<u>One-Dimensional Net Force Practice</u>

Problem #1:

What is the net force acting on a boy if the earth pulls downward on him with 400 Newtons of force (We call this force the boy's weight, or the gravitational force acting on him.) while a stair pushes upward on him with 300 Newtons of force? Let's assume no other forces are acting on the boy. <u>Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation</u>.

Problem #2:

What is the net force acting on a boy if the earth pulls downward on him with 400 Newtons of force while a stair pushes upward on him with 600 Newtons of force? Let's assume no other forces are acting on the boy. <u>Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation</u>.

Problem #3:

What is the net force acting on a tug-of-war rope if Team A pulls to the left on the rope with 1,000 Newtons of force while Team B pulls on the rope with 1,000 Newtons of force. Let's assume the two teams are pulling in opposite directions and that no other forces are acting on the rope. <u>Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation</u>.

Problem #4:

What is the net force acting on a tug-of-war rope if Team A pulls to the left on the rope with 1,000 Newtons of force while Team B pulls on the rope with 1,500 Newtons of force. Let's assume the two teams are pulling in opposite directions and that no other forces are acting on the rope. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Problem #5:

What is the net force acting on my desk if I push on it to the right with 700 Newtons of force while the floor pushes on it to the left with 700 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Problem #6:

What is the net force acting on my desk if I push on it to the right with 900 Newtons of force while the floor pushes on it to the left with 700 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Problem #7:

What is the net force acting on my desk if I push on it to the right with 700 Newtons of force while the floor pushes on it to the left with 800 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Problem #8:

What is the net force acting on my car when my four kids each push forward on it with 500 Newtons of force? Let's assume no other forces are acting on the car. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Problem #9:

What is the net force acting on my car when my four kids each push forward on it with 500 Newtons of force while friction pushes backward on the car with 1,200 Newtons of force? Let's assume no other forces are acting on the car. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solutions

Problem #1:

What is the net force acting on a boy if the earth pulls downward on him with 400 Newtons of force (We call this force the boy's weight, or the gravitational force acting on him.) while a stair pushes upward on him with 300 Newtons of force? Let's assume no other forces are acting on the boy. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force.

400 N – 300 N = 100 N

In addition, the direction of the net force is the same as the direction of the larger of the two forces.

The larger force pulls downward on the boy, and so the net force points downward.

The net force acting on the boy is 100 N downward.

According to Newton's Second Law of Motion, the direction of the net force acting on the boy is the same as the direction of the boy's acceleration. Thus, in this situation, the boy is accelerating in the downward direction. In other words, if the boy is moving down the stairs, he is speeding up, but if the boy is moving up the stairs, he is slowing down.

Problem #2:

What is the net force acting on a boy if the earth pulls downward on him with 400 Newtons of force while a stair pushes upward on him with 600 Newtons of force? Let's assume no other forces are acting on the boy. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force.

600 N – 400 N = 200 N

In addition, the direction of the net force is the same as the direction of the larger of the two forces.

The larger force pushes upward on the boy, and so the net force points upward.

The net force acting on the boy is 200 N upward.

According to Newton's Second Law of Motion, the direction of the net force acting on the boy is the same as the direction of the boy's acceleration. Thus, in this situation, the boy is accelerating in the upward direction. In other words, if the boy is moving up the stairs, he is speeding up, but if the boy is moving down the stairs, he is slowing down.

Problem #3:

What is the net force acting on a tug-of-war rope if Team A pulls to the left on the rope with 1,000 Newtons of force while Team B pulls on the rope with 1,000 Newtons of force. Let's assume the two teams are pulling in opposite directions and that no other forces are acting on the rope. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force. The two forces in this problem are the same size, and so it doesn't matter which force we write first when subtracting because we will end up with an answer of zero Newtons either way.

1,000 N – 1,000 N = 0 N

Because the net force is equal to zero, it has no direction.

The net force acting on the rope is 0 N.

According to Newton's First Law of Motion, if the rope has zero net force acting on it, the rope is in mechanical equilibrium and will not accelerate. Thus, if the rope is at rest, it will stay at rest, but if the rope is moving, it will continue moving at a constant velocity (constant speed in a straight line).

Problem #4:

What is the net force acting on a tug-of-war rope if Team A pulls to the left on the rope with 1,000 Newtons of force while Team B pulls on the rope with 1,500 Newtons of force. Let's assume the two teams are pulling in opposite directions and that no other forces are acting on the rope. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force.

1,500 N – 1,000 N = 500 N

In addition, the direction of the net force is the same as the direction of the larger of the two forces.

