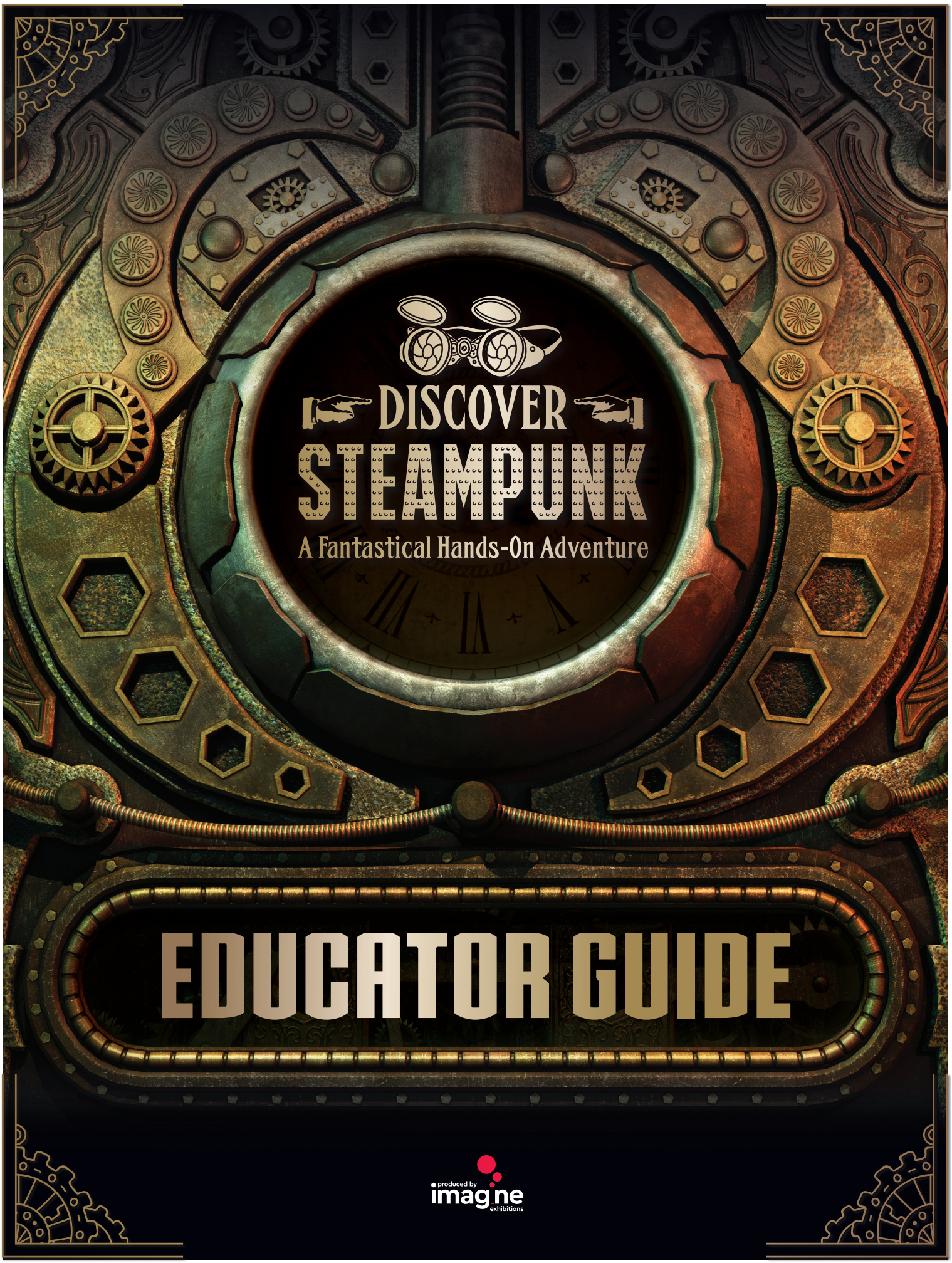
DISCOVER
STEAMPUNK
A Fantastical Hands-On Adventure
EDUCATOR GUIDE
produced by
imagine
exhibitions

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INTRODUCTION TO THE EXHIBITION

Imagine a futuristic world powered by old technology. Imagine an alternative history that was inspired by Victorian ideals where steam power drove innovation. Imagine these possibilities, and you have steampunk. Steampunk is a movement and an aesthetic as varied as the individuals within it. It has become a form of artistic expression and an educational tool that teaches ingenuity, collaboration, and self-reliance, and above it all, it truly embraces the concept of STEAM (science, technology, engineering, art, and mathematics).

In this dynamic Exhibition, steampunk is explored and explained through the stories behind iconic 19th century visionaries and steampunk-inspired exhibits. The Exhibition is divided into eight galleries, each focused around a different historical visionary and how that visionary's art, innovations, and ideas have shaped our modern world. The Exhibition offers a wide array of learning across many STEAM subjects such as creative expression, interchangeable parts, photography, automation, and much more.

ABOUT THIS GUIDE

The guide is composed of fifteen activities including two design challenges that embody the ideals of STEAM and are aligned with the Idaho Science Performance Standards. These lessons and activities bridge the learning from the Exhibition to the classroom.

Eight of the activities cover a variety of 3rd through 5th grade performance expectations, and eight of the activities cover a variety of 6th through 8th grade performance expectations, so teachers can choose which activities are best aligned with their curriculum and which are best to fit their students' needs and interests.

ACTIVITIES

For each of the eight galleries within the Exhibition, there are two corresponding activities. Some of the activities should be done at the Exhibition, but most are either introductory or follow-up activities designed to enhance and expand students' experience with the Discover Steampunk Exhibition.

