Thermal answers

1. What is thermodynamic system, give its classification

Thermodynamics is the study of the relations between heat, work, temperature, and energy.
There are three types of systems in thermodynamics: open, closed, and isolated.

2. What is quasistatic process

A thermodynamic process that occurs slowly enough for the system to maintain internal thermodynamic equilibrium

3. Define Avogadro's law

Equal volumes of all gases, at the same temperature and pressure, have the same number of molecules.

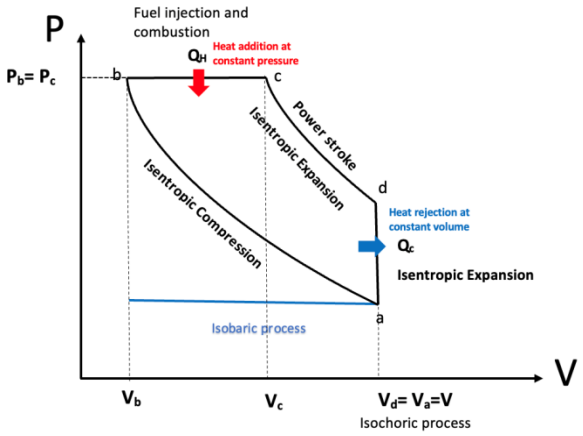
4. What is Mayors relation, mention about each term?

The difference in molar heat capacity values for a gas at constant pressure (Cp) and at constant volume (Cv) is called Mayer's relation

$Cp - Cv = R$

Where,
R = Universal gas constant.

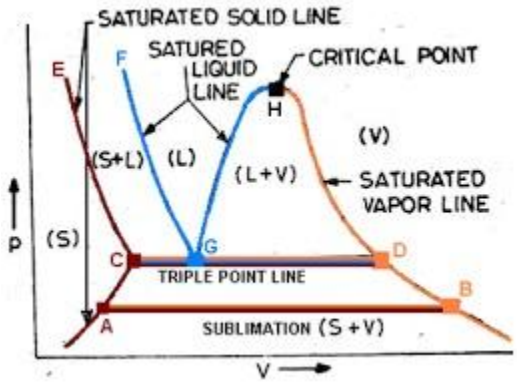
5. Draw the PV diagram of diesel cycle and mark different processes



6. Explain heat balance sheet, give an account of approximate distribution of heat loss of an IC engine

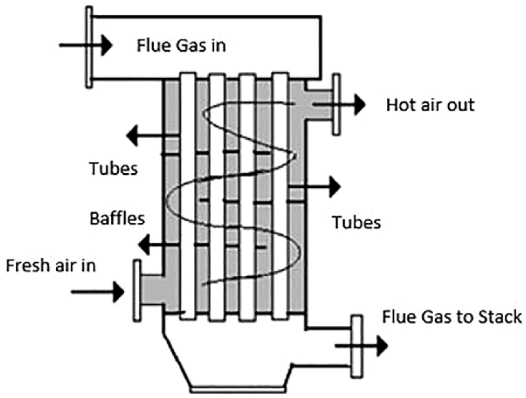
Heat input per minute	*kcal (kj)*	*%*	*Heat expenditure per minute*	*kcal (kj)*	*%*
Heat supplied by the combustion fuel	Q_s	100%	(a) Heat in BP. (b) Heat carried by jacket cooling water (c) Heat Carried by exhaust gases (d) Heat unaccounted for = $Q_s - (a + b + c)$	-- -- -- --	-- -- -- --
Total	Q_s	100%			100%

7. Draw the PV diagram of steam formation



8. With the help of neat diagram explain the function of air preheater used in boiler.

The main function of the air preheater is to preheat the air which means the temperature of the input air is increased. Other accessories like economizer and super heater in a boiler do a similar function. This preheating process of air is done before it enters the furnace. The air preheating process is done with the help of hot flue gases.



9. Calculate the radiant flux density from a black body at 400^{O}C?

Q = σT4

Where,
Q = Radiant flux density
σ = Stefan-Boltzmann constant = 5.67 × 10-8 W/m^{2}K^4
T = Temperature of black surface in Kelvin

Calculation:

Convert temperature from Celsius to Kelvin
T = 400 + 273 = 673 K

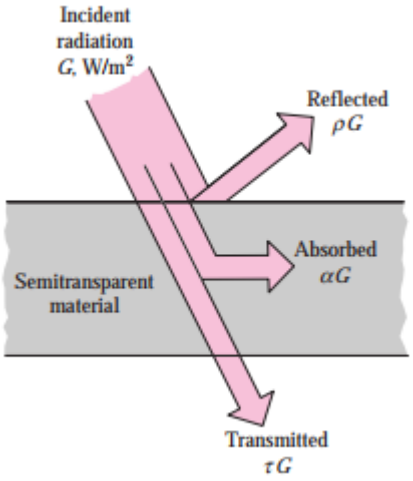
Substitute the values in the formula
Q = σT4
Q = 5.67 × 10-8 × (673)^4
Q = 11,631.7 W/m2

10. Define the terms in connection with thermal radiation
    a) reflectivity, b) absorptivity, & c) transmissivity,

absorptivity.
The fraction of irradiation absorbed by the surface is called the absorptivity (α)

reflectivity.
The fraction of radiation reflected by the surface is called the reflectivity (ρ).

transmissivity.
The fraction of radiation transmitted is called the transmissivity (τ)



11. Make a statement for the following laws
    a) Charles's law b) Joule's law c) Avogadro's law

Charles's Law
Charles's Law is an ideal gas law where at constant pressure, the volume of an ideal gas is directly proportional to its absolute temperature.
$V \propto T$

