Physics Happenings with Amusements, Newton's Laws, Triangulation, and Other Magic Park (PHANTOM Park)

SAMPLE DATA

Students of Shadowville General High School have collected the following data for the rides at PHANTOM Park. Some of this information was measured, while other data were gathered from the ride operators.

SAMPLE DATA (continued)

Bumper Cars

A uniformly moving bumper car traversed a 5.0 m distance in the following times: 3.1 s, 3.2 s, 2.9 s, 3.1 s, and 8.9 s.

Stopping distances varied, but approximate distances were: ⅓ m, ¼ m, and about 3 cm when hitting the side wall. Stopping times were all under 0.1 s, as well as the average impact times.

Twenty cars were operational at the time the data were taken.

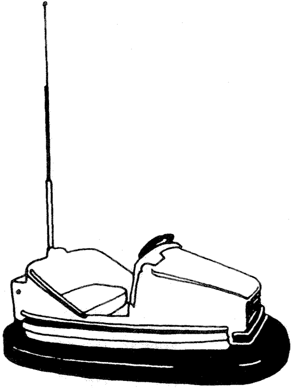
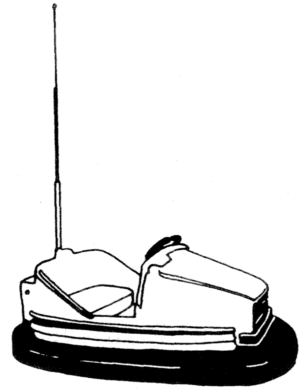


Figure 47. Bumper Car

Requirements:
CP: 9 points
AP: 12 points

BUMPER CARS



Bumper Car

Group A 1 point questions

FIND SOMEONE WITH WHOM TO DO THESE EXPERIMENTS.

1. What happens in a collision to each car when:
   a. one bumper car is not moving?
   b. a rear-end collision occurs?
   c. a head-on collision occurs?
   d. there is a collision with a stationary object, such as a wall?
   e. cars sideswipe?
2. Describe how you feel when any type of collision occurs. Are you a well-packaged passenger? Please explain your answer.
3. How is electrical energy supplied to the bumper cars? Describe the complete circuit for one of the cars.
4. Why do the cars have rubber bumpers?

Group B 2 point questions

5. During collisions, is kinetic energy always conserved? Please explain your answer.
6. Is the total mechanical energy (kinetic + potential) of the bumper cars conserved? Please explain your answer.
7. Estimate the average speed of a bumper car in motion.
8. Estimate the stopping distance of a bumper car in an average collision. Try to observe the approximate amount of "give" of a bumper in a number of different collisions where the car comes close to stopping after the collision.
9. Describe, qualitatively, the conservation (or loss) of momentum for a single collision. Consider a head-on collision and one at a 90° angle.
10. Assuming the mass of a car to be 40 kg, calculate the kinetic energy of a car. Be sure to include your own mass in the calculation.
11. Calculate the bumper car's momentum at full speed.
12. Draw a vector sketch showing the before and after momenta of the different collisions listed in Question 1 above.

Group C 3 point questions

13. Find the average negative acceleration of a bumper car in an "average" collision. How many g's is this? Be sure to show all of your work.

(continued)