15. Heat

Exercises

1 A. Question

When an object is heated, the molecules that make up the object

A. begin to move faster

B. lose energy

C. become heavier

D. become lighter

Answer

When any object is heated the molecules gain kinetic energy and starts moving faster and the number of collisions between the molecules increases.

1 B. Question

The temperature of a body is an indicator of

A. the total energy of the molecules of an object

B. the average energy of the molecules of an object

C. the total velocity of the molecules of the object

D. the average kinetic energy of the molecules of an object

Answer

The kinetic energy of all the molecules averaged out gives the temperature of the body.

1 C. Question

A and B are two objects. The temperature of A is greater than that of B. This means that

A. the molecules of A move faster on an average than the molecules of B

B. the total energy of A is greater than the total energy of the molecules of B

C. the average potential energy of A is greater than the average potential energy of B

D. the heat content of A will always be greater than that of B

Answer

The temperature of a body is the average kinetic energy of all the molecules inside the body, so if an object A has a temperature more than object B, then the molecules inside the object A will move faster than the molecules of object B because the temperature of object A is more than object B.

2 A. Question

Fill in the blanks with suitable words:

1. The degree of hotness of a body is called_____ (heat/ temperature)

2. Temperature is expressed in_____(degree centigrade/joule)

3. A substance changes from liquid to gas at constant temperature.

It is called _____(condensation/boiling point)

4. The temperature of boiling water in the Celsius scale of temperature is _____°C (100/373/212/32)

5. The SI unit of heat is _____(Joule/Celsius)

Answer

1. Temperature.

Temperature of a body is measured as degrees of hotness of a body. Heat is due to the temperature or the intensity of the temperature.

2. Degree Centigrade.

Degree Centigrade is the unit to measure the temperature while Joule is the unit of energy or heat.

3. Boiling point.

The phase change of any liquid to gas at a constant temperature is called boiling and the temperature at that point is called boiling point.

4. $100^{\circ}C$

5. Joule.

Joule is the SI unit of the heat while Celsius is the unit of temperature.

3. Question

State whether the following statements are true or false:

1. Liquids expand on heating.

2. The unit of heat and temperature are the same.

3. A bimetallic strip is used in fans.

Answer

1. The statement is true.

Any liquid on heating will expand because the molecules of the liquid will gain kinetic energy from the heat and the collisions between the molecules increases due to increased vibrations of the molecule. Due to all this, the volume of the liquids will increase and they expand.

2. The statement is False.

SI unit of temperature is Celsius while the SI unit of heat is Joule.

3. The statement is False.

Bimetallic strips have two different metals with different expansion coefficient they are commonly used in switches and thermostats.

4 A. Question

Answer the following :

Distinguish between heat and temperature.

Answer

The temperature of any object is the average of the kinetic energies of all the molecules inside the object. It is a measure of the thermal or heat energy present in a substance. All the molecules in an object may not have the same energy so the average of all the energies of molecules will give the temperature of the object.

Heat, on the other hand, is the total energy of the motion of molecules in a substance. The movement of molecules is random and every molecule has a different energy. The sum total of the energies of all the molecules is the heat.

4 B. Question

Answer the following :

Mention three different effects produced by heat.

Answer

Effects of heat on a substance are:

(i) Change in the phase or the state of the substance.

For example boiling of water changes its state from liquid to vapours.

(ii) Change in colour.

Heating some elements can result in a change of colour like iron when heated changes its colour to red.

(iii) Change of shape of the substance.

A candle when burned, the wax will melt and the shape of the candle will change.

4 C. Question

Answer the following :

Give one example to illustrate that heat can be generated from the energy of motion.

Answer

During any motion all the energy provided is not converted to useful work some of the energy is released in other forms. Relative motion between two objects will produce heat due to the release of energy which causes the molecules of the substance to move faster. While driving a car, the road and tires will be in contact and have motion between them due to which tires will be heated. This is because of the friction between tires and road which will cause tires to heat up.

4 D. Question

Answer the following :

Describe an experiment to show the change in state on heating.

Answer

An experiment that can be used to show a change of state on heating is melting of wax.

Materials required: coloured wax candles, pan, gas stove or burner.

Steps involved:

(i) Take 2 to 3 coloured wax candles in a pan. (Coloured wax will be easy to identify after melting).

(ii) Provide heat to the pan containing candles with help of gas stove or burner.

(iii) Keep the pan undisturbed for some time.

(iv) After a few minutes wax will start to melt into a liquid.

(v) There is a change of physical change happening in form of change of state of the wax from solid to liquid.

Result: the wax candles will be melted completely on the application of heat and will undergo a change of state.

4 E. Question

Answer the following :

Name two devices which use the bimetallic strip.

Answer

Thermostats and miniature circuit breaker are devices using bimetallic strips.

4 F. Question

Answer the following :

A thick glass tumbler often cracks when boiling water is poured into it. Why?

