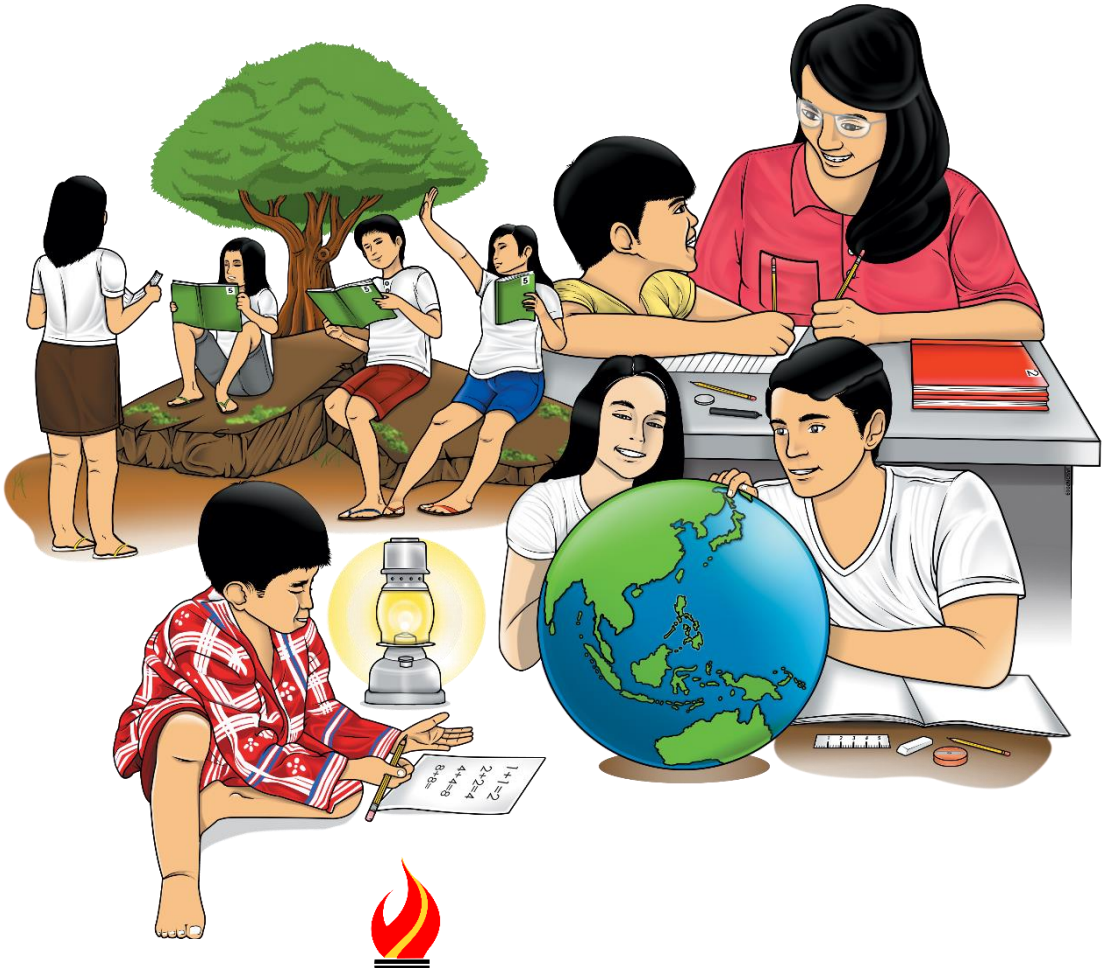
8

DepED
DEPARTMENT OF EDUCATION

Science
Quarter 1 – Module 6:
Heat and Temperature



ALTERNATIVE DELIVERY MODE
ADM

Science – Grade 8
Alternative Delivery Mode
Quarter 1 - Module 6: Heat and Temperature
First Edition, 2020

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Author:	Niña Mae M. Pangapalan
Editor:	Rhoda M. Delos Santos
Reviewers:	Bernabe L. Linog, Relyn D. Raza, Jonas F. Saldia, Delia C. Pioco, Kevin Hope Z. Salvaña
Illustrator:	Charlie F. Culminas
Layout Evaluators:	Celeste Faith R. Almanon, Jay S. Ayap
Management Team:	Francis Cesar B. Bringas Isidro M. Biol, Jr. Maripaz F. Magno Josephine Chonie M. Obseñares Gregoria T. Su Marvilyn C. Francia Jay S. Ayap Nonita C. Patalinghug

Printed in the Philippines by _____

Department of Education – Caraga Region

Office Address: Teacher Development Center
J.P. Rosales Avenue, Butuan City, Philippines 8600
Telefax: (085) 342-8207/ (085) 342-5969
E-mail Address: caraga@deped.gov.ph

8

Science
Quarter 1 – Module 6:
Heat and Temperature

DepED
DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using them.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

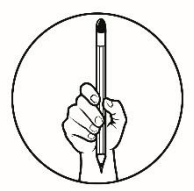
Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you master heat and temperature. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

After going through this module, you are expected to:

1. Differentiate between heat and temperature in molecular level (MELC Week 4: S8FE-Ig29).



What I Know

Directions: Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

1. What average energy of particles does temperature measure?
   A. chemical
   B. kinetic
   C. mechanical
   D. potential

2. What happens to the temperature of an object when the particles are moving faster?
   A. reduces
   B. increases
   C. remains constant
   D. increases then reduces

3. Do all particles of the substance at a certain temperature move at the same speed and in the same direction?
   A. No
   B. Yes
   C. Maybe
   D. None of the above

4. Does the temperature of a substance depend on how much of the substance is present?
   A. No
   B. Yes
   C. Maybe
   D. None of the above

5. When a substance undergoes thermal expansion, its _____.
   A. mass increases
   B. volume decreases
   C. particles get colder
   D. particles spread out

6. All substances will expand equally with the same change in temperature.
   A. True
   B. False
   C. Neither
   D. Either true or false

7. Which of the following is NOT a unit of temperature?
   A. Calorie
   B. Celsius
   C. Fahrenheit
   D. Kelvin

8. The decrease in temperature of a substance indicates that the _____.
   A. number of particles in it decreases
   B. average velocity of its particles increases
   C. average potential energy of particles decreases
   D. average kinetic energy of its particles decreases

9. The normal body temperature is 37 °C. What is this in Fahrenheit?
   A. 32 °F
   B. 99 °F
   C. 212 °F
   D. 373 °F

10. Which of the following happens when ice changes into a liquid at 0 °C?
   A. The molecules move slower than before.
   B. The temperature of the substance increases.
   C. The potential energy of the molecules increases.
   D. The average movement of the molecules increases.

