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DEPARTMENT

BE(E)

SUBJECT

THERMODYNAMICS

Q1(a)

State the following along with mathematical expressions.

- i. The ideal gas law
- ii. Dalton's law of partial pressure

ANS i. THE IDEAL GAS LAW:-

The gas laws are the mathematical equations that show the relationship between volume, temperature, pressure, and amount of gas.

As with all laws, they were discovered by experiments.

MATHEMATICAL EXPRESSION:-

$$PV = nRT$$

Where the pressure - P , is in atmosphere (atm)

Volume - V , is in liters (L)

The moles - n , are in moles (m)

Temperature - T is in Kelvin (K)

The R value is the ideal Gas Law Constant. ~~which~~

ii

Dalton's law of partial pressure:-

Dalton's law of partial pressure states that the total pressure of a mixture of gases is the sum of the partial pressure of its components.

The partial pressure of a gas in a mixture is the pressure that the gas would exert if alone.

$$P_T = P_A + P_B + P_C$$

P_T Total pressure

P_A = Partial Pressure of gas A

P_B = Partial pressure of gas B

P_C = Partial pressure of gas C

Q1(b)

Let the initial volume of the gas

ANS SOLUTION:-

$$P_1 V_1 = P_2 V_2$$

$$\frac{P_1 V_1}{V_2} = \frac{P_2 V_2}{V_2}$$

$$\frac{P_1 V_1}{V_2} = P_2$$

$$P_1 = 4 \text{ atm}$$

$$P_2 = ?$$

$$V_1 = 6 \text{ liters}$$

$$V_2 = 2.50 \text{ L}$$

$$P_2 = \frac{P_1 V_1}{V_2} = \frac{(4 \text{ atm})(6 \text{ L})}{(2.5 \text{ L})}$$

$$P_2 = 9.6 \text{ atm}$$

Q2(a) You need to buy a

the refrigerator.

Ans. -> Look for the energy star energy star is the simple choice for saving energy.

2) Consider a Refrigerator with a Top-Mounted Freezer. A top-freezer refrigerator that has earned the ENERGY STAR uses less energy than a 60-watt light bulb.

3) Purchase an Appropriately Sized Refrigerator. The larger the refrigerator, the greater the energy consumption.

4) Consider the Features that are Most important to you. Which features do you need in your new fridge? Think about whether you'll want an icemaker, through the door ice or hot water.

Q2(b)

Explain vapour absorption refrigeration system.

ANS

PRINCIPLE: - Here the heat energy is utilized to achieve the refrigeration. An electric heater or system is used to add the heat to the refrigerant for its evaporation. Also an absorber, a pump and a generator are used to complete the cycle.

CONSTRUCTION: -

Here a ~~herotic~~ throttle valve is connected between an evaporator and a condenser. One pump is connected between an absorber and a separator. Water is filled in the absorber and it is connected to the evaporator. The evaporator is kept in the storage room. The separator is connected to the condenser. Both the condenser and evaporator consist of pipes in coil form to provide more contact surface area for the refrigerant.

Q3

Distinguish between water tube and fire tube boilers.

ANS:-

WATER-TUBE BOILERS:-

These are the most efficient boilers. Water runs in the tubes the hot gases surround it hence the heat transfer area is low value.

FIRE-TUBE BOILERS:-

These type of boilers consist of a nest of tubes through which the hot gases flows. The tubes being surrounded by water. Since the contact area b/w the water and gases is greater than in the case of shell tube type hence it has the ability to generate larger quantities of steam. It has efficient difficulties greater than shell tube type. The Marine boilers and locomotive boilers are its examples.

WORKING:-

Dry ammonia vapour from the evaporator enters the absorber containing water where it is absorbed by the water becomes a strong ammonia solution with an increase in temperature. The heat generated during this process is removed to some extent by circulating cold water through a pipe. Otherwise absorbing capacity reduces with hot water. The strong ammonia solution is now pumped by a pump to the generator where it is heated by an electric coil. As result ammonia vaporize and separates out from the water.

Q4

State the meaning of the
----- engine.

ANS

STROKE:-

A stroke is movement of the piston from top dead center (T.D.C) to bottom dead center (B.D.C)

FOUR-STROKE ENGINE:-

Four stroke cycle engine works on four stroke principle. There are four stroke in one cycle engine

1) INTAKE STROKES:-

In the intake stroke the piston is moving down inside the cylinder. The intake valve is open therefore atmospheric pressure pushes the fresh air fuel.

2) COMPRESSION STROKE:-

When the piston reaches the B.D.C then the piston moves up on the compression stroke. During this stroke both the valves are closed therefore no air-fuel mixture can enter or goes out of the cylinders.

3) POWER STROKE:-

During the compression stroke the piston & spark plug produces a spark which ignites the ^{compressed} air-fuel mixture. Due to which the temperature and the pressure of gas rises. As during this stroke we obtain power therefore it is called power stroke.

4) EXHAUST STROKE:-

During the power stroke as the piston reaches B.D.S the exhaust stroke valve opens then the piston moves up on exhaust stroke. When the piston moves up it pushes out the burnt gases from the cylinder through exhaust valve. When the piston reaches I.D.C the exhaust valve closes and intake valve opens for the second cycle.

Q₅^(a)

Explain the concept of Scavenging?

ANS:- The process of explosion of burnt gases and the entering of fresh air-fuel mixture is known as scavenging. The scavenging in two stroke engine is different than that of four stroke cycle engine.

The shape of two stroke engine is slightly different, it is somewhat pear-shaped. It does not contain camshaft, push rod, rocker arm and valves. Instead of these have three ports i.e. Exhaust port, Intake port and Transfer port.

The cycle of the two stroke is completed in one revolution of crankshaft while in four stroke engine cycle is completed in two revolutions of crankshaft. So it means that two stroke engine provides more power as compared to four stroke engine.

Q5(b) Several provincial

decision

Ans:-

Due to being equipped with 2-stroke engines, are the most inefficient vehicles in complete burning of fuel and thus contribution most to emission of air pollutants in the environment. The major pollutants from two stroke engines are Carbon Monoxide (CO), Nitrogen Oxide (NOx) Hydrocarbons (HC) and particulate Matter (PM). Their presence in the environment causes a number of respiratory diseases and other illnesses. e.g. CO and NOx are notorious irritants of respiratory system and have potential suffocating action. PM causes premature death and illness. Its presence is accompanied by increase hospital admissions for asthma and other bronchial conditions such as bronchitis etc.