

# Technology Dissection: A Lesson in Reverse Engineering



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## Goals and Objectives

### Goals-

- (1) Encourage students to think about and understand how different technologies work.
- (2) Improve students' cooperative learning skills.
- (3) Help students develop skills for the 21<sup>st</sup> Century workplace.

#### 21<sup>st</sup> Century Skills-

Creativity and Innovation  
Critical Thinking & Problem Solving  
Communication  
Collaboration  
Information Literacy  
Media Literacy  
Information and Communications Technology (ICT) Literacy  
Flexibility & Adaptability  
Initiative & Self Direction  
Social & Cross Cultural Skills  
Productivity & Accountability  
Leadership & Responsibility

<http://www.p21.org>

[http://www.p21.org/storage/documents/21stcskillsmap\\_science.pdf](http://www.p21.org/storage/documents/21stcskillsmap_science.pdf)

- (4) Expose students to the field of engineering.

### Objectives-

#### OVERALL:

- Students will define technology as “anything human-made that is used to solve a problem or fulfill a desire.” (Source: **Engineering is Elementary** from *The Museum of Science, Boston*)
- Students will identify the three types of technology as an- object, system, or process.
  - **Object**
    - An object as a technology is one that is composed of only one part.
    - Examples: spoon, paper clip, eraser, key, screw, nail, bowl, cup, fork, etc.

- **System**
  - A system is a technology that is made of multiple parts that must all work together in order for the technology to function. In other words, a group of parts that work together to meet a goal.
  - Examples: ball-point pen, sticky notes, glue stick, pencil, broom, candle, chair, etc.
- **Process**
  - A process is a series of actions or steps leading to a result or goal.
  - Examples:
    - canning food
    - dry cleaning clothing
    - hydraulic fracturing/fracking (in mining)
    - an automated car wash
    - an appendectomy (surgery to remove the appendix)
    - an assembly line to create a product, like a car

– **Engineering is Elementary** from *The Museum of Science, Boston*

- Students will identify whether a given technology is an object, system, or process and explain why.
- Given a technology, students will describe-
  1. what problem the technology solves.
  2. how this technology has evolved over time.
  3. what else the technology could be used for.
  4. what other materials the technology could be made of.
  5. how they could improve on the technology.
- After having taken apart a technology, students will be able to describe-
  1. the parts of the technology.
  2. each part's function.
  3. how the parts work together to solve a problem.
- Students will create their own technology by combining parts of existing technologies that they have reverse engineered.
- Students will understand that engineers improve on and create technologies.
- Students will understand that engineers work collaboratively.
- Students will know and understand the steps of the engineering design process (ask, imagine, plan, create, improve).
- Students will use various steps in the engineering design process (ask, imagine, plan, create, improve) to reverse engineer.

# Standards

## International Technology and Engineering Education Association (ITEEA) Standards

### Standard 1. Students will develop an understanding of the characteristics and scope of technology.

#### K-2

- A.  
The natural world and human-made world are different.
- B.  
All people use tools and techniques to help them do things.

#### 3-5

- C.  
Things that are found in nature differ from things that are human-made in how they are produced and used.
- D.  
Tools, materials, and skills are used to make things and carry out tasks.
- E.  
Creative thinking and economic and cultural influences shape technological development.

### Standard 2. Students will develop an understanding of the core concepts of technology.

#### K-2

- A.  
Some systems are found in nature, and some are made by humans.
- B.  
Systems have parts or components that work together to accomplish a goal.
- C.  
Tools are simple objects that help humans complete tasks.
- D.  
Different materials are used in making things.
- E.  
People plan in order to get things done.

#### 3-5

- F.  
A subsystem is a system that operates as a part of another system.
- G.  
When parts of a system are missing, it may not work as planned.
- H.  
Resources are the things needed to get a job done, such as tools and machines, materials, information, energy, people, capital, and time.
- I.  
Tools are used to design, make, use, and assess technology.
- J.  
Materials have many different properties.

### Standard 6. Students will develop an understanding of the role of society in the development and use of technology.

#### K-2

- A.  
Products are made to meet individual needs and wants.

**3-5**

B.

Because people's needs and wants change, new technologies are developed, and old ones are improved to meet those changes.

C.

Individual, family, community, and economic concerns may expand or limit the development of technologies.

**Standard 7. Students will develop an understanding of the influence of technology on history.**

**K-2**

A.

The way people live and work has changed throughout history because of technology.

**3-5**

B.

People have made tools to provide food, to make clothing, and to protect themselves.

**Standard 9. Students will develop an understanding of engineering design.**

**K-2**

A.

The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.

B.

Expressing ideas to others verbally and through sketches and models is an important part of the design process.

**3-5**

C.

The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.

D.

When designing an object, it is important to be creative and consider all ideas.

E.

Models are used to communicate and test design ideas and processes.

