

## Section 2 – Heat affects Matter in different ways

## 2.1 States of Matter and The Particle Model

- Water has a distinct characteristic that sets it apart from other liquids on Earth. Water expands when it freezes. This means that solid ice is ...
  - More dense than liquid water
  - Less dense than liquid water**
  - Thicker than liquid water
  - Thinner than liquid water
- The Particle Model of Matter helps to explain ideas about Thermal Energy. This model includes each of the following points EXCEPT ...
  - all substances are made up of tiny particles that are too small to see
  - the particles are always in motion
  - the particles increase their energy output when they collide**
  - the particles have spaces between them
- Another important idea about temperature and the particle theory is that the motion of particles increases when the temperature increases. Which statement below is correct?
  - as the motion of particles decreases the temperature remains the same
  - as the temperature decreases the motion of the particles also increases
  - as the motion of the particles decreases the temperature decreases**
  - as the temperature increases the motion of the particles decreases
- The energy of movement is the kind of energy the particles of matter have. This energy is called ...
  - potential energy
  - kinesthetic energy
  - phase energy
  - kinetic energy**
- Transferring heat energy from water in a gas state causes it to change into a liquid. This cooling process is called ...
  - fusion
  - condensation**
  - precipitation
  - evaporation
- As more heat is transferred to a solid, the particles vibrate and some of the particles in the solid break loose. The solid begins to change state. This is an example of ...
  - heating a solid
  - heating a liquid
  - melting a solid**
  - freezing a liquid
- Which change of state involves a release of energy?
  - melting
  - sublimation
  - evaporation
  - fusion**
- Which of the following statements about energy is a correct scientific description of what energy is?
  - energy is a substance that can be transferred
  - the mass of energy can be measured using a precision instrument
  - energy fills the space with highly charged tiny particles
  - energy is a description of a quality or a condition**

8. Certain materials are found naturally in the environment. Chlorine is found most often in the gas state. To change it to a liquid, this would have to be done ...
- A. add heat
  - B. remove heat**
  - C. increase its temperature
  - D. maintain its temperature
9. During a change of state, the temperature remains the same, so the particles have ...
- A. less average energy
  - B. more average energy
  - C. the same average energy**
  - D. a faster speed
10. When heat is added to or removed from moving particles it changes their ...
- A. physical characteristics
  - B. speed**
  - C. ability to change state
  - D. size

## 2.2 Heat and Temperature

1. Absolute zero is a temperature on the Kelvin scale. Although no one has ever been able to cool anything down to absolute zero, scientist know that it is ...
- A. - 137.15 K
  - B. - 237.15 K
  - C. - 173.15 K
  - D. - 273.15 K**
2. A device, used to show the expansion of air when there was an increase in temperature, was used as early as 200 B.C. This device is now generally known as a ...
- A. thermometer
  - B. thermograph
  - C. thermoscope**
  - D. thermopile
3. The thermal energy of a substance is the ...
- A. total kinetic energy of all the particles**
  - B. average kinetic energy of the particles
  - C. kinetic energy of each particle separately
  - D. measure of how hot or cold the substance is
4. The temperature of a substance is the ...
- A. total kinetic energy of all the particles
  - B. average kinetic energy of the particles**
  - C. kinetic energy of each particle separately
  - D. measure of how hot or cold the substance is
5. Which of the following energy transfers would be correct?
- A. thermal energy in a hot drink is transferred to cold hands**
  - B. thermal energy is transferred from a room to a heater, so it can be heated
  - C. an ice cube loses thermal energy when it melts in hot lemonade
  - D. thermal energy is lost when a snowball melts

6. Galileo Galilei, an Italian scientist, invented the first device for measuring temperature in the 1590s. But it wasn't until the 1700s that an accurate way to measure temperature was developed by a German physicist. The scale that he created on his thermometer is still used in many countries, including the United States. It is called the ...
- A. Celcius scale
  - B. Absolute zero scale
  - C. Fahrenheit scale
  - D. Locke scale
7. One of the most sensitive substances to heat was used in early thermometers, until it was found that it was highly toxic. This substance is ...
- A. mercury
  - B. alcohol
  - C. air
  - D. water
8. A material, affected by changes in some feature of the environment, such as temperature, is called a ...
- A. circuit
  - B. sensor
  - C. signal
  - D. responder
9. Because your senses can easily be fooled, thermometers were developed, because they are more reliable. The earliest thermometers contained a glass bottle with a long glass tube for the liquid to rise and fall. An important part was missing though. It was the ...
- A. type of liquid that senses temperature change
  - B. type of glass that doesn't expand
  - C. the calibrated scale of relative temperatures
  - D. the protective stoppers to prevent the liquid from escaping
10. Estimating temperature, without using a thermal sensing device, is something that we do automatically. Touching something to see how hot or cold it is represents one technique that we use. Another is to ...
- A. use a thermometer
  - B. look at the moving particles
  - C. observe the color
  - D. use the back of your hand

### 2.3 Heat Affects Volume – Gasses, Liquids and Solids

1. When air is heated inside a balloon, the air makes the balloon rise. This happens because – compared to the air outside the balloon, the heated air is ...
- A. less dense
  - B. more dense
  - C. warmer
  - D. cooler
2. When a substance is heated the particles gain energy and spread out, creating more volume (spaces between the particles). So what about the mass of the substance? What happens to the mass of a substance when it is heated?
- A. mass is lost
  - B. mass increases
  - C. mass decreases
  - D. mass remains the same

