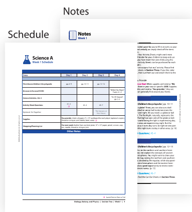
Instructor's Guide Quick Start

The BookShark™ Instructor's Guide (IG) is designed to make your educational experience as easy as possible. We have carefully organized the materials to help you and your children get the most out of the subjects covered. If you need help reading your schedule, see "How to Use the Schedule" in **Section Four**.

This IG includes a 36-week schedule, notes, assignments, readings, and other educational activities. For specific organizational tips, topics and skills addressed and other suggestions for the parent/teacher see **Section Three**. Here are some helpful features that you can expect from your IG.



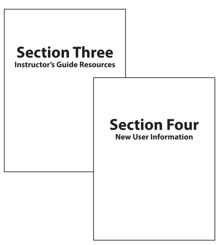
Easy to use
Everything you need is located right after the schedule each week. If a note appears about a concept in a book, it's easy to find it right after the schedule based on the day the relevant reading is scheduled.

4-Day Schedule
Designed to save one day a week for music lessons, sports, field trips, co-ops, or other extra-curricular activities.

Notes

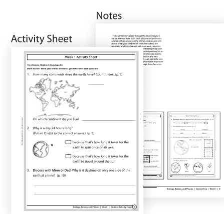
When relevant, you'll find notes about specific books to help you know why we've selected a particular resource and what we hope your children will learn from reading it. Keep an eye on these notes to also provide you with insights on more difficult concepts or content (look for "Note to Mom or Dad").

Note: What are the two kinds of poisonous lizards? The book only lists one – the Gila monster (*Heloderma suspectum*) native to the southwestern United States. The other kind is known as a beaded lizard (*Heloderma horridum*) and is found in Mexico and Guatemala. [p. 35]



Instructor's Guide Resources and **New User Information**
Don't forget to familiarize yourself with some of the great helps in **Section Three** and **Section Four** so you'll know what's there and can turn to it when needed.

Activity Sheets and **Answer Keys**
Activity Sheets follow each week's notes and are customized for each lesson to emphasize important points in fun ways. They are designed with different skills and interests in mind. You may want to file them in a separate binder for your student's use. Corresponding Answer Keys have been included within your weekly Notes.



How to Use the Schedule

More notes with important information about specific books.

The N symbol provides you with a heads-up about difficult content. We tell you what to expect and often suggest how to talk about it with your kids.

4-Day Schedule:

This entire schedule is for a 4-Day program. Designed to save one day a week for music lessons, sports, field trips, co-ops and other activities.

Find the Activity Sheets for students directly after the Notes. Students should complete only the questions assigned.

We schedule optional assignments to be used if desired.

Find all the supplies needed for <u>this</u> week as well as the supplies needed for <u>next</u> week here.

Additional space for writing extra assignments, activities, or notes.

Science A
Week 1 Schedule

Date:	Day 1	Day 2	Day 3	Day 4
The Usborne Children's Encyclopedia	pp. 8–9	pp. 10–11	pp. 12–13	
***Discover & Do Level K* DVD**				"Before You Begin" Tracks #1–3
Science Activities, Vol. 2				"Air All Around" pp. 2–3
Activity Sheet Questions	#1–2 N	#3–4	#5–7	
Optional: Do Together			The Seasons at Your House	
Supplies	**You provide:** sheets of paper, 8" x 10" cardboard for each player (optional: crayons, thread or string or yarn) bottle, bowl, water. N			
Shopping/Planning List	**For next week:** feather from any bird, plate, 10" x 10" paper, pencil, scissors, crayons, needle, thread or string or yarn.			

Other Notes

N Special Note to Mom or Dad

Biology, Botany, and Physics | Section Two | Week 1 | 1

Science H
Week 1 Schedule

Date:	Day 1	Day 2	Day 3	Day 4	Day 5
Robotics	chap. 1 pp. 1–14 N	chap. 1 pp. 15–23	chap. 2 pp. 27–33	Lab pp. 24–26 N	
Activity Sheet Questions	#1–8	#9–14 N	#15–18	#19–22	
Supplies	**We provide: HSK**— DC motor (use the taller motor without wires), electrical tape, foam cup, 2 AAA batteries, rubber band, 1′ insulated electrical wire (with red and white plastic coating), one jumbo craft stick, cork. **You provide:** wire cutter, foam mounting tape (or duct tape), 3 markers, cardboard box lid, plain white or light-colored paper, optional: pipe cleaners, craft sticks, styrofoam or wooden pieces, decorative glue-ons, googly eyes, glitter pens, quick-dry glue, or hot glue gun.				
Shopping/Planning List	**For next week:** ½ cup warm water, 3 teaspoons water, 4 teaspoons white (Elmer's type) or gel glue, food coloring (optional), plastic bag or container.				

Other Notes

Day 1

Robotics | Chapter 1 pp. 1–14

Activity Sheets

Find Activity Sheets after each week's notes, and answer the questions listed on the schedule page. We provide an Answer Key page directly after these notes and before the Student Activity Sheets.

Note: Throughout the year, you will see some Activity Sheet questions marked as **Challenge** or as **Critical Thinking**. These are questions with answers that are not necessarily in the book. While we believe the material covered in these questions are worthwhile for your students to know, it may not be specifically explained in their reading assignment. As always, if you think any question is too difficult for your children, please feel free to skip.

For **Challenge** questions, you and your student may need to complete outside research to answer the question. If you choose to do your research online, please review "Tips When Using the Internet" found in **Section Four** of our guide for precautions on surfing the web.

