Chapter 7 Homework Answer Key

Chapter 7: 47, 49, 51, 53, 57, 58, 61, 62, 63
65, 67, 71, 74, 79, 80, 81, 85, 90,
91, 92, 99, 101, 105, 106, 113, 118.

58) How hot must the air in a balloon be heated if initially it has a volume of 750. L at 20°C and the final volume must be 1,000. L?

$P_1 = —$
$V_1 = 750.\,L$
$n_1 = —$
$T_1 = 20°C$
$+273.15$
293.15

$P_2 = —$
$V_2 = 1{,}000.\,L$
$n_2 = —$
$T_2 = ?$

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

$\frac{T_2V_1}{T_1} = V_2$

$T_2 = \frac{V_2T_1}{V_1}$

$T_2 = \frac{(1{,}000.\,L)(293.15\,K)}{750.\,L}$

$= 390.8\overline{6}\,K$
-273.15
$117.7266\overline{6}\,°C$

$= \boxed{120\,°C}$

62) If a plastic container at 1.0 °C and 750. mmHg is heated in a microwave oven to 80. °C, what is the pressure inside the container?

$P_1 = 750.\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.986842\ atm$

$V_1 = —$

$n_1 = —$

$T_1 = 1.0°C + 273.15 = 274.15\ K$

$P_2 = ?$

$V_2 = —$

$n_2 = —$

$T_2 = 80.°C + 273.15 = 353.15\ K$

$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$ Drop out V & n. Solve for P_2

$$P_2 = \frac{T_2 P_1}{T_1} = \frac{(353.15\ K)(0.986842\ atm)}{(274.15\ K)}$$

$$= 1.27121213\ atm \times \frac{760\ mmHg}{1\ atm}$$

$$= 966.12256006\ mmHg$$

$$= \boxed{1.27\ atm \text{ or } 966\ mm\ Hg}$$

74) An unknown amount of gas occupies 30.0L at 2.1 atm and 298k. How many moles does the sample contain? What is the mass if the gas is helium? What is the mass if the gas is Argon?

$P = 2.1\,atm$
$V = 30.0\,L$
$n = ?$
$T = 298k$

$PV = nRT$

$n = \frac{PV}{RT}$

$$n = \frac{(2.1\,atm)(30.0\,L)}{(0.0821\,\frac{L\,atm}{mol\,k})(298K)} = 2.57\underset{\uparrow}{5}0231\ moles$$

$$= \boxed{2.6\ moles\ gas}$$

If helium:

moles He $\longrightarrow$ g He use the unrounded moles to calc mass.

$$2.57\underset{\uparrow}{5}0231\ moles\ He \times \frac{4.003\,g\,He}{1\ mole\ He} = 10\underset{\uparrow}{.}30782\,g\,He$$

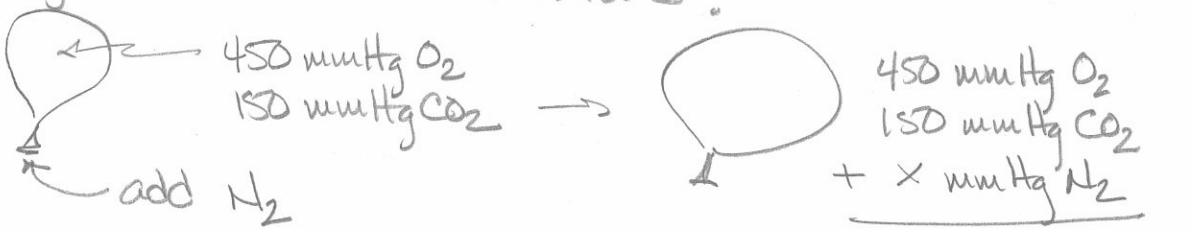
$$= \boxed{10.\,g\,He}$$

If Argon:

$$2.57\underset{\uparrow}{5}0231\ moles\ Ar \times \frac{39.95\,g\,Ar}{1\ Mole\ Ar} = 10\underset{\uparrow}{2}.87\,21726\,g\,Ar$$

$$= \boxed{1.0 \times 10^{2}\,g\,Ar}$$

80) If N_2 is added to a balloon that contains O_2 (partial pressure 450 mmHg) and CO_2 (partial pressure 150 mmHg) to give a total pressure of 850 mmHg, What is the partial pressure of each gas in the final mixture?



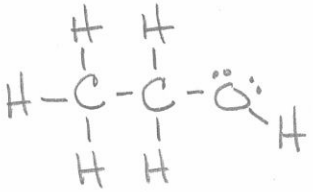
$$P_T = P_{O_2} + P_{CO_2} + P_{N_2}$$

$$P_{N_2} = P_T - P_{O_2} - P_{CO_2} = 850\ mmHg - 450\ mmHg - 150\ mmHg$$

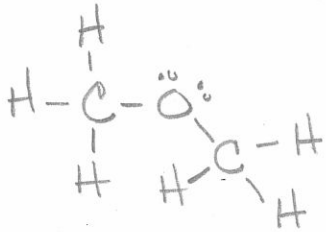
$$P_{N_2} = 250\ mmHg$$

$$\boxed{P_{O_2} = 450\ mmHg \quad P_{CO_2} = 150\ mmHg \quad P_{N_2} = 250\ mmHg}$$

90) Ethanol and dimethyl ether have the same Molecular formula

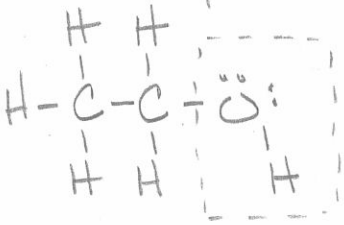


Ethanol



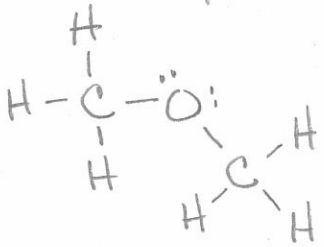
Dimethyl Ether

a) What type of intermolecular forces are present in each compound?



