

Name: _____

Period: _____

Date: _____ **Hybrid Chemistry Regents Prep**

Ms. Hart/Mr. Kuhnau

UNIT 5: Solutions and Gases

Lesson 3: Kinetic Molecular Theory and Ideal Gases!

**By the end of today, you will have an answer to:
Under what conditions does a gas behave like an ideal gas?**

Do Now: QUIZ!

The Kinetic Molecular Theory (KMT) of Gases

- Defines the assumptions made about gases in order to simplify our understanding about the behavior of gases

	Postulate	Representation
1		
2		
3		
4		
5		

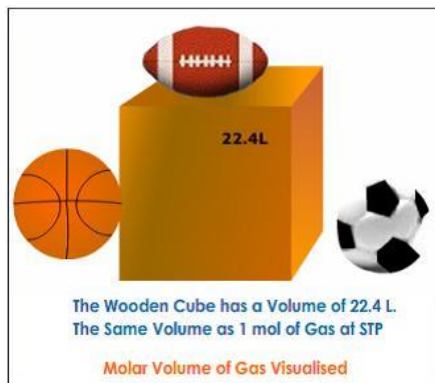
Brainstorm... In reality gases are complicated because...	<p>PRACTICE:</p> <p>Under the same conditions of temperature and pressure, which of the following gases would behave most like an ideal gas?</p> <p>(1) He(g) (2) NH₃(g) (3) Cl₂(g) (4) CO₂(g)</p>
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REAL GASES ACT LIKE IDEAL GASES WHEN AT:

Condition	Reason

How do we count gas particles?

- 1 mole (6.022×10^{23} particles) of gas ALWAYS TAKES UP 22.4 L of space at STP
- At the same temperature, pressure, and volume, every gas has the same amount of particles REGARDLESS OF IDENTITY.



PRACTICE:

Which two samples of gas at STP contain the same total number of molecules?

- (1) 1 L of CO(g) and 0.5 L of N₂(g)
(2) 2 L of CO(g) and 0.5 L of NH₃(g)
(3) 1 L of H₂(g) and 2 L of Cl₂(g)
(4) 2 L of H₂(g) and 2 L of Cl₂(g)

Closing thought:

Why do you think we can make this assumption that at the same temperature, volume, and pressure, the exact same number of gas particles are present?

Name: _____

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CW 5.3—Kinetic Molecular Theory and Ideal Gases

10 points

In-class Practice:

Directions: Answer the following questions based on your knowledge of chemistry.

- The concept of an ideal gas is used to explain
 - the mass of a gas sample
 - the behavior of a gas sample
 - why some gases are monatomic
 - why some gases are diatomic
- The kinetic molecular theory assumes that the particles of an ideal gas
 - are in random, constant, straight-line motion
 - are arranged in a regular geometric pattern
 - have strong attractive forces between them
 - have collisions that result in the system losing energy
- A real gas behaves more like an ideal gas when the gas molecules are
 - close and have strong attractive forces between them
 - close and have weak attractive forces between them
 - far apart and have strong attractive forces between them
 - far apart and have weak attractive forces between them
- Under which conditions of temperature and pressure would helium behave most like an ideal gas?
 - 50 K and 20 kPa
 - 50 K and 600 kPa
 - 750 K and 20 kPa
 - 750 K and 600 kPa
- Under which conditions of temperature and pressure would a sample of $\text{H}_2(\text{g})$ behave most like an ideal gas?
 - 0°C and 100 kPa
 - 0°C and 300 kPa
 - 150°C and 100 kPa
 - 150°C and 300 kPa
- At the same temperature and pressure, 1.0 liter of CO (g) and 1.0 liter of CO_2 (g) have
 - equal masses and the same number of molecules
 - different masses and a different number of molecules
 - equal volumes and the same number of molecules
 - different volumes and a different number of molecules
- A sample of oxygen gas is sealed in container X. A sample of hydrogen gas is sealed in container Z. Both samples have the same volume, temperature, and pressure. Which statement is true?
 - Container X contains more gas molecules than container Z.
 - Container X contains fewer gas molecules than container Z.
 - Container X and Z both contain the same number of gas molecules.
 - Containers X and Z both contain the same mass of gas.
- The table below shows data for the temperature, pressure, and volume of four gas samples

Data for Four Gas Samples

Gas Sample	Temperature (K)	Pressure (atm)	Volume (mL)
A	100.	2	400.
B	200.	2	200.
C	100.	2	400.
D	200.	4	200.

Which two gas samples have the same total number of molecules?

- A and B
- A and C
- B and C
- B and D

9. The kinetic molecular theory assumes that the particles of an ideal gas
- (1) move in curves, avoiding colliding with each other and walls
 - (2) are arranged in a regular geometric pattern
 - (3) have no attractive forces between them
 - (4) have collisions that result in the system losing energy
10. Under which conditions would gases behave most like ideal gases?
- (1) High temperature and high pressure
 - (2) Low temperature and low pressure
 - (3) High temperature and low pressure
 - (4) Low temperature and high pressure
11. How many liters of $O_2(g)$ would occupy the same volume as 2 L of $CO_2(g)$ at 298 K and 1.0 atm of pressure?

