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KINETIC MODEL OF MATTER

	SOLIDS	LIQUIDS	GAS
Inter-particle forces	very strong attraction	strong attraction	weak attraction
Inter-particle distances	close	far apart	very far apart
Shape	fixed shape	takes shape of the container	entirely fills the container
Compression	not easily compr.	not easily compressed	easily compressed
Motion of particles	vibration about fixed points	random rotation and translation	random rotation and translation

TEMPERATURE AND MOLECULAR MOTION

→ at high temperature, molecules have higher kinetic energy

→ at high temperature, molecules have greater speed

→ at high temperature, molecules have become more vigorous

→ at high temperature, molecules … more frequently, resulting in more pressure

PRESSURE EXERTED BY GAS

→ according to kinetic molecular theory, gas molecules are always in continuous and random motion

→ they collide with each other and with the walls of the container

→ due to the collisions they exert a force per unit surface area of the container and pressure is produced.

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EVAPORATION

→ the liquid molecules are always moving randomly at different speeds

→ when the molecules gain heat energy, their average kinetic energy increases

→ the molecules which are more energetic are able to overcome forces of attraction in the liquid and escape from the surface of liquid into atmosphere

Factors affecting evaporation:

1. Increase in temperature, ↑

↳ molecules gain more k.e

2. Increase in surface area, ↑

↳ more surface for the molecules to escape from

3. Decrease of humidity, ↓

↳ water vapors are already present

4. Increase of wind speed, ↑

↳ air carries away escaped molecules and reduces chances of coming back

5. Decrease in atmospheric pressure, ↑

↳ more molecules escape the surface

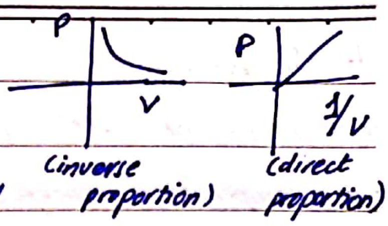
6. Decrease the boiling point, ↑

→ the molecules that escape take a lot of energy with them, hence the average k.e decreases causing the temperature to decrease

↳ cooling effect

Date:

THERMAL PROPERTIES OF MATTER



melting : the process of state of change from solid to liquid
the change occurs at a fixed/constant temperature and is called the melting point

solidification : the reverse process of melting, changing a liquid into a solid
a pure substance solidifies at a temperature equal to its melting point
during solidification, temperature remains constant and heat is released by the substance

boiling : change of state from a liquid into a vapour
change occurs at a fixed/constant temperature and is called the boiling point

condensation : the process in which a vapour changes into liquid at the same constant temperature
heat is given out by the su

BOILING	EVAPORATION
1. Occurs at a fixed temperature	1. Occurs at any temperature
2. Quick process	2. Slow process
3. Takes places within the liquid	3. Takes place on the surface
4. Bubbles are formed in the liquid	4. No bubbles are formed
5. Temperature remains constant	5. Temperature may change
6. Heat is supplied by an energy source	6. Heat is absorbed from surroundings

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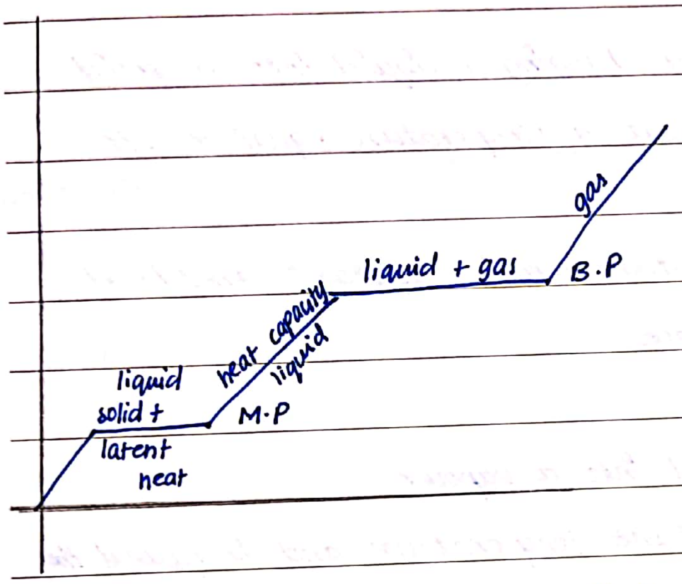
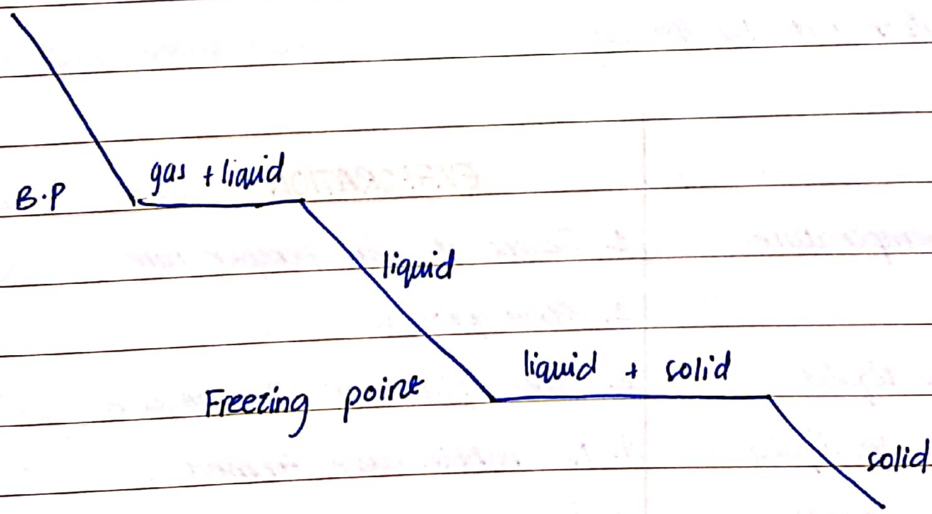
→ when ice at $-10°C$ is heated, it first converts into water and then steam
→ the temperature change occuring with time are recorded
→ a graph b/w temperature and time is then plotted and is called the heating curve



