# Chemistry Class 9

# Chapter 5

# Important Q/A's

**QUESTION 1**

**What are the typical properties of gases?**

**ANSWER**

## GASES

A form of matter known as gas lacks both a set shape and a fixed volume. Compared to other states of matter, such as solids and liquids, gases have a lower density. Particles with a lot of kinetic energy and little attraction to one another are separated by a lot of unoccupied space

## Typical properties of gases

Following are the typical properties of gases

- **Diffusion**

Diffusion is the process through which gas molecules move from a location of higher concentration to a region of lower concentration such that it spreads uniformly

OR

A net movement of atoms or molecules from a region of high concentration to a region of low concentration is called diffusion. Alternatively put, the transfer of atoms or molecules from a location with a high chemical potential to a region with a low chemical potential. The Latin term diffuser, which means to spread out, is where the word diffusion comes from.

## Example

When we spray perfume in one corner of a room the scent quickly disperses throughout the whole room.

- ## Effusion

The escape of gas molecules one by one from the container through a small hole of molecular dimension is termed effusion.

## Example

The loss of gas molecules from a balloon with time is a common example of effusion.

- ## Pressure

Pressure is the amount of force a substance applies to another substance per unit of area. The force that the gas applies to the container boundaries is known as the gas's pressure

## Pressure Unit

The System International unit of pressure is pascal (denoted as Pa) which is equivalent to one newton per square metre (N/m2 or kg m-1s-

2). Interestingly, this name was given in 1971. Before that pressure in SI was measured in newtons per square metre

- **Compressibility**

The degree to which a given volume of a gas changes instantly when subjected to pressure is known as compressibility

- **Mobility**

Gases can flow and can be transferred to long distances through pipes but they can also leak through small holes this is due to the gas's tendency to fill the available space.

- **Density**

Mass per unit volume is known as density. The density of a gas is very as compared to the same amount of solids or liquids. This is because the molecules of gas occupy a very large volume.eg density of $O_2$ is 1.5 $g/dm^3$ at $0^0C$.

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**QUESTION 2**

## How is volume affected by temperature and pressure change?

**ANSWER**

**Effect Of Change Of Pressure**

According to kinetic molecular theory gas molecules are in constant random motion they move in a straight line until they collide with other gas molecules or walls of the container. The force produced by the striking of gas molecules with the walls of a container is known as the pressure of a gas. The pressure of a gas is inversely proportional to the volume occupied by a gas as predicted by Boyle's law. Consequently when the pressure is increased on gas its volume decreases and vice versa

## Effect Of Change Of Temperature

The average kinetic energy of a gas varies directly with the Kelvin temperature. This means that when the temperature is increased volume increases it is because when the temperature is increased it results in a corresponding increase in the gas's internal energy which results in the gas molecules moving farther away from each other and hence the increase in volume.

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## QUESTION 3

## State and Explain Boyle's Law.

## ANSWER

## Discoverer

Boyle law was discovered was Charles Boyle in the year 1662.

## Statement

A gas law known as Boyle's law asserts that a gas's pressure is inversely proportional to its volume when it is held at a fixed temperature and of a given mass

## Explanation

According to Boyle's law, a gas's pressure will change if its volume changes while remaining at the same quantity and temperature. To put it another way, the ratio of a gas's beginning pressure to its initial volume is equal to the ratio of the gas' final pressure to its final volume (at constant temperature and number of moles). Following are several mathematical ways to express this law:

$$P_1V_1=P_2V_2$$

This can be derived as follows;

$V \propto 1/P$

V=1/P [Constant]

V x P = Constant

The above relationship shows that the product of pressure and volume remains constant.This means that the increase in values of pressure or volume will cause a relative decrease in the other quantity so that the product of the quantities remains constant.

## Example

The pressure drop that occurs when a scuba diver quickly ascends from a deep area to the surface of the water may cause the gas molecules in his or her body to expand. The diver may die as a result of these gas bubbles damaging their internal organs. Another illustration of Boyle's law is the expansion of the gas brought on by the scuba diver's ascent. Another comparable example is the deep-sea fish that perishes after rising to the water's surface (due to the expansion of dissolved gasses in their blood.

**QUESTION 4**

## What are the assertions of Charles's law.

**ANSWER**

### Discovery

Charles law was put up by Jacques Charles in the year 1787.

### Statement

According to Charles' law, with, the volume of an ideal gas increases in direct proportion to the absolute temperature. The law also stipulates that when the pressure on a sample of a dry gas is held constant, the Kelvin temperature and volume will be in direct proportion.

### Explanation

Gases expand when heated, according to Charles' law. The law of volume is another name for this rule. Because the volume of gases directly correlates with their temperature, an increase in temperature also increases their volume

It can be mathematically expressed as follows

$V \alpha T$

$V = T$ [Constant]

$V/T =$ Constant

| TEMPERATURE | VOLUME |
|---|---|
| 100 | 1.37 |
| 200 | 1.73 |

The above equation shows for any increase in values of temperature causes an increase in the corresponding values of volume which is characterized as such the ratio of volume and temperature is a constant quantity.