11. What happens to the surface of the water when the rate of evaporation is greater?
   A. It becomes cooler.
   B. It absorbs less energy.
   C. It becomes more massive.
   D. It absorbs greater energy.

12. During warm days, you cool yourself by damping your skin with a wet towel. Which of the following takes place?
   A. Your skin absorbs the coldness of the water.
   B. Your skin releases energy when water from your skin evaporates.
   C. The temperature of your skin increases as water evaporates from your skin.
   D. The temperature of the water on your skin decreases as it evaporates.

13. Contraction of a solid indicates that _____.
   A. the number of particles decreases
   B. the space between particles increases
   C. the average velocity of particles increases
   D. there is a decrease in the average kinetic energy of particles

14. The boiling point of water is 100 °C. What is this in kelvin?
    A. 173 K
    B. 212 K
    C. 373 K
    D. 512 K

15. The natural direction of heat flow between two bodies depends on _____.
    A. their volume
    B. their temperature
    C. their heat capacity
    D. whether they are in a liquid, a solid or gaseous state

Lesson 1 Heat and Temperature and the Effects of Heat

Heat transfer from one body to another of different temperatures happens around us all the time. Our naked eyes may not see its process, but we can see its effects. We even depend on these effects. The heat we get from the sun, air conditioning, and cooking of food are just some processes or activities that involve heat transfer. Hence, heat transfer is essential in our daily lives.

You have learned in the previous grade that heat transfers from one body to another of different temperatures through conduction, convection, and radiation. Heat always moves from a body of higher temperature to a lower temperature. Moreover, the conductivity of materials and temperature differences are some factors that affect the rate of heat transfer.

People think that heat and temperature are the same. However, in Physics, although they are related, these terms are not the same. So, in this module, you will learn the difference between heat and temperature. Also, you will learn more about heat transfer and the factors that affect the amount of heat an object can absorb or release.

What's In

Directions: Below is a word search puzzle. Find the words related to heat and temperature by encircling them. The words may be written horizontally, vertically, or diagonally.

HEAT WORD SEARCH

Y	**C**	**E**	**G**	**D**	**C**	**I**	**C**	**T**	**S**	**S**	**N**	**R**	**Q**	**S**
T	**O**	**V**	**N**	**I**	**Q**	**O**	**A**	**W**	**S**	**B**	**A**	**L**	**O**	**K**
I	**N**	**A**	**I**	**L**	**T**	**E**	**N**	**E**	**Y**	**D**	**I**	**L**	**H**	**L**
C	**V**	**P**	**Z**	**O**	**H**	**S**	**N**	**D**	**I**	**Q**	**I**	**D**	**W**	**E**
A	**E**	**O**	**E**	**S**	**L**	**T**	**Q**	**A**	**U**	**D**	**Z**	**R**	**R**	**B**
P	**C**	**R**	**E**	**G**	**O**	**Y**	**T**	**I**	**I**	**C**	**D**	**U**	**K**	**O**
A	**T**	**A**	**R**	**H**	**W**	**I**	**D**	**F**	**R**	**D**	**T**	**U**	**P**	**I**
C	**I**	**T**	**F**	**E**	**O**	**Z**	**I**	**Q**	**H**	**A**	**T**	**I**	**J**	**L**
T	**O**	**I**	**G**	**N**	**E**	**C**	**Y**	**G**	**R**	**E**	**N**	**E**	**O**	**I**
A	**N**	**O**	**I**	**T**	**A**	**S**	**N**	**E**	**D**	**N**	**O**	**C**	**Y**	**N**
E	**Q**	**N**	**J**	**T**	**P**	**S**	**P**	**M**	**E**	**L**	**T**	**I**	**N**	**G**
H	**N**	**O**	**I**	**T**	**A**	**M**	**I**	**L**	**B**	**U**	**S**	**G**	**A**	**S**
P	**V**	**O**	**S**	**S**	**E**	**N**	**D**	**L**	**O**	**C**	**F**	**B**	**C**	**Y**
L	**N**	**X**	**E**	**T**	**H**	**E**	**R**	**M**	**O**	**M**	**E**	**T**	**E**	**R**
X	**Z**	**C**	**P**	**H**	**A**	**S**	**E**	**C**	**H**	**A**	**N**	**G**	**E**	**E**

BOILING	COLDNESS	CONDENSATION	CONDUCTION
CONVECTION	ENERGY	EVAPORATION	FREEZING
HEAT	HEAT CAPACITY	HOTNESS	LIQUID
MELTING	PHASE CHANGE	RADIATION	SOLID
SOLIDIFICATION	SUBLIMATION	TEMPERATURE	THERMOMETER

Notes to the Teacher

Please provide an extra copy of this page for students' use.

What's New

Have you ever experienced having a fever? You usually touch your forehead or neck to check if you have a fever or not. You use your sense of touch to tell whether an object is hot or cold or one is hotter or colder than the other. When bathing a baby, you dip your fingers in the water, and when you prepare baby's milk, you sprinkle a few drops of milk on your wrist to check if the temperature is just right. When you are about to fry some food, you sprinkle some water to see if the frying pan is already hot. When you feel you are warm, you often say you have a high temperature. When an object is cold, you often say it has a low temperature.

Temperature is commonly associated with coldness or hotness of a body. How do we quantify this difference in the hotness or coldness of a body? You might have experienced that your mother checked your temperature by putting a small glass tube or a digital device called a thermometer in your underarm.

1. Look at the data below obtained in an experiment where 200 mL of pure water is heated and boiled.
2. Observe what happens to the temperature as the water is being heated.

