

Force Makes Motion

Use net force and mass to find acceleration.

GRADE 8 • TEKS 8.7.A

8.7.A "calculate and analyze how the acceleration of an object is dependent upon the net force acting on the object and the mass of the object using Newton's Second Law of Motion; and"

NAME _____

DATE _____

THE BIG IDEA

Newton's Second Law is $F = ma$. To find acceleration, divide net force by mass: $a = F/m$. A larger net force causes more acceleration, while a larger mass causes less acceleration when the net force stays the same.

WORKED EXAMPLE

A 9 kg wagon has a net force of 45 N acting on it. What is its acceleration?

1. Start with $a = F/m$.
2. Substitute: $a = 45 \text{ N} / 9 \text{ kg}$.
3. Divide: $a = 5 \text{ m/s}^2$.

Answer: 5 m/s²

PRACTICE 6 problems

- 1** PRACTICE 1: A 6 kg object has a net force of 24 N. What is its acceleration?

ANSWER _____

- 2** PRACTICE 2: A 7 kg backpack on a cart accelerates at 3 m/s^2 . What net force acts on it?

ANSWER _____

- 3** PRACTICE 3: A net force of 32 N causes an object to accelerate at 8 m/s^2 . What is the object's mass?

ANSWER _____

- 4** PRACTICE 4: Two carts have the same mass. Cart A has a net force of 12 N and accelerates at 2 m/s^2 . Cart B has a net force of 36 N. What is Cart B's acceleration? How does its net force compare with Cart A's?

ANSWER _____

- 5** PRACTICE 5: A 4 kg object accelerates at 4 m/s^2 when a net force of 16 N acts on it. A second object has a mass of 8 kg and the same net force. What is the second object's acceleration?

ANSWER _____

- 6** PRACTICE 6: A 3 kg box has an 18 N force pushing right and a 6 N force pushing left. What are the net force and acceleration?

ANSWER _____

APPLY IT Show your work

- 1** APPLY 1: During a test ride, an electric scooter has a net forward force of 54 N. The scooter and rider have a total mass of 18 kg. What is the scooter's acceleration?

WORK SPACE

ANSWER _____

- 2** APPLY 2: A robotics club robot has a mass of 4 kg. Its motors push it forward with 34 N, while friction pushes backward with 10 N. Find the robot's net force and acceleration.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE: Object X and Object Y each have a net force of 36 N. Object X has a mass of 6 kg, and Object Y has a mass of 12 kg. In two sentences, calculate both accelerations and explain why they are different.

WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	PRACTICE 1: A 6 kg object has a net force of 24 N. What is its acceleration?	4 m/s²
2	PRACTICE 2: A 7 kg backpack on a cart accelerates at 3 m/s ² . What net force acts on it?	21 N
3	PRACTICE 3: A net force of 32 N causes an object to accelerate at 8 m/s ² . What is the object's mass?	4 kg
4	PRACTICE 4: Two carts have the same mass. Cart A has a net force of 12 N and accelerates at 2 m/s ² . Cart B has a net force of 36 N. What is Cart B's acceleration? How does its net force compare with Cart A's?	6 m/s²; Cart B's net force is 3 times Cart A's net force.
5	PRACTICE 5: A 4 kg object accelerates at 4 m/s ² when a net force of 16 N acts on it. A second object has a mass of 8 kg and the same net force. What is the second object's acceleration?	2 m/s²
6	PRACTICE 6: A 3 kg box has an 18 N force pushing right and a 6 N force pushing left. What are the net force and acceleration?	12 N right; 4 m/s² right

PART 2 • APPLY IT

- 3 m/s² forward** Use $a = F/m$. Divide 54 N by 18 kg to get 3 m/s² forward.
- 24 N forward; 6 m/s² forward** Subtract the backward force from the forward force: 34 N - 10 N = 24 N forward. Then divide 24 N by 4 kg.

CHALLENGE

Object X accelerates at 6 m/s², and Object Y accelerates at 3 m/s². Because both objects have the same net force and Object Y has twice the mass, Object Y has half the acceleration.

Accept equivalent use of $a = F/m$ or $F = ma$. Require direction when forces act in opposite directions or when a direction is given in the problem.