Tiny Particles in Matter
Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode–do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the filmstrip to the left. (View/Hide Filmstrip.)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.

Materials Needed Per Group:

Explore: Too Small to Be Seen

Empty water bottle	Balloon	Plastic glasses, 3
Water	Ice	Paper towels
Food coloring	Large, metal spoon	Stirring sticks, 2
Warm water	Sugar cubes, 2-3	Granulated sugar
Snack baggies, 2		

Explain: Behave Yourself

Small white bowl	Round peppermint candy	Water

Materials Needed Per Class

Engage: Is It Matter?

Electronic scale	Document camera	Candle
Candle holder or dish	Match or fire starter	Water
Beaker	Smartphone	Vinegar
Alcohol	Balloon	

Graduated cylinders (10-50 mL), 2 per group

Explore: Too Small to Be Seen

Tongs

Explain: Behave Yourself

Balloon	White paper towels, 2	Clear, plastic glasses, 3
Yellow food coloring	Blue food coloring	Water

Other Materials

Student Recording Sheets	Pencils
Student Summative Evaluation	Science notebooks
Goggles, 1 pair per student	

Tiny Particles in Matter
Teacher Facilitation Notes, p. 2

Engage: Is It Matter?

- Pour about 10 mL of alcohol in one graduated cylinder for each group. Pour about 10 mL of vinegar in the second graduated cylinder for each group.
- Show the first engage slide. Call on volunteers to read the questions aloud.
- Do a Think-Pair-Share to discuss their possible answers to the questions.
- Use the next 5 slides to review appropriate safety rules for science labs.
- Have each student use their recording sheet to predict if each of the terms listed in the first column of the data table is matter.
- Show students a candle. Ask, *Is this candle matter? What is your evidence for your answer?* Make sure students mention that matter has mass and volume. Say, *Since you think it is matter, we can find its mass.* Put the candle on the electronic scale and find its mass. Have students record the mass of the candle in the table.
- Have students answer the question *Is it Matter?* on their recording sheet and explain why it it matter (it has a volume).
- Next, place the candle in a candle holder and find its combined mass. Write the mass on the board. Point out the next two things on the table: light and heat. Have students predict is light and heat are matter. Ask, *How can we find out if light and heat are matter?* Someone should say to find their mass.
- If light and heat are matter, the mass of the candle system should increase when the candle is lit and is producing light and heat. Light the candle. Observe its mass for about a minute. Ask, *Does the mass of the candle system change when it is lit and producing light and heat?* (NO) Since it doesn't change, can light and heat be matter? Why not? Have students complete the table rows for light and heat.
- Show students the phone. Is it matter? Complete the row for the phone.
- Ask is the sound a phone can make is matter. Have students make their predictions. Find the mass of the phone. Use the phone to play music. See if the mass of the phone changes as it produces sound. Complete the row of the data table for sound.
- Give each group the two graduated cylinders filled with liquids. Have them complete the table row for the graduated cylinder. (Find the mass of an empty graduated cylinder for students to record.)
- Discuss how they could tell if the liquids are matter. Complete the rows for the two liquids.
- Ask students if they can tell what liquids are in the cylinders just by looking. Discuss how you might be able to tell by wafting.

Tiny Particles in Matter
Teacher Facilitation Notes, p. 3

Engage: Is it Matter?, continued

- Have students waft each of the liquids to identify them.
- Ask the following questions:
  - How were you able to identify the mystery liquids?
  - How did the odor get from the graduated cylinder to your nose?
  - Why can we not see the odors?
- Discuss the balloon. Is it matter? Find and record its mass.
- Discuss air. Is it matter? How can we find out. (Lead students to the idea of filling the balloon with air and comparing the inflated balloon's mass to the mass of the empty balloon.) Ask:
  - Is a gas matter?
  - How do you know?
- Discuss the engage activities as desired.

Explore: Too Small to Be Seen

- Read and discuss the introductory slide with the Explore questions.
- Call on volunteers to read the paragraphs on the next slide. Ask students what they think the crystals inside the bubble are made of. What else besides air is inside the bubble?

