

Force in Motion

Use net force and mass to calculate acceleration.

GRADE 8 • TEKS 8.7

8.7 "Force, motion, and energy. The student understands the relationship between force and motion within systems. The student is expected to: calculate and analyze how the acceleration of an object is dependent upon the net force acting on the..."

NAME _____

DATE _____

THE BIG IDEA

Newton's Second Law connects net force, mass, and acceleration: $F_{\text{net}} = m \times a$. To find acceleration, divide net force by mass. Acceleration points in the same direction as the net force.

WORKED EXAMPLE

A 7 kg equipment cart has a net force of 35 N pushing it forward. What is its acceleration?

1. Start with $F_{\text{net}} = m \times a$.
2. Solve for acceleration: $a = F_{\text{net}} / m$.
3. Substitute: $a = 35 \text{ N} / 7 \text{ kg} = 5 \text{ m/s}^2$.
4. The acceleration is forward because the net force is forward.

Answer: 5 m/s² forward

PRACTICE 6 problems

- 1** A 6 kg cart has a net force of 24 N to the right. Calculate its acceleration.

ANSWER _____

- 2** A 9 kg robot has a net force of 54 N forward. Calculate its acceleration.

ANSWER _____

- 3** An 8 kg sled accelerates at 3 m/s² north. Calculate the net force on the sled.

ANSWER _____

- 4** A 15 kg scooter has a net force of 30 N west. Calculate its acceleration.

ANSWER _____

- 5** A 12 kg crate is pushed with 42 N east while friction pushes with 18 N west. Calculate the crate's net force and acceleration.

ANSWER _____

- 6** A 21 kg diving platform cart has a net force of 63 N south. Calculate its acceleration.

ANSWER _____

APPLY IT Show your work

- 1** At a skate park, a 9 kg electric scooter has a 50 N force pushing it forward. Rolling resistance pushes backward with 14 N. What are the scooter's net force and acceleration?

WORK SPACE

ANSWER _____

- 2** An amusement park ride gondola has a mass of 300 kg. The cable pulls upward with 4800 N, while gravity pulls downward with 3600 N. What are the gondola's net force and acceleration?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A 20 kg practice robot is pushed forward with 90 N. It accelerates forward at 3 m/s^2 . Friction is the only force acting backward. What friction force acts on the robot? Show your reasoning.

WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A 6 kg cart has a net force of 24 N to the right. Calculate its acceleration.	4 m/s² to the right
2	A 9 kg robot has a net force of 54 N forward. Calculate its acceleration.	6 m/s² forward
3	An 8 kg sled accelerates at 3 m/s ² north. Calculate the net force on the sled.	24 N north
4	A 15 kg scooter has a net force of 30 N west. Calculate its acceleration.	2 m/s² west
5	A 12 kg crate is pushed with 42 N east while friction pushes with 18 N west. Calculate the crate's net force and acceleration.	Net force: 24 N east; acceleration: 2 m/s² east
6	A 21 kg diving platform cart has a net force of 63 N south. Calculate its acceleration.	3 m/s² south

PART 2 • APPLY IT

- Net force: 36 N forward; acceleration: 4 m/s² forward** Subtract the backward resistance from the forward force: 50 N - 14 N = 36 N forward. Divide 36 N by 9 kg to get 4 m/s² forward.
- Net force: 1200 N upward; acceleration: 4 m/s² upward** Subtract the downward force from the upward force: 4800 N - 3600 N = 1200 N upward. Divide 1200 N by 300 kg to get 4 m/s² upward.

CHALLENGE

30 N backward. The net force is $20 \text{ kg} \times 3 \text{ m/s}^2 = 60 \text{ N}$ forward, so friction must be $90 \text{ N} - 60 \text{ N} = 30 \text{ N}$ backward.

Accept equivalent wording for directions, such as right for east. Students must use the net force, not just one force, when opposing forces are given.