Plot 48 Muwayire Rd (behind IHK Hospital)
P.O.BOX 5337, KAMPALA - UGANDA
Tel: 256783111908
Email: info@stagnes.co.ug
Website: www.stagnes.co.ug

FORMS OF ENERGY

Energy is the body's ability to do work

Matter

Matter is anything that has mass and volume

OR

anything that has weight and occupies space

The meaning of each of the following

a. **Mass: is a quantity of matter in an object.**

b. **Volume:** Is the space occupied by an object.

c. **Molecules:** It is the smallest particles of matter.

d. Weight: is the gravitational force exerted on an object by the earth.

States of matter

There are three different states of matter

- Solids - Liquids - Gases

Solids

Examples of solids.

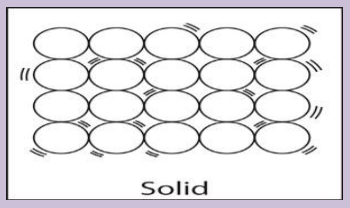
- Wood
- Rubber
- Glass
- Plastic

Characteristics of solids.

- Molecules are closely packed.
- Particles are held together very tightly.

- Molecules do not move from position but vibrate.
- Solids have shape, size and volume apart from irregular objects.

Diagram to show the arrangement of molecules.



Liquids

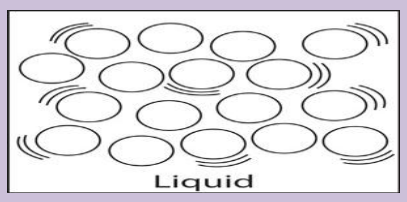
Examples of liquids.

- Water
- Soda
- Oils
- Juice

Characteristics of liquids.

- Molecules are spaced.
- Molecules loosely held together.
- Liquids have a proper volume (capacity)
- Liquids have no definite shape (take up the shape of the container in which they are poured)

Diagram to show the arrangement of molecules.



Gases

Examples of gases.

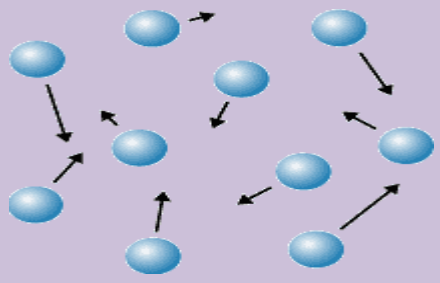
- Nitrogen
- Carbon dioxide
- Oxygen

- Rare gases

Characteristics of gases.

- Molecules are far apart
- Gases have no definite shape
- Gases have a particular volume.
- Molecules move freely.

Diagram to show the arrangement of molecules.



ACTIVITY

1. **What is energy?**
2. **What is matter?**
3. **Name the three states of matter.**
4. **In which state of matter are the following**
    a) **water**
    b) **metal**
    c) **oxygen**

ENERGY

Energy is ability to do work

F**orms of energy.**

- Heat energy
- Sound energy
- Light energy
- Sound energy
- Electric energy

- Magnetic energy
- Chemical energy
- Solar energy.

Types of energy

- Kinetic energy
- Potential energy

Potential energy

Is the energy that is stored by an object at rest.

Examples of potential energy

- A baby being asleep in a cot
- A car standing still at traffic lights
- A pupil sitting and listening to the teacher
- A stone / book ruler resting on a table /ground /cupboard etc

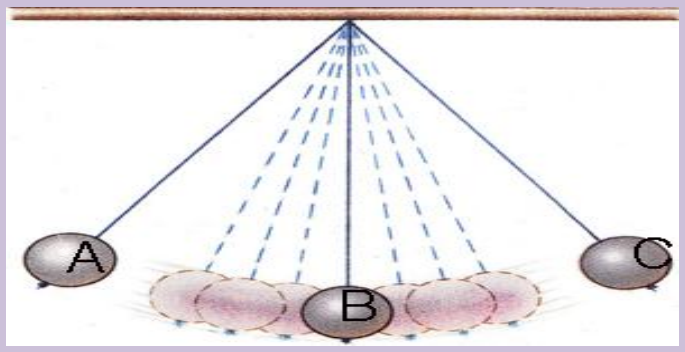
Kinetic energy

This is the energy possessed by a moving object or an object in motion. It is also referred to as the energy in motion

Examples of kinetic energy

- A girl running along the road
- An arrow flying through the air
- A stone thrown up in air
- A brick dropping from a wall
- A leaf falling to the ground from a tree

Think of a stone or a pendulum swinging in air



At A, the stone possess potential energy

At B, the stone possess kinetic energy

Activity

1. Mention the two types of energy.
2. Define the following types of energy
    a. potential energy.
    b. kinetic energy.
3. List down any three forms of energy.

