GENERATIONGENIUS
STREAM. EDUCATE. ENTERTAIN.

TEACHER INFO

PARTICLE NATURE OF MATTER
GRADES 3-5

NOTE: This lesson will be better understood if students have already learned about conservation of matter so that they understand that matter cannot vanish, and phase changes so they understand how the same substance can exist as a solid, liquid and gas under different conditions. If you haven't already done so, WATCH THE GENERATION GENIUS CONSERVATION OF MATTER VIDEO with the class.

COMMON MISCONCEPTIONS

- Extremely large or small scales are impossible to understand.
  Students often struggle to grasp the size of particles because they are so small compared to everyday objects. In the video, particles are said to be 100,000 times smaller than the width of a human hair—an abstract comparison that is still difficult to visualize. Using interactive simulations, zoomable scale diagrams, or relatable size analogies (like stacking marbles inside a soccer ball) can help students make better sense of scale.

- Matter disappears when it dissolves or evaporates.
  When a substance like salt dissolves in water or water evaporates into the air, students may think the matter is gone. In reality, the matter still exists—it has simply changed form or moved into another phase (like liquid to gas or solid to liquid). Reinforce the idea that matter is conserved and doesn't vanish, even if it becomes invisible to the eye.

- Gases are weightless and don't count as matter.
  Students may not recognize gases as matter because they are invisible and hard to detect. However, gases take up space and have mass. For example, an inflated balloon weighs slightly more than an empty one. Simple experiments using balances or sealed containers can help students observe that gases have measurable weight.

MATTER

Matter is anything that has weight and takes up space. Matter can exist in solid, liquid, and gas form, and each of these forms have weight and take up space, even if they appear to be invisible. As matter changes form, the amount of matter stays constant. For example, if an ice cube (solid water) melt into liquid, the liquid will weigh as much as the ice did. If that liquid water then evaporates in a contained space, the water vapor (gas) captured from the evaporating liquid will also weigh the same as the liquid and solid. This is called the conservation of matter. If the water vapor is not contained, matter is still conserved but the gas will become part of the surrounding air.

PARTICLES

All matter is made up of pieces of whatever type of matter it is. If you break apart any type of matter, it is still the same type of matter, just a smaller piece. For example, an ice shard from an ice cube is still solid water and a droplet next to a glass of water is also still water, just less of it. If you could divide matter into the smallest possible pieces they would be extremely tiny—too small to see with your eyes. Particles of matter are much, much smaller than the width of a human hair—approximately 100,000 times smaller. That means about 100,000 particles could fit across a human hair! Because they are so small, we can't see particles. But we know they are there because they explain the properties of solids, liquids and gases.

In solid materials, particles are packed tightly together. They don't move much, if at all. Conversely, gas particles spread far apart and move freely. Gases particles spread to fill the shape of the container they are inside. Particles in a liquid are somewhere in between. They aren't spread as far and free as gas, but they aren't as tightly packed and stationary as particles in solids. Remember, for any type of matter these are the same particles—the come together as solids and spread apart as liquids and even further as gases!

MODELING IN SCIENCE

When scientists want to explain something, they often develop models. These can be especially useful in explaining things that can't be seen. In everyday life, we tend to think of models like model airplanes, or styrofoam balls modeling the solar system. While creating a smaller version of something to scale is part of modelling, models can also be very useful for showing how processes work. For example, we often draw models to show how water cycles or how rocks cycle. In this lesson the focus is on particles of matter. Models are created and refined based on new knowledge to explain materials and interactions that can't be seen. We don't have a way to see for sure if our model is correct, but a model becomes more and more accepted if it provides a way to explain various phenomena. Scientists sometimes find evidence that doesn't support a model and they have to figure out what changes need to be made to their understanding. The model might need to be changed a little bit.

Models don't have to be three-dimensional. They might be drawings, computer simulations, mathematical equations or even use people to represent other things. Also, models aren't perfect. It is important for students to be clear about what each part of a model represents in a real system, and also to define the system it represents (what is included and what is not). Models can then be a clear way to communicate ideas with others.

PARTICLE MODEL OF MATTER

The Particle Model of Matter simply shows that all matter is made up as particles, and that these particles exhibit different qualities when the matter is solid, liquid or gas. We can use this model to explain phenomena that we observe with solids, liquids and gases. Other ideas or models about what matter is made of may exist, but the Particle Model of Matter is accepted in science because it has worked to explain our observations of matter so far.