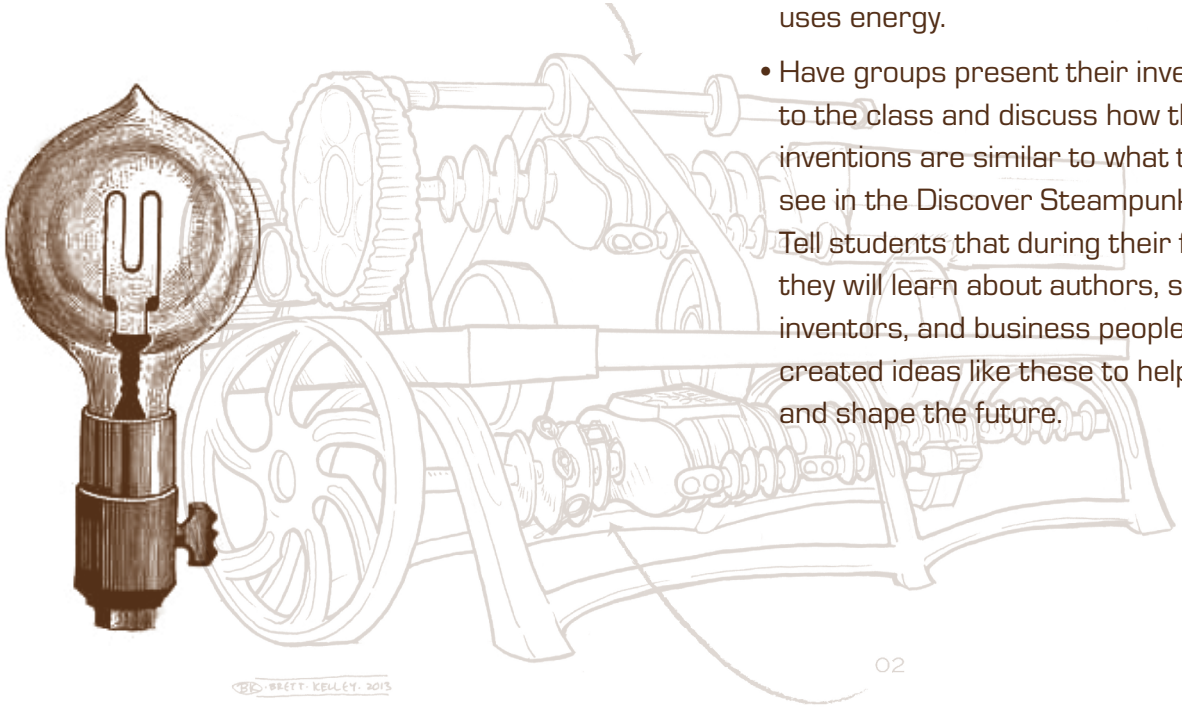
ACTIVITY 1

INTRODUCTORY GALLERY

ACTIVITY: Adaptation, collaboration, and problem solving – students identify an old form of technology that is still in use today and design a model to demonstrate how that technology converts energy.

- **Grade Level:** 4th
- **Performance Standard:** PS1-4-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- **Materials:** Art supplies (paper, glue, markers, toilet paper rolls, pipe cleaners, etc.) and computer (optional).
- **Description**
  - Before visiting the Discover Steampunk Exhibition, discuss with students how the world has changed dramatically over the past 300 years. Discuss how the Industrial Age transformed Western society from being primarily an agricultural society where most people lived near farms into an industrial society where most people lived in cities.

- Ask students to name some of the inventions developed during the Industrial Age and write them on the board. Students should list things like railroads and manufacturing. Ask students what types of energy powered these innovations and list responses–like steam and coal energy–on the board.
- Discuss with students how most historians believe we are currently in the Information Age and have been for at least the past 50 years. Discuss some of the technological inventions that came about during the Information Age. List them on the board. List the types of energy that powered these innovations. Most of the current innovations are powered with electrical energy.
- Ask students to discuss which inventions from the Information Age are new ideas and which are simply advances on inventions from the Industrial Era. For example, a digital watch is not a new idea but rather an evolution of the clock.
- Put students in groups, and tell them that they are now going to invent things in the opposite direction. Instead of improving on an old innovation by using new technology they are going to try to envision how a modern invention could be made using old technology. Have students choose one invention that was developed during the Information Age, and ask groups to brainstorm how that invention could be made by using only the technology that was available during the Industrial Age. For example, how can the internet exist without computers? What other ways are there to communicate all that information?
- Have students design and build a model of their new invention. The models can be made of standard art materials, created on a computer, or drawn, but students should focus on how their invention uses old technology to make modern inventions. Be sure to have students explain how their invention obtains and uses energy.
- Have groups present their invention to the class and discuss how their inventions are similar to what they will see in the Discover Steampunk Exhibition. Tell students that during their field trip, they will learn about authors, scientists, inventors, and business people who created ideas like these to help predict and shape the future.



ACTIVITY 2

WHAT IS STEAMPUNK?

ACTIVITY: In an effort to define steampunk, students observe the kinetic machines in the Exhibition and identify how they are powered.

- **Grade Level:** Middle School
- **Performance Standard:** PS3-MS-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **Materials:** Paper and pencil.
- **Description**
  - Before visiting the Discover Steampunk Exhibition, ask students to define steampunk. Some students may have never heard the term, and others may be immersed the genre. After hearing students' ideas, as a class come up with a working definition of steampunk.
  - Ask students what types of energy make machines and other man-made devices move. List their responses on the board. Some examples could be electrical, gravitational, magnetic, spring, and thermal energy.
  - Have students make a table and label each column with each type of energy listed on the board. Have students list as many machines or devices that they know of that run on that type of energy. For example, students could list a Tesla under the electrical energy column.
  - When students visit the Discover Steampunk Exhibition, have them bring their tables with them, and when they see a device that moves, have them identify what type of energy it is using and then list that device in the appropriate column. If the device uses a new type of energy, create a new column.
  - When you return to class, have students share their data and observations and use these to refine the class definition of steampunk. Be sure to ask what the most common and least common forms of energy were in the Exhibition. Compare your definition with what you find on the internet.

ACTIVITY 3

THE POWER OF IMAGINATION IN SCIENCE: H.G. WELLS

ACTIVITY: Design Challenge - Students learn the principles of conducting controlled experiments by designing and constructing parachutes.

- **Grade Level:** 3rd
- **Performance Standard:** PS1-2-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- **Materials:** Tissue paper, newspaper, paper clips, washers, string, plastic bags, coffee filters, tape, aluminum foil, and stopwatch.
- **Description**
  - After visiting the Discover Steampunk Exhibition, ask students to reflect on the H.G. Wells Gallery. Remind students that H. G. Wells predicted the invention of parachutes, lasers, and the internet. Tell students that now that these things have been invented, it is time to perfect them. The challenge is to design, build, and test a parachute with the goal of having the slowest descent rate of any group in the class.
  - Draw a picture of a parachute on the board, and ask students to list all the parachute's variables that can be manipulated. Put the list on the board. The list should include things like length of the strings, type of material, and size parachute top. Tell students that these are the independent variables. The dependent variable will be the descent rate.
  - Tell students that each group will choose ONE variable to test how it affects descent rate. Have groups choose one of the variables on the board and create three parachutes where their variable is different on each. For example, if students choose string length, they would make one parachute with 5 cm strings, one with 10 cm strings, and a third with 15 cm strings. Tell students that all other variables need to stay the same. For this example, the size of the top of the parachute, the type of material, and all other aspects of their three parachutes should be exactly the same.
  - Test parachutes by dropping them from 10 feet high and recording the time it takes for them to reach the ground. Have groups graph their results and post graphs around the room.
  - Have students observe the graphs of all the groups and discuss the results. Have students discuss what the best design would be, and have students design, construct, and test their new and optimal parachutes.
  - Come back together as a class, and discuss which designs had the best results and why. Discuss what worked and didn't work in the design process.

ACTIVITY 4

TRANSMITTING INFORMATION

ACTIVITY: Students compare and contrast ways that information is transmitted.