HEAT ENERGY

Heat energy is a form of energy that increases temperature of an object

Standard units for measuring heat.

Heat **Calories**

Instruments used to measure heat.

Heat **Calorimeter**

sources of heat

These are objects that produce heat.

Types of sources of heat.

i. Natural sources of heat
ii. Artificial sources of heat

Natural sources

Natural sources of heat provided by nature.

Examples.

- Sun (main natural source of heat)
- Food
- Stars
- Erupting volcanoes

Artificial sources.

These are sources of heat made by people.

Examples of artificial sources of heat.

- Lamps
- Bulbs
- Candles

Uses of heat to man

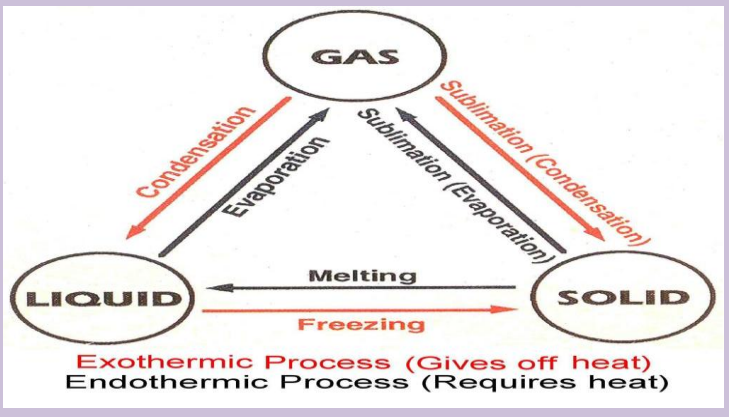
- Used for ironing clothes
- Heat is used to run some machines e.g. steam engines. Diesel engines, rockets etc.
- Used to dry harvested crops before storage.
- Heat evaporates the water in water bodies and plants during rain formation
- Heat enables us to cook our food
- Heat can act as a disinfectant.

Effects of heat on matter

Heat causes the following effects to matter.

- Melting.
- Expansion.
- Evaporation.
- Sublimation.

Diagram to show physical changes of state of matter.



A - Melting physical change from solid to liquid

B - Evaporation physical change from liquid to gas.

C - Freezing physical change from liquid to solid.

D - Condensation – Physical change from gas to liquid

E - Sublimation physical change from solid to gas.

F - Sublimation physical change from gas to solid.

ACTIVITY

1. **What is heat energy?**
2. **Name two the types of sources of heat in the environment.**
3. **Give two examples of each of the following sources of heat**
    a. **Natural source of heat.**
    b. **Artificial source of heat.**
4. **Identify any two effects of heat on a state of matter.**

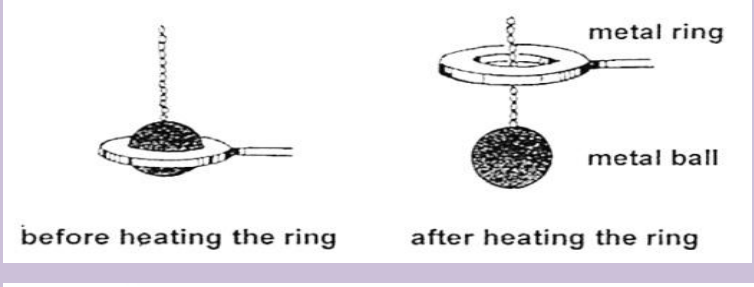
EFFECTS OF HEAT ON EACH STATE OF MATTER.

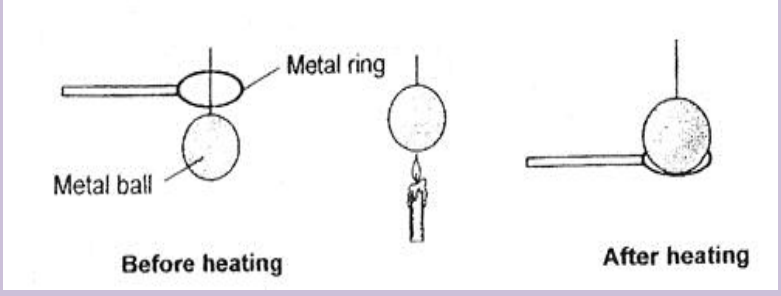
SOLIDS.

- Metals expand.

