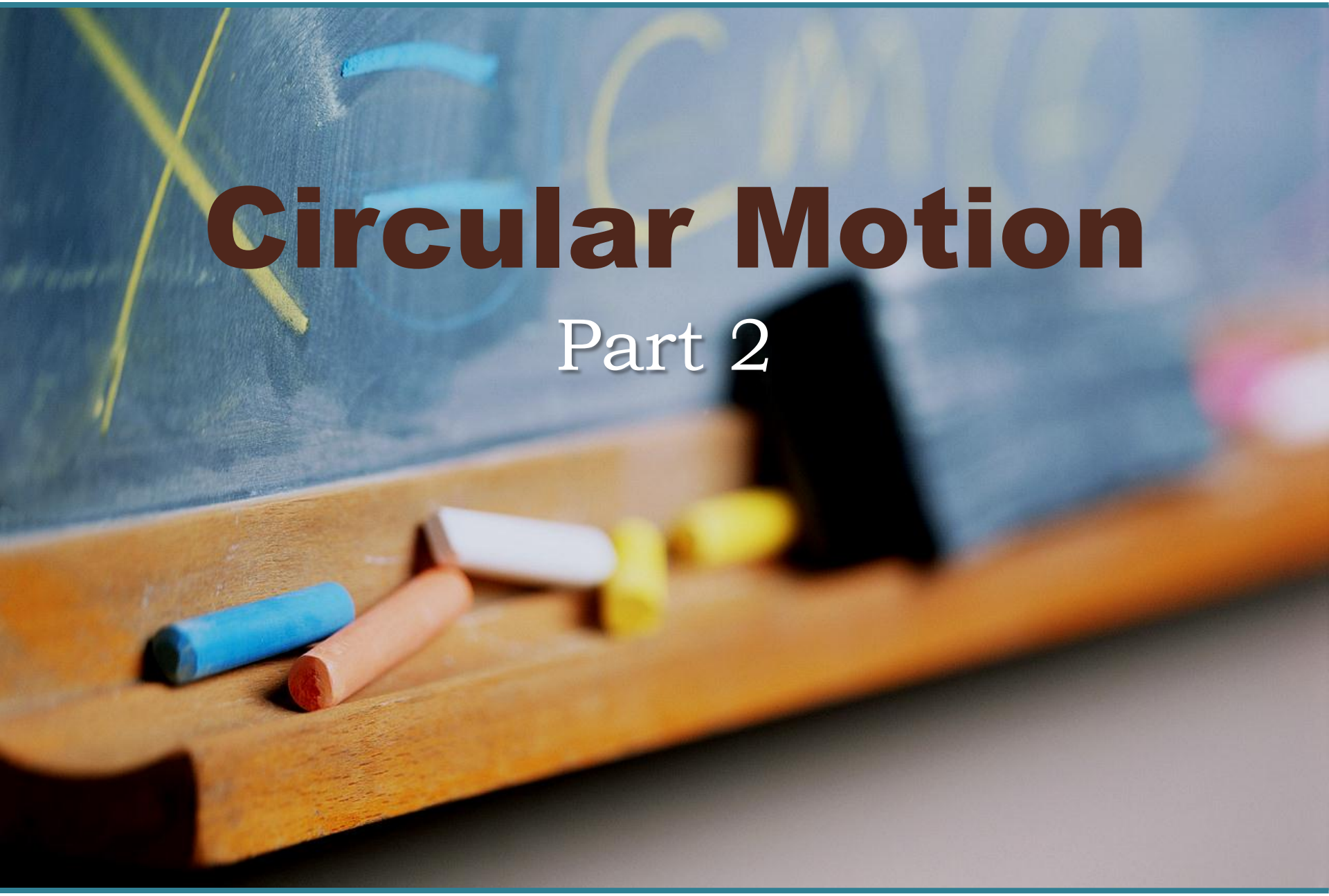


Circular Motion

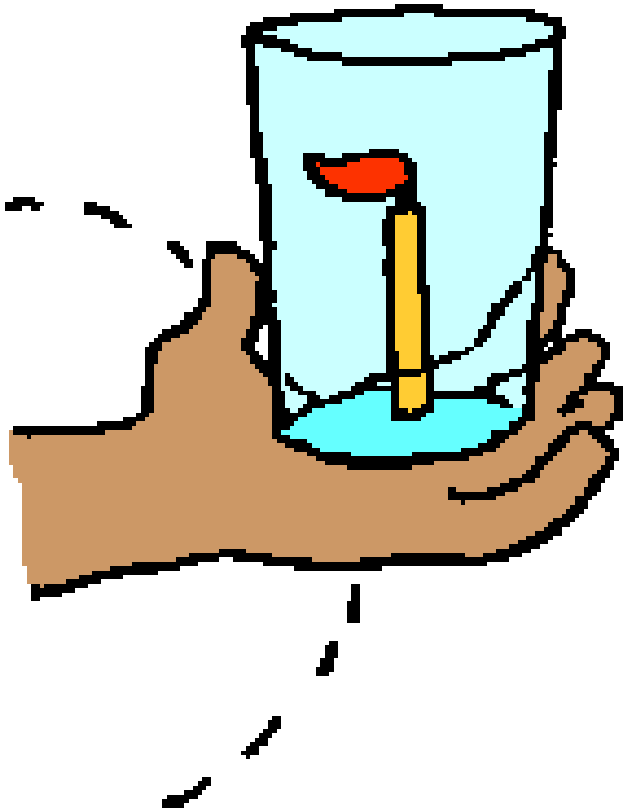
Part 2

Centripetal Acceleration

