

## PART-I (SHORT QUESTIONS)

Q.2 Write short answers to any SIX (6) questions.

(i) Differentiate between diffusion and effusion.

Ans. **Diffusion:**

*"Diffusion is defined as spontaneous mixing up of molecules by random motion and collisions to form a homogeneous mixture."*

**Effusion:**

*"It is escaping of gas molecules through a tiny hole into a space with lesser pressure."*

(ii) Define pressure. Write its formula and SI unit.

Ans. **Pressure:**

**Definition:**

*"Pressure (P) is defined as the force (F) exerted per unit surface area (A)".*

Mathematically,

$$P = \frac{F}{A}$$

where,

P = pressure,

F = force,

and

A = area

**SI Unit of Pressure:**

The SI unit of pressure is Pascal.

Pascal is defined as following:

$$1 \text{ Pa} = \text{Nm}^{-2}$$

(iii) Define compressibility of gases. Why gases are compressible?

Ans. **Compressibility of Gases:**

**Definition:**

*"When we put some pressure on gases, their volume decreases. This is called compressibility of gases".*

**Compressibility of Gases:** Gases are highly compressible due to empty spaces between their molecules. When the gases are compressed, the molecules come closer to one another and occupy less volume as compared to the volume in uncompressed state.

(iv) Define standard atmosphere pressure. What are its units?

Ans. **Standard Atmospheric Pressure :**

It is the pressure exerted by the atmosphere at the sea level.

**Definition:**

*"It is defined as the pressure exerted by a mercury column of 760 mm height at sea level."*

**Units of Pressure:**

(1) Pascal (2) atm (3) torr

(v) What do you mean by Pascal? How many Pascal and mm of Hg are equal to 1 atm?

Ans. **Pascal:**



Pascal is the SI unit of pressure.

**Definition:**

"One Pascal is the pressure, exerted by a force of 1 newton on an area of 1 metre square."

Mathematically,  $1 \text{ Pa} = \frac{1 \text{ N}}{1 \text{ m}^2} = 1 \text{ Nm}^2$

**Relation Between Pascal and Atm:**

$1 \text{ atm} = 101325 \text{ Pa}$

**Relation Between Atm and Pascal:**

$1 \text{ atm} = 760 \text{ mm of Hg}$

(vi) **Convert the following?**

- (a) 70 cm Hg to atm
- (b) 3.5 atm to torr
- (c) 1.5 atm to Pa

Ans. (a) **Conversion of 70 cm Hg to atm**

We know that

$760 \text{ mm of Hg} = 1 \text{ atm}$

or  $1 \text{ mm of Hg} = \frac{1}{760} \text{ atm}$

$70 \text{ mm of Hg} = 70 \times \frac{1}{760} \text{ atm}$   
 $= 0.092 \text{ atm}$

$70 \text{ cm of Hg} = 10 \times 0.092 \text{ atm}$   
 $= 0.92 \text{ atm}$

(b) **Conversion of 3.5 atm to torr**

We know that

$1 \text{ atm} = 760 \text{ torr}$

$3.5 \text{ atm} = 3.5 \times 760 \text{ torr}$

(c) **Conversion from 1.5 atm to Pa**

We know that

$1 \text{ atm} = 101325 \text{ Pa}$

$1.5 \text{ atm} = 101325 \text{ Pa} \times 1.5$

$1.5 \text{ atm} = 151987.5 \text{ Pa}$

(vii) **Define density. Why gases have low density as compared to liquids and solids?**

Ans. **Density:**

"Density is defined as mass per unit volume".

Mathematically,  $d = \frac{m}{v}$

where,  $d$  = density,  $m$  = mass,  $v$  = volume.

**Density of Gases:**

Gases have low density than liquids and solids. It is due to light mass and more volume occupied by the gas molecules.

(viii) **Why does the density of a gas increase on cooling?**

Ans. The density of gases increases by cooling because their volume decreases.

For example, at normal atmospheric pressure, the density of oxygen gas is  $1.4 \text{ gdm}^{-3}$  at  $20^\circ\text{C}$  and  $1.5 \text{ gdm}^{-3}$  at  $0^\circ\text{C}$ .

(ix) **Why is the density of gas measured in  $\text{gdm}^{-3}$  while that of a liquid is expressed in  $\text{gcm}^{-3}$ ?**

Ans. Due to light mass and more volume occupied by the gas molecules, the density of gases is expressed in  $\text{gdm}^{-3}$ . Whereas, the density of liquids is expressed in  $\text{gcm}^{-3}$ , because liquids and solids are 1000 times denser than gases.