Metallic ball ring experiment

a). Before heating the metallic ball goes through the ring.





b). After heating the metallic ball does not pass through the ring

Reasons why metallic ball did not go through the ring after heating

The metallic ball had expanded

Conclusion

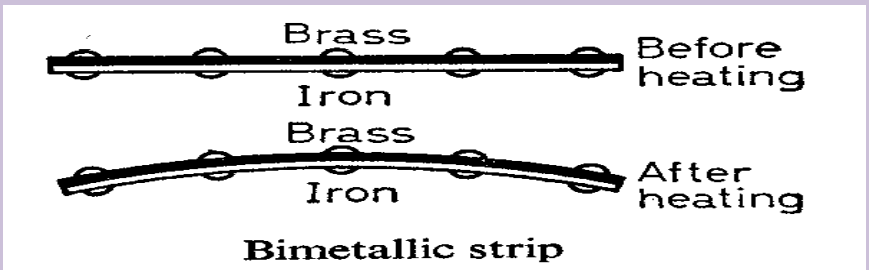
Metals expand when heated

What do you think can happen to the metallic ball if dipped into cold water?

The hot metallic ball will contract and pass through the ring again.

Bimetallic strip.

Before heating and after heating



Bimetallic strip

Observation

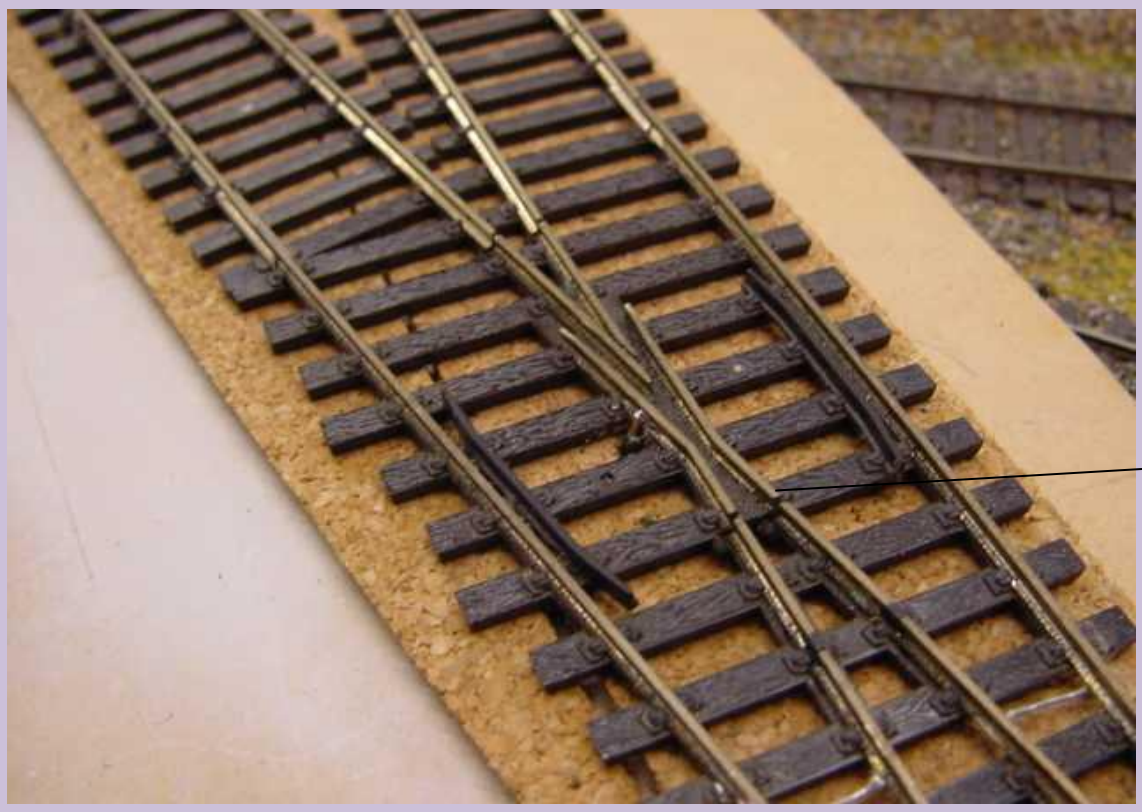
The iron strip heats up and expands faster than the copper strip hence bending to wards the copper.

Qn: 1. which of the two metals is the best conductor of heat?

IMPORTANCE OF A Bimetallic.

- Bimetallic strips are used in automatic switches of electric kettles, flat irons, fridges, freezers etc.

Illustration of a railway line showing the gaps left during construction.



