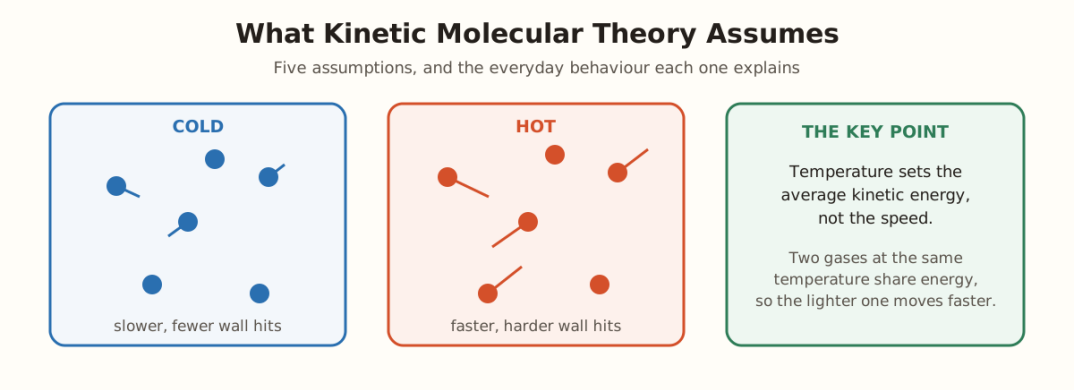
Kinetic Molecular Theory Worksheet

Grade 11 Chemistry · the five assumptions and what they explain

Name: Date: Score: / 19



Before you start: every answer here is an explanation, not a number, except Part D. Say what the particles are doing, then say what that does to the measurement. Part D needs molar masses and a square root.

Part A · why does each assumption matter?

For each assumption, give one thing it lets us explain.

1. Gas particles are in constant, random motion.

2. The particles themselves take up a negligible fraction of the volume.

3. Collisions are perfectly elastic — no kinetic energy is lost.

4. There are no attractive or repulsive forces between particles.

5. Average kinetic energy is proportional to absolute temperature.

Part B · explain the observation

#	Observation	Explanation in terms of particles
6	A balloon left in a cold car shrinks.	
7	A gas can be squeezed into a smaller cylinder but a liquid cannot.	
8	Pressure rises when more gas is pumped into a fixed tank.	
9	You smell perfume across a room within a minute or two.	
10	A sealed, rigid can bursts when heated.	

#	Observation	Explanation in terms of particles
11	Helium escapes a balloon faster than air does.	

Part C · what happens, and why?

#	Situation	Effect and reason
12	amount and volume held constant; temperature is doubled (in kelvin)	
13	amount and temperature held constant; volume is halved	
14	amount and pressure held constant; temperature is doubled (in kelvin)	
15	volume and temperature held constant; the number of particles is doubled	

Part D · Graham's law: which moves faster, and by how much?

#	Pair	Faster gas	Times faster (3 s.f.)
16	H_2 and O_2		
17	He and N_2		
18	CH_4 and CO_2		
19	NH_3 and HCl		

Answer Key

Kinetic Molecular Theory · Grade 11 Chemistry

Part A · accept any reasonable equivalent

1. **Gas particles are in constant, random motion.**
   It explains why a gas fills its container and why pressure is the same on every wall.
2. **The particles themselves take up a negligible fraction of the volume.**
   Almost all of a gas is empty space, which is why gases compress and liquids do not.
3. **Collisions are perfectly elastic — no kinetic energy is lost.**
   A sealed gas does not slowly go quiet and settle at the bottom.
4. **There are no attractive or repulsive forces between particles.**
   Particles travel in straight lines until they hit something.
5. **Average kinetic energy is proportional to absolute temperature.**
   Two different gases at the same temperature have the same average kinetic energy, not the same speed.

Part B

6. **A balloon left in a cold car shrinks.**
   Lower temperature means lower average kinetic energy, so particles hit the wall less often and less hard. The balloon contracts until the inside pressure matches outside again.
7. **A gas can be squeezed into a smaller cylinder but a liquid cannot.**
   Gas particles are mostly empty space, so reducing the volume mainly removes gaps. A liquid has almost no gaps to remove.
8. **Pressure rises when more gas is pumped into a fixed tank.**
   More particles in the same volume means more collisions with the walls per second, and pressure is collisions per unit area.
9. **You smell perfume across a room within a minute or two.**
   Particles move quickly and randomly, but collide constantly, so they spread by a slow random walk rather than in a straight line.
10. **A sealed, rigid can bursts when heated.**
    Volume cannot change, so the extra kinetic energy goes entirely into harder and more frequent wall collisions, raising pressure.
11. **Helium escapes a balloon faster than air does.**
    Helium has the smallest molar mass, so at the same temperature its particles move fastest and find the pores sooner.

Part C

12. **pressure doubles**
    particles hit the walls harder and more often
13. **pressure doubles**
    the same particles strike half the wall area, so collisions per unit area double
14. **volume doubles**
    the gas must expand to keep collisions per unit area constant
15. **pressure doubles**
    twice as many particles means twice as many wall collisions

Part D

#	Working	Answer
16	$M(H_2) = 2.02$, $M(O_2) = 32.00 \rightarrow \sqrt{(32.00 / 2.02)}$	**H_2**, 3.98× faster
17	$M(He) = 4.00$, $M(N_2) = 28.02 \rightarrow \sqrt{(28.02 / 4.00)}$	**He**, 2.65× faster
18	$M(CH_4) = 16.05$, $M(CO_2) = 44.01 \rightarrow \sqrt{(44.01 / 16.05)}$	**CH_4**, 1.66× faster
19	$M(NH_3) = 17.04$, $M(HCl) = 36.46 \rightarrow \sqrt{(36.46 / 17.04)}$	**NH_3**, 1.46× faster