For **Critical Thinking** questions, the answers may be inspired by information that your student previously learned or may be a statement of opinion. Encourage your student to take some time to write their best answer.

You do not have to do every question on the Activity Sheets. Feel free to adjust and/or omit activities to meet the needs of your students.

Suggestion: Your Activity Sheets might work more easily in a small binder for your children to keep and use as assigned. If you have more than one child using this program, extra Activity Sheets can be purchased for each child (Item # HSB1).

N Special Note to Mom or Dad

Notes
Week 1

Note: There is an error in the book on page 10. The arrow pointing down under "Does it see, touch, hear, smell, or detect radiation?" should say "No."

Activity Sheet Questions | #1–8

Day 2

Robotics | Chapter 1 pp. 15–23

Robotic Arm Implant

The book mentions a robotic arm implant that should be widely available by 2015. We conducted some research and cannot say for certain that it is "widely" available, though we did find some interesting videos about them. For links to these videos, see our IG Links page.

Activity Sheet Questions | #9–14

Mars Rovers Research

Today's Activity Sheet assignment asks your students to visit nasa.gov to look up the latest news on *Opportunity* or *Curiosity*, two Mars Rovers. The NASA site is fairly easy to navigate. If they type "Mars Rovers" into the search pane, they should find pages of information they can use for this assignment. Please provide them with whatever assistance or guidance they may need as they use the Internet today.

Day 3

Robotics | Chapter 2 pp. 27–33

Activity Sheet Questions | #15–18

Day 4

Robotics | Lab pp. 24–26

Note: Duct tape can be used in lieu of foam mounting tape for this experiment.

Note to Mom or Dad: In Week 30, your students will bury two bags of garbage in the ground, water them for two weeks and then dig them up to observe how the items inside decompose. Since this lab will probably be easiest to complete during warmer months, please consider rescheduling this lab if you plan to complete Week 30 during the winter before the ground thaws. If you do not have a yard, also decide where your students could bury the garbage without bothering anyone, and yet have it remain undisturbed for the entire two week period.

Activity Sheet Questions | #19–22 ■

Week 1 Activity Sheets

Robotics

1. To many roboticists, what cycle must a robot be able to complete? Name each step in the cycle in the boxes, and then use the lines below to describe what happens at each step. On the last line, list the part needed in order to perform each step. (p. 6)

(Sense)	→	(Think)	→	(Act)
(To take in information about its surroundings)		(To use the information to choose the next step to take)		(To do something that affects the outside world)
Part: (sensor)		Part: (controller)		Part: (effector)

2. Do all roboticists agree that a robot must be able to follow the above steps in order to truly be a robot? Why or why not? (p. 7)

   (No, some think that any machine that can act on its own is a robot. It doesn't necessarily have to make decisions or "think" in order to be a robot.)

3. How do more simple models help further the field of robotics? (p. 7)

   (More simplistic models make it easier for hobbyists to get involved and study in robotics because the machines they use are cheaper and easier to build. With more people involved, our society is able to contribute more creative energy to the science and possibly make more advancements than if only specialists could participate. The models they build can help scientists build more complicated versions.)

Week 1 Activity Sheets

4. Complete the activity on pages 8–10 in the space below to determine whether or not each device is a robot, based on the Sense-Think-Act definition. Please add two devices of your own at the end of the list to analyze. (pp. 8–10)

Device	Sensor	Controller	Effector	Robot?
television	*(light sensor)*	*(remote control)*	*(video screen)*	☐ Yes ☑ No
automatic garage door opener				☐ Yes ☑ No
calculator				☑ Yes ☐ No
clothes dryer				☐ Yes ☑ No
automatic supermarket door				☐ Yes ☑ No
electric toothbrush				☐ Yes ☑ No
smoke detector				☐ Yes ☑ No
automatic soap dispenser				☐ Yes ☑ No
				☐ Yes ☐ No
				☐ Yes ☐ No

Please see the answers printed at the bottom of page 10 in the book.
Tips as your students work through the flow chart to determine whether each device is or isn't a robot:
- *If it does not have a controller, it is not a robot.*
- *If it has a remote control, strictly speaking, it isn't a robot.*
- *If it doesn't have any arms, lights, speakers, etc., it isn't a robot.*

Week 1 Activity Sheets

5. Why have true robots (ones that can sense, think and act) only been possible for the last 50 years or so? (p. 11)
(because they require computers in order to run, and electronic computers were invented about 50 years ago)

6. Why are automata and punch cards the predecessors to today's robots? (p. 13)
(they are machines that could do things by themselves)

7. Compare and contrast Wiener's theory that both people and machines use feedback, communication and control to make decisions with the Turing test. (p. 13)

They are similar because…	They are different because…
(In both tests, both humans and machines "think" and make decisions.)	*(To pass the Turing test, a machine has to think so convincingly that people think the machine is human.)*

8. Based on the descriptions of the famous fictional robots on page 14, would any pass the Turing test? (p. 14)
(Only Maria might have, because she was disguised as a human. In each of the other stories, the humans were well aware that the robot characters were not human.)

9. Do you think developing robots for use in toys and art is as important as other applications? Why? (pp. 16–17)
(Possible: By using robotics in these two areas, roboticists may interest the younger generation or a segment of the population who might not have been otherwise interested in robotics. Doing so could create more exposure for the science, spark interest, and help to expand and further the field of robotics.)