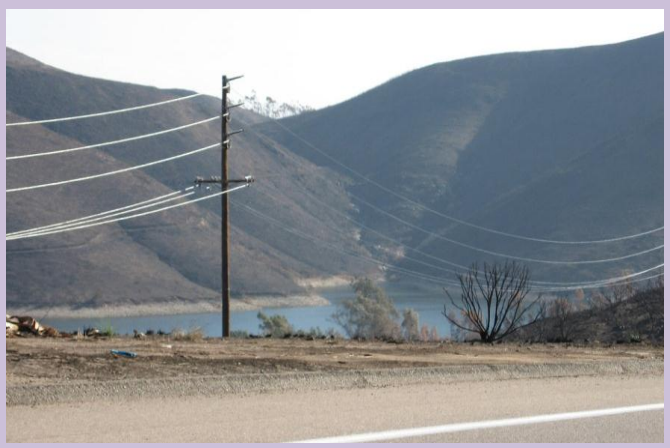
Qn: What happens if gaps were not left between rails during construction?

The rails would expand on hot days bend and cause railway accidents.

2. Why are gaps left between railways during construction?

To leave room for expansion on a hot day.

<u>Diagrams to show the effect of heat on electric / telephone wires On a hot day.</u>



Electric / telephone wires expand become loose and starts sagging / slacking.

On a cold day wire contract and become shorter appearing relatively tight.

Qn; 1. Why are gaps left between electric / telephone wires during construction?

To allow room for expansion.

2. What would happen to the wires when tied tightly fixed on the poles?

The wires would break due to contraction on cold days

Activity

1. Why gaps left between the railway lines during construction?
2. Why telephone wires are loosely fixed on the poles?
3. what happens to electric wires on the following

a. Cold days.

b. Hot days.

EFFECTS OF HEAT ON ICE.

What happens to ice when heated?

- Ice melts

- The volume decreases, the density increases and the mass remains the same.

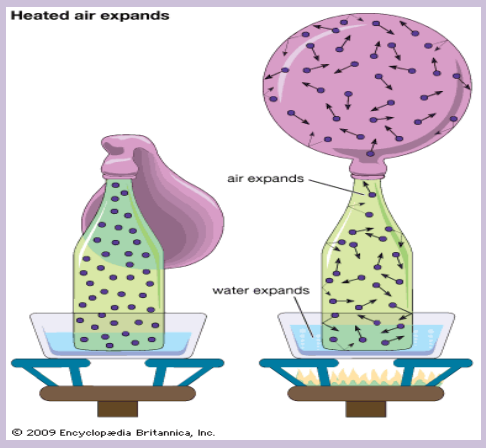
EFFECTS OF HEAT ON GASES

What happens to gases when:-

a). Heated - Gases expand

b). Cooled - Gases contract

EXPERIMENT TO SHOW THAT GASES EXPAND WHEN HEATED.



QN:1. Why does the balloon in diagram A expand?

Due to expansion of air inside the plastic bottle.

3. What happens to the balloon when the bottle is removed from the hot water?

The balloon collapses due to contraction of the air inside the plastic bottle.

Effects of heat on liquids

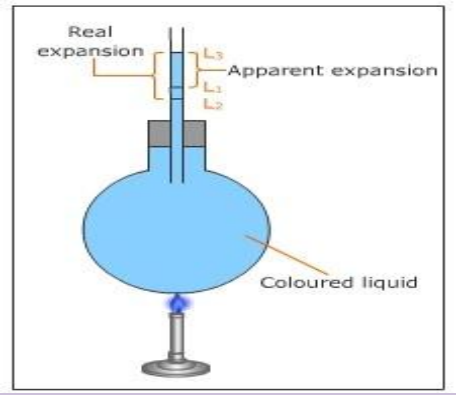
- Liquids expand when heated.
- Liquids evaporate when heated.

- Liquids contract when cooled

Effects of freezing of liquids

- Liquids increase in volume
- Liquids reduce in density
- Mass of liquids remains the same.

Diagram to show that liquids expand when heated.



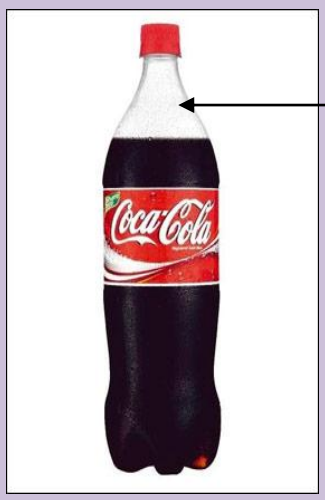
Qn: 1. why is space left while bottling drinks like soda?

To leave room for increase in volume when frozen.

2. Why is carbon dioxide packed in bottled drinks like soda?

To preserve the soda.

A BOTTLE WITH THE SPACE LEFT



Space left to give room for increase in volume on freezing.

