Turn the Loop

Plan and evaluate a magnetic field investigation

PHY.5.5 "Design and conduct an investigation of magnetic poles, magnetic flux and magnetic field using online simulations, probe systems, and/or laboratory experiences."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the variable deliberately changed, underline two conditions held steady, and number the three measurements in recording order to show how the investigation tests its question.

Does Turning a Loop Change the Field?

1. A student wants to find out whether turning a wire loop changes the magnetic field around a bar magnet or only the magnetic flux through the loop. Magnetic field describes a direction and strength at each point. Outside a bar magnet, its direction runs from the north pole toward the south pole. A compass needle aligns with the local field, while a magnetic field probe can report its strength. Flux describes how much magnetic field passes through an area. It depends on the field strength, the loop's area, and the angle between the field and the loop.

2. In a simulation, fix the magnet and mark one spot near its north pole for the field probe, compass, and center of a small loop. Keep the loop's area, its center, and the magnet fixed. First orient the loop so its flat face points toward the local field direction. Record the probe reading, compass direction, and simulated flux. Then turn the loop by 45 degrees and 90 degrees without moving its center. Repeat each orientation three times. Change only the angle, so a shift in flux can be linked to the turn rather than to distance or area.

3. A loop catches the most flux when its flat face points toward the field direction, so the field passes straight through it. When the loop's flat face lies along the field, little or no field passes through. If the magnet and measuring spot remain fixed, turning the loop should not change the field probe's reading or the compass direction. Record each trial before deciding whether the pattern supports the prediction. If readings disagree across repeated trials, check whether the loop's center drifted, the probe moved, or the simulation used a different scale. Report the measurements and one possible source of error.

2 ANSWER WITH EVIDENCE

Use the passage

1. What is the variable changed on purpose? Name two conditions that must stay fixed to make the comparison fair.

2. Why does the student record both compass direction and field probe strength instead of recording flux alone?

3. Predict what will happen to flux, probe strength, and compass direction as the loop turns from facing the field to lying along it.

4. Suppose one flux reading at 45 degrees differs sharply from the other two. What should the student check before drawing a conclusion, and why?

3 YOUR TURN

Your own words

Design a different simulation investigation to test how distance from a bar magnet affects field strength and flux through a loop. State what you will change and keep fixed, how you will record repeated measurements, and what result would support your prediction.

ANSWER KEY

Turn the Loop

PART 1 · READ AND MARK

Circle the variable deliberately changed, underline two conditions held steady, and number the three measurements in recording order to show how the investigation tests its question. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What is the variable changed on purpose? Name two conditions that must stay fixed to make the comparison fair.	**The loop's angle changes. Its area and center stay fixed. The magnet also stays fixed.**
2	Why does the student record both compass direction and field probe strength instead of recording flux alone?	**The compass and probe check whether the field at the measuring spot changes. Flux alone cannot show whether a change came from the field or the loop's angle.**
3	Predict what will happen to flux, probe strength, and compass direction as the loop turns from facing the field to lying along it.	**Flux will decrease to little or none. Probe strength and compass direction should remain the same because the magnet and measuring spot do not move.**
4	Suppose one flux reading at 45 degrees differs sharply from the other two. What should the student check before drawing a conclusion, and why?	**Check whether the loop's center or probe moved, or whether the simulation scale changed. Any of these could affect the comparison.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will place a field probe and the center of a fixed-size loop at 2 cm, 4 cm, and 6 cm from the magnet's north pole in a simulation. At each position, I will keep the loop's face pointed toward the local field and record field strength and flux three times. I will keep the magnet, probe orientation, and loop area unchanged. I predict that both the probe reading and flux will decrease as distance increases. I will compare the averages at each distance and note any readings that do not agree.

Accept other workable distances and recording methods. The plan should change distance while controlling loop area and orientation, repeat measurements, and compare field strength with flux.