- **Grade Level:** 6th-8th
- **Performance Standard:** PS4-MS-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
- **Materials:** One piece of graph paper per student, one piece of printer paper per student. black markers.
- **Description**
  - Discuss the H.G. Wells Gallery in the Discover Steampunk Exhibition. Remind students that Wells was an author who dreamed up some of the technology we use today. He invented the idea of ray guns–or lasers–which led him to investigate how to communicate information wirelessly.
  - Ask students to describe how information is communicated wirelessly. Ask about TVs, cell phones, and radios. Tell students that technology has improved dramatically over the last century, and today they are going to investigate one of those advancements by exploring the difference between digital signals and analog signals.
  - Pass out a sheet of plain paper, and have them cut the paper into six equal-sized portions. Have each student write the numbers one through six in the top corner of the portions of paper.

- Tell students to make a simple drawing on the plain portion of paper labeled #1. The drawing should take less than a minute and should only have lines, no shading. Pictures can be letters, shapes, or happy faces, any simple drawing.
- Have each student pass the drawing to another student and on the portion of paper labeled #2, the new student should make a copy of the drawing by tracing it.
- Pass the copy–not the original–of the drawing to another student and have that student trace it onto sheet #3. Pass the copy on sheet #3 to a new student and have that student make another copy onto sheet #4. Repeat until a fifth copy is made on sheet #6, and return all the copies back to the original drawer.
- Hand out a sheet of graph paper to every student. Have them cut the graph paper into six equal-sized portions. Have each student write the numbers one through six in the top corner of the portion of graph paper.
- Have students make a different drawing on the graph paper. The drawing should be done by only coloring in individual squares, not by drawing lines. When the drawing is done have students pass it to another student to make a copy. After they are finished that copy, have students pass their copy to another student, and have them make a copy of their copy in the same way they did with previous drawing. Repeat this process until there are five copies, and return all copies back to the student who originally drew the images.
- Have students line up their drawings in the order they were created and look for differences. Have students walk around the room to make observations of what they see in other students' copies.
- As a class, debrief what students noticed. Ask them why the copies of the first drawings on the plain paper are less accurate than the drawing on the graph paper. Explain that these two methods represent the difference between analog and digital signals. Analog waves are smooth and continuous, similar to how students traced the images, while digital waves are stepping, square, and discrete, similar to how students colored in squares on the graph paper. Because digital waves have these characteristics, they are easier to replicate without distortion.
- Discuss with students that the methods for wireless communication have changed and improved over the years, but it was because of creative minds like H.G. Wells that transmitting information through space was even possible.

ACTIVITY 5

ETHICS AND ELECTRICITY: MARY SHELLEY

ACTIVITY: Ethics quiz – students build a circuit board that lights up when students agree about ethics in science issues.

- **Grade Level:** 4th
- **Performance Expectation:** PS1-4-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- **Materials for each student or group:** One half sheet of cardstock, six strips of masking tape, hole punch, six strips of aluminum foil, three alligator clips, D battery, D battery holder, light bulb, and light bulb holder.

- **Description**
  - After visiting the Discover Steampunk Exhibition, ask students to reflect on the Mary Shelley Gallery. Give students a brief overview of the story of *Frankenstein*, telling them that it's the story of a young scientist who, through unorthodox methods, creates a terrible and frightening yet wise and gentle creature. The book has many themes, but a central one is about the responsibility of humans for their creations.

- Ask the students the following questions:
  - ✧ Should Dr. Frankenstein have made his creature?
  - ✧ What do students think of the statement "with great power comes great responsibility"?
- Tell students that the goal of this activity is not to look for any of the right answers but to start thinking about some of these larger questions and to try to identify their personal ethical code.
- Pass out the materials to students, and tell them to make a table similar to the one below with six rows and two columns on their piece of cardstock. After they have made the table, write each quote on the board, and have students write the quotes in their tables, and as you write them on the board, ask for students to share their ideas about the quotes. Ask students to explain what each quote means.

QUOTES	RANKING
◯ Integrity is doing the right thing, even if nobody is watching. -ANONYMOUS	1. ◯
◯ It is curious – curious that physical courage should be so common in the world, and moral courage so rare. -MARK TWAIN	2. ◯
◯ Ethics is knowing the difference between what you have a right to do and what is right to do. - POTTER STEWART	3. ◯
◯ Relativity applies to physics, not ethics. -ALBERT EINSTEIN	4. ◯
◯ You can't put someone else in charge of your morals. Ethics is a personal discipline. -PRICE PRITCHETT	5. ◯

- Tell students to rank the quotes from one to five, with one being the quote that most resonates with them and five being the quote that means the least to them. Tell students they are then going to build a circuit board quiz that will reveal their answers to others.
- Have students punch holes in the left and right side of each row of their table as seen in the image above. Have students flip over their cards and draw a line from the hole next to a quote to the hole with their ranking. For example, if a student thinks that the Einstein quote resonates most, she should draw a line from the hole next to that quote to the hole next to #1 ranking on the right column. Students should rank and draw lines for all five quotes.
- Students then tape down their foil strips to their lines one by one. The foil needs to cover the entire hole on both the left and right side but not go over the end of the paper. After each piece of foil is taped on, students should put a piece of masking tape over it before putting down the next sheet of foil. Students should follow this process for all five quotes.
- Have students make an open circuit using the alligator clips, a light, and a battery. Give students time to try to figure out how the circuit should work but know the set up should go like this:

ALLIGATOR CLIP ➤ BATTERY ➤ ALLIGATOR CLIP ➤ LIGHT ➤ ALLIGATOR CLIP.

To test that the circuit works, touch the alligator clips on the ends together, and the light should come on.

Students should test their circuit board quiz by putting one alligator clip on the foil/hole by the quote and the other one on foil/hole of their answer and seeing if the light lights up. Ask students to explain how the circuit works and what kind of energy is being converted. It's chemical energy in the battery into light energy.

Discuss with students how lighting up their thoughts is like bringing a creation to life, just like with *Frankenstein*.

After all the circuit boards are made, put students in pairs, and have them ask each other a couple questions about their ethical code and then each student should take the other's "quiz" to see how the other student ranked the quotes. Students should repeat this with two or three other students.

Come back together as a class, and have a discussion about their observations. What quotes were generally the most and least popular? Why do they think that is? What does this tell us about the overall ethical code of the class?

ACTIVITY 6

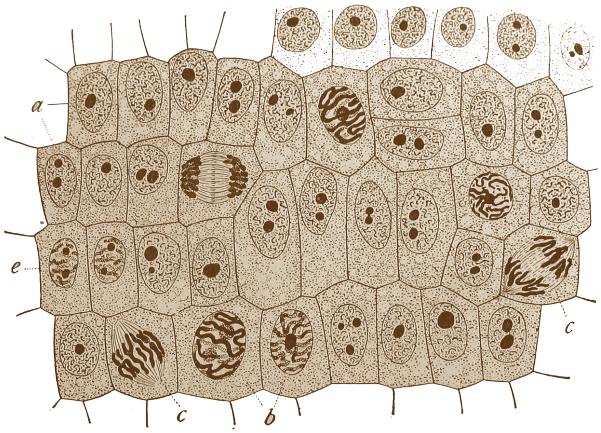
SHOULD FRANKENSTEIN'S MONSTER BE ALIVE?