Temperature of 200 mL heated and boiled water at a particular time

TIME (min)	TEMPERATURE (°C)	TIME (min)	TEMPERATURE (°C)	TIME (min)	TEMPERATURE (°C)
0	30	10	53	20	79
1	32	11	55	21	80
2	34	12	58	22	83
3	35	13	60	23	86
4	38	14	62	24	88
5	41	15	64	25	90
6	44	16	66	26	94
7	46	17	69	27	96
8	48	18	74	28	98
9	51	19	76	29	100 water boils

Source: *OHSP Module 13 Transit Energies: Heat and Work, p. 6*

3. Answer the following questions:

A. What happens to the temperature of water as time elapses?

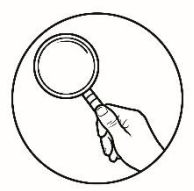
_____

B. What is the temperature when the water boils?

_____

C. What happens to the temperature of water while it is boiling?

_____



What is It

What happens to the temperature of the water when heated? In the activity, as time elapses, the temperature of the water increases. The temperature of the water as it begins to boil is 100 °C and remains the same while it is boiling.

In layman's term, temperature is a measure of hotness or coldness of an object. Kinetic molecular theory tells us that all matter has molecules or atoms which are constantly moving; thus, they have kinetic energy. Molecules are constantly moving but at different speeds and in the same direction. Moreover, the faster these molecules move, the more kinetic energy they have. The more kinetic energy, the higher is the temperature of an object. Temperature is a measure of the average kinetic energy of molecules. When molecules move faster, they have higher temperatures while when molecules move slower, they have lower temperatures.

How do you determine the temperature of an object? Can you use your senses to determine the temperature? Try this simple activity as illustrated below. Set up three glasses of water: glass A with lukewarm water or *maligamgam na tubig*, glass B with cold water, and glass C with tap water (fresh from the faucet). Dip your left forefinger in glass A, while the right forefinger in glass B for 40 seconds. Then quickly dip both your forefingers in glass C. What did you feel? This shows that our senses give us an inaccurate measure of hotness or coldness of an object, making them not reliable indicators of temperature. Thus, we need a thermometer to measure temperature. Grand Duke of Tuscany, Ferdinand II, invented the most common type of thermometer, liquid-in-glass thermometer, in 1650. This type of thermometer is a sealed glass tube containing mercury and with an imprinted temperature scale. The mercury expands or contracts, causing it to move up or down when there are changes in the temperature.

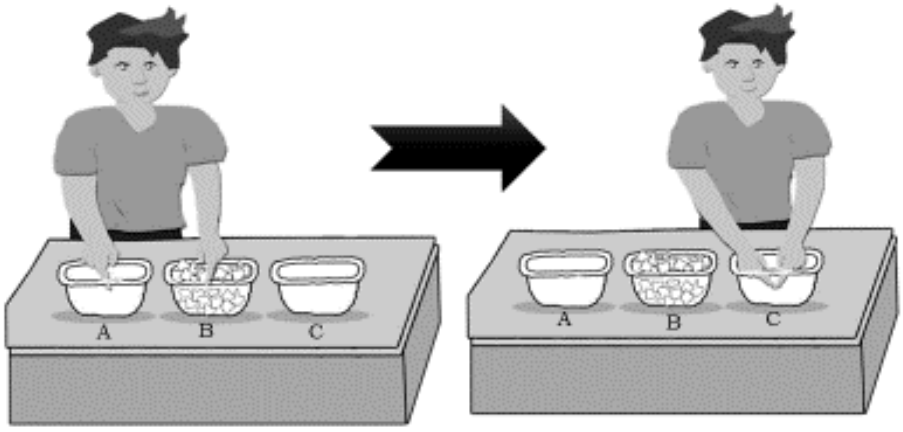


Figure 1: Water with different temperature
Illustrated by: Charlie F. Culminas

What is heat?

When a barbecue has just been removed from the fire, you know it is hot and may burn your tongue, so you do not bite it immediately. Caloric theory is an early theory on heat. It considered heat to consist a fluid called caloric fluid which flows from hotter objects to colder objects. James Prescott superseded this theory by proving that a measurable amount of mechanical energy can always be transformed into definite amounts of heat. He called this quantity as a mechanical equivalent of heat and has a value of 4.186 Joules (J) equivalent to 1 calorie (cal). Prescott further concluded that heat is another form of energy.

Heat is produced from molecules of matter that continuously vibrate. Heat is an energy form that transfers from a body of higher temperature to another body of lower temperature. Once heat is transferred or released, it affects the internal energy of the body. Internal energy is the total energy in a body. Thus, it includes the potential energy and the kinetic energy of the molecules or atoms in an object.

Joule (J) is the SI unit of heat. Another common unit of heat is calorie (cal), defined as the amount of heat needed to change the temperature of one gram of water by 1 °C at a pressure of 1 atmosphere (atm). To avoid confusion, Calorie is not used to refer to an amount of heat. It is used by dieticians or nutritionists to specify energy content of food.

Temperature Scales

The three common temperature scales are Celsius, Fahrenheit, and kelvin. Anders Celsius introduced the Celsius scale in 1741 while Daniel Gabriel Fahrenheit introduced the Fahrenheit scale in 1724. Both scales used the freezing and boiling points of water as reference points. On the Celsius scale, the freezing point of water is 0 °C while its boiling point is 100 °C under a pressure of 1 atm, having 100 intervals between two reference points. On the Fahrenheit scale, the freezing point of water is 32 °F while its boiling point is 212 °F, having 180 intervals between two reference points. The difference between these two reference points is divided equally into intervals called degrees (°).

William Thompson also known as Lord Kelvin, introduced the third temperature scale which is called kelvin. This scale is based on absolute zero corresponding to 0 kelvin. It is the lowest possible temperature and it is when the molecules of the substance have the lowest energy. Kelvin scale cannot have negative temperatures. On the kelvin scale, the freezing point of water is 273 K while its boiling point is 373 K. The temperature difference is 100 kelvin. The difference in temperature between two reference points in the Celsius scale is also 100 C°. So, when comparing kelvin and Celsius scales in terms of change or difference in temperature, 1 K is equivalent to 1 C°.