★ from $-10°C$ to $0°C$, the temperature of ice increases
★ at $0°C$ it remains constant b/c ice is converting into water
(the heat dused during this state converts into latent heat of fucion)

↑ temperature difference = ↑ heat flow
thermal equilibrium ⇒ no temperature difference

Cooling Curve :



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thermal expansion : the increase in the volume of a substance on heating

{when a substance is heated, its molecules gain heat energy and move apart from each other, the average gap b/w the molecules increases and the substance expands}

order of expansion : the amount of expansion depends upon the strength of the intermolecular forces of a substance

the stronger the forces, the least expansion & vice versa

→ for the same quantity of heat supplied, the following is the order of expansion

Expansion of gases > expansion of liquids > expansion of solids

1 : 10 : 100

internal energy : it is the sum of kinetic energy (dependant on temp.; heat capacity) and potential energy (dependant on state (increases b/c of decrease in inter-molecular forces); latent) of substance

(↑ temperature : ↑ k.e & p.e : ↑ internal energy)

p gas ke p.e sabsay ziada, liquid ke kam, solid ke sabsay kam {inverse r×p with intermolecular forces)

Effect of temperature changes on volume :

→ the volume increases with increase in temperature

→ in solids, the increase in volume is extremely small with change in temperature so the effect on the density of a solid is negligible

→ in liquids, the increase in volume is large enough, with increase in temperature so there will be appreciable effects on density of liquids i.e as temperature increases, volume increases and density of liquids *heat capacity & latent heat will not be present at the same time

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decreases

→ since the increase in volume of gas is much greater so the density of gases is greatly affected with rise of temperature e.g/ formation of sea and land breezes b/c of this effect

*melting tab tak shuru nahin hogi jab tak m.p na ajaye – ek drop bhi nahin

↗ energy that changes temperature

heat capacity : heat energy required to raise the temperature of any mass of a substance throug 1 K

(-10°C (e.g) say 0°C tak rise in temp.) ≈ when heating

$$Q = C\Delta\theta \qquad C = \frac{Q}{\theta}$$

Q = heat energy supplied (J)
C = Heat capacity (J/K or J/C°)
Δθ = Increase in temperature (K or °C)

*insulators have ↑ H.C, conductors require less energy to show change in temperature – exactly why mercury is more responsiveness

specific heat capacity : heat energy required to raise the temperature of 1kg of a substance through 1 K

$$Q = mc\Delta\theta \qquad c = \frac{Q}{m\theta}$$

Q = heat energy supplied (J)
m = mass of substance (Kg)
c = specific heat capacity (J/KgK or J/KgC)
Δθ = increase in temperature (K or °C)

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latent heat : the amount of heat energy required to change the substance from one state to the other at a constant temperature

energy that changes heat

specific latent heat of fusion : the amount of heat energy required to change 1kg solid into liquid & vice versa without change in temperature (0° pay he pani hai substance - ab state badal rahi hai) ⇒ bonds are being broken - lekin slightly - separation slightly hai

$Q = ml_f$

Q = quantity of heat energy (J)

m = mass of substance (Kg) that has changed state *

l_f = latent heat of fusion (J/kg)

specific latent of vaporation : the amount of heat energy required to change 1kg of liquid into vapours and vice versa without change in temperature (greater than heat of fusion) ∵ ismein separation infinity karni hai to work done is greater

$Q = ml_v$

Q = quantity of heat energy (J)

m = mass of substance (kg) that has changed state (difference in mass at * start and at end)

l_v = specific latent heat of vaporation (JKg)

