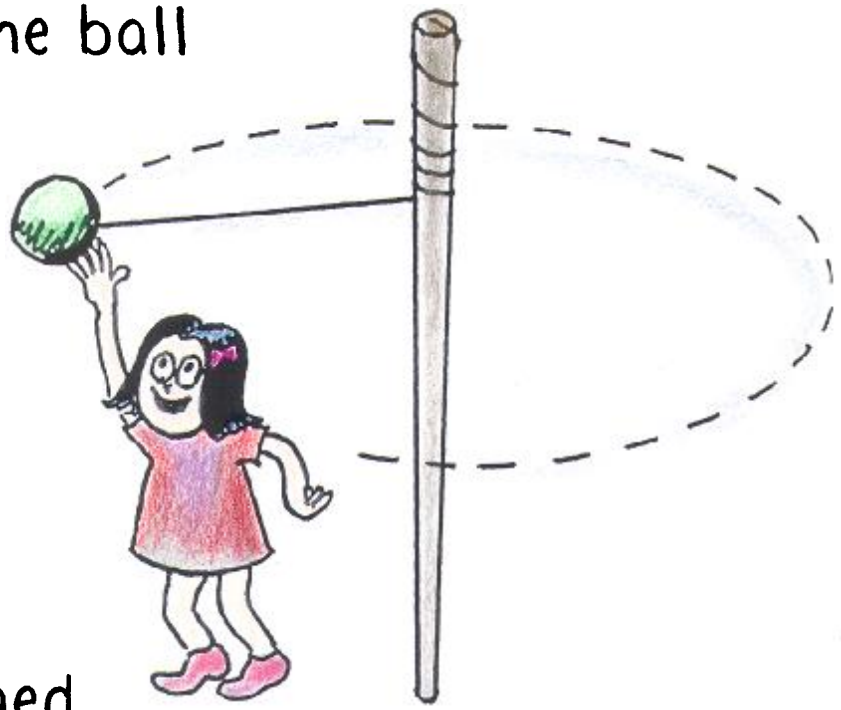
When a tether ball wraps around a pole, the speed of the ball

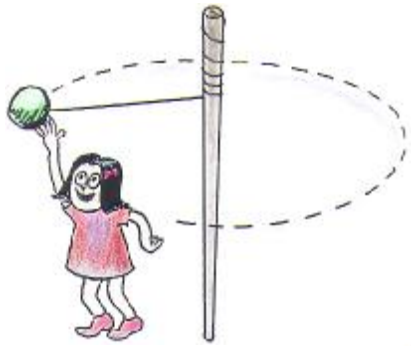


a) increases.
b) decreases.
c) remains unchanged.

NEXT-TIME QUESTION

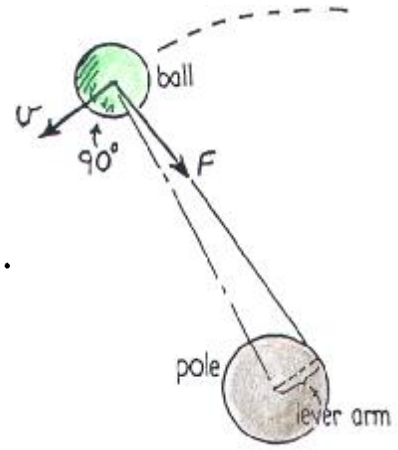
When a tether ball wraps around a pole, the speed of the ball

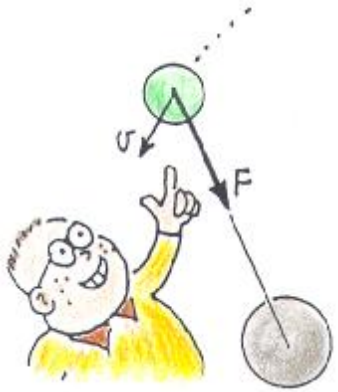
a) increases.
b) decreases.
c) remains unchanged.



Answer: c

The speed doesn't change because the instantaneous velocity of the ball is perpendicular to the cord at all times. The tension in the cord, being perpendicular to the ball's velocity, does no work on the ball and cannot change its kinetic energy. So the speed remains constant. If you answered a, you likely thought of angular momentum. But angular momentum is conserved only in the absence of a torque. Relative to the center of the pole, the cord exerts a torque on the ball, causing it to lose angular momentum. As the ball spirals in, its radius and angular momentum decrease while its speed doesn't change.





If the ball were instead *pulled in* at the center of the pole, with zero lever arm and zero torque, the ball would speed up in accord with angular momentum conservation. Then there would be a component of *F* along *v*, work would be done, and KE would increase.

Note the ball's center of turn follows a circular path—complicated!

CONCEPTUAL Physics

ARBOR SCIENTIFIC
TOOLS THAT TEACH.

Hewitt Drew it!