ACTIVITY: Students identify what it means to be alive and debate if certain imaginary creatures like Frankenstein's monster are alive or not.

- **Grade Level:** 6th-8th
- **Performance Standard:** MS-LS1-4. Construct a scientific argument based on evidence to defend a claim of life for a specific object or organism.
- **Materials:** Living or nonliving objects for five stations. These can include but are not limited to things like seashells, dead bugs, raisins in soda water, dry yeast, and corks.

- **Description**
  - Discuss the Mary Shelley Gallery with students, and ask them to reflect on what was in that Gallery. Remind students that Mary Shelley wrote *Frankenstein* which was not only one of the first and most influential works of science fiction but also a novel that questioned humans' responsibility in creating new things and the ethics involved in modern science.
  - Tell students that they are going to debate whether or not certain fictional creatures are alive or not, but first they need to determine what it means to be alive.
  - Ask students to define what it means to be alive by listing the characteristics something needs to have to be considered alive. Write down student ideas on the board. Some common answers are: needs air and breathes, moves, eats, poops, etc.
  - Have students choose 10 of the characteristics they've come up with and create a data table where the first column lists the 10 characteristics followed by five blank columns.

- Setup five stations around the room with your living or nonliving objects. Have groups spend about five minutes at each station determining if the objects meet the criteria for each characteristic listed on their data chart. Have students mark the data chart with a yes or no if it meets the criteria.
- Have a class discussion debating if each object should be labeled living, nonliving, or dead.

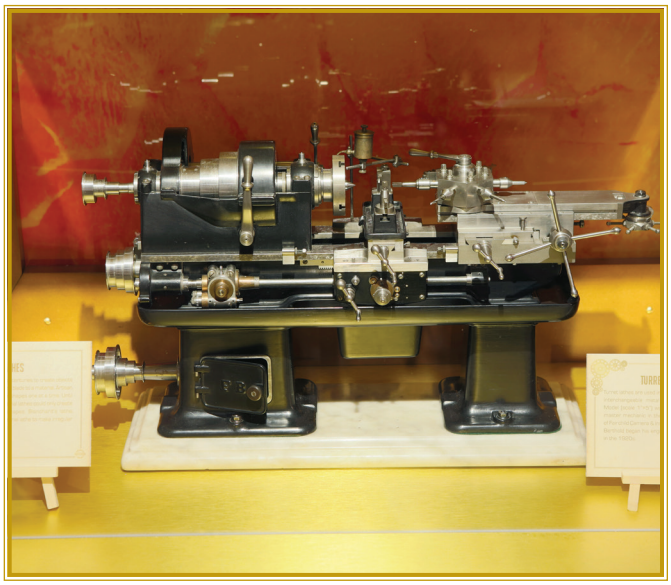


- Create a list of the "official" characteristics of living things:
  - ✓ Has cells
  - ✓ Grows
  - ✓ Can reproduce
  - ✓ Responds to the environment
  - ✓ Metabolizes
  - ✓ Maintains homeostasis
  - ✓ Made of organic molecules (proteins, lipids, carbohydrates, and nucleic acids)
- Ask class if any nonliving things possess some of the same characteristics as living things. Which ones? Ask students if all things that can move are "alive." Have them defend their opinions by referring to the results of their explorations at the stations. Ask students to describe what kinds of nonliving things move.
- Ask students to debate if they would classify Frankenstein's monster as living, nonliving, or dead. Challenge students' ideas as you can defend many claims about classifying Frankenstein's monster as either nonliving or living.
- Have students think of other fictional creatures and ask them to debate if those creature are alive or not. A few interesting creatures to debate are Transformers, the Smurfs, vampires, and Zeus but it's also fun to come up with your own list!

ACTIVITY 7

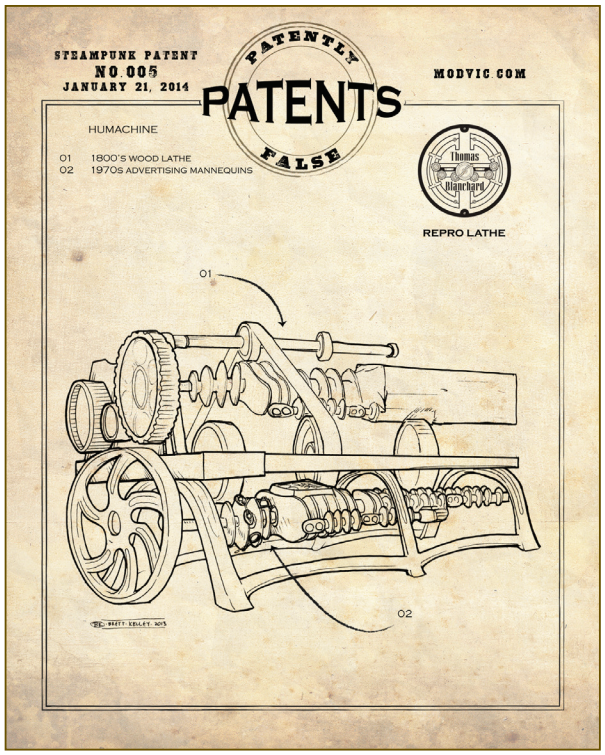
STEAM AUTOMATION AND LEISURE: THOMAS BLANCHARD

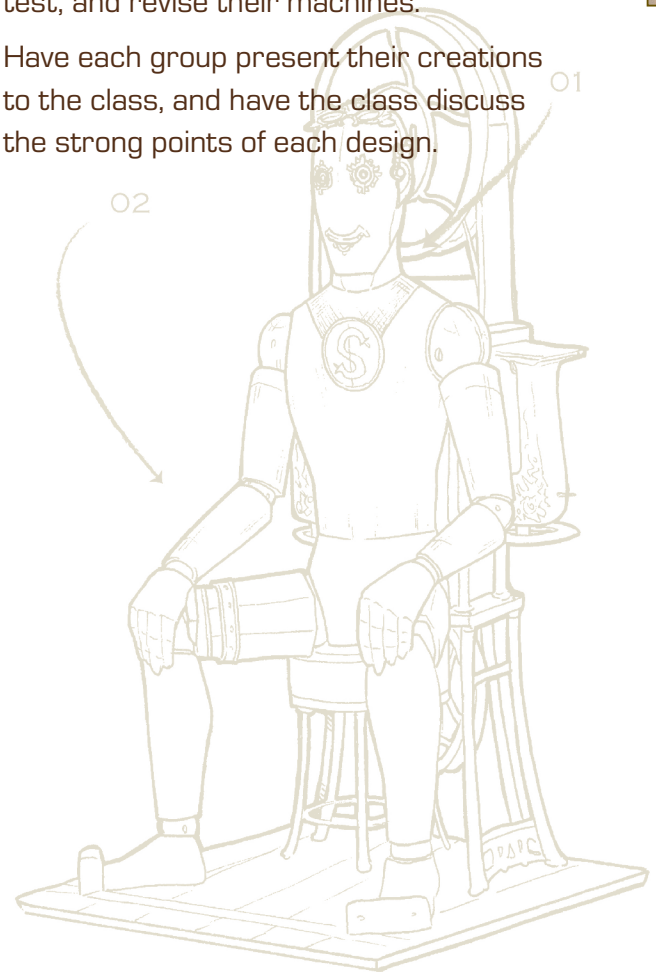
ACTIVITY: Automation – Students design, build, and test a device that uses the energy in a boiling pot of water to move a toy train or car.