## SCIENCE Next Generation Sunshine State Standards (NGSSS)

### The Nature of Science

#### Third Grade

##### SC.3.N.1.1

Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

##### SC.3.N.1.3

Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

#### Fourth Grade

##### SC.4.N.1.1

Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

#### Fifth Grade

##### SC.5.N.1.1

Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

## ENGLISH LANGUAGE ARTS Common Core State Standards (CCSS)

### Comprehension and Collaboration

**CCSS.ELA-Literacy.SL.3.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.

**CCSS.ELA-Literacy.SL.4.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

**CCSS.ELA-Literacy.SL.4.3** Identify the reasons and evidence a speaker provides to support particular points.

**CCSS.ELA-Literacy.SL.5.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

### Presentation of Knowledge and Ideas

**CCSS.ELA-Literacy.SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

**CCSS.ELA-Literacy.SL.3.6** Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (See grade 3 Language standards 1 and 3 [here](#) for specific expectations.)

**CCSS.ELA-Literacy.SL.4.4** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

**CCSS.ELA-Literacy.SL.5.4** Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.



## Course Outline

Lesson 1	<b>What is Technology?</b> Students will learn what a technology is, as well as the different types of technology.
Lesson 2	<b>Technology Evolution</b> Students will explore how different technologies have evolved over time.
Lesson 3	<b>What is Engineering?</b> Students will learn the steps of the engineering design process and use it to solve a problem. <i>-Perspiring Penguins Lesson</i> from Museum of Science Boston's Engineering is Elementary.
Lesson 4	<b>Why Reverse Engineer?</b> Students will learn how reverse engineering can be used to understand how a technology works and use this new knowledge to improve the technology or create a new technology.
Lesson 5	<b>Technology Dissection</b> Students will take apart their technology, describe its parts, their functions, and how they work together to solve a problem.

## Possible Items to Reverse Engineer

- camera
- ball point pen
- push toy
- electric pencil sharpener
- outdated technology- walkman, old cell phones, tape players, etc.

## Budget for Adapter Grant

ITEM	VENDOR	PRICE
Trash 2 Treasure Membership	Trash 2 Treasure	\$75.00
Tools- screw drivers, pliers, etc.	Various	varies
Poster board or science board to display dissected items	Various	varies
Glue	Various	varies
<b>ITEMS for Dissection</b>		
Push toys, wind up toys	Various	varies
Ball point pens (both retractable and with cap kind)	Various	varies
Disposable camera	Various	varies

## Sample Worksheets

- ENGINEERING DESIGN PROCESS (PAGE 1)
- ENGINEERING DESIGN PROCESS (PAGE 2)
- LESSON 1 WORKSHEET: WHAT IS TECHNOLOGY? (PAGE 1)
- LESSON 1 WORKSHEET: WHAT IS TECHNOLOGY? (PAGE 2)
- LESSON 2 WORKSHEET: TECHNOLOGY EVOLUTION (PAGE 1)
- LESSON 2 WORKSHEET: TECHNOLOGY EVOLUTION (PAGE 2)
- LESSON 5 WORKSHEET: TECHNOLOGY DISSECTION (PAGE 1)
- LESSON 5 WORKSHEET: TECHNOLOGY DISSECTION (PAGE 2)
- LESSON 5 WORKSHEET: TECHNOLOGY DISSECTION PART INVENTORY
- SAMPLE TECHNOLOGIES

# The Engineering Design Process

Engineering is Elementary (EIE)



Retrieved From: <http://www.eie.org/content/engineering-design-process>

# The Engineering Design Process

Engineering is Elementary (EIE)

## ASK

- What is the problem?
- What have others done?
- What are the constraints?

## IMAGINE

- What are some solutions?
- Brainstorm ideas.
- Choose the best one.

## PLAN

- Draw a diagram.
- Make lists of materials you will need.

## CREATE

- Follow your plan and create it.
- Test it out!

## IMPROVE

- Talk about what works, what doesn't, and what could work better.
- Modify your designs to make it better.
- Test it out!

*After you improve your design one, you may want to begin the Engineering Design Process all over again to refine your technology. Or you may want to focus on one step. The Engineering Design Process can be used again and again!*

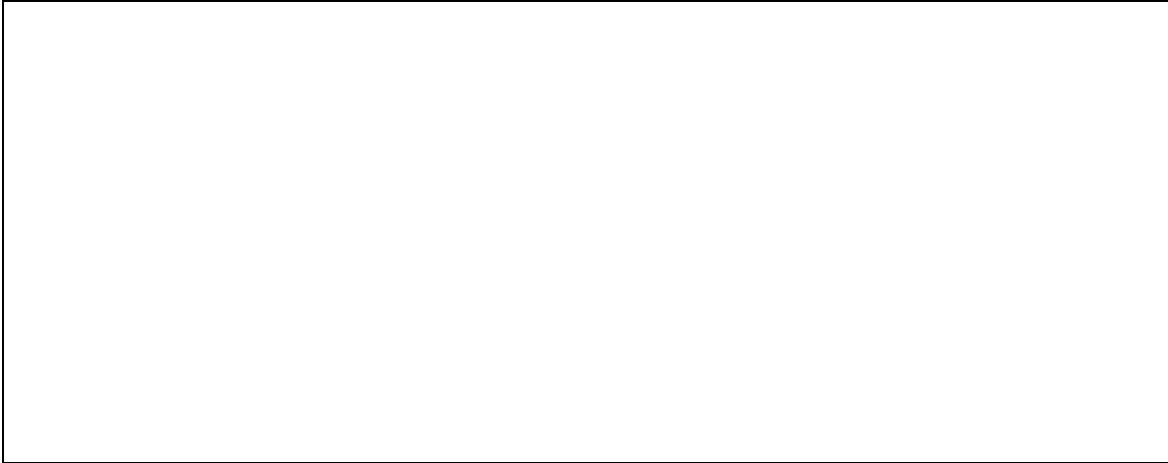
Retrieved From: <http://www.eie.org/content/engineering-design-process>