Task #1

- Have students complete Task #1 using the water bottle and the balloon. Be sure they answer the questions and record their data on their recording sheet. Ask the following questions:
  - Was the water bottle really empty? What was inside of it?
  - What happened when you first squeezed the empty bottle? What did you feel when you squeezed it?
  - What happened to the balloon when you squeezed the water bottle? Why do you think this happened?
  - Is air matter? What evidence do you have to prove that air is matter?
- Explain that the air particles, or molecules, inside the bottle are so small that you cannot see them. When you squeezed the bottle, you pushed the air particles out of the bottle into the balloon, causing the balloon to inflate. You know that air has tiny particles that you cannot see because it takes up space inside the balloon.
- If desired, show students the following animation: https://www.acs.org/education/resources/k-8/inquiryinaction/fifth-grade/particles-gas-bottle-balloon.html
- Discuss as desired.

Tiny Particles in Matter
Teacher Facilitation Notes, p. 4

Explore: Too Small to Be Seen, continued

Task #2

- Prior to beginning this part of the lesson, fill each plastic cup about ½ full of water. Add a few drops of blue or red food coloring to the water.
- Give each group a prepared glass of water and a paper towel. Have students record their observations about the system on their recording sheet.
- Call on volunteers to read the remainder of the procedure steps on the slide. Complete each step and discuss as desired. (Use tongs to carefully place enough ice cubes in each glass to almost fill it when appropriate.)
- Have the students wipe the outside of the glass with a paper towel to prove that the water did not come from inside the glass. (If the water came from inside the glass, the water on the paper towel would be colored–not clear.)
- Ask the following questions:
  - How did the moisture get on the back of the spoon?
  - How did the water get on the outside of the glass?
  - What is condensation?
  - What evidence do you have that water is made up of tiny particles too small to be see?

Task #3

- Prior to beginning this part of the lesson, put 2-3 sugar cubes in a snack baggie. Put about 15 mL of granulated sugar in another snack baggie. Heat water so that it is warm, but not hot.
- Give each group two glasses about ¾ filled with warm water and the other needed materials.
- Call on volunteers to read the remainder of the procedure steps on the slide. Complete each step and discuss as desired.
- Ask the following questions:
  - When the sugar was mixed with the water, did the sugar disappear? What did it do?
  - Could you see the sugar before it was added to the water? After?
  - How do you know the sugar was still in the water even though you couldn't see it?
  - Thinking about the three labs you did, what evidence do you have that matter is made up of tiny particles too small to be seen?

Tiny Particles in Matter
Teacher Facilitation Notes, p. 4

Explain: Behave Yourself

- Several hours before beginning the explanations for this lesson, set up the following demonstration*as students observe: Place the three clear, plastic glasses side by side. Pour about ½ inch of water in the center cup. Fill the other two cups ½ full of water. Add a generous amount of food coloring to each one: yellow in one cup and blue in the other. Fold each paper towel 4-5 times. Place one end of each paper towel in the colored water and one end in the clear water. Let set for 2-3 hours.
- Read the introductory slide and discuss. Do the following as you read through the *Behave Yourself* slides.
    - Slide #1–Read and discuss. Ask students if they know of any other things they can see or feel that is not matter. (They might mention sound energy, mechanical energy, etc.)
    - Slide #2–Read and discuss. Ask why a special microscope is needed to see the tiny particles in matter.
    - Slide #3–Read and discuss. Remind students that the particles in a gas are spread and move very quickly.
    - Slide #4–Read and discuss. View and discuss the animation, *Observing Gas in a Bottle.* DEMONSTRATION: Direct students' attention to their recording sheets for this activity. Model blowing up a balloon as shown in the illustration. Have students complete the diagram of how a gas would look in each balloon as it is inflated.
    - Slide #5–Read and discuss. View and discuss the animation, *Particles of a Liquid in a Bottle*. Discuss the results of the colored water demonstration. Ask students why the water in the middle cup turned green. How does this demonstration prove that a liquid like water is made up of tiny particles too small to be seen?
    - Slide #6–Read and discuss. View and discuss the animation, *Particles of a Solid Hammer and Nail*. *Give each group a small white foam bowl. Pour in enough water to cover the peppermint candy. Place the bowls on a flat surface and put a peppermint in the center of the bowls. Observe. Ask students how this demonstration provides evidence that a solid is made up of particles too tiny to be seen.
    - Slide #7–Read and discuss.
- Have students answer the questions on their recording sheets. Discuss as desired.