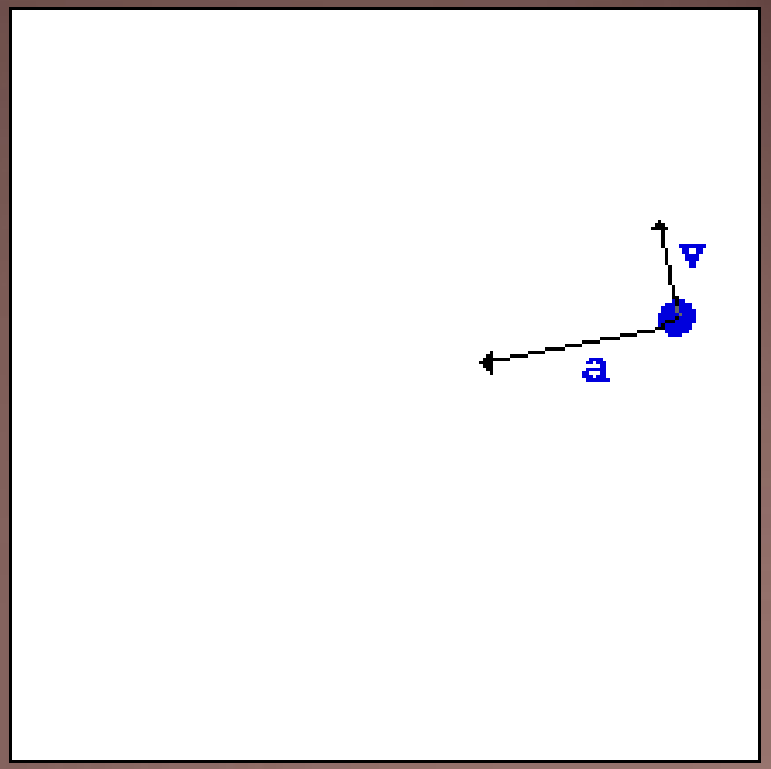
Centripetal Acceleration- the acceleration of an object that travels in a circle.

