Recap… Chapter 3, Gas laws

- What is the definition of an ideal gas, under which conditions can we consider a gas to be ideal?
- What are different gas laws discovered in the 17-19th centuries?
- What is the equation of state of ideal gas?
- Which corrections are assumed for real gases (van der Waals gas)?

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Avogadro's law:	Gasses with identical P, T and V contain the same number of molecules.

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$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

(a: pressure correction, b: volume correction)

Recap… Chapter 4, Kinetic theory of gases

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- What is the relation between Pressure, Volume and particle velocity?

- How is the kinetic energy of ideal gas related to macroscopic T?

- How can we compute the root-mean-square velocity v_{rms} of gas particles?

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$$\boxed{v_{\mathrm{rms}} = \sqrt{\langle v^2\rangle} = \sqrt{\frac{2\langle K\rangle}{m}} = \sqrt{\frac{3kT}{m}}}$$

Quizzzz time

- The T of an ideal gas increases. Which of the following is true? a) the pressure must decrease. b) the pressure must increase. c) the pressure must increase while the volume decreases. d) the volume must increase while the pressure decreases. e) the pressure, the volume or both may increase.

- An ideal gas in a sealed rigid container (closed system). The average kinetic energy of the gas molecules depends mostly on a) the size of the container; b) the number of molecules in the container; c) the temperature of the gas; d) the mass of the molecules. What about the rms velocity of gas molecules?

- Why should you not put a closed, empty glass jar with the lid on tight into a campfire? What could happen?

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- Why should you not put a closed, empty glass jar with the lid on tight into a campfire? What could happen?
    - Heat Expansion: —> pressure increase!
    - Glass Breaking: Glass can break or shatter due to thermal stress caused by uneven heating or rapid temperature changes, in particular if the glass transitions quickly from being hot to cool.
    - —> Risk of Explosion due to combination of increased internal pressure and the thermal stress

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- Two ideal gases, A & B, are at the same T. If the molecular mass of the molecules in gas A is twice that of molecules in gas B, the molecules' root-mean-square velocity is a) the same in both gases; b) twice as great in A; c) 1.4 times greater in A; d) twice as great in B; or e) 1.4 times greater in B?

- In a mixture of the gases Oxygen and Helium, which statement is valid? a) The He atoms will be moving faster than the O molecules on average; b) both will be moving at the same speed. c) The O molecules will be on average moving faster. d) The kinetic energy of the He atoms will exceed that of the O molecules. e) none of the above.

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    - e) is correct. v_rms ~ 1/sqrt(m) —> This is because if the molecular mass of A is twice that of B, the rms velocity of A will be smaller by a factor of 1/sqrt(2), and hence, the rms velocity of B will be 1.4 times greater than that of A.
    - mA = 2 mB; & v_rms,B ~ 1/sqrt(mB)
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    - a) is correct, because He atoms are lighter… Oxygen (O_2) is a diatomic molecule with a molar mass of approximately 32 g/mol (16 g/mol for each oxygen atom), whereas Helium (He) is a monatomic gas with a molar mass of about 4 g/mol. Thus, oxygen molecules are heavier than helium atoms.