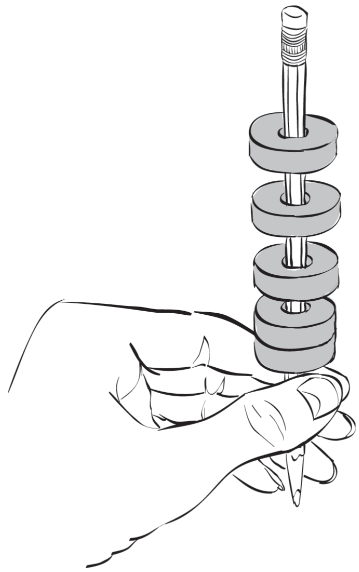
BENCHMARK ASSESSMENT

MAGNETISM AND ELECTRICITY



INTRODUCTION

The Existing FOSS Assessment System. The assessment system incorporated into your © 2000 or © 2005 FOSS Teacher Guide features both formative assessments and summative assessments. The formative assessments are integrated into the instructional sequence, providing opportunities to monitor student progress throughout the module. The single opportunity for summative assessment occurs at the end of the module after instruction is complete. The end-of-module assessment provides a one-time look at student achievement.

The New FOSS Assessment System. The new assessment system still uses the integrated formative assessments throughout the instructional sequence, but the summative assessment tools and procedures have been revised extensively. The summative assessments are different in form, function, and name. The new summative assessments are called **benchmark assessments**, and they include

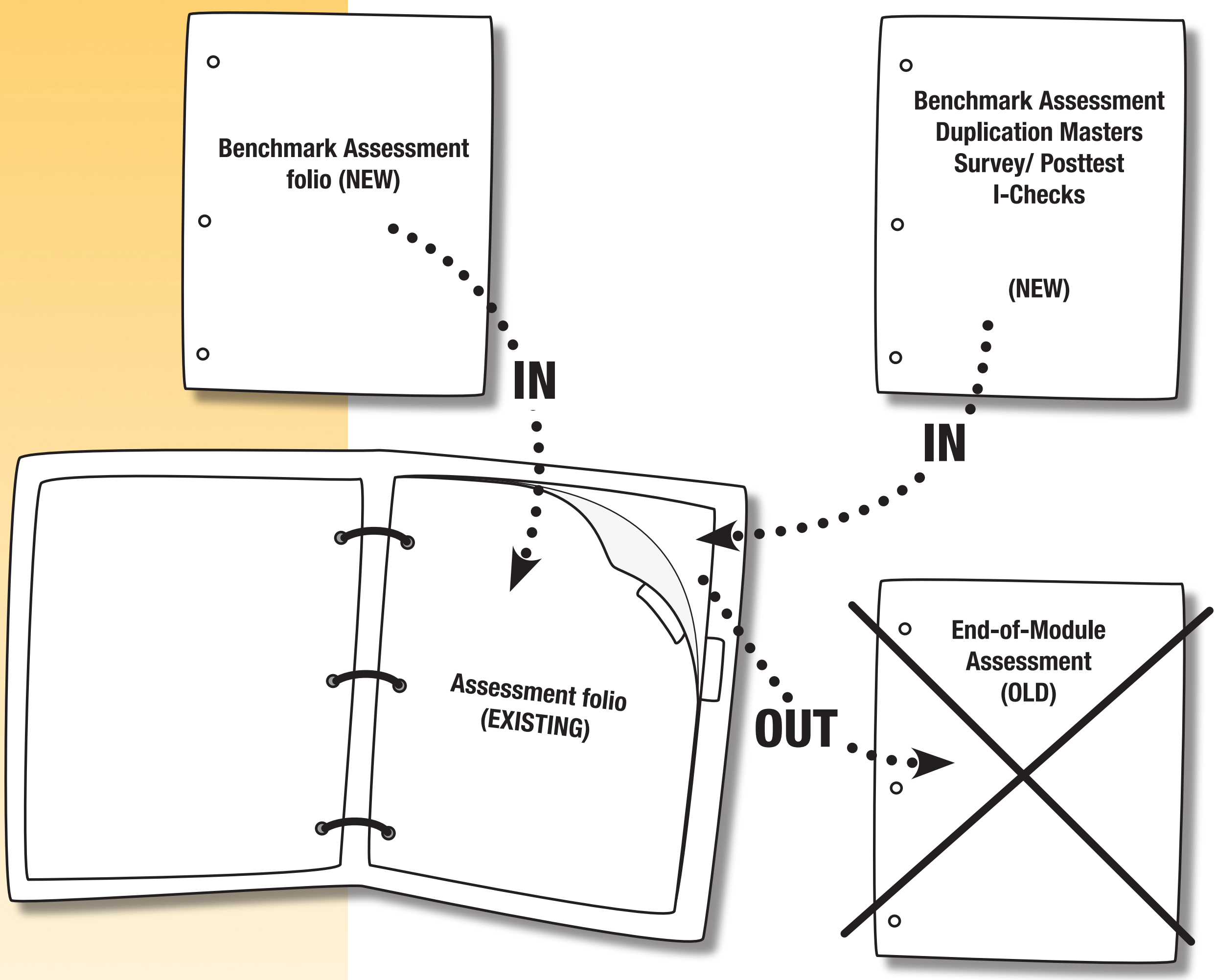
- A **survey (pretest)**, given before instruction begins.
- **I-Checks**, given at the end of each investigation.
- A **posttest**, given after instruction is complete.

BENCHMARK ASSESSMENT CONTENTS

REORGANIZE YOUR TEACHER GUIDE

This new Benchmark Assessment folio can be inserted into your teacher guide just in front of the existing Assessment folio. The formative assessment information and guidance in the existing Assessment folio is still useful and current. The summative assessment information in the existing folio, which pertains to the end-of-module assessment only, should no longer be used. The information and guidance in the remainder of this Benchmark Assessment folio should be used in its place.

The new Benchmark Assessment Duplication Masters can be inserted into the teacher guide in place of the existing End-of-Module Duplication Masters. The new Benchmark Assessment Duplication Masters include the Survey / Posttest and I-Checks.



OVERVIEW

The new FOSS assessment system features **benchmark assessments**. Benchmark assessments are short tests that are given at critical junctures throughout the teaching of a module. The benchmarks serve three functions. First, they provide summative information—achievement data that can be used for grading and accountability. Second, benchmark assessments provide formative information for teachers—diagnostic information that they can use to improve the effectiveness of their teaching. And third, benchmark assessments provide information directly to students, guiding them to think critically about their learning and to revise their thinking about the science being investigated.

This third use of the benchmark assessments is important. Research has shown that self-assessment practices are powerful *instructional* tools for enhancing student learning. These reflective practices help students understand the learning goals and expectations, and take more responsibility for their own learning. Self-assessment also helps students clarify their thinking so they can communicate their understanding of complex ideas more effectively. And self-reflection motivates students to work more thoughtfully and carefully.

Benchmark assessments occur in three places during a module.

- The **survey** is given before instruction begins, and includes 10–15 items, some open-response and some multiple-choice.
- **I-Checks** are given at the end of most investigations. Each I-Check consists of 5–10 items, in multiple formats. I-Checks are so named because students play an active role in checking their own understanding of the concepts being taught.
- The **posttest** is given after the module has been completed. The items are the same ones that appear on the survey.

USING BENCHMARK ASSESSMENTS

SURVEY ASSESSMENT

If you are using the benchmark assessments for school or district accountability purposes, you will need to follow specified procedures, such as those used when giving standardized tests. This means students will read and answer questions without any assistance. If you are using the benchmark assessments in your classroom only, you may want to read the questions out loud and move through the test question by question to minimize the effect of reading proficiency.

The survey is administered a few days before instruction begins. Students are often uneasy having to take a "test" when they haven't yet had the instruction they need to do well. They need to know that the survey is not graded, but will be used to help you determine what students already know and what they need to learn. Help students see the survey as a learning tool. At the end of the module they will get to compare their answers on the survey and the posttest to see how much they have learned. Students have few opportunities to see how their knowledge has changed.

When you administer the survey, encourage students to answer the questions as best they can. Even if they think they don't know the answers, they should try to think about something related that they do know and apply that knowledge. Collect the surveys, code them for diagnostic purposes, but don't make any marks on them. Hold them until after students take the posttest.

I-CHECK ASSESSMENTS

I-Check assessments are administered after you complete most investigations. To track achievement (a summative use), code all of the items using the coding guides in this folio. We recommend that you code one item at a time, across all students. Coding tends to be more consistent across students when you use this method. Even though you have to shuffle papers more, you will find that it actually takes less time to code the assessments overall. This method also allows you to think about the class as a whole and reflect on necessary next steps.

The I-Checks can also be used for formative assessment. Research has shown that students learn more when they take part in evaluating their own responses. The procedure described below has worked for many teachers using the FOSS assessment system.

1. Have students complete the I-Check either unassisted or using a read-aloud strategy with the whole class.
2. Code the I-Check item by item, but do not write codes on students' tests. Record codes in a grading program or grade book. Make notes about each item and identify important points to discuss with students.
3. Return I-Checks to students. Use one of the self-assessment strategies described later in this folio to help students reflect on and refine their thinking.

POSTTEST

Have students take the posttest after all of the investigations are completed. It can be administered in any of the ways described above for the other benchmark assessments. After coding the posttests, return them and the surveys to students. Have them compare their survey and posttest responses. Discuss the changes that have occurred.

Use the posttest for formative evaluation of the module, and make notes about things you might want to focus on the next time you teach the module.

CODING BENCHMARK ITEMS

An item is a question or statement designed to elicit evidence of learning from a student. Usually the items are presented in writing, and students respond by choosing an answer from a list (multiple choice), producing a long or short written answer, or generating another kind of artifact that provides evidence of learning. The quality and reliability of the information accrued from any assessment is directly related to the quality and reliability of the items.

