Reflex in Frames

Plan a fair test and graph visible response times.

HAP.6.5 "Enrichment: Plan and conduct an experiment to test reflex response rates under varying conditions. Using technology, construct graphs in order to analyze and interpret data to explain and communicate conclusions."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the condition that changes, circle two features kept the same, and number the steps used to turn video frames into a comparison graph.

Does Hand Clasping Change a Knee Reflex?

1. A tap below the kneecap stretches a thigh muscle and triggers a spinal reflex that extends the lower leg. A student tests whether clasping both hands changes the time from a tap to the first visible leg movement. One volunteer sits with legs hanging freely. The student records video at 250 frames per second, so each frame lasts 4 milliseconds.

2. For each trial, the student taps the same spot with the same reflex hammer while the volunteer either rests both hands or clasps and pulls them. The student alternates conditions and records four trials per condition. Video software marks the tap frame and the first motion frame. Each time equals the frame gap multiplied by 4 milliseconds.

TIME FROM TAP TO FIRST VISIBLE LEG MOVEMENT

Trial	Hands resting (ms)	Hands clasped (ms)
1	120	116
2	128	120
3	124	124
4	132	120

3. The table shows one volunteer's results. To compare conditions, the student will enter the times into a spreadsheet, calculate each condition's mean, and make a bar graph of the two means. A shorter time means a quicker visible response, not necessarily a faster nerve signal. Tap strength and video judgment can affect times; one volunteer cannot represent everyone.

2 ANSWER WITH EVIDENCE

Use the passage

1. If a tap appears at frame 40 and leg movement begins at frame 71, what response time should the student record? Show your calculation.

2. Calculate the mean time for each condition. What labels and values should the student use for a bar graph of the means?

3. What do the results suggest about visible response time when hands are clasped? Give one reason the student should limit the conclusion.

4. How could the student reduce one possible source of error in a repeat test? Explain how your change would help.

3 YOUR TURN

Your own words

Plan a safe follow-up with a partner that changes a condition not used in the passage. In one paragraph, state your prediction, what you will keep the same, how you will collect at least four trials per condition, how you will use technology to make a labeled graph, and what result would support your prediction.

ANSWER KEY

Reflex in Frames

PART 1 · READ AND MARK

Underline the condition that changes, circle two features kept the same, and number the steps used to turn video frames into a comparison graph. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	If a tap appears at frame 40 and leg movement begins at frame 71, what response time should the student record? Show your calculation.	**71 − 40 = 31 frames; 31 × 4 ms = 124 ms.**
2	Calculate the mean time for each condition. What labels and values should the student use for a bar graph of the means?	**Hands resting: 126 ms. Hands clasped: 120 ms. Label the horizontal axis by hand condition and the vertical axis mean time (ms); plot bars at 126 and 120.**
3	What do the results suggest about visible response time when hands are clasped? Give one reason the student should limit the conclusion.	**The clasped-hands mean is 6 ms shorter, suggesting a quicker visible response for this volunteer. Only one volunteer was tested, and tap strength or frame selection could affect the times.**
4	How could the student reduce one possible source of error in a repeat test? Explain how your change would help.	**Have the same person use the same hammer and practice making similar taps, reducing differences in tap strength between conditions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I predict that closing the volunteer's eyes will not change the knee reflex response time. My partner will sit with legs hanging freely while I tap the same spot with the same hammer. We will record four eyes-open trials and four eyes-closed trials, alternating conditions. I will use video software to measure the time from each tap to the first leg movement. A spreadsheet will calculate the two means and make a bar graph labeled with eye condition and mean time (ms). Similar means would support my prediction.

Accept other reasonable error controls and interpretations grounded in the data. For Part 3, accept a different safe condition if the plan includes repeated trials, controls, a technology-made graph with labeled axes, and a testable prediction.