**Lesson 1 Worksheet: What is Technology? (PAGE 1)**

**Name:** \_\_\_\_\_

1. What is it? \_\_\_\_\_

2. Draw a picture of it below. Label any parts.



3. What purpose does it serve or what problem does it solve?

\_\_\_\_\_  
\_\_\_\_\_

4. What are its components (parts)?

\_\_\_\_\_

5. Is it man-made or found in nature? \_\_\_\_\_

6. What material(s) is (are) it made of? \_\_\_\_\_

7. What other material(s) could it be made of? \_\_\_\_\_

8. Is it technology? Why or why not? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Lesson 1 Worksheet: What is Technology? (PAGE 2)**

*After having discussed your item with the class, do you still agree with your answer to question number 10? Now answer this question again.*

Revisit Question #10: Is it technology? Why or why not?

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9. In the table below, list 10 items that are examples of technology and 10 items that are NOT technology. The first ones have been done for you.

TECHNOLOGY	NOT TECHNOLOGY
1. <i>broom</i>	1. <i>leaf</i>
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

10. There are three different types of technology: (1) objects, (2) systems, (3) and processes. List 4 examples of each below. The first ones have been done for you.

OBJECT	SYSTEM	PROCESS
1. <i>sock</i>	1. <i>shoe</i>	1. <i>how to tie your shoe</i>
2.	2.	2.
3.	3.	3.
4.	4.	4.

**Lesson 2 Worksheet: Technology Evolution (PAGE 1)**

**Name:** \_\_\_\_\_

**Technology topic being researched:** \_\_\_\_\_

Ideas: writing instruments, writing surfaces, phone, computer, bicycle, food preservation, light bulbs, etc.

**List the inventor(s) or major contributor(s) to the development of the technology (3 points).**

\_\_\_\_\_

**List at least 5 major events in the history of this technology (include dates, locations, and important people). (10 points)**

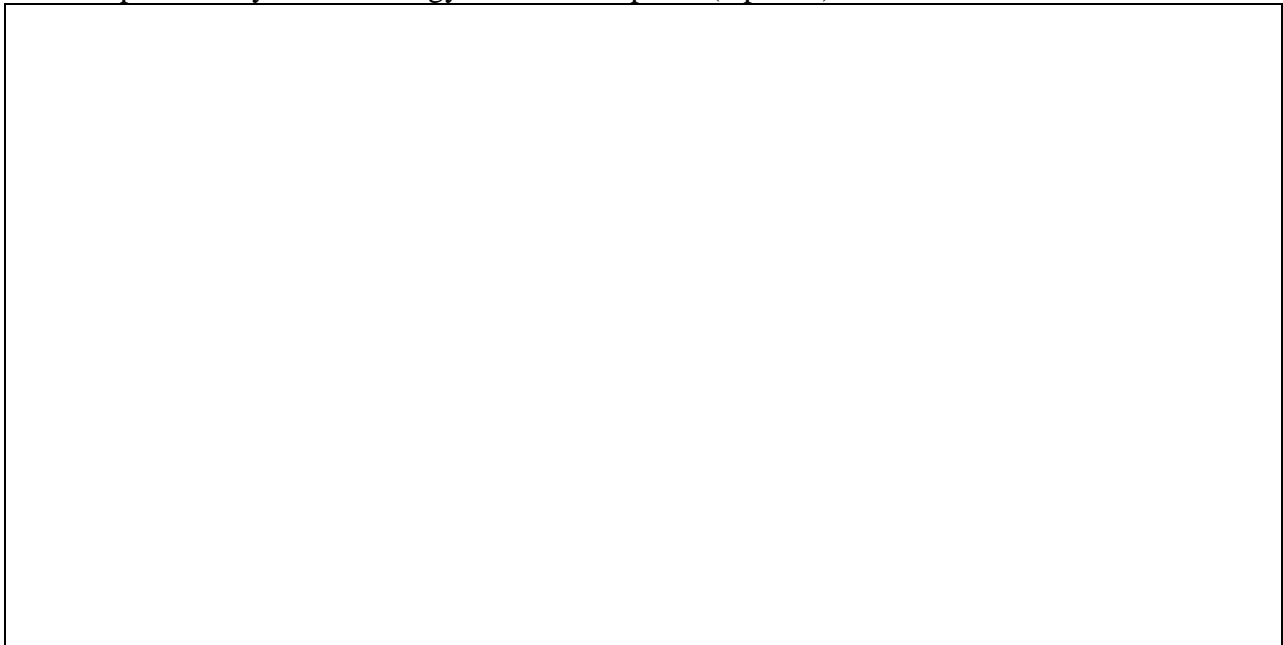
DATE(S)	EVENT
	1.
	2.
	3.
	4.
	5.