The items in the benchmark assessments have been scrupulously designed and rigorously tested in 48 classrooms with more than 1000 students. As a result, we can be sure that the items will yield the kind of information about student learning that we want them to yield, and that they will produce the valued information time after time in all kinds of situations. In other words, the assessment items are valid and reliable. If they are used as intended in the context of teaching this FOSS module, they will inform you about student learning as you progress through the curriculum, and students will engage the important ideas of science in greater depth and with refreshing clarity.

Student performance on the benchmark assessments exposes the depth of their learning and the degree to which students are meeting the goals of the curriculum. To help you determine how students are performing, this Benchmark Assessment folio contains coding guides for each benchmark item. Coding guides are composed of model student responses. The responses are numbered—the higher numbers are associated with more sophisticated, complete responses—but they are not intended to be scores. Instead, they are numerical codes that refer to the depth and accuracy of a student's conceptual understanding.

Performance on the benchmark assessments can be used as a component of a student's grade, but you should not simply add up the numbers to assign a grade. Instead we suggest that you look at the frequency of the codes. If you see mostly 0s and 1s, the student needs further instruction. If you see mostly 2s, the student is developing science vocabulary and can state a number of scientific facts and simple relationships. If you see 3s, the student is developing the expected conceptual understandings. And if you see 4s, the student is able to apply conceptual knowledge to new situations. A grade should be based on multiple sources of evidence, including factors such as group participation, responsibility for learning, verbal expression, perseverance, and progress, that is, change between a student's starting knowledge and his or her knowledge after instruction.

SELF-ASSESSMENT

Self-assessment is more than reading correct answers to the class and having students mark whether or not they got the right answer. Self-assessment should provide an opportunity for students to think about their answers and to figure out how they could improve their answers. This kind of reflective process also helps students develop a better understanding of what a well-constructed response looks like.

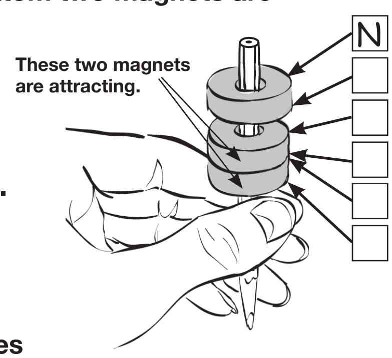
Self-assessment requires deep, thoughtful engagement with complex ideas. It involves students in whole-class or small-group discussion, followed by critical analysis of their own work. For this reason we suggest that you focus your probing discussions on two or three questions from an I-Check, rather than the entire test. The techniques described below are meant to give you a couple of strategies for entering the process of self-assessment. There is no "right way" to engage students in this process, but it seems to work best when you change the process from time to time to keep it fresh.

Review and Critique Anonymous Responses. After you have reviewed student work on an I-Check and have discovered one or more problems in student understanding associated with an item, fabricate three or four "student responses" that mirror the problems you saw in student work. Project these responses for students to read and comment on as a class. Discuss the strengths and weaknesses of each response, and when necessary, have students make suggestions for how to improve them. This is a good strategy to use during the first part of the year to help students better understand what constitutes a well-constructed response. Have students review their own answers, draw a line of learning (see page 9), and revise their answers.

Key Points. After reviewing student work on an I-Check and discovering a consistent problem in student understanding associated with an item, return the unmarked I-Checks to students. Direct their attention to the problematic item and discuss it together. After it is clear that students understand the item prompt, call on individuals or groups to suggest key points that should be included in a complete answer. Write the key points on the board as phrases, and number them.

Here is an example of an item on I-Check 1 from the **Magnetism and Electricity Module**.

20. Look at the picture on the right below. (The top two magnets are pushing apart; the bottom two magnets are stuck together.)



a. Label the poles on each magnet.

b. Explain why you labeled the poles the way you did.

During class discussion, students might generate this list of key points.

1. Every magnet has a north pole and a south pole.
2. Two north poles repel; two south poles repel.
3. A north pole and a south pole attract.

Students then turn to their own I-Checks and rework their responses to item 20b. They endeavor to *confirm* the key points that they included in their original work, *correct* parts of their responses that were wrong, and add key points to *complete* their response until they are satisfied that they have written the best answer possible.

Annotated Revision. One way students can process their work is by using the numbers associated with the key points to annotate their original writing. A number written at the start of a sentence or phrase confirms that the key point was included. Students correct and annotate sentences that don't represent key points. The add more points to the explanation, accompanied by the appropriate number.

Revision with Color. In a similar fashion, students can use color to confirm, correct, and complete the ideas in their original work. For instance, they can use green underlining to confirm key points present in the original writing. A red line through an entry can indicate wrong ideas that need correcting. They can use blue to add missing points to make the explanation complete.

Line of Learning. Many teachers have students use a line of learning to show how their thinking has changed. When students return to original work to revise their understanding of a concept, they start by drawing and dating a line of learning. This line delineates students' original, individual thinking from their thinking after a class or group discussion has helped them refine their thoughts. For example, students can use the line of learning after they use the review and critique strategy or the key points strategy. Students draw a line under their original answer and add any new information they need to make their answer complete. When you look at their responses, you will know what they wrote on their own (above the line) and what they added as a result of discussion (below the line).

January 29, 2007

Focus question. Explain why the two bottom magnets are touching and the top magnet is not touching.

The two bottom magnets stick because they have different poles. Different poles attract. The top magnet has two poles the same. The top magnet is repelling on the bottom two.

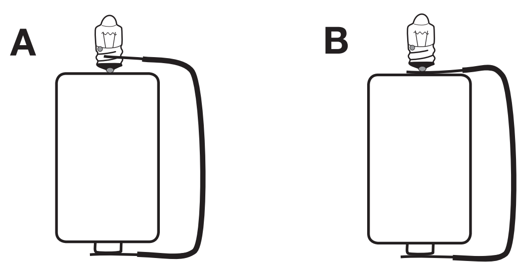
January 30, 2007

The important thing is that every magnet has two different poles. One side is N pole and the other side is S pole. When two N poles are together they repel. When two S poles are together they repel. When one N pole and one S pole are together, the magnets stick because they attract. The two bottom magnets are sticking because they have a S pole and a N pole attracting. The top magnet repels because it has a S pole pointing at a S pole on the two magnets.

Class Debate. When one student volunteers an answer to a question (usually one that many students are having trouble with or that elicits a persistent misconception), that student is in charge of the debate. He or she puts forth an answer or explanation. Other students agree or disagree, but must provide evidence to back up their thinking. Students are allowed to "disagree with themselves" if they hear an argument during the discussion that leads them to change their thinking. You can ask questions to keep the discussion on track, but otherwise you stay on the sidelines.

Critical Competitor. Use the critical competitor strategy when you want students to pay close attention to a specific detail. You need to present students with two things that are similar in all but one or two aspects. For example, if students are not considering contact points on the components of an electric circuit, you can present them with two pictures of circuits that differ only in contact points and ask them to determine which will work and why.

12. Look at the two bulb-and-battery circuits (A and B). Only one will light the bulb. Why does one circuit work, but the other doesn't?



Or if students write descriptions of how a circuit works, you can read one of them out loud and have students draw the circuit to see if the writing describes a complete circuit. The drawing becomes the critical competitor to the writing. You can use any medium; the point is to compare two pieces of communication in a way that helps students focus on the important points they are missing.

Sentence Starters. After class discussion of a response sheet or a notebook sheet, you might want to have students write a short reflection. Sentence starters can help them begin to put their reflections down on paper.

> "I used to think...but now I think..."
> "I should have gotten this one right, I just..."
> "I know...but I'm still not sure about..."
> "The most important thing to remember is..."
> "Can you help me with..."
> "I shouldn't have gotten this one wrong because I knew..."
> "I'm still confused about..."
> "Next time I will remember to..."
> "Now I know..."

Multiple-Choice Discussions. Students sit in groups of three or four, depending on how many possible answers there were for a given question. You assign an answer to each student (not necessarily the answer they chose). Each student is responsible for explaining to the group whether the assigned answer is correct or not and why. Another version of this strategy is to have students meet in different corners of the classroom according to the answer they chose and come up with an argument to convince the rest of the class why that answer is correct. As in class debate, students are allowed to disagree with themselves if in the process of thinking it through they realize they should have chosen a different answer, but then they must also explain why they decided to make the change.

SURVEY/POSTTEST ANSWER SHEET—1 OF 7

MAGNETISM AND ELECTRICITY

ANSWERS

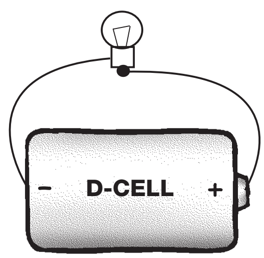
Survey/Posttest

1. Wait for your teacher before you begin. Your teacher will tell you how to complete this item.

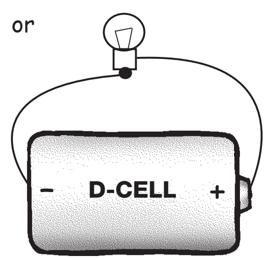
Object	a. Sticks to magnets?	b. Conducts electricity?
Iron nail	Y	Y
Plastic straw	N	N
Steel wire screen	Y	Y
Wooden craft stick	N	N
Brass ring	N	Y

NOTE: *The materials used in this item are provided in the kit. Tell students you will hold up each item for them to see. They should then answer the questions with Y (for yes) or N (for no). Be sure that every student has the opportunity to see each item.*

2. Draw wires to show how you would light the bulb.



or



SURVEY/POSTTEST CODING GUIDES—1 OF 7

1a

Code	If the student...
3	indicates use of the rule “only iron sticks to magnets” (iron nail and steel wire screen).
2	indicates use of the rule “all metals stick” (marks same objects as in 1b).
1	indicates no apparent rule.
0	makes no attempt.

