PRACTICE

Activity 7: Multiple Forces and Motion

Name Date Class

Part 1

Forces are *unbalanced* if the total force in one direction is greater than the total force in the opposite direction. If an object is speeding up, the forces are *unbalanced in the direction of motion*. If an object is slowing down, the forces are *unbalanced in the direction opposite the motion*. If the object has constant speed, either *there are no interactions affecting the motion*, or *the forces on the object are balanced.*

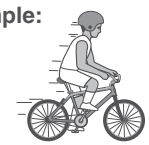
1. For each situation shown below:

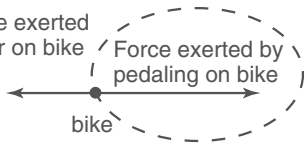
a) *Circle* which force (if any) is the *stronger* of the two for each situation.

b) State whether the forces are *balanced*, *unbalanced in the direction of motion*, or *unbalanced in the direction opposite the motion.*

(To keep the pictures from being too complicated, the force arrows are drawn beside the sketches. A dot represents each object. The first one is done for you.)

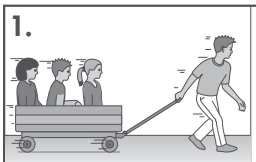
Example:

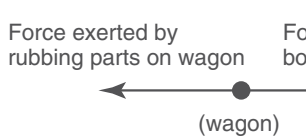




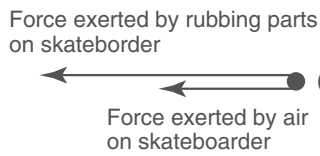
The forces are *unbalanced in the direction of motion.*

1.

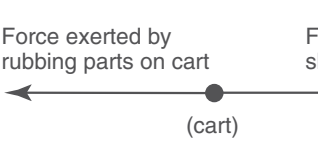




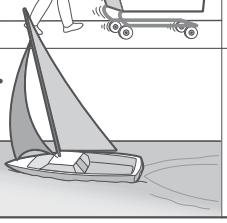
2.

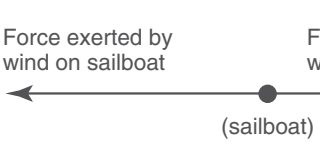


3.

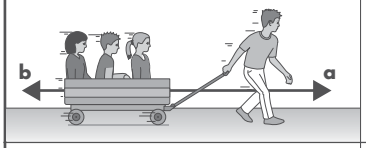
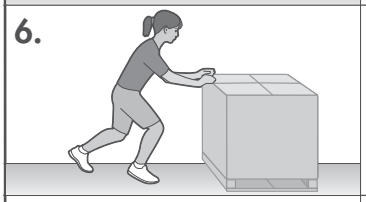
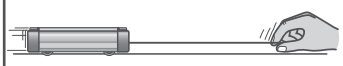
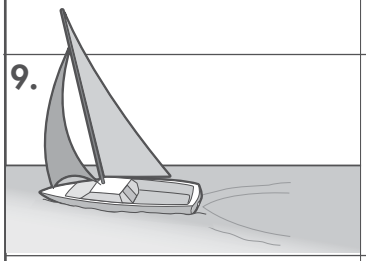


4.





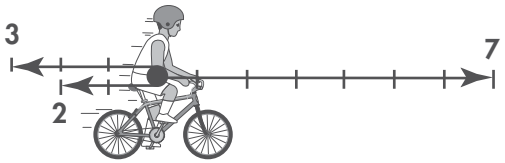
(Questions 5-10) Given the following descriptions of the forces and the motion, *draw and number* the corresponding force arrows. Be careful about the length of your force arrows! The first one is done for you.

Example: 	The wagon is speeding up. **a)** forces exerted by boy on wagon (applied) **b)** forces exerted by rubbing parts on wagon (friction)
5. 	The kayak is slowing down. **a)** forces exerted by water on kayak (drag) **b)** forces exerted by paddling on kayak (applied)
6. 	The crate moves at constant speed. **a)** forces exerted by woman on crate (applied) **b)** forces exerted by floor on crate (friction)
7. 	The low-friction car is speeding up. **a)** force exerted by string on low-friction car (applied)
8. 	The cookie box is slowing down. **a)** force exerted by the table on the cookie box (friction)
9. 	The sailboat speeds up. **a)** forces exerted by wind on boat (applied) **b)** forces exerted by water on boat (drag)
10. 	The drag car with the parachute attached slows down. **a)** forces exerted by air on drag car (drag) **b)** forces exerted by rubbing parts on drag car (friction)

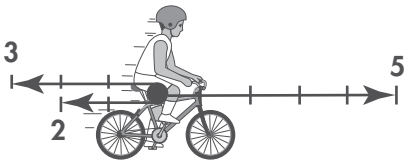
Part 2

(Question 1) Suppose you have more than two forces acting on an object. How can you determine if the object *speeds up*, *slows down*, or *has a constant speed*?

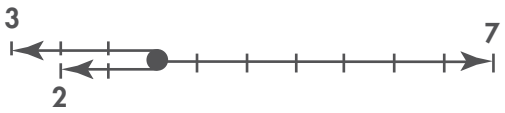
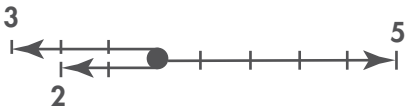
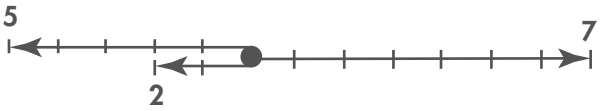
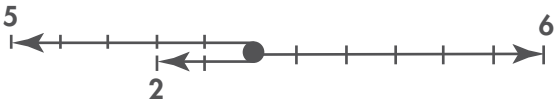
One way is to add up all the forces to the right, then add up all the forces to the left, and compare them. For example, suppose a force from pedaling exerted on a bicycle has 7 units of force to the right. This force is represented on the diagram below with a force arrow and strength value (without labels, for simplicity). The forces to the left are 2 units (from friction) and 3 units (from drag), for a total of 5 units to the left. Thus, the force from pedaling to the right (7 units) is greater than the sum of the forces to the left (5 units), so the forces are unbalanced in the direction of motion (to the right). Thus, the bicycle will speed up.



Another example shows the same two forces and strengths to the left, but now the force to the right has been reduced in strength to 5 units. Here, the force to the right (5 units) is equal to the sum of the forces to the left (5 units), so the forces are balanced. In this situation, the bicycle will move with a constant speed to the right.



Complete the chart below. Assume the bicycle is moving to the right. The first two examples are done for you.

Force Arrows	Describe *forces*	Describe *motion*
Example: 	Unbalanced in the direction of motion.	Speeds up
Example: 	Balanced	Constant speed
a) 		
b) 		
c) 		
d)