**Lesson 2 Worksheet: Technology Evolution (PAGE 2)**

**List 3 interesting facts about your technology (6 points)**

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Draw a picture of your technology and label its parts. (5 points)**



**Sources:** List at least 3 sources you used for your research. (6 points)

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

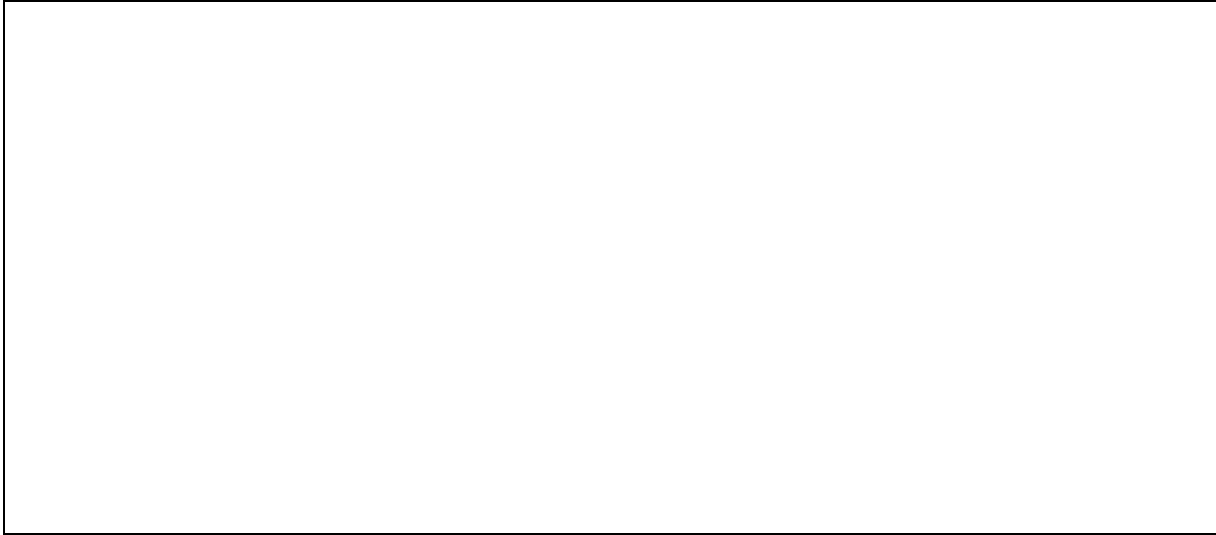
\_\_\_\_\_/30 points



**Lesson 5 Worksheet: Technology Dissection (PAGE 1)**

**Name:** \_\_\_\_\_

1. What is the technology? \_\_\_\_\_
2. Draw a picture of it below. Label any parts.



3. What purpose does the technology serve or what problem does it solve?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Begin taking the technology apart. Be sure to save every part. If it is there, it serves some purpose. Use a tray or box to put small parts in as you work. Lay the parts out on poster board as you remove them. You may use the poster board to jot down notes and observations. The poster board will serve as a 3-dimensional diagram of the technology. Take photographs of the parts as you remove them, as well as your poster board and the technology itself. You may need tools to take the technology apart. Be sure to follow all safety precautions for the tools you are using.
5. In the table on the Part Inventory worksheet, draw a picture of each part of the technology. Also write down the part's name, the material it is made of, and its function (what it does). If you don't know exactly what the part's name is, you can name it yourself or research it later on.
6. As you work, write down your steps for taking the technology apart. Be sure to number them as well. You can do this on a separate sheet of paper. This will help you when you put the technology back together.

## Lesson 5 Worksheet: Technology Dissection (PAGE 2)

7. What did you learn about your technology by reverse engineering?
8. How could you improve your technology?
9. What parts of this technology could you use to create a different technology? How would you use them?

**Extension: Choose one of the following extension activities to pursue.**

1. **Reverse-Reverse Engineering:** Try to put the technology back together and make sure it still functions properly.
2. **Frankenstein Technology:** Take parts from this technology and other technologies you have dissected ( or reverse engineered) and try to create a new technology.
3. **Technology Timeline:** Research the technology you have dissected. Discover the predecessors of your technology. Become the expert on your piece of technology and the history behind its development.












