Virial Theorem:-

The time Ratio of change of momentum is known as force And this is also known as Newton's Second law of Motion. And the force is sum of Applied force And Constraint force.

$$f_i = \dot{p}_i \quad \text{--- (1)}$$

Now let us Consider a Generating function G which is a Components of Possition as well as momentum which can be Expressed

$$G = p_i r_i$$

$$\frac{dG}{dt} = \dot{p}_i r_i + \dot{r}_i p_i \quad \text{--- (2)}$$

If τ is the time Period of motion of particle then Average Value of above Eq Can be written as

$$\frac{1}{\tau}\int_0^{\tau} \frac{dG}{dt}\, dt = \overline{\dot{p}_i r_i} + \overline{\dot{r}_i p_i}$$

$$\frac{1}{\tau}\left[G(\tau) - G(0)\right] = \overline{\dot{p}_i r_i} + \overline{p_i \dot{r}_i}$$

After Completing the circle when particle has its initial Possition then

$$G(\tau) = G(0)$$

then $$\overline{\dot{p}_i r_i} + \overline{p_i \dot{r}_i} = 0$$

$$\overline{m v_i^2} + \overline{r_i f_i} = 0$$

$$\Rightarrow 2\times\left[\frac{1}{2} m v_i^2\right] + \overline{r_i f_i} = 0$$

$$2T + \overline{r_i f_i} = 0$$

$$0 = 2T + r_i\left(-\frac{dV}{\partial r_i}\right) \quad (3)$$

this is relation b/w Average K.E And P.E Can be Expressed as

$$V_i = K r_i^{n+1}$$

$$r_i \frac{dV_i}{\partial r_i} = (n+1) K r_i^{n} r_i$$

$$r_i \frac{dV_i}{\partial r_i} = (n+1)(K r_i^{n+1})$$

$$0 = 2\bar{T} + (n+1)\bar{V_i}$$

$$\boxed{\text{or} \quad 2\bar{T} = (n+1)\bar{V}}$$

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