1b

Code	If the student...
3	indicates use of the rule “all metals conduct” (iron nail, wire screen, and brass ring).
2	confuses “what sticks to magnets” rule with what conducts electricity rule (marks same objects as in 1a).
1	provides any other answer.
0	makes no attempt.

2

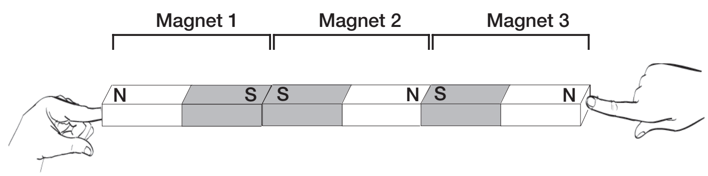
Code	If the student...
3	draws a complete pathway with correct contact points.
2	draws a pathway, but the contact points on the bulb and/or battery are incorrect.
1	provides any other answer.
0	makes no attempt.

SURVEY/POSTTEST ANSWER SHEET—2 OF 7

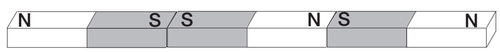
MAGNETISM AND ELECTRICITY

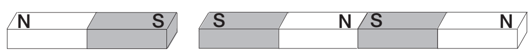
ANSWERS

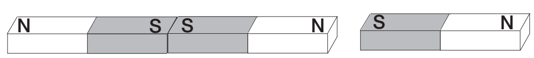
Survey/Posttest

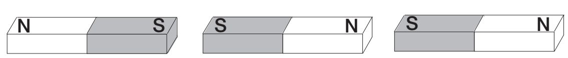


3. Three bar magnets are held together as you see above. What are the magnets going to look like when they are released?

A.


B.


C.


D.


4. Wendy is making an electromagnet. She wrapped a long, insulated wire around an iron nail. What should Wendy do next to complete the electromagnet?

Wendy should hook one end of the wire to the negative side of a D-cell, and the other end of the wire to the positive side of the D-cell.

[Students may suggest including a switch.]

SURVEY/POSTTEST CODING GUIDES—2 OF 7

3

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

4

Code	If the student...
3	indicates that one end of the long wire needs to be attached to one end of the D-cell and the other end of the wire to the other end of the D-cell.
2	indicates that a D-cell needs to be added but gives no other information.
1	provides any other answer.
0	makes no attempt.

SURVEY/POSTTEST ANSWER SHEET—3 OF 7

MAGNETISM AND ELECTRICITY

ANSWERS

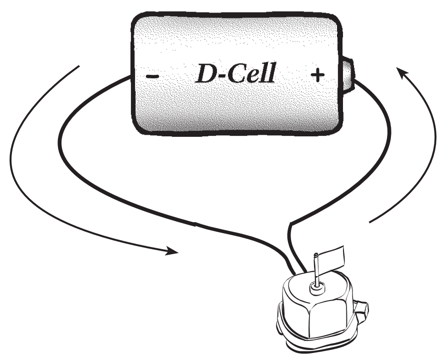
Survey/Posttest

5. Arthur was playing with magnets. He had one magnet on the table, and one in his hand. As he moved the magnet in his hand closer to the one on the table, the magnets suddenly snapped together.

   Explain to Arthur why the magnets snapped together.

   The magnets don't have to touch to attract. When magnets are close together, the force of magnetism pulls them together.

6. Draw arrows on the picture to show which direction electricity flows through the circuit to run the motor.



SURVEY/POSTTEST CODING GUIDES—3 OF 7

5

Code	If the student...
3	indicates that this happens because the magnetic force works at a distance, so magnets do not have to touch to interact.
There is no level 2 for this item.	
1	provides any other answer.
0	makes no attempt.

6

Code	If the student...
2	indicates flow of electricity goes from negative to positive.
1	draws anything else.
0	makes no attempt.

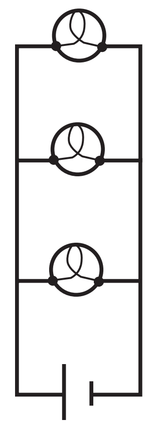
SURVEY/POSTTEST ANSWER SHEET—4 OF 7

MAGNETISM AND ELECTRICITY

Survey/Posttest

ANSWERS

7. Look at the schematic diagram.



- What will happen to the other two bulbs if the middle bulb burns out?

  They will stay lit.

- Why does that happen?

  Each bulb has its own pathway to the D-cell. The bulbs are in a parallel circuit. Bulbs that didn't burn out will continue to shine.

8. Annie was making an electromagnet. She had three rivets that she could use to wrap wire around. One was copper, one was iron, and one was steel. Which rivet or rivets should she use and why?

   Annie should use either the iron rivet or the steel rivet to make the electromagnet. Both iron and steel can be made into temporary magnets.

SURVEY/POSTTEST CODING GUIDES—4 OF 7

7

Code	If the student...
3	indicates that the other two bulbs will remain lit because each bulb has its own pathway to the energy source.
2	indicates that the other two bulbs remain lit because it is a parallel circuit or because the bulbs still get electricity.
1	provides any other answer.
0	makes no attempt.

8

Code	If the student...
4	indicates that both the iron rivet and the steel rivet can be used for the core because both iron and steel can become temporary magnets.
3	indicates that either the iron rivet or the steel rivet can be used for the core; does not state that this is because these metals can become temporary magnets.
2	indicates that any (or all) of the rivets may be used because they are all made of metal.
1	provides any other answer.
0	makes no attempt.

FOSS

SURVEY/POSTTEST ANSWER SHEET—5 OF 7

MAGNETISM AND ELECTRICITY

ANSWERS

Survey/Posttest

9. Imagine you have a box of the following materials: a large iron nail, several permanent magnets, lots of insulated wire, a D-cell, and a switch.

   a. Describe one way to make the nail a temporary magnet.

   Touch or rub the nail with a permanent magnet.

   b. Describe another way to make the nail a temporary magnet.

   Make an electromagnet. Wind the wire around the nail and attach the ends of the wire to the negative and positive terminals of the D-cell. [Students may include a switch in their circuit.]

10. Samuel Morse, the inventor of the telegraph, had a problem. His telegraph's signal was too weak. He needed a stronger electromagnet. What is one way that he might have increased the strength of the electromagnet for his telegraph?

    He could use more winds of wire on the core. **or**

    He could use more or bigger (stronger) batteries.

FOSS Magnetism and Electricity Module

Survey/Posttest
Page 5

SURVEY/POSTTEST CODING GUIDES—5 OF 7

9a

Code	If the student...
3	indicates that a temporary magnet can be made by touching or rubbing the nail with a permanent magnet.
There is no level 2 for this item.	
1	provides any other answer.
0	makes no attempt.

9b

Code	If the student...
3	describes how to make an electromagnet.
2	implies construction of an electromagnet but gives incomplete explanation (e.g. only makes a list of materials).
1	provides any other answer.
0	makes no attempt.

10

Code	If the student...
2	describes one way to make an electromagnet stronger.
1	provides any other answer.
0	makes no attempt.

NOTE: *Students may provide these answers in either order, but codes should be recorded as described here. The code for using a permanent magnet should be recorded as 9a and the code for building an electromagnet should be recorded as 9b.*

MAGNETISM AND ELECTRICITY

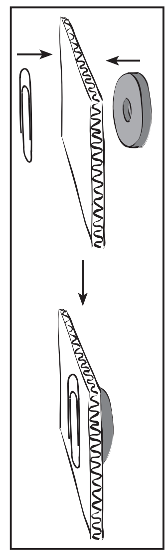
ANSWERS

Survey/Posttest

11. Electricity can be changed into other forms of energy.

    - The bulb in a lamp changes electric energy into light.
    - A motor changes electric energy into motion (or sound).

12. Julie placed a paper clip, piece of cardboard, and magnet together like you see in the pictures.

    Why did the paper clip stay against the cardboard rather than fall to the floor?

    The magnetism goes through the cardboard to make the paper clip stay in place.

SURVEY/POSTTEST CODING GUIDES—6 OF 7

11

Code	If the student...
3	writes that the bulb converts electric energy into light and the motor converts electric energy into motion or sound (movement, spinning, buzzing, etc.).
2	writes that the bulb converts electric energy into light, but that the motor converts electric energy into something other than motion or sound.
1	provides any other answer.
0	makes no attempt.

12

Code	If the student...
3	indicates that the magnetism goes through the cardboard, holding the paper clip in place.
2	indicates that the paper clip is attracted to the magnet because the paper clip is made of iron or steel.
1	provides any other answer.
0	makes no attempt.

SURVEY/POSTTEST ANSWER SHEET—7 OF 7

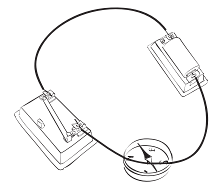
MAGNETISM AND ELECTRICITY

ANSWERS

Survey/Posttest

13. A student set up the circuit you see in the picture. There was a compass sitting on the table next to the circuit. When the student connected the plastic-coated copper wire to the battery, the compass needle moved.

Why did the compass needle move?



(Circle the one best answer.)

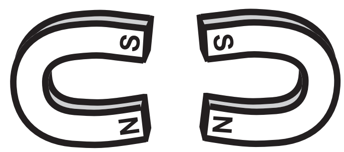
A. Electricity was flowing through the wire to the compass.

B. Magnetic force was flowing from the battery to the compass.

C. The energy flowing through the wire caused the compass to vibrate.

D. Magnetism was created when electricity flowed through the wire.

14. A student placed two horseshoe magnets near each other on a table. What will happen when she lets go of the two magnets?



(Circle the one best answer.)

A. One side of the magnet will repel and the other side will attract.

B. The two magnets will repel and push apart.

C. The two magnets will attract and stick together.

D. The force will be cancelled between the magnets.

15. When black sand and iron filings are mixed together, they look like a black powder. Which of the following would be the easiest way to separate the sand and the filings?

(Circle the one best answer.)

