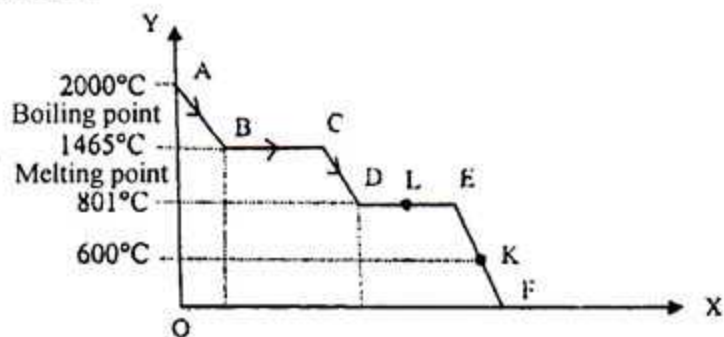


Ques. ► 1



[B.B.-17]

- What is called Potassium in Latin? 1
- Why metal conducts electricity? 2
- Explain the physical changing of the substance with the temperature from point B to point E mentioned in the stem. 3
- Analyze the changing of intermolecular force with the temperature of the substance in the point A, L and K. 4

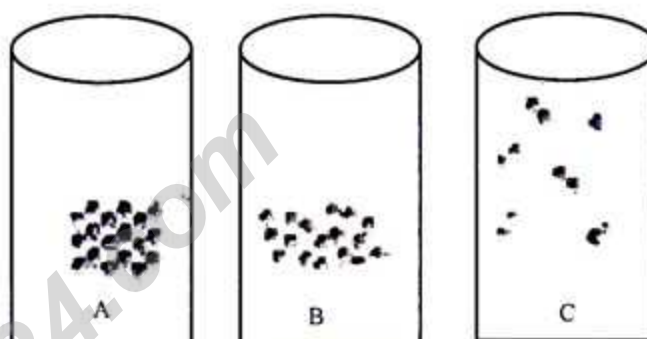
Answer to the question no. 1

- The Latin name of potassium is Kalium.
- All of the metals have less number of electrons in the last energy shell. In the metal crystal, these electrons come out of the atom orbit and move around freely in the entire piece of metal. The free electrons don't depend on any fixed atom. Rather, they become of the entire metal piece. The metal atoms become positive ions by losing electrons and stay in one three-dimensional crystal. The ions seem to be immersed in an electron sea. The free electrons move around in the entire metal piece. Metals conduct electricity due to these moving electrons.
- The B point of the stem indicates the boiling point of the object which is 1465°C . The object starts changing from gaseous state to liquid state in this temperature. The object stays in both gaseous and liquid state from B to C. But the object stays in a liquid state from C and D due to temperature decrease. Again, since the melting point of the object is 801°C in point D so the object starts changing into solid state and the object stays in both liquid and solid state from D to E at 801°C temperatures.
- Since the temperature of the object at point A is more than its boiling point so the object is in gaseous state. The molecules of an object stay in high motion state in gaseous state and move away from each other. As a result, the value of intermolecular energy remains less. The reason is the object molecules absorb heat and gain kinetic energy. Again, point L is at the melting point temperature of the object. The object stays in both liquid and solid state at this point. Since the kinetic energy of the object molecules is less in liquid and solid state than gaseous state so the intermolecular energy of the

object at point L is more than in point A. Again, K is at a temperature lower than the melting point. The object is in solid state in this point. The kinetic energy of the molecules is less in low temperature. As a result, the molecules stay close to each other and the value of intermolecular energy remains very high.

Ques. ► 2 See the pictorial statement and answer following questions.

States of Matter



[Mymensingh Girls' Cadet College, Mymensingh]

- What is sublimation? 1
- Why is effusion faster than diffusion? 2
- Explain the state changes in accordance to the stem. 3
- How could you detail the inter conversion of the matters in light of kinetic particle theory. 4

Answer to the question no. 2

- If a solid directly converts to gas on heating and the gas directly converts to solid on cooling, this phenomenon is called sublimation.
- Diffusion refers to the process of particles moving from an area of high concentration to one of low concentration. But effusion refers to the process of particles moving from an area of high pressure to one of low pressure. So in case of diffusion pressure is not involved. The particles are not under pressure in case of diffusion. But the particles are under pressure in case of effusion. So effusion is faster than diffusion.
- Solid has a fixed volume and definite shape. Molecules in solid remain very close to one another and keep vibrating due to the strong attraction force. Liquid takes the shape of the container in which they are kept without changing their volume. Volume is slightly compressible with pressure. The motion of particles of liquid is higher than that of solid. The intermolecular compulsion force is less than that in solid so the molecules in liquid remain at a moderate distance. Gaseous substance can occupy the whole area of the container in which it is kept. Distances between gas molecules are large,

as they have little attractive force. The particles of gaseous substance move freely. The molecules spread around with motion. Volume is highly compressible with pressure.

d It is possible to transform a matter from one state to using heat energy on the basis of theory of kinetics.

