Grip Force Mystery

Use sensor data to investigate muscle fatigue

HAP.5.6 "Use technology to plan and conduct an investigation that demonstrates the physiology of muscle contraction, muscle fatigue, or muscle tone. Collect and analyze data to interpret results, then explain and communicate conclusions."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the tools used to measure or time the test, underline what Maya keeps the same, and number the four force readings in the order she collects them. Use your marks to trace how her grip force changes.

What Happens to Grip Force?

1. At a school sports lab, Maya tests whether repeated gripping reduces the force her hand can produce. She connects a handgrip force sensor to a laptop that displays force in newtons (N). A timer sets each interval. She keeps the same hand, grip position, and sensor settings for every trial so the readings can be compared.

2. First, Maya squeezes as hard as she can for five seconds and records the highest force. She then makes repeated squeezes for 30 seconds and takes another five-second maximum reading. She repeats the 30-second squeezing period and maximum test, rests for two minutes, and tests once more. The table shows one participant's readings.

ONE PARTICIPANT'S HIGHEST GRIP FORCE

Test point	Peak force (N)
Before repeated squeezes	280
After 30 seconds of squeezing	235
After 60 seconds of squeezing	195
After two minutes of rest	260

3. A peak-force reading is the highest force during a test, not a measure of nerve signals or the amount of energy stored in muscle cells. A lower force after activity can be consistent with muscle fatigue, but this sensor alone cannot identify its cause. One participant's results also may not represent everyone's response.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which tool measures grip force, and which tool sets the intervals?

2. How does peak force change from before the repeated squeezes to after 60 seconds of squeezing? Give the change in newtons.

3. Compare the reading after rest with both the reading after 60 seconds of squeezing and the starting reading. Use numbers.

4. What conclusion about muscle fatigue do these results support? What cause of the change can the sensor data not establish?

3 YOUR TURN

Your own words

Plan a follow-up test to find out whether a longer rest changes grip-force recovery. In four or five sentences, state a prediction, name what you will change and measure, describe how you will keep the test fair and collect data, and explain what results would support your prediction.

ANSWER KEY

Grip Force Mystery

HIGH SCHOOL · HAP.5.6

PART 1 · READ AND MARK

Circle the tools used to measure or time the test, underline what Maya keeps the same, and number the four force readings in the order she collects them. Use your marks to trace how her grip force changes. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which tool measures grip force, and which tool sets the intervals?	**The handgrip force sensor measures force, and the timer sets the intervals.**
2	How does peak force change from before the repeated squeezes to after 60 seconds of squeezing? Give the change in newtons.	**Peak force decreases from 280 N to 195 N, a drop of 85 N.**
3	Compare the reading after rest with both the reading after 60 seconds of squeezing and the starting reading. Use numbers.	**After rest, peak force is 260 N. That is 65 N above the 195 N reading after squeezing but 20 N below the 280 N starting reading.**
4	What conclusion about muscle fatigue do these results support? What cause of the change can the sensor data not establish?	**The drop during repeated squeezing and partial recovery after rest are consistent with temporary muscle fatigue. Force data alone cannot identify the nerve or muscle-cell processes that caused the change.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I predict that five minutes of rest will bring peak grip force closer to its starting value than two minutes of rest. On two separate days, I will use the same hand, grip position, sensor settings, and squeezing periods, changing only the rest time. A timer will set the periods, and the sensor will record peak force before squeezing, after squeezing, and after rest on each day. I will compare each post-rest reading with its starting reading. If the five-minute reading is closer to its starting value, the results will support my prediction.

Accept equivalent calculations and conclusions supported by the table. For the follow-up plan, look for two rest durations, a grip-force measure, consistent testing conditions, and a comparison that accounts for each session's starting force.