A. Use a magnifying glass.

B. Add water to the mixture.

C. Use a magnet.

D. Use a hot plate to heat the mixture.

SURVEY/POSTTEST CODING GUIDES—7 OF 7

13

Code	If the student...
2	circles D.
1	circles A, B, C, or more than one answer.
0	makes no attempt.

14

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

15

Code	If the student...
2	circles C.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

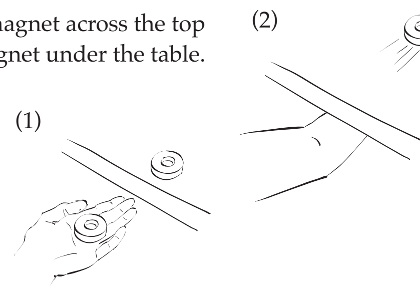
INVESTIGATION 1 I-CHECK ANSWER SHEET—1 OF 5

I-CHECK

Investigation 1—The Force

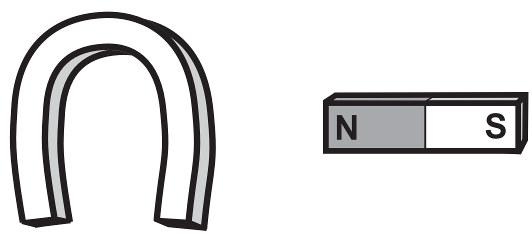
ANSWERS

16. José discovered that he could move a magnet across the top of a wood table by moving another magnet under the table.



Explain why José is able to move the magnet on top of the table without touching it.

The magnetism goes through the table, so the magnets can push and pull each other even though the table is in between.



17. Kari has a horseshoe magnet, but she isn't sure which pole is the north pole. She also has a bar magnet marked N and S.

How can Kari use her bar magnet to find out which pole of the horseshoe magnet is north?

Kari can move the north pole of the bar magnet toward one end of the horseshoe magnet. If the magnets repel, the pole on the horseshoe magnet is the north pole. **or**

Kari can find the pole on the horseshoe magnet that attracts the S pole of the bar magnet. That pole is the N pole because opposite poles attract.

INVESTIGATION 1 I-CHECK CODING GUIDES—1 OF 5

16

Code	If the student...
2	implies that the magnetism can go through the table.
1	provides any other answer.
0	makes no attempt.

17

Code	If the student...
3	writes a procedure that uses the bar magnet in an appropriate way to apply the rule that opposite poles attract and like poles repel.
2	writes a procedure that uses the bar magnet in an appropriate way; does not include how to tell which pole is north or south.
1	provides any other answer.
0	makes no attempt.

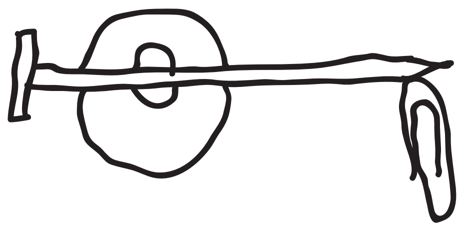
INVESTIGATION 1 I-CHECK ANSWER SHEET—2 OF 5

I-CHECK

Investigation 1—The Force

ANSWERS

18. Anne is investigating objects and magnets. She recorded this in her notebook.



I was surprised! A nail was stuck to the magnet. When I accidentally touched the nail to a paper clip, the paper clip stuck to the nail. I wonder what's going on.

a. Explain to Anne why the paper clip stuck to the nail.

When a steel nail is stuck to a magnet, the nail becomes a temporary magnet. When the nail touches the steel paper clip, the paper clip sticks because steel (iron) objects stick to magnets.

b. If Anne touched the nail to a copper penny, what do you think would happen and why?

The copper penny would not stick. Only iron and steel objects stick to magnets.

INVESTIGATION 1 I-CHECK CODING GUIDES—2 OF 5

18a

Code	If the student...
4	indicates that when the magnet interacts with a steel (iron) nail, the nail becomes a temporary magnet and that the steel (iron) paper clip then sticks to the magnetic nail.
3	indicates that when the magnet touches the nail, the nail becomes a temporary magnet (does not have to use the word "temporary," but implication should be clear).
2	has the right idea but gives unclear explanation (e.g. "the magnet sticks to the nail, so the magnet helps the nail get some power and then the paper clip is stuck to the nail").
1	provides any other answer.
0	makes no attempt.

18b

Code	If the student...
3	writes that the copper penny will not stick to the nail because only iron sticks to magnets.
2	writes that the copper penny will stick because all metals stick to magnets.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 1 I-CHECK ANSWER SHEET—3 OF 5

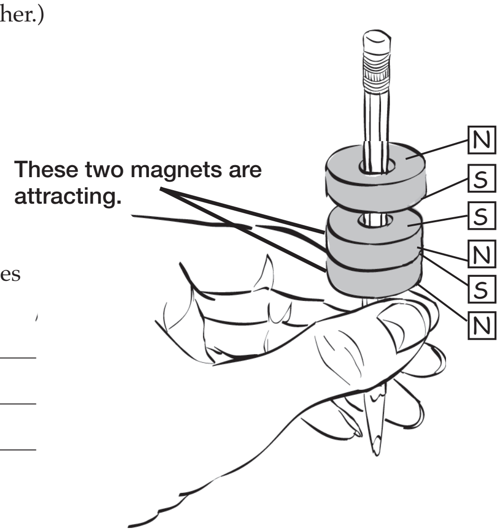
I-CHECK

ANSWERS

Investigation 1—The Force

19. Keys can be made of iron or aluminum.
    - If you want to find out if a key is made of iron, what can you do?
      Test the key with a magnet.
    - How will you know if the key is made of iron?
      If the key sticks to the magnet, the key is made of iron.

20. Look at the picture on the right below. (The top two magnets are pushing apart; the bottom two magnets are stuck together.)
    a. Label the poles on each magnet.



    b. Explain why you labeled the poles the way you did.
       Like poles repel and opposite poles attract.

INVESTIGATION 1 I-CHECK CODING GUIDES—3 OF 5

19

Code	If the student...
2	suggests using a magnet and explains that if the key is made of iron, it will stick to the magnet.
1	provides any other answer.
0	makes no attempt.

20a

Code	If the student...
2	labels all poles correctly.
1	provides any other answer.
0	makes no attempt.

20b

Code	If the student...
2	indicates that like poles repel and opposite poles attract.
1	provides any other answer.
0	makes no attempt.

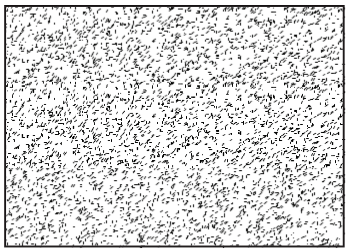
INVESTIGATION 1 I-CHECK ANSWER SHEET—4 OF 5

I-CHECK

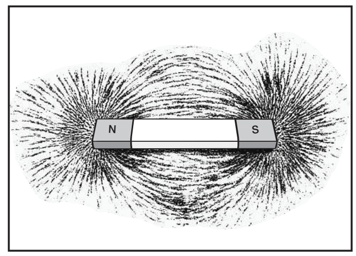
Investigation 1—The Force

ANSWERS

21. Look at the two pictures below.



Plastic container of iron filings

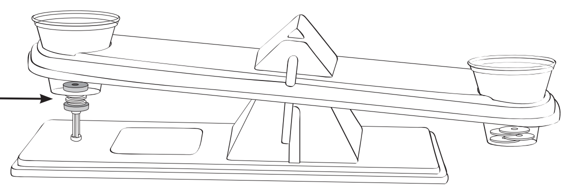


Magnet placed on top of the container

When a magnet is placed on top of the container, the iron filings move into the pattern you see on the right. Why does that happen?

The iron filings line up with the magnetic field (magnetic force) of the magnet.

22. Think about the experiment you did in class using the balance shown in the picture.



a. What is the purpose of putting the spacers between the magnet in the cup and the magnet on the post?

The spacers increase the distance between the magnets.

b. What happens to the force between the magnets as more spacers are added?

The force of attraction between the magnets gets weaker as the distance between them increases.

INVESTIGATION 1 I-CHECK CODING GUIDES—4 OF 5

21

Code	If the student...
3	indicates that the iron filings line up with the magnetic field produced by the bar magnet.
2	indicates that the iron filings are attracted to the magnet *or* that they move because of the magnet.
1	provides any other answer.
0	makes no attempt.

22a

Code	If the student...
3	indicates that the spacers increase the distance between the magnets.
2	indicates that the plastic spacers block the force of magnetism between the magnets.
1	provides any other answer.
0	makes no attempt.

22b

Code	If the student...
3	states the relationship between the force of attraction and the distance: the force of attraction between the magnets gets weaker as the distance between them increases.
2	does not state the relationship but only writes "gets weaker" or "less" or something similar.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 1 I-CHECK ANSWER SHEET—5 OF 5

I-CHECK

ANSWERS

Investigation 1—The Force

23. The Acme Recycling Company recycles cans. Some of the cans are made of aluminum and some are made of iron. Which of the following would be the best way to separate the two types of cans?

(Circle the one best answer.)

A. Use a strong magnet to separate the cans.

B. Heat the cans at high temperature until they melt.

C. Put the cans in water to see which sink and which float.

D. Shine a light on the cans to determine which are aluminum.

24. Sally picked up a doughnut-shaped black object she found lying on the ground at school. Which of the statements below is an observation of the object (not an inference or conclusion)?

(Circle the one best answer.)

A. The object must be a magnet because it picks up steel pins.

B. The object sticks to the refrigerator.

C. One of the children from Sally's class must have lost the object.

D. The object would break in half if it were frozen.

25. Mandy set up an experiment. She recorded her findings in a chart.

	No. of paper clips picked up		
No. of magnets	Trial 1	Trial 2	Trial 3
1	8	9	7
2	13	16	14
3	22	23	24

Which question was Mandy testing?