*This activity is taken from *Science For a Year*.

Tiny Particles in Matter
Teacher Facilitation Notes, p. 5

Elaborate

- **NOTE:** This is an elaboration of the topic. Atoms and molecules are not specifically mentioned in the Student Expectation.
- Read through and discuss the first three slides of the Elaboration.
- On the fourth slide, briefly discuss the scientific names for the various atoms. (The scientific term for a one atom substance is *element*. Elements and the Periodic Table of Elements are formally introduced in Grade 6. Depending on student ability levels, this term may be introduced at this time.)
- Follow these directions for the PHET *Build a Molecule* simulation:
  - Click on the illustration to open the website.
  - Click on "Single" to begin the simulation.
  - Call students' attention to the large white box on the right side of the page entitled *Your Molecules.* Tell students that they are going to be combining atoms of the same and different substances (elements) to form molecules. The types of molecules they will be forming are listed in this box.
  - The first listed molecule is H_2O (a water molecule). Ask students what the H stands for (hydrogen). Why is there a 2 after the H? (There should be two atoms of hydrogen.) What is the O? (oxygen). Ask the students to identify what should be dragged and dropped onto the screen (two atoms of hydrogen and one atom of oxygen.)
  - When the blue arrow appears next to the box under the title H_2O, drag and drop the molecule into the box.
  - Click on the arrow in the gray box at the bottom of the page to move to a new set of atoms.
  - Continue in this manner until all of the molecules have been built for this set.
  - Build other molecules as time and interest dictate.
- Discuss as desired.

Evaluate

Have students complete the quiz independently. NOTE: Page 4 is optional, depending on the teacher decision to teach or not teach atoms and molecules.

Tiny Particles in Matter

Name: KEY

Evaluation

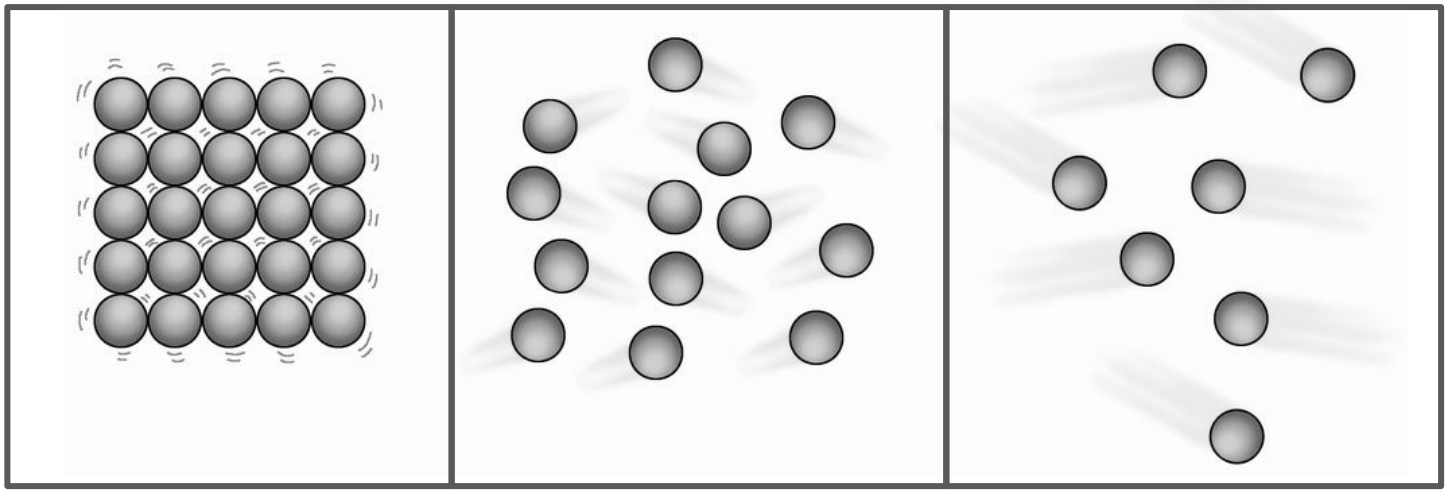
1. Which of the following are made up of tiny particles? (Mark all that apply.)

