

Forces Up Close

Read how one investigation reveals a force pattern.

4.7 "Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each force named in the passage. Circle each observation that shows what a force did to an object, so you can find the pattern.

Maya Tests a Magnet

- ① Maya planned an investigation about magnetism. She asked, "How does the distance between a bar magnet and a paper clip affect the paper clip?" She placed a ruler on her desk and set one paper clip at the zero mark. Each trial began with a gap between the magnet and clip. She kept the same magnet, clip, and tabletop for every trial.
- ② Maya tested starting distances of 10, 8, 6, 4, and 2 centimeters. Before each trial, she separated the clip from the magnet, returned it to zero, and positioned the magnet at the new distance. She held the magnet still and watched. At 10 and 8 centimeters, the clip stayed still. At 6 centimeters, it slid toward the magnet. At 4 and 2 centimeters, it moved quickly and stuck to the magnet. She recorded each observation.
- ③ Maya found a pattern: the clip moved only when the magnet was close enough, and it moved more strongly at closer distances. Magnetism acted at a distance because the magnet did not need to touch the clip to pull it. If Maya changed the paper clip or used a different magnet, she would need to make a new fair comparison. Gravity also pulls objects without touching them, while friction happens when surfaces touch.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What question was Maya trying to investigate?

2 Name two things Maya kept the same. What did she change during her trials?

3 Give two observations that support Maya's pattern about distance and magnetism.

4 Which forces in the passage act at a distance, and which force happens through contact?

3 YOUR TURN

Your own words

Plan and conduct a friction investigation with a toy car on three teacher-approved horizontal surfaces. Teacher supplies the same car, a stable secured low ramp, metric ruler and three long level test lanes, such as tile, cardboard and carpet. Pretest the lanes so the car can stop within each; keep people out of the path. Place each surface flush at the ramp bottom. Set and keep the ramp top 10 cm above the floor. Plan what changes and what stays the same in the table. Then release the same car from the marked ramp-top position without pushing. Measure from ramp bottom to the car's front when it stops. Repeat three times per surface. In the table record all three actual distances with cm and an observation; add paper if needed. Compare the repeated results and write one conclusion about how surface contact affects motion, citing your evidence. If a car passes a lane end, record that limit and ask the teacher to extend the lane or lower the SAME ramp setting for ALL surfaces before restarting.

SURFACE YOU CHANGE	WHAT YOU KEEP THE SAME	THREE ACTUAL DISTANCES (CM)	WHAT YOU OBSERVE

PART 1 • READ AND MARK

Underline each force named in the passage. Circle each observation that shows what a force did to an object, so you can find the pattern. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What question was Maya trying to investigate?	She investigated how the distance between a bar magnet and a paper clip affects the paper clip.
2	Name two things Maya kept the same. What did she change during her trials?	She kept the same magnet, paper clip, and tabletop. She changed the distance between the magnet and the clip.
3	Give two observations that support Maya's pattern about distance and magnetism.	At 10 and 8 centimeters, the clip stayed still. At 4 and 2 centimeters, it moved quickly and stuck to the magnet. Also accept the 6-centimeter observation.
4	Which forces in the passage act at a distance, and which force happens through contact?	Magnetism and gravity act at a distance. Friction happens through contact between surfaces.

PART 3 • YOUR TURN (SAMPLE ANSWER)

SURFACE YOU CHANGE	WHAT YOU KEEP THE SAME	THREE ACTUAL DISTANCES (CM)	WHAT YOU OBSERVE
smooth tile	same car, ramp, release position; no push	record actual 3 distances	compare where car stops
cardboard	same car, ramp, release position; no push	record actual 3 distances	compare where car stops
carpet	same car, ramp, release position; no push	record actual 3 distances	compare where car stops

Preserve all four correct source answers. For Your Turn, require the actual plan, nine measured stopping distances and a supported pattern/conclusion, not only this planning template. Observe the same car/ramp/release position without pushes and only surface changing. Accept any actual ordering or inconclusive result with control checks; do not prescribe which surface must win. Example conditional conclusion: if carpet repeatedly gives shorter distances than tile, its greater resistance to rolling is consistent with stronger contact effects in this setup. Retain the original magnet investigation as evidence analysis; no demand to test every force. Teacher pretests/securing the ramp and safely stopping the car make the conduct feasible.