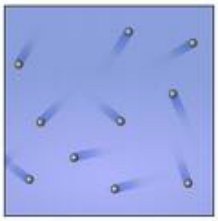
KINETIC THEORY

Name: _____ Date: _____ Class: _____

The Kinetic Theory Worksheet

Instructions: As you go through the simulation, please answer the following questions. This is **individual** work unless I say otherwise! **All** the answers are in the text and vocabulary list, so read everything carefully! **This is to be finished by the end of class…it can be done!**



Vocabulary List

Theory: an accepted statement about science that has been tested and peer reviewed many times that explains observations (facts) can be used to make predictions.

Kinetic: this word means movement. Kinetic energy is energy that has to do with things moving and is stored in objects.

To examine: means to look at or study.

Rigid: Solid, difficult to bend, not flexible.

Pressure: The amount of force per area. If you are pushing against a wall, you are putting pressure on the wall.

Internal Pressure: The amount of pressure inside a container. Gas molecules can push against the walls of a container.

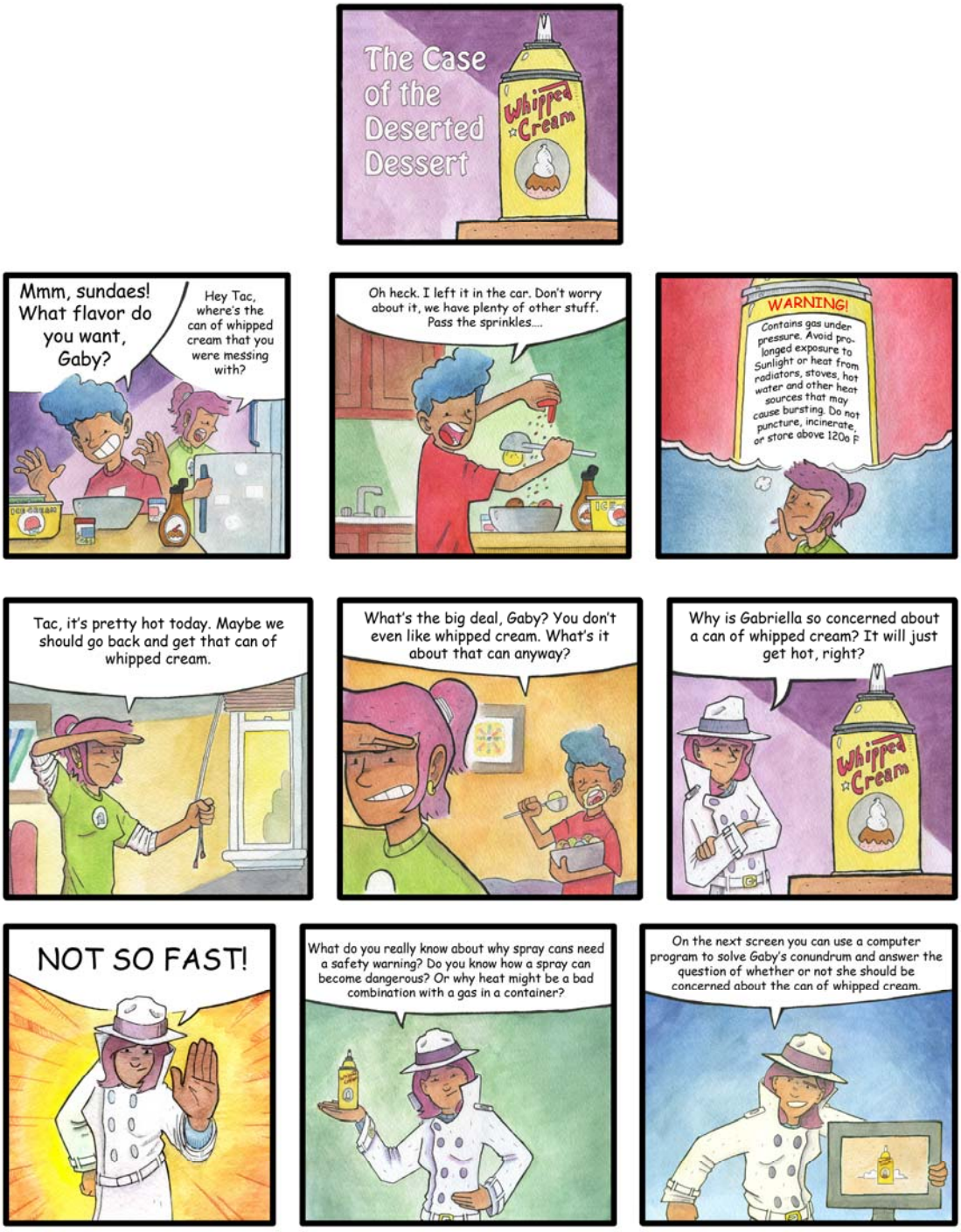
External Pressure: The amount of pressure put on the outside of a container. If you sit on a box, you put pressure on the box. Atmospheric pressure is external pressure that presses down all over you.

