1. Physical Properties Review

1. When does boiling occur? (note: has nothing to do with temp) $P_{VAP} \geq P_{ATM}$
2. What does NORMAL BOILING POINT mean?

   ↳ Temp at which L → G @ STD Pressure

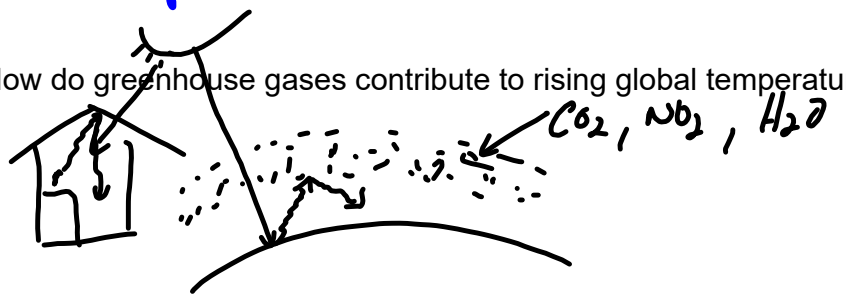
   101.3 kPa
   760 mmHg
   1 atm
3. Classify the following as exo or endo thermic:
   a) Freezing exo
   b) Melting endo
   c) Boiling endo
   d) Sublimation S→G endo

2. Gases in the Atmosphere

1. What are the 4 most abundant gases in the atmosphere? Give their approximate percentages.

   N_2 – 78%
   O_2 – 20%
   Ar – 1%
   CO_2 < 1%
2. What does the ozone layer do?

   filters uv light
3. How do greenhouse gases contribute to rising global temperatures?



3. Pressure

1. Define pressure

force / area

2. Give 3 ways in which you feel pressure (not peer pressure)

- ears pop on a plane 20%
- diving
- difficulty breathing @ high altitudes

3. Some gas is trapped in a syringe. If the volume of the gas is reduced, what do you think will happen to the pressure? Explain why at the particle level.

↳ increases - less space, collide w/ container more often

4. Pressure

1. Define pressure.

force / area

2. a) If the volume of a gas is increased, what happens to the pressure?

decrease

b) Is this inverse or direct?

3. Convert 750mmHg to kPa.

$$750\ mmHg \times \frac{101.3\ kPa}{760\ mmHg} = 99.97\ kPa$$

5. Boyle's Law (P-V)

1. A gas has a volume of 200mL at 1.5 atm of pressure. If the pressure is lowered to 700mmHg, find the new volume.

$700\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.92\ atm$

$P\downarrow V\uparrow$

$200\ mL \times \frac{1.5\ atm}{0.92\ atm} = 326.1\ mL$

2. A gas has a volume of 200mL at 760mmHg. If the volume is changed to 450mL, what is the pressure (in kPa)?

$P_1V_1 = P_2V_2$

$(760\ mmHg)(200\ mL) = P_2(450\ mL)$

$P_2 = 337.8\ mmHg \times \frac{101.3\ kPa}{760\ mmHg} = 45.02\ kPa$

6. Boyle's Law/Theory

1. What is the difference between a barometer and a manometer?

P_{atm} P_{gas}

2. Give 2 effects of a rise in global temperatures.

Sea level ↑
ice melts (ice cap)
loss of habitat

3. A gas has a pressure of 1atm and a volume of 10L what would be the volume if the pressure was raised to 2atm?

(half) 5L

7. Boyle's Law

A gas has a volume of 200mL at 760mmHg. If the volume is changed to 450mL, what is the pressure (in kPa)?

