"Final Examination"

Name:- Anny Konika Das
ID No:- 2120190011
Program:- B.Sc in CSE
Semester:- Fall - 2022
Course Title:- Physics - I
Course Code:- PHY - 117

Ans to the ques no: 1 (a)

First law of Thermodynamics: The first law of Thermodynamics, also known as the law of conservation of Energy, states that energy can not be created or destroyed, only transformed from one form to another.

Second Law of Thermodynamics: The second Law of Thermodynamics states that the total entropy (or disorder) of an isolated system will always tend to increase over time. This means that in any energy transfer or transformation, some energy will inevitably be wasted, often in the form of heat.

Ans to the ques no: 1 (b)

The five fundamental assumptions of the kinetic theory of gases are:

1. Gases consist of large numbers of particles (atoms or molecules) in constant, random motion.

2. The collisions between gas particles are perfectly elastic and have no lasting effect.

3. The particles are in constant, random motion and have no interactions except for brief, elastic collisions.

4. The average kinetic energy of the gas particles is proportional to the absolute temperature.

5. The volume occupied by the gas particles is negligible compared to the volume of the container they occupy.

Ans to the ques no: 2(a)

distinguish between elastic and plastic materials:

Elastic materials and plastic materials are materials that behave differently under the influence of an external force or stress.

Elastic materials are materials that: when subjected to an external force, deform temporarily and then return to their original shape when the force is removed. Elastic materials exhibit a linear relationship between stress and strain, meaning that the amount of deformation is proportional to the amount of stress applied. Examples of elastic materials include steel, rubber, and some polymers.

Plastic materials, on the other hand, are materials that, when subjected to an external force, undergo permanent deformation and do not return to their original shape when the force is removed. plastic materials exhibit a non-linear relationship between stress and strain, meaning that the amount of deformation is not proportional to the amount of stress applied. Examples of plastic materials include many metals and some polymer.

In summary, the main difference between elastic and plastic materials is their ability to return to their original shape after being subjected to an external force. Elastic materials can return to their original shape, while plastic materials cannot.

Ans to the ques no: 2(b)

If Y, K and η represent the young's modulus (Y), bulk modulus (K), and modulus of rigidity (η) can be derived from the equations that describe the behavior of an isotropic and homogeneous material under the influence of stress.

Young modulus (Y) is a measure of the materials resistance to elastic deformation when subjected to a longitudinal tensile stress. It is defined as the ratio of longitudinal stress to longitudinal strain.

Bulk Modulus (K) is a measure of the material's resistance to volumetric deformation when subjected to a hydrostatic pressure. It is defined as the ratio of ~~shear stress~~ hydrostatic pressure to volumetric strain.

Modulus of regidity (T) is a measure of the material's resistance to shear deformation when subjected to a shear stress. It is defined as the ratio of shear stress to shear strain.

The relationship between these three moduli can be derived as follows:

$$Y = 3K\nu / (3K + \nu)$$

Where ν is the poisson's ratio, which describes the ratio of lateral strain to longitudinal strain in a material when subjected to longitudial tensile stress.

This equation shows that the young's modulus, bulk modulus, and modulus of regidity are interrelated and that the value of each modulus depends on the values of the other two moduli and poisson's ratio.

Ans to the ques no: 3 (a)

The root mean square velocity (RMS velocity) of the molecules of a gas is a measure of the average speed of the gas molecules in a particular direction. It is defined as the square root of the average of the squared velocities of the particles in a gas. The RMS velocity provides a way to quantify the speed of the molecules in a gas, and is useful in describing macroscopic properties of gases, such as pressure and temperature.

The RMS velocity is related to the temperature of the gas, and as the temperature increases, the RMS velocity of the gas molecules increases, meaning that the gas molecules move faster. In an ideal gas, the RMS velocity of the particles is proportional to the square root of the temperature in kelvin.

Ans to the ques no: 3(b)

From the kinetic theory of gases, pressure can be derived as follows:

1. pressure is defined as the force exerted by the gas particles per unit area of the container.

2. According to the kinetic theory of gases, gas particles are in constant, random motion and collide with the walls of the container.

3. The pressure exerted by the gas is proportional to the number of collisions per unit time and the average force of each collision.

4. The average force of each collision can be calculated by multiplying the average velocity of the particles by their mass and then multiplying by the change in velocity per collision.

~~5. Combing~~

5. combining these results, we obtain the following expression for pressure:

$P = (1/V) * (1/3) * m \times (RMS\ velocity)^2$

where V is the volume of the container, m is the mass of each particle, and RMS velocity is the root mean square velocity of the gas particles.

Using the ideal gas low, $PV = nRT$, where n is the number of moles and R is the gas constant, the above expression can be written as:

$$P = (1/3) \times (n/V) \times R \times T$$

Finally, dividing both sides by (n/V), we get:

$$PV = RT$$

This is the ideal gas low, which states that the pressure times volume of a gas is proportional to the temperature times the number of particles in the gas.

Ans to the ques no: 5(a)

Difference between a heat engine and a refrigerator:

A heat engine and a refrigerator are similar in that they both transfer heat from one location to another. However, there is an important difference in the way they do this.

A heat engine is a device that converts heat into mechanical work. It operates by absorbing heat from a high-temperature source and using this heat perform work, such as turning a turbine. The waste heat produce by the engine is then released into a low-temperature sink.

A refrigerator, on the other hand, is a device that removes heat from a low-temperature location and releases it into a high-temperature location. This process causes the temperature in the low-temperature location to decrease, effectively cooling it.

In summary, the main difference between a heat engine and a refrigerator is the direction of heat flow. A heat engine transfers heat from a high-temperature source to a low-temperature sink, while ~~an~~ refrigerator transfers heat from a low-temperature location to a high-temperature location.

Ans to the ques no: 5(b)

The efficiency of a heat engine is a measure of the amount of useful work that the engine produces compared to the amount of heat energy it absorbs. It is defined as the ratio of the useful work done by the engine to the total amount of heat energy absorbed from the high-temperature source.

The efficiency of a heat engine can be
expressed mathematically as:

Efficiency = Useful work Output/Heat Energy Input

In an ideal heat engine, all of the heat energy
absorbed from the high-temperature source
would be converted into useful work. However,
in real-world heat engines, some of the
energy is lost due to friction, heat losses.
and other inefficiencies. As a result, the
efficiency of real-world heat engines
is always less than 100%.

The efficiency of a heat engine is an
important factor to consider when evaluating
the performance of the engine and determining
its potential to generate power. Improving
the efficiency of a heat engine can lead to
increased energy output and reduced waste
heat, making it more environmentally friendly
and cost-effective technology.

—o—