



# 3055 BA SANGAM COLLEGE

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## Worksheet 14

School: Ba Sangam College

Year/Level: 11

Subject: Physics

Strand	3 – Fluid Statics	
Sub-strand	3.3 – Hydrometer and Pressure	
Content	Learning	Objective:
Outcome		1. Explain the difference between heat energy and temperature. 2. Show understanding of the meaning of the terms conduction, convection and radiation.

### HEAT ENERGY

Heat is a form of energy. Heat flows from one substance to another substance if there is a difference in the degree of hotness in the two substances.

Temperature is the degree of hotness in a body. It is measured by the thermometer.

#### Difference between Heat energy and Temperature

Heat Energy	Temperature
A form of Energy	Degree of hotness of an object.
Unit: Joule (J)	Unit: Kelvin (K)/ Degree Celsius (C)
Sum of the kinetic energy and potential energy of the particles.	Average kinetic energy of the particles.
Derived quantity	Base quantity (fundamental quantity)

#### KINETIC THEORY OF MATTER

The kinetic theory of matter was postulated to explain the existence of the various physical states of matter (i.e. solid, liquid and gas)

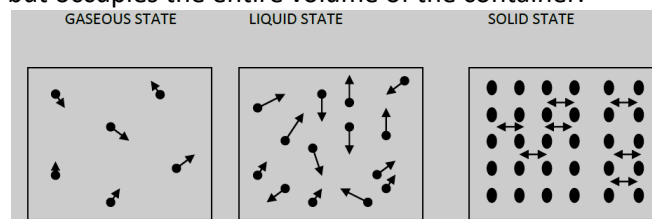
The basic assumptions of the kinetic theory are:

1. Matters are made up of particles and these particles are in constant motion

**SOLID STATE** : the particles are in fixed positions but vibrate about the position. This means that there are strong bonding forces between the particles of the solids and hence solids have a fixed volume and are incompressible. Solids therefore have a regular, repeating molecular pattern.

**LIQUID STATE** : The particles have weaker bonding forces between them although they are not in fixed position i.e. liquid has no fixed shape, it takes the shape of the container. There is a fixed volume and liquids are incompressible.

**GASEOUS STATE** : The molecules are much farther apart than in solids or liquids and so they are less dense. There are very weak bonding forces between the particles so a gas has no fixed volume or shape but occupies the entire volume of the container.



The diameter of the particles are negligible compared to the inter-particle distances. This implies that there are a lot of empty spaces in matter.

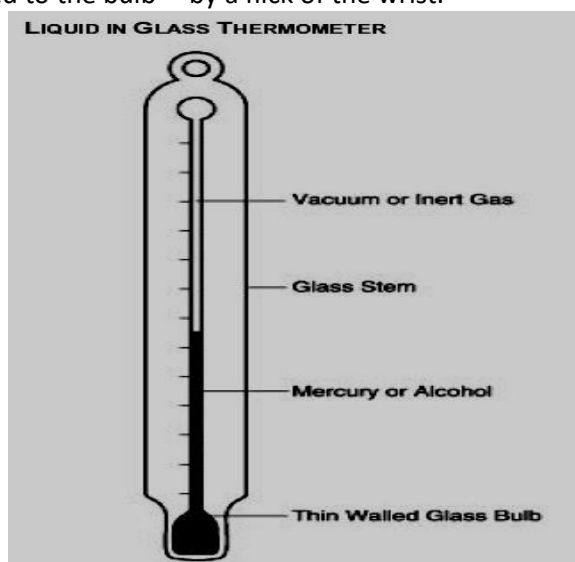
2. The particles in the liquid and gaseous states are in constant random motion and they collide with each other very frequently.
3. Because of the inter-particle collisions are elastic, there will be no loss in energy and momentum during the collision. Thus, both the kinetic energy and momentum is conserved.

#### MEASUREMENT OF TEMPERATURE

The temperature of a body tells us how hot it is and is measured by a thermometer, usually in degrees Celsius (C). There are different kinds of thermometer, each type being more suitable than another for a certain job.

#### CLINICAL THERMOMETER

This is a special type of mercury-in-glass thermometer used by doctors. The tube has a constriction (i.e. a narrower part) just beyond the bulb. When the thermometer is placed under the tongue the mercury expands, forcing its way past the constriction. When the thermometer is removed from the mouth, the mercury in the bulb cools and contracts, breaking the mercury thread at the constriction. The mercury beyond the constriction stays in the tube and shows the body temperature. After use the mercury is returned to the bulb— by a flick of the wrist.



#### Advantages Of Using Mercury In A Thermometer

1. mercury does not evaporate in hot water
2. mercury can be seen easily
3. mercury expands when heated
4. mercury does not freeze in cold water

#### EXPANSION & CONTRACTION

Matter (solid, liquid or gas) expands when heated the kinetic of heat helps us to understand why substances usually expand when heated. When a substance is heated its materials are made to move faster (vibrate) because of this they need more room and therefore collide with nearby molecules. These collisions cause the molecules to spread further apart causing the substance to expand.

#### PROBLEMS WITH EXPANSION

All structures made out of solid expand in hot weather

1. Railway lines expand during hot weather, to allow for this expansion considerable gap is left between two lines. When the temperature increases, the rails become slightly longer and the gaps become smaller.

But without the gaps any expansion would result in buckling of the rails.

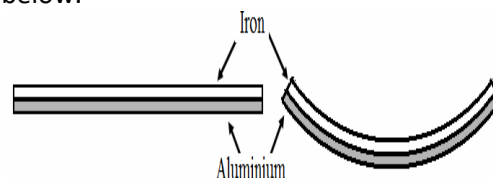
2. Steel bridges expand in hot weather so they have to be set on rollers.
3. Power lines are loosely suspended so that they do not break on contraction in weather.

#### EXPANSION OF VARIOUS SUBSTANCES

When rods of same length but different substances are heated through the same range of temper experiment shows that their expansions are not equal brass for example expands about 1 ½ as much as steel- Aluminum expands twice as much as steel.

#### BIMETALLIC STRIP

Bimetallic Strip contains two different types of metal attached. Different metals have different rates of expansion. Both metals are good conductors of heat but aluminum is a better conductor. This means that when a bimetallic strip containing aluminium and iron is heated, aluminum will expand more than iron. Since aluminum expands more, it expand a little extra than iron and hence, aluminum will bend upwards. Bending of bimetallic strips depends on temperature. If the temperature is increased, the strip will bend more. If the aluminium is on top of the iron, aluminium will bend downwards as shown in the diagram given below.



#### Metal expand



- A - aluminum - expand most on heating
  - B - brass of copper-zinc
  - C - copper
  - I - iron
  - Z - zinc
  - I - invar - expand least on heating
- 

#### APPLICATIONS OF BIMETALLIC STRIPS

The idea that a bimetallic strip bends on heating is useful in many situations. Two common applications of Bimetallic Strips are:

1. Air –Conditioners
2. Fire Alarm System

#### ACTIVITY (Research Work) (10 marks)

Explain with the aid of diagrams the following TWO common applications of bimetallic strips.

1. Air –Conditioners (5 MARKS)
2. Fire Alarm System

(5 MARKS)

**THE END**