Week 1 Activity Sheets

10. How does the da Vinci Surgical System improve a patient's surgical experience? (p. 18)
(this robot helps surgeons make smaller and more precise cuts, which shortens a patient's recovery time)

11. Why are robots excellent workers in the manufacturing industry? (pp. 19–20)
(robots can move heavier objects, work longer hours, work in more dangerous conditions and never have to leave their workspace [so they can keep the working environment clean], which means they can do all of these things better than their human counterparts)

12. Thinking about the examples of robots on pages 16 through 21, if you could construct a robot to improve human life, what would you make it do? Why? (pp. 16–21)
(answers will vary)

13. How have robots helped scientists further our understanding of hard-to-visit places like volcanoes and the deep sea or outer space? (pp. 22–23)
(since robots are not alive, they can go places and endure harsher environments than humans can, and transmit data about the places they visit back to the humans who control them)

14. With your parents' permission, visit nasa.gov and search for "Mars Rovers" to look up the latest news on *Opportunity* or *Curiosity*, the Mars Rovers. Summarize three interesting points you find in the space below. (p. 23)

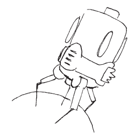
Date you visited the page: ____________

Summary: *(answers will vary)*

Week 1 Activity Sheets

15. Why has it proven useful to make robots of different sizes—some giant ones and nanobots which you can't even see without a microscope? (p. 28)

    (giant robots can do large jobs like spray orchards or smooth concrete floors, and researchers hope to one day use nanobots to perform surgery or attack cancer cells within the body)



16. How does a robot swarm differ from modular robots? (p. 29)

    (A swarm is a group of identical robots that work together to form some task. Modular robots can work alone or connect together to form a larger robot)

17. What types of materials do robot designers use for prototypes? Why? (pp. 30–32)

    (they use materials that are cheap and easy to work with, like cardboard, styrofoam, pvc pipe and even kids' building sets. This way, they can make design changes easily)

18. Why is the Uncanny Valley a problem for roboticists? (p. 33)

    (when a robot looks almost real, most people perceive it as frightening. When people are sure something isn't real, it doesn't bother them but when a robot is not-quite-believably real, it's creepy! Roboticists who build life-like robots would prefer that their creations not scare people, so they have to figure out a way to build them so they don't "fall into the Uncanny Valley.")

Week 1 Lab Activity Sheet

Lab: *Robotics* | pp. 24–26

Vibrobot

19. How well did your Vibrobot work the first time? Were you happy with it? Why? (pp. 24–26)

    (answers will vary)

20. Were you able to adjust it to improve how well it worked? (pp. 24–26) **Yes** **No** *(answers will vary)*

21. What adjustments did you need to make? (pp. 24–26)

    (answers will vary)

22. If you made it again, what would you do to improve or change its design? (pp. 24–26)

    (answers will vary)

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Week 1 Activity Sheets

Robotics

1. To many roboticists, what cycle must a robot be able to complete? Name each step in the cycle in the boxes, and then use the lines below to describe what happens at each step. On the last line, list the part needed in order to perform each step. (p. 6)

Part:	Part:	Part:

2. Do all roboticists agree that a robot must be able to follow the above steps in order to truly be a robot? Why or why not? (p. 7)

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Week 1 Activity Sheets

4. Complete the activity on pages 8–10 in the space below to determine whether or not each device is a robot, based on the Sense-Think-Act definition. Please add two devices of your own at the end of the list to analyze. (pp. 8–10)

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calculator				☐ Yes ☐ No
clothes dryer				☐ Yes ☐ No
automatic supermarket door				☐ Yes ☐ No
electric toothbrush				☐ Yes ☐ No
smoke detector				☐ Yes ☐ No
automatic soap dispenser				☐ Yes ☐ No
				☐ Yes ☐ No
				☐ Yes ☐ No

5. Why have true robots (ones that can sense, think and act) only been possible for the last 50 years or so? (p. 11)

6. Why are automata and punch cards the predecessors to today's robots? (p. 13)

7. Compare and contrast Wiener's theory that both people and machines use feedback, communication and control to make decisions with the Turing test. (p. 13)

They are similar because…	They are different because…

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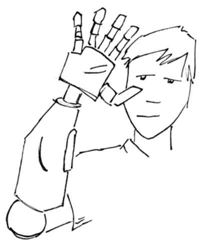

13. How have robots helped scientists further our understanding of hard-to-visit places like volcanoes and the deep sea or outer space? (pp. 22–23)

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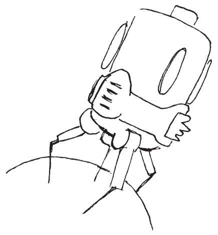
15. Why has it proven useful to make robots of different sizes—some giant ones and nanobots which you can't even see without a microscope? (p. 28)



16. How does a robot swarm differ from modular robots? (p. 29)

17. What types of materials do robot designers use for prototypes? Why? (pp. 30–32)

18. Why is the Uncanny Valley a problem for roboticists? (p. 33)

Week 1 Lab Activity Sheet

Lab: *Robotics* | pp. 24–26

Vibrobot

19. How well did your Vibrobot work the first time? Were you happy with it? Why? (pp. 24–26)

20. Were you able to adjust it to improve how well it worked? (pp. 24–26) **Yes** **No**

21. What adjustments did you need to make? (pp. 24–26)

22. If you made it again, what would you do to improve or change its design? (pp. 24–26)

Science H
Week 2 Schedule

Date:	Day 1	Day 2	Day 3	Day 4	Day 5
Robotics	chap. 3 pp. 38–47	chap. 4 pp. 55–59	chap. 5 pp. 68–71, 74–78	Lab pp. 34–35 N	
Activity Sheet Questions	#1–7	#8–13	#14–15	#16–18	
Supplies	**We provide: HSK**— 2 foam cups, 2 craft sticks for stirring, 1-2 teaspoons borax, styrofoam plate. **You provide:** ½ cup warm water, 3 teaspoons water, 4 teaspoons white or gel glue, food coloring (optional), plastic bag or container, 1-4 teaspoons cornstarch (optional).				
Shopping/Planning List	**For next week:** pencil with eraser, clear tape, scissors, hot glue gun, cookie sheet.				