   A Water
   B Plastic
   C Light
   D Oxygen
   E Sound
   F People
   G Electricity

2. Which of the following best describes how the tiny particles in a liquid move? The particles–

   F are fairly close together, always moving and can slide past one another.
   G vibrate in position but do not move around and past each other.
   H are frozen in place, blink on and off, and don't move at all.
   J are very far apart and constantly move at a high rate of speed.

3. Study the diagrams below. Label the diagrams as *gas, solid,* or *liquid* based on how the tiny particles in matter move.



solid | liquid | gas

Tiny Particles in Matter

Name: _____KEY_____

Evaluation

4. Which of these best describes how the particles in a solid move? The particles–

   F are close together, always moving, and can slide past one another

   G are frozen in place and don't move past each other

   H vibrate in position but don't move past each other

   J are very far apart and are constantly moving

5. Which of the these activities will provide evidence that matter is made up of tiny particles too small to be seen?

   1. Blow air into a balloon and observe it get bigger and bigger.
   2. Observe 5 mL of salt dissolve in 40 mL of warm water.
   3. Use a flashlight to find objects in a very dark room.
   4. Squeeze an empty water bottle without the lid. Put the lid on the bottle and squeeze again.
   5. Ring a small bell to get the attention of all the students in the class.

   A #1 and #2

   B #3 and #5

   C #1, #2, and #4

   D #2, #3, and #4

6. Which of the following are characteristics of solids? Mark all that apply.

   F The particles in a solid are very close together.

   G A solid takes the shape of its container.

   H A solid has a definite volume.

   J The particles in a solid slip and slide over each other.

   K You can find the mass of a solid using a triple beam balance.

Tiny Particles in Matter

Name: _____KEY_____

Evaluation

7. A teacher sprays air freshener from a can in the front of the classroom. After about 2 seconds, the students in the back of the room smell the fragrance. How does this prove or disprove that matter like the gas in the can is made up of particles too small to be seen?

   A Since the students in the back of the room cannot smell the air freshener right away, that means that the gas inside the can is not made of tiny particles.

   B The students in the back of the room can smell the air freshener because a gas is made of tiny particles that move quickly to fill up a space.

   C It is impossible to prove that a gas is made up of tiny particles too small to be seen.

   D Students can walk around the room and ask if other people can smell the air freshener.

8. A student leaves a glass of ice water on the table for a few minutes. After a few minutes, she observes small drops of water on the outside of the glass. Why do the small drops of water appear on the outside of the glass?

   F Water seeps through tiny holes in the sides of the glass.

   G The ice causes the water to overflow and stick to the sides of the glass.

   H Tiny particles in the solid ice melt and move quickly to the outside of the glass.

   J Tiny water particles in the air condense and form liquid water as they touch the outside of the cold glass.

Tiny Particles in Matter

Name: _____KEY_____

Evaluation

9. Why are atoms sometimes called the building blocks of matter?

A All matter is made up of atoms.
B Atoms can be taken apart into smaller particles.
C Solids are made of atoms, but gases are not.
D All atoms are exactly the same.

10. What is a molecule?

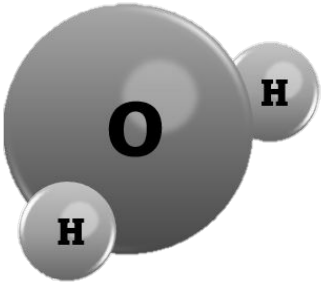
F The smallest parts of matter
G The substance at the center of an atom
H Two or more atoms combined together
J Tiny particles that dissolve in water

11. What is the smallest unit of a substance that has all the properties of that substance?

A A molecule
B An atom
C A slice
D A solid

12. The illustration shows a water molecule. Why do you think the chemical name for a water molecule is H_2O? The molecule is made up of–

F only 3 atoms
G particles too tiny to be seen
H 2 oxygen atoms and 1 hydrogen atom
J 2 hydrogen atoms and 1 oxygen atom



Tiny Particles in Matter

Name: _____

Engage: Is It Matter?

Directions: Think about matter and its properties. Is everything you see and feel matter? Study the things listed in the first column of the table below. Predict if you think it is matter. Complete the rest of the table as your teacher demonstrates some properties of each thing listed.