The symbols °C, °F, and K are used to report temperatures of objects while C°, F°, and K are used for temperature difference or change in temperature. For example, the freezing point of water in the three scales is 0 °C, 32 °F, and 273 K and its boiling point is 100 °C, 212 °F, and 373 K respectively. Hence, the temperature of the water from freezing to its boiling increased by 100 C°, 180 F°, and 100 K. Thus, 100 C° is equal to 180 F° and also equal to 100 K.

The relation between temperature in Celsius scale (T_C), temperature in Fahrenheit scale (T_F), and temperature in Kelvin (T_K) are as follows:

$T_C = \frac{5}{9}(T_F - 32)$ $\quad$ $T_F = \frac{9}{5}T_C + 32$ $\quad$ $T_K = T_C + 273.15$

$T_C = T_K - 273.15$ $\quad$ $T_F = \frac{9}{5}T_K - 459.67$ $\quad$ $T_K = \frac{5}{9}(T_F + 459.67)$

Example: What is the normal human body temperature (37 °C) in the Fahrenheit scale? In the kelvin scale?

37 °C to °F	37°C to K
$T_F = \frac{9}{5}T_C + 32$ $T_F = \frac{9}{5}(37) + 32$ $T_F = 66.6 + 32$ $\boldsymbol{T_F = 98.6}$ °F $\approx$ **99** °F	$T_K = T_C + 273.15$ $T_K = 37 + 273.15$ $\boldsymbol{T_K = 310.15K \approx 310\ K}$

Phase Change

When the temperature of substances changes, the molecular structure and movement also change which results to phase change. Fusion or melting is the process that causes a solid to change to its liquid state. The amount of heat required to produce this change is called heat of fusion. When liquids release heat, the water molecules begin to move at a slower pace. The space between the molecules becomes compact. The process of changing liquids to solids is called solidification or freezing. When water boils, evaporation takes place. Heat is absorbed and water is converted into steam or water vapor. The amount of heat needed for a liquid to evaporate depends on the boiling point of the liquid. When water vapor releases heat, its gas state changes to the liquid state through condensation which accounts for the formation of clouds in the water cycle. In addition, sublimation is the process of transforming a substance from the solid phase directly to the gas state without passing the liquid phase and requires additional energy. On the other hand, deposition is the process of transforming a substance from gas to solid without passing the liquid phase and requires a release of energy. During any of these phase changes, energy is either given off or taken in. When a substance changes phase, the temperature does not change, only the amount of energy changes.

Thermal Expansion

Have you experienced when a metal lid cover of a bottle or glass container gets stuck? What do you usually do? Yes! You heat it or you pour hot water over the metal lid to open the bottle or glass container. The hot water or high temperature causes the metal lid cover to expand. What do you usually do when

drinking glasses stick to each other? The safe way of separating them is by pouring cold water in the inner glass and dip the outer glass in hot water. Why? This is because substances expand when heated and contract when cooled, making it easier for the two glasses to be pulled apart. The amount of expansion and contraction depends on the kind of material and cannot be seen by the naked eye.

When temperature changes, thermal expansion in solids happens. It causes a change in their length, width, height, area, and volume. Molecules or atoms of materials vibrate constantly. Heating these materials causes the particles to vibrate faster, fill in more spaces, and move to empty spaces resulting in the materials to expand or increase in size. On the other hand, when the temperature is reduced, the particles vibrate slower and move closer to each other. Generally, materials expand when the temperature is increased or contract when the temperature is reduced. This is what happens to the mercury inside the glass tube of thermometers. The mercury expands at a different rate than the tube. Thus, as the temperature increases, it rises and drops when temperature decreases.

Thermal expansion also happens in liquids and gases. Molecules of fluids vibrate faster, tend to move farther away from each other, and attract weakly to each other when heated. When cooled, the molecules vibrate slower and move closer to each other. When the temperature is increased, fluids expand. On the other hand, when the temperature is reduced, the fluids contract. The increase or decrease in the temperature causes the volume of the fluids to change. This concept of expansion and contraction in fluids is not applicable to water. It behaves differently from other liquids. Whether increased or reduced from 4 °C, water expands. This is why water is densest at 4 °C.

The mass of the material is constant when it expands. Its volume increases and it becomes less dense. When cooled, the mass also remains constant but the volume of the material reduces and it becomes more dense.

Heat Capacity and Specific Heat

Consider this situation. There are five blocks of different metals such as aluminum, iron, copper, gold and lead with a mass of 100 grams each. They also have the same cross-sectional area and initial temperature. Each of the metal was placed on a separate block of ice. Gold melts the most ice and sinks the deepest. Second is aluminum. Third is iron. Fourth is copper and lead is the last. This shows us that although these metals have the same mass and initial temperature, they absorbed and gave off different amounts of heat. This is because these metals have different heat capacities.

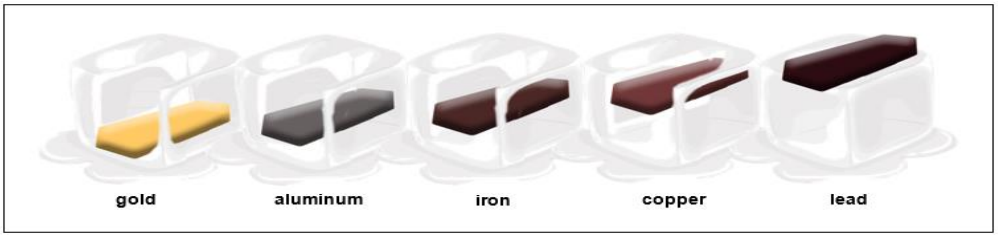


Figure 2: Metals with different heat capacities
Illustrated by: Charlie F. Culminas

The heat capacity of a body is the quantity of heat necessary to raise its temperature by 1 ºC. Substances with high heat capacities cool down slowly because they have to give off more heat and also heat up slowly because they have to absorb more heat. Substances with a low heat capacity heat up quickly and they lose their heat quickly. For example, you are stirring a pot of soup on a stove using a metal spoon. If you leave the spoon on the pot, the spoon will be hot enough and may burn your hand while the soup will feel warm. This is because the metal spoon has a lower heat capacity than the soup.