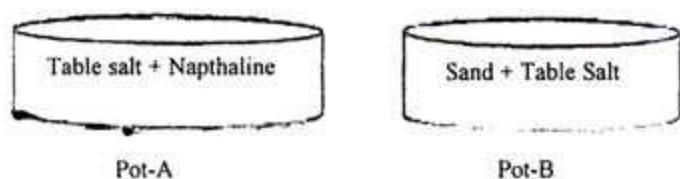
In solid state intermolecular attraction force is the highest. Intermolecular distance is the lowest. The kinetic energy of the molecules increases with increase of heat and they start moving fast.

In liquid state inter molecular attraction force is relatively lower. Inter molecular distance increases. Molecules in liquid remain at large distance.

On boiling, gaseous molecules go out from the upper layer of liquid and gain sufficient energy as they can move around freely. In gaseous state intermolecular attraction force is very little. Intermolecular distance is increased to an extent that the molecules travel around freely and spread outside beyond the intermolecular attractions.

When solid is heated to its melting point it converts into liquid. When liquid is heated to its boiling point it converts to gaseous state.

Ques. ▶ 3



[Rangpur Cadet College, Rangpur]

- What is molar volume? 1
- Why fuels should be pure? Explain. 2
- Which of the matter in Pot-A will evaporate first if the temperature is increased? Explain. 3
- Is it possible to separate the elements in Pots A and B by the same method? Justify your answer. 4

Answer to the question no. 3

a The volume of one mole of substance is called the molar volume.

b The fuel, which on burning does not produce harmful substance for human health and environment, is called the pure fuel. Burning these fuels in insufficient air, harmful carbon-mono-oxide gas is also produced with carbon-di-oxide gas which is dangerous for health. On the other hand, if fuel contains particularly sulfur and nitrogen containing compounds, then on burning of fuel various oxides of nitrogen and sulfur harmful to the health and environment is produced. Sulfur-di-oxide combines with atmospheric water vapor and produce sulfuric acids which causes acid rain. So, it is very important to ensure the use of pure fuels for safety of health and environment.

c The ingredients present in pot – B are – table salt (NaCl) and naphthalene. When they are heated, NaCl is first converted to liquid by melting, then to vapor. But when naphthalene is heated, it doesn't convert to liquid, rather it converts to vapor directly, because of sublimation.

If a solid substance converts to gaseous substance due to application of heat and converts to solid directly due to cooling, then the substance is called volatile substance and the process is called sublimation.

So, when the temperature is increased, naphthalene will be the first to be vaporized between the ingredients present in the stem, because of sublimation of naphthalene. It will convert to vapor directly, avoiding the liquid phase. So, when the temperature is increased, naphthalene will evaporate first.

d In the pot – B, there is a mixture of table salt and sand. This mixture is separated by dissolution, filtration and vaporization method. Sand is insoluble in water. In this method, the mixture of table salt and sand is taken into a beaker and mixed with water. Then it is stirred with a glass rod to dissolve the table salt completely in water. Then in another beaker, the mixture of table salt and sand is filtered by filter paper held on a funnel. Then the sand remains on the filter paper washed by water and the table salt is collected as filtrate. When the filtered solution is vaporized, the water vaporizes and, in the beaker, crystals of table salt are obtained. Thus, the mixture of table salt and sand is separated by dissolution, filtration and vaporization.

Ques. ▶ 4 (i) NH₃ (ii) SO₂ [RAJUK Uttara Model College, Dhaka]

- What is rust? 1
- Why mango become yellow when ripe? 2
- Determine the total number of molecules that is present in 400 ml of the gas given in no. (i) of the stem at standard condition. 3
- Between the gas (i) and (ii) which has the greater rate of diffusion? Explain mathematically. 4

Answer to the question no. 4

a If iron is kept exposed in open air, it undergoes reaction with oxygen and water vapor and produces ferric oxide known as rust.

b A sour green mango contains various organic acids like succinic acid, malloic acid etc. which makes it sour. As it ripens, these acids transform into glucose and fructose in chemical reaction and turn the mango sweet. During this chemical reaction, the green mango undergoes a color change towards yellow.

c 1 mole NH₃ = 17 g NH₃ = 6.023 × 10²³ no. NH₃ molecules = 22.4 liter NH₃ gas in standard temperature and pressure.

In standard temperature and pressure 22.4 liter NH₃ gas contains = 6.023 × 10²³ no. NH₃ molecules.

Therefore, 400 ml or 0.4 L NH₃ molecules gas contains

$$= \frac{6.023 \times 10^{23} \times 0.4}{22.4}$$

$$= 1.076 \times 10^{22} \text{ molecules.}$$

d A gas with lesser atomic mass will have greater diffusion rate.

