Minimum K.E. Required to Complete the Loop

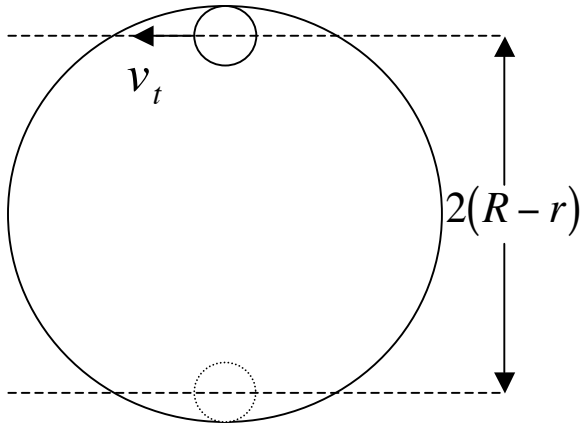
Solution:

The correct answer is d.)

The important thing to realize here is that the ball has a certain amount of kinetic energy as it enters the loop (no P.E.), part of which gets converted to P.E. by the time it reaches the top of the loop. In other words, the K.E. of the ball at the top of the loop is less than what it was at the bottom, and this is, in fact, why we use a different symbol v_t to denote speed at the top of the loop.

Minimum K.E. Required to Complete the Loop

This is also where the importance of defining a reference level for potential becomes apparent, since the height of the center of mass above the dashed reference line can be clearly seen to be $2(R-r)$. Thus, total energy:



$$(mg)\left[2(R-r)\right]+\left(\frac{1}{2}\right)mv_t^2=2.5mg(R-r)$$