(Circle the one best answer.)

A. How many paper clips can you pick up with a magnet?

B. How many trials are needed to pick up the most paper clips?

C. Does the strength of magnetism increase if more magnets are used?

D. How can you find the average number of paper clips picked up by magnets?

INVESTIGATION 1 I-CHECK CODING GUIDES—5 OF 5

23

Code	If the student...
2	circles A.
1	circles B, C, D, or more than one answer.
0	makes no attempt.

24

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

25

Code	If the student...
2	circles C.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

INVESTIGATION 2 I-CHECK ANSWER SHEET—1 OF 6

I-CHECK

ANSWERS

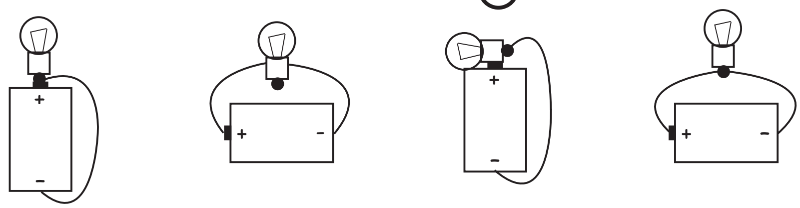
Investigation 2—Making Connections

26. Only one setup below will light the bulb.

- Which setup will light the bulb?

  (Circle the one best answer.)

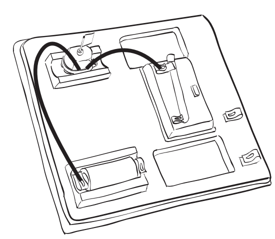
A B C D



- Why is that the only setup that will make the bulb light?

  C is the only circuit in which all of the contact points are correct.

27. Look at the circuit in the picture. It is incomplete.



a. Can you use a piece of string to make the motor run? Why or why not?

No, string is an insulator (not a conductor).

String will not make a complete circuit.

b. Can you use a piece of aluminum foil to make the motor run? Why or why not?

Yes, aluminum foil is metal. All metals conduct. The aluminum foil would complete the circuit.

INVESTIGATION 2 I-CHECK CODING GUIDES—1 OF 6

26

Code	If the student...
3	circles C and gives a reasonable explanation for why it works (includes a reference to contact points or "touching the right places").
2	circles C but gives an explanation that does not include any reference to contact points.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

27a

Code	If the student...
2	indicates that string could not be used because it is an insulator (it is not a conductor and therefore would not complete the circuit).
1	provides any other answer.
0	makes no attempt.

27b

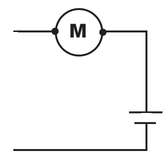
Code	If the student...
2	indicates that aluminum foil could be used because it is metal and all metals conduct electricity.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 2 I-CHECK ANSWER SHEET—2 OF 6

I-CHECK
Investigation 2—Making Connections

ANSWERS

28. Look at the schematic diagram at the right.



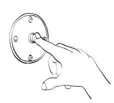
- Will the motor run? *(Circle one.)*

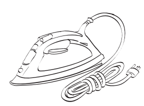
  yes no

- Why did you choose that answer?

  It is not a complete circuit. The pathway for electricity has a break.

29. Each of the objects below converts electric energy into another form of energy. Complete the sentence next to each picture.


A buzzer converts electric energy into sound.


A clothes iron converts electric energy into heat.


A headlamp converts electric energy into light.

INVESTIGATION 2 I-CHECK CODING GUIDES—2 OF 6

28

Code	If the student...
2	circles “no” and states that the circuit is not complete or a wire is missing.
1	provides any other answer.
0	makes no attempt.

29

Code	If the student...
3	writes the correct energy conversions for each item: buzzer—sound or noise; clothes iron—heat or warmth; headlamp—light.
2	writes the correct energy conversion for one or two of the objects.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 2 I-CHECK ANSWER SHEET—3 OF 6

I-CHECK

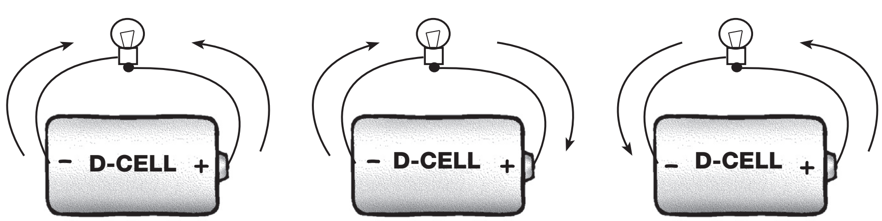
ANSWERS

Investigation 2—Making Connections

30. Which picture has arrows that show how electricity flows through a bulb and battery circuit?

(Circle the one best answer.)

A B C



31. Think about a complete circuit.

a. What does the D-cell do in a complete circuit?

The D-cell provides electricity to the circuit.

b. What do the wires do in a complete circuit?

The wires provide a pathway for the electricity to flow in the circuit.

c. What does a switch do in a complete circuit?

A switch opens and closes the circuit (turns it on and off).

INVESTIGATION 2 I-CHECK CODING GUIDES—3 OF 6

30

Code	If the student...
2	circles B.
1	circles A, C, or more than one answer.
0	makes no attempt.

31a

Code	If the student...
2	indicates that the D-cell provides electricity to the circuit.
1	provides any other answer.
0	makes no attempt.

31b

Code	If the student...
2	indicates that the wires provide a pathway for the electricity.
1	provides any other answer.
0	makes no attempt.

31c

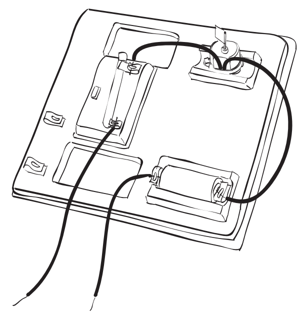
Code	If the student...
2	indicates that a switch opens and closes the circuit or turns the flow of electricity on and off.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 2 I-CHECK ANSWER SHEET—4 OF 6

I-CHECK

ANSWERS

Investigation 2—Making Connections



32. Lee has an object he wants to test to see if it is an insulator or a conductor. He is going to use the setup you see in the picture.

    a. Describe how he can use the setup to test the object.

    He should put one of the loose wires on one part of the object and the other loose wire on another part of the object (and see if it completes the circuit).

    b. How will he know if the object is a conductor?

    If the motor runs, the object is a conductor.

33. Paul wrote in his science notebook.

    All metals stick to magnets. All metals conduct electricity.

    That's easy to remember!

    Paul is a little confused. Rewrite the first two sentences so that they are correct.

    Only iron and steel stick to magnets. All metals conduct electricity.

INVESTIGATION 2 I-CHECK CODING GUIDES—4 OF 6

32a

Code	If the student...
3	suggests putting the item between the loose wires (to complete the circuit).
2	suggests an incomplete procedure (e.g. suggests putting the item across the switch but does not connect the wires).
1	provides any other answer.
0	makes no attempt.

32b

Code	If the student...
2	indicates that the item is a conductor if the motor runs.
1	provides any other answer.
0	makes no attempt.

33

Code	If the student...
2	writes that only iron (and steel) sticks to magnets but that all metals conduct electricity.
1	provides any other answer.
0	makes no attempt.

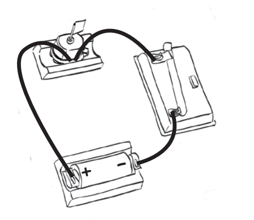
INVESTIGATION 2 I-CHECK ANSWER SHEET—5 OF 6

I-CHECK

ANSWERS

Investigation 2—Making Connections

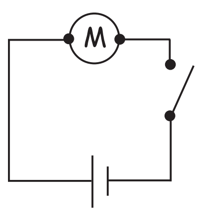
34. a. Describe how you would trace the flow of electricity in the circuit you see in the picture.



Start at the negative terminal of the D-cell. Follow the wire to the switch, then to the motor, and then back to the positive terminal of the D-cell.

[Students could choose to start at any point in the circuit.]

b. Draw a schematic diagram of the circuit shown above.



INVESTIGATION 2 I-CHECK CODING GUIDES—5 OF 6

34a

Code	If the student...
3	knows electricity flows from negative to positive; may make minor errors in description of flow through the circuit.
There is no level 2 for this item.	
1	provides any other answer (e.g. describes flow of electricity from both ends of the D-cell to the motor).
0	makes no attempt.

34b

Code	If the student...
3	draws schematic diagram correctly, using appropriate symbols.
2	makes minor errors in the schematic diagram (e.g. puts contact points on battery symbol at ends instead of sides).
1	draws schematic diagram any other way (including using pictures instead of symbols).
0	makes no attempt.

INVESTIGATION 2 I-CHECK ANSWER SHEET—6 OF 6

I-CHECK

ANSWERS

Investigation 2—Making Connections

35. A toaster oven changes electric energy to

(Circle the one best answer.)

A. sound energy.
B. heat energy.
C. magnetic energy.
D. solar energy.

36. Which of the materials below is a good conductor of electricity?

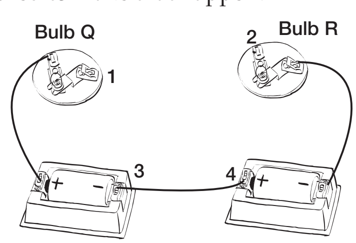
(Circle the one best answer.)

A. glass
B. rubber
C. wood
D. metal

37. Mark wants to complete the circuit you see in the picture to make only bulb Q light up. Where should another wire be attached to make that happen?

(Circle the one best answer.)

A. between point 1 and point 2
B. between point 2 and point 3
C. between point 1 and point 3
D. between point 2 and point 4



INVESTIGATION 2 I-CHECK CODING GUIDES—6 OF 6

35

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

36

Code	If the student...
2	circles D.
1	circles A, B, C, or more than one answer.
0	makes no attempt.

