EVERWIN MATRIC. HR. SEC. SCHOOL

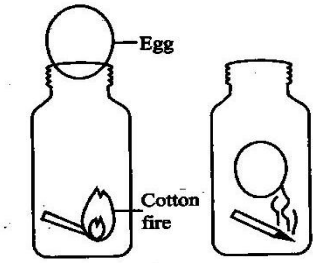
29.07.19 Chemistry - Material STD: XI

1. Name two items that can serve as a model for Gay Lusaac' law and explain.

i) PαT at constant volume (or) $\frac{P_1}{T_1}=\frac{P_2}{T_2}$

ii) Example 1: If you fill tyre completely full of air on the hottest day of summer. The tyre cannot change its shape and volume. But when winter came, the pressure inside the tyre is reduced and shape is also reduced.

iii) Example 2: The egg in the bottle experiment



A glass bottle is taken, inside the bottle, put some pieces of cotton with fire. Then place a boiled egg, the temperature inside the bottle increases from the fire rising the pressure. This makes the egg to be sucked into the bottle PαT is proud (or) $\frac{P_1}{V_1}=\frac{P_2}{V_2}$

2. Can a Vander Waals gas with a=0 be liquefied? Explain.

If the Vander Waals constant (a)=0 for a gas, then it behaves ideally.

i.e., there are no intermolecular forces, moreover we know,

$P_c=\frac{a^2}{27b^2}$ where P_c is the critical pressure.

If a=0, then the product of P_c and $27b^2=0$, which means that either $P_c=0$ (or) b=0 which is not possible.

∴ Therefore, the gas cannot be liquefied.

3. Suppose there is a tiny sticky area on the wall of a container of gas. Molecules hitting this area stick there permanently. Is the pressure greater or less than on the ordinary area of walls?

When molecules hitting this sticky area permanently means increases the frequency of collisions with the walls must lead to an increasing the pressure of the gas. Thus, the pressure of a gas becomes larger as the volume of the gas smaller. So pressure is greater than of ordinary area of walls.

4. Explain the following observations:

a) Aerated water bottles are kept under water during summer:

Because aerated water contains dissolved CO_2 gas under pressure. During summer as the temperature rises, solubility of gas in aerated water decreases and the free gas above it exerts high pressure on the walls of the bottle. In order to avoid a built-up of an excessive pressure leading to the bursting of the bottle. So the bottles are kept under water during summer.

b) Liquid ammonia bottle is cooled before opening the seal.

Liquid ammonia has very high pressure at room temperature. In bottles, the liquid ammonia is held under pressure. When the bottle is opened without cooling, a sudden release of pressure causes a rapid vapourisation of ammonia and hence a near explosive situation. So, the bottle is cooled before opening to reduce its vapour pressure.

c) The tyre of an automobile is inflated to slightly lesser pressure in summer than in winter.

During summer, the atmospheric temperature is high, the tyres of an automobile, when it's running get heated up

excessively due to friction with the road. The air inside gets heated up and since volume of the tube is constant, pressure against the walls of the rubber tube increases. This may cause a tyre burst.

d) The size of a weather balloon becomes larger and larger as it ascends up into larger altitude.

At higher altitudes, atmospheric pressure is lower. As a result, the gas inside the balloon tends to expand. This causes an increase in the size of the balloon at higher altitudes.

5. Give suitable explanation for the following facts about gases.

a) Gases don't settle at the bottom of a container.

Gases are less denser than solids and liquids. They have negligible intermolecular force of attraction between free particles, so are free to move. Hence gases don't settle at bottom of the container.

b) Gases diffuse through all the space available to them.

Diffusion is the process of two or more gases mixing together and spreading out evenly so as to form a homogeneous mixture. Gas molecules diffuse to mix thoroughly and fill the container, since they have greater kinetic energy and lesser intermolecular force of attraction.

