5. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position, and has a speed u. The magnitude of the change in its velocity as it reaches a position where the string is horizontal is ***(1998S - 2 Marks)***

(a) $\sqrt{u^2 - 2gL}$ (b) $\sqrt{2gL}$

(c) $\sqrt{u^2 - gL}$ (d) $\sqrt{2(u^2 - gL)}$

(d) Applying the principle of conservation of energy $(K.E.)_B + (P.E.)_B = (K.E.)_A + (P.E.)_A$, we get

$$\frac{1}{2}mv^2 + mgL = \frac{1}{2}mu^2$$

Hence, $v = \sqrt{u^2 - 2gL}$ ... (i)

Change in velocity $= |\vec{v} - \vec{u}| = \sqrt{v^2 + u^2}$

$= \sqrt{2(u^2 - g\ell)}$ [From (i)]