Effects of heat on sublimates

NB: Sublimates are substances which can directly change from solid to gas.

Examples of sublimates

i. Iodine granules (crystals)

ii. Ammonium chloride(salts)

iii. Solid carbon dioxide.

TEMPERATURE

Is the degree of hotness or coldness of an object.

Standard units for measuring temperature.

Temperature **Degrees**

Instrument used to measure temperature.

Temperature **Thermometer**

Thermometer

Thermometer is an instrument used to measure temperature.

The following thermometer measure the following:-

- Lowest temperature of the day **Minimum thermometer**
- Highest temperature of the day **Maximum thermometer**
- Room temperature or temperature of the air **Wall thermometer**
- Highest and lowest temperature of the day **Six's thermometer**
- Human body temperature **Clinical thermometer**

Places where we find clinical thermometer in daily life

- In clinics
- In hospitals
- In dispensaries

Places or common sites on our bodies where a clinical thermometer can be placed while measuring the human body temperature

- Under the arm pits
- In the anus
- In the mouths / under the tongue

Diagram of clinical thermometer

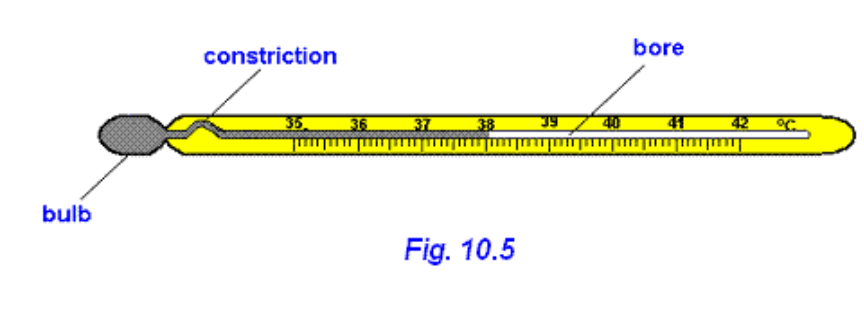


Fig. 10.5

Importance of each part

Stem: Protects the inside parts of a thermometer

Kink: Prevents the back flow of mercury to the bulb before the actual temperature is taken.

Bore: The bore has a regular scale.

Bulb: The bulb store mercury.

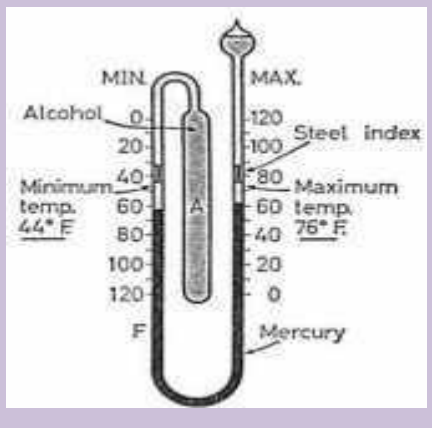
Liquids commonly used in thermometers.

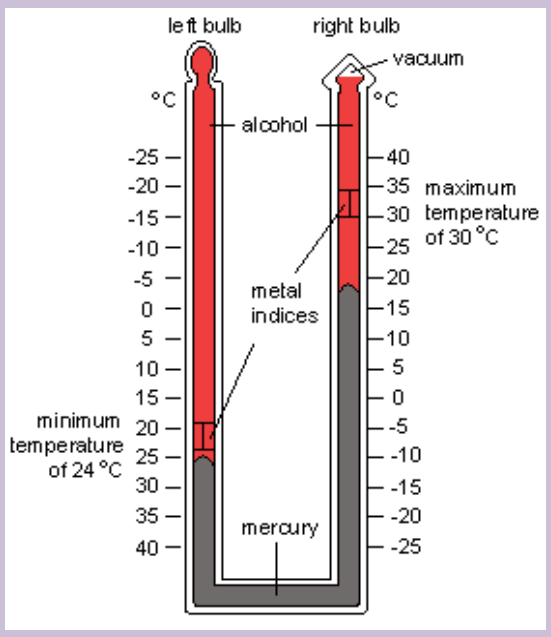
- Alcohol
- Mercury

ACTIVITY

1. **What is temperature?**
2. **State the difference between heat and temperature.**
3. **Name the any one type of thermometer.**
4. **Which liquids are used in the thermometers**

SIX'S THERMOMETER (MINIMUM AND MAXMUM THERMOMETER)





Reasons why mercury is used in a thermometer

- Mercury is a good conductor of heat
- Mercury does not stick on the walls of the bulb / bore.
- Mercury can easily be seen in the glass.
- Mercury has even and regular expansion.