Particles: All matter is made up of tiny particles. Think of them as tiny, round, hard balls.

Variable: Something that varies or changes.

Atmosphere: This is a unit of pressure represented by 'atm'.

Kelvin: This is a unit of temperature that scientist use represented by 'K'. 298 K is about room temperature (= 25 degrees C).


The Case of the Deserted Dessert
Whipped Cream
Mmm, sundaes! What flavor do you want, Gaby?
Hey Tac, where's the can of whipped cream that you were messing with?
Oh heck. I left it in the car. Don't worry about it, we have plenty of other stuff. Pass the sprinkles....
WARNING!
Contains gas under pressure. Avoid prolonged exposure to Sunlight or heat from radiators, stoves, hot water and other heat sources that may cause bursting. Do not puncture, incinerate, or store above 120o F
Tac, it's pretty hot today. Maybe we should go back and get that can of whipped cream.
What's the big deal, Gaby? You don't even like whipped cream. What's it about that can anyway?
Why is Gabriella so concerned about a can of whipped cream? It will just get hot, right?
Whipped Cream
NOT SO FAST!
What do you really know about why spray cans need a safety warning? Do you know how a spray can become dangerous? Or why heat might be a bad combination with a gas in a container?
On the next screen you can use a computer program to solve Gaby's conundrum and answer the question of whether or not she should be concerned about the can of whipped cream.

Questions to do BEFORE you mess with the simulation!!

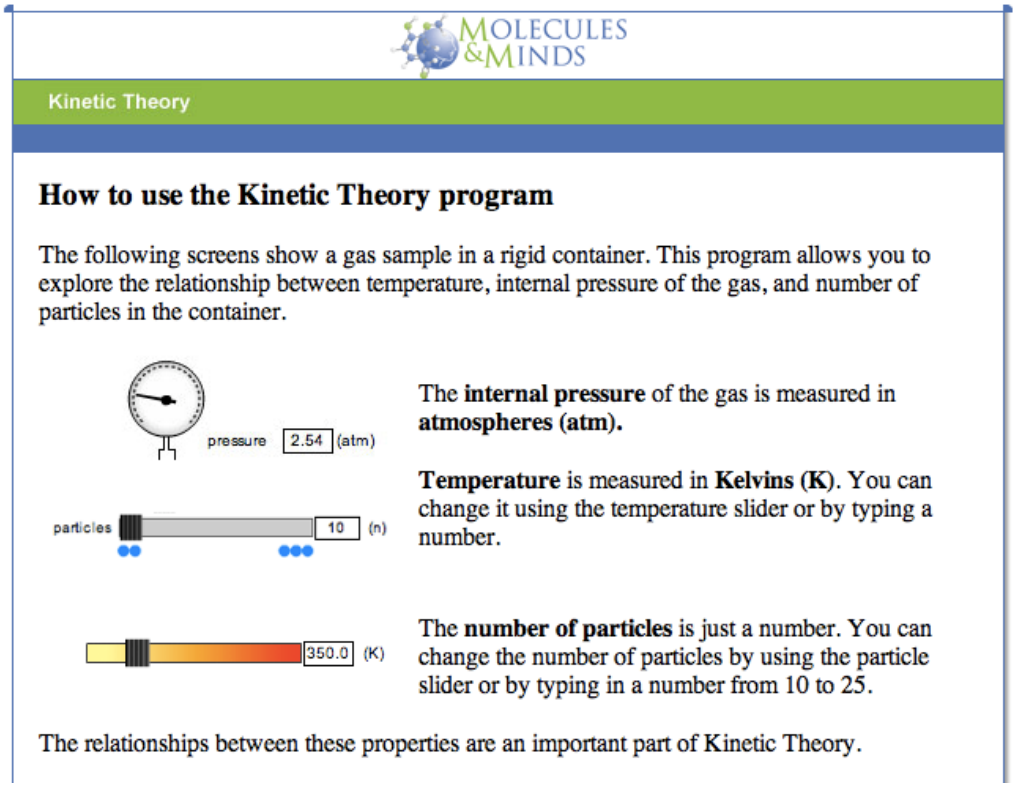
The Case of the Deserted Dessert: Kinetic Molecular Theory in Action

