Cart Lab Clues

Use trial data to find what affects acceleration.

8.9 "Use data from an investigation to identify factors that affect acceleration."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two factors the students changed, then write F beside two table rows that test force and M beside two rows that test mass while the other factor stays fixed.

What Makes a Cart Speed Up?

1. In a school lab, students wanted to find out what changes how quickly a cart speeds up. They pulled a cart along a smooth track and used a motion sensor to measure its acceleration. A force sensor measured the net forward force, the forward pull after opposing forces were subtracted. Each run began from rest.

2. The students changed the cart's mass by adding weights and changed the net force by adjusting the pull. They kept the track and wheels the same and recorded each run in the table. When they compared runs, they checked whether only one tested factor had changed. That made it possible to link a change in acceleration to a likely cause.

CART TRIALS

Run	Mass (kg)	Net force (N)	Acceleration (m/s²)
A	1	2	2
B	1	4	4
C	2	4	2
D	2	2	1

3. A larger net force can produce greater acceleration when mass stays the same. Greater mass can reduce acceleration when net force stays the same. But changing both at once can hide these effects: acceleration may even stay the same. To make a fair claim, hold one factor steady and compare measured accelerations.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare runs A and B. What does their data show about the effect of net force on acceleration?

2. Compare runs B and C. What does their data show about the effect of mass on acceleration?

3. Compare runs C and D. Does their data support the same force pattern you found in runs A and B? Explain.

4. Runs A and C have equal acceleration. Why can't those two runs alone show the effect of changing mass?

3 YOUR TURN

Your own words

Plan a fifth run with a 3 kg cart and a 6 N net force. Predict its acceleration, explain your prediction using two different runs in the table, and state how you would check it.

Cart Lab Clues

PART 1 · READ AND MARK

Underline the two factors the students changed, then write F beside two table rows that test force and M beside two rows that test mass while the other factor stays fixed. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare runs A and B. What does their data show about the effect of net force on acceleration?	**At the same mass of 1 kg, doubling net force from 2 N to 4 N doubled acceleration from 2 to 4 m/s^2.**
2	Compare runs B and C. What does their data show about the effect of mass on acceleration?	**At the same net force of 4 N, doubling mass from 1 kg to 2 kg reduced acceleration from 4 to 2 m/s^2.**
3	Compare runs C and D. Does their data support the same force pattern you found in runs A and B? Explain.	**Yes. At a mass of 2 kg, reducing net force from 4 N to 2 N reduced acceleration from 2 to 1 m/s^2.**
4	Runs A and C have equal acceleration. Why can't those two runs alone show the effect of changing mass?	**Both mass and net force changed between A and C, so their data do not isolate the effect of mass.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would use a 3 kg cart and adjust the pull until the force sensor reads 6 N net force. I predict an acceleration of 2 m/s^2 because run A has 2 N for 1 kg and run C has 4 N for 2 kg, and both have an acceleration of 2 m/s^2. I would check it with a motion sensor.

Accept any valid marking pairs that hold one factor fixed. For the fifth run, accept 2 m/s^2 with reasoning that the net force and mass increase together in the same proportion.