Q. Give a molecular explanation for latent heat.

→ there are strong forces of attraction b/w solids as well as liquid molecules, energy is required to overcome those forces

→ the amount of energy required for this purpose is called latent of heat

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APPLICATIONS OF THERMAL ENERGY

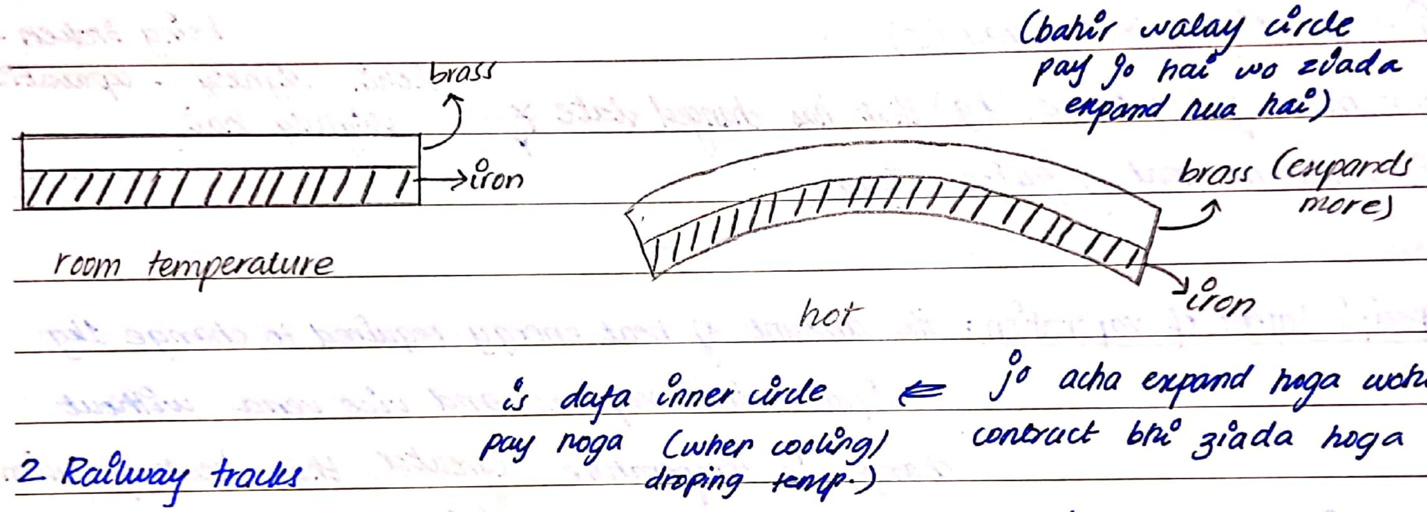
1. Thermostats

→ a bimetallic strip is made up of two different metals

→ on heating, the strip bends due to different rate of expansion of given metals

→ on cooling, the strip becomes straight again

→ it is used in thermostats to maintain the temperature steady.



2. Railway tracks

→ can be bent or damaged on a very hot day if there is no allowance for the expansion of the rails

3. Power lines

→ the overhead power lines expand and sag in summers and contract and tighten in winters

4.

→ concrete blocks of pavements and road surfaces are laid with soft material, which can be squashed when blocks expand in summer

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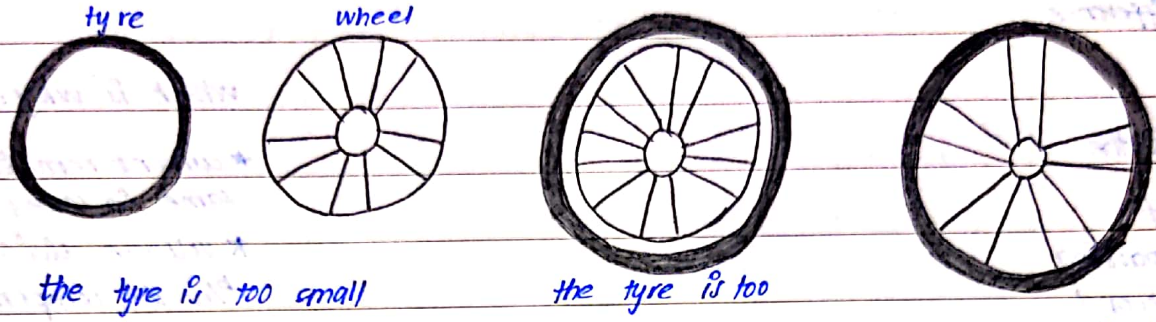
5. Fixing a metal tyre

→ on heating, the tyre expands and passes over the wheel

→ on cooling, tyre contracts to give a tight fit on the wheel



the tyre is too small when cold

the tyre is too big when hot

the tyre is tight fit when cold again

Disadvantages:-

- wear & tear
- deformation

to avoid: leave gaps to allow them to expand

solid
liquids
Gases

↓ Rate of Thermal Expansion