KEY

Chapter 10/11 Quiz Study Guide

1. If you put a 600 mL beaker out in the rain, and your friend next door puts out a 25 mL graduated cylinder, **what will you observe**?
   - a. The same VOLUME of rain but different HEIGHTS
   - [✓ b.] The same HEIGHT of rain but different VOLUMES
   - c. The same height AND volume of rain
   - d. Neither height NOR volume will be the same
2. **Explain** your choice for Question #1.

Rain falls evenly over all surfaces, so the height will be same. The base of the 600mL beaker is bigger, so it will contain a bigger volume of rain @ the same height.

3. Describe the concept of gas pressure in terms of **molecular motion**.

Atoms/molecules move around & collide w/ objects & walls of containers. More frequent/harder → from faster moving particles. collisions = More pressure

4. At 290 K, the pressure inside a glass bottle with a volume of 240 mL is 3.4 atm. If the temperature of the bottle is raised to 315 K, **what is the new pressure** inside the bottle?

rigid container = Gay-Lussac's

~~V_1~~	~~240 mL~~	~~V_2~~	~~240 mL~~
T_1	290 K	T_2	315 K
P_1	3.4 atm	P_2	? atm

← not needed

a. Which variables are changing? P and T

b. Which variable is NOT changing? V

c. Which gas law applies here? Gay-Lussac's

d. Draw the appropriate triangle next to the variable table above.

e. Calculate the proportionality constant, $k = \frac{P_1}{T_1} = \frac{3.4 atm}{290 K} = \boxed{0.012 \frac{atm}{K}}$

f. Complete the question asked - What is the new pressure?

$$P_2 = k \cdot T_2 = 0.012 \frac{atm}{\cancel{K}} \cdot (315\cancel{K}) = 3.78 atm$$

5. The force of gas molecules colliding with the walls of a container is known as:
    a. Volume
    b. Temperature
    [✓ c.] Pressure
    d. Heat

6. **How** does decreasing the volume of a gas at constant temperature cause an increase in pressure?

If I collapse the walls of a container, I push the same amt of molecules into a smaller space. They travel @ the same speed (temp), but have less distance to travel, so hit the walls harder & more frequently, thus higher P.

    a. Does this show a proportional or inversely proportional relationship? **Explain your choice.**

Inversely proportional, because as one value (V) decreases, the other (P) increases

7. At a pressure of 1.3 atm and 25 °C, the volume of a balloon is 3.4 L. Assuming the temperature stays the same, **what is the volume of the balloon after** the pressure increased to 1.6 atm? (refer to #4 for steps to work through a gas law problem)

Boyle's Law

$V_1 = 3.4\,L$

$V_2 = ?\,L$

~~$T_1 = 25°C$~~

~~$T_2 = 25°C$~~

$P_1 = 1.3\,atm$

$P_2 = 1.6\,atm$

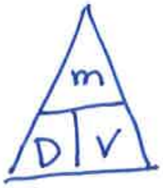
$k = V_1 \cdot P_1 = 3.4\,L \cdot 1.3\,atm$

$k = 4.42\,L \cdot atm$

$$V_2 = \frac{k}{P_2} = \frac{4.42\,L\cdot \cancel{atm}}{1.6\,\cancel{atm}}$$

$$V_2 = \boxed{2.76\,L}$$

8. What is **true** about a chunk of dry ice that has been placed in a bag and allowed to sublime into CO_2 gas?
   a. It is now a solid
   b. It is now a liquid
   [✓ c.] It now has a lower density
   d. It now has a lower temperature



9. What is the **mass** of 6.7 L of CO_2 (*g*) (density of CO_2 (*g*) is 0.0019 g/ml)

$V = 6.7\ L \qquad D = 0.0019 \frac{g}{mL}$

$\frac{6.7\ \cancel{L}}{1} \times \frac{1000 mL}{\cancel{L}} = 6700 mL$

$\frac{6700 \cancel{mL}}{1} \times \frac{0.0019 g}{\cancel{mL}}$

$= \boxed{12.73 g}$

10. 23 g of solid CO_2 is put in a sealed bag and allowed to sublime. The bag can only hold 12 L before it will burst. **Will the amount of gas produced by the dry ice burst the bag or not?** Show your work and be precise (no rounding until end!)

