Design for Relief

Use test evidence to improve an ergonomic device.

HAP.5.8 "Enrichment: Use an engineering design process to develop effective ergonomic devices to prevent muscle fatigue and strain (e.g., carpal tunnel, exoskeletons for paralysis, or training plans to prevent strains/sprains/cramps).*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the design constraints, underline test evidence, and write 1 beside the first prototype and 2 beside its revision. These marks will help you track how test results shape the device.

A Better Editing Setup

1. During a school video project, Maya notices that long editing sessions leave her wrist aching. Repeated mouse use can tire forearm muscles, especially when the wrist stays bent or the hand grips tightly. Tingling or numbness may signal nerve irritation and should be reported to a health professional, not treated as ordinary fatigue. Maya's team frames an engineering problem: reduce wrist strain during editing without making the mouse hard to control. Their device must fit different forearm lengths, stay stable on a desk, cost under fifteen dollars, and leave the fingers free to click.

2. The team sketches a padded forearm support that slides to change its position and lets the wrist stay near a straight, relaxed position. They build a prototype from cardboard, foam, and reusable fasteners. To test it, three volunteers complete the same ten-minute editing task with and without the support, taking breaks between trials. Each volunteer rates forearm effort from zero to ten after each trial, while a partner counts missed clicks. The team also checks whether the support slips or presses on the wrist. Ratings are personal reports, so the team uses them as clues, not proof of injury prevention.

3. With the prototype, two volunteers report lower effort, but the third reports higher effort and misses more clicks. The team watches that volunteer's setup and finds that the fixed pad edge pushes against the wrist when the mouse moves sideways. They revise the prototype by shortening the pad so it supports the forearm without contacting the wrist, then repeat the same test with the same volunteers. The third volunteer now reports lower effort and misses no extra clicks. The result supports further testing, not a claim that the device prevents carpal tunnel syndrome. Longer trials and more users would help check both comfort and control.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which two design constraints could the team check during a desk trial, and how could they check each one?

2. Why did the team count missed clicks as well as collect effort ratings?

3. Which test result revealed a problem with the first prototype, and what observation explained it?

4. How did the revision address the problem, and why do the results not prove the device prevents carpal tunnel syndrome?

3 YOUR TURN

Your own words

A cafeteria worker repeatedly grips tongs to serve food. In four or five sentences, propose an ergonomic device, name one constraint, describe a fair test using two measures, and explain when you would revise the device.

Design for Relief

PART 1 · READ AND MARK

Circle the design constraints, underline test evidence, and write 1 beside the first prototype and 2 beside its revision. These marks will help you track how test results shape the device. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which two design constraints could the team check during a desk trial, and how could they check each one?	**They could check whether the support stays stable by watching for slipping and whether fingers remain free to click by observing mouse use.**
2	Why did the team count missed clicks as well as collect effort ratings?	**The device needed to reduce effort without making the mouse harder to control. Missed clicks gave the team a way to check control.**
3	Which test result revealed a problem with the first prototype, and what observation explained it?	**One volunteer reported higher effort and missed more clicks. The pad edge pushed against that volunteer's wrist during sideways mouse movements.**
4	How did the revision address the problem, and why do the results not prove the device prevents carpal tunnel syndrome?	**Shortening the pad kept it from contacting the wrist. A brief test with three volunteers cannot establish that the device prevents a medical condition.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would make a removable, washable sleeve that widens the tong handles so the worker can grip them with less force. The sleeve must stay secure and be safe to clean for food service. The worker would move the same number of items with the same tongs before and after adding the sleeves, taking a rest between trials. After each trial, the worker would rate hand effort from zero to ten, and I would count dropped items. If effort falls but drops rise, I would change the sleeve texture and repeat the test.

Accept other feasible constraints and observations that are supported by the passage. For the open task, look for a device that addresses grip strain, a practical constraint, a comparable test with two measures, and a revision tied to a possible result.