Who is the main character? _____

What is her issue or problem? _____

_____

Information Page (Screen 2 – 5 minutes)



What does 'kinetic' mean? _____

_____

Give a real life example of a gas that is affected by the kinetic theory?

_____

Do variables change or remain constant? _____

List 2 variables that affect gas particle motion:

_____ _____

What are the 2 aims for this simulation?

Aim1:_____

_____

Aim2:_____

_____

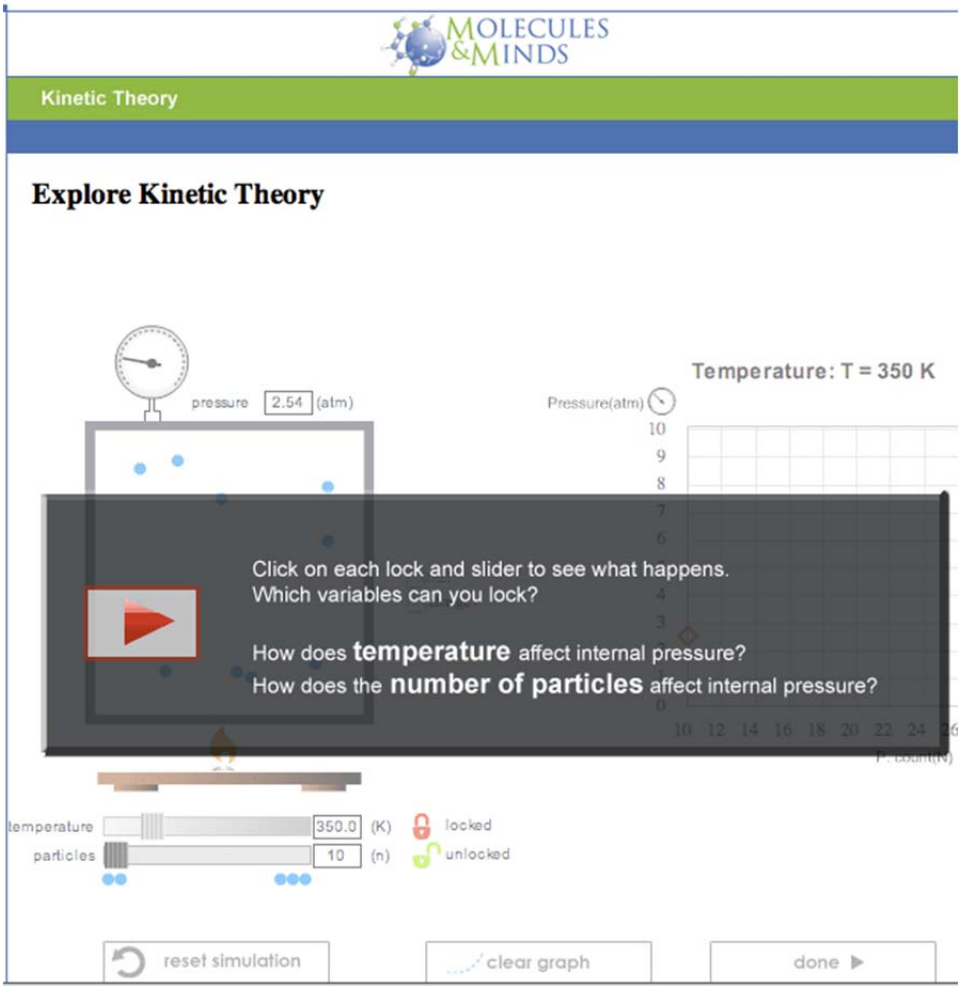
What are the units of each property we are studying?

