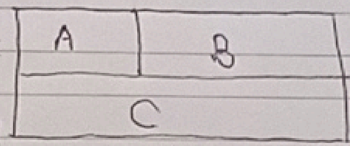
Date ____________

Expt. No. ____________ Page No. ____________

Zeroth law of Thermodynamics:—

A thermodynamic system is said to be in thermal equilibrium if any two of its independent thermodynamic co-ordinates X and Y remain constant as long as the external condition remain unaltered. Let us consider a gas enclosed in a cylinder fitted with a piston. If the pressure and volume of the enclosed mass of gas are P and V at the tempr. of the surrounding, these value P and V will remain constant as long as the remains unchanged. The gas is said to be in thermal equilibrium with the surroundings.

This law states that If, of three systems A, B & C, A and B are separately in thermal equilibrium with C, then A and B are also thermal in thermal equilibrium with one another.



In other words, we say that If three or more systems are in thermal contact, each to each by means dia thermal walls and are all in thermal equilibrium together, then any two systems taken separately are in thermal equlibrium with one another.

Consider three fluids A, B and C. Let P_A, V_A represents the pressure and volume of A, P_B, V_B represent of B, and P_C, V_C represents of C respectively.

If A and B are in thermal equilibrium, then

$$\phi_1(P_A, V_A) = \phi_2(P_B, V_B)$$

or, $F_1(P_A, V_A, P_B, V_B) = 0$ —— (i)

Expression (i) can be solved and

$P_B = f_1(P_A, V_A, V_B)$ — (ii)

Teacher's Signature ____________

Expt. No. ______ Date ______

Page No. ______

If B and C are in thermal equlibrium

$\phi_2(P_B, V_B) = \phi_3(P_C, V_C)$ ——

$\therefore F_2(P_B, V_B, P_C, V_C) = 0$

$\therefore P_B = f_2(V_B, P_C, V_C)$ —— (iii)

From eqn.(ii) & (iii), for A and C to be in thermal equilibrium separately, $f_1(P_A, V_A, V_B) = f_2(V_B, P_C, V_C)$ — (iv)

If A and C are in thermal equilibrium with B separately then according to the zeroth law, A and C are also in thermal equilibrium with one another.

$\therefore F_2(P_A, V_A, P_C, V_C) = 0$ —— (v)

eqn (iv) contains a variable V_B where as eqn (v) does not contain the variable V_B. It means

$\phi_1(P_A, V_A) = \phi_3(P_C, V_C)$ —— (vi)

In general,

$\phi_1(P_A, V_A) = \phi_2(P_B, V_B) = \phi_3(P_C, V_C)$ — (vii)

These three functions have the same numerical value through the parameters (P, V) of each difference. This numerical value is termed as tempr. T of the body

$\therefore \phi(P, V) = T$ — (viii)

This is called the eqn of state of the fluid.

Therefore the tempr. of a system can be defined as the property that determines whether or not the body is in thermal equilibrium with neighbouring systems. If a number of systems

Teacher's Signature ______

Expt. No. ______ Date ______

Page No. ______

are in thermal equilibrium, this common property of the system can be represented by a single numerical value called the ~~temperature~~ temperature. It means that if two systems are not in thermal equilibrium, they are at different temperatures.