Thing	Predict Yes or No	Mass	Is it Matter? Yes or No	Why or why not?
Candle				
Light				
Heat				
Phone				
Sound				
Graduated Cylinder				
Liquid #1				
Liquid #2				
Balloon				
Air				

1. What are the two mystery liquids? How do you know? _____

   _____

   _____

2. What is one method you can use to see if something is matter? _____

   _____

Tiny Particles in Matter

Name: _____

Explore: Too Small to Be Seen

Directions: Answer the questions and record your observations as you complete the three labs in this activity.

Task #1:

1. Can you see anything inside the bottle? What might be in the bottle that you can't see? _____

   _____

   _____

2. What do you feel when you hold your hand above the water bottle and squeeze it? _____

   _____

3. What did you observe when you squeezed the water bottle with the balloon on it? Why do you think this happened? _____

   _____

4. Is air matter? What evidence do you have to prove or disprove that air is made up of particles too small to be seen? _____

   _____

   _____

Task #2:

5. Record your observations about the glass of water. Describe the physical properties of the glass and the water inside. _____

   _____

   _____

6. How does the spoon look? How does it feel? _____

   _____

Tiny Particles in Matter

Name: _____

Explore: Too Small to Be Seen, page 2

7. What do you see on the back of the spoon when you blow hot air on it? How did the moisture get on the spoon? _____

_____

8. Is water matter? What evidence do you have to prove or disprove that a liquid like water is made up of tiny particles too small to be seen?

_____

_____

Task #3:

9. Record your observations about the sugar cube and the plain sugar. Describe their physical properties, including state of matter. _____

_____

_____

10. What happened when you stirred the sugar cube into the warm water?

_____

11. What happened when you stirred the plain sugar into the warm water?

_____

12. Are the sugar cubes and the plain sugar matter? What evidence do you have to prove or disprove that a solid like sugar is made up of tiny particles too small to be seen? _____

_____

_____

Tiny Particles in Matter

Name: _____

Explain: Behave Yourself!

The illustration shows a boy blowing up a balloon. Complete the diagrams below by drawing a model of the amount of gas (air) particles in the balloon at each stage of inflation.

#1 **#2** **#3**

#1

#2

#3

1. What is inside the balloon that makes it get larger? _____

2. What evidence that a gas is made up of tiny particles is shown by blowing up the balloon? _____

   _____

3. How does the paper towel demonstration provide evidence that a liquid like water is made up of particles too tiny to be seen? _____

   _____

   _____

4. How does the peppermint candy demonstration provide evidence that a solid like candy is made up of particles too tiny to be seen? _____

   _____

   _____

Tiny Particles in Matter

Name: _____

Evaluation

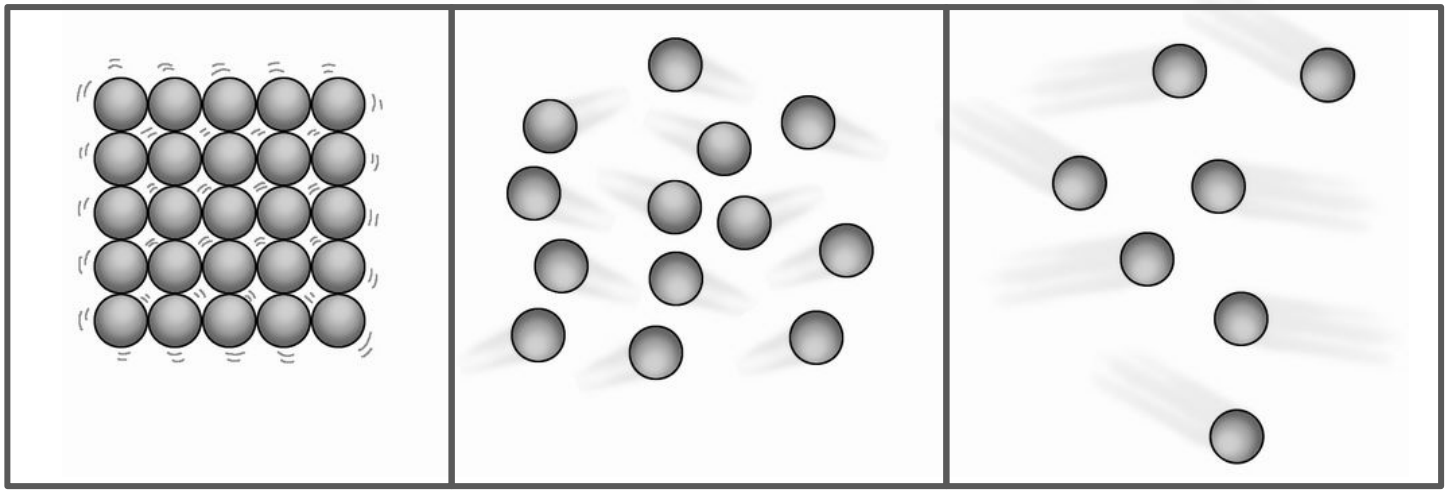
1. Which of the following are made up of tiny particles? (Mark all that apply.)