$m = 23g$ solid $CO_2 = 23g\ CO_2(g)$ $\qquad$ V of bag = 12 L

$D\ CO_2(g) = \frac{0.0019 g}{mL}$

$\frac{23g}{1} \times \frac{1 mL}{0.0019g} = 12{,}105 \cancel{mL} \times \frac{L}{1000 \cancel{mL}} = \boxed{12.105 L \quad \text{Bag will burst}}$

11. A syringe containing 35 mL of air is capped at sea level and 20 °C. If the syringe is heated to temperature of 35 °C,
   a. will the plunger move **out or in**?

Heat air → molecules move faster & away from each other → Syringe plunger moves $\boxed{\text{OUT}}$

P ø mentioned,
Charles Law

   b. What will the **new volume** of the syringe be?

$V_1 = 35 mL \qquad V_2 = ?\ mL$

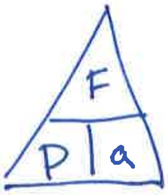
$T_1 = 20°C + 273 = 298K \qquad T_2 = 35°C + 273 = 308K$

$k = \frac{V_1}{T_1} = \frac{35 mL}{298 K} = 0.117 \frac{mL}{K}$

$V_2 = k \cdot T_2$

$= 0.117 \frac{mL}{\cancel{K}} (308\cancel{K})$

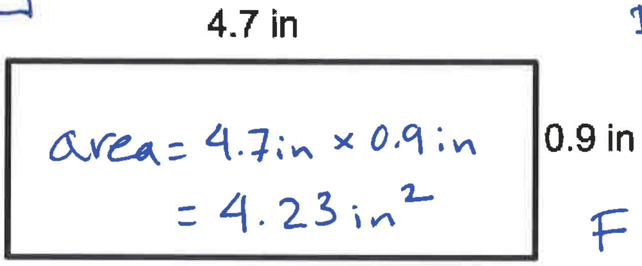
$V_2 = \boxed{36.17 mL}$



12. For the shape below, calculate the total weight of air pressure pushing on it. Assume it is at sea level where air pressure = 1.0 atm = 14.7 lb/in^2.

$P = \frac{F\,(lb)}{a\,(in^2)}$

$P = 1\,atm = \frac{14.7\,lb}{in^2}$



$area = 4.7\,in \times 0.9\,in$

$= 4.23\,in^2$

$a = 4.23\,in^2$

$F = P \cdot a = \frac{14.7\,lb}{\cancel{in^2}} \times \frac{4.23\,\cancel{in^2}}{1}$

$\boxed{F = 62.18\,lb}$

13. If the shape is taken underwater to a depth of 100 ft and a pressure of 3 atm, what amount of weight would be pressing on the shape?

$62.18\,lb \times 3 = \boxed{186.54\,lb}$

OR $\left(\frac{14.7\,lb}{in^2}\right) \times 3 = \frac{44.1\,lb}{\cancel{in^2}} \times 4.23\,\cancel{in^2} = \boxed{186.54\,lb}$

BONUS: A 6.0 L balloon at 1.2 atm and 345 K floats upward in the atmosphere. **What is the volume of the balloon** when the pressure is 0.85 atm and the temperature is 312 K? (refer to #4 for steps to work through a gas law problem)

combined gas law (ALL are changing)

$V_1 = 6.0\,L$

$T_1 = 345\,K$

$P_1 = 1.2\,atm$

$V_2 = ?\,L$

$T_2 = 312\,K$

$P_2 = 0.85\,atm$

$T \cdot \left(k = \frac{PV}{T}\right) \cdot T$

$\frac{Tk}{P} = \frac{\cancel{P}V}{\cancel{P}}$

$V = \frac{Tk}{P}$

$k = \frac{(1.2\,atm)(6.0\,L)}{345\,K}$

$k = 0.021\,\frac{atm \cdot L}{K}$

$V_2 = \frac{T_2\,(k)}{P_2}$

$= \frac{312\,\cancel{K}\left(0.021\,\frac{\cancel{atm}\cdot L}{\cancel{K}}\right)}{0.85\,\cancel{atm}}$

$\boxed{V_2 = 7.71\,L}$