Other Notes

Day 1

Robotics | Chapter 3 pp. 38–47

Strandbeests, p. 42

For a fascinating video of Theo Jansen's Strandbeests, visit our IG links web page.

Activity Sheet Questions | #1–7

Day 2

Robotics | Chapter 4 pp. 55–59

Activity Sheet Questions | #8–13

Day 3

Robotics | Chapter 5 pp. 68–71, 74–78

Activity Sheet Questions | #14–15

Day 4

Robotics | Lab pp. 34–35

Note: Use regular Elmer's glue instead of gel glue for this experiment.

Activity Sheet Questions | #16–18 ■

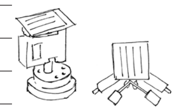
N Special Note to Mom or Dad

Week 2 Activity Sheets

Robotics

1. Why are solar powered batteries a good choice for the Mars rovers? (p. 40)
   (because the rovers do not come back to Earth on a regular basis for scientists to service them, change batteries or charge them. Solar powered batteries make the rovers more independent)

2. Why do BEAM robots move sporadically? (p. 41)
   (BEAM robots contain a capacitor that stores electricity like a battery until there is enough to make the robot's motor move. When it has enough, it releases it all at once, and then waits to move again until the capacitor is full. The time it takes to fill depends on the amount of sunshine.)



3. **Critical Thinking:** Why is deciding upon a power source an important decision when designing a robot? (pp. 38–43)
   (A roboticist needs to consider the function of the robot (Will it move? Does it need to be light? Does it need to be strong? etc.) as well as where it will operate (Will there be sunlight? Does it need to be water-tight? Can we service it regularly?) in order to make a wise decision for a robot's power source. Selecting the wrong power source means a robot simply won't work.)

4. Without looking at the book, match each term to the correct definition. (pp. 43–45)

(g) actuator		a.	uses air or gases pushed through tubes to make a machine move
(d) DC motor		b.	wheels that have interlocking teeth that transfer motion from one part of a machine to another
(i) force		c.	an electromagnetic device that pushes a rod up and down
(b) gears		d.	a motor with a shaft that spins around; it spins in one direction, according to the current that powers it
(h) hydraulic system		e.	a special motor whose motion can be controlled electronically
(a) pneumatic system		f.	the amount of force it takes to turn something
(e) servo		g.	the part of a robot that makes it move; a type of motor
(c) solenoid		h.	uses water or oil pushed through tubes to make a machine move
(f) torque		i.	a push or a pull that changes an object's speed or direction

Week 2 Activity Sheets

5. How does a servo differ from a DC motor? (pp. 43–44)
   (A DC motor only runs when a current moves through it—so it is either "on" or "off", and the only way to change its direction is to reverse the current with a switch or by reversing the batteries. A robot's controller can tell the servo how far to turn and in what direction)

   If you were to build a robot, describe how you might use a DC motor and a servo.
   (Possible: A DC motor would be useful to make a robot drive around the room, and a servo could make it move its arm or turn its head)

6. Compare and contrast hydraulic and pneumatic systems. (pp. 44–45)

They are similar because…	They are different because…
(both systems use the force of something moving through pipes to make a machine move; both use a solenoid to push a rod up and down)	*(pneumatic systems use gases or air and hydraulic systems use a liquid like water or oil to make them move; hydraulic systems are louder but stronger than pneumatic systems)*

7. Why do most robots move around on wheels or tracks instead of legs? (pp. 46–47)
   (because it is easier for a robot to balance on wheels or tracks. Legs are much more difficult to control and compensate for and correct a robot if it starts to tip over)

8. **Challenge!** Use a dictionary to define the words *affect* and *effect*. Use the word in a sentence. (pp. 55–56)
   affect: *([verb] to influence; ie. The new air conditioner affected the temperature in the room greatly.)*

   effect: *([noun] a result, or the thing that happens because of some sort of stimulus; ie. The effect of the cooler room on Yuong's mood was remarkable.)*

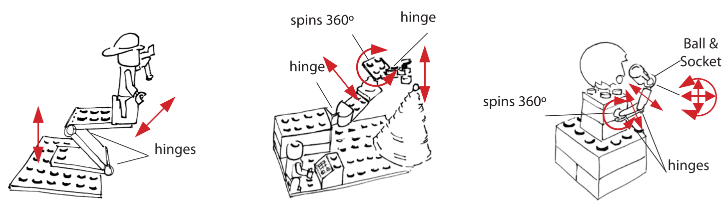
   Why do you think the tool on a robot is called an "effector" instead of an "affector"? *(If an "effect" is the thing that happens because of a stimulus, then an "effector" could be thought of as the thing that becomes active because of some sort of command.)*

Week 2 Activity Sheets

9. Why can a robot's effector be anything from a light to a vacuum to a rock grinder? (pp. 55–56)
(because an effector is anything a robot uses to affect the world around it)

10. **Critical Thinking:** Based on its description in the book, how could an exoskeleton be put to use practically? (p. 57)
(Possible: On a construction site, it could lift large loads of materials so they are in a better location for workers to use, or hold heavy building materials in place while workers secure them; could be used to load trucks or shipping containers with freight.)