37

Code	If the student...
2	circles C.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

INVESTIGATION 3 I-CHECK ANSWER SHEET—1 OF 5

I-CHECK

ANSWERS

Investigation 3—Advanced Connections

38. Which statement best describes how electricity flows through a circuit that makes a buzzer sound? Electricity flows from

(Circle the one best answer.)

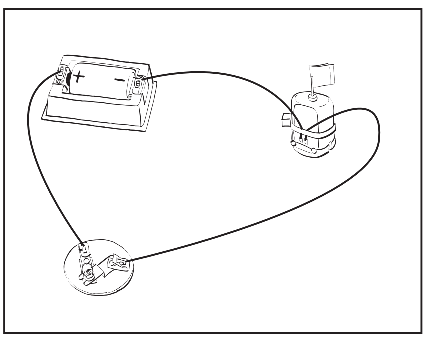
A. both the negative and positive ends of the battery to the buzzer.

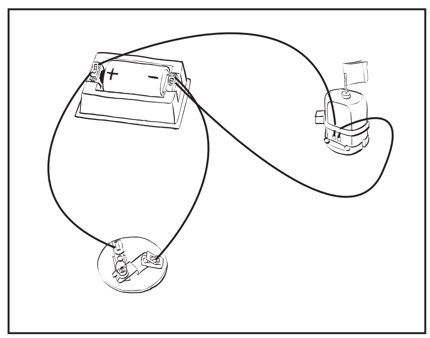
B. the negative terminal of the battery to the buzzer to the positive terminal of the battery.

C. the positive terminal of the battery to the buzzer to the negative terminal of the battery.

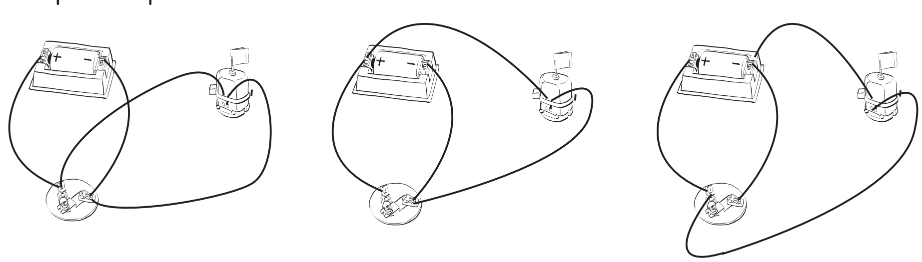
39. a. In the box below, draw wires to connect the motor and bulb in a series circuit.

b. In the box below, draw wires to connect the motor and bulb in a parallel circuit.





other possible parallel circuits



INVESTIGATION 3 I-CHECK CODING GUIDES—1 OF 5

38

Code	If the student...
2	circles B.
1	circles A, C, or more than one answer.
0	makes no attempt.

39a

Code	If the student...
2	draws a series circuit (may include minor errors with regard to contact points).
1	provides any other answer.
0	makes no attempt.

39b

Code	If the student...
3	draws a parallel circuit (may include minor errors with regard to contact points).
2	draws a series circuit or draws a parallel circuit with extra wires.
1	provides any other answer.
0	makes no attempt.

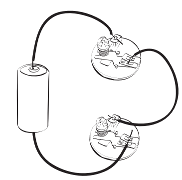
INVESTIGATION 3 I-CHECK ANSWER SHEET—2 OF 5

I-CHECK

ANSWERS

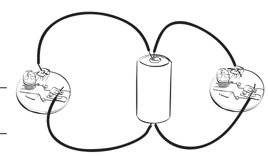
Investigation 3—Advanced Connections

40. When you build a series circuit using two bulbs and one D-cell, the bulbs are dim. When you build a parallel circuit with two bulbs and one D-cell, the bulbs are bright.



- Why are two bulbs in series dim?

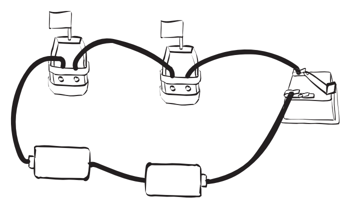
  In series the two bulbs have to share one pathway, so the light is dim.



- Why are two bulbs in parallel bright?

  In parallel each bulb has a direct path to the D-cell (energy source), so both bulbs shine brightly.

41. The switch in the circuit shown at right is open.



Describe what will happen when the switch is closed and explain why.

Nothing will happen (the motors won't run). The D-cells are connected negative terminal to negative terminal, so there is no flow of electricity.

FOSS Magnetism and Electricity Module

Investigation 3 I-Check
Page 2

INVESTIGATION 3 I-CHECK CODING GUIDES—2 OF 5

40

Code	If the student...
3	indicates that in series, bulbs have to share one pathway (electricity), but in parallel each bulb has a direct pathway to the D-cell (minor errors are OK).
2	focuses on structure only (e.g. one wire to bulbs in series, two wires to bulbs in parallel).
1	provides any other answer.
0	makes no attempt.

41

Code	If the student...
3	writes that the motors won't run or nothing will happen (there is no flow of electricity) because the batteries are oriented incorrectly (positive to positive or negative to negative).
2	writes that the circuit will work (the motors will run) because there is a complete pathway between all of the components. [Misses the fact that the batteries are hooked up negative terminal to negative terminal.]
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 3 I-CHECK ANSWER SHEET—3 OF 5

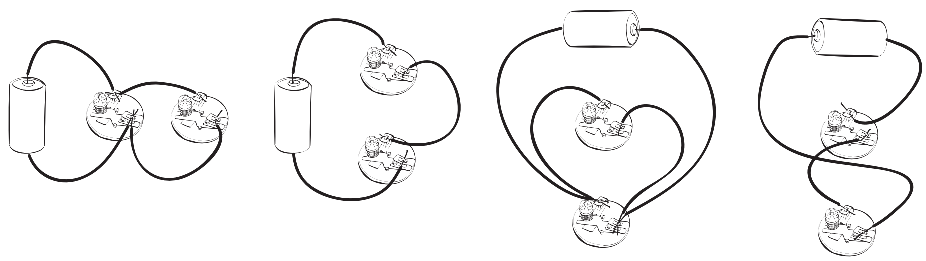
I-CHECK

ANSWERS

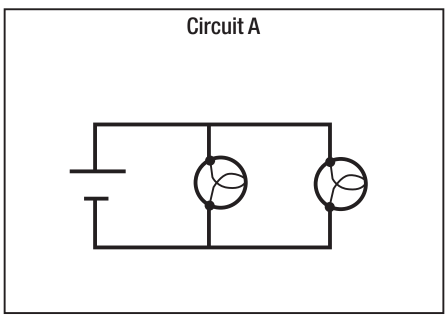
Investigation 3—Advanced Connections

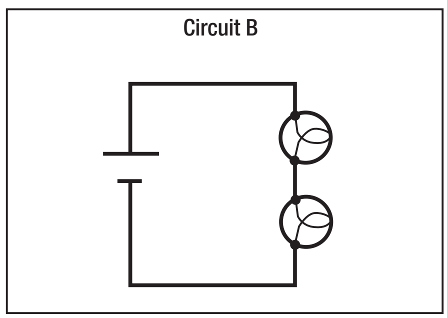
42ab. Look at each circuit below. If it is a series circuit, write S on the line above the drawing. If it is a parallel circuit, write P on the line.

A. P B. S C. P D. S



c. Draw schematic diagrams of circuits A and B in the boxes below.





43. Leslie has two magnets and thin pieces of wood, plastic, aluminum foil, and cloth. She wants to find out if the force of magnetism goes through all of these materials. What do you think she will find out?

The force of magnetism (magnetic field) will go through all of those materials.

FOSS Magnetism and Electricity Module

Investigation 3 I-Check
Page 3

INVESTIGATION 3 I-CHECK CODING GUIDES—3 OF 5

42a

Code	If the student...
2	identifies circuit A as parallel and circuit B as series.
1	provides any other answer.
0	makes no attempt.

42b

Code	If the student...
3	identifies circuit C as parallel and circuit D as series.
There is no level 2 for this item.	
1	provides any other answer.
0	makes no attempt.

42c

Code	If the student...
3	draws the schematic diagrams correctly, using appropriate symbols.
2	makes minor errors in drawing the schematic diagrams (e.g. puts contact points on battery symbol at ends instead of sides).
1	draws schematic diagrams any other way (including using pictures instead of symbols).
0	makes no attempt.

43

Code	If the student...
2	indicates that the force of magnetism (magnetic field) will pass through all of the materials.
1	provides any other answer.
0	makes no attempt.

NOTE: *The coding guide 42a codes the answers for circuits A and B. Coding guide 42b codes the answers for circuits C and D.*

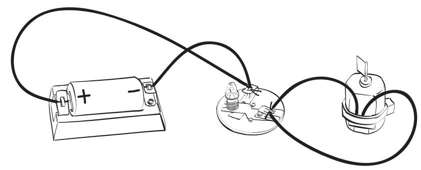
INVESTIGATION 3 I-CHECK ANSWER SHEET—4 OF 5

I-CHECK

ANSWERS

Investigation 3—Advanced Connections

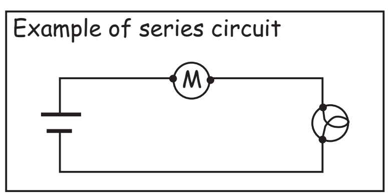
44. Look at the picture to the right.

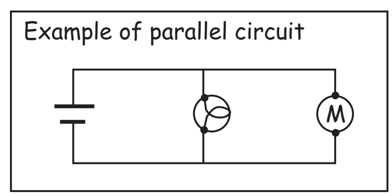


a. The bulb will not light and the motor will not run. Explain why not.

The wires from the battery do not connect to both contact points on the bulb (holder), so the electricity can't go through the bulb or to the motor.

bc. Draw a schematic diagram showing how to build the circuit so both the bulb will light and the motor will run.





