Interactive Lab Circular Motion

Name______________________ Block____

In this interactive you are going to test your skills about Centripetal Acceleration and driving.

1. Why does must there be acceleration when a car goes around a curve?

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2. On the equation sheet find the equations for centripetal acceleration and period. Write these equations here.

Part 1

In the first simulation, you race a car around a circular track. Both your car and the computer's move around the loop at constant speeds. You control the speed of the blue car. Halfway around the track, you encounter an oil slick. If the centripetal acceleration of your car is greater than 3.92 m/s^2 at this point, it will leave the track and you will lose. The radius of the circle is 21.0 m.

To win the race, set your velocity so that your centripetal acceleration is equal to 3.92 m/s^2. It is suggested that you round **down** the velocity to the nearest 0.1 m/s; this is a value that will keep your car on the track and beat the computer car.

1.1 Calculate the velocity your car needs to win the race. Show all work including substitution with units.

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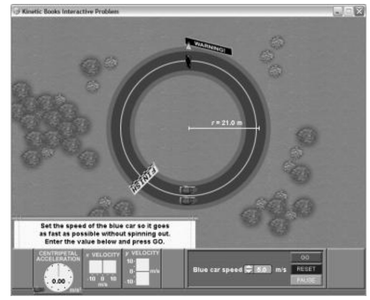

Open the shortcut “IL Circular Motion” on one of the lab stations.

Open the top simulation contained in this section. **Do Not follow the directions in the simulation follow these instructions.**

Enter this value using the controls in the simulation. Press GO to start the simulation and test your calculations.

1.2 Did it work? _____________ *(If you made it around the track but lost the race try a higher value. If you lost control off the track try a lower value.)* Record **all** trials here including the centripetal acceleration of your car. Circle the ones that worked.

1.3 Why did the oil slick lower the centripetal acceleration the car could have and still stay on the track?

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1.4 Find the centripetal acceleration that the car could have had if there had not been an oil slick. Try increasing the velocity of your car until you can no longer stay on the track before the oil slick. Use a velocity 0.1 m/s less than this value to calculate the maximum centripetal acceleration for the car on dry pavement. Show all work including substitution with units.

1.5 Why would it be possible for the red car to win even if it had a lower speed than the blue car?

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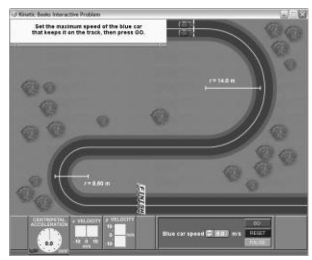
Part 2

In the second simulation, the track consists of two half-circle curves connected by a straight section. Your blue car runs the entire race at the speed that you set for it. You want to set this speed to just keep the car on the track.

The first curve has a radius of 14.0 meters; the second, 8.50 meters. On either curve, if the centripetal acceleration of your car exceeds 9.95 m/s^2, its tires will lose traction on the curve, causing it to leave the track. If your car moves at the fastest speed possible without leaving the track, it will win.

2.1 Calculate the velocity your car needs to win the race. Since the car will go the same speed on both curves, you need to decide which curve determines your maximum speed. Show all work including substitution with units.



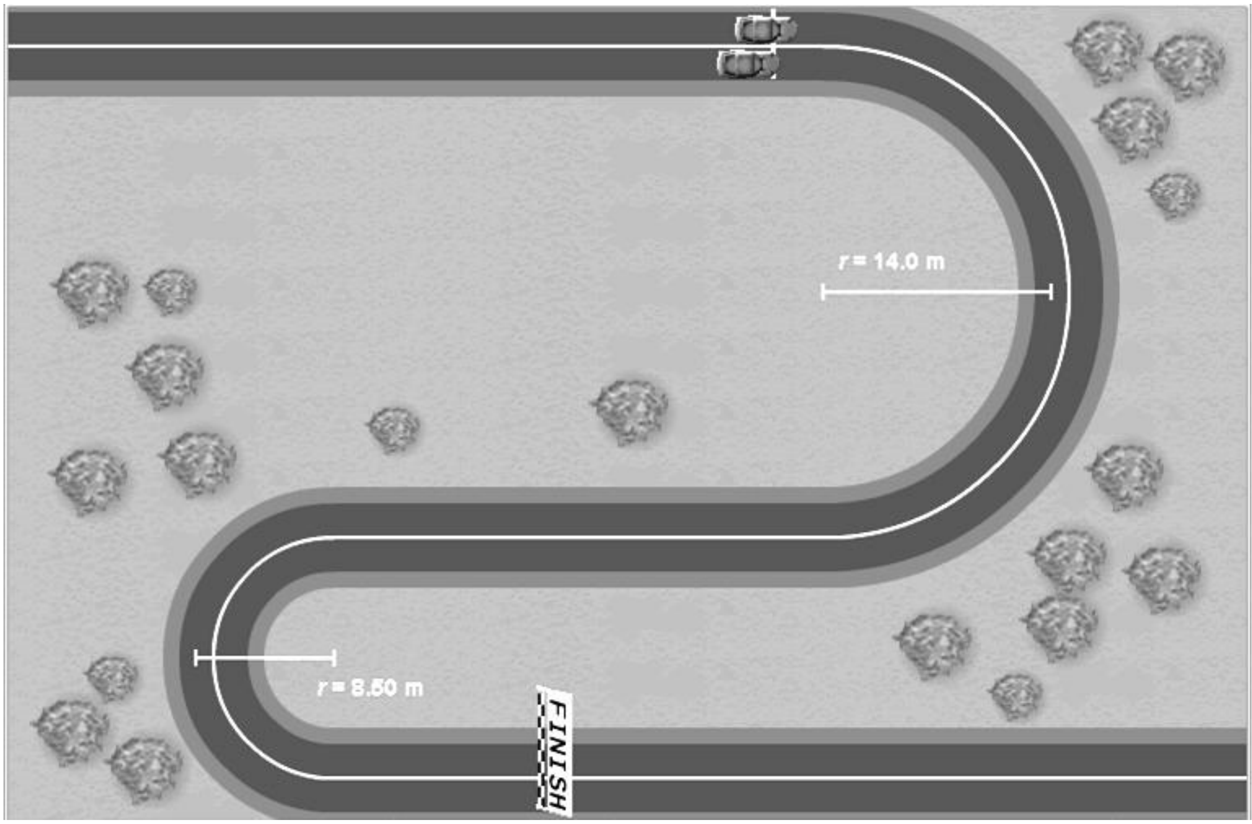
Open the lower simulation contained in this section. **Do Not follow the directions in the simulation follow these instructions.**

Enter this value using the controls in the simulation. Press GO to start the simulation and test your calculations.

2.2 Did it work? ______________ *(If you made it around the track but lost the race try a higher value. If you lost control off the track try a lower value.)* Record **all** trials here including the centripetal acceleration of your car. Circle the ones that worked.

2.3 Run your winning race again. Watch the race closely using the pause button if necessary to get exact values. On the diagram below record these areas and values.

Draw a blue line on the diagram to indicate sections of the race where blue is gaining on red.
Draw a red line on the diagram in indicate sections of the race where red is gaining on blue.
Record the acceleration of the blue car on each curve.



2.4 Using the measurements given on the diagram and your skills of estimation, find the approximate speed of the red car. Show all work including substitution with units.