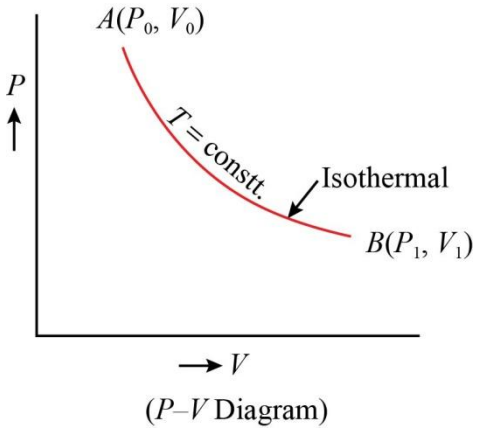
Joule's Law
Joule's Law states that when a current flows in a conductor the amount of heat generated is proportional to current, resistance, and time in the current flowing.
$H=I^2RT$

Avogadro's law
Avogadro's law states that equal volumes of all gases, at the same temperature and pressure, have the same number of molecules.

12. What is thermodynamic equilibrium

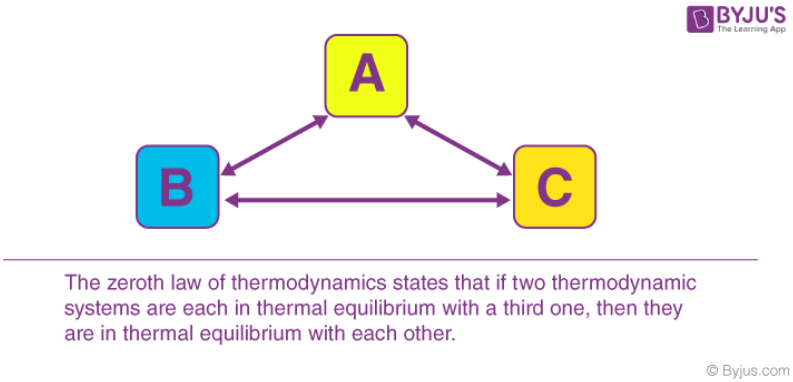
A system is said to be in thermodynamic equilibrium if there is no macroscopic change such as a change in entropy, internal energy and other. The thermodynamic equilibrium of a body is determined by its intensive properties like temperature, pressure, volume, mass etc.

13. Draw and mark PV diagram for isothermal process

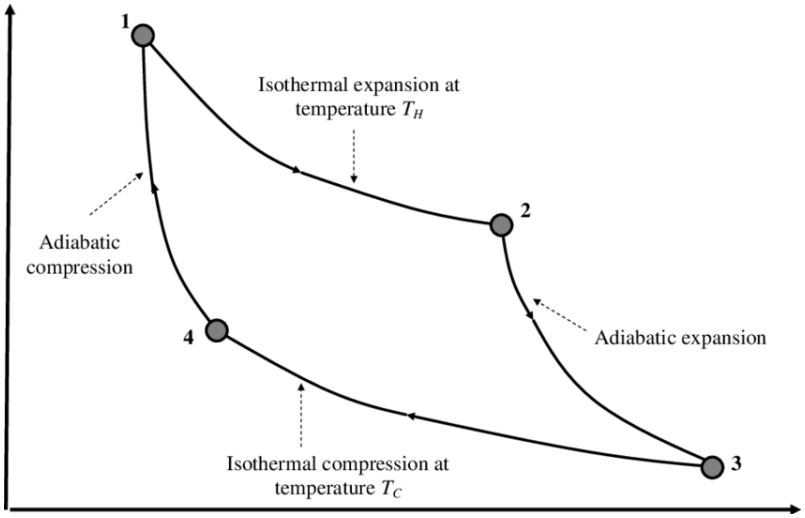


(P–V Diagram)

14. Explain about Zeroth law of thermodynamics



15. Draw the PV diagram of Carnot cycle and mark the different processes



16. Define the following terms
    a) Mechanical efficiency b) specific fuel consumption c) indicated thermal efficiency

(a)Mechanical efficiency. It is the ratio of brake power (B.P.) to the indicated power (I.P.).

(b)Specific fuel consumption (SFC) is defined as the amount of fuel consumed by a vehicle for each unit of power output.

(c) Indicated thermal efficiency. It is the ratio of the heat equivalent to one kW hour to the heat in the fuel per I.P. hour.

Full note

17. What is throttling process

The process of throttling involves utilizing a throttle valve to change a high-pressure fluid into a low-pressure fluid. Throughout the throttling process, enthalpy is constant and work is negligible. And it is a very fast process so it is considered in an adiabatic process.

18. Draw the principle of fire tube boiler

Diagram

The Fire tube boiler is intended for transmitting hot-gases using heat source as well as cycle. These gases flow through pipes with a water-filled drum. This procedure efficiently transmits the heat from the hot gas to the water, which efficiently produces steam. The main features of fire tube boilers include a simple design, easy to operate as well as the low cost to purchase. These boilers are extremely flexible in producing the average to low degrees of force with the capacity as well as skilled to be arranged in different designs.

19. The total area of the glass window pane is 0.5m². Calculate how much heat is conducted per hour through the glass window pane if thickness of the glass is 6 mm, the temperature of the inside is 23^{O}C and of the outside surface is 2^{O}C, thermal conductivity of glass is 1 W/mK.

Equation for the answer - click

20. Explain about vane type compressors

The operating principle for vane compressors is similar to many compressed air expansion motors. Vanes are usually made of special cast alloys, and most of the compressors are oil-lubricated. A rotor with radials, movable blade-shaped vanes is mounted eccentrically in a stator housing.
When it rotates, the van is pressed against the stator walls by centrifugal force. the air is drawn as the distance between the rotor and the stator increases.
The air is captured separately in the compressor pocket, which decreases in volume with rotation. The air is discharged when the vans pass through the outlet.