- **Grade Level:** 5th
- **Performance Standard:** PS1-4-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- **Materials:** Water, heating source, toy trains or cars, and miscellaneous building materials like tracks, piper cleaners, balloons, cardboard, dominoes, etc.
- **Description**
  - Reflect on the Thomas Blanchard Gallery, and ask students to share what they remember from this Exhibition. Remind them that Thomas Blanchard was the quintessential steampunk inventor. Not only was he an innovator for new technologies, but his inventions often involved trains and steam. What could be more steampunk than that?
  - Tell students that they are going to recreate some of Thomas Blanchard's inventions by trying to figure out how to take the energy from steam and use it to move a toy train.
  - Discuss energy with students. Discuss that energy is movement, that it can take many forms, and that it can be transferred from one place to another.
  - Ask students to share out what forms for energy they know about, and list them on the board. Help students think of energy forms like heat, electric, kinetic, potential, and chemical.

- Put students in groups, and tell them that they are going to be challenged with making a train move by using the energy from boiling water. Tell them that they need to design a device that will take the heat energy from the boiling water and convert it into at least two other forms of energy before they make the train move.
- Do an internet search of Rube Goldberg machines to give the students an idea of the types of devices they should make.
- Have students draw out their plans, reminding them to be sure to label where and when energy will be transferred.
- After their plans have been approved by the teacher, give students time to build, test, and revise their machines.
- Have each group present their creations to the class, and have the class discuss the strong points of each design.





ACTIVITY 8

IMPACT OF AUTOMATION

ACTIVITY: Students debate whether automation is taking away people's jobs or giving them more freedom for leisure.

- **Grade Level:** 6th-8th
- **Idaho Social Studies Content Standard:** 6-9.GWH.3.2.6. Investigate how physical geography, productive resources, specialization, and trade have influenced the way people earn income.
- **Materials:** Internet access.
- **Description**
  - Ask students what they love about technology and innovation. Ask students what innovations have helped their lives, and ask them which innovations have had the most impact on the world. Encourage students to think beyond games and phones and about things that have changed society. List at least 10 innovations on the board. They can include smartphones, cars, the internet, or any technological or industrial innovation over the past 200 years.
  - Ask students if they think there is any downside to technology or industry. Ask them if there have been any unintended consequences with new innovations.

- Tell students to think back to the Discover Steampunk Exhibition and the Thomas Blanchard gallery, and ask them if they remember why it was called Steam Automation and Leisure. Discuss with students how Blanchard's main focus was on automation. As a boy, he devised an apple-paring machine that operated six times faster than paring by hand. While this is great for the owner of the apple orchard, it's not as good news for the worker who pares the apples; he's being replaced by a machine!
- Discuss with students how every generation believes that automation will one day entirely replace humans, but ask if this is a good thing or a bad thing. Does automation create joblessness or opportunities for better jobs or more time for leisure?
- Put students in pairs, and assign them one of the innovations listed on the board to debate. Before they begin, have both partners think about the following questions:
  - ✧ Who does this innovation help?
  - ✧ Who does it hurt?
  - ✧ How has it made the world better?
  - ✧ How has it made it worse?
  - ✧ How would things be different if this innovation was never invented?
- Randomly assign one person to be pro and one person to be con, and have students debate whether that innovation has had a positive impact on society or not.
- Have students swap roles, and give them another innovation to debate, but this time, give them time to research the innovation on the internet to gather more details about the impact it had on society.
- After the second round of debates, come back together and debrief as a class. Were there any themes or ideas that percolated to the top? How did having time to research their topics help to improve their arguments? What was it like to have to defend an argument they didn't believe in? Did they have any ah-ha moments during the debates, or did they ever change their minds?

ACTIVITY 9

THE POWER OF THE MIND: JULES VERNE

ACTIVITY: How does the ocean affect me? Students create a poster or comic or presentation that demonstrates the impact the oceans have on our daily lives.

- **Grade Level:** 5th
- **Performance Standard:** ESS2-5-1. Using an example, develop a model to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- **Materials:** Art materials and internet access.
- **Description**
  - Discuss with students how Jules Verne was the godfather of science fiction and that some of his most groundbreaking work was on what many consider the last frontier–the oceans. His ideas and imagination helped in the development of submarines and deep sea exploration which led to us learning more about what lives in the ocean, its topography, and its chemical makeup.
  - Ask students why we care about the ocean. Ask them to explain why the ocean is important to humans.

- Put students into groups, and tell them that they are going to research and create a poster or a comic or a presentation that describes why the ocean is important to humans. Tell groups they must answer the following four questions in their presentation:
  - ✧ How does the ocean affect the climate, and why do I care about the climate?
  - ✧ What does the ocean have to do with the oxygen I breathe, and why do I care about oxygen?
  - ✧ What role does the ocean play in our food chain, and why do I care about the food chain?
  - ✧ What's a carbon sink, and why do I care about a carbon sink?
- Give groups time on the internet to research and answer these questions. Have groups make a poster, comic, or presentation that answers these questions in a fun and creative way.
- Have groups present their work to the class, and come up with class explanation to "How does the ocean affect me?"

ACTIVITY 10

THE VALUE OF IDEAS: JAN MATZELIGER

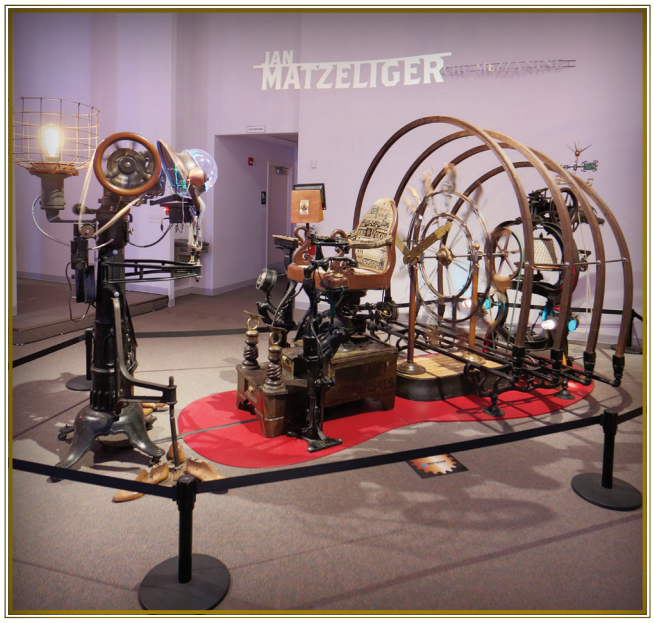
ACTIVITY: Save us! Students identify the types of natural disasters that are causing the most damage to humans and come up with new designs to try to reduce the impact of these natural disasters.

