Centripetal Force Questions

1. A ball with a weight of 2 N is attached to the end of a cord of length 2 meters. The ball is whirled in a vertical circle counterclockwise as shown below. The tension in the cord at the top of the circle is 7 N and at the bottom it is 15 N. (Do not assume that the speed of the ball is the same at these points.)



(a) Three students discuss the net force on the ball at the top.

 ***Angelica:*** “The net force on the ball at the top position is 7 N since the net force is the same as the tension.”

 ***Bo:*** “The net force on the ball at the top position is 9 N. Both the tension and the weight are acting downward so you have to add them.”

 ***Charles:*** “No, you are both wrong. You need to figure out the centripetal force (mv2/r) and include it in the net force.”

Which, if any, of these students do you think is right?

*Angelica* \_\_\_\_\_\_\_ Bo \_\_\_\_\_\_\_ *Charles* \_\_\_\_\_\_ None of them \_\_\_\_\_\_\_

Explain your reasoning.

(b) Now the three students discuss the net force on the ball at the bottom.

 ***Angelica:*** “The net force on the ball at the bottom position is 15 N since the net force is the same as the tension.”

 ***Bo:*** “The net force on the ball at the bottom position is 17 N, since you need to add the weight of 2 N to the tension of 15 N.”

 ***Charles:*** “The net force on the ball at the bottom position is 13 N. I agree that you need to take into account both the weight and the tension but they are in different directions so they will subtract.”

Which, if any, of these students do you think is right?

*Angelica* \_\_\_\_\_\_\_ Bo \_\_\_\_\_\_\_ *Charles* \_\_\_\_\_\_ None of them \_\_\_\_\_\_\_

Explain your reasoning.

1. Four identical small metal cylinders rest on a circular horizontal turntable at the positions shown in the top view diagram at right. The turntable is rotating clockwise at a constant rate.

At the positions shown in the diagram, indicate the direction of the velocity, the acceleration, and the net force for each cylinder. Use the directions labeled on the rosette.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Cylinder at *P* | Cylinder at *R* | Cylinder at *S* | Cylinder at *T* |
| Direction of the velocity of the cylinder |  |  |  |  |
| Direction of the net force on cylinder |  |  |  |  |
| Direction of the acceleration of the cylinder |  |  |  |  |

1. At the county fair I used to go to, my favorite ride was the Starship 3000. It was a spinning ride where you stood inside it and as it spun faster, you would feel like you were pressed into the seat by “centrifugal force”. Of course we know this is not entirely accurate. a) Draw the Force Diagram of a person standing next to a wall and being able to be suspended in the air as the ride is going. b) Assuming the ride has a radius of 8 m and a coefficient of friction between the wall and the person of .6, what speed (in rpm’s) would the ride need to be going at to hold the person against the wall and have them not slide down? **(13.6 rev/min)**