ASSIGNMENT

Q) EXPRESS the equation for workdone in an isothermal process in terms of pressure

$W=2.303\ \mu RT\log\frac{V_2}{V_1}$

Ans) Suppose 1 mole of gas is enclosed in isothermal container. Let $P_1, V_1, T$ be initial pressure, volumes and temperature. Let expand to volume $V_2$ & pressure reduces to $P_2$ & temperature remain constant. Then, work done is given by

$$W = \int dW$$

$$W = \int_{V_1}^{V_2} P\,dV$$

$$\text{as } PV = RT \qquad (n = \text{mole})$$

$$P = \frac{RT}{V}$$

$$W = \int_{V_1}^{V_2} \frac{RT}{V} dV$$

$$W = RT \int_{V_1}^{V_2} \frac{dV}{V}$$

$$= RT\,[\ln V]_{V_1}^{V_2}$$

$$= RT\,[\ln V_2 - \ln V_1]$$

$$W = RT \ln \frac{V_2}{V_1}$$

$$\boxed{W = 2.303RT \log_{10} \frac{V_2}{V_1}}$$

for constant temperature

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

So, also

$$\boxed{W = 2.303.RT \log_{10} \frac{P_1}{P_2}}$$