**Lesson 5 Worksheet: Technology Dissection Part Inventory**

**Technology:** \_\_\_\_\_ **Name:** \_\_\_\_\_

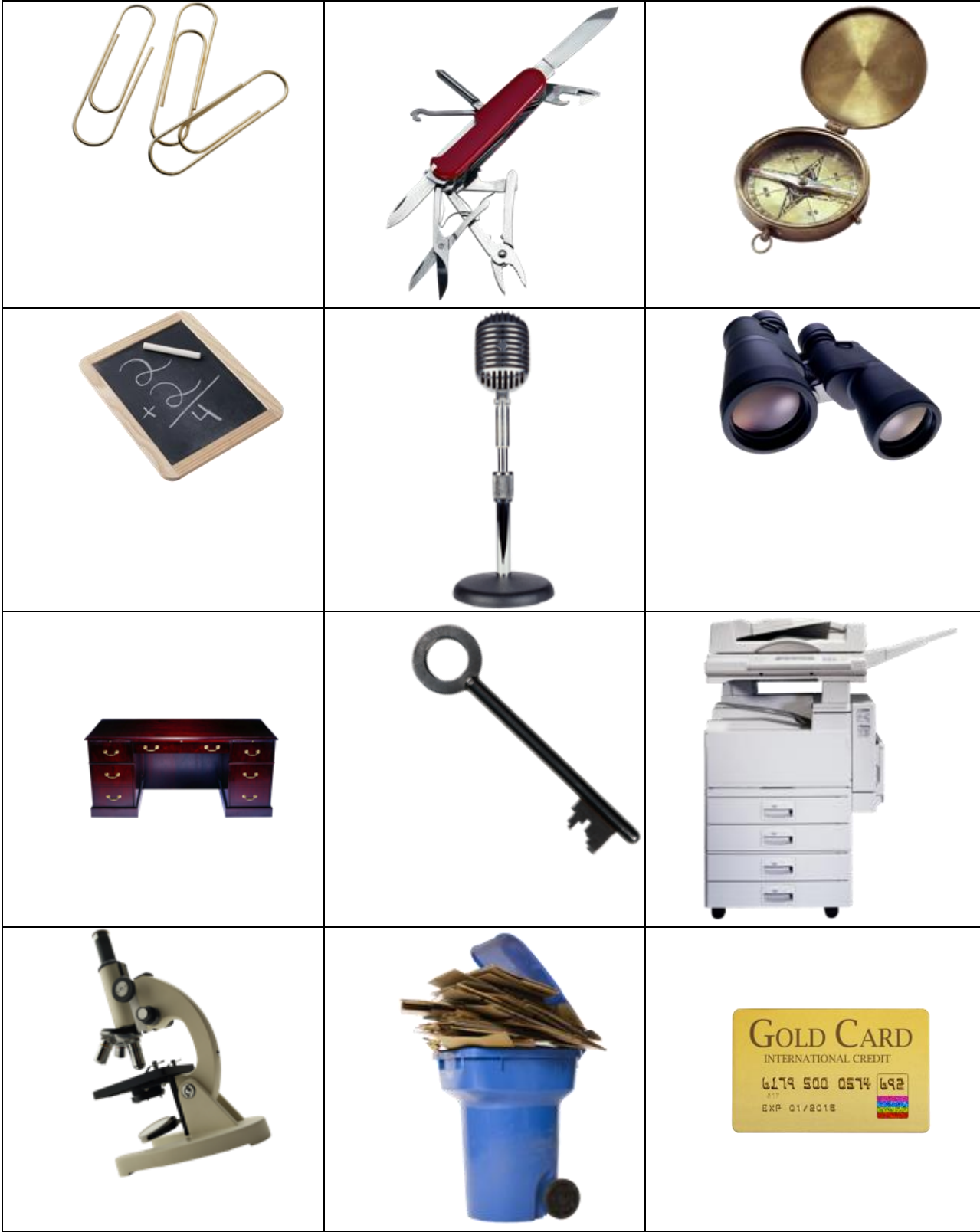
In the table below, draw a picture of each part of the technology. Also write down the part's name, the material it is made of, and its function (what it does) if you know it. If you don't know the name of a part, you can look it up on the Internet, or give it your own name.

Part #	PICTURE	NAME	MATERIAL	FUNCTION

## Sample Technologies





## Lesson Plans

### Lesson 1: What is Technology?

**Grade Level:** 2<sup>nd</sup> – 5<sup>th</sup> grade

**Time:** Approximately 30 – 45 minutes

**Materials:**

- Rock
- Standard number 2 pencil
- Mechanical pencil
- Plastic spoon
- Metal spoon
- Calculator
- Directions for how to tie a shoelace
- Feather

**Resources:**

- Technology Flash Card IOS App
  - <http://www.eie.org/engineering-adventures/resources/technology-flashcards>
- What is the Technology? Guess the technology?
  - [http://www.eie.org/sites/default/files/resource/file/ea\\_prep\\_guess\\_the\\_technology.pdf](http://www.eie.org/sites/default/files/resource/file/ea_prep_guess_the_technology.pdf)
- Technology Tag
  - [http://www.eie.org/sites/default/files/resource/file/ea\\_prep\\_technology\\_tag.pdf](http://www.eie.org/sites/default/files/resource/file/ea_prep_technology_tag.pdf)
- Technology Ice Breaker
  - [http://www.eie.org/sites/default/files/resource/file/ea\\_prep\\_technology\\_ice\\_breaker.pdf](http://www.eie.org/sites/default/files/resource/file/ea_prep_technology_ice_breaker.pdf)
- Technology Over Time
  - <http://www.pbslearningmedia.org/resource/ate10.sci.engin.design.techvertime/technology-over-time/>
  - <http://www.pbs.org/wgbh/aso/tryit/tech/index.html>
- Technology Timeline
  - <http://www.pbslearningmedia.org/resource/phy03.sci.engin.design.techtime/technology-timeline/>
- What is Technology?
  - [https://www.youtube.com/watch?v=Giiz81\\_uzK8](https://www.youtube.com/watch?v=Giiz81_uzK8)
- <https://science.education.nih.gov/supplements/nih4/technology/guide/lesson1.htm>