11. Draw arrows by the models of robotic arms to show the directions it can move, based on the provided degrees of freedom. Tip: Twisting is 1 degree of freedom; ball and socket joints provide 3 total degrees of freedom. (p. 58)



2 degree of freedom | **3 degrees of freedom** | **6 degrees of freedom**

For extra credit: Use Lego® blocks or another building toy to construct an example of an arm with 4 degrees of freedom!

12. If degrees of freedom make a robotic arm more versatile, why do roboticists try to include as few degrees of freedom as they can? (pp. 58–59)
(because each degree of freedom requires its own power and control systems, which means they make the robot more complicated to build)

Week 2 Activity Sheets

13. Think about the design of the Universal Jamming Gripper. Why do you think it is important for scientists and designers to start fresh, try new ideas and work "outside the box" when they can? (p. 59)
(The Universal Jamming Gripper does not look or function anything like a human hand, and yet it can handle some objects a robotic hand might not be able to handle—like a penny lying flat on a table. By thinking in a new way, its developers were able to accomplish new things.)

14. Label the following as either input (I) or output (O) for a human. (p. 69)

(O) a sneeze	*(I)* hearing your favorite song
(I) the taste of chocolate	*(O)* dancing
(I) seeing a brilliant sunset	*(I)* noticing the bathroom floor is cold
(O) squinting	*(O)* putting your slippers on
(I) feeling an itch	*(I)* hearing thunder
(O) scratching	*(O)* moving your bike into the garage out of the rain

15. Use the terms in the box to help you identify a sensor that could appropriately perform each function. **Note:** You will use two of the terms twice. (pp. 70–78)

lever
tilt switch
photoresistor
UV light sensor
sonar/radar/lidar
accelerometer
infrared
GPS

(tilt switch)	turn off a space heater when it falls over
(GPS)	help a robot find its way from your house to the library
(photoresistor)	turn on a battery-operated security light when the power goes out
(sonar/radar/lidar)	make a robot stop before it bumps into something
(accelerometer)	automatically slow a robot down if it rolls down a hill.
(lever)	make a robot turn off
(photoresistor)	turn on a closet light when you open the door
(UV sensor)	make automatic shades close when it is sunny
(infrared)	find a warm body in a dark room
(tilt switch)	make a toy ball play music when it rolls across the floor.

Week 2 Lab Activity Sheet

Lab: ***Robotics*** | pp. 34–35

Frubber

16. Was it easy or difficult to get a good mixture of Frubber that was malleable but not sticky? (pp. 34–35) **Yes** **No**

    If was hard at first but you eventually worked out the texture, how did you do it? *(answers will vary. The book does classify the substance made from their recipe as a non-Newtonian fluid, but your student may have had a different experience.)*

17. Would you classify your Frubber as a non-Newtonian fluid (a substance that can hold its shape like a solid and flow like a liquid)? Why or why not? (pp. 34–35)

    (Answer will vary)

18. Why are non-Newtonian fluids useful for roboticists? (pp. 33–35)

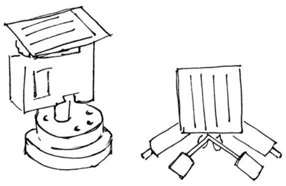
    (soft robots that use this type of material can squeeze through tight spaces, or the material can be filled with sensors to provide skin-like feedback to the robot)

Week 2 Activity Sheets

Robotics

1. Why are solar powered batteries a good choice for the Mars rovers? (p. 40)

2. Why do BEAM robots move sporadically? (p. 41)



3. **Critical Thinking:** Why is deciding upon a power source an important decision when designing a robot? (pp. 38–43)

4. Without looking at the book, match each term to the correct definition. (pp. 43–45)

_______	actuator	a.	uses air or gases pushed through tubes to make a machine move
_______	DC motor	b.	wheels that have interlocking teeth that transfer motion from one part of a machine to another
_______	force	c.	an electromagnetic device that pushes a rod up and down
_______	gears	d.	a motor with a shaft that spins around; it spins in one direction, according to the current that powers it
_______	hydraulic system	e.	a special motor whose motion can be controlled electronically
_______	pneumatic system	f.	the amount of force it takes to turn something
_______	servo	g.	the part of a robot that makes it move; a type of motor
_______	solenoid	h.	uses water or oil pushed through tubes to make a machine move
_______	torque	i.	a push or a pull that changes an object's speed or direction

Week 2 Activity Sheets

5. How does a servo differ from a DC motor? (pp. 43–44)

If you were to build a robot, describe how you might use a DC motor and a servo.

6. Compare and contrast hydraulic and pneumatic systems. (pp. 44–45)

They are similar because…	They are different because…

7. Why do most robots move around on wheels or tracks instead of legs? (pp. 46–47)

8. **Challenge!** Use a dictionary to define the words *affect* and *effect*. Use the word in a sentence. (pp. 55–56)

affect:

effect:

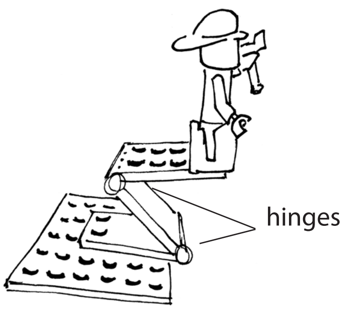
Why do you think the tool on a robot is called an "effector" instead of an "affector"?

