

Note :- The diffusion of a solid substance into another solid substance is so slow that many people think that diffusion does not take place in solid at all.

Relation between Kelvin scale and Celsius scale:-

The common unit of temperature is degree Celsius but the SI unit of measuring temperature is Kelvin. The melting point of ice on Celsius scale of temperature is 0°C . The boiling point of water on Celsius scale is 100°C .

$$0^{\circ}\text{C} = 273\text{ K}$$

Temperature on Kelvin scale = Temperature on Celsius scale + 273 K

Convert the temperature of 300 K to the Celsius scale.

$$\Rightarrow 300 - 273$$

Temp. on Celsius scale :- 27°C

The flow of heat is called temperature.

Change of state of matter:-

We can change the physical state of matter in two ways:-

[i] By changing the temperature.

[ii] By changing the pressure.

Effect of change of temperature:-

Solid to Liquid (change) [Melting]:-

The process in which a solid substance changes into a liquid on heating is called Melting. The temperature at which a solid substance melts & changes into a liquid at atmospheric pressure is called melting point of the substance.

Ex:- The ice melt at a temperature of 0° Celsius to form liquid water. So, the melting point of ice is 0° .

The melting point of a solid is a measurement of the force of attraction between its particles. When a solid is heated sufficiently it changes its physical state & becomes a liquid.

Liquid to gas (change) (Boiling or Vaporisation):

The process in which a liquid substance changes into a gas rapidly on heating is called boiling. The temperature at which a liquid boils & changes rapidly into a gas at atmospheric pressure is called boiling point of the liquid. The boiling point of liquid is a measure of the force of attraction between its particles. When a liquid is heated it changes its physical state & become a gas.

Ex:- The boiling point of mercury is very high 357°C .

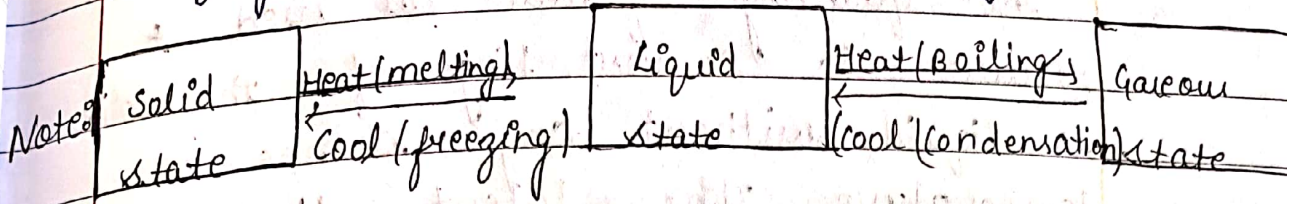
Gas to Liquid (Change) Condensation:-

The process of changing a gas to a liquid by cooling is called condensation. Condensation is the reverse of boiling.

Liquid to solid (change) (Freezing):-

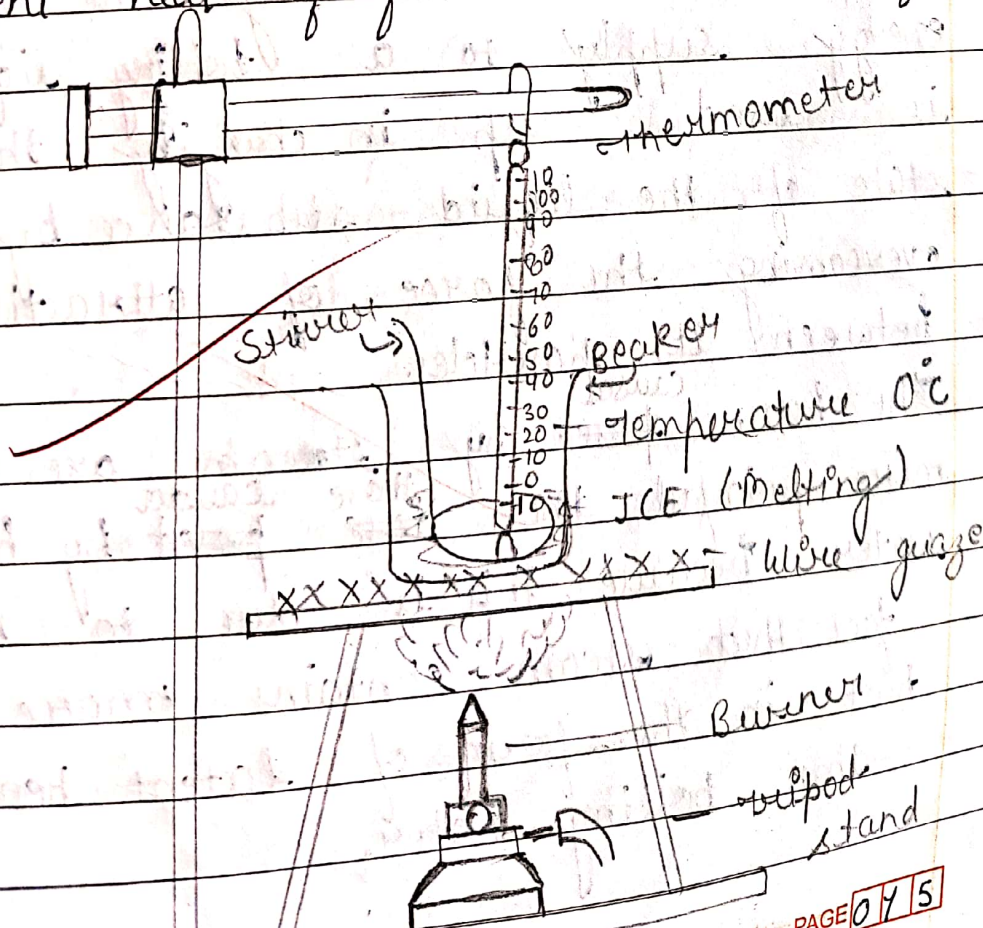
The process of changing a liquid into a solid by cooling is called freezing. Freezing means solidification.