Reasons why water is not used in a clinical thermometer

- Water is not easily seen
- Water is a bad conductor of heat
- Water needs a lot of heat to expand.
- Water's does not expand uniformly.

Why do doctors shake a clinical thermometer before using it on other patients?

- To draw the mercury back to the bulb

Reason why a clinical thermometer is sterilized using surgical spirit

- Boiling it will make the stem expand and burst.

The normal human body temperature

- Celsius 37^0c.
- 98.6^0c degrees Fahrenheit.

Changing from Celsius to Fahrenheit

a. 20^0c

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{20} \times 9}{\cancel{5}}) + 32$

$F^0 = (4 \times 9) + 32$

$F^0 = 36 + 32$

$^0F = 68^0$

b. 25^0c

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{25} \times 9}{\cancel{5}}) + 32$

$F^0 = (5 \times 9) + 32$

$F^0 = 45 + 32$

$^0F = 77^0$

c. 5^0c

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{5} \times 9}{\cancel{5}}) + 32$

$F^0 = (1 \times 9) + 32$

$F^0 = 9 + 32$

$^0F = 41^0$

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{0} \times 9}{\cancel{5}}) + 32$

$F^0 = (0 \times 9) + 32$

$F^0 = 0 + 32$

$^0F = 32^0$

d. 80^0c

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{80} \times 9}{\cancel{5}}) + 32$

$F^0 = (16 \times 9) + 32$

$F^0 = 144 + 32$

$^0F = 176^{0c}$

e. 100^0c

$F = (c \times \frac{9}{5}) + 32^0$

$F^0 = (\frac{\cancel{100} \times 9}{\cancel{5}}) + 32$

$F^0 = (20 \times 9) + 32$

$^0F = 180 + 32$

$^0F = 212^0$

ACTIVITY

Change the following from degrees Celsius to degrees Fahrenheit

1. **5^oc**
2. **10^0c**
3. **100^0c**
4. **0^0c**
5. **80^0c**

Changing temperature from Fahrenheit to Celsius

Example 41^0F to C^0

$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (41 - 32) \times {}^5/_9$
$C^0 = (41^0 - 32) \times {}^5/_9$
$C^0 = 9 \times {}^5/_9$
$C^0 = 1 \times 5$
$C^0 = 5^0$

Change 68^0F to C^0

$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (68^0 - 32) \times {}^5/_9$
$C^0 = 36 \times {}^5/_9$
$C^0 = 4 \times 5$
$C^0 = 20^0$

Change 32^0F to C^0
$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (32^0 - 32) \times {}^5/_9$
$C^0 = 0 \times {}^5/_9$
$C^0 = 0 \times 5$
$C^0 = 0^0$

Change 59^0F to C^0
$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (59^0 - 32) \times {}^5/_9$
$C^0 = 27 \times {}^5/_9$
$C^0 = 3 \times 5$
$C^0 = 15^0$

Change 95^0F to C^0
$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (95^0 - 32) \times {}^5/_9$
$C^0 = 63 \times {}^5/_9$
$C^0 = 7 \times 5$
$C^0 = 35^0$

Change 77^0F to C^0
$C^0 = (F - 32) \times {}^5/_9$
$C^0 = (77^0 - 32) \times {}^5/_9$
$C^0 = 45 \times {}^5/_9$
$C^0 = 5 \times 5$
$C^0 = 25^0$

ACTIVITY

Change from Fahrenheit to Celsius

1. **68^{0c}**
2. **32^{0c}**
3. **41^{0c}**
4. **77^{0c}**

HEAT TRANSFER

How heat travels through the states of matter

1. Solids by Conduction
2. Liquids by Convection
3. Gases by Convection

Vacuum by Radiation

Vacuum

A vacuum is a space without molecules.

Importance of molecules in heat transfer

- Molecule act as a medium of heat transfer.

Qn: In which state of matter does heat travel?

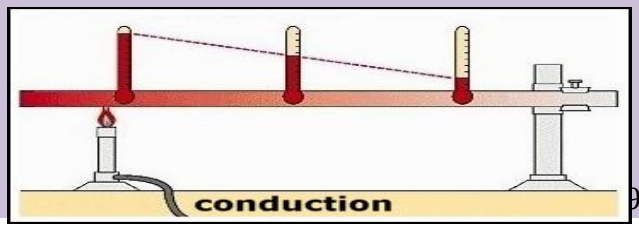
A) **Fastest –** gases

Why? The molecules in gaseous state move freely than in any other state of matter.

Slowest – Solids

Why? The molecules do not move freely.

An illustration of heat transfer in solids



Qn: 1. how does heat move from point B to point A?

