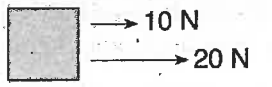
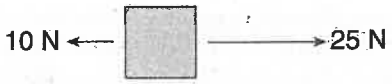
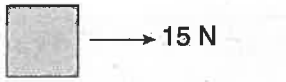
Assessment Anchors and Eligible Content: S8.A.1.2.3, S8.C.3.1.1

Force Diagrams

Scientists draw pictures called force diagrams to help them understand all of the forces acting on an object. These pictures include arrows that represent the forces. Forces have both a magnitude (size) and a direction. Look at the table below. In the first example, a 10 N force and a 20 N force pull an object to the right. The net force on the object is 30 N to the right. In the second example, a 10 N force pulls an object to the left and a 25 N force pulls the object to the right. The net force on the object is 15 N to the right.

If the applied forces are . . .	. . . then the net force is:
	
	

A force diagram does *not* show an object's motion. The arrows show the size and direction of the forces acting on an object, not the speed or direction of the object itself. Look at the first example in the table. The diagram shows a net force of 30 N to the right acting on the object. It says nothing about the object's speed or direction. That object could be moving to the left at 5 m/s but slowing down because the net force is acting to the right. Or, the object could be at rest and just starting to move to the right because the net force is acting to the right.

In the box below, draw a picture in which a single object experiences a force of 15 N to the left and another force of 45 N to the right.

What is the net force acting on the object you drew? (Give both magnitude and direction.)

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Suppose the object you drew is moving to the left. Is it speeding up, slowing down, or staying at the same speed?

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If the object has a mass of 15 kg, what is the magnitude of its acceleration, in m/s^2?

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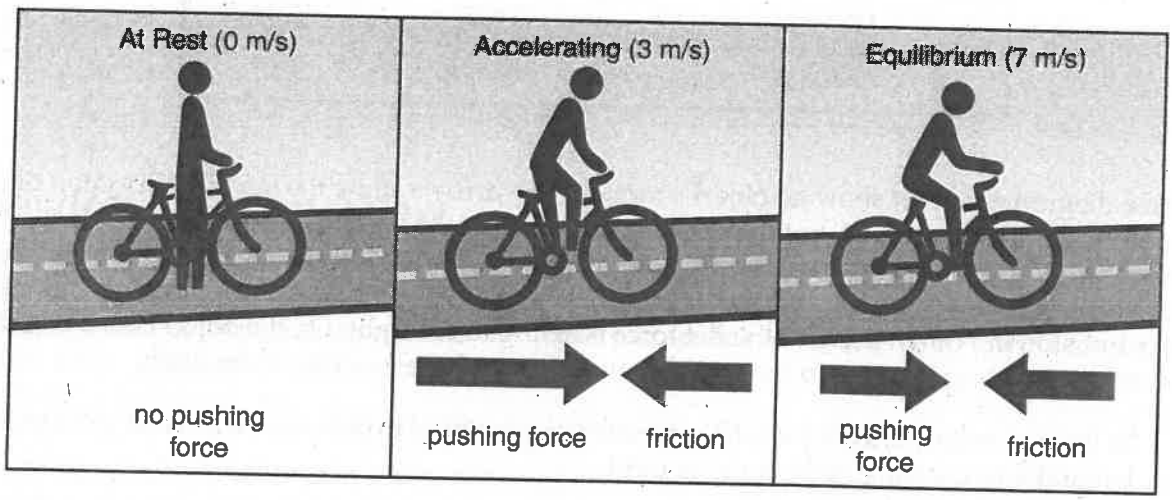
It is easy to grasp that the net force for an object at rest is zero. It may be harder to see how objects moving at a constant speed in a straight line also have a net force of zero. This idea becomes clearer when you consider Sharon on her bicycle. Look at the diagram below.



In the first panel, Sharon is at rest. In the second panel, she starts accelerating. To start moving, the first few pushes she gives the pedals must provide a force that is greater than the friction from the road. In other words, the pushing and friction forces are unbalanced. A net force greater than zero acts in the direction of her motion to make her go faster. By the third panel, Sharon's pushing force is equal to the force of friction from the road. The forces are balanced, the net force is zero, and Sharon moves at a constant speed in a straight line.

Sharon cruises east at 7 m/s. She then uses her brakes and comes to a gentle stop. As Sharon slows, how does the direction of the net force compare to that of her motion?

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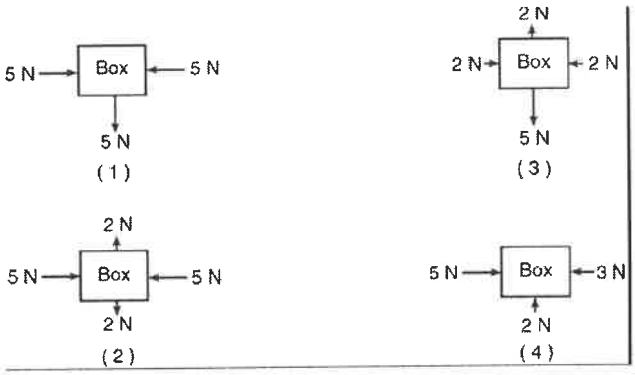
Force Diagrams



In the box below, draw a picture in which a single object experiences a force of 15N to the left and another force of 45 N to the right

What is the net force acting on the object that you drew? (Both direction and magnitude