Ch. 5 – Gases

① How big of a volume of dry oxygen at STP (1.0 atm, 273 K) would you need to get the same number of oxygen molecules as there are hydrogen molecules in 25.0 L at 0.850 ATM and 35°C?

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(.850)(25)}{(.0821)(308)}$$

$$n = 0.840 \text{ mols } H_2 \text{ molecules}$$

a) 0.068 L

b) 4.2 L

c) 32.3 L

(d) 18.8 L

e) 0.656 L

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{(.840)(.0821)(273)}{1}$$

$$V = 18.8 \text{ L}$$

(2) A road bike's tires can handle a pressure of 150 psi. What is this pressure in mm Hg?

a) 7.76×10^3 mm Hg

~~b)~~ 760 mm Hg

~~c)~~ 775 mm Hg

~~d)~~ 10.2 mm Hg

e) 1470 mm Hg

1 psi = 51.71 mm Hg

$$150 \cancel{\text{psi}} \times \frac{51.71 \text{ mm Hg}}{1 \cancel{\text{psi}}} = 7.8 \times 10^3 \text{ mm Hg}$$

1 atm = 760 mm Hg

(3) A 268 cm^3 sample of an ideal gas at 18°C and 748 Torr is placed in a 648 cm^3 container. To what temperature (centigrade) must the assembly be heated so that the gas will fill the whole chamber at 748 Torr?

a) 597 °C

b) 120 °C

c) 324 °C

d) 431 °C

e) 704 °C

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

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

$$T_2 = \frac{(648)(291)}{268}$$

$$T_2 = 431\ °C$$

(4) An unknown gas, Gas A, diffuses at 1.25 times the rate of carbon dioxide at identical pressure and temperature. What is the molar mass of Gas A?

a) 52.2 g/mol

b) 28.2 g/mol

c) 64 g/mol

d) 22 g/mol

e) 14 g/mol

$$\frac{Rate_1}{Rate_2} = \frac{\sqrt{MM_2}}{\sqrt{MM_1}}$$

$$1.25 = \frac{\sqrt{44.01}}{\sqrt{MM_1}}$$

$$\left(\sqrt{MM_1}\right)^2 = \left(\frac{\sqrt{44.01}}{1.25}\right)^2$$

$$MM_1 = \left(\frac{\sqrt{44.01}}{1.25}\right)^2$$

$$MM_1 = 28.2 \text{ g/mol}$$

(5) A motorist fills her tires to 32 lb/in^2 pressure at a temperature of 30° c. Assuming no change in volume, what will the pressure in the tires be when she drives her car through Death Valley, which has a pavement temperature of 78° c?

$lb/in^2 = psi$

a) 12 lb/in^2

b) 37 lb/in^2

c) 83 lb/in^2

d) 4.8 lb/in^2

e) 28 lb/in^2

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

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

$$P_2 = \frac{(32)(351)}{303}$$

$$P_2 = 37 \text{ psi}$$

$$PV = nRT$$

$$R = \frac{PV}{nT}$$

Ex:

$P = 1$ atm

$P = 760$ mm Hg

$$R = \frac{[\ \ ][L]}{[\text{mols}][K]}$$

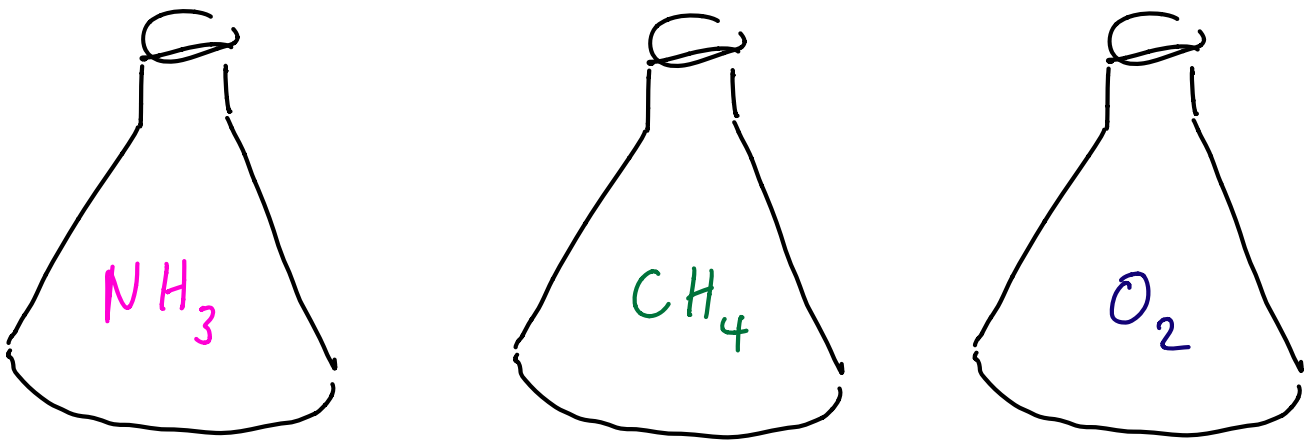
P: mm Hg

Torr

psi

atm

(6) Flask(s) _____ is/are most likely to exhibit ideal behavior because _____.