By conduction

2. Which of the above wax will melt first?

Wax 1.

Reason: Wax 1 is nearest to the flame

3. Which of the above wax will melt last?

Wax 4

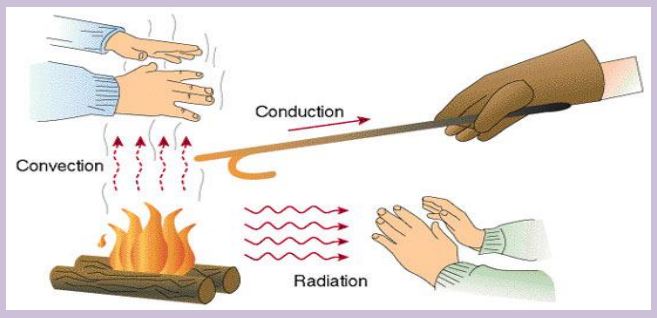
Reason: wax 4 is furthest from the flame.

Importance of heat transfer by conduction

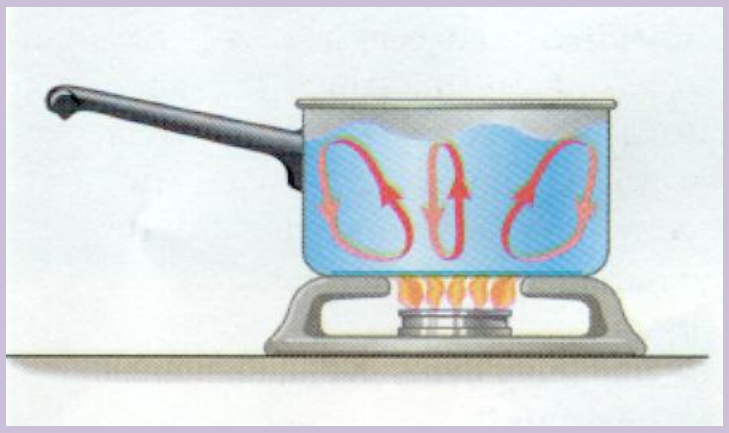
- Ironing our clothes using hot bodies like flat irons, iron boxes.
- Cooking food.
- Boiling water in a kettle.
- Welding or smelting metallic objects.
- Roasting meat using an iron rod.

<u>Diagram to show convection of heat</u>

a) <u>in gases.</u>



b) <u>liquids</u>



Importance of convection in our daily life

- helps smoke to move out of the kitchen through the chimney.
- Convection current helps in free circulation of fresh air in our houses.
- Convection currents help in formation of breezes.
- Taking of bad smell through the vent pipes of a VIP latrine**.**

Importance of each of the following on a house.

1. Ventilators: let out warm air

2. Windows: let in fresh air

3. Doors: let in fresh air

ACTIVITY

1. How does heat travel through the following

a) Solids?

b) Liquids?

c) Gases?

d) Vacuum?

3. in which state of matter does heat travel

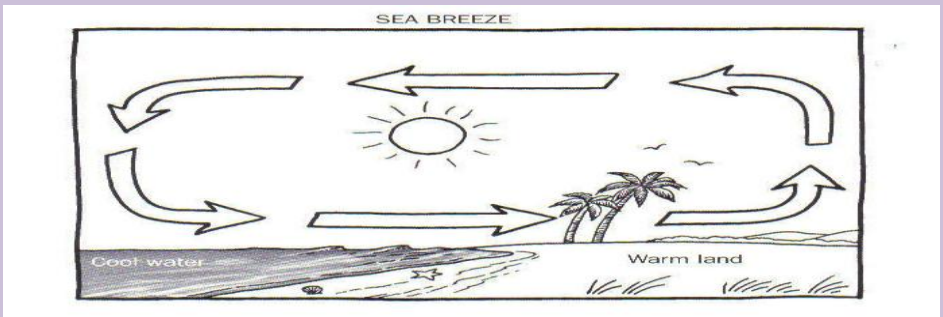
a) fastest

b) slowest

<u>SEA AND LAND BREEZE.</u>

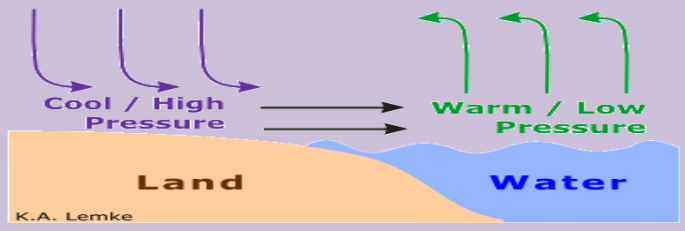
Sea breeze.