Freezing is the reverse of melting.



Latent Heat :-

The heat energy which has to supply to change the state of a substance is called its latent heat. The latent heat which we supply is used up in all coming the forces of attraction between the particles of a substance during the change of state. Latent heat is of two types:-
latent heat of fusion: (solid to liquid change)



The latent heat of fusion of a solid is the quantity of heat is used & require to convert 1kg of the solid to liquid without any change in temperature. The latent heat of fusion of ice is $3.34 \times 10^5 \text{ Joule/kg}$.

Latent Heat of Vaporisation:-

The latent heat of vaporisation of a liquid is the quantity of heat in joules require to convert 1kg of the liquid to vapour or gas without any change in temp. The latent heat of vaporisation of water is $22.5 \times 10^5 \text{ Joule/kg}$. The heat energy supply to a boiling liquid is used up in changing the state of the liquid substance by overcoming the force of attraction between its particles.

The burn ^{caused} ~~posed~~ by steam are much more painful than ~~these~~ ^{those} ~~posed~~ ^{caused} by boiling water because this is due to the fact that steam contains more heat in the form of latent heat than boiling water.

Sublimation:-

The changing of a solid directly into vapour on heating & of vapour into solid on pulling.

Ex:- Ammonium Chloride, Iodine, ~~Naphthalene~~ Naphthalen

Solid $\xrightleftharpoons[\text{cooling}]{\text{Heating}}$ Vapour (or gas)

Effect of change of pressure:-

The physical state of matter can also be changed by changing the pressure. Gases can be liquified by applying pressure and lowering temperature. Ammonium gas can be liquified by applying pressure & lowering the temperature. Solid Carbon dioxide is stored under high pressure. The conversion of solid ~~in~~ carbon-dioxide into carbon dioxide is a change of state which is caused by the decrease in pressure & higher atmospheric pressure. It is used to deep freeze food & to keep ice-cream cold.

Evaporation:-

The process of a liquid changing into vapour even below its boiling point

is called evaporation. Whatever be the temperature at which evaporation takes place, the latent heat of vaporisation must be supplied when ever a liquid changes into vapour.

Factor affecting evaporation:-

(i) Temperature:-

The rate of evaporation increases on increasing the temperature of the liquid. The rate of evaporation of a liquid can be increased by heating it.

(ii) Surface area of the liquid:-

The rate of evaporation increases on increasing the surface area of the liquid.

(iii) Humidity of Air:-

When the humidity of air is low then the rate of evaporation is high & when the humidity of air is high then the rate of evaporation is low.

[iv] Wind speed :-

The rate of evaporation of a liquid increases with increasing wind speed.

Cooling Caused by evaporation :-

The cooling caused by evaporation is based on the fact when a liquid evaporates, it draws the latent heat of vaporisation from 'anything' which it touches. If we put a little of spirit on the back of our hand & wave it around, the spirit evaporates rapidly & our hand feels very cold. During hot summer days, water is usually kept in an matka to keep it cool.

Plasma :-

Plasma is a mixture of free electrons & ions. Plasma occurs naturally in the stars. The sun & other stars glow because of the presence of plasma in them. Plasma can also be made on the earth by passing electricity through gases at very low pressures taken in a glass tube. Plasma makes a fluorescent

Bose-Einstein Condensate:-

In 1920, an Indian scientist Satyendra Nath Bose did some calculations for the 5th state of matter. On the basis of his calculations, Albert Einstein gave the existence of a new state of matter called Bose-Einstein Condensate. This state gets by cooling a gas of low density to super low temperature.