Property	Unit

List two ways that you can change the temperature on the computer program

_____

KMT: Explanatory Model and Graph (20 minutes)



Explanatory Model **Graph**

Question: Just what is the relationship between number of particles and internal pressure of a container?

What are the two variables you need to explore to answer this question?

_____ _____

In order to answer this question using the simulation what variable do you need to keep constant?

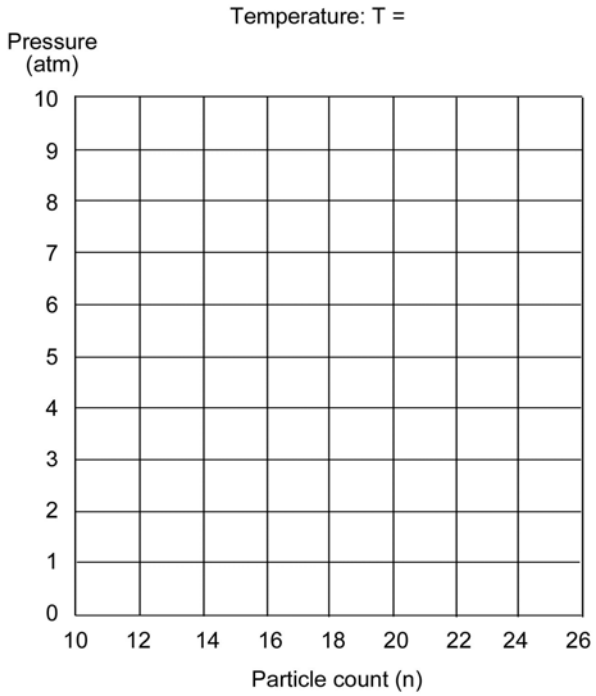
_____

Although you will explore the relationship between number of particles and internal pressure using the model (container), the values that you choose will show on the graph.
Your challenge is to answer the question.
You need to graph at least **12 points** for each graph, I'm going to start you off but you need to complete the rest!

- ❑ Graph 1: lock the temperature at any temp you want. T = _____ K

Number of Particles	Internal Pressure (atmospheres)
10	
11	
12	
13	
14	

Before you go on, please copy the graph you made onto this worksheet.

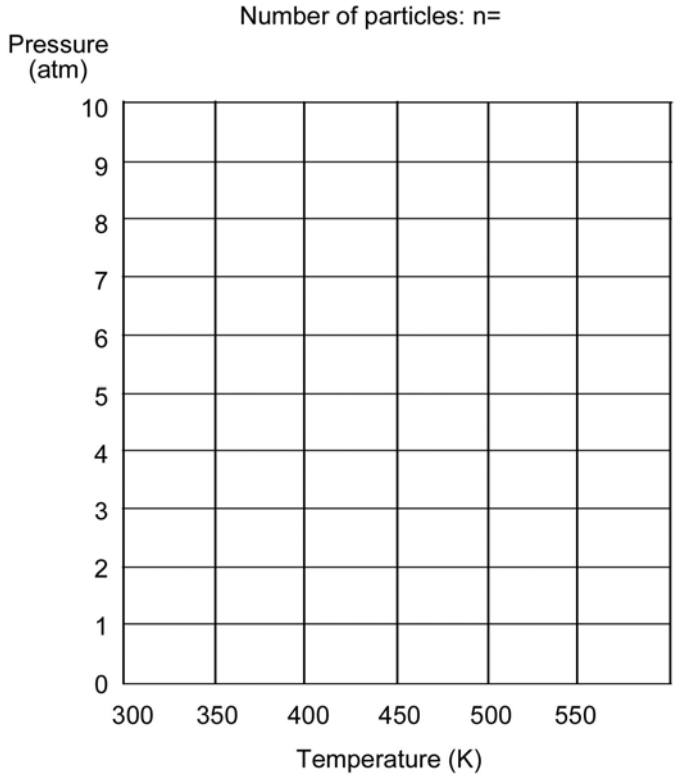


Question: Just what is the relationship between temperature and internal pressure?

- ❑ Graph 2: lock the number of particles at any number you want. Number of particles = _____ particles.

Temperature (Kelvin)	Internal Pressure (atmospheres)
300	
325	
350	
400	
475	

Before you go on, please copy the graph you made onto this worksheet.