“Centripetal” mean center seeking

Centripetal Acceleration



A candle flame accelerometer indicates an inward acceleration

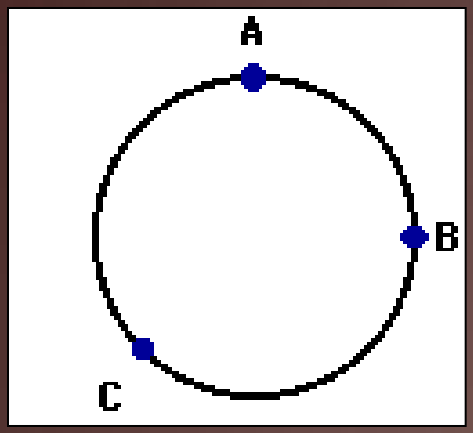


Centripetal Acceleration

$$a_c = \frac{v^2}{r}$$

Measured in m/s^2

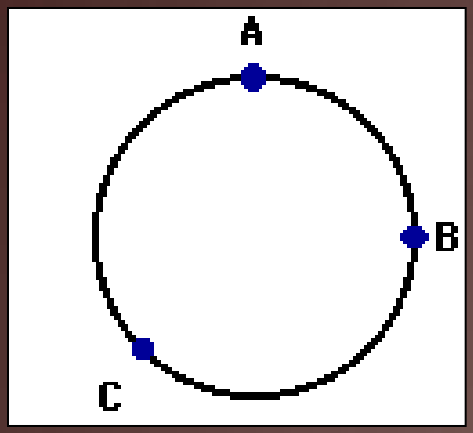
Centripetal Acceleration



An object is moving in a clockwise direction around a circle at constant speed.

Which vector below represents the direction of the acceleration vector when the object is located at point C on the circle?

Centripetal Acceleration



An object is moving in a clockwise direction around a circle at constant speed.

Which vector below represents the direction of the acceleration vector when the object is located at point B on the circle?

Centripetal Acceleration

The minimum centripetal acceleration for an object traveling in a vertical circle is the acceleration due to gravity

Minimum $a_c = 9.8\ m/s^2$

Centripetal Force

Centripetal Force- any force that is directed at a right angle to the path of a moving object and tends to produce circular motion.

“Centripetal” mean center seeking

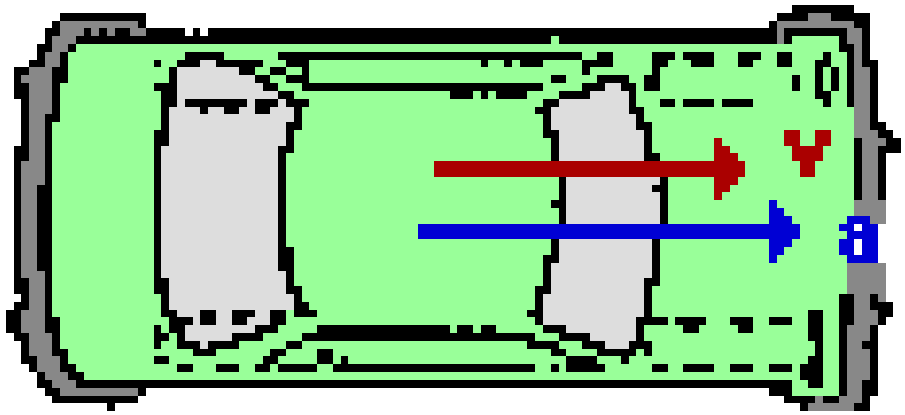
Centripetal Force

$$F_c = ma_c$$

Measured in Newtons

Centripetal Force

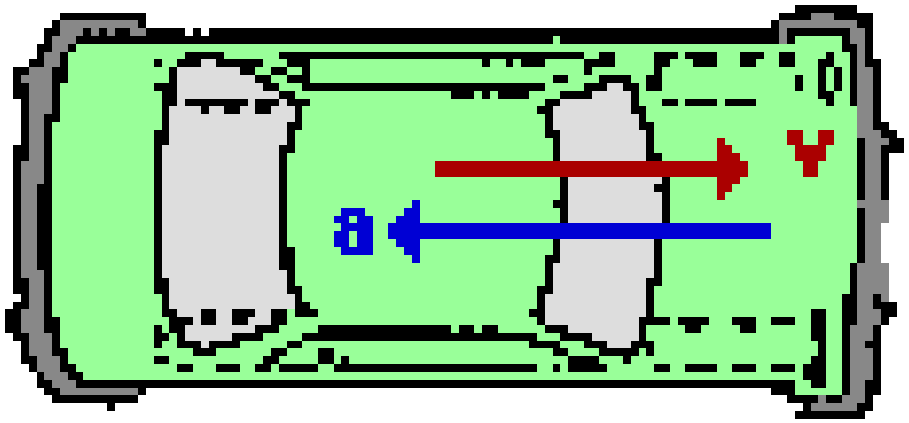
Car Starts from Rest



A passenger at rest would remain at rest, thus causing the "sensation of a backwards acceleration."