It is when cool gentle current from the sea moves to the land to replace the warm risen air. It occurs during day.



land breezes.

It is when cool gentle current from the land moves to the sea to replace the warm risen air. It occurs at night.



Nb: Sea breeze brings cool fresh air on land.

RADIATION.

It is the process by which heat passes through a vacuum.

QN: How does a person standing in Namboole on sunny day receive heat from the sun?

By radiation.

Importance of heat transfer by radiation in the environment

- Radiation is used while roasting meat, fish or chicken in an oven.
- Warming our bodies using warmers or heaters.
- Dries harvested crops / wet clothes on wires.

<u>Reflectors and absorbers or heat.</u>

Reflectors: are shiny surface that reflect heat and light

Absorbers: are dull / black surface that absorb heat and light.

Examples of reflectors

- Mirrors
- Glasses

Absorbers

- Black clothes
- Black cars

Why are most houses, vehicles and fridges in most tropical countries like Uganda painted white? **To reflect heat**

If John washed a black and a white shirt and spread under sunshine;

a. Which shirt would dry first? **The black shirt.**

Reason: Black absorbs a lot of heat.

Last? The white shirt

Reason: The white shirt would reflect heat.

Conductors and insulators of heat

Good conductors: - are materials which allow heat to pass through them easily.

Examples of good conductors of heat

i.	Iron	iv.	Brass	vii.	Silver
ii.	Mercury	v.	Zinc	viii.	Lead
iii.	Aluminum	vi.	Copper		

Insulators of heat

Insulators are the materials which don't allow heat to pass through them easily.

OR

Insulators are bad (poor) conductors of heat

Examples of bad conductors of heat

i.	Distilled Water	iii.	Plastic
ii.	Rubber	iv.	Paper

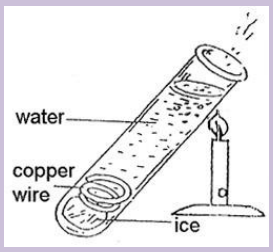
v. Cotton wool
vi. Cloth
vii. Sponges.

ACTIVITY

1. How does heat from the sun reach people on earth?
2. State two importance of heat transfer by radiation in the environment.
3. What are insulators?
4. Give four examples of insulators.

1.

Experiment to show that water is a poor conductor of heat



Observation

- Ice did not melt
- The water will boil at the area being heated while the ice cubes at the bottom will remain unmelted.

Use of conductors

- Used to make saucepans
- Used to make kettles
- Used to make bottoms of iron boxes

Insulators

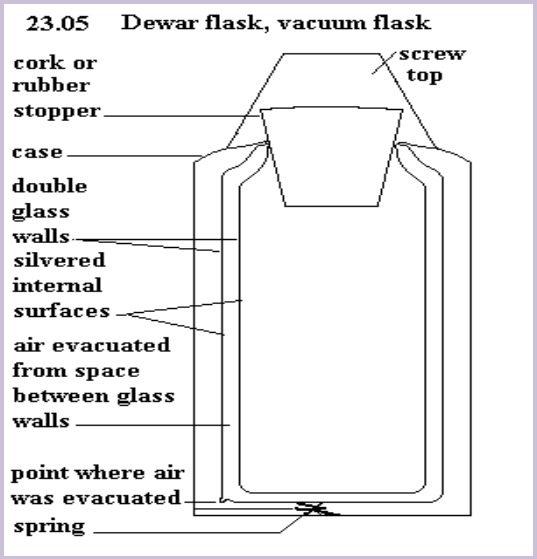
- Paper is used to make cards
- Cloth keeps us warm
- Cork prevents heat loss in a vacuum flask.
- Why are handles of iron boxes, frying pans, flat irons made of wood, rubber / plastics?

To prevent the user from getting burnt.

A VACUUM FLASK (THERMOMETER FLASK)

A vacuum flask keeps hot things hot and cold things cold.

A DIAGRAM OF A VACUUM FLASK



Uses of each part of a vacuum flask

Cork: Prevents heat loss or gain by conduction.

Silvered surfaces: prevents heat loss or gain by radiation (a good reflect of heat).

Vacuum: Prevents heat loss or gain by both conduction and convection.

Felt (cork base): Absorbs shocks to prevent the glass from breaking. Felt are also poor conductors of heat.

Vacuum seal: Prevents matter form entering the vacuum.

ACTIVITY

1. **Of what importance is the thermos flask at home?**
2. **Why is a vacuum seal important in thermos flask?**
3. **What is the use of the cork on the vacuum flask?**
4. **Why are the walls of a vacuum flask double silvered?**