Week 2 Activity Sheets

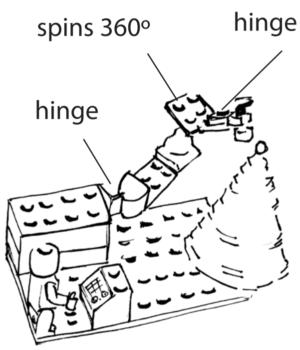
9. Why can a robot's effector be anything from a light to a vacuum to a rock grinder? (pp. 55–56)

10. **Critical Thinking:** Based on its description in the book, how could an exoskeleton be put to use practically? (p. 57)

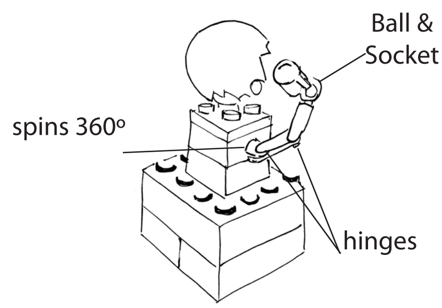
11. Draw arrows by the models of robotic arms to show the directions it can move, based on the provided degrees of freedom. Tip: Twisting is 1 degree of freedom; ball and socket joints provide 3 total degrees of freedom. (p. 58)



2 degree of freedom



3 degrees of freedom



6 degrees of freedom

For extra credit: Use Lego® blocks or another building toy to construct an example of an arm with 4 degrees of freedom!

12. If degrees of freedom make a robotic arm more versatile, why do roboticists try to include as few degrees of freedom as they can? (pp. 58–59)

Week 2 Activity Sheets

13. Think about the design of the Universal Jamming Gripper. Why do you think it is important for scientists and designers to start fresh, try new ideas and work "outside the box" when they can? (p. 59)

____

____

____

____

14. Label the following as either input (I) or output (O) for a human. (p. 69)

______ a sneeze	______ hearing your favorite song
______ the taste of chocolate	______ dancing
______ seeing a brilliant sunset	______ noticing the bathroom floor is cold
______ squinting	______ putting your slippers on
______ feeling an itch	______ hearing thunder
______ scratching	______ moving your bike into the garage out of the rain

15. Use the terms in the box to help you identify a sensor that could appropriately perform each function. **Note:** You will use two of the terms twice. (pp. 70–78)

lever
tilt switch
photoresistor
UV light sensor
sonar/radar/lidar
accelerometer
infrared
GPS

________________________ turn off a space heater when it falls over

________________________ help a robot find its way from your house to the library

________________________ turn on a battery-operated security light when the power goes out

________________________ make a robot stop before it bumps into something

________________________ automatically slow a robot down if it rolls down a hill.

________________________ make a robot turn off

________________________ turn on a closet light when you open the door

________________________ make automatic shades close when it is sunny

________________________ find a warm body in a dark room

________________________ make a toy ball play music when it rolls across the floor.

Week 2 Lab Activity Sheet

Lab: *Robotics* | pp. 34–35

Frubber

16. Was it easy or difficult to get a good mixture of Frubber that was malleable but not sticky? (pp. 34–35) **Yes** **No**

    If was hard at first but you eventually worked out the texture, how did you do it? ______________________

    ____

    ____

17. Would you classify your Frubber as a non-Newtonian fluid (a substance that can hold its shape like a solid and flow like a liquid)? Why or why not? (pp. 34–35)

    ____

    ____

    ____

18. Why are non-Newtonian fluids useful for roboticists? (pp. 33–35)

    ____

    ____

    ____

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Science H
Week 3 Schedule

Date:	Day 1	Day 2	Day 3	Day 4	Day 5
Robotics	chap. 6 pp. 85–93	chap. 7 pp. 104–110	chap. 7 pp. 111–113	Lab pp. 48–49 N	
Activity Sheet Questions	#1–5	#6–9	#10	#11–13	
Supplies	**We provide: HSK**— shorter DC motor with wires, solar panel, recycled CD or DVD, electrical tape, clear dome from drink cup. **You provide:** pencil with eraser, tape, scissors, hot glue gun, cookie sheet.				
Shopping/Planning List	**For next week:** super strong disk magnet (optional), scissors, flat head nail (thin enough to fit in straw, optional).				

Other Notes

Day 1

Robotics | Chapter 6 pp. 85–93

Coding Websites

For two websites that let students practice basic coding on their own, visit our IG links web page. The first site allows them to try coding in Logo on their own, and the second lets them try out basic programming conditional statements, subroutines and loops.

You may find the first website suggestion helpful as you check your students' coding work later on.