6. Suggest why there is no hydrogen (H_2) in our atmosphere. Why does the moon have no atmosphere?

There are many factors responsible for that. Some of them are:

i) Hydrogen is the lightest element yet found. Thus when produced in free form it rises above all other gases to the top of the atmosphere, when it is open to cosmic storms and solar flares. There it literally leaks from the atmosphere to the empty space.

ii) Hydrogen easily gains velocity required to escape Earth's magnetic field. (Kinetic energy is given by the formula $^1/_2mv^2$, a lighter body will have more velocity than a heavier body for the same kinetic energy being provided.

iii) Moon has no atmosphere because the value of acceleration due to gravity 'g' on surface of Moon is small. Therefore, the value of escape velocity on the surface of the Moon is small (only 2-5 km). The molecules of the atmosphere gases on the surface of the Moon have thermal velocities greater than the escape velocity. That's why all the molecules of gases have escaped and there is no atmosphere on Moon.

7. Explain whether a gas approaches ideal behavior or deviates from ideal behaviour if

a) it is compressed to a smaller volume at constant temperature

If a gas is compressed to a smaller volume at constant temperature, pressure is increased which results in intermolecular force of attraction. At high pressure with a smaller volume, the gas deviates from ideal behaviour.

b) the temperature is raised at while keeping the volume constant

If a gas temperature is raised keeping the volume constant, the pressure of the gas will increases hence it deviates from ideal behaviour.

c) more gas is introduced into the same volume and at the same temperature

If more gas is introduced into the same volume and at the

same temperature results in intermolecular force of attraction between molecules. Hence it deviates from ideal behaviour.

8. Which of the following gases would you expect to deviate from ideal behaviour under conditions of low temperature F_2, Cl_2 or Br_2? Explain.

The condition for a gas to deviate from ideal behaviour is high pressure and low temperature. As both conditions increase the intermolecular force of attraction, greater the deviation from the ideal behaviour. F_2, Cl_2 and Br_2 are all non polar molecules but the heaviest molecule will have stronger dispersion force. Dispersion force increases with molar mass, so Br_2 would deviate most.

9. Aerosol cans carry clear warning of heating of the can. Why?

Aerosol can carry clear warning of heating of the can because, there are volatile liquids inside often a propellant. If these are heated, then they will produce more vapour inside the can, which will make the pressure rise very quickly.

A temperature rise of 30^0C can double the pressure inside.

Even though as well as being volatile, the propellant (or) other contents could also be flammable. However the cans are tested, they will burst if the pressure goes up too far. A bursting can could be dangerous in its own right.

Even if the liquefied gas propellant has run out, (i.e., the can is empty) (or) it uses a pressurised gas propellant, that can should still not be heated. This is because of the effect of the pressure, raising the temperature of the gas inside will increase its pressure. So once again, the can might burst.

10. Would it be easier to drink water with a straw on the top of Mount Everest?

It is difficult to drink water with a straw on the top of Mount Everest.

This is because the reduced atmospheric pressure is less effective in pushing water into the straw at the top of the mountain because gravity falls off gradually with height. The air pressure falls off there is not enough atmospheric pressure to push the water up in the straws all the way to the mouth.

11. Why do astronauts have to wear protective suits when they are on the surface of moon?

Astronauts have to wear protective suits when they are on the surface of the Moon, because in space (or) surface of the Moon, there is no air to breath and no air pressure. Moon is extremely cold and filled with dangerous radiation. Without protection, an Astronaut would quickly die in space.

Space suits are specially designed to protect astronauts from the cold, radiation and low pressure in space. They also provide air to breathe. Wearing a space suit allow an astronaut to survive and work in space.

12. When ammonia combines with HCl, NH_4Cl is formed as white dense fumes. Why do more fumes appear near HCl?

When ammonia combines with HCl acid-base reaction takes place. NH_4Cl is formed as white dense fumes because these fumes consists of particles of solid ammonium chloride suspended in air. It appears as if ammonia is fuming in HCl atmosphere. So only white dense fumes appear.

$NH_3 + HCl \rightarrow NH_4Cl$