Graph summaries (circle the words in parentheses)

Graph 1: As I increased the number of particles, the internal pressure _____.
This means the gas molecules collided (more / less) against the walls of the container. When I put more molecules into the container, they want to escape (more / less).

Graph 2: As I increased the temperature, the internal pressure _____.
This means the gas molecules pushed (harder / softer) against the walls of the container. When I put more molecules into the container, they want to escape (more / less).

Please hit 'DONE' on the simulation, then fill out a quick survey and hit 'SUBMIT'…you are almost finished!

The last part…bringing it all together

OH, USE COMPLETE SENTENCES THIS TIME…

1. How are the particles inside the spray can of cream that Tac left in the car like the moving particles in the program?

   _____

   _____

2. How is the can **like** and **not like** the container in the program?

   Like:_____

   Not Like: _____

3. Based on the kinetic theory, would Gabriella have been as worried if the atmospheric temperature was less? _____

   Why or why not? _____

   _____

NOW HIT 'DONE" AND YOU ARE…DONE! Thanks!

If you still have time (a little added bonus):
Log back into the program and set a particle number and temperature. Then click on the 'Trail' and 'Color' button. Watch the one particle. Does it move in a specific pattern?

_____

Would you describe the motion of the particle as purposeful or random and what evidence allowed you to decide?

Circle the right description for the particle motion (Purposeful/Random)

Evidence from simulation:

If you increase the temperature, does that particle move faster or slower? _____

Homework: Conversions

200 hm = _____ m 5000 mm = _____ dm 100 cm = _____ km

5.5 g = _____ mg 200 kg = _____ g 50 mg = _____ g

km	hm	dam	m	dm	cm	mm
kg	hg	dag	g	dg	cg	mg

Lesson Plan: Kinetic Molecular Theory (For teachers)

Aim: What is the Kinetic Theory and how do we know the simulation was true?

Agenda:

- Do Now – 7 min
- Thoughts on the Simulation – 5 min
- Gases – KMT – lecture/notes – 15 min
- What is pressure? – 10 min
- Demos – balloon and temp / can and water – 10 minutes
- What's next??? (diffusion) – 5 minutes

Simulation feedback…what was the most confusing thing? What worked…any improvements I can make on the handout?

Kinetic Molecular Theory: Describes the behavior of gases.
The variables involved are pressure, volume, temperature, and # of particles, size of particles.
Gases contain particles that are in straight, random motion
Gases particles collide with each other and the wall…these collisions are elastic (not like a tennis ball)
Gas particles are spread out, so they don't take up space.
Gas particles are not attracted to each other

Demonstration*: Balloon and flask on hot plate*

What is pressure?
Pressure is the amount of force applied over a surface.
To apply pressure on a wound; to apply pressure on a wall; water pressure;
Gas molecules can apply pressure on the walls of a container.

Shake up a coke bottle…the bottle becomes harder because you've increased the pressure inside the bottle. How?

Internal vs. External Pressure
Pressure is measured in atmospheres (atm)

The simulation…As you increased the temperature, the pressure went up.
As you increased the number of particles, the pressure went up.
If the pressure of the gas increases, would it push harder or softer against the walls.

Balloon → increase temperature, # of particles is locked (or constant), what happens to the pressure inside the balloon?

What keeps the bottle's shape? Why does an empty bottle not completely crumple up?

Diffusion has to do with injecting a gas into a container and seeing how long it takes to spread out.

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Do Now: Kinetic Theory

What did you think about the simulation? _____

Why? _____

_____

Other than any technical difficulties, what are some improvements that could be made?

_____

_____

_____

When you increased the temperature, what happened to the pressure?

_____

When you increased the number of particles, what happened to the pressure?

_____

When there is more pressure inside the container, do you think the gas particles wanted to escape more or less from the container?

_____

When you increased the temperature, did the particles move faster or slower?

_____

When the particles were moving did you think they were moving in a pattern or a random motion?

_____

If you didn't do the simulation (didn't get past the first 10 questions in the handout), please explain to me why you didn't get that far…for full credit on the Do Now you need to write at least five complete sentences. Can you answer the questions above? Do you feel lost in this class? What do you need to do to catch up? (answer on the back of the page)

Image of Balloon Demonstration Set-up

What do you predict will happen if we heat the air in a bottle with a balloon attached over the open top of the bottle?

What did you learn from the simulation that makes you confident about your prediction?