Allows for Hydrogen bonding

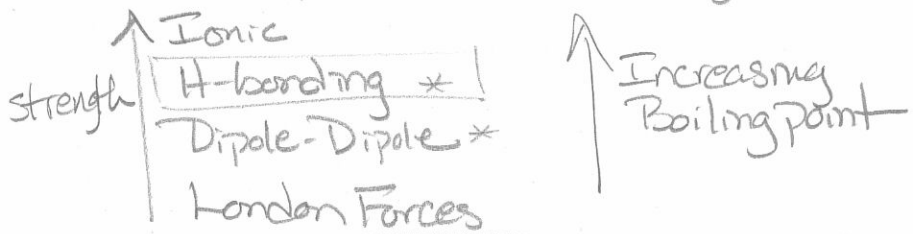
C-O polar
O-H polar
C-H non-polar



no H on oxygen.
Can't hydrogen bond.
only dipole-dipole

Both molecules are polar, but ethyl alcohol (Ethanol) allows for Hydrogen bonding

b) Which compound has the higher boiling point?



⟹ Ethanol Higher Boiling

c) Higher Vapor pressure goes with the lower boiling material.

⟹ Dimethyl Ether has higher Vapor Pressure

92) Using the given boiling points, predict which compound has the higher vapor pressure at the given temperature.

a) Ethanol 78°C or propanol 97°C

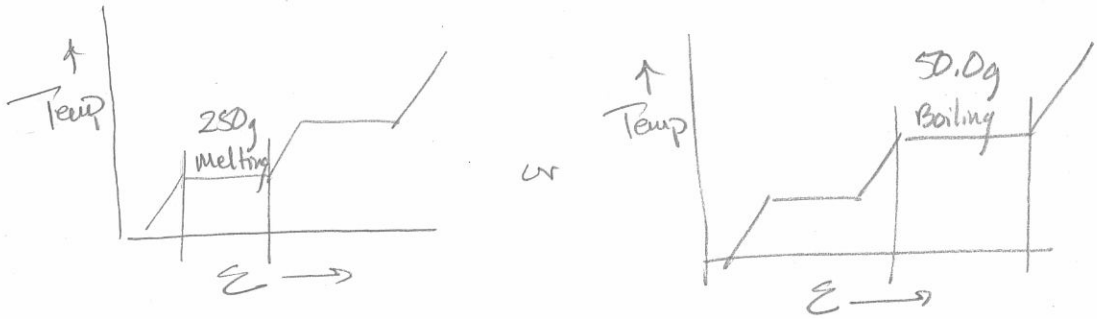
Boiling occurs when vapor pressure equals atmospheric pressure. The lower boiling material will have the higher vapor pressure.

$\Rightarrow$ **Ethanol**

b) Hexane 69°C or Octane 125°C

$\Rightarrow$ **Hexane**

106) Which process requires more energy, Melting 250g of ice or vaporizing 50.0 g H_2O? The heat of fusion is 79.7 cal/g and heat of vaporization is 540 cal/g.



Melting 250 g Ice

$E = H_f \times \text{mass}$

$= 79.7 \text{ cal/g} \times 250 \text{ g} = 19925 \text{ cal} = 20. \text{ kcal}$

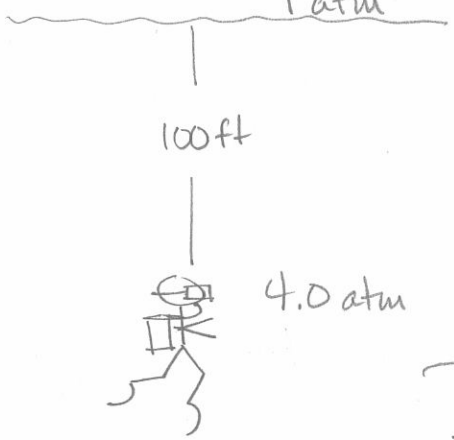
Boiling 50.0 g H_2O

$E = H_v \times \text{mass}$

$= 540 \text{ cal/g} \times 50.0 \text{ g} = 27000 \text{ cal} = \boxed{27 \text{ kcal}}$

Boiling 50.0 g H_2O takes more energy

118) If a scuba diver inhales 0.50L of air at a depth of 100.ft and 4.0 atm pressure, what volume does this air occupy at the surface of the H_2O? When a scuba diver must make a rapid ascent to the surface, he is told to exhale slowly as he ascends. How does your result support this recommendation?



$P_1 = 4.0\,atm$ $\quad P_2 = 1\,atm$

$V_1 = 0.50L$ $\quad V_2 = ?$

$n_1 = —$ $\quad n_2 = —$

$T_1 = —$ $\quad T_2 = —$

$$\frac{P_1 V_1}{\cancel{n_1 T_1}} = \frac{P_2 V_2}{\cancel{n_2 T_2}}$$

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(4.0\,atm)(0.50L)}{(1.0\,atm)}$$

$$= \boxed{2.0L\ gas}$$

If the diver does not slowly exhale, he/she is at risk of hurting their lungs as the air expands on ascent.