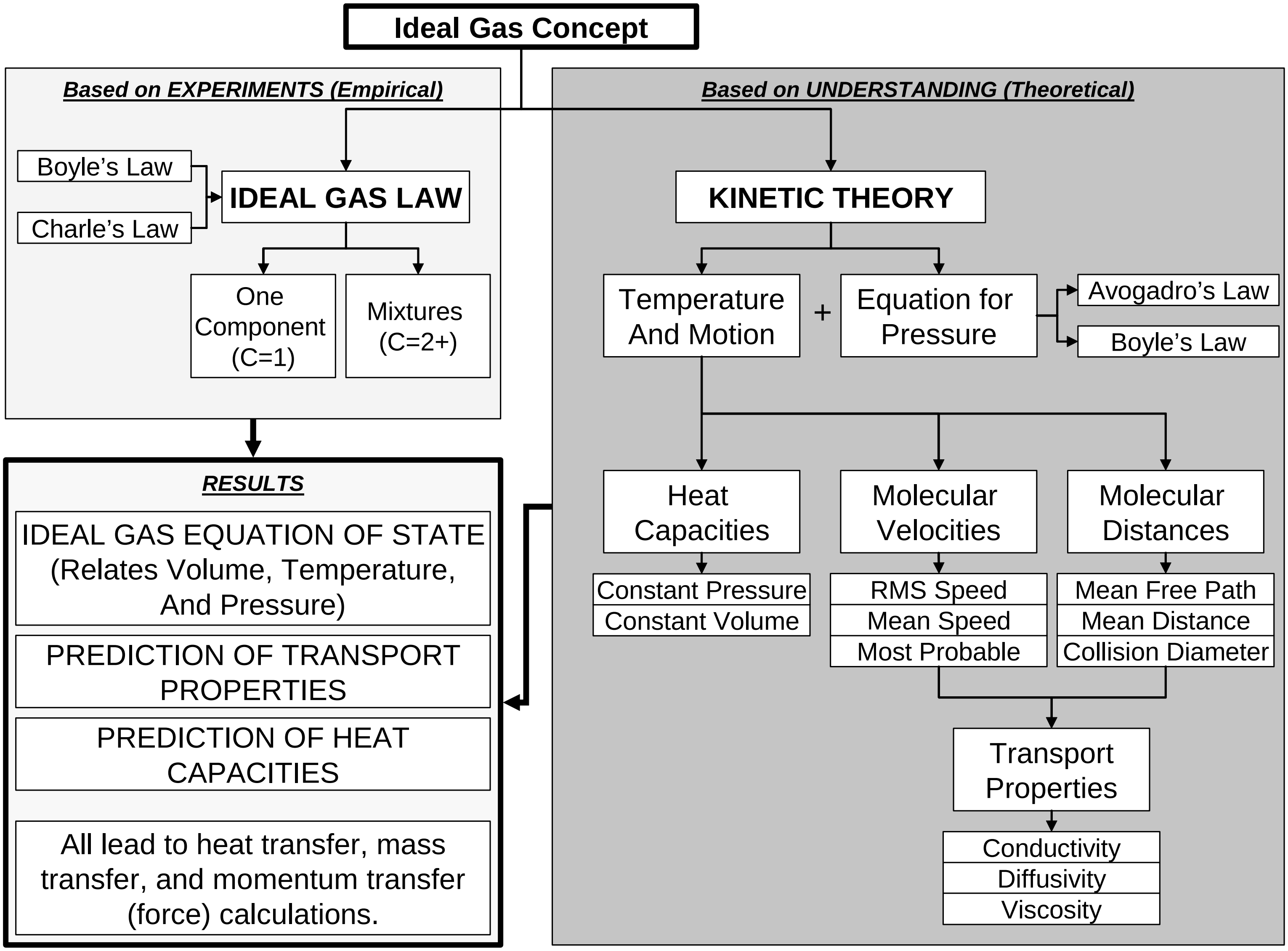
ENGG 201 – HANDOUT

IDEAL GASES – "THE BIG PICTURE OF CHAPTER 5"



FORMULA SHEET – Chapter 5

<u>Constants / Conversions</u>

$R = 8.314 \frac{kPa.m^3}{kmol.K} = 8.314 \frac{J}{mol.K}$ $N_A = 6.023x10^{26} \frac{molecules}{kmol}$ $g = 9.81 m/s^2$

$R = 0.08205 \frac{atm.m^3}{kmol.K}$ $k = \frac{R}{N_A} = 1.3805x10^{-23}\, J/K$ $1\ cP = 10^{-3}\ Pa.s$

101.325 kPa =1 atm *1 bar = 100 kPa* $1\ L = 1000\ cm^3 = 1000\ mL = 0.001\ m^3$

760 mmHg = 1 atm *1 inch = 2.54 cm*

<u>Geometric Shapes</u>

$V_{sphere} = \frac{4}{3}\pi r^3$ $SA_{sphere} = 4\pi r^2$ $V_{cylinder} = \pi r^2 h$

<u>Ideal Gas</u>

$Pv = nRT$

<u>Kinetic Theory of Gases</u>

$c_{mp} = \sqrt{\frac{2RT}{M}}$ $\sqrt{\overline{c^2}} = \sqrt{\frac{3RT}{M}}$ $\bar{c} = \sqrt{\frac{8RT}{\pi M}}$

$P = \frac{N_A m\overline{c^2}}{3V_m}$ $E_k = \frac{1}{2} m\overline{c^2}$ $k = \frac{R}{N_A}$

$\lambda = \frac{1}{\sqrt{2}\pi\sigma^2 \rho_N}$ $\delta = \left[\frac{kT}{P}\right]^{1/3}$ $\rho_N = \frac{N_A}{V_m} = \frac{P}{kT}$

<u>Kinetic Theory of Gases - Transport Properties</u>

$\mu = \frac{M}{N_A \pi\sigma^2}\sqrt{\frac{RT}{\pi M}}$ $\kappa = \frac{C_v}{N_A \pi\sigma^2}\sqrt{\frac{RT}{\pi M}}$ $D_{AA} = \frac{RT}{PN_A \pi\sigma^2}\sqrt{\frac{RT}{\pi M}}$

$\mu = \frac{\rho_N \bar{c}\lambda m}{2}$ $\kappa = \frac{\lambda \rho_N \bar{c}}{2}\frac{C_v}{N_A}$

$F/A = -\mu \frac{du}{dz}$ $Q/A = -\kappa \frac{dT}{dz}$ $j_A = -D\frac{dC}{dz}$

$C_v = \frac{3}{2}R$ $C_p = \frac{5}{2}R$ $C_p = C_v + R$