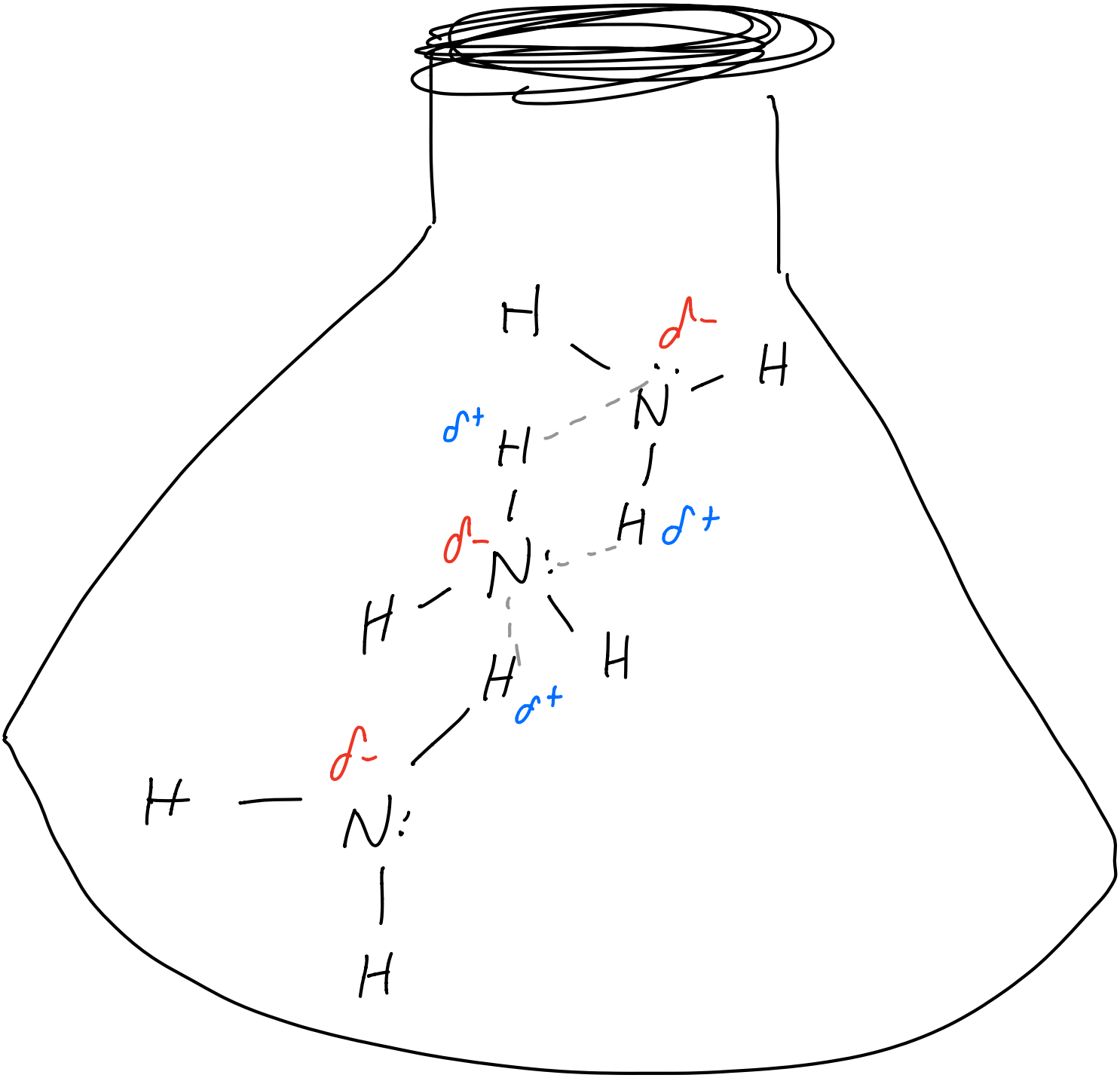
Flask 1 2 3

a) Flask 2 (CH_4) because it is a hydrocarbon.

b) Flask 1 (NH_3) because it has the lowest molar mass.

c) Flask 1 (NH_3) because ammonia is a polar molecule.

d) Flasks 2 and 3 because methane and oxygen are non-polar molecules.


H
δ−
H
δ+
H
N
H
δ−
N
H
δ+
H
H
H
δ+
δ−
H
N
H