Centripetal Force

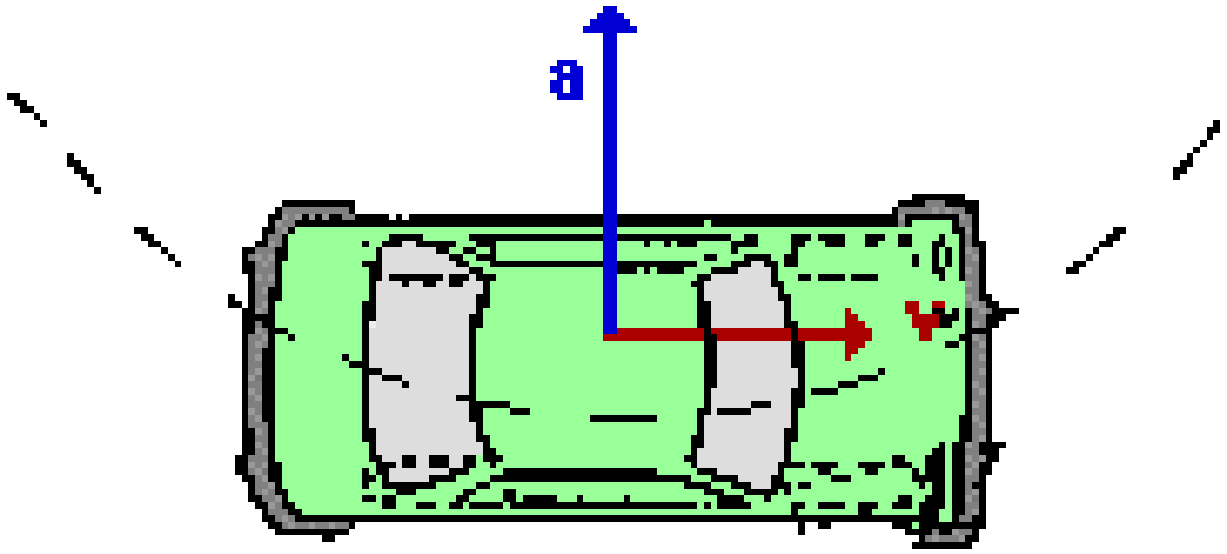
Moving Car Brakes to Stop



A passenger in motion would remain in motion, thus causing the "sensation of a forwards acceleration."