12. Given the balanced equation representing a reaction:



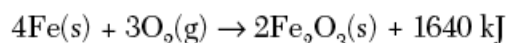
Which statement is true about energy in this reaction?

- (1) The reaction is exothermic because it releases heat.
 - (2) The reaction is exothermic because it absorbs heat.
 - (3) The reaction is endothermic because it releases heat.
 - (4) The reaction is endothermic because it absorbs heat.
13. What is the ΔH for the reaction in #12? (Use Table I) _____

14. Which change is exothermic? (Use Table I)

- | | |
|-----------------------------|---------------------------|
| (1) freezing of water | (2) melting of iron |
| (3) vaporization of ethanol | (4) sublimation of iodine |

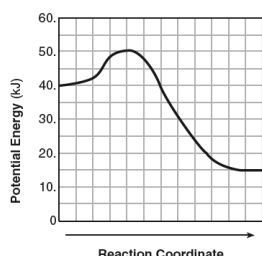
15. Given the balanced equation:



Which phrase best describes this reaction?

- (1) endothermic with $\Delta H = +1640 \text{ kJ}$
 - (2) endothermic with $\Delta H = -1640 \text{ kJ}$
 - (3) exothermic with $\Delta H = +1640 \text{ kJ}$
 - (4) exothermic with $\Delta H = -1640 \text{ kJ}$
16. Which statement correctly describes an endothermic chemical reaction?
- (1) The products have higher potential energy than the reactants, and the ΔH is negative.
 - (2) The products have higher potential energy than the reactants, and the ΔH is positive.
 - (3) The products have lower potential energy than the reactants, and the ΔH is negative.
 - (4) The products have lower potential energy than the reactants, and the ΔH is positive.

17. Given the potential energy diagram for a chemical reaction:



- (1) The activation energy is 10 kJ and the reaction is endothermic
- (2) The activation energy is 10 kJ and the reaction is exothermic
- (3) The activation energy is 50 kJ and the reaction is endothermic
- (4) The activation energy is 50 kJ and the reaction is exothermic

Which statement correctly describes the energy changes that occur in the forward reaction?

Name: _____

Period: _____

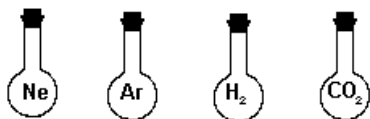
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HW 5.3—Kinetic Molecular Theory and Ideal Gases**10 points****REGENTS PRACTICE:**

- An ideal gas is made up of gas particles that
 - have volume
 - can be liquified
 - attract each other
 - are in random motion
- A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?
 - The number of gas molecules increases.
 - The number of collisions between gas molecules per unit time decreases.
 - The average velocity of the gas molecules increases.
 - The volume of the gas decreases.
- Equal volumes of $\text{SO}_2(g)$ and $\text{O}_2(g)$ at STP contain the same number of
 - atoms
 - molecules
 - electrons
 - protons
- One reason that a real gas deviates from an ideal gas is that molecules of the real gas have
 - a straight line motion
 - no net loss of energy on collision
 - a negligible volume
 - forces of attraction for each other



The diagram represents four 500-milliliter flasks. Each contains the gas represented by the symbol. All gas samples are at STP. Each flask contains the same number of

- atoms, only
- molecules, only
- atoms and molecules
- atoms but different number of molecules

6. Which of the following gases behaves most like an ideal gas?

- $\text{H}_2(g)$
- $\text{O}_2(g)$
- $\text{NH}_3(g)$
- $\text{CO}_2(g)$

7. A sample of $\text{H}_2(g)$ and a sample of $\text{N}_2(g)$ at STP contain the same number of molecules. Each sample must have

- the same volume, but a different mass
- the same mass, but a different volume
- both the same volume and the same mass
- neither the same volume nor the same mass

8.

Sample	Substance	Temperature (K)	Pressure (atm)	Volume (L)
A	He	273	1	22.4
B	O ₂	273	1	22.4
C	Ne	273	2	22.4
D	N ₂	546	2	44.8
E	Ar	546	2	44.8

The table shows the temperature, pressure, and volume of five samples. Which sample contains the same number of molecules as sample A?

- E
- B
- C
- D

9. Suppose you have two balloons, one filled with helium and the other with carbon dioxide. The pressure, temperature, and volume of the two gases are identical.

- Why is the mass of the carbon dioxide balloon greater?
- What do you know about the number of atoms in the balloons?

Work hard. Be nice.

Your second homework assignment is to complete test corrections on your Unit 4 test below. Use the supports in place for this class if you help! No excuses!

Question #:	Original Answer:	Correct Answer:
Explanation:		
Question #:	Original Answer:	Correct Answer:
Explanation:		
Question #:	Original Answer:	Correct Answer:
Explanation:		
Question #:	Original Answer:	Correct Answer:
Explanation:		
Question #:	Original Answer:	Correct Answer:
Explanation:		