45. Billie spilled a box of pins on the floor. She used a magnet to pick them up. She noticed that some of the pins were only touching other pins, but not the magnet.

- What do you think the pins were made of?

  The pins had to be iron or steel (or they wouldn't stick to a magnet).

- Explain why some of the pins Billie picked up could be sticking to other pins, but not directly to the magnet.

  The pins that were stuck to the magnet were turned into temporary magnets, so they attracted the other pins.

INVESTIGATION 3 I-CHECK CODING GUIDES—4 OF 5

44a

Code	If the student...
3	indicates that it won't work because the two wires from the battery go to the same contact point (clip) on the bulb holder, so no electricity is going through the bulb or the motor.
2	indicates that the wires are attached incorrectly; gives no specific information for changes needed.
1	provides any other answer.
0	makes no attempt.

44b

Code	If the student...
2	draws a circuit (either series or parallel) that would both light the bulb and make the motor run.
1	provides any other answer.
0	makes no attempt.

NOTE: *The diagram is coded twice.*

44b codes for whether the circuit will both light the bulb and make the motor run.

44c codes for the quality of the schematic drawing.

44c

Code	If the student...
3	draws a schematic diagram, using appropriate symbols.
2	makes minor errors in drawing the schematic diagram (e.g. puts contact points on battery symbol at ends instead of sides).
1	draws schematic diagrams in any other way (including using pictures instead of symbols).
0	makes no attempt.

45

Code	If the student...
4	writes that when the magnet touches a pin, the pin becomes a temporary magnet, and when that pin touches another pin, it also becomes a temporary magnet, and so forth; must indicate that all the pins that were picked up become temporary magnets.
3	indicates that the pins touching the magnet become temporary magnets; may not be explicit about the pins that were not touching the permanent magnet (does not have to use the word "temporary," but implication should be clear).
2	has the right idea but gives unclear explanation.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 3 I-CHECK ANSWER SHEET—5 OF 5

I-CHECK

ANSWERS

Investigation 3—Advanced Connections

46. Kalli's band uses the system you see pictured below to make their voices louder. The system includes a microphone, an amplifier, and speakers. In this system, which of the following types of energy is used to make a person's voice louder?

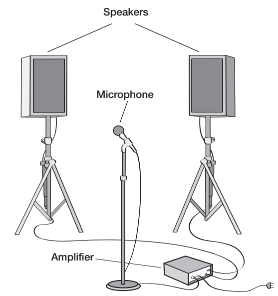
(Circle the one best answer.)

A. electric energy

B. heat energy

C. light energy

D. thermal energy



47. Which statement best describes a parallel circuit?

(Circle the one best answer.)

A. There is one pathway for electricity to flow through.

B. The electricity that flows through the circuit has two sources.

C. Electric energy flows through more than one pathway.

D. The flow of electricity can be changed from one pathway to another.

48. The table shows the amount of time four different batteries powered a small radio.

Battery brand	Number of minutes radio played
W	360
X	640
Y	426
Z	555

Which of the following claims can be made based on the evidence shown on the chart?

(Circle the one best answer.)

A. Brand W caused the radio to sound louder than any other brand.

B. Brand X kept the radio working longer than any other brand.

C. Brand Y was longer lasting than brand Z, but not as long lasting as W.

D. Brand Z cost more to buy than any of the other brands.

INVESTIGATION 3 I-CHECK CODING GUIDES—5 OF 5

46

Code	If the student...
2	circles A.
1	circles B, C, D, or more than one answer.
0	makes no attempt.

47

Code	If the student...
2	circles C.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

48

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

INVESTIGATION 4 I-CHECK ANSWER SHEET—1 OF 7

I-CHECK

ANSWERS

Investigation 4—Current Attractions

49. The rule you use to help you decide whether two magnets will attract or repel when they come close together is ___like___ poles repel and ___opposite___ poles attract.

50. Steve wants to make an electromagnet.

a. Write a letter to Steve describing how to build one.

Sample answer:

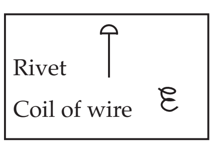
Dear Steve,

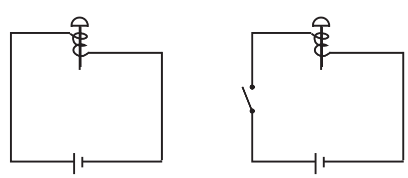
1. Wrap a long insulated wire around a steel rivet.

2. Connect one end of the wire to the positive terminal of a battery.

3. Connect the other end of the wire to the negative terminal.

b. Draw a schematic diagram to show Steve how to make his electromagnet. Use the symbols you already know plus the new ones shown below.





Examples of correct diagrams
(Switch is optional.)

INVESTIGATION 4 I-CHECK CODING GUIDES—1 OF 7

49

Code	If the student...
2	indicates that like poles repel and opposite poles attract.
1	provides any other answer.
0	makes no attempt.

50a

Code	If the student...
3	clearly knows how to build an electromagnet (consider both words and schematic diagram).
There is no level 2 for this item.	
1	provides any other answer.
0	makes no attempt.

50b

Code	If the student...
3	draws a schematic diagram, using appropriate symbols.
2	makes minor errors in drawing the schematic diagram (e.g. puts contact points on battery symbol at ends instead of sides).
1	draws schematic diagrams in any other way (including using pictures instead of symbols).
0	makes no attempt.

INVESTIGATION 4 I-CHECK ANSWER SHEET—2 OF 7

I-CHECK

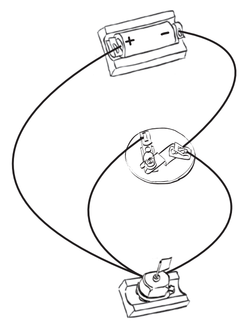
ANSWERS

Investigation 4—Current Attractions

51. When you make an electromagnet, where does the magnetism come from?

The magnetism comes from the electricity flowing through the wires.

52. Look at the picture of the circuit to the right.



- What will happen to the motor if the lightbulb burns out?

  The motor will continue to run.

- Why does that happen?

  This is a parallel circuit so the motor and the bulb have separate pathways to the D-cell. The bulb's burning out does not affect the pathway to the motor.

53. What do you know about making temporary magnets that would help you decide whether to use a brass rivet or an iron rivet for the core of an electromagnet?

I know that only iron or steel can be turned into a temporary magnet, so I need to use iron (or steel) for the core.

INVESTIGATION 4 I-CHECK CODING GUIDES—2 OF 7

51

Code	If the student...
3	indicates that the magnetism comes from the electricity flowing through the wire.
2	indicates that the magnetism comes from the core (steel rivet) of the electromagnet.
1	provides any other answer.
0	makes no attempt.

52

Code	If the student...
3	indicates that the motor will continue to run; explains that each component has its own pathway to the energy source.
2	writes only that it is a "parallel circuit" *or* because the motor still gets electricity.
1	provides any other answer.
0	makes no attempt.

53

Code	If the student...
3	indicates that the core of the electromagnetic must be made of a material that can become a temporary magnet (i.e. iron or steel).
There is no level 2 for this item.	
1	provides any other answer.
0	makes no attempt.

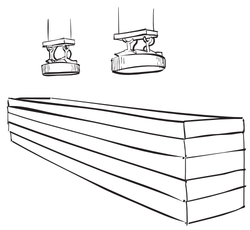
INVESTIGATION 4 I-CHECK ANSWER SHEET—3 OF 7

I-CHECK

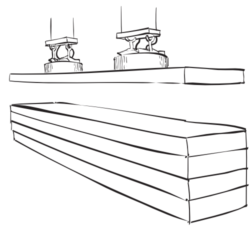
ANSWERS

Investigation 4—Current Attractions

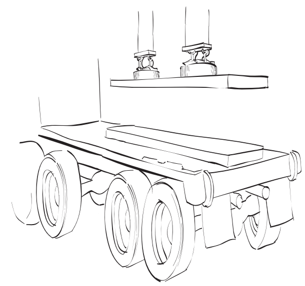
54. The machine you see in the pictures is used to load steel beams onto delivery trucks.



Getting ready to lift a beam



Lifting a beam



Dropping a beam on a truck

There are no hooks or ropes that attach the steel beams to the lifting machine.

How is the machine able to pick up and drop the steel beams?

The machine uses electromagnets. When the electricity is on, strong electromagnets lift the steel beams.

When the electricity is turned off, the magnetism stops, and the beams drop onto the delivery truck.

INVESTIGATION 4 I-CHECK CODING GUIDES—3 OF 7

54

Code	If the student...
3	states that the machine includes electromagnets, that when electricity flows (or is "on") the electromagnets can pick up the steel beams, and that when the electricity stops (is "off"), the steel beams are dropped.
2	implies that it is an electromagnet but does not directly say it (e.g. talks about turning it on or off, opening the switch, etc., but doesn't use the word "electromagnet").
1	provides any other answer.
0	makes no attempt.

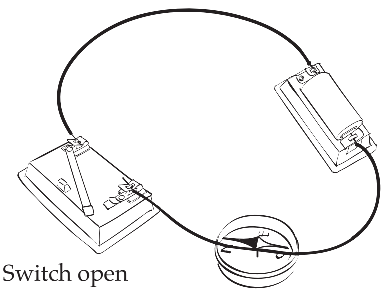
INVESTIGATION 4 I-CHECK ANSWER SHEET—4 OF 7

I-CHECK

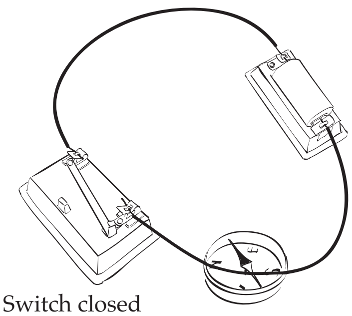
ANSWERS

Investigation 4—Current Attractions

55. If you put a compass under a wire and close a switch so electricity flows through the wire, the compass needle will move.