⑤ moon
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Very Short Answer Type Questions

1. The boiling point of water is 100°C . Express this in SI units (Kelvin scale).
2. The Kelvin temperature is 270 K. What is the corresponding Celsius scale temperature ?
3. Convert the temperature of 573 K to the Celsius scale.
4. Convert the temperature of 373°C to the Kelvin scale.
5. The boiling point of alcohol is 78°C . What is this temperature on Kelvin scale ?
6. The Kelvin scale temperature is 0 K. What is the corresponding Celsius scale temperature ?
7. Give the usual name for the following :
Heat required to change the state of a substance without changing the temperature.
8. What is the (a) common unit of temperature, and (b) SI unit of temperature ?
9. Write the relation between Kelvin scale and Celsius scale of temperature.
10. What should be added to a Celsius scale reading so as to obtain the corresponding Kelvin scale reading ?
11. What is meant by saying that the latent heat of fusion of ice is $3.34 \times 10^5 \text{ J/kg}$?
12. What is meant by saying that the latent heat of vaporisation of water is $22.5 \times 10^5 \text{ J/kg}$?
13. Name the temperature at which :
(a) a liquid changes into a gas. (b) a solid changes into a liquid.
14. Name one common substance which can be easily changed from one state to another by heating or cooling.
15. What is the name of the process in which :
(a) a solid turns directly into a gas ? (b) a gas turns directly into a solid ?
16. Name one property which is shown by ammonium chloride but not by sodium chloride.
17. What is the name of the process due to which dry ice changes into carbon dioxide gas ?
18. What is the common name of solid carbon dioxide ?
19. Why is solid carbon dioxide known as dry ice ?
20. State one condition necessary to liquefy gases (other than applying high pressure).
21. State whether the following statement is true or false :
Solid carbon dioxide is stored under low pressure.
22. What is the chemical name of dry ice ?
23. Fill in the following blanks with suitable words :
(a) Gases can be liquefied by applying and lowering
(b) When steam condenses to form water, heat is.....
(c) Temp on Kelvin scale = Temp on Celsius scale +
(d) Scientists say that there are actually five states of matter : solid, liquid, gas, and.....
(e) The state of matter called.....makes a fluorescent tube (or neon sign bulb) to glow..

Short Answer Type Questions

24. What do you understand by the term 'latent heat' ? What are the two types of latent heat ?
25. Why is heat energy needed to melt a solid ? What is this heat energy called ?
26. Under what conditions heat can be given to a substance without raising its temperature ?

MATTER IN OUR SURROUNDINGS

27. Why does the temperature remain constant during the melting of ice even though heat is supplied continuously?
28. Why does the temperature remain constant during the boiling of water even though heat is supplied continuously?
29. Explain why, ice at 0°C is more effective in cooling than water at the same temperature.
30. Would you cool a bucket of water more quickly by placing it on ice or by placing ice in it? Give reasons for your answer.
31. Why does steam cause more severe burns than boiling water?
32. Which contains more heat, 1 kg of ice at 0°C or 1 kg of water at 0°C ? Give reason for your answer.
33. Which contains more heat, 1 kg of water at 100°C or 1 kg of steam at 100°C ? Give reason for your answer.
34. Explain why, steam at 100°C is better for heating purposes than boiling water at 100°C . *Not more heat than water at the same temperature because*
35. Which produces more severe burns: boiling water or steam? Why?
36. Why does the temperature of a substance remain constant during the change of state?
37. What is the physical state of water :
(a) at 0°C ? (b) at 25°C ? (c) at 100°C ? (d) at 250°C ?
38. Explain why, there is no rise in temperature of a substance when it undergoes a change of state though heat is supplied continuously.
39. Define 'melting point' of a substance? What is the melting point of ice?
40. Define 'boiling point' of a substance? What is the boiling point of water?
41. Define the following terms :
(a) Melting (b) Boiling
42. Define the following terms :
(a) Condensation (b) Freezing
43. Explain why, naphthalene balls kept in stored clothes in our homes disappear over a period of time.
44. Explain briefly, how gases can be liquefied.
45. How is ammonia gas liquefied?
46. How does applying pressure (or compression) help in the liquefaction of a gas?
47. How does perspiration or sweating help keep our body cool on a hot day?
48. Why does all the water of the earth not get evaporated during hot summer days?
49. If the back of your hand is moistened with alcohol, you will find that it rapidly becomes dry. Why is it that while it is drying, your hand feels cool?
50. Why does a desert cooler cool better on a hot, dry day?
51. How does the water kept in an earthen pot (*matka*) become cold during summer?
52. What type of clothes should we wear in summer? Why?
53. Why are we able to sip hot tea or milk faster from a saucer rather than from a cup?
54. Why does our palm feel cold when we put some acetone (or perfume) on it?
55. How will you demonstrate that water vapour is present in air?