Centripetal Force

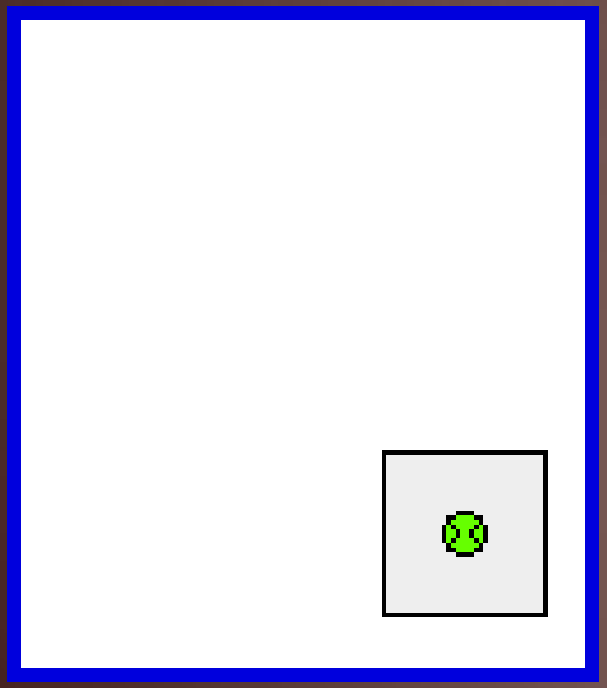
Car in Motion Makes a Left-Hand Turn



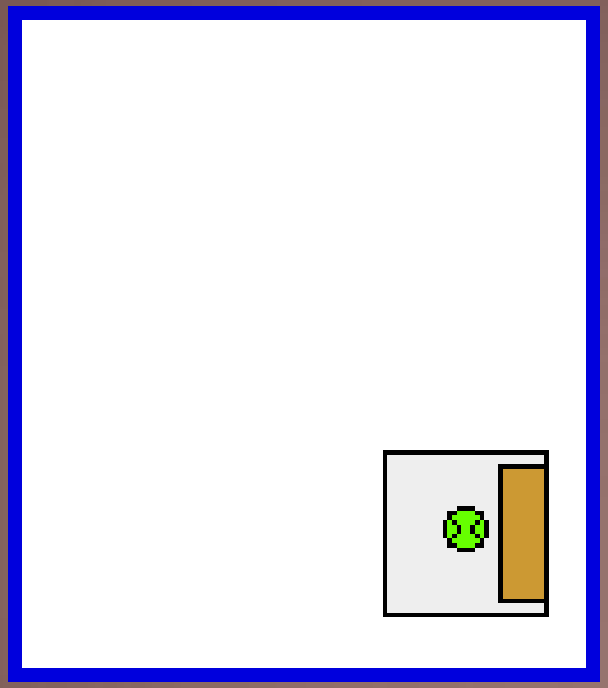
A passenger in motion would remain in motion with the same speed and in the same direction, thus causing the "sensation of an outwards acceleration."

Centripetal Force

Without a centripetal force, an object in motion continues along a straight-line path.



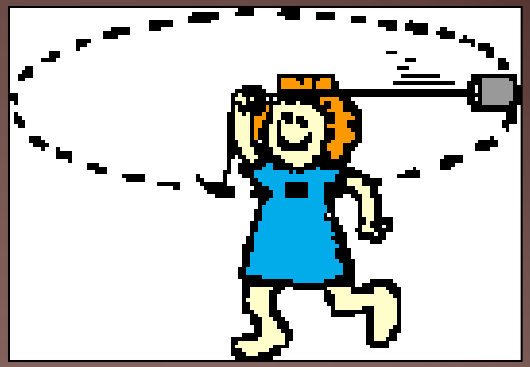
With a centripetal force, an object in motion will be accelerated and change its direction.

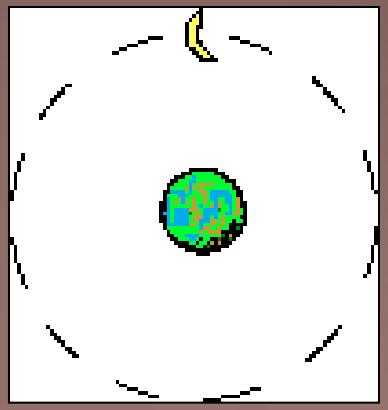


Centripetal Force

Centripetal Force could be:

Force of Tension
Force of Gravity
Force of Friction
Normal Force





It all depends upon the situation.

Centrifugal Force

Centrifugal Force- a fictitious force that supposedly pulls you outward as you travel in a circle.

“Centrifugal” mean center-fleeing

Rex Things and Doris Locked are out on a date. Rex makes a rapid right-hand turn. Doris begins sliding across the vinyl seat (which Rex had waxed and polished beforehand) and collides with Rex. To break the awkwardness of the situation, Rex and Doris begin discussing the physics of the motion which was just experienced. Rex suggests that objects which move in a circle experience an outward force. Thus, as the turn was made, Doris experienced an outward force which pushed her towards Rex. Doris disagrees, arguing that objects which move in a circle experience an inward force. In this case, according to Doris, Rex traveled in a circle due to the force of his door pushing him inward. Doris did not travel in a circle since their was no force pushing her inward; she merely continued in a straight line until she collided with Rex. Who is correct? Argue one of these two positions.