The larger force acting on the rope is to the right.

The net force acting on the rope is 500 N to the right.

According to Newton's Second Law of Motion, the direction of the net force acting on the rope is the same as the direction of the rope's acceleration. Thus, in this situation, the rope is accelerating to the right. In other words, if the rope is moving to the right, it is speeding up, but if the rope is moving to the left, it is slowing down.

Problem #5:

What is the net force acting on my desk if I push on it to the right with 700 Newtons of force while the floor pushes on it to the left with 700 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force. The two forces in this problem are the same size, and so it doesn't matter which force we write first when subtracting because we will end up with an answer of zero Newtons either way.

700 N – 700 N = 0 N

Because the net force is equal to zero, it has no direction.

The net force acting on the desk is 0 N.

According to Newton's First Law of Motion, if the desk has zero net force acting on it, the desk is in mechanical equilibrium and will not accelerate. Thus, if the desk is at rest, it will stay at rest, but if the desk is moving, it will continue moving at a constant velocity (constant speed in a straight line).

Problem #6:

What is the net force acting on my desk if I push on it to the right with 900 Newtons of force while the floor pushes on it to the left with 700 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force.

900 N – 700 N = 200 N

In addition, the direction of the net force is the same as the direction of the larger of the two forces.

The larger force acting on the desk is to the right.

The net force acting on the desk is 200 N to the right.

According to Newton's Second Law of Motion, the direction of the net force acting on the desk is the same as the direction of the desk's acceleration. Thus, in this situation, the desk is accelerating to the right. In other words, if the desk is moving to the right, it is speeding up, but if the desk is moving to the left, it is slowing down. *Note: In this particular situation, it is likely that* *the desk starting moving because I pushed it, and so it is likely that the desk is moving to the right and speeding up.*

Problem #7:

What is the net force acting on my desk if I push on it to the right with 700 Newtons of force while the floor pushes on it to the left with 800 Newtons of force? Let's assume no other forces are acting on the desk. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in opposite directions, we subtract the smaller force from the larger force to find the net force.

800 N – 700 N = 100 N

In addition, the direction of the net force is the same as the direction of the larger of the two forces.

The larger force acting on the desk is to the left.

The net force acting on the desk is 100 N to the left.

According to Newton's Second Law of Motion, the direction of the net force acting on the desk is the same as the direction of the desk's acceleration. Thus, in this situation, the desk is accelerating to the left. In other words, if the desk is moving to the left, it is speeding up, but if the desk is moving to the right, it is slowing down. *Note: In this particular situation, it is likely that the desk starting moving because I pushed it, and so it is likely that the desk is moving to the right and slowing down.*

Problem #8:

What is the net force acting on my car when my four kids each push forward on it with 500 Newtons of force? Let's assume no other forces are acting on the car. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

When two forces act in the same direction, we add the forces together to find the net force.

500 N + 500 N + 500 N + 500 N = 2,000 N

In addition, the direction of the net force is the same as the direction of the forces. In this problem, the kids all push forward on the car. The direction of the net force acting on the car is forward.

The net force acting on the car is 2,000 N forward.

According to Newton's Second Law of Motion, the direction of the net force acting on the car is the same as the direction of the car's acceleration. Thus, in this situation, the car is accelerating forward. In other words, if the car is moving forward, it is speeding up, but if the car is moving backward, it is slowing down.

Problem #9:

What is the net force acting on my car when my four kids each push forward on it with 500 Newtons of force while friction pushes backward on the car with 1,200 Newtons of force? Let's assume no other forces are acting on the car. Use one or more of Newton's Three Laws of Motion to describe what might be physically happening in this situation.

Solution:

In this problem, we have four forces acting in the forward direction on the car while one force acts backward on the car. First, I will add together the four forces acting in the forward direction on the car to find the total force acting in the forward direction on the car.

500 N + 500 N + 500 N + 500 N = 2,000 N

Thus, the total force acting in the forward direction is 2,000 N.

Now, we can find the net force acting on the car by subtracting the smaller backward force from the larger total forward force (We subtract when forces point in opposite directions.).

2,000 N – 1,200 N = 800 N

The net force acting on the car points in the forward direction because the total force in the forward direction is larger than the force in the backward direction.

The net force acting on the car is 800 N forward.

According to Newton's Second Law of Motion, the direction of the net force acting on the car is the same as the direction of the car's acceleration. Thus, in this situation, the car is accelerating forward. In other words, if the car is moving forward, it is speeding up, but if the car is moving backward, it is slowing down.