Long Answer Type Questions

56. (a) Define the term 'latent heat of fusion' of a solid. How much is the latent heat of fusion of ice?
(b) Draw a labelled diagram of the experimental set-up to study the latent heat of fusion of ice.
57. (a) Define the term 'latent heat of vaporisation' of a liquid. What is the value of the latent heat of vaporisation of water?
(b) Draw a labelled diagram of the experimental set-up to study the latent heat of vaporisation of water.
58. (a) What is sublimation? Name two substances (other than ammonium chloride) which undergo sublimation.
(b) Draw a labelled diagram of the experimental set-up to demonstrate the sublimation of ammonium chloride.
59. (a) What are the two ways in which the physical states of matter can be changed?
(b) Draw the 'states of matter triangle' to show the interconversion of states of matter.
(c) How can the evaporation of a liquid be made faster?
60. (a) What is evaporation? State the various factors which affect evaporation.
(b) Why does evaporation cool a liquid?

Multiple Choice Questions (MCQs)

61. Which of the following are also considered to be the states of matter ?
 (i) Plasma (ii) Platelets (iii) BEC (iv) BHC
 (a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iii) (d) (ii) and (iv)
62. One of the following does not undergo sublimation. This one is :
 (a) iodine (b) sodium chloride (c) ammonium chloride (d) camphor
63. Which of the following process/processes release heat ?
 (i) condensation (ii) vaporisation (iii) freezing (iv) melting
 (a) only (i) (b) only (iv) (c) (i) and (iii) (d) (ii) and (iv)
64. If the temperature of an object is 268 K, it will be equivalent to :
 (a) -5°C (b) $+5^{\circ}\text{C}$ (c) 368°C (d) -25°C
65. The boiling point of ethane is, -88°C . This temperature will be equivalent to :
 (a) 285 K (b) 288 K (c) 185 K (d) 361 K
66. When heat is constantly supplied by a gas burner with small flame to melt ice, then the temperature during melting :
 (a) increases very slowly (b) does not increase at all
 (c) first remains constant and then increases (d) increases to form liquid water
67. When water at 0°C freezes to form ice at the same temperature of 0°C , then it :
 (a) absorbs some heat (b) releases some heat
 (c) neither absorbs nor releases heat (d) absorbs exactly $3.34 \times 10^5 \text{ J/kg}$ of heat
68. When heat is constantly supplied by a burner to boiling water, then the temperature of water during vaporisation :
 (a) rises very slowly (b) rises rapidly until steam is produced
 (c) first rises and then becomes constant (d) does not rise at all
69. The latent heat of fusion of ice is :
 (a) $33.4 \times 10^5 \text{ J/kg}$ (b) $22.5 \times 10^5 \text{ J/kg}$ (c) $33.4 \times 10^4 \text{ J/kg}$ (d) $2.25 \times 10^4 \text{ J/kg}$
70. The latent heat of vaporisation of water is :
 (a) $2.25 \times 10^6 \text{ J/kg}$ (b) $3.34 \times 10^6 \text{ J/kg}$ (c) $22.5 \times 10^4 \text{ J/kg}$ (d) $33.4 \times 10^5 \text{ J/kg}$
71. Which one of the following set of phenomena would increase on raising the temperature ?
 (a) diffusion, evaporation, compression of gases
 (b) evaporation, compression of gases, solubility
 (c) evaporation, diffusion, expansion of gases
 (d) evaporation, solubility, diffusion, compression of gases
72. Which of the following represent the suitable conditions for the liquefaction of gases ?
 (a) low temperature, low pressure (b) high temperature, low pressure
 (c) low temperature, high pressure (d) high temperature, high pressure
73. During summer days, water kept in an earthen pot (pitcher) becomes cool because of the phenomenon :
 (a) diffusion (b) transpiration (c) osmosis (d) evaporation
74. On converting 25°C , 38°C and 66°C to Kelvin scale, the correct sequence of temperatures will be :
 (a) 298 K, 311 K and 339 K (b) 298 K, 300 K and 338 K
 (c) 273 K, 278 K and 543 K (d) 298 K, 310 K and 338 K
75. The conversion of a solid into vapours without passing through the liquid state is called :
 (a) vaporisation (b) fusion (c) sublimation (d) freezing
76. The evaporation of water increases under the following conditions :
 (a) increase in temperature, decrease in surface area
 (b) increase in surface area, decrease in temperature
 (c) increase in surface area, rise in temperature
 (d) increase in temperature, increase in surface area, addition of common salt