3. Solids made of different metals were all heated to  $100^{\circ}\text{C}$  to determine how their volume and length would be affected. Which statement describes the most likely outcome of this experiment?
- A. All the volumes changed the same amount and the lengths remained constant.
  - B. All the volumes changed, but each substance was the same length.
  - C. Only some of the volumes changed with their length being increased.
  - D. All of the volumes changed and so did their lengths.
4. Some students performed an experiment testing the affect of heat on different solids. Which of the following variables would have been the manipulated variable.
- A. the amount of heat used
  - B. the size and color of each solid
  - C. the different types of solids
  - D. the different length to which the solids expanded
5. When thermal energy is added to a solid the volume of the solid will change. Steel beams bending or even breaking in a bridge, because of an extreme change in temperature are a result of thermal...
- A. conduction
  - B. contraction
  - C. expansion
  - D. design
6. Students set up an experiment to determine if a gas expands when heated. The experiment didn't work because the students were missing an important element to get the results they predicted. Which of the following variables is necessary to perform an experiment such as this?
- A. proper safety equipment
  - B. a very large balloon
  - C. a heat resistant flask
  - D. a heat source
7. A balloon filled with helium was put into a freezer to determine what the effect the lowering of the temperature would have on a gas. The responding variable in this experiment was the ...
- A. amount of gas in the balloon before and after
  - B. the volume of the balloon before and after
  - C. the temperature variation of the freezer
  - D. the amount of time needed to change the balloon



## 2.4 Heat Transfers by Conduction

1. A certain type of thermal energy transfer moves the energy by direct collisions, particle-to-particle. This type of thermal energy transfer is called ...
- A. concurrent
  - B. conduction
  - C. conduit
  - D. convective
2. Special thermal protection tiles cover the underside of the space shuttles. As the shuttles reenter the Earth's atmosphere these tiles can withstand  $1400^{\circ}\text{C}$  of heat caused by friction in the atmosphere. The material that these tiles are made of is ...
- A. plastic
  - B. fiberglass
  - C. ceramic
  - D. thermofilm

3. One of the key characteristics of conduction is that heat transfers in only one direction – from areas of ...
- A. greater kinetic energy to areas of less kinetic energy**
  - B. less kinetic energy to areas of greater kinetic energy
  - C. greater potential energy to areas of less potential energy
  - D. less potential energy to areas of greater potential energy
4. Students did an experiment with four pieces of metal with a slab of butter placed on the end of each. They placed them in a beaker of hot water and timed how long it took for the butter to melt enough to slide down the metal and enter the water. Each metal showed a different time. The fastest time was recorded on the copper metal. Which of the following variables is the responding variable?
- A. The temperature of the water**
  - B. The length of the metal
  - C. The time it took for the butter to melt**
  - D. The different types of metal used
5. Materials that allow an easy transfer of heat are called ...
- A. conductors**
  - B. insulators
  - C. energizers
  - D. thermals
6. Plastic, cork and wood are materials that do not allow an easy transfer of heat. They reduce the amount of heat that can transfer from a hot object to a colder object. They are called ...
- A. conductors**
  - B. insulators**
  - C. energizers
  - D. thermals

## 2.5 Heat Transfers by Convection and Radiation

1. In a liquid the particles are moving quickly. When heat is added they have more energy, but this energy is transferred from particle to particle in a different way than in a solid. The reason for this is because of the ...
- A. speed of the particles**
  - B. space between the particles**
  - C. types of particles
  - D. temperature of the particles
2. The transfer of heat energy in a fluid is different than what happens in a solid. The heated particles become less dense and so they rise, with the colder, denser particles rushing in to take their place. This type of thermal energy transfer creates a ...
- A. conduction current**
  - B. convection current**
  - C. radiation pathway
  - D. concurrent current
3. In a hot tub, your body gains thermal energy from the hot water. This thermal energy is then transferred throughout the inside of your body by each of your living cells. It can be dangerous to stay in the tub for a long period of time, because your ...
- A. cells will get so large they will burst, losing all of their nutrients to the water**
  - B. normal body temperature begins to be transferred to the water**
  - C. cells will shrink because of osmosis
  - D. blood vessels enlarge, blood pressure goes down, and your heart rate increases

4. Storm windows were used in the past to prevent heat from leaving the inside of the house in the winter. They weren't very efficient, because the space between the two panes of glass allowed convection current to take heat out even more. The new energy efficient windows prevent this from happening by preventing convection from happening. Krypton gas fills the space between the panes of glass because it is a ...
- A. better conductor than air
  - B. better insulator than air**
  - C. poor insulator
  - D. noble gas
5. Energy systems have five things in common - input energy, energy transfer, output energy, waste energy and ...
- A. collisions between particles
  - B. energy source**
  - C. energy equilibrium
  - D. concentrated flow
6. Radiation is the transfer of energy without any movement of matter. This type of energy transfer is called ...
- A. radiative transduction
  - B. radioactive transfer
  - C. electrospectrum radiation
  - D. electromagnetic radiation**