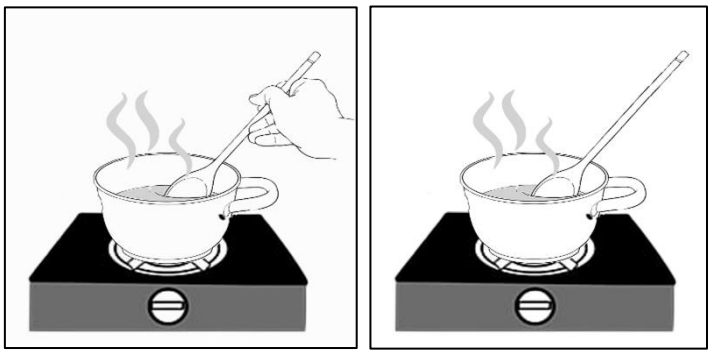
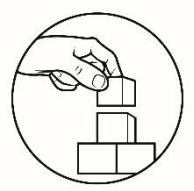


Figure 3: Metal spoon has lower heat capacity than soup.
Illustrated by: Charlie F. Culminas

The specific heat is the amount of heat necessary to raise the temperature of one gram of a substance by one degree Celsius.



What's More

Activity 1. Heat and Temperature

Directions: Complete each statement using a term or terms from the list below. Write your answers on a separate sheet of paper.

Celsius	expands
higher temperature	Joules
how fast molecules vibrate	less internal energy
lower temperature	more internal energy
the number of molecules	calories
Fahrenheit	kelvin

HEAT VS TEMPERATURE

Heat and temperature are related but they are not the same. Heat depends on (1) _____ and also on (2) _____ that vibrate. More vibrating molecules usually mean (3) _____. Fewer vibrating molecules usually mean (4) _____. Faster vibrating molecules mean (5) _____. Slower vibrating molecules mean (6) _____. Heat is measured in units called (7) _____ and (8) _____. Temperature is measured in units called (9) _____, (10)_____ and (11)_____. When matter is heated, it (12) _____.

Activity 2. More about Heat and Temperature

Directions: Write TRUE if the statement is correct and FALSE if the statement is wrong. Write your answers on a separate sheet of paper.

_____ 1. Heat depends only on how fast molecules vibrate.
_____ 2. Joule is a unit of heat energy.
_____ 3. We measure temperature with a thermometer.
_____ 4. The faster molecules vibrate, the more heat they give off.
_____ 5. Temperature measures the average kinetic energy per molecule.

Activity 3. Units of Temperature

Directions: Study the figure below that shows thermometers in different temperature scales. Answer the questions that follow and write your answers on a separate sheet of paper.

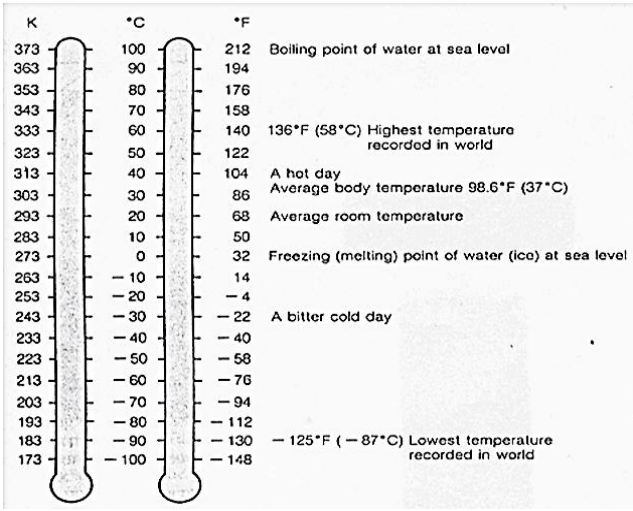


Figure 4: Temperature of Water in Different Scales
Source: *OHSP Module 13 Transit Energies: Heat and Work, p. 7*

1. What are the units used in measuring temperature?
   _____

2. Complete the table below.

Temperature	**Freezing point of water**	**Boiling point of water**	**Temperature difference between freezing point and boiling point**
Celsius	0 °C		
Fahrenheit			
Kelvin		373 K	

Activity 4. Conversion of Temperature

Directions: Solve the following problems. Show your solutions on a separate sheet of paper. Refer to the examples on pages 9 - 10.

1. The boiling point of chlorine is -34 °C. What is this temperature in Fahrenheit scale? In Kelvin scale?
2. What is the temperature in Celsius scale if the reading of the air temperature is 83 °F? What is the temperature in kelvin?
3. Which is greater 50 °C or 50 °F?

Activity 5: Heat and Phase Change

Directions: Use the figure to determine whether each statement is correct or not. Write TRUE if the statement is correct, and FALSE if the statement is wrong. Then, answer the questions that follow. Write your answers on a separate sheet of paper.