V_1 $P_1 = 101.3\text{kPa}$ V_2

$P_1V_1 = P_2V_2$

$(200\text{mL})(101.3\text{kPa}) = P_2(450\text{mL})$

$P_2 = 45.02\text{kPa}$

$V \uparrow P \downarrow$

$101.3\text{kPa} \times \frac{200\text{mL}}{450\text{mL}} = 45.02\text{kPa}$

Worksheet answers:

① 231.25mL ③ 6.4L ⑤ 87.5mL ⑦ 1.15L

⑤ $V_1 = 175\text{mL}$, $P_1 = 75\text{kPa}$

$\frac{(75\text{kPa})(175\text{mL})}{150} = \frac{(150\text{kPa})V_2}{150}$

$V_2 = 87.5\text{mL}$

8. Boyle's Law (PV), Charles' Law (VT)

$800\text{mmHg} \times \frac{1\text{atm}}{760\text{mmHg}} = 1.05\text{atm}$

2L (V_1) of a gas has a pressure of 1.5 atmospheres (P_1). If the pressure is changed to 800mmHg, find the new volume. (P_2)

$P_1V_1 = P_2V_2$

$(1.5\text{atm})(2\text{L}) = (1.05\text{atm})V_2$

$V_2 = \frac{(1.5\text{atm})(2\text{L})}{1.05\text{atm}} = 2.86\text{L}$

$P \downarrow V \uparrow$

$2\text{L} \times \frac{1.5\text{atm}}{1.05\text{atm}} = 2.86\text{L}$

A gas has a volume of 30mL, how do you think the volume would change if the temperature were doubled?

increased

9. Boyle's Law (PV), Charles' Law (VT)

A gas has a pressure of 1 atmosphere and a volume of 30mL. If the pressure is changed to 600mmHg, find the new volume.

760mmHg P_1 V_1

$P_1V_1 = P_2V_2$ P_2

$(760\text{mmHg})(30\text{mL}) = 600\text{mmHg}(V_2)$

$V_2 = 38\text{mL}$

$PV\uparrow$

$30\text{mL} \times \frac{760\text{mmHg}}{600\text{mmHg}} = 38\text{mL}$

303K T_1 V_1

At 30 degrees celsius a gas has a volume of 25mL. What would the temperature have to be in order to change the volume to 45mL? V_2

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$T_2 \frac{25\text{ml}}{303\text{k}} = \frac{45\text{mL}}{T_2} T_2$

$\frac{(T_2)(25\text{ml})}{303\text{K}} = 45\text{mL}$

$T_2 = \frac{(45\text{mL})(303\text{k})}{25\text{mL}}$

$T_2 = 545.4\text{ K}$

$V\uparrow T\uparrow$

$303\text{k} \times \frac{45\text{mL}}{25\text{mL}} = 545.4\text{k}$

10. Boyle's Law (PV), Charles' Law (VT), Gay-Lussac's Law (PT)

1. 500.0 mL of a gas is collected at 745.0 mm Hg. What will the volume be at standard pressure? V_1 P_1 P_2

$P_1V_1 = P_2V_2$

$(745\text{mmHg})(500\text{mL}) = (760\text{mmHg})V_2$

$V_2 = \frac{(745\text{mmHg})(500\text{mL})}{760\text{mmHg}} = 490\text{mL}$

2. What would be the new volume if the temperature on 450 mL of gas is changed from 45°C to -5°C? 318K 268K

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{450\text{mL}}{318\text{K}} = \frac{V_2}{268\text{K}}$

$V_2 = \frac{(450\text{mL})(268\text{K})}{318\text{K}} = 379\text{ mL}$

3. A sample of a gas has a pressure of 1.07 atm at a temperature of 120°C. What will the pressure be at a temperature of 205°C if the volume remains the same? 393K 478K

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$\frac{1.07\text{atm}}{393\text{K}} = \frac{P_2}{478\text{K}}$

$P_2 = \frac{(1.07\text{atm})(478\text{k})}{393\text{k}} = 1.3\text{ atm}$

11. Combined Gas Law

A gas has a volume of 800mL at -23^{0}C and 300mmHg. What would the volume of the gas be at STP? 760mmHg, 273K

250K

T↑ V↑ P↑ V↓

$$800\,mL \times \frac{273K}{250K} \times \frac{300\,mmHg}{760\,mmHg} = 344.8\,mL$$