Answer

When heat is applied to any object it expands. This is the reason why a thick glass tumbler cracks when boiling water is poured into it. As the heat is transferred from boiling water to tumbler it will cause the glass to expand, glass being solid will resist to expansion and will cause cracks in the glass tumbler.

4 G. Question

Answer the following :

State similarities and differences between the laboratory thermometer and the clinical thermometer.

Answer

Similarities between laboratory and clinical thermometer are:

(i) The body of both of them is long and narrow.

(ii) A bulb containing mercury is attached at one end.

(iii) Mercury is used to measuring temperature on the Celsius scale.

Differences between laboratory and clinical thermometer:

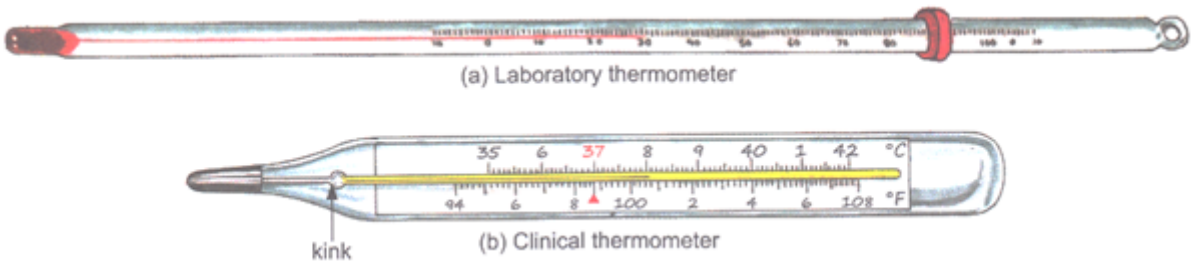
(i) Laboratory thermometer is used to measure temperature change in the surrounding, while the clinical thermometer is used to measure body temperature.

(ii) The range of laboratory thermometer is from -10°C to 110°C, while for a clinical thermometer range is 35°C to 45°C.

(iii) The clinical thermometer has kink near bulb to prevent mercury from falling after rising which is missing in

laboratory thermometer.

The diagram is shown below:



4 H. Question

Answer the following:

Convert 100 °F into Celsius and Kelvin scale of temperature.

Answer

Formula for converting Fahrenheit to Celsius = $(°F - 32) \times \frac{5}{9} = °C$

100°F in to Celsius scale:

100°F = (100 – 32) x (5/9) = 37.7°C

100°F into Kelvin scale:

37.7°C = 37.7 + 273.15 = 310.85.

As 37.7°C is 100°F in Celsius scale it can be directly converted to Kelvin scale by adding 273.15 K.

5. Question

Match the following :

A	B
1. formation of icebergs	a. kelvin scale
2. rise of mercury level in thermometer	b. sudden contraction
3. automatic electric iron	c. celsius scale
4. cracking of hot glass plate when touched by cold object.	d. boiling point
	e. bimetal strip
	f. thermal expansion
	g. anomalous expansion of water

Answer

1-(a): formation is iceberg: anomalous expansion of water.

Water should contract in size in changing state from liquids to the solid but anomalous expansion of water is a property of water in which water expands instead of contracting when the temperature is falling from $4^{\circ}C$ to $0^{\circ}C$. Due to this expansion the density of water decreases which causes the iceberg to float on water.

2-(f): the rise of mercury in a thermometer: thermal expansion.

Mercury used in thermometer to measure temperature rises due to heat from the body. The rise in mercury is due to the thermal expansion phenomenon in which the molecules move faster and away from each other causing expansion of any substance on the application of heat.

3-(e): automatic electric iron: bimetal strip.

A bimetallic strip is made up of two metals which have different expansion on heating. In automatic electric iron, thermostat is used which contain bimetallic strip. The thermostat is used to maintain the temperature of the iron which contain bimetal strip. The bimetal strip is used as a cut off of power when the thermostat reaches fixed temperature.

4-(b) cracking of hot glass plate when touched by cold object: sudden contraction.

All the objects expand on heating and regain their original shape on cooling. A hot plate glass plate will expand to a point when touched by a cold object the heat will flow quickly to the cold object and due to this, there will be a sudden contraction in the plate which will cause cracking of the plate.

6 A. Question

Project Ideas :

Meet a veterinary doctor (a doctor who treats animals). Find out the normal body temperature of domestic animals and birds.

Answer

The student should do by themselves.

6 B. Question

Project Ideas :

Write a report on the history of measurement systems using books/internet for reference.

Answer

i. The earliest recorded systems of weights and measures originated in the 3rd or 4th millennium BC.

ii. The earliest civilizations needed a measurement for purposes of agriculture, construction, and trade.

iii. Early standard units applied to a single community or small region, developing its own standards for lengths, areas, volumes, and masses.

iv. However, with the development of manufacturing technologies, and the growing importance of trade between communities and ultimately across the Earth, standardized weights and measures became critical.

v. Starting in the 18th century, modernized, simplified and uniform systems of weights and measures were developed, with the fundamental units defined by ever more precise methods in the science of metrology.