## Procedure:

1. Ask students the question “What is Technology?”. Facilitate a group discussion and record student answers to the question. You can record answers on chart paper or on an interactive whiteboard. Be sure to save the document so that you can refer back to it later. Common student responses are that technology is something you plug in, something that runs on batteries, and something that uses electricity. Student answers also usually include examples of technology, such as computers, cell phones, and the Internet.
2. Divide students into groups of 2-3. Give each group one of the following objects –
  - Rock
  - Standard number 2 pencil
  - Mechanical pencil
  - Plastic spoon
  - Metal spoon
  - Calculator
  - Directions for how to tie a shoelace\*
  - Feather

\*Must include.
3. Ask groups to discuss answers to the following questions:
  - What is it?
  - What purpose does it serve or what problem does it solve?
  - Is it man-made or found in nature?
  - What material(s) is (are) it made of?
  - What other material(s) could it be made of?
  - What are its components (parts)?
  - What else could it be used for?
  - How can it be improved?
  - Is it technology? Why or why not
4. Have students record their answers on page 1 of their worksheet.
5. After students have finished page 1 of their worksheet, have each group present their object to the class and discuss if they think it is technology or not.
6. After all groups have presented, reveal to students which objects were technologies and which were not. NOTE: All objects were technologies except for the feather and the rock. Students should understand that while those natural objects could be used as part of a technology (example: rock being tied to a stick and used as a club or the feather being used as writing instrument) that they alone are not considered technology because they are not man-made.
7. Then, as a class, develop a definition of technology.



8. Share with the class the way engineers define technology-  
“anything human-made that is used to solve a problem or fulfill a desire.”  
(Source: **Engineering is Elementary** from *The Museum of Science, Boston*)
9. Explain to students that technologies can be objects, systems, or processes. Give them an example of each from the objects given to student groups (Example: object- spoon, system- sticky notes, process- how to tie your shoe directions). Have students classify the rest of their objects as either an object, a system, or a process.

### **Three types of Technology**

#### **a. Object**

- i. An object as a technology is one that is composed of only one part.
- ii. Examples: spoon, paper clip, eraser, key, screw, nail, bowl, cup, fork, etc.

#### **b. System**

- i. A system is a technology that is made of multiple parts that must all work together in order for the technology to function. In other words, a group of parts that work together to meet a goal.
- ii. Examples: ball-point pen, sticky notes, glue stick, pencil, broom, candle, chair, etc.

#### **c. Process**

- i. A process is series of actions or steps leading to a result or goal.
- ii. Examples:
  1. canning food
  2. dry cleaning clothing
  3. hydraulic fracturing/fracking (in mining)
  4. an automated car wash
  5. an appendectomy (surgery to remove the appendix)
  6. an assembly line to create a product, like a car

– **Engineering is Elementary** from *The Museum of Science, Boston*

10. Have students complete page 2 of their worksheet.

## **Lesson 2: Technology Evolution**

**Grade Level:** 2<sup>nd</sup> – 5<sup>th</sup> grade

**Time:** Approximately 30 – 45 minutes

### **Materials:**

Computers

### **Resources:**

- Technology Over Time
  - <http://www.pbslearningmedia.org/resource/ate10.sci.engin.design.techovertime/technology-over-time/>
  - <http://www.pbs.org/wgbh/aso/tryit/tech/index.html>
- Technology Timeline
  - <http://www.pbslearningmedia.org/resource/phy03.sci.engin.design.techtime/technology-timeline/>
- History of Writing Instruments
  - <http://www.history.com/shows/modern-marvels/videos/writing-instruments>
- The Birth of Telecommunications
  - <http://www.history.com/topics/inventions/alexander-graham-bell/videos/the-telegraph-and-telephone?m=5189719baf036&s=All&f=1&free=false>
- Inventions
  - <http://www.history.com/topics/inventions>

### **Procedure:**

Using the resources above, have students research different technologies and how they have evolved over time. Students can work in groups of 2 – 3. Each group will pick a technology, research its history, and present to the class.

### **Evaluation:**

[http://www.readwritethink.org/files/resources/printouts/30700\\_rubric.pdf](http://www.readwritethink.org/files/resources/printouts/30700_rubric.pdf)

Research Project and Presentation Rubric

[http://www.readwritethink.org/files/resources/lesson\\_images/lesson812/Rubric.pdf](http://www.readwritethink.org/files/resources/lesson_images/lesson812/Rubric.pdf)

<https://www2.uwstout.edu/content/profdev/rubrics/elemresearchrubric.html>

<http://www.schrockguide.net/assessment-and-rubrics.html>

### Lesson 3: What is Engineering?

Use the following resources to teach students about engineering.

