

Matter: Properties and Change

Date:

6.P.2 Understand the structure, classifications and physical properties of matter.

6.P.2.1 Recognize that all matter is made up of atoms and atoms of the same element are all alike, but are different from the atoms of other elements.

6.P.2.2 Explain the effect of heat on the motion of atoms through a description of what happens to particles during a change in phase.

6.P.2.3 Compare the physical properties of pure substances that are independent of the amount of matter present including density, boiling point, melting point and solubility to properties that are dependent on the amount of matter present to include volume, mass and weight.

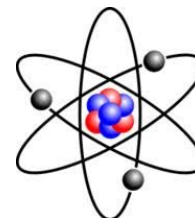
As a Matter of Fact

What makes up matter?

•The Greek philosopher _____ thought matter could be divided into smaller units until you obtained a particle that could not be cut.

•He called this particle _____, meaning "not able to be divided."

•Scientists have come to agree that matter is made up of small particles, and they use the term _____ to describe them.



•An _____ is the smallest particle into which an element can be divided and still be the same element.

•Scientists now know that atoms are made of even smaller particles, but the atom is the _____ unit that has the chemical properties of an element.

•There are _____ types of atoms that _____ in different ways to make all substances.

Something Old, Something New

Who developed the atomic theory?

•In 1808, John _____ published an _____ theory, stating that all matter is made up of atoms that cannot be created, divided, or destroyed.

•This _____ also stated that all atoms of a certain element are identical, but they differ from atoms of all other elements.

•_____ substance is made up of atoms combined in certain ways.

•In 1897, J. J. Thomson's experiments provided evidence that atoms contain negatively charged particles, which were later called



_____.

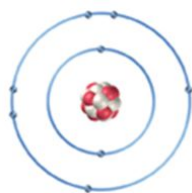
•_____ thought that an atom was a positive sphere with the electrons mixed through it.

Electron •In 1909, Ernest Rutherford's experiment suggested that atoms

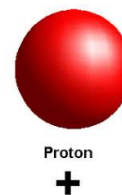
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have a _____—a small, dense center that has a positive charge.

- Rutherford later found that the nucleus is made up of smaller, positively charged particles that he called _____.

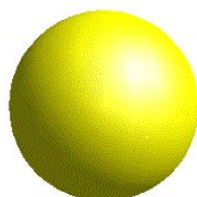


- Niels _____ suggested a model in which electrons move around the nucleus in _____ paths, with each path at a certain distance from the nucleus.



What is the current atomic theory?

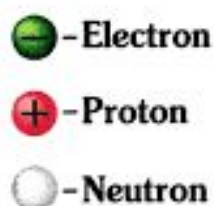
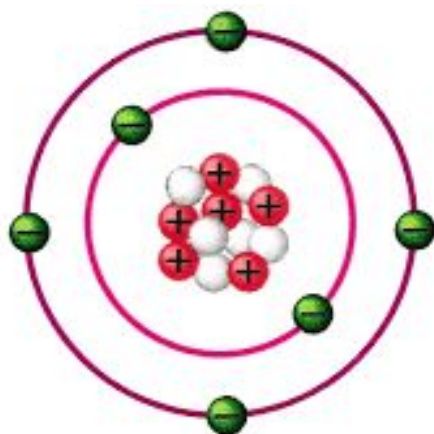
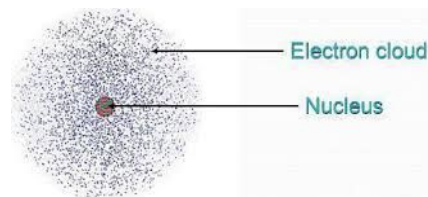
- In 1932, James Chadwick discovered that the nucleus contains uncharged particles called _____.



Neutron
no charge

- In the current atomic theory, _____ do not move in circular paths _____ the nucleus as Bohr thought.

- Instead, the current theory suggests that electrons move within an area around the nucleus called the _____.

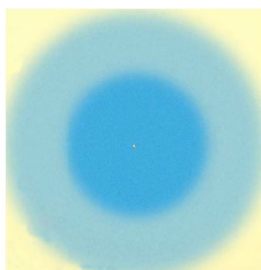


Up and Atom!

What are the parts of an atom?

- _____ are made up of protons, neutrons, and electrons.
- Protons are the _____ charged particles of atoms. The relative charge of a single proton is written as 1+.
- In the unified _____ (u), the mass of a proton is about 1 u.