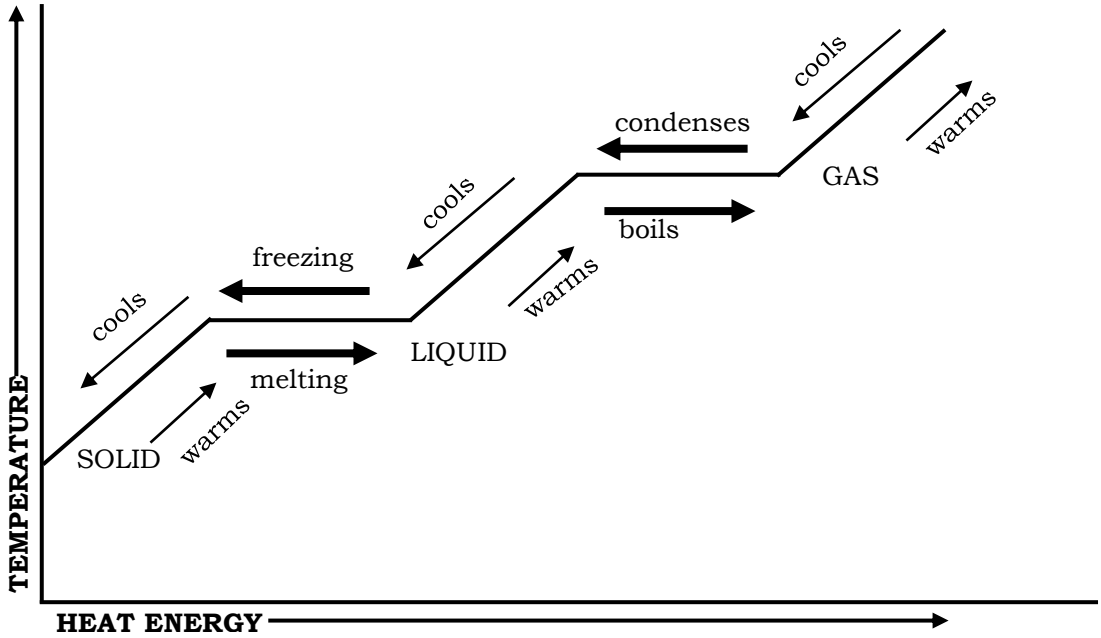


Figure 5. Temperature vs Heat Energy of Water
Illustrated by: Nina Mae M. Pangapalan

1. The temperature increases during melting.
2. Energy is required for each phase change.
3. When the water warms, the temperature decreases.
4. The temperature remains the same when an object freezes.
5. Water may change directly from solid to gas.

Questions:

1. What happens to the temperature as ice changes to water and water changes to vapor?

_____

2. At which phase changes do water absorb energy?

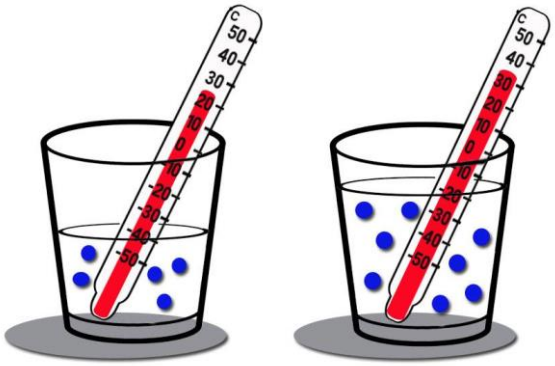
_____

3. At what phase changes do water release energy?

_____

Activity 6: Heat Energy

Directions: Given the set-up below, answer the questions that follow. Write your answers on a separate sheet of paper.



Glass A Glass B

Figure 6: Water with different temperature
Illustrated by: Charlie F. Culminas

1. In which glass does the water molecules move faster?

_____

2. Which glass of water has higher amount of internal energy? Why?

_____

3. How is internal energy related to temperature?

_____

4. If 100 calories of heat energy is added to both glasses:
   a. In which glass does the water molecules move faster?

_____

   b. Which glass of water has higher amount of internal energy? Why?

_____

Rubric for Scoring 2 and 4b

Points	Description
2	Discussion is complete with no misconception.
1	Discussion is incomplete with minor misconception.
0	No discussion made.

Activity 7: Thermal Expansion

Directions: Read and analyze each item carefully. Tell whether the situation applies the concept of thermal expansion. Write YES if it does, otherwise NO.

1. Lina's family went on a summer vacation. It was a hot day when they traveled. On their way, they have noticed that one of the tires of their car has exploded due to the increase in temperature, affecting the air inside the tire.
2. Ana celebrated her 8th birthday yesterday, and it was great. One of the fun games she could not forget was blowing the biggest balloon which she won.
3. Pedro was alarmed when he saw cracks on the glass when he poured hot water into it.
4. John received money as a birthday gift from his uncle. He decided to buy a new pair of shoes. It was a very cold day when he went to the shoe store. He was surprised because his feet which he knew to be size 9 would fit in size 8 shoes.
5. Jose tried to impress the audience in a talent show by bending a heavy metal rod and stretching a thick rubber band.

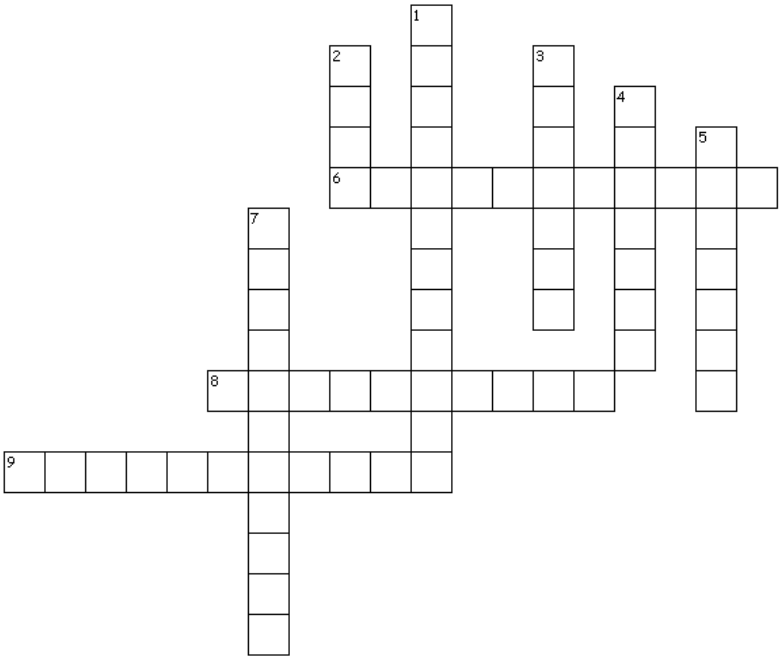
Activity 8: Thermal Expansion and Heat Capacity

Directions: Write TRUE if the statement is correct and FALSE if the statement is wrong. Write your answers on a separate sheet of paper.

