-Start w/ Hindenburg video -why did it explode? -gases-we'll learn in this unit.

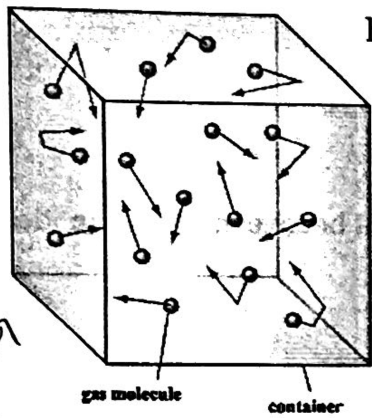
Kinetic Molecular Theory: Real vs. Ideal Gases

-Then: can you make observations of a solid? A liquid? What about a gas? No. Why?

The Kinetic Molecular Theory (KMT) is the theory that all matter is made up of particles that are constantly moving.

- This energy of motion is called kinetic energy
  - Temperature is a measure of the average kinetic energy in a sample
    - The higher the temperature, the more energy the particles have, and the faster the particles will move
      - Order the states of matter from least KE to most KE:

        Solid < liquid < gas



- In gases, the particles move so fast that we usually can't see them. So how do we know about their behavior?
  - The KMT of Gases is a model that explains the behavior of gases. It provides a set of assumptions that predicts how a gas will behave.

According to the KMT, gas particles:	In reality...
➢ Movement: travel in a straight line	➢ Movement: don't always travel in a straight line
(look @ pic & ask students to compare volume of particles compared to empty space.) ➢ Volume: are much smaller than the empty space around them; considered to have negligible volume	➢ Volume: do have some volume (atomic radii)
➢ Attractions: not attracted to one another	➢ Attractions: do attract each other (some IMF) van der Waals -draw on board
➢ Collisions: perfectly elastic; no energy is lost during a collision	➢ Collisions: some energy is lost/transferred when particles collide.
*We call these IDEAL gases. -imaginary, but used to predict & explain behavior of gases	*We call these REAL gases. -actual gases in nature & in the lab.

Gases behave *most* like ideal gases under conditions of high temp low pressure.

- Why? Under these conditions, the particles are moving faster & are farther apart, so have less a chance of attracting one another or colliding.

P L I G H T

Pressure Low Ideal Gas High Temp } or think of a tropical vacation

hydrogen and helium gases are the two gases that behave most like an ideal gas. This is because:

- small
- low mass
- not many e^-, so weak IMF

SUMMARIZING THE KINETIC MOLECULAR THEORY

Choose words from the word list to fill in the blanks in the following statements.

Attraction	empty	kinetic	potential
collisions	energy	molecules	volume
elastic	great	motion	

1. A gas is composed of individual particles called molecules.
2. These particles are separated by great distances. Thus a gas is mostly empty space.
3. The actual volume of these particles is negligible compared to the volume of the space in which they are contained.
4. These particles are in continuous, rapid, straight-lined motion.
5. These particles collide with each other and with the walls of the container. These collisions are elastic, which means no ~~kinetic~~ potential energy is lost as a result of the collision.
6. The pressure of a sample of gas is the force per unit area exerted against the walls of the container due to the collisions between the particles and the wall.
7. The temperature of a sample of gas is the measure of the average kinetic energy of the particles which are in rapid, random motion.
8. The particles are assumed to have no forces of attraction between one another.

Deviations from Ideal Behavior

Gases whose behavior is exactly predicted by the kinetic theory are called ideal, or perfect gases. No gases are truly ideal because each one deviates from the gas laws in some manner.

9. Describe a way in which gases deviate from ideal behavior that is related to statement 3.

Real gases have mass & volume.

10. Describe a way in which gases deviate from ideal behavior that is related to statement 8.

Real gases are attracted to one another (some level of IMF).

11. Gases deviate most from ideal behavior under conditions of very low temperature and very high pressure. Explain why this is true.

under these conditions, particles would be close together & moving quickly, so would collide often.

12. If gases deviated from the principle described in statement 5, how would the temperature of these gas samples change when observed for long periods of time?

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