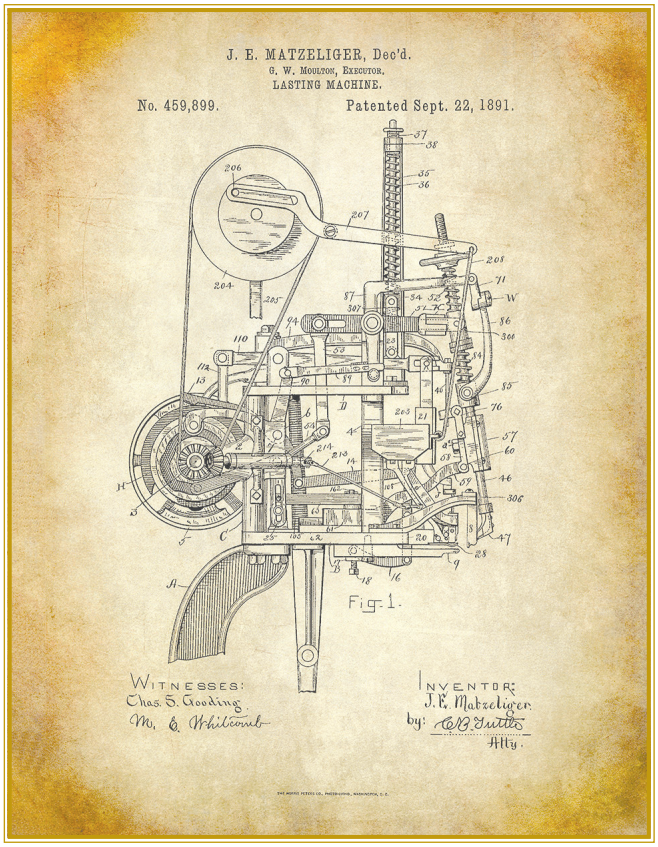
- **Grade Level:** 5th
- **Performance Standards:** ESS3-4-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- **Materials:** Internet access.
- **Description**
  - Ask students what they learned about patents in the Jan Matzeliger Gallery. Remind them he was the shoemaker who made shoes affordable to the average person because his patent created a method for making shoes so much cheaper. His patent helped to improve the lives of average people.
  - Tell students now it's their turn to develop an idea that will help their community. Ask students what types of natural disasters cause damage in their state. Ask them what kinds of damage these disasters cause and what people do to try to prevent that damage from occurring. Tell students that they are going to be challenged with coming up with new solutions to prevent damage from these disasters.
  - Put students in groups, and using the internet, have them answer the following questions:
    - ✧ What type of natural disaster causes the most monetary damage in your state?
    - ✧ What three things are currently being done to prevent the damages from these disasters?
  - Come together as a class, and have groups share their findings. As a class, come to an agreement on the most devastating type of natural disaster.
  - Put groups back together, and have them brainstorm new and innovative solutions to combating this type of natural disaster. Have groups create an image or a model of their invention and present it to the class. Have the class give feedback on each idea, and after all groups have presented, discuss what ideas bubbled to the top. Ask students if now, after hearing all the other ideas, they have new ideas on how to improve their innovations.

ACTIVITY 11

FIX IT

ACTIVITY: Students identify how humans are negatively impacting the environment, and imagine and design a model that will mitigate these impacts.





- **Grade Level:** 6th-8th
- **Performance Standards:** ESS3-MS-3. Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.
- **Materials:** Internet access.
- **Description**
  - Ask students how Jan Matzeliger helped improve people's lives. Remind them that he was the inventor who designed a machine to make shoes affordable to the average person. He demonstrated how inventions are not just for the monetary good of the inventors but can help society. Tell students that they are going to identify ways that humans negatively impact the environment, and they are going to come up with new ideas about how to reduce that impact.
  - Put students in groups, and have them answer the following questions using the internet:
    - ✧ What are the three most urgent human-caused environmental issues in your state?
    - ✧ What causes these environmental issues?
    - ✧ What is currently being done to address these three issues?

- Come together as a class, and have groups share their findings. As a class, come to an agreement on the environmental issue that every group is going to focus on.
- Put groups back together, and challenge them to come up with a new idea to mitigate the impact humans are having on their environmental issue. Tell students their idea must:
  - ✧ Be realistic
  - ✧ Include a plan for implementation and a monitoring plan
  - ✧ Have an end goal–define what success looks like
- Give groups time and internet access to research the issue and to design an innovation that will mitigate the impact humans are having. Instruct them to create a presentation of the invention that addresses all the criteria above and to present it to the class. Have the class give feedback on each idea, and after all groups have presented, discuss what ideas bubbled to the top, and ask students if now, after hearing all the other ideas, if they have new ideas or ways of improving their previous ideas.

ACTIVITY 12

PARTS OF A WHOLE: ISAAC SINGER

ACTIVITY: It's not worth anything if no one buys it. Students identify something in their lives that they love but is not popular then they develop an advertisement for that product.

- **Grade Level:** 3rd
- **Idaho Social Studies Standard:** 3.SS.3.1.1. Explain the concepts of supply and demand and the role of the consumer and producer.
- **Materials:** Art materials.
- **Description**
  - Before visiting the Discover Steampunk Exhibition, ask students to brainstorm things that they use all the time and love but that are not very popular. It could be a toy or food or article of clothing. Any response is a good response and the more obscure, the better.
  - Write the students' responses on the board, and when students share the things they love, have them explain why they love them.
  - Ask students to talk about their favorite commercials or advertisements. Ask them to explain what they like about those advertisements, and put some of the main ideas on the board. Main ideas can include things like: it's funny, or has characters I like, or it has a catchy song, or it makes me feel happy.
  - Ask students the purpose of advertisements. Talk with students about the idea of supply and demand and how for producers to sell more product,

they need to increase the demand from consumers, and that is often done through effective advertising.

- Put students into groups, and tell them they are going to have to come up with an advertising campaign for one of the products listed on the board so that the things they love can become more popular.
- Have groups decide which item they are going to create an advertisement for and which of the main themes they are going to focus on.
- Have groups create a poster, a jingle, a commercial, or new branding for their item and present it to the class. Ask the class if they are more likely to buy the product or not after seeing the advertisement.
- When students visit the Isaac Singer Gallery in the Discover Steampunk Exhibition, be sure they visit the commercial advertising interactive, and when they return to class, ask them how they could use what they learned from that interactive to improve their advertisements.