1. Generally, substances contract when cooled.
2. When an object expands upon heating, its volume increases.
3. Substances with high heat capacities heat up more slowly because they can absorb more heat before their temperature rises.
4. Materials of the same composition but of varying amounts have the same heat capacities.
5. The specific heat is the amount of heat necessary to raise the temperature of one kilogram of a substance by one Celsius degree.

What I Have Learned

Directions: Complete the crossword puzzle below.



Across

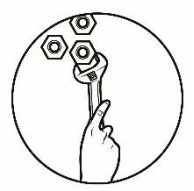
6. a device used to measure temperature
8. a phase change in which gaseous substance changes into solid without passing through the liquid state
9. a phase change which occurs when a solid substance changes into gas

Down

1. a phase change which occurs when a gas state of matter changes to liquid
2. the quantity of thermal energy absorbed or given off by an object
3. a unit of heat
4. _____ expansion occurs when molecules push each other apart due to change in temperature
5. a unit of temperature
7. the measure of the average kinetic energy of molecules

Notes to the Teacher

Please provide extra copies of this activity for students' use.



What I Can Do

Directions: Write TRUE if the statement is correct, FALSE if the statement is wrong. Write your answers on a separate sheet of paper.

_____ 1. When storing water inside a freezer at night, closing tightly the metal cover of the glass container would make it difficult to open the following day.

_____ 2. Boiling water causes more damage to the skin than steam at 100 °C.

_____ 3. The air blown from a wide open mouth is warm while the air blown from slightly closed lips is cold.

_____ 4. A glass of water with ice floating on it cools faster than a glass of water with ice pushed to the bottom of the glass.

_____ 5. Inflated balloon will shrink when kept inside a freezer.

Assessment

Directions: Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

1. Who introduced the absolute temperature scale?

   A. Andres Celsius
   B. William Rankine
   C. William Thompson
   D. Gabriel Fahrenheit

2. Which expands the greatest when heated at the same temperature?

   A. gas
   B. solid
   C. liquid
   D. all expand equally

3. A substance releases heat without changing its temperature whenever it is _____.

   A. melting and boiling
   B. boiling and condensing
   C. melting and condensing
   D. freezing and condensing

4. A change in 10 K corresponds to _____.

   A. -263 °C
   B. -263 C°
   C. 10 C°
   D. 10 °C

5. Why is sand hotter than water at daytime but colder at night?

   A. Sand is solid while water is liquid.
   B. Sand has higher specific heat than water.
   C. Sand and water have equal specific heats.
   D. Sand has a lower specific heat than water.

6. What happens to water when its temperature reaches 4 °C?

   A. It becomes denser.
   B. It becomes less dense.
   C. Its volume will reduce.
   D. Its volume will not change.

7. What is the absolute zero temperature?

   A. -273 °C
   B. -32 °F
   C. 0 °C
   D. 273 K

8. What happens to the temperature if more heat is added to a sample of boiling water in the stove at 1 atm?

   A. decreases
   B. increases
   C. remains the same
   D. increases then decreases

9. Dry ice has a temperature of -110.2 °F. What would its temperature be on the Celsius scale?

   A. -711.0 °C
   B. -198.0 °C
   C. -142.2 °C
   D. -79.00 °C

10. Temperature of a body measures the molecular_____.

A. average kinetic energy
B. average potential energy
C. differences in kinetic energy
D. differences in potential energy

11. Which of the following is TRUE about boiling?

A. It is slower than evaporation.
B. It takes place at a specific temperature.
C. It is the same for all liquids at the same temperature.
D. It takes place when bubbles begin to appear in the liquid.

12. During warm days, you cool yourself by damping your skin with a wet towel. Which of the following takes place?

A. Wet towel has no effect on your body.
B. Wet towel releases heat energy to your body.
C. Wet towel absorbs heat energy from your body.
D. Wet towel has the same temperature as your body.

13. Which of the following happens when ice changes into liquid at 0 °C?

A. The molecules are not moving.
B. The molecules move slower when ice changes into liquid.
C. The temperature of the liquid is higher than the temperature of the ice.
D. The temperature of the liquid is the same as the temperature of the ice.

14. A decrease in temperature of a substance indicates that the_____.

A. volume of the substance increases
B. volume of the substance remains the same
C. particles of the substance get closer with each other
D. particles of the substance move farther from each other

15. Why does liquid in the thermometer rise when put in hot water?

A. The liquid is boiling.
B. The liquid is evaporating.
C. The liquid gains heat from the hot water causing it to expand.
D. The liquid loses heat from the hot water causing it to contract.