Activity Sheet Questions | #1–5

Day 2

Robotics | Chapter 7 pp. 104–110

Activity Sheet Questions | #6–9

Day 3

Robotics | Chapter 7 pp. 111–113

Activity Sheet Question | #10

N Special Note to Mom or Dad

Notes
Week 3

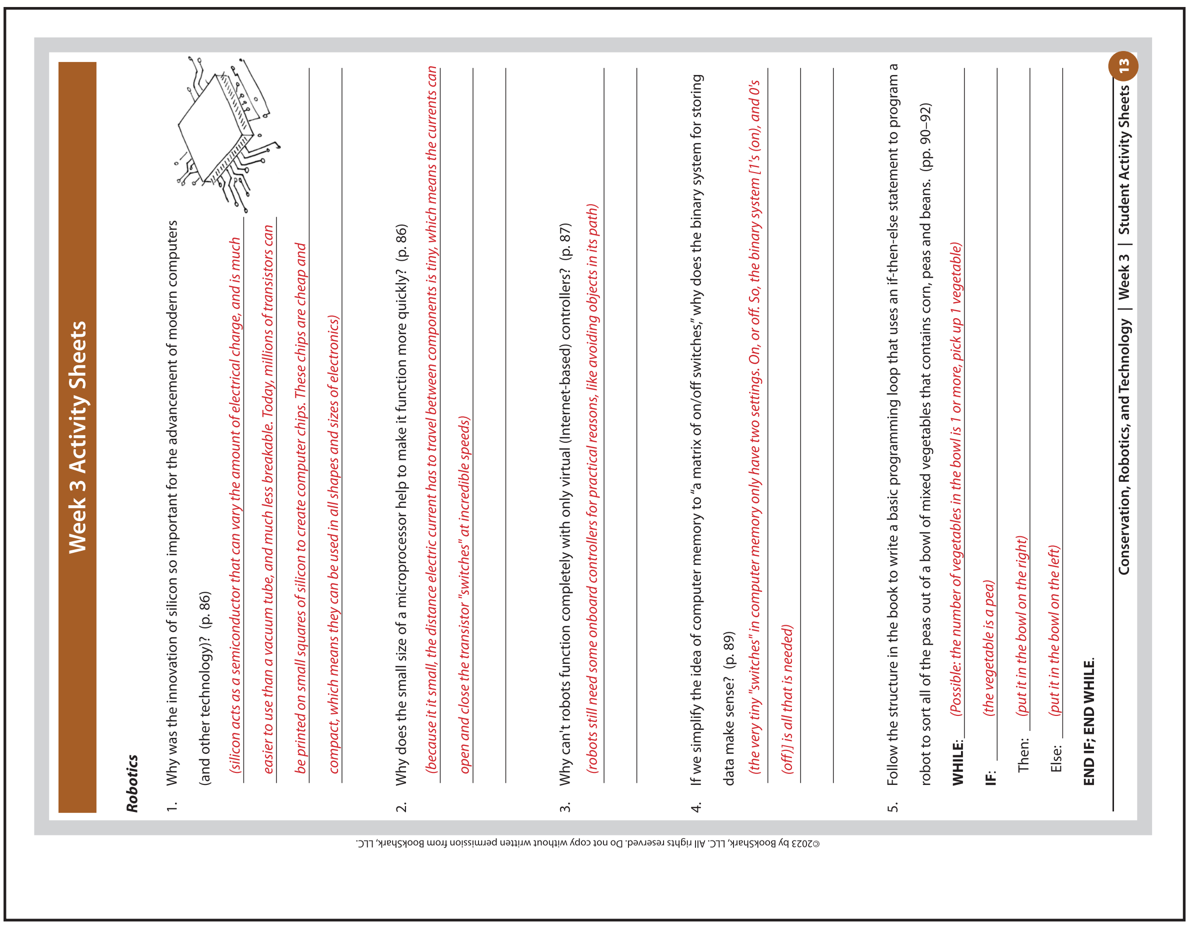
Day 4

Robotics | Lab pp. 48–49

We recommend the following tips when doing this experiment:

- **Step 4:** Make sure the glue has dried before putting pressure on the motor shaft.
- **Step 6:** When connecting the wires: carefully strip about 1/2 inch of plastic coating from the end of each wire using a wire stripper or scissors. Then, set the black wires parallel to each other to twist the exposed wire and tape securely. Repeat with the red wires; gently pull the solar panel wires towards the center of the panel and glue the wires so they hang down from the middle of the panel. Be careful not to break the connection to the end of the solar panel. Tuck all the wires inside the dome and balance the panel over the dome opening. When the solar panel is centered and balanced, glue it in place; The WobbleBot works best on smooth surfaces and in bright sunlight.

Activity Sheet Questions | #11–13 ■



Week 3 Activity Sheets

Robotics

1. Why was the innovation of silicon so important for the advancement of modern computers (and other technology)? (p. 86)
   (silicon acts as a semiconductor that can vary the amount of electrical charge, and is much easier to use than a vacuum tube, and much less breakable. Today, millions of transistors can be printed on small squares of silicon to create computer chips. These chips are cheap and compact, which means they can be used in all shapes and sizes of electronics)
2. Why does the small size of a microprocessor help to make it function more quickly? (p. 86)
   (because it it small, the distance electric current has to travel between components is tiny, which means the currents can open and close the transistor "switches" at incredible speeds)
3. Why can't robots function completely with only virtual (Internet-based) controllers? (p. 87)
   (robots still need some onboard controllers for practical reasons, like avoiding objects in its path)
4. If we simplify the idea of computer memory to "a matrix of on/off switches," why does the binary system for storing data make sense? (p. 89)
   (the very tiny "switches" in computer memory only have two settings. On, or off. So, the binary system [1's (on), and 0's (off)] is all that is needed)
5. Follow the structure in the book to write a basic programming loop that uses an if-then-else statement to program a robot to sort all of the peas out of a bowl of mixed vegetables that contains corn, peas and beans. (pp. 90–92)
   WHILE: *(Possible: the number of vegetables in the bowl is 1 or more, pick up 1 vegetable)*
   IF: *(the vegetable is a pea)*
   Then: *(put it in the bowl on the right)*
   Else: *(put it in the bowl on the left)*
   END IF; END WHILE.