ACTIVITY 13

ECONOMIES OF SCALE

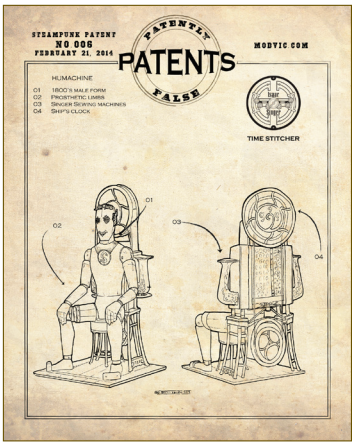
ACTIVITY: Isaac Singer was not just a great inventor but a great businessman who utilized the idea of economies of scale. In this activity, students will learn the math behind this concept.

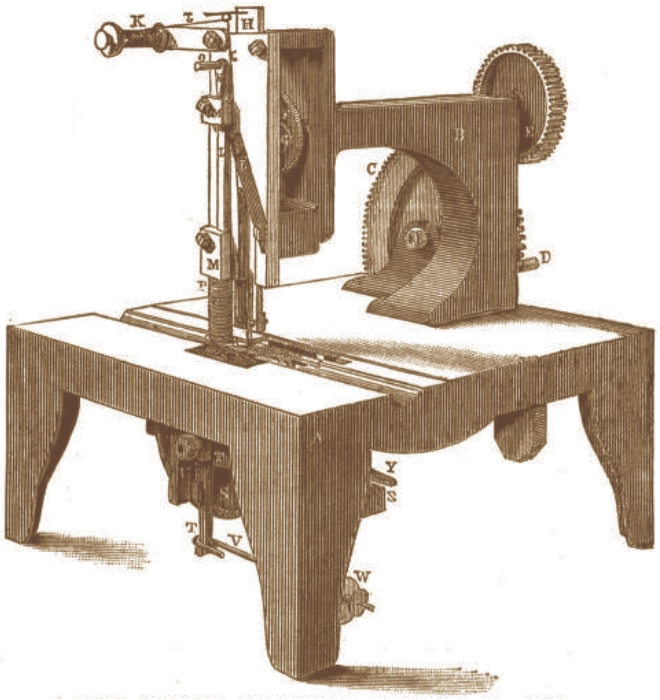
- **Grade Level:** 6th-9th
- **Idaho Social Studies Standards:** 6-9. GWH.3.2.6. Investigate how physical geography, productive resources, specialization, and trade have influenced the way people earn income.
- **Materials:** None.
- **Description**
  - Before going to the Discover Steampunk Exhibition, tell students that on the field trip they are going to learn about an inventor named Isaac Singer who came up with a new design on creating an inexpensive and fast sewing machine and also was able to capitalize on the idea of economies of scale.
  - Ask students if they have heard of the term economies of scale before. Ask them what they think it might mean, and ask them to describe how it works. If they have no idea, no problem.
  - Tell students that they are going to pretend to be the CFO of a sewing machine factory, and they are going to be in charge of generating the most profit as possible. The most you can charge for your sewing machines is $25 because if you charge more, customers will go to another company. Give students the following scenarios, and ask them to try to figure out the math and make a choice:

- ✧ Your company is currently selling 100 sewing machines a month for $25 each, and it costs you $15 to make each machine. However, if you spend $1000 on advertising a month, you will be able to sell 300 sewing machines every month. Do you spend the money on advertising? After students have done the math and replied, say, yes! Your profit would go from $1,000 to $3,000 a month. Selling more product generates more profit, even when you're spending more.
- ✧ Your company is now selling 300 machines a month at $25 each, but you discover that you can get your parts for cheaper if you buy in bulk. If you buy the parts for 400 sewing machines, you can make them each for $10. You'd have 100 sewing machines that don't sell, but you'd bring your cost per unit down. Should you do it? After students have done the math and replied say, yes! Even if you only sell 300 of the 400 machines, you increase your profit from $3,000 to $3,500 a month.

• The market is hot, and you can now sell 500 machines a month, but to do so, you need to build a new factory. The factory will cost $100,000. Is it worth it? After students have done the math and replied, say, probably not. It would take a long time to make up the profits from that new factory. The idea here is that there is often a limit to the economy of scale where getting too big adds too much complexity and too much new cost and leads to low profitability.

• Tell student this was a very simple example of how some aspects of economies of scale work, and ask students to try to explain again what the concept means. Tell students when they visit the Isaac Singer Gallery of the Discover Steampunk Exhibition to visit the cheese/rice interactive and see if it enhances their understanding of the concept.





ACTIVITY 14

ENVISIONING THE FUTURE: GEORGE EASTMAN

ACTIVITY: Projector in a box – Students make a projector out of cardboard that goes over their heads and projects an image to demonstrate how real cameras reflect light.

- **Performance Standards:** PS2-4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- **Materials:** For each group: Two-foot by two-foot cardboard box or larger, printer paper, duct tape, foil, pin, utility knife, and a dark towel or scarf (something to wrap around their necks).

