LESSON MAKER PRO

Force and Inertia

Use mass and acceleration to reason about force.

GRADE 8 · S8P3.c

S8P3.c "Construct an argument from evidence to support the claim that the amount of force needed to accelerate an object is proportional to its mass (inertia)."

NAME _____ DATE _____

FORCE FOLLOWS MASS

Mass describes inertia, or how much an object resists a change in motion. When objects have the same acceleration, an object with more mass needs more force. Use force = mass x acceleration, and remember that if mass doubles, the needed force doubles.

WORKED EXAMPLE

A 7 kg cart accelerates at 3 m/s². What force is needed?

1. Write the relationship: force = mass x acceleration.
2. Substitute: force = 7 kg x 3 m/s^2.
3. Multiply: 7 x 3 = 21.

Answer: 21 N

PRACTICE 6 problems

1 A 4 kg drone accelerates at 5 m/s^2. What force is needed?

ANSWER _____

2 A force of 36 N accelerates a cart at 6 m/s^2. What is the cart's mass?

ANSWER _____

3 Two carts accelerate at 2 m/s^2. Cart A has a mass of 8 kg. Cart B has a mass of 16 kg. Find the force needed for each cart. Then compare the forces.

ANSWER _____

4 A 9 kg stage prop accelerates at 4 m/s^2. What force is needed?

ANSWER _____

5 A force of 48 N accelerates a robot at 8 m/s^2. What is the robot's mass?

ANSWER _____

6 During tests at the same acceleration, a 5 kg cart needs 10 N of force and a 10 kg cart needs 20 N of force. Write a claim supported by this evidence about mass and required force.

ANSWER _____

APPLY IT Show your work

1 An esports club is filming a tournament and needs to move a 12 kg camera cart at 4 m/s^2. Use the test data. How much force is needed? Then use one comparison from the table to support the claim that force is proportional to mass when acceleration stays the same.

CAMERA CART TESTS AT 4 M/S²

Mass (kg)	Force (N)
2	8
5	20
9	36

ANSWER _____

2 A robotics team has an 18 kg robot that must accelerate at 5 m/s^2. Its battery system can provide at most 72 N of force. Find the force needed for the target acceleration. Can the robot meet the target? If not, what is the greatest acceleration the battery can provide?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student says that a 20 kg cart can accelerate at 6 m/s^2 with 100 N of force. Use the test data to decide whether the claim is supported. State the correct force and explain your reasoning.

CART TESTS AT 6 M/S²

Mass (kg)	Force (N)
4	24
11	66
16	96

WORK SPACE AND ANSWER

ANSWER KEY

Force and Inertia

GRADE 8 · S8P3.c

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A 4 kg drone accelerates at 5 m/s^2. What force is needed?	**20 N**
2	A force of 36 N accelerates a cart at 6 m/s^2. What is the cart's mass?	**6 kg**
3	Two carts accelerate at 2 m/s^2. Cart A has a mass of 8 kg. Cart B has a mass of 16 kg. Find the force needed for each cart. Then compare the forces.	**Cart A: 16 N. Cart B: 32 N. Cart B needs twice the force.**
4	A 9 kg stage prop accelerates at 4 m/s^2. What force is needed?	**36 N**
5	A force of 48 N accelerates a robot at 8 m/s^2. What is the robot's mass?	**6 kg**
6	During tests at the same acceleration, a 5 kg cart needs 10 N of force and a 10 kg cart needs 20 N of force. Write a claim supported by this evidence about mass and required force.	**The 10 kg cart has twice the mass and needs twice the force, so at the same acceleration force is proportional to mass.**

PART 2 · APPLY IT

1. **48 N. For example, a 2 kg cart needs 8 N and a 5 kg cart needs 20 N. In both cases, force is 4 times the mass.** Multiply 12 kg by 4 m/s^2 to get 48 N. The table has the same force-to-mass ratio, 4 N/kg, in every row.
2. **The robot needs 90 N. No, 72 N is less than 90 N. The greatest acceleration is 4 m/s^2.** Calculate 18 x 5 = 90 N. Then divide 72 N by 18 kg to find a maximum acceleration of 4 m/s^2.

CHALLENGE

The claim is not supported. The correct force is 120 N because each test has a force-to-mass ratio of 6 N/kg, so 20 kg x 6 N/kg = 120 N.

Accept equivalent statements that identify the constant force-to-mass ratio when acceleration is fixed. Units should be included for calculated force, mass, and acceleration.