"Idontgetit" Tales

Matheus Wonders What Atoms have to do with States of Matter

"Ok, so there are watery atoms, hard atoms, and gassy atoms…" mumbles Matheus as he fills in his homework.

"Man, that sounds gross," says Lily.

"And wrong," Amy butts in.

"You know, Amy, just because your mom is a science teacher doesn't mean you know everything."

"That's what you think. But I know that there's no such thing as a watery atom. And, that's enough for me!" And she skips away.

"Shoot. There really isn't a watery atom? My homework says that I'm supposed to describe atoms in liquids. I remember that Amy taught us that water is a liquid so I thought that the atoms would be watery. Man… why'd she leave?"

"You know how else we could learn it, don't you?"

"Yeah but…."

"Oh come on… don't you kinda want to know?"

"Oh fine, I guess I do… I just don't like atom-land very much. OK, fine. I dontgetit!"

The words are barely out of his mouth when the vortex grab them. They feel themselves shrinking, and they swirl straight towards the root beer can.

"Oh no!"

Even though the colors are swirling and they can feel all of their own little atoms getting tinier and tinier, they can see that they were about to smack straight into the side of the …. CAN! Splat!

The next thing Matheus and Lily know, they were sitting on atoms again. Once again, the atoms are vibrating, just like in the wood. And, these atoms are arranged neatly in rows and columns, just like in the wood. But these atoms are bigger. Lily looks towards the center of her atom and the nucleus contains 13 protons.

"Hey, I saw that on my periodic table[3]! That's aluminum. We are in the can… I mean IN the can, as in, IN the aluminum that forms the side of the can."

"And we…." They hear voices coming from all around them, "are in solid form right now. Aluminum CAN melt if it gets really hot, but at most normal temperatures, aluminum is solid, that's why we're just vibrating and not flowing." Lily and Matheus realize that the aluminum atoms are talking to them.

Matheus says, "But, the can isn't moving. So, how are you moving?"

Lily thinks for a second, "Yeah, you're right. Those atoms inside the desk were moving too, remember? But the desk is totally still. Now these aluminum atoms are moving, but I swear my can wasn't moving the last time I looked at it."

"Ha ha!" giggle the aluminum atoms, "That's where you're wrong! All atoms move all the time. But, when we're in a solid state, we just vibrate. We're so tiny, humans can't actually see us moving. But we are!!" Lily and Matheus look at each other, both thinking that aluminum atoms are a little goofy.

"Splosh, splosh, splash!" Lily and Matheus look around. They can see root beer just a few layers of atoms away from them. They realize that although they are inside the side of the can, they must be right near the inside of the can, where the root beer touches the aluminum.

"It's kinda like the beach," says Lily.

"A pretty weird beach… where the ocean is root beer, but ok…"

"Let's check it out!" They start hopping from aluminum atom to aluminum atom, until they get to the layer on the very inside of the can.

"Wow." The aluminum atoms shake slightly, but the root beer atoms, which are mostly water molecules, swoosh past them. They know that no one in regular-sie world is moving the can. The aluminum atoms aren't moving any more than their usual vibrations. But the root beer atoms are sweeping and gliding all around the inside of the can.

"Those water molecules look just like little boats," says Lily.

"Water whats?"

"Molecules – that's what it's called when atoms join together. They call it a molecule. Those molecules are H_20. The big atom there is oxygen and the two little ones are hydrogens. Wow. I sound like Amy, don't I?" Lily hits herself in the face.

"Yeah. You do. You actually sound pretty smart. It's cool! Ok, so those are water molecules. I want to ride one!" He pushs off from his aluminum atom and grabs onto a water molecule, which immediately takes him swimming and swooping around the can.

As they swim around, the molecules started talking to Matheus, of course, "So, how do you like the movement of atoms in a liquid state?"

"Do all atoms do this when they're liquids? I thought it was just root beer!"

"No way, Jose. When atoms are in a solid, they just vibrate. But when we're in a liquid we get to swish and swoop. It's great! And I HATE it when people make root beer popsicles out of me, because then I become a solid and it's SO boring."

Matheus has a great time swooping around but he has to cling really tightly to the water molecule. There are so many molecules swooshing around him that he almost gets knocked off the molecule over and over again, "Ow! That was my head!"

"Oh no!" he hears Lily cry out as she almost gets knocked off of the molecule that she's riding.

"Want to try something cool?" asks the water molecule.

"What?" asks Matheus nervously.

"If I become a gas, we can fly even faster, and we atoms are more spread out, you won't get bumped as much."

"Are you serious? You can become a gas?"

"Oh yeah! I just need to go to the top of the can and get evaporated."

"Evapora—whatted?"

"Evaporated. It means turning a liquid into a gas. It happens every time a spill dries up, or when you dry off after swimming… where do you think the water goes? It goes into the air, of course! It actually becomes part of the air – called water vapor. Here we go!"

The molecule swoops towards the can opening and the next thing Matheus knows, warm air hits his molecule, making him swoop faster and faster and faster… and finally, "Whoo-hooo!" the molecule launches out of the can and into the air. "We're water vapor! We've changed into a gas!"

All Matheus can think is roller coaster. He sees Lily's molecule dive-bomb past. He holds on as tight as he can. The gas molecules are so far apart, none bump him, but they are whirling so fast, he's sure he's going to fall, "Ok! I get it! Atoms in solids vibrate. Atoms in liquids swoop. And, atoms in gasses go crazy! Now stop!"

And the next thing they know, the vortex lands them safe and sound, right back in their seats.

Review Questions:

1. How does Lily know that the first atoms that they see are aluminum atoms?

2. How can you tell that aluminum and root beer are different states of matter?
    a. They are not different states of matter.
    b. Aluminum atoms vibrate, so they're liquid; root beer atoms swoop, so they are solid.
    c. Aluminum atoms vibrate, so they're solid; root beer atoms swoop, so they are liquid.
    d. Aluminum atoms are stacked messily, so they're solid; root beer atoms are stacked neatly, so they are liquid.

3. What are two main differences between atoms in a liquid state and atoms in a gas state? (Hint: think about how they act and how they are arranged.)

4. In order for liquids to evaporate, what must happen to them?
    a. They have to be near the opening of a can.
    b. Energy has to be added to them, usually in the form of heat.
    c. They must want to become gas.
    d. Most liquids don't evaporate.

5. Density measures how close atoms are to each other. Which of the following best describes the density of atoms in different states of matter?
    a. Solids are the most dense, then gases, then liquids.
    b. Gases are the most dense, then liquids, then solids.
    c. Liquids are the most dense, then gases, then solids.
    d. Solids are the most dense, then liquids, then gases.

What do the following words mean *in the context of the passage*? (Words are underlined in the passage.)

6. Temperature
    a. The heat in an object
    b. Freezing
    c. Warming
    d. The speed in an object

7. Molecules
    a. A group of atoms
    b. A part of an atom
    c. A piece of aluminum
    d. Another name for an electron

8. Immediately
    a. Regretfully
    b. Later
    c. Right away
    d. Never ending, permanent

9. Evaporated
    a. Turned into a solid
    b. Turned into a liquid
    c. Turned into a gas
    d. Changed states of matter

10. Vapor
    a. Snake
    b. Solid
    c. Liquid
    d. Gas

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[3] A **periodic table** is a chart, often used in chemistry, that shows all of the known elements, their atomic number (how many protons they have) and their atomic weight. Using a periodic table, you could identify any atom (if you could see the atom!)