Self Evaluation

MODULE B.6

BASICS

1. Define the following terms:

   (a) Temperature - "A measure of the quality of heat that a body possesses" - "A measure of the degree of hotness a body possesses".

   Your definition should make certain that you are defining the quality of heat and not the quantity.

   (b) Heat - "A quantity of energy that a substance possesses due to its temperature, specific heat and mass."

2. In explaining the meaning of the following terms you should cover the points detailed:

   (a) Saturation temperature - is the temperature at which the change of state from liquid to vapour occurs and it depends upon the pressure of the fluid.

   (b) Sensible Heat - is the heat which is needed to raise the liquid temperature from 0°C to the saturation temperature. You could also describe sensible heat as the heat which when added to the liquid will cause a temperature rise.

   (c) Latent Heat of Vapourization - is the energy which is required to change the state of the fluid from liquid to vapour. Whilst this heat is being added the fluid temperature remains constant.

   (d) Subcooled Liquid - describes any liquid which exists below the saturation temperature for the pressure of the liquid. It is liquid which has not received all its sensible heat.

   (e) Saturated Liquid - describes a specific condition, ie, when the liquid has received all its sensible heat and has therefore reached the saturation temperature. Any further addition of heat will cause a change of state in which the liquid is changed into vapour.

(f) Wet Steam - describes the region between the two extremes of saturation. At one end with minimal enthalpy is the saturated liquid. As the enthalpy is increased vapour is generated. As the enthalpy of the fluid is further increased the ratio of vapour/liquid increases as more liquid is used to generate steam until finally there is no liquid remaining and there is 100% steam still at the saturation temperature. Wet steam describes the condition anywhere between these two limits.

(g) Saturated Steam - is steam which has received all its latent heat and is still at the saturation temperature. It contains no liquid and is sometimes referred to as 'dry steam'.

(h) Superheated Steam - This steam is now behaving more like a gas and exists at a temperature above the saturation temperature and therefore cannot possibly have any moisture content.

3. Your graph should look similar to this one:

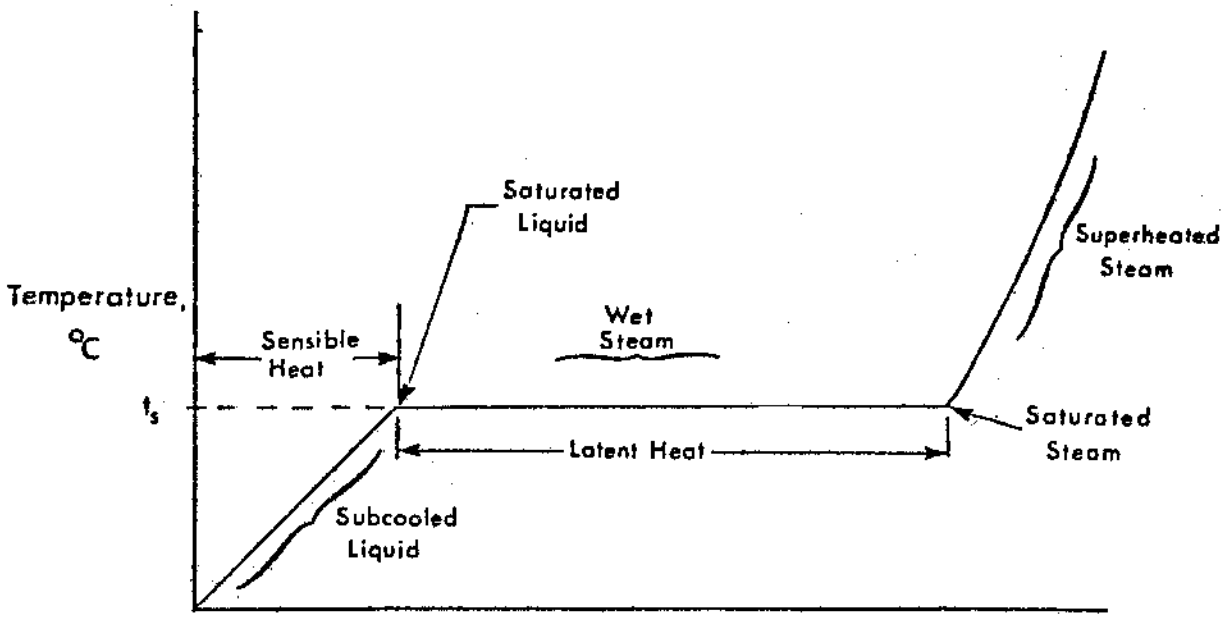

Fig. 6.3

4. (a) Conduction - heat transfer from molecule to molecule in a substance, with no transfer of mass involved. An example is the heat transfer through the tubes of a feedheater from the extraction steam side to the feedwater side.

   (b) Natural Convection - heat transfer due to fluid movement, when the fluid movement is because of density differences that occur in the fluid as heat is transferred. An example is the circulation of cooling oil in a transformer.

   (c) Forced Convection - heat transfer due to fluid movement, when the fluid movement is due to pressure difference created by pumps, fans, etc. An example is the primary heat transport D_2O flowing past the fuel in the reactor, picking up heat and carrying it to the boiler.

   (d) Radiation - heat transfer from a high temperature substance by emission of radiant energy. An example is the heat emitted by a quartz element radiant heater.

5. The compression process is a rapid event and produces extreme turbulence of the gas which results in the increase in temperature. The volume of the gas increases due to the higher temperature. The volume of the gas is reduced using an aftercooler so that either more gas may be stored in the receiver or a smaller receiver may be used for the same mass of gas.

6. Raising the temperature of a closed volume of gas raises its pressure. In the cover gas system, the pressure is kept constant at some value just above atmospheric pressure to prevent air in leakage. If the moderator temperature rises, the cover gas temperature will rise causing the pressure to rise above the set-point. The increase above the set point will result in the operation of the bleed valves to restore setpoint pressure.

7. Gas cylinders may become contaminated with oxygen and moisture from the air if allowed to completely empty. This occurs due to reverse flow or "suck-back". The contamination may also result in an explosive mixture when dealing with flammable gases.

   The contents of a compressed gas cylinder are checked by reading the pressure gauge.

   The contents of a liquified gas cylinder are checked by weighing the cylinder.

8. Gas is a compressible fluid and requires high levels of energy to raise its pressure. Most of this energy is recoverable and if recovered in a very short time, eg, if the system ruptures, the result will be an explosion.

An incompressible fluid, ie, liquid should be used for pressure testing because liquids only use very small amounts of energy to raise their pressure.

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When you have compared your test with the self evaluation sheet, take both the test and self evaluation sheet to the Course/Shift Manager and let him discuss your test. If you are both satisfied with the results, the Manager should sign the progress summary sheet. If there are some areas that need further reinforcement that have been identified, work on these and then take the test again when you are confident.

When you have completed this module proceed to Module B.5 - "Steam Tables."

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