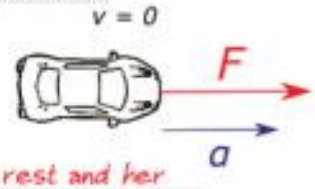
NAME _____ DATE _____

Scenario

Angela is in a stopped car at a traffic light when the light turns green and she accelerates.

Using Representations

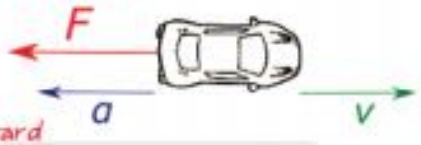
PART A: Sketch and label vectors for velocity, acceleration, and net force on the car. (This is NOT a free-body diagram.)



Which way does Angela's body "feel" pushed? Explain in a short sentence why she feels this way.

She feels pushed Backward because she was at rest and her body wanted to continue at rest, so she feels the back of the seat pushing her forward while her head remains at rest. It feels like something is pushing her head back.

PART B: As she approaches a stop sign, she slams on the brakes. Sketch and label vectors for velocity, acceleration, and net force on the car. (This is NOT a free-body diagram.)

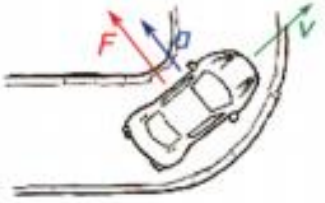


Which way does Angela's body "feel" pushed? Forward

Which way is the car accelerating? Backward

Which direction is the net force on the car? Backward

PART C: As Angela continues driving, she rounds a corner at a constant speed. Sketch and label vectors for velocity, acceleration, and net force on the car. (This is NOT a free-body diagram.)



Which way does Angela's body "feel" pushed? toward the outside of the circle

Which way is the car accelerating? toward the center of the circle

Which direction is the net force on the car? toward the center of the circle

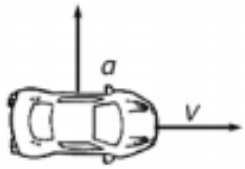
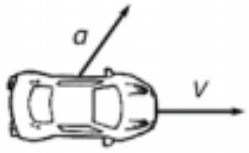
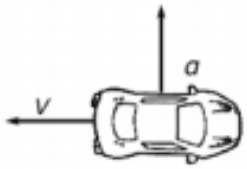
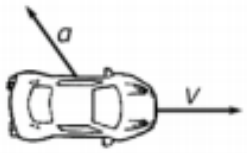
NAME _____ DATE _____

Scenario

A car is traveling along a long road. Air resistance can be ignored.

Using Representations

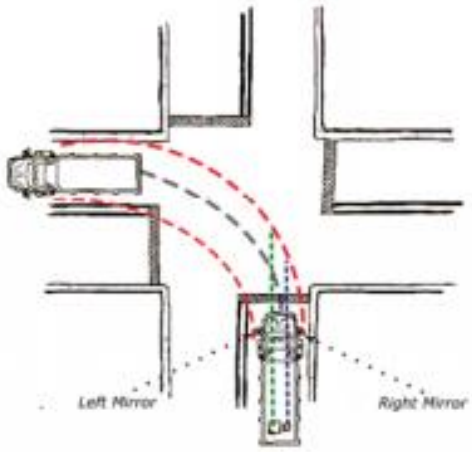
PART A: For the following situations, determine if the car is speeding up, slowing down, or staying at a constant speed and turning clockwise, counterclockwise, or not turning.

Physical Scenario	*Speeding Up/ Slowing Down/ Constant Speed*	*Turning Clockwise/ Turning Counterclockwise/ Not Turning*
	Constant Speed	Counterclockwise
	Speeding Up	Counterclockwise
	Constant Speed	Clockwise
	Slowing Down	Counterclockwise

NAME _____ DATE _____

Scenario

A dump truck is making a very fast left turn as shown. In the back are two blocks of ice, one mass M and one mass m (M > m). The truck does not roll over.



Using Representations

PART A: Sketch the paths that the left and right mirrors take during the turn.

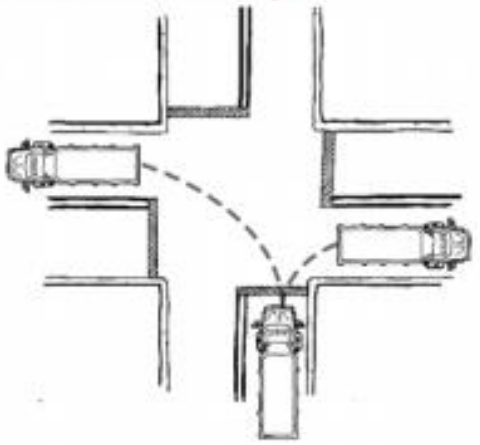
PART B: Using two different colors, sketch the paths that the two blocks of ice take during the turn. Assume that friction between the bed of the truck and the ice may be neglected.

Argumentation

PART C: Your friend, who is not in physics class, says the blocks go to the outside of the truck because a centrifugal force is acting on them. In a few brief sentences, explain why your friend is incorrect. Reference the diagram above in your answer.

The reason the blocks "appear" to go to the outside is that they were moving in a straight line and will continue to do so until they run into the side of the truck, which is turning.

PART D: The truck then approaches another intersection to make a turn. The truck can either make a left turn or a right turn as shown in the diagram. Assume that the truck approaches, makes the turn, and continues in the new direction all without changing speed.



The centripetal force for the turn is provided by the force of static friction, which is determined by the relationship $F_{f_s} = \mu_s F_N$. In a few short sentences, explain why the force of static friction, and not kinetic friction, is exerted on the truck even though the truck is in motion.

Even though the truck is in motion, at each instant, one part of the tire is at rest relative to the road so that it does not slide. If the wheels were skidding on the road, it would be kinetic friction.

PART E: In a few short sentences, explain what happens if the value of $\frac{mv^2}{r}$ is greater than the value of $\mu_s F_N$.

If $\frac{mv^2}{r} > \mu_s F_N$, then there will not be enough friction force, which provides the centripetal force needed to keep the truck going in the desired circle at the desired speed. The truck will slide off the road.

PART F: Which turn (left or right) requires the truck to slow down more in order to make the turn safely? Explain your answer using appropriate relationships.

The centripetal force is equal to $\frac{mv^2}{r}$. If r is large, then v can be larger with the same friction force. If r is small, then v also has to be smaller with the same friction force. You will have to slow down more on the smaller radius turn, so you have to slow down more on the right-hand turn.

Checklist:

- I answered the question directly.
- I stated a law of physics that is always true.
- I connected the law or laws of physics to the specific circumstances of the situation.
- I used physics vocabulary (force, mass, acceleration, coefficient, velocity, speed, time, radius).