Switch open



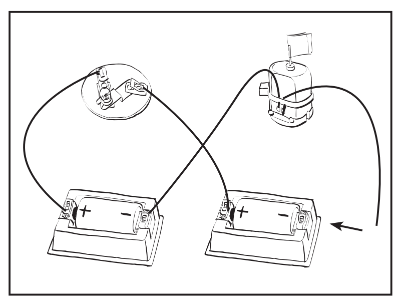
Switch closed

Explain why the compass needle moves.

The electricity flowing in the wire produces a magnetic field (that interacts with the magnetic needle of the compass).

56.
- What will happen when the loose wire on the right side of the motor is connected to the negative terminal of the D-cell as shown in the picture?

  Nothing will happen. (The motor won't run and the bulb won't light.)



- Why do you think that will happen?

  If you follow the pathway from the positive terminal on the left D-cell to the bulb and then to the next D-cell, you will see that the connected terminals are both positive. D-cells have to be connected from positive to negative for electricity to flow.

INVESTIGATION 4 I-CHECK CODING GUIDES—4 OF 7

55

Code	If the student...
3	indicates that the electricity flowing in the wire produces a magnetic field (magnetism).
2	is on track but gives vague or incomplete answer.
1	provides any other answer.
0	makes no attempt.

56

Code	If the student...
3	writes that the circuit won't work because the batteries are oriented incorrectly (positive to positive or negative to negative).
2	writes that the circuit will work (the bulb will light and the motor will run) because there is a complete pathway between all of the components.
1	provides any other answer.
0	makes no attempt.

NOTE: *Even though there is a pathway, it runs from the positive terminal on one D-cell to the positive terminal on the other D-cell. This means there will be no flow of electricity.*

INVESTIGATION 4 I-CHECK ANSWER SHEET—5 OF 7

I-CHECK

ANSWERS

Investigation 4—Current Attractions

57. Lynley made an electromagnet, but it was very weak. Below is a list of ways she thinks might be used to make it stronger.

Help Lynley by marking an X next to each of the ways the strength of an electromagnet can be increased.

(You may mark more than one answer.)

__X__ Increase the number of winds around the core.

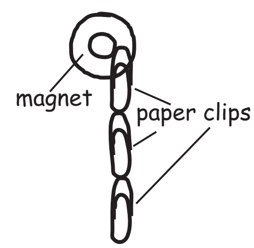
__X__ Use thicker wire.

__X__ Add another D-cell in the circuit.

_____ Add a switch in the circuit.

58. Kurt was investigating which objects stick to magnets. He made an entry in his science notebook and drew a picture to help explain what he did.

I picked up a paper clip with a magnet.
Then that paper clip picked up another one,
and then another one. And they weren't
hooked together either. All they had
to do was touch each other.



Explain to Kurt why he was able to pick up three paper clips, even though the magnet was only touching the first one.

When the first paper clip stuck to the magnet, the paper clip turned into a temporary magnet. When it touched the next paper clip, that one also turned into a temporary magnet. Each paper clip becomes a temporary magnet, so it can stick to other things made of iron.

INVESTIGATION 4 I-CHECK CODING GUIDES—5 OF 7

57

Code	If the student...
3	marks "Increase the number of winds around the core," "Use thicker wire," and "Add another D-cell" only.
2	marks one or two correct answers, but no wrong answer.
1	marks the choices any other way.
0	makes no attempt.

58

Code	If the student...
4	writes that when the magnet interacts with the first paper clip that paper clip becomes a temporary magnet, and when it touches the next paper clip it also becomes a temporary magnet, and so forth; explicitly says that all three paper clips become temporary magnets.
3	indicates that the first paper clip becomes a temporary magnet; is not explicit about the other two (does not have to use the word "temporary," but implication should be clear).
2	has the right idea but gives unclear explanation.
1	provides any other answer.
0	makes no attempt.

INVESTIGATION 4 I-CHECK ANSWER SHEET—6 OF 7

I-CHECK

ANSWERS

Investigation 4—Current Attractions

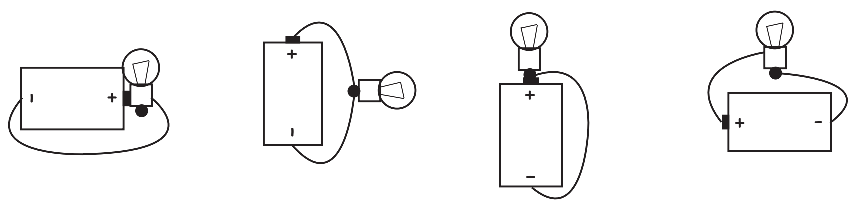
59. Complete the following sentences.

- A hair dryer converts electric energy into heat .
- A doorbell converts electric energy into sound .

60. Only one circuit below will light the bulb. Which one will work?

(Circle the one best answer.)

A B C D



Why is that the only circuit that will work?

It is the only circuit that uses the correct contact points.

INVESTIGATION 4 I-CHECK CODING GUIDES—6 OF 7

59

Code	If the student...
3	indicates that the hair dryer converts electric energy into heat and the doorbell converts electric energy into sound.
2	writes the correct energy conversion for one of the items.
1	provides any other answer.
0	makes no attempt.

60

Code	If the student...
3	circles D; gives a reasonable explanation for why it works (includes a reference to contact points or "touching the right places").
2	circles D; gives explanation that does not include any reference to contact points.
1	circles A, B, C, or more than one answer.
0	makes no attempt.

INVESTIGATION 4 I-CHECK ANSWER SHEET—7 OF 7

I-CHECK

ANSWERS

Investigation 4—Current Attractions

61. Robbie made an electromagnet by winding a coil of insulated wire around a nail. What kind of energy was changed into magnetic energy?

(Circle the one best answer.)

A. heat energy

B. electric energy

C. sound energy

D. light energy

62. The graph shows the results of an investigation with an electromagnet. If 22-gauge wire is used, how many nails will it pick up?

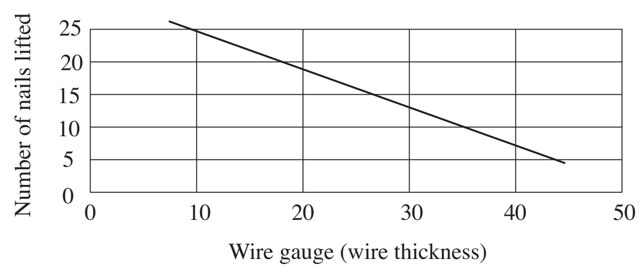
(Circle the one best answer.)

A. 15 nails

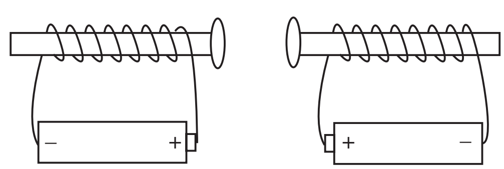
B. 24 nails

C. 18 nails

D. 10 nails



63. Two electromagnets were placed near each other. Which statement about the two magnets is true?



(Circle the one best answer.)

A. The electromagnets will repel each other.

B. The forces of the electromagnets will be cancelled (nothing will happen).

C. The electromagnets will attract.

D. Electricity will flow from one electromagnet to the other.

INVESTIGATION 4 I-CHECK CODING GUIDES—7 OF 7

61

Code	If the student...
2	circles B.
1	circles A, C, D, or more than one answer.
0	makes no attempt.

62

Code	If the student...
2	circles C.
1	circles A, B, D, or more than one answer.
0	makes no attempt.

63

Code	If the student...
2	circles A.
1	circles B, C, D, or more than one answer.
0	makes no attempt.

	Survey Post	Inv 1	Inv 2	Inv 3	Inv 4
CONTENT KNOWLEDGE					
• The magnetic force causes magnetic interactions. • A force is a push or a pull. • The magnetic force acts through space and most materials. • The magnetic force of attraction between two magnets decreases with distance. • Magnetism can be induced only in iron or steel (and a few other metals). • Only iron sticks to magnets. • Iron filings and iron objects can detect a magnetic field. • Two magnets attract or repel when they interact. • Compasses can detect a magnetic field.	1a 3 9a 14 15	18b 19 20a 20b 22a 23	(33)	43	49 63
• A circuit with only one pathway for current flow is a series circuit. • Components in a series circuit "share" the electric energy. • A parallel circuit splits into two or more pathways before coming back together at the battery. • Components in a parallel circuit each have a direct pathway to the energy source. • A circuit is a pathway through which electric current flows. • Materials that allow the flow of electricity are conductors. • Materials that do not allow the flow of electricity are insulators. • All metals are conductors. • Electricity flows through a circuit from negative to positive terminals. • Cells in series must be oriented in the same direction in order to work. • A D-cell is a source of electric energy. • A bulb is an energy receiver that produces light. • A motor is an energy receiver that produces motion. • A switch is a device that opens and closes a circuit.	1b 2 6 11		28 29 30 31a 31b 31c 32b 33 34a 35 36 37	38 39a 39b 42a 42b 46 47	52 56 59 60
• The greater the number of winds of wire around the iron core, the stronger the magnetism produced. • There are many ways to change the strength of an electromagnet, including tighter coils, number of D-cells, and different wire gauge. • A magnet can be made by winding an insulated wire around an iron core and running current through the wire. • The magnetism produced by an electromagnet can be turned on and off. • Wire used to make an electromagnet must be insulated. • All wire coils must be wound in the same direction.	4 9b 10 13				50a 51 54 55 57 61
CONDUCTING INVESTIGATIONS and BUILDING EXPLANATIONS					
• Planning investigations		17 25			
• Gathering and organizing data		24	32a 34b	42c 44bc	50b
• Interpreting data and building explanations	5 7 8 12	16 18a 21 22b	26 27a 27b	40 41 44a 45 48	53 58 62 63