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- _____ are particles that have ____ electrical charge.
 - The _____ of a neutron is _____ more than that of a proton, but it is still close to 1 u.
 - Most atoms contain at _____ as _____ neutrons as protons.
 - Together, protons and neutrons _____ the _____ of the atom.
 - The _____ charge of the nucleus is _____ to the charge on the _____ number of protons in the nucleus.
 - The _____ is small but very _____.
 - The _____ charged particles of an atom are called _____. The charge of a single electron is represented as 1-.
 - It is _____ possible to determine the exact position and speed of an electron at the same time.
 - So we _____ the electrons as being in an electron cloud around the nucleus.
 - Compared with protons and neutrons, _____ have very _____ mass.
 - The _____ of protons and electrons in an atom are the _____, so their charges are _____ and the atom has an overall charge of 0.
 - An atom can _____ or _____ electrons to become an _____, which has a _____ positive or negative charge.



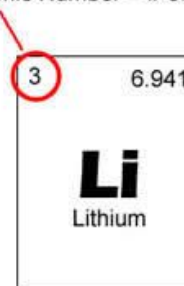
- In this model of an atom, where is the nucleus and where are the electrons?

Take a Number!

How can we describe atoms?

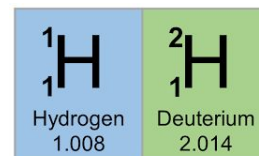
- _____ combinations of protons, neutrons, and electrons produce atoms with different _____.
- The _____ of each kind of _____ in an atom determines its _____ properties.
- These different atoms _____ to form the _____ substances all around us.
- The number of _____ distinguishes the atoms of one element from the atoms of another.
- The number of protons in the nucleus of an atom is the _____ of that atom.

Atomic Number = # of Protons

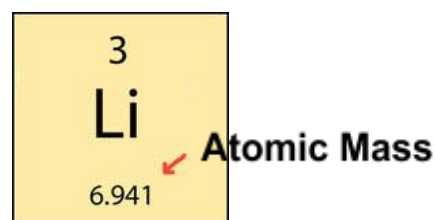


- The atoms of a certain element always have the same number of protons, but the number of _____ may _____.

- _____ are atoms of the same element that have different numbers of neutrons.



- The total number of protons and neutrons in an atom's nucleus is its _____.

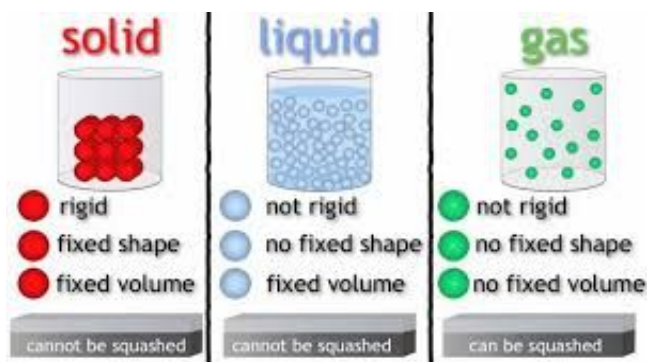


Particles in Motion

How do particles move in solids, liquids, and gases?

- The _____ states that all matter is made of tiny particles that are in constant motion.
- The state of _____ is determined by how much particles _____ and how often they bump into each other. _____ a substance is, the _____ its particles move.

- A _____ is a substance with a definite volume and shape. Particles are close together and do not move freely.
- A _____ is a substance with a definite volume but not a definite shape.
- A _____ is a substance that does not have a definite volume or shape.



The Fact of the Matter

What happens when matter changes state?

- The _____ most familiar states of matter are solid, liquid, and gas.
- A _____ of state is the change of a substance from _____ physical _____ of matter to _____.
- When a substance undergoes a _____ change, it does _____ change its _____, just its appearance.
- To _____ a substance from one state to another, _____ must be added or removed.
- When a substance _____ or loses _____, its _____ changes or its state changes.
- _____ matter is made of tiny particles that are in _____ motion. During a change of state, the motion of the particles changes.
- _____ can break away from each other and gain more freedom to move, or they may attract each other more strongly and have less freedom to move.
- During a change of state, a substance _____ energy from or _____

energy to the environment, but the total amount of energy is

_____.

Shape Up!

How does particle motion affect the properties of solids, liquids, and gases?