## Charles Law Example

When you place a basketball on the ground outside in the winter and the temperature drops, the ball contracts. The sole reason it's crucial to check the tire pressure in your automobile before heading outside on a chilly day is for this reason. This holds for any inflated object as well, which is why it's a good idea to check the tire pressure on your car when the weather becomes chilly.

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## QUESTION 5

## What is evaporation explain with example.

## ANSWER

## Evaporation

The process of interchange of a liquid into vapours or gaseous phase at any temperature is known as evaporation.

## Explanation

A type of vaporization called evaporation includes the transition of liquid particles into the gaseous phase and typically takes place on the surface of liquids. As a result, it is claimed that this process involves a change in the matter state of liquids. The sample evaporating shouldn't saturate the gas. Depending on how they interact, the liquid's molecules either absorb or release energy when they come together. In most cases, when a molecule close to the surface expends enough energy to exceed the vapour pressure, the liquid particles will normally escape and enter the surrounding air as a gas. The temperature of the liquid will drop as evaporation takes place because energy is removed from the vaporized liquid.

## Example

A crucial phase of the water cycle is evaporation. A liquid transforms into a gas during evaporation. It is easy to picture when drops of rain "disappear" on a hot day or when wet clothing dries in the day. In these instances, the liquid water is evaporating into a gas known as water vapour rather than dissipating.

## Factors Affecting Evaporation

- **Temperature:** The rate of evaporation increases with the temperature of the liquid and its surroundings
- **Liquid's surface area:** Since evaporation is a surface phenomenon, the more surface area a liquid occupies, the more quickly it evaporates.
- **Environment humidity:** The rate of evaporation is inversely proportional to the humidity of the air surrounding the water.

A breeze or blowing air directly affects the rate of evaporation.

**QUESTION 6**

## What is meant by vapor pressure?

**ANSWER**

### Vapour Pressure

The pressure exerted by the vapours upon the liquid in the state of equilibrium is termed vapour pressure.

### Explanation

The pressure exerted by vapours with their stronger intermolecular phases (solid or liquid) in a closed system at a specified temperature is known as vapour pressure, also known as vapour equilibrium pressure. It is well known that the equilibrium vapour pressure can be used to estimate how quickly a liquid will evaporate. It is assumed that there is a relationship between the ability of particles to escape from a liquid (or a solid). A substance is typically said to as volatile if it has a high vapour pressure at room temperature. It should be noted that vapour pressure refers to the pressure that a vapour exerts upon a liquid surface.

### Experiment

The molecules of a liquid are observed to be traveling at different speeds and in various directions when the liquid is placed in a vessel that is continuously heated. This is brought on by the various kinetic energies that the liquid's molecules have. The temperature of the liquid is maintained constant while evaporation proceeds at a consistent rate. Some liquid molecules in the vapour phase may return to the liquid phase if they come into contact with container walls or the liquid's surface. Condensation is the term for this action. But as time goes on, both the number of molecules in the vapour phase and the rate of condensation grow. It reaches a point when the rate of condensation and evaporation are equal. The equilibrium stage is the name given to this stage. The pressure the molecules are exerting at this time, as shown by the manometer, is referred to as the liquid's vapour pressure. The pressure that the vapour that is present above the liquid exerts is known as vapour pressure.

## Factors Affecting Vapour Pressure

- **Nature Of Liquids**

Weak intermolecular forces exist in liquids. The vapour pressure of the liquid can be increased by heating the liquid, which can help turn them into vapours. For instance, at a specific temperature, acetone and benzene have higher vapour pressure than water.

- **Temperature**

With an increase in the liquid's temperature, the vapour pressure increases. At greater temperatures, the liquid's molecules have more energy.

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## QUESTION 7

## What is boiling and the factors that affect boiling point.

## ANSWER

## BOILING POINT

The temperature at which the vapour pressure of the liquid becomes equivalent to the pressure of the atmosphere is known as boiling point.

## Explanation

The temperature at which a liquid's surrounding pressure equals the pressure exerted by the liquid's vapour is known as the boiling point. At this temperature, the addition of heat causes the liquid to turn into its vapour without rising the temperature. A liquid partially vaporizes into the space above it at any temperature up until the vapour pressure of the liquid at that temperature, which is a characteristic value. When a liquid reaches its boiling point, vapour bubbles form inside the liquid and rise to the surface as the temperature rises, increasing the vapour pressure

## Effect of External Pressure

The boiling point of a liquid would increase or decrease depending on the amount of pressure applied to it. A liquid's boiling point can be raised by applying more external pressure, while a liquid's boiling point can be lowered by applying less external pressure. A liquid boils when its vapour pressure reaches an equilibrium with the surrounding atmospheric pressure. Therefore, if the pressure outside of the system changes, the boiling point will too. So, by altering the external pressure, a liquid can be made to boil at any temperature. More heat is needed to equalize vapour pressure with external pressure when external pressure rises. As a result, the boiling point rises. Similar to this, a liquid absorbs less heat and boils at a lower temperature when the external pressure is reduced

**Example**

At 1 atmospheric pressure water boils at 100°C. At high altitude as Murree where atmospheric pressure is 0.921 atm water boils at 98°C. While at the summit of Mount Everest water boils at only 69°C. The boiling point of water is 120°C at 1489 torr and 25°C at 23.7 torr.