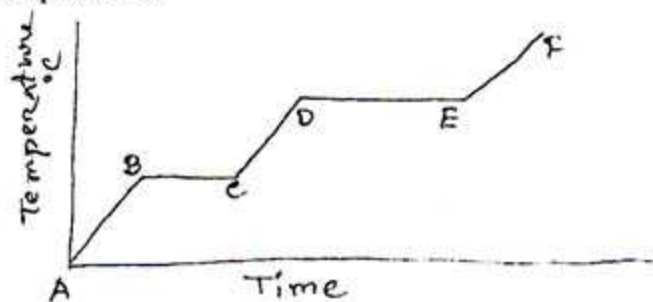
The two gases in the stem are (i) NH₃ and (ii) SO₂. Atomic mass of these two gases are:

$$\text{NH}_3 = 14 + (1 \times 3) = 17$$

$$\text{SO}_2 = 32 + (16 \times 2) = 64$$

So, atomic mass NH₃ and SO₂ are 17 and 64 respectively. Since ammonia is the gas with the least atomic mass, its rate of diffusion is faster than sulphur dioxide.

Ques. ► 5 Observe the following table and answer the related questions:



[Chetona Model Academy, Dhaka]

- What is Tollen's reagent? 1
- Why the elements of group-17 in periodic table called hallogen. 2
- Explain the fact that occurred between point B and C. 3
- Arrange the point C, D, F according to their molecular force and intermolecular space with logic. 4

Answer to the question no. 5

a Silver nitrate solution in basic medium is called Tollen's reagent.

b The elements of group-17 in periodic table are F, Cl, Br, I, and At. These five elements together are called halogen. The meaning of the word halogen is salt maker. They form halide ion by receiving one electron at their outermost energy level and reacts with group-1 and group-2 elements to form salt. That's why they are called Halogens.

c In between point B and C, the state of matter changed from solid to liquid but temperature remained same.

In solid state, the kinetic energy of the molecules is least and their intermolecular distance is very small. So, the molecules remain close to one another. The kinetic energy of the molecules increases with increase of heat and they start moving fast. Molecules in liquid remain at large distance as their kinetic energy is more than the solid. So, the state of that matter changes from solid to liquid.

d At point C, the matter is in liquid form at melting temperature just after being melt. At point D, the matter is in liquid state at boiling temperature and about to vaporize. At F point, the matter is in gaseous form at above boiling temperature.

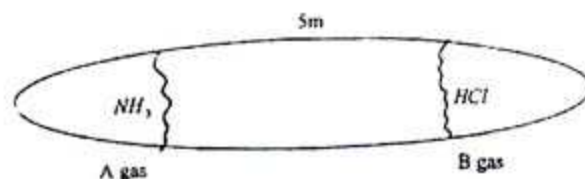
Molecular forces: In solid state inter molecular attraction force is the highest. In liquid state inter molecular attraction force is relatively lower. As C and D are both in liquid, molecular forces for C will be greater because it has less temperature. In gaseous state inter molecular attraction force is very little (F). Therefore, according to intermolecular forces:

$$C > D > F$$

Intermolecular space: In solid state, Inter molecular distance is the lowest. In liquid state, inter molecular distance increases. In gaseous state, Inter molecular distance is increased to an extent that the molecules travel around freely and spread outside beyond the intermolecular attractions. Therefore, according to intermolecular space:

$$C < D < F$$

Ques. ► 6



[Millennium Scholastic School and College, Bogura]

- What is boiling point? 1
- Why does temperature of ice not change while melting? 2
- Which gas has more diffusion rate in given stem? Explain. 3
- Where will A gas meet with B gas in given glass tube? 4

Answer to the question no. 6

a At normal pressure (1 atm), the temperature at which a liquid matter attains gaseous state is called the boiling point of liquid.

b The heat used in boiling and melting does not change the temperature of the matter. It only transforms the state of the matter. While melting, the temperature remains stagnant at 0°C until all ice cubes melt into water. Because, all the heat applied is used in changing the state of ice into water. That's why the temperature of ice does not change while melting.

c Here, gas A and B are NH₃ and HCl respectively.

The molecular mass of NH₃ gas is = (14 + 3×1) = 17 and the molecular mass of HCl is = (1 + 35.5) = 36.5

The rate of diffusion is inversely proportional to the square root of molecular mass of a gas. A gas with lesser molecular mass will have better diffusion rate. Therefore, A gas or NH₃ (molecular mass 17) has more diffusion rate than B gas or HCl gas (molecular mass 36.5).

d Here, A gas is NH₃ and B gas is HCl. The molecular mass of A gas (NH₃) is 17 and that of B gas (HCl) is 36.5.

Hence, the density of A gas is also smaller that that of B gas.

The rate of diffusion is inversely proportional to the square root of molecular mass or density of a gas. Due to lesser density A gas has greater rate of diffusion than that of B gas. As a result, A gas will travel greater distance compared to B gas in same period of time due to greater diffusion rate. Therefore, A gas will meet near the end of the glass tube from which B gas started diffusing.