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Q.3 **Write short answers to any FIVE (5) questions.**

(i) **What is meant by mobility of gases? Why gases are mobile?**

Ans. **Mobility of Gases:**

"Gas molecules can move from one place to another within the container. This is called mobility of gases".

**Cause of Mobility of Gases:**



Gas molecules are in continuous state of motion. They have high kinetic energy and thus, can move from one place to another within the container. That is why gases are mobile.

- (ii) **State Boyle's Law. Derive its mathematical formula.**

**Ans. Boyle's Law**

*"The volume of a given mass of a gas is inversely proportional to its pressure provided the temperature remains constant."*

**Mathematical Formula:**

According to Boyle's law, the volume (V) of a given mass of a gas decreases with the increase of pressure (P) and vice versa.

Mathematically, it can be written as:

$$\begin{aligned}\text{Volume} &\propto \frac{1}{\text{Pressure}} \\ \text{or } V &\propto \frac{1}{P} \\ \text{or } V &= \frac{k}{P} \\ \text{or } VP &= k = \text{constant}\end{aligned}$$

where 'k' is proportionality constant.

This equation establishes the relationship between pressure (P) and volume (V) of a gas at constant temperature.

- (iii) **State Charles' law. Write its mathematical formula.**

**Ans. Charles' Law**

*"The volume of a given mass of a gas is directly proportional to the absolute temperature if the pressure is kept constant."*

**Derivation of Mathematical Relation:**

According to Charles' law, when pressure 'P' is kept constant, the volume 'V' of given mass of a gas is proportional to absolute temperature 'T'.

Mathematically it is represented as:

$$\begin{aligned}\text{Volume} &\propto \text{Temperature} \\ \text{or } V &\propto T \\ \text{or } V &= kT \\ \text{or } \frac{V}{T} &= k = \text{constant}\end{aligned}$$

where 'k' is proportionality constant.

- (iv) **What is absolute temperature scale and absolute zero?**

**Ans. Absolute Temperature Scale/ Kelvin Scale of Temperature**

Lord Kelvin introduced absolute temperature scale or Kelvin scale.

**Definition:**

*"The scale of temperature which starts from 0 K or -273.15 °C, is given the name of absolute temperature scale."*

**Absolute Zero:**

*The zero of absolute scale of temperature or Kelvin scale of temperature, is called absolute zero. Its value is 0 K or -273.15 °C.*

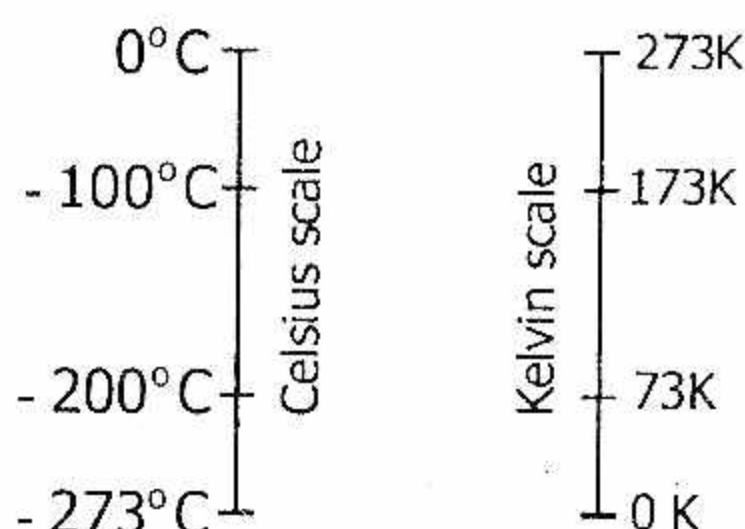
It is the temperature at which an ideal gas would have zero volume.

- (v) **How we can convert Kelvin temperature to Celsius temperature and vice versa?**

**Ans. Conversion of Kelvin Scale into Celsius Scale:**



As both scales have equal degree range, therefore, when 0 K is equal to  $-273^{\circ}\text{C}$ , then 273 K is equal to  $0^{\circ}\text{C}$  as shown in the scales.



