



UNIT 7

PROPERTIES OF MATTER

SHORT QUESTIONS

Q.1 What is Kinetic molecular theory? Write down its postulates. (LHR 2013)

Ans: Most of the properties of solids, liquids, and gases can be explained on the basis of the intermolecular forces. Kinetic molecular model has some important features.

- Matter is made up of particles called molecules.
- The molecules remain in continuous motion. The motion of molecules could be linear, vibrational, or rotational.
- The molecules attract each other.

Q.2 What is plasma? (GRW 2013)

The kinetic energy of gas molecules goes on increasing if a gas is heated continuously. This causes the gas molecules move faster and faster. The collisions between atoms and molecules of the gas become so strong that they tear off the electrons. Atoms lose their electrons and become positive ions. This ionic state of matter is called plasma.

Q.3 What do you know about density? (LHR 2013)

Ans: Density of a substance is defined as its mass per unit volume.

$$\text{Density} = \frac{\text{mass of a substance}}{\text{volume of that substance}}$$

Unit

SI unit of density is kilogram per cubic meter (kg m^{-3}).

Density Equations

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Mass} = \text{Density} \times \text{Volume}$$

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$

Q.4 Define pressure and write down its unit. (GRW 2014)

The force acting normally per unit area on the surface of a body is called pressure.

Thus $P = \frac{\text{Force}}{\text{Area}}$

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

Quantity

Pressure is a scalar quantity.

Unit

In SI units, the unit of pressure is N m^{-2} also called Pascal (Pa). Thus, $1 \text{ N m}^{-2} = 1 \text{ Pa}$

Q.5 Define pressure in liquids.

Ans: Liquids exert pressure. The pressure of a liquid acts in all directions. If we take pressure sensor (a device that measures pressure) inside a liquid, then the pressure of the liquid varies with the depth of sensor.

Q.6 State Pascal's Law.

(LHR 2015)

Ans: Pressure applied at any point of a liquid enclosed in a container, is transmitted without the loss to all other parts of the liquid.

An external force applied on the surface of a liquid increases the liquid pressure at the surface of the liquid. This increase in liquid pressure is transmitted equally in all direction and to the walls of the container in which it is filled.

Q.7 Explain the braking system of the vehicles.

Ans: The brakes of cars, buses etc. work on the principle of Pascal's law. In such a type of brakes, when brake pedal is pushed, it exerts pressure on the master cylinder, which increases the liquid pressure in the cylinder. The liquid pressure is transmitted equally through the liquid in the metal pipes. Due to the increase pressure of the liquid pressure, the pistons in the cylinder move outwards pressing the brake pads with brake drums. The force of friction between friction the brake pads and the brake drum stops the wheels.

Q.8 State Archimedes Principle.

(LHR 2016)

Ans: When object is totally or partially immersed in a liquid, an upthrust act on it equal to the weight of the liquid it displaces.

Q.9 Define principle of floatation

A floating object displaces a fluid having weight equal to weight of the object.

Q.10 What is atmospheric pressure?

The earth is surrounded by a cover of air is called atmosphere. It extends to a few hundred kilometers above sea level. Just as certain sea creatures live at the bottom of ocean, we live at the bottom of a huge ocean of air. Air is the mixture of gases. The density of air in the atmosphere is not uniform. It decreases continuously as we go up.

Q.11 What is barometer?

The instruments that measure atmospheric pressure are called barometers. One of the simple barometers is a mercury barometer. It consists of a glass tube 1 m long closed at one end.

Q.12 Why mercury is used in barometer instead of water?

(LHR 2014)

Mercury is 13.6 times denser than water. Atmospheric pressure can hold vertical column of water is about 13.6 times the height of mercury column at a place. Thus, at sea level, vertical height of water column would be $0.76 \text{ m} \times 13.6 = 10.34 \text{ m}$. Thus, a glass tube more than 11 m long is required to make a water barometer.

Q.13 What weather changes can be expected due to decrease of atmospheric pressure?

- A gradual and average drop in atmospheric pressure means a low pressure in a neighboring locality.
- Minor but rapid fall in atmosphere indicates a windy and showery condition in the nearby region.
- A decrease in atmospheric pressure accompanied by breeze and rain.
- A sudden fall in atmospheric pressure often followed by a storm, rain and typhoon to occur in few hours time.

