 #27) A spray can is used until it is empty except for the propellant gas, which has a pressure of 1344 torr at 23 °C. If the can is thrown into a fire (T = 475 °C), what will be the pressure in the hot can?

12) (From Chapter 8.2 #28) What is the temperature of an 11.2-L sample of carbon monoxide, CO, at 744 torr if it occupies 13.3 L at 55 °C and 744 torr?

13) (From Chapter 8.2 #29) A 2.50-L volume of hydrogen measured at –196 °C is warmed to 100 °C. Calculate the volume of the gas at the higher temperature, assuming no change in pressure.

14) (From Chapter 8.2 #30) A balloon inflated with three breaths of air has a volume of 1.7 L. At the same temperature and pressure, what is the volume of the balloon if five more same-sized breaths are added to the balloon? (think moles…)

15) (From Chapter 8.2 #31) A weather balloon contains 8.80 moles of helium at a pressure of 0.992 atm and a temperature of 25 °C at ground level. What is the volume of the balloon under these conditions?

16) (From Chapter 8.2 #32) The volume of an automobile air bag was 66.8 L when inflated at 25 °C with 77.8 g of nitrogen gas. What was the pressure in the bag in kPa?

17) (From Chapter 8.2 #33) How many moles of gaseous boron trifluoride, BF_3, are contained in a 4.3410-L bulb at 788.0 K if the pressure is 1.220 atm? How many grams of BF_3?

18) (From Chapter 8.2 #34) Iodine, I_2, is a solid at room temperature but sublimes (converts from a solid into a gas) when warmed. What is the temperature in a 73.3-mL bulb that contains 0.292 g of I_2 vapor at a pressure of 0.462 atm?

(From Chapter 8.2 #35) How many grams of gas are present in each of the following cases?

19) 0.100 L of CO_2 at 307 torr and 26 °C

20) 8.75 L of C_2H_4, at 378.3 kPa and 483 K

21) 221 mL of Ar at 0.23 torr and –54 °C

22) (From Chapter 8.2 #36) A high altitude balloon is filled with 1.41×10^4 L of hydrogen at a temperature of 21 °C and a pressure of 745 torr. What is the volume of the balloon at a height of 20 km, where the temperature is –48 °C and the pressure is 63.1 torr?

23) (From Chapter 8.2 #37) A cylinder of medical oxygen has a volume of 35.4 L, and contains O_2 at a pressure of 151 atm and a temperature of 25 °C. What volume of O_2 does this correspond to at normal body conditions, that is, 1 atm and 37 °C?

24) (From Chapter 8.2 #39) A 20.0-L cylinder containing 11.34 kg of butane, C_4H_{10}, was opened to the atmosphere. Calculate the mass of the gas remaining in the cylinder if it were opened and the gas escaped until the pressure in the cylinder was equal to the atmospheric pressure, 0.983 atm, and a temperature of 27 °C.

(From Chapter 8.2 #43) The effect of chlorofluorocarbons (such as CCl_2F_2) on the depletion of the ozone layer is well known. The use of substitutes, such as $CH_3CH_2F(g)$, for the chlorofluorocarbons, has largely corrected the problem. Calculate the volume occupied by 10.0 g of each of these compounds at STP (**S**tandard **T**emperature [273.15K] and **P**ressure [1 atm]):

25) $CCl_2F_2(g)$

26) $CH_3CH_2F(g)$

27) (From Chapter 8.2 #45) A balloon with a volume of 100.21 L at 21 °C and 0.981 atm is released and just barely clears the top of Mount Crumpit in British Columbia. If the final volume of the balloon is 144.53 L at a temperature of 5.24 °C, what is the pressure experienced by the balloon as it clears Mount Crumpit?

28) (From Chapter 8.2 #47) If the volume of a fixed amount of a gas is tripled at constant temperature, what happens to the pressure?

29) (not in book) A balloon has been filled to a volume of 1.90L with 0.0920 mol of helium gas. If 0.0210 mol of additional helium is added to the balloon while the temperature and pressure are held constant, what is the new volume of the balloon? (add the original mol and the additional mol for the new total mol) (Answer 2.33L)