   A Water
   B Plastic
   C Light
   D Oxygen
   E Sound
   F People
   G Electricity

2. Which of the following best describes how the tiny particles in a liquid move? The particles–

   F are fairly close together, always moving and can slide past one another.
   G vibrate in position but do not move around and past each other.
   H are frozen in place, blink on and off, and don't move at all.
   J are very far apart and constantly move at a high rate of speed.

3. Study the diagrams below. Label the diagrams as *gas, solid,* or *liquid* based on how the tiny particles in matter move.



_____ _____ _____

Tiny Particles in Matter

Name: _____

Evaluation

4. Which of these best describes how the particles in a solid move? The particles–

   F are close together, always moving, and can slide past one another

   G are frozen in place and don't move past each other

   H vibrate in position but don't move past each other

   J are very far apart and are constantly moving

5. Which of the these activities will provide evidence that matter is made up of tiny particles too small to be seen?

   1. Blow air into a balloon and observe it get bigger and bigger.
   2. Observe 5 mL of salt dissolve in 40 mL of warm water.
   3. Use a flashlight to find objects in a very dark room.
   4. Squeeze an empty water bottle without the lid. Put the lid on the bottle and squeeze again.
   5. Ring a small bell to get the attention of all the students in the class.

   A #1 and #2

   B #3 and #5

   C #1, #2, and #4

   D #2, #3, and #4

6. Which of the following are characteristics of solids? Mark all that apply.

   F The particles in a solid are very close together.

   G A solid takes the shape of its container.

   H A solid has a definite volume.

   J The particles in a solid slip and slide over each other.

   K You can find the mass of a solid using a triple beam balance.

Tiny Particles in Matter

Name: _____

Evaluation

7. A teacher sprays air freshener from a can in the front of the classroom. After about 2 seconds, the students in the back of the room smell the fragrance. How does this prove or disprove that matter like the gas in the can is made up of particles too small to be seen?

   A Since the students in the back of the room cannot smell the air freshener right away, that means that the gas inside the can is not made of tiny particles.

   B The students in the back of the room can smell the air freshener because a gas is made of tiny particles that move quickly to fill up a space.

   C It is impossible to prove that a gas is made up of tiny particles too small to be seen.

   D Students can walk around the room and ask if other people can smell the air freshener.

8. A student leaves a glass of ice water on the table for a few minutes. After a few minutes, she observes small drops of water on the outside of the glass. Why do the small drops of water appear on the outside of the glass?

   F Water seeps through tiny holes in the sides of the glass.

   G The ice causes the water to overflow and stick to the sides of the glass.

   H Tiny particles in the solid ice melt and move quickly to the outside of the glass.

   J Tiny water particles in the air condense and form liquid water as they touch the outside of the cold glass.

Tiny Particles in Matter

Name: _____

Evaluation

9. Why are atoms sometimes called the building blocks of matter?

   A All matter is made up of atoms.

   B Atoms can be taken apart into smaller particles.

   C Solids are made of atoms, but gases are not.

   D All atoms are exactly the same.

10. What is a molecule?

   F The smallest parts of matter

   G The substance at the center of an atom

   H Two or more atoms combined together

   J Tiny particles that dissolve in water

11. What is the smallest unit of a substance that has all the properties of that substance?

   A A molecule

   B An atom

   C A slice

   D A solid

12. The illustration shows a water molecule. Why do you think the chemical name for a water molecule is H_2O? The molecule is made up of–

   F only 3 atoms

   G particles too tiny to be seen

   H 2 oxygen atoms and 1 hydrogen atom

   J 2 hydrogen atoms and 1 oxygen atom