Centripetal Acceleration and Force

A 900-kg car moving at 10 m/s takes a turn around a circle with a radius of 25.0 m.

a) Determine the acceleration of the car.

b) Determine the net force acting upon the car.

Tangential Speed

A 900-kg car moving at 10 m/s takes a turn around a circle with a radius of 25.0 m.

a) Determine the acceleration of the car.

$$a_c = \frac{v^2}{r} \qquad a_c = \frac{10^2}{25}$$

$$a_c = 4\ m/s^2$$

Tangential Speed

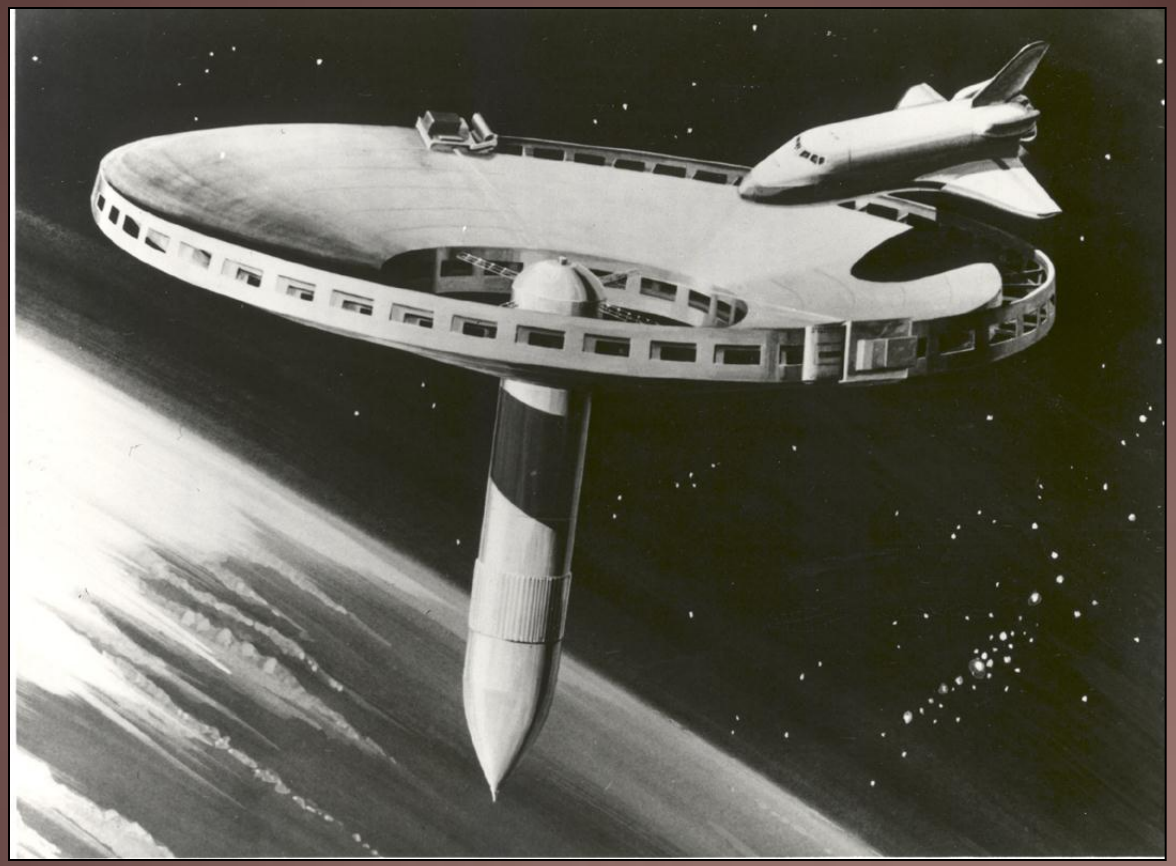
b) Determine the net force acting upon the car.

$$F_c = ma_c \quad F_c = (900)(4)$$

$$F_c = 3600 \text{ N}$$

Simulated Gravity

In a circular spaceship, gravity could be simulated by rotating around in a circle.



Simulated Gravity

The larger the radius of the space station, the more g's you would experience.

The closer to the center the fewer g's you would experience.

Simulated Gravity