Newton’s third law: interaction pairs

Student activity • observation and reasoning

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The question

How can equal interaction forces produce different changes in motion?

Compare two connected force meters, then draw interaction pairs on separate objects.

Equipment

- Two suitably rated force meters and short connecting loop
- Booklet, ruler and interaction diagrams

Keep meters low over the bench, use small steady pulls and stay below the lower rated maximum. Do not jerk, release stretched meters or attach them to people.

Course coverage: Physics only: 1.29P. Newton’s third law.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Check two matching force meters are zeroed and undamaged. Connect their hooks with a short secure loop, keeping the meters horizontal just above the bench.

2. One partner holds each outer end. Increase the pull gently through three low readings within the lower meter rating, then ease it off. Do not jerk or release a stretched meter.

3. Read both meters at each setting and compare within their scale resolution. Use both readings even when they are not identical.

4. Draw the force exerted by meter A on B and the force exerted by B on A, on separate object diagrams. Label the same interaction type and opposite directions.

5. Apply the idea to a foot pushing backward on the ground and the ground pushing forward on the foot. Explain how the ground's force can accelerate the person.

6. Use a hypothetical light trolley and heavy trolley interacting: the force magnitudes match, but their accelerations differ because their masses differ.

Cleanup

- Ease the force to zero before disconnecting; return meters and loops.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Third-law partners act simultaneously on different objects and are equal in magnitude and opposite in direction. They do not cancel in a single object's resultant. Two meters may show slightly different readings because of zero error or limited resolution; that is not evidence that the law fails.

Setting	Meter A / N	Meter B / N	Comparison
1			
2			
3			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Which objects receive the two interaction forces?

2. Do interaction partners cancel on one trolley?

3. Why might the meter readings differ slightly?

4. Which force pushes a walker forward?

5. For the same force, which of two masses has the larger acceleration?

6. Is the table’s support on a book the partner of Earth’s pull on the book?