[www.eie.org/sites/default/files/perspiringpenguinsppt.pptm](http://www.eie.org/sites/default/files/perspiringpenguinsppt.pptm)

<http://www.auburn.edu/~cgs0013/ETK/SaveThePenguinsETK.pdf>

### Lesson 4: Why Reverse Engineer?

Have students explore the following resources and then discuss as a class what reverse engineering is, how can it be used, and what are the ethical considerations and controversies surrounding reverse engineering. **NOTE: This lesson is for middle or high school students.**

#### **Resources:**

- Reverse Engineering in the News  
<http://www.cbsnews.com/videos/iran-attempting-to-reverse-engineer-us-drone/>
- Reverse Engineering  
<http://www.computerworld.com/article/2585652/app-development/reverse-engineering.html>
- Reverse Engineer the Brain
  - <http://www.engineeringchallenges.org/cms/8996/9109.aspx>
- <http://www.scientificamerican.com/article/mit-neuroscientist-discusses-quest-reserve-engineer-human-brain/>
- <http://www.theatlantic.com/technology/archive/2014/01/how-netflix-reverse-engineered-hollywood/282679/>
- <http://ethics.csc.ncsu.edu/intellectual/reverse/study.php>
- <https://www.khanacademy.org/science/discoveries-projects/Reverse-Eng>
- <http://app.discoveryeducation.com/player/view/assetGuid/C5CA38DA-123A-4E12-9E75-A43069DB9EF6>

#### **Background Information:**

Reverse-engineering is breaking something down in order to understand it, build a copy of it, or improve it.

### Lesson 5: Technology Dissection

Utilize included worksheets for this lesson.

## Evaluation & Student Assessment

### TEAMWORK RUBRIC

<u>Team Members</u>	<u>Participation</u>	<u>Cooperation</u>	<u>Sportsmanship</u>	<u>Team Member TOTAL</u>
Name:	_____/10	_____/10	_____/10	_____/30
Job/Role:	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	COMMENTS:
Name:	_____/10	_____/10	_____/10	_____/30
Job/Role:	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	COMMENTS:
Name:	_____/10	_____/10	_____/10	_____/30
Job/Role:	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	Day 1= 0 1 2 Day 2= 0 1 2 Day 3= 0 1 2 Day 4= 0 1 2 Day 5= 0 1 2	COMMENTS:

# Resource List

## Websites

- <http://www.iteea.org/Resources/tewebsites.htm>
- <http://www.iteea.org/TAA/PDFs/xstnd.pdf>
- [https://www.teachengineering.org/view\\_activity.php?url=collection/cub\\_/activities/cub\\_engineering\\_in\\_reverse/cub\\_engineering\\_in\\_reverse.xml](https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_engineering_in_reverse/cub_engineering_in_reverse.xml)
- [http://encyclopedia.kids.net.au/page/re/Reverse\\_engineering](http://encyclopedia.kids.net.au/page/re/Reverse_engineering)
- [http://learningcenter.nsta.org/product\\_detail.aspx?id=10.2505%2f4%2fss09\\_032\\_08\\_38http://legacy.mos.org/designchallenges/](http://learningcenter.nsta.org/product_detail.aspx?id=10.2505%2f4%2fss09_032_08_38http://legacy.mos.org/designchallenges/)
- <http://pbskids.org/zoom/activities/build/>
- <http://www.pbs.org/wgbh/buildingbig/educator/index.html>
- <http://pbskids.org/designsquad/parentseducators/resources/index.html?category=green>
- <http://pbskids.org/designsquad/parentseducators/guides/index.html>
- <http://pbskids.org/designsquad/engineers/>
- <http://www.makelearningfun.info/2011/09/make-homemade-paddleboat.html>
- <http://www.clickmagkids.com/trythis/crafts/make-a-paddle-wheel-boat>
- [http://pbskids.org/designsquad/pdf/parentseducators/DS\\_Act\\_Guide\\_Lead\\_PaddlePower.pdf](http://pbskids.org/designsquad/pdf/parentseducators/DS_Act_Guide_Lead_PaddlePower.pdf)
- <http://www.pbs.org/teachers/stem/>
- <http://pbskids.org/designsquad/parentseducators/workshop/process.html>
- [http://www.floridascienceolympiad.org/ESO\\_Comppetition\\_Files.htm](http://www.floridascienceolympiad.org/ESO_Comppetition_Files.htm)
- <http://www.pbs.org/wgbh/buildingbig/index.html>
- [http://tinkering.exploratorium.edu/sites/default/files/Instructions/toy\\_take\\_apart.pdf](http://tinkering.exploratorium.edu/sites/default/files/Instructions/toy_take_apart.pdf)

## Books

Abarca, Javier, et al. Introductory Engineering Design: A Projects-Based Approach. (Textbook for GEEN 1400: First-Year Engineering Projects course.) Third Edition (spiral bound), Eds. Janet L. Yowell and Denise W. Carlson. Boulder, CO: Integrated Teaching and Learning Laboratory, College of Engineering and Applied Science, University of Colorado at Boulder, Fall 2000.