- Particles in a solid _____ but remain in fixed positions.
- Solids _____ easily change shape or volume.
- _____ take the shape of their container.
Particles in a liquid are _____ together but _____ tightly arranged.
- Particles in liquids slide _____ past each other, creating _____.
- Particles in _____ are _____ apart.
- The _____ between gas particles can change _____.
- Gases take on the _____ of their container.

What happens when substances change state?

- The process in which a solid becomes a liquid is called _____.
- As a solid is _____, if the vibrations in the particles are _____ enough, the particles break loose and _____ past one another.
- When temperatures of a liquid are lowered, causing a solid to form, it is called _____.
- _____ temperatures cause the particles to move _____ enough for the attractions between them to cause the _____ to become a _____.
- Water freezes at _____, but other substances can freeze at room temperature.
- When substances _____ or _____ energy, one of two things can _____ to the substance: its temperature can change or its state can change.

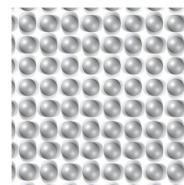
Particle Party

What is the kinetic theory of matter?

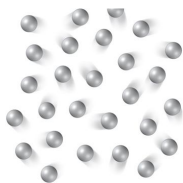
- The _____ **of matter** states that all of the particles that make up matter are constantly in motion.
- Because the particles are in _____, they have _____ energy.
- The _____ they move, the _____ kinetic energy they have.
- The motion of the particles is _____.
- The _____ particles have different amounts of kinetic energy, but their _____ kinetic energy takes into account their different random motions.
- Solids, liquids, and gases have _____ average kinetic energies.

How do particles move in solids, liquids, and gases?

- The kinetic theory of matter _____ the motion of particles in solids, liquids, and gases.

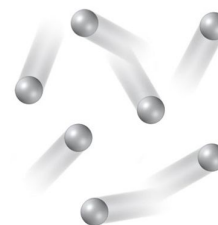


- The particles in a solid do _____ move around much.



- The particles in a liquid move much more _____ than the particles in a solid. They slide past and tumble over each other.

- The particles in a gas are far apart, move at _____ speeds, and _____ with one another.



Mercury Rising

How does temperature relate to kinetic energy?

- _____ is a measure of the average kinetic energy of all the particles in an object.
- The _____ a substance is, the _____ its particles move.

How is temperature measured?

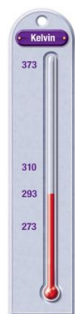
- There are ___ common temperature scales.
- They all _____ the _____ kinetic energy of particles.
- The scales are called Celsius, Fahrenheit, and Kelvin.
- In the _____ and _____ scales, temperature is measured in units called _____.
- _____ ($^{\circ}$) are equally spaced units between two points. The space between degrees can vary from one scale to another.
- In the _____ scale, ___ degree sign is used. The unit is just called a kelvin.
- Temperature is measured with a _____.



- The _____ scale is the temperature scale most commonly used around the world.

- The _____ scale is used most commonly in the United States.

- The _____ scale is used most commonly by physicists.



Physical Education

What are physical properties of matter?

- A characteristic of a substance that can be observed without changing the identity of the substance is called a _____.

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- _____ of the _____ can be used to _____ physical properties.
 - _____ and _____ are physical properties.
 - _____ the mass or volume of a substance does _____ change the substance's identity.
 - The _____ of matter is a physical property. The state of matter is the _____ form of the matter.
 - Most matter _____ as a solid, liquid, or gas.
 - _____ conductivity is a measure of how well electric currents move through a substance.
 - _____ is the measure of the amount of matter in a given volume.
 - _____ conductivity is the rate at which a substance transfers heat.
 - _____ is the ability of a substance to dissolve in another substance.
 - _____ is the ability of a substance to be rolled or pounded into various shapes.
 - _____ attraction is also a physical property that can be observed.
 - The shine, or _____, of a metal can be easily observed.
 - The _____ point of a substance is the temperature at which it changes from a _____ to a _____.
 - The _____ point of a substance is the point at which the substance _____.

Property Boundaries

What is the difference between physical and chemical properties?

- _____ properties can be observed _____ changing the identity of a substance.
- _____ properties can be _____ only by _____ the identity of a substance.

Physical vs. Chemical Properties

- | <u>Physical Properties</u> | <u>Chemical Properties</u> |
|----------------------------|----------------------------|
| - Color | - Flammability |
| - Shape | - Rusting |
| - Size | - Burning |
| - Density | - Corrosion |
| - Amount | - Reactivity |
| - Volume | |