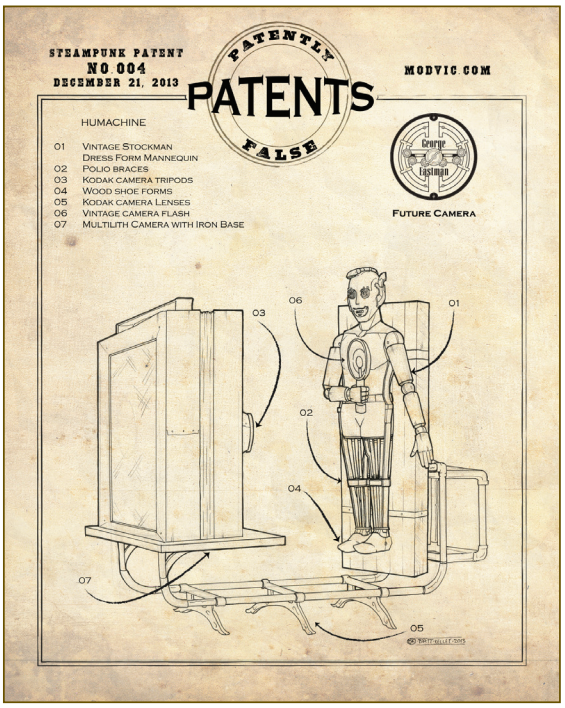
Description

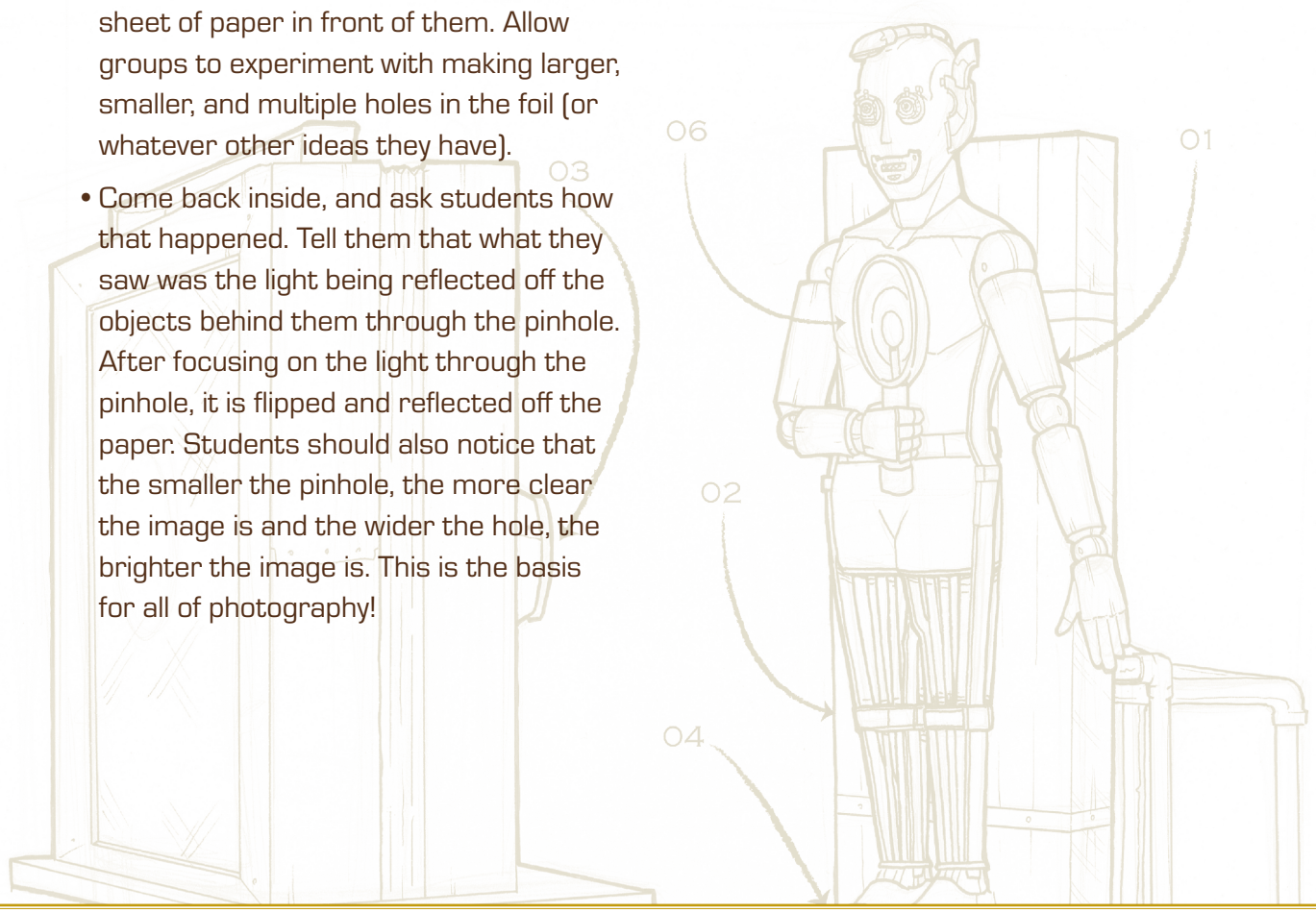
- Discuss with students how George Eastman was a visionary, making photography "convenient as a pencil," and while his techniques seem old-fashioned now, he helped make photography accessible for everyone. Tell students that the innovations he used were innovative for their time but are now obsolete, but the principles he applied about the behavior of light are still the same.
- Tell students that they are going to make their own cameras by putting a box on their heads to demonstrate how light reflects off of everything. Pass out the materials, and ask students how they think they can project an image inside the box with the supplies they are given. Listen to students' ideas and then have them follow these directions:

  - ✧ Tape a sheet of the printer paper to one of the inside side walls of the box.
  - ✧ Seal box shut with duct tape.
  - ✧ Cut a hole in the bottom of the box just large enough to squeeze your head through. When you put your head through, it should face the white paper inside.

- ✧ Seal the box with duct tape so no light gets in. Put your head through to check for leaks. Patch leaks with duct tape.
- ✧ Cut a 2x2-inch hole in the box just above where the back of your head is when it's in the box, and tape a piece of foil over the hole.
- ✧ Use a push pin or sharp pencil to poke a tiny hole in the foil.
- ✧ Go outside, and have students take turns putting the box over their heads and use the scarf to block any sun from coming in the neck hole.

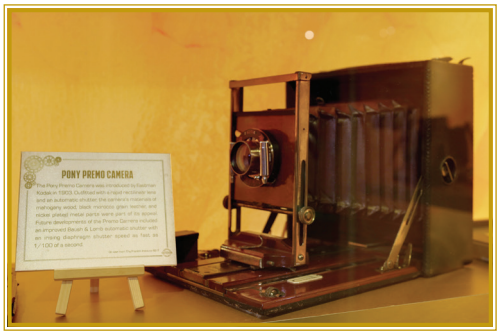
- It will take a couple minutes for students' eyes to adjust, but eventually they will be able to see whatever is behind them projected upside down on the white sheet of paper in front of them. Allow groups to experiment with making larger, smaller, and multiple holes in the foil (or whatever other ideas they have).
- Come back inside, and ask students how that happened. Tell them that what they saw was the light being reflected off the objects behind them through the pinhole. After focusing on the light through the pinhole, it is flipped and reflected off the paper. Students should also notice that the smaller the pinhole, the more clear the image is and the wider the hole, the brighter the image is. This is the basis for all of photography!





ACTIVITY 15

CAPTURING WAVES



ACTIVITY: Students use digital cameras and TV remotes to observe similarities and differences of infrared and visible light.

- **Grade Level:** 6th-8th
- **Performance Standard:** PS4-MS-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- **Materials:** For each group: Remote controllers that do not have a light that you can see when you push a button, digital camera, sheet of glass or plastic, black trash bag, foil, mirror.
- **Description**
  - Ask students to reflect on how light is captured through photography in the George Eastman Gallery. Ask students what different types of waves are used.
  - Tell students that today they are going to experiment with infrared light. Ask students if they have heard of infrared light or know what it is. Give each group a remote control, and turn off the light. Have them press the power button, and ask if they can see anything. Ask them if there is nothing there, or if they just can't see anything. Turn the lights back on.
  - Have groups press the power button on the remote control while looking through the digital camera. Be sure the disable the infrared filter on your camera. Ask students why they can see the light through the camera but not with their eyes.
  - Have students predict if the light from the remote control will go through the foil, glass, or black plastic. Ask them if they think it will behave like visible light or behave differently. Have students put the foil, glass, and black plastic in front of the camera and predict. Test if the light passes through these materials.
  - Have students predict and test if the light from the remote will reflect off the mirror.
  - Come back together as a class and debrief. Ask students to try to explain what is happening and explain that the light from the remote is infrared light which has a longer wavelength and lower frequency than visible light and is out of the range of what the human eye can see. Infrared light bounces off of metals and mirrors just like visible light but can pass through some substances like black

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