## QUESTION 8

## What is melting and freezing of a solid?

## ANSWER

### Melting

The temperature at which a substance's solid and liquid states can coexist in equilibrium is known as the melting point.

A solid's temperature will rise when it is heated until the melting point is achieved. The solid will then convert to a liquid with further heating without changing temperature.

### Freezing

A liquid's freezing point is the temperature at which it converts to a solid. Similar to the melting point, the freezing point typically rises with increasing pressure.

## Explanation

The freezing point of a liquid can vary depending on its crystal system, and impurities can lower the freezing point, so the actual freezing point may differ from the melting point. Generally speaking, the melting temperature of a solid is thought to be the same as the freezing point of the corresponding liquid. Therefore, it is preferred to use the melting point to describe a substance.

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**QUESTION 9**

## What is sublimation process?

**ANSWER**

## Sublimation

Sublimation refers to the passage, transformation, or conversion that substances go through when transitioning from one state to another from a solid to a gas.

## Explanation

Sublimation is the process by which a substance changes from its solid to a gaseous state without transitioning to its liquid state. At a temperature and pressure below the sample's triple point, an endothermic phase transition takes place. The opposite of this process, desublimation or deposition, involves the instantaneous transformation of a gas into a solid state.

## Example

The best illustration of sublimation is dry ice, which is carbon dioxide that has been frozen. Dry ice directly transforms from its solid state to a gaseous state, which is visible as fog, when it is exposed to air. The gaseous state of frozen carbon dioxide is more stable than the solid state.

## QUESTION 10

## Which are the two types of solid state?

## ANSWER

Following are the two types of solid state:

- ✓ **Crystalline Solids**

Crystalline solids are made up of their constituent atoms, ions, or molecules in a predictable, regular three-dimensional configuration. The unit cell is the smallest repeating pattern of crystalline solids, and unit cells are similar to the bricks in a wall in that they are all identical and repetitive. Crystalline solids have sharp melting and boiling points. e.g NaCl

- ✓ **Amorphous Solids**

amorphous solid, any non-crystalline solid in which the atoms and molecules are not organized in a definite 3d pattern and do not contain any crystal lattice. Such solids include glass, plastic, and gel. Amorphous solids melt over a range of temperatures and do not have a specific melting point.

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**QUESTION 11**

## What are allotropes explain with examples?

**ANSWER**

### Allotropes

Some chemical elements have the potential to exist in two or more distinct forms, known as allotropes of the element, in the same physical state

### Examples Of Allotropes

### Carbon Allotropes

Following are the allotropes of carbon.

- ✓ **Diamond**

It is the purest form of crystallized carbon. It has several carbons that are tetrahedrally connected. The carbon atoms that make up each tetrahedral unit are linked together by four additional carbon atoms. An allotrope of carbon resulting from this has a three-dimensional arrangement of C-atoms.

### ✓ Graphite

It is a pure form of carbon as well. This type of carbon is made up of flat, two-dimensional layers of hexagonally organized carbon atoms. It is smooth, dark, and slick solid. Due to how easy it cleaves in between the layers, graphite retains this characteristic.

### ✓ Bucky Ball

A spherical molecule having the formula C60 is known as a bucky-ball. It features a fused ring structure that resembles a soccer ball and is cage-like. It consists of 20 hexagons and 12 pentagons, with a carbon atom at each polygon vertex and a bond running along each polygon edge.

## Allotropes Of Phosphorous

Various allotropic forms of phosphorus can be found in nature. White, black, and red phosphorus are the three main allotropic forms of phosphorus.

## Allotropes Of Sulphur

Monoclinic and yellow rhombic sulphur (sulfur), respectively.
The most intriguing character is their thermal stability; for example, rhombic sulphur transforms into monoclinic sulphur when heated over 369K.

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## EXAMPLES

**A gas with a volume 350 $cm^3$ has a pressure of 650 mm of Hg. If its pressure is reduced to 325 mm of Hg, calculate what will be its new volume.**

**Data**

$V_1$ = 350 cm3

$P_1$= 650 mm of Hg

$P_2$= 325 mm of Hg

**Solution**

**By using the equation of Boyle's Law**

$P_1V_1 = P_2V_2$

By putting the values

$V_2 = P_1 X V_1 / P_2$

$V_2$= 650 X 350/325

$V_2$= 700$cm^3$

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**2. A sample of oxygen gas has a volume of 250 cm up to 700 cm 1 at 30 $^0$C. If gas is allowed to expand at constant pressure, find out its final temperature.**

$V_1$ = 250 cm

$T_1$= 30 $^O$C = 243 K

$V_2$= 700cm3

**Solution**

**By using the equation**

$V_1/T_1 = V_2/T_2$

$T_2 = V_2 X T_1 / V_1$

$T_2$= 700 X 243/250

$T_2$= 680.4 K

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