[http://itll.colorado.edu/index.php/courses\\_workshops/geen\\_1400/resources/textbook/](http://itll.colorado.edu/index.php/courses_workshops/geen_1400/resources/textbook/)

## Supplemental Materials

DVD-

**ABC Nightline's-** *The Deep Dive: One Company's Secret Weapon for Innovation*  
(originally aired on 7/13/99)

\*This video can be viewed on YouTube or purchased for \$149.95 from-

[http://films.com/id/11160/The\\_Deep\\_Dive\\_One\\_Companys\\_Secret\\_Weapon\\_for\\_Innovation.htm](http://films.com/id/11160/The_Deep_Dive_One_Companys_Secret_Weapon_for_Innovation.htm)

<http://www.pbs.org/nerds/part2.html>

## Bibliography

Boston Museum of Science, Engineering is Elementary, "The Engineering Design Process," accessed June 24, 2009.  
[http://www.mos.org/eie/engineering\\_design.php](http://www.mos.org/eie/engineering_design.php)

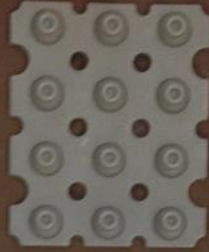
## Student Work Samples





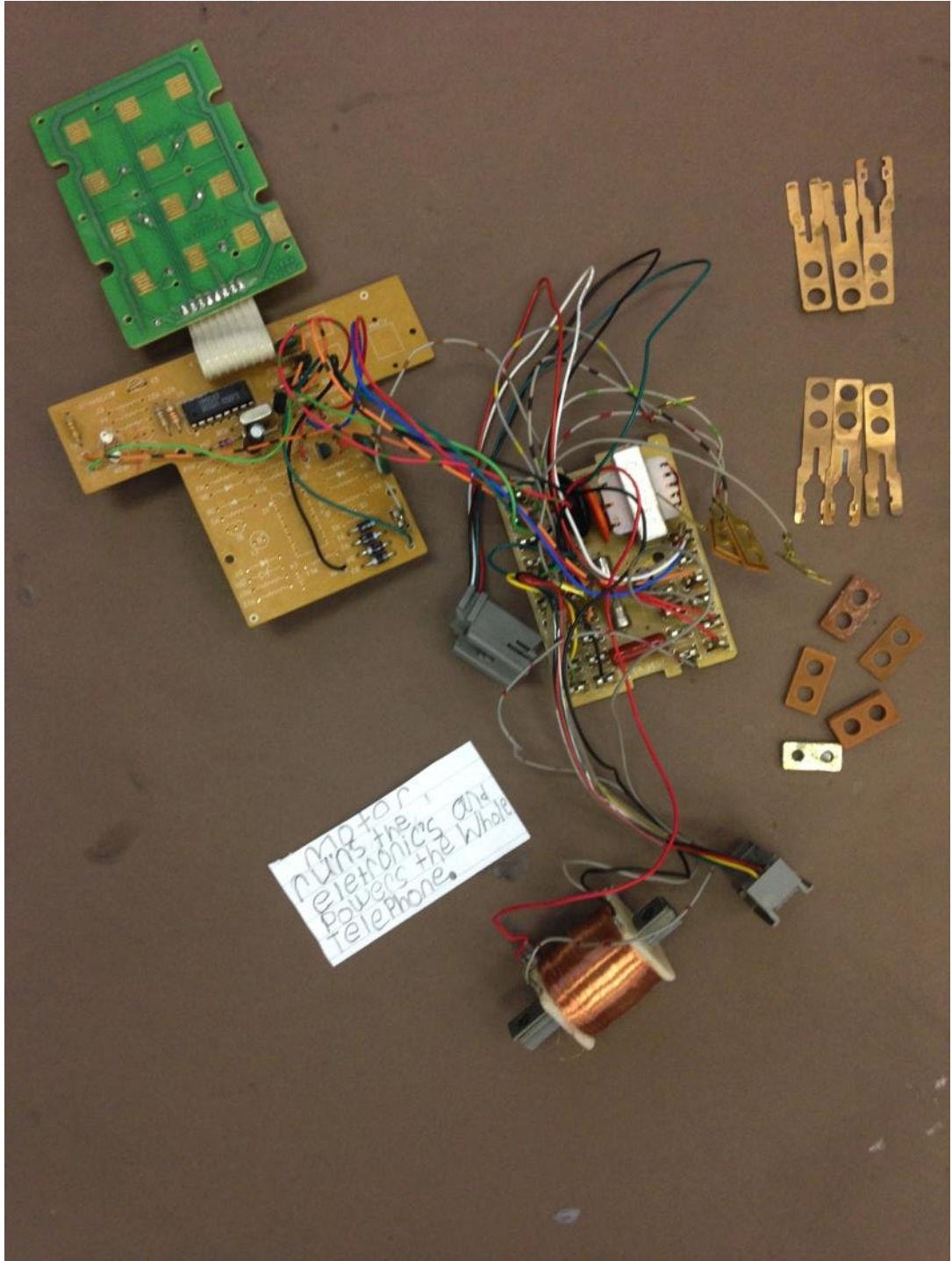


It rings the  
switches on the  
board to call  
the handle  
wires & wires  
the circuit board.



Keypad  
The keypad is the buttons  
that you press to contact  
another phone.







Base  
The base is the part of  
phone that keeps all the rest  
electronics together and connects