Q.14 What weather changes can be expected due to increase of atmospheric pressure?

- An increasing atmospheric pressure with a decline later on predicts an intense weather conditions.
- A gradual large increase in the atmospheric pressure indicates a long spell of pleasant weather.
- A rapid increase in atmospheric pressure means that it will soon be followed by a decrease in the atmospheric pressure indicating poor weather ahead.

Q.15 What is Elasticity?

Ans: The property of a body to restore its original size and shape as the deforming force ceases to act is called elasticity.

Deforming force

The applied force that changes shape, length or volume of a substance is called the deforming force.

Q.16 What is stress?

(LHR 2016)

Ans: The force that acts on unit area at the surface of a body and thus changes its shape or size is called stress.

Mathematical form

If a force F is applied on an area A of an object, the stress is) mathematically defined as:

$$\text{Stress} = \frac{F}{A}$$

Unit

In System International, the unit of stress is Nm^{-2} .

Q.17 What is strain?

Ans: A stress can produce a change in shape, length or volume of an object.

A comparison of change caused by the stress with the original length, volume or shape is called the strain.

Tensile strain

If a stress produces a change in length of an object then the strain is called tensile strain. Therefore,

$$\text{Tensile Strain} = \frac{\text{Change in Length}}{\text{Original Length}}$$

Unit

As the strain is a ratio between two similar quantities so it has no unit.

Q.18 Hooke's Law

(LHR 2013)

Ans: The strain produced in a body by the stress applied to it is directly proportional to the stress within the elastic limit of the body.

Mathematical Formula

Stress \propto strain

Stress = constant \times strain

Or $\frac{\text{Stress}}{\text{Strain}} = \text{constant}$

Hooke's law is applicable to all kinds of deformation and all types of matter i.e. solids, liquids or gases within certain limit.

Q.19 Define Young's Modulus.

Ans: The ratio of stress and strain is a constant within the elastic limit, this constant is called the Young's Modulus.

Unit

SI unit of Young's Modulus is Newton per square metre (N m^{-2})

Q.20 What is elastic Limit?

(GRW 2014)

Ans: When stress is increased, the strain also goes on increasing until there comes a limit. When stress is removed, the object does not come back to its initial state. This limit of stress is called elastic limit.

Q.21 What are the elastic materials? Give some examples.

Ans: An object is said to be elastic if it restores its original size and shape after the external force ceases to act. For example rubber, plastic, nylon, iron etc.

Q.22 How property of elasticity is used in our body?

Ans: Not only metals and other materials are elastic, our body muscles are also elastic. Most of the actions of our body are possible due to expansion and contraction of the muscles.

Q.23 Prove that the SI unit of Young's modulus is Pascal or Nm^{-2} .

Ans: Pressure is calculated mathematically as:

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

$$P = \frac{N}{m^2} = Nm^{-2}$$

Thus, SI unit of pressure is Nm^{-2} and it is also named as Pascal (pa).

Q.24 Prove that liquid pressure does not depend upon mass of the liquids.

Ans: Liquid pressure is given by the formula:

$$P = \rho gh$$

Above equation is independent of mass of the liquid. So, liquid pressure does not depend upon the mass of the body.

Q.25 Under what condition the object floats in water?

Ans: If the buoyant force 'F' is greater than the 'w' of the immersed object, the resultant force (F – w) will act in the upward direction and it will push the object in upward direction. In this situation, some part of the object will be raised above the water so that the buoyant force 'F' becomes equal to the weight. So, equilibrium is established and the object floats.

Q.26 Write any three applications of the Pascal's law in our daily life.

- i. Raw cotton and clothes are pressed to form their bundles for their easy transportation.
- ii. For the service of heavy vehicles, these are lifted by the use of hydraulic press.
- iii. The brakes of certain vehicles work on the principle of hydraulic press.

Q.27 When an inflated balloon is heated it bursts. Why?

Ans: When inflated balloon is heated then motion of the molecules of the gas increases in the balloon and they will increase pressure on the walls of the balloon so it will burst because of this increased gas pressure on it.

Q.28 Under what condition the object sinks in water?

Ans: If the weight 'w' of the immersed object is greater than the buoyant force 'F' of the liquid, the resultant force (w – F) will act in the downward direction and the object will sink.

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