Conservation, Robotics, and Technology | Week 3 | Student Activity Sheets 13

Week 3 Activity Sheets

6. How is the science of Artificial Intelligence different than most basic computer programs? (p. 105)
   (basic computers still need people to tell them what to do. The goal of artificial intelligence is to make computers smart enough to make decisions for themselves without human interaction)

7. Why is a CAPTCHA test like a reverse Turing test? (p. 105)
   (A Turing test is a series of questions that tries to determine if a computer can think like a human being. CAPTCHA tests are used to prove that someone entering data is a human and not another computer—which is just the opposite.)

8. Describe some of the ways computers can learn. (pp. 106–107)
   (by people changing their programming; by observing humans, determining patterns in human behavior and copying them; by collecting information about the user to apply to future situations)

   Why do you think Artificial Intelligence researchers try to design programs that can learn? (p. 107)
   (Possible: They don't have to teach a computer everything it knows that way; the computer can "grow smarter" independently; the computer can become more specialized for its specific role if it can learn from situations it is exposed to; etc.)

9. Why are social robots useful? (pp. 107–110)
   (many researchers believe that robots that have personality and show feelings are easier for humans to work with; they've been shown capable of cheering people up the way animals do, and could act as a pet for someone who couldn't care for a real pet; could help children learn new words; help autistic children learn to interact better with others)

10. What do you think about the discussion of robot ethics? Should robots be programmed to adhere to certain laws? Should they fill roles that cause people to care about them, even if they could potentially hurt a human's feelings? Why? (pp. 111–112) *(answers will vary.)*

Week 3 Lab Activity Sheet

Lab: *Robotics* | pp. 48–49

Beam-Type Solar Wobblebot

11. Did your Wobblebot work as indicated the first time? (pp. 48–49) **Yes** **No** *(answers will vary)*
    Either way, which modifications would you make to the design to make it better or more interesting?
    (answers will vary)

12. Try running the Wobblebot with a bright artificial light and with bright sunshine. Which works better? (pp. 48–49)
    (answers will vary)
    Why do you think this is true? *(answers will vary)*

13. Use your imagination to think of one practical use for a Wobblebot and write it here (pp. 48–49):
    (answers will vary)

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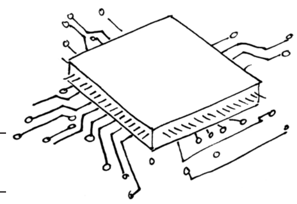
Week 3 Activity Sheets

Robotics



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WHILE: __________

IF: __________

Then: __________

Else: __________

END IF; END WHILE.

Week 3 Activity Sheets

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Week 3 Lab Activity Sheet

Lab: *Robotics* | pp. 48–49

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    ____

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    ____

    ____

    Why do you think this is true? ______________________________

    ____

13. Use your imagination to think of one practical use for a Wobblebot and write it here (pp. 48–49):

    ____

    ____

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Science H—Weekly Subject List

Week	Subject
1	robots: robot development/robot bodies
2	robots: moving robots/robotic action/robotic sensors/robot skin
3	robots: robotic thinking/future of robots/robots vs. humans
4	technology: holograms/cameras/game consoles/tablet/smart watch/touchscreens
5	technology: 3-D printing/modern instruments/OLED TV/RFID/bioluminescence
6	technology: hoverboard/Falcon Heavy/smart wheelchair/Tesla car/SpaceShipTwo/biomethane/Orion spacecraft
7	technology: hybrid airship/personal jet aircraft/modes of transportation/airbus/automated ships/New Horizons/passenger drones
8	technology: architecture/Burj Khalifa/Blue Planet/Icehotel/Khan Shatyr/Pompidou Center/cantilever bridges
9	technology: architecture/Lotus Temple/Guggenheim Museum of Modern Art/floating hotels/Palm Jumeirah/tunnel boring machine/material advancements/trainable robots
10	technology: Raspberry Pi/excavators/bionic exoskeletons/Large Hadron Collider/solar powered technology
11	technology: jet engines/hydroelectricity/firefighter helmets/pet toys/rotating houses/water filtration/
12	technology: e-readers/bionic limbs/commercial drones/activity trackers/cameras/retinal implants
13	technology: living on mars/International Space Station/ocean trash/medical technologies/customizable phones/invisibility
14	technology: passenger drones/flying cars/advancements in space technology/Hyperloop/teleportation/Internet of Things
15	technology: artificial intelligence/James Webb Space Telescope/quantum computers/gravity waves
16	engineering: canal and dam engineering/physics of canals
17	engineering: amazing canals/canal catastrophes
18	engineering: physics of dams/amazing dams/dam disasters
19	energy: electricity/hydrogen
20	energy: petroleum/natural gas/coal/nuclear power
21	energy: wind power/hydropower/solar power
22	energy: biomass/future of energy
23	Industrial Revolution: textiles/industrial revolution comes to America
24	Industrial Revolution: labor unions/transportation in the future/communication
25	Industrial Revolution: Edison and electricity/captains of industry/20th century industry
26	Earth Science: biomes/air/water
27	Earth Science: sun/life on earth/pollution
28	Earth Science: global warming and ozone/nature at risk/recycling and balance
29	Earth Science—conservation: garbage quantity/garbage history
30	Earth Science—conservation: where does trash go/hazardous waste/reducing garbage
31	Earth Science—conservation: reuse/recycle/rethink
32	Earth Science—climate: weather/climate change/sun/atmosphere/greenhouse gasses and effect
33	Earth Science—climate: global warming/climate zones/local climates/water/oceans/currents/clouds
34	Earth Science—climate: clouds and wind/air/wind/fronts/extreme weather
35	Earth Science—climate: weather study/forecast/change in weather/weather journal
36	Earth Science—climate: icy earth/life impact/conservation/alternative energy/future climate change/weather journal

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