Mathematically, we have

$$(T) \text{ K} = (T) ^{\circ}\text{C} + 273$$

**Conversion of Celsius Scale into Kelvin Scale:**

$$(T) ^{\circ}\text{C} = (T) \text{ K} - 273$$

**(vi) Why does volume of a gas decrease with increase of pressure?**

**Ans.** The volume of a gas decreases with increase of pressure. This is because, large empty spaces are present between the gas molecules. When pressure is applied on a gas, the gas molecules come close to each other. Kinetic energy and attractive forces start dominating. That is why the volume of a gas decreases with increase of pressure.

**(vii) When a gas is allowed to expand, what will be its effect on its temperature?**

**Ans.** According to Charles' law 'the volume of a given mass of a gas is directly proportional to the absolute temperature provided the pressure is kept constant.' Thus, when a compressed gas is allowed to expand into a region of low pressure, it gets hot.

**(viii) Is the Boyle's Law valid at very high temperature?**

**Ans.** The Boyle's law is valid at very high temperature. It is because, in Boyle's law temperature is kept constant.

**(ix) What will happen if the pressure on a sample of gas is raised three times and its temperature is kept constant?**

**Ans.** If the pressure on a sample of gas is raised three times and its temperature is kept constant, then its volume will reduce to three times (i.e. it will reduce to  $\frac{1}{3}$  times).



**Q.4 Write short answers to any FIVE (5) questions.**

**(i) Define evaporation. How it is affected by surface area?**

**Ans. Evaporation:**

*"The process of changing of a liquid into a gas phase is called evaporation."*

**Effect of Surface Area on Evaporation:**

Evaporation is a surface phenomenon. Greater is surface area, greater is evaporation and vice versa.

For example, sometimes a saucer is used if tea is to be cooled quickly. This is because evaporation from the larger surface area of saucer is more than that from the smaller surface area of a tea cup.

**(ii) Differentiate between evaporation and condensation.**

**Ans.** Evaporation is reverse to condensation in which a liquid changes into gas contrary to condensation in which a gas changes to liquid.

**(iii) Why evaporation causes cooling?**



**Ans.** Evaporation is a cooling process. When the high kinetic energy molecules vapourize, the temperature of remaining molecules falls down. To compensate this deficiency of energy, the molecules of liquid absorb energy from the surroundings. As a result the temperature of surrounding decreases and we feel cooling.

For example, when we put a drop of alcohol on palm, the alcohol evaporates and we feel cooling effect.

**(iv) Define boiling point. What is the effect of external pressure on boiling point?**

**Ans. Boiling Point:** *"The temperature at which the vapour pressure of a liquid becomes equal to the atmospheric pressure or any external pressure is called boiling point."*

**iii. Effect of External Pressure:**

Boiling point of a liquid depends upon external pressure. Boiling point of a liquid is controlled by external pressure in such a way, that it can be increased by increasing external pressure and vice versa. This principle is used in the work of 'Pressure Cooker'.

**(v) Define vapour pressure. What is the effect of temperature on vapour pressure?**

**Ans. Vapour Pressure**

*"The pressure exerted by the vapours of a liquid at equilibrium with the liquid at a particular temperature is called vapour pressure of a liquid."*

**Effect of Temperature on Vapour Pressure:**

At high temperature, vapour pressure is higher than at low temperature. At elevated temperature, the kinetic energy of the molecules increases enough to enable them to vapourize and exert pressure.

**(vi) What is the relationship between evaporation and boiling point of a liquid?**

**Ans. Relationship b/w Evaporation and Boiling Point:**

When a liquid is heated, its molecules gain energy. The number of molecules which have more than average kinetic energy increases. More and more molecules become energetic enough to overcome the inter molecular forces. Due to this, rate of evaporation increases that results in increase of vapor pressure until a stage reaches where the vapor pressure of a liquid becomes equal to atmospheric pressure. At this stage the liquid starts boiling. This is the relationship b/w evaporation and vapour pressure.

**(vii) Differentiate between crystalline and amorphous solids.**

**Ans. Difference b/w Crystalline and Amorphous Solids:**

Crystalline Solids	Amorphous Solids
<b>(1)</b> In crystalline solids, particles are arranged in a definite three-dimensional pattern.	<b>(1)</b> Amorphous means shapeless. In amorphous solids the particles are not regularly arranged or their regular shapes are destroyed.
<b>(2)</b> They have definite surfaces or faces.	<b>(2)</b> They do not have definite surfaces or faces.
<b>(3)</b> They have sharp melting points.	<b>(3)</b> They do not have sharp melting points.
<b>(4)</b> Each face has definite angle with	<b>(4)</b> As they do not have faces, thus, there is



the other.

no concept of angle.

(viii) Define allotropy. Give two examples.

Ans. Allotropy:

"The existence of an element in more than one form in same physical state is called allotropy."

Examples:

- (1) Oxygen has two allotropes. These are  $O_2$  and  $O_3$ .  $O_3$  is called ozone.
- (2) Carbon has three allotropes. These are diamond, graphite and bucky balls.



## PART-II (LONG/DESCRIPTIVE QUESTIONS)

Q.5 (a) State Boyles Law. Derive its mathematical formula. (4)

(b) How can you verify Boyle's law with the help of an example? (3)

Ans. (a) See Chapter 5 Q.No.18

(b) See Chapter 5 Q.No.19

Q.6 (a) State and verify Charles' Law with the help of experiment. (4)

(b) It is desired to increase the volume of fixed amount of gas from 87.5 to 118  $cm^3$  while holding the pressure constant. What would be the final temperature if the initial temperature is 23  $^{\circ}C$ ? (3)

Ans. (a) See Chapter 5 Q.No.28

(b) See Chapter 5 N.NO. 5

Q.7 (a) Define evaporation. On what factors it depends upon? Explain the effect of each factor on evaporation. (4)

(b) What is vapour pressure? On what factors it depends upon? Discuss the effect of each factor on vapour pressure. (3)

Ans. (a) See Chapter 5 Q.No.41

(b) See Chapter 5 Q.No.50

Q.8 (a) Define boiling point. Explain how it is affected by different factors? (4)

(b) Convert the following unit? (3)

(a) 750 $^{\circ}C$  to K

(b) 150 $^{\circ}C$  to K

(c) 100K to  $^{\circ}C$

(d) 172K to  $^{\circ}C$

Ans. (a) See Chapter 5 Q.No.9

(b) See Chapter 5 Exc. Q.No.2

Q.9 (a) What is meant by freezing point? Explain with example. Explain how it is affected by different factors? (4)

(b) A gas occupies a volume of 35.0  $dm^3$  at 17 $^{\circ}C$ . If the gas temperature rises to 34 $^{\circ}C$  at constant pressure, would you expect the volume to double? If not calculate new volume. (3)

Ans. (a) See Chapter 5 Q.No.10

(b) See Chapter 5 Exc. Q.No.9





### PART-III (PRACTICAL QUESTIONS)

10.

- (i) The boiling point of water on a mountain location is found to be less than  $100^{\circ}\text{C}$ . Suggest a way to raise the boiling point of water. (2)
- (ii) Huge glaciers of ice remain in sun for years but do not melt whereas ice cubes taken out from refrigerator melt within a few minutes. Explain. (3)

Ans. (i) If water boils at a temperature less than  $100^{\circ}\text{C}$  at a mountain, then its boiling point can be increased by adding some salt or other impurities in it.

- (ii) Melting point of any substance depends upon the atmospheric pressure. It decreases with increases in pressure and vice-versa. Thus, small ice cubes taken from the refrigerator and placed in sunshine will melt immediately due to high atmospheric pressure at the ground level. At the mountain tops due to low pressure the ice of glaciers does not melt because due to low pressure their melting point is increased.

11. (i) Why do solid air freshners disappear after a few days? (2)

- (ii) Alcohol is colourless liquid but red coloured alcohol is used in thermometers. (3)

(a) What is the purpose of using coloured alcohol instead of using any other liquid?

(b) Why use of alcohol is preferred over mercury in thermometers?

Ans. (i) Solid air freshners used to keep the atmosphere of room pleasant disappear after few days because these solids are sublime and are directly converted into vapours.

(ii)

(a) In thermometers, red coloured alcohol is used in instead of any other liquid so that changes in temperature can be easily noted.

(b) Mercury is hazardous to eyes and also carcinogenic while alcohol is not injurious to human health. That is why alcohol is preferred over mercury for use in thermometers.

12. (i) Vapour pressure of which liquid, alcohol and water, will be higher at room temperature?

- (ii) Explain how steam is produced when calcium oxide is added to water? Can you suggest any commercial application of this reaction? (3)

Ans. (i) Non-polar solvents have high vapour pressure as compared to polar solvents. Since, alcohol is non-polar solvent, thus, it has high vapour as compared to water.

- (ii) When calcium oxide is added to water, an exothermic reaction takes place and lot of heat is produced. This, heat converts water into steam. When calcium oxide is added in water, calcium hydroxide called lime water is produced. This solution is used as white wash on commercial scale.