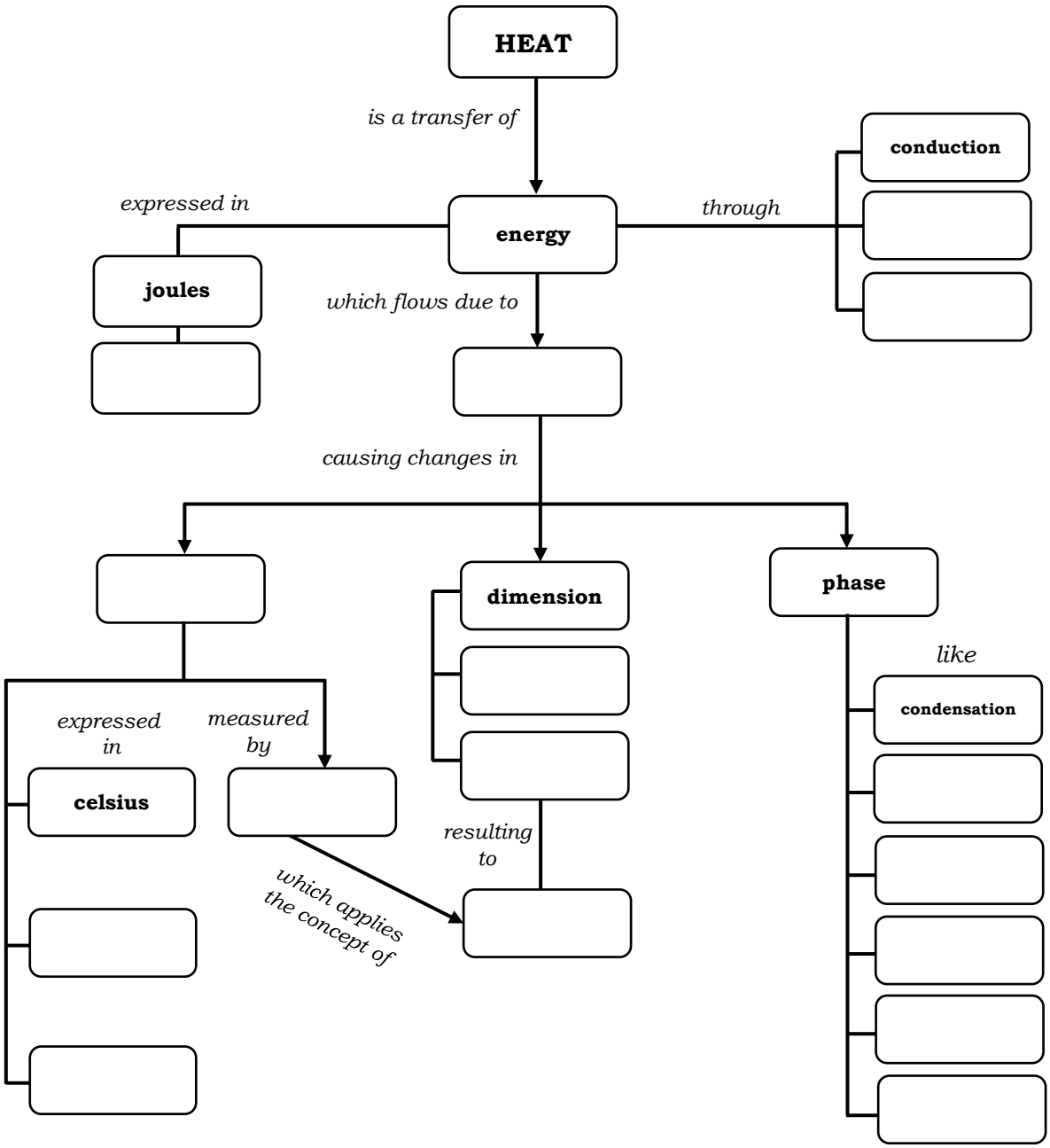
Additional Activities

Notes to the Teacher

Please provide extra copies of this activity for students' use.

Directions: Complete the concept map below. Choose your answers from the words in the box.

area	difference in temperature	kelvin	temperature
calories	evaporation	melting	thermal expansion
convection	fahrenheit	radiation	thermometer
deposition	freezing	sublimation	volume

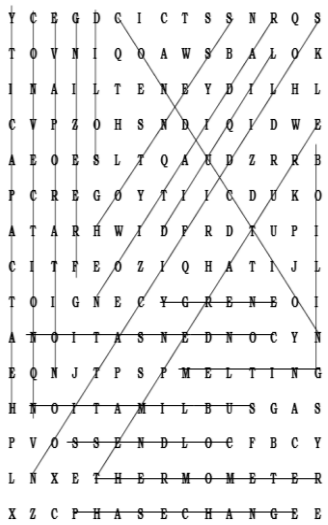


Answer Key

What I Know

1. B
2. B
3. A
4. A
5. B
6. B
7. A
8. D
9. B
10. D
11. D
12. B
13. D
14. C
15. B

What's In



What's New

a. As time passes, the temperature of the water increases.
b. The temperature of the water as it begins to boil is 100°C.
c. The temperature of water while it is boiling remains the same.

What's More

Activity 1

1. how fast molecules vibrate
2. the number of molecules
3. more internal energy
4. less internal energy
5. higher temperature
6. lower temperature
7 - 8. Joules, calories
9 - 11. Celsius, Fahrenheit, kelvin
12. expands

What's More

Activity 2

1. false
2. true
3. true
4. true
5. true

What's More

1. Celsius, Fahrenheit, kelvin

2.

Temperature	Freezing point of water	Boiling point of water	Temperature difference between freezing point and boiling point
Celsius	0°C	100°C	100C°
Fahrenheit	212°F	32°F	180F°
kelvin	273K	373K	100K

What I have Learned

1. condensation
2. Heat
3. calorie
4. Thermal
5. Celsius
6. Thermometer
7. Temperature
8. Deposition
9. sublimation

What's More

Activity 8

1. true
2. true
3. true
4. true
5. true

What's More

Activity 7

1. yes
2. no
3. yes
4. yes
5. no

What's More

Activity 6

1. Glass B
2. Glass B. It contains more molecules of water.
3. The higher the temperature, the higher internal energy.
4. a. Glass B

   b. Glass B. The more water molecules, added with constant amount of heat energy, the higher the internal energy.

What's More

Activity 5

1. False
2. True
3. False
4. True
5. False

Questions:

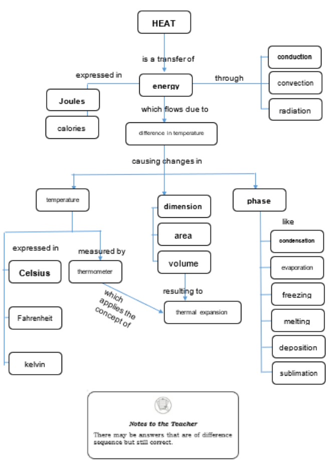
1. The temperature remains constant.
2. melting, evaporation
3. freezing, condensation

What's More

Activity 4

1. -29°F , 239.15K
2. 28.33°C , 301.48K
3. 50°C is greater than 50°F because in Kelvin scale 50°C is equivalent to 323K while 50°F is equivalent to 283K.

Additional Activity



Assessment

1. C
2. A
3. D
4. C
5. D
6. A
7. A
8. C
9. D
10. A
11. B
12. C
13. D
14. C
15. C

What I Can Do

1. true
2. false
3. true
4. true
5. true

References

Campo, Pia C., et.al. *Science 8 Learner's Module.* Pasig: Vibal Publishing House, Inc., 2013.

Department of Education. OHSP Module 13 Transit Energies: Heat and Work, pp 1-37.

For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph