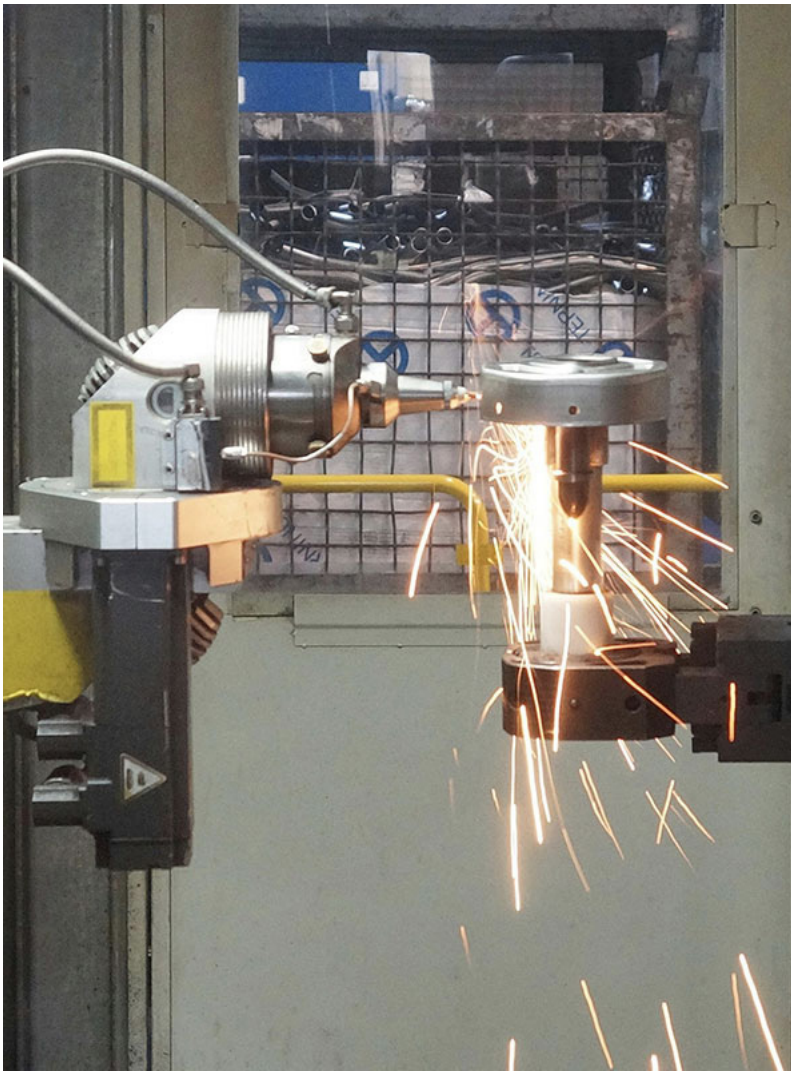


ADVANCED MANUFACTURING

- **Aerospace Engineering**
  - » Design a Blueprint
  - » Paper Airplane Design & Flight Test
- **Robotics Engineering**
  - » Robot Sensors Challenge
  - » Design a Robot
- **Welding**
  - » Welding Joints
  - » Weld with Chocolate

Course Advanced Manufacturing
Section: Aerospace Engineering

James Rumsey Technical Institute

Draw a Blueprint

What You Will Do

Learn about basic Orthographic drawings and create a blueprint of an object with dimensions.

1. Read about engineering drawings create your first blueprint with dimensions.
2. Choose an object with simple lines such as a rectangular block of wood or Legos that is easy for you to measure and draw the different sides.
3. Select which sides you what to be the front, right, and top.
4. Create an Orthographic projection of the object that shows 3 sides.
5. Use the ruler to measure the dimensions of your object.
6. Draw the front, top, and right side of the object and add dimensions.

Materials You Will Need

- Pencil
- Paper (graph paper if you have it)
- Eraser
- Ruler
- Small to medium size object

Blueprint

Artists draw objects for others to look at and enjoy. Engineers draw objects so that they can be accurately constructed by others. While there are many different types of drawing methods, this lesson will cover orthographic projection and how to include dimensions.

Important Terms

- **Orthographic projection** - A method of drawing a 3-dimensional object in 2 dimensions.
- **Planar drawings** - Drawings that simplify complex 3D forms into flat, angular planes.
- **Extension lines** - Solid lines that extend from the edges of an object and help define the specific area to which the dimension applies.
- **Dimension lines** - Lines used to show the size or location of features in an engineering drawing.
- **Scale** - A ratio that represents the proportion of the drawing to the actual size of an object. For example, the drawing is 1/3 scale or 3 times smaller than the actual size of the object.

Study Examples

Look at the example provided in Figure 1. In the top right-hand corner, you will see an orthographic drawing of a block that shows a 3-dimensional view with labels for sides.

The other 3 drawings show just the front, top, and right side. The front of the object is usually at the center of the drawing with the top stationed above it and on the right side to it's right.

If there were a need to include a bottom or left drawing, then those would be placed respectively below and to the left.

Figure 2 shows the drawings with extension lines and dimensions added.

After reviewing the drawings, do you believe that you would be able to construct this block based on the information included or do you believe something is missing? If so, what would you include?

Planar and Orthographic Drawing

Measure the sides of your object and write the dimensions down. Which side do you want to be the front or top?

Do your best to make an orthographic drawing of your object. Since this is your first blueprint do not worry about scale. Use your ruler to help create straight edges of your drawing.

Draw the front of the object, then top, and finally the right side as in the examples in figure 1.

Label Measurements

Add extension lines like those in Figure 2 to all the sides you think are necessary to convey to the person making the part. Try not to duplicate dimensions you have already added.

Add dimension lines. Leave a space in the center of the dimension lines for your dimensions.

Add the dimensions.

Look at your blueprint. Do you believe that someone else can build that object using your blueprint?

Practice

Blueprints and drawings are used throughout the aerospace industry. Aircraft manufacturers, mechanics, engineers, and parts manufacturers utilize different drawings to design, repair, and make improvements on aircraft and spacecraft.

Students in the Aerospace Engineering class make drawings of their protypes during the research and design phases. These serve as the base for CAD (Computer Aided Design) programs.

For practice, choose more complicated objects to draw and/or design part of a remote control aircraft or drone.

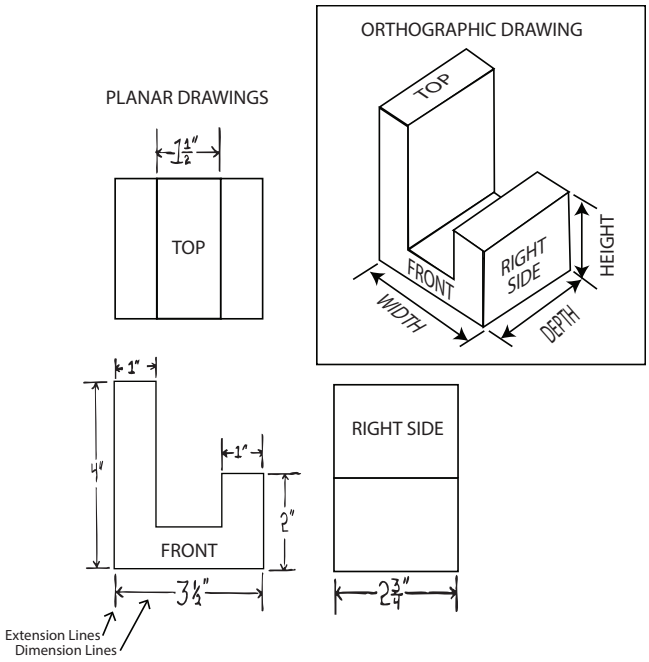


Figure 1

Course **Advanced Manufacturing**
Section: **Robotics Engineering**

James Rumsey Technical Institute

Robot Sensors Challenge

What You Will Do

- Build a simple obstacle course.
- Guide a robot using only sensor commands.
- Practice giving clear instructions.
- Learn how robots detect obstacles and respond.

Materials You Will Need

- At least one partner to work with.
- Books, chairs, or boxes to create obstacles.
- A scarf or cloth for a blindfold (optional).
- Tape or paper to mark a start and finish line (optional).

Robotic Sensors

Robots use sensors to understand their environment. Sensors detect distance, motion, light, or touch. Engineers program robots to respond when sensors detect nearby objects.

In this activity, one of you will be the robot and the other will be the sensor. The robots only moves when it receives a command from the sensor.

Step 1: Build the Obstacle Course

1. Place objects around the room to create a path.
2. Leave space so someone can walk between obstacles.
3. Mark a start and finish location.
4. Make sure that the course is safe. Clear any obstacles that could harm the person playing the robot.

Step 2: Assign Roles

Choose one person to be the robot and one to be the sensor.

Step 3: Guide the Robot

1. **Robot**: Close your eyes. Listen for input from the sensor. Only do what the sensor commands.
2. **Sensor**: Give commands such as “move forward, turn left, turn right, or stop.” Your commands have to be simple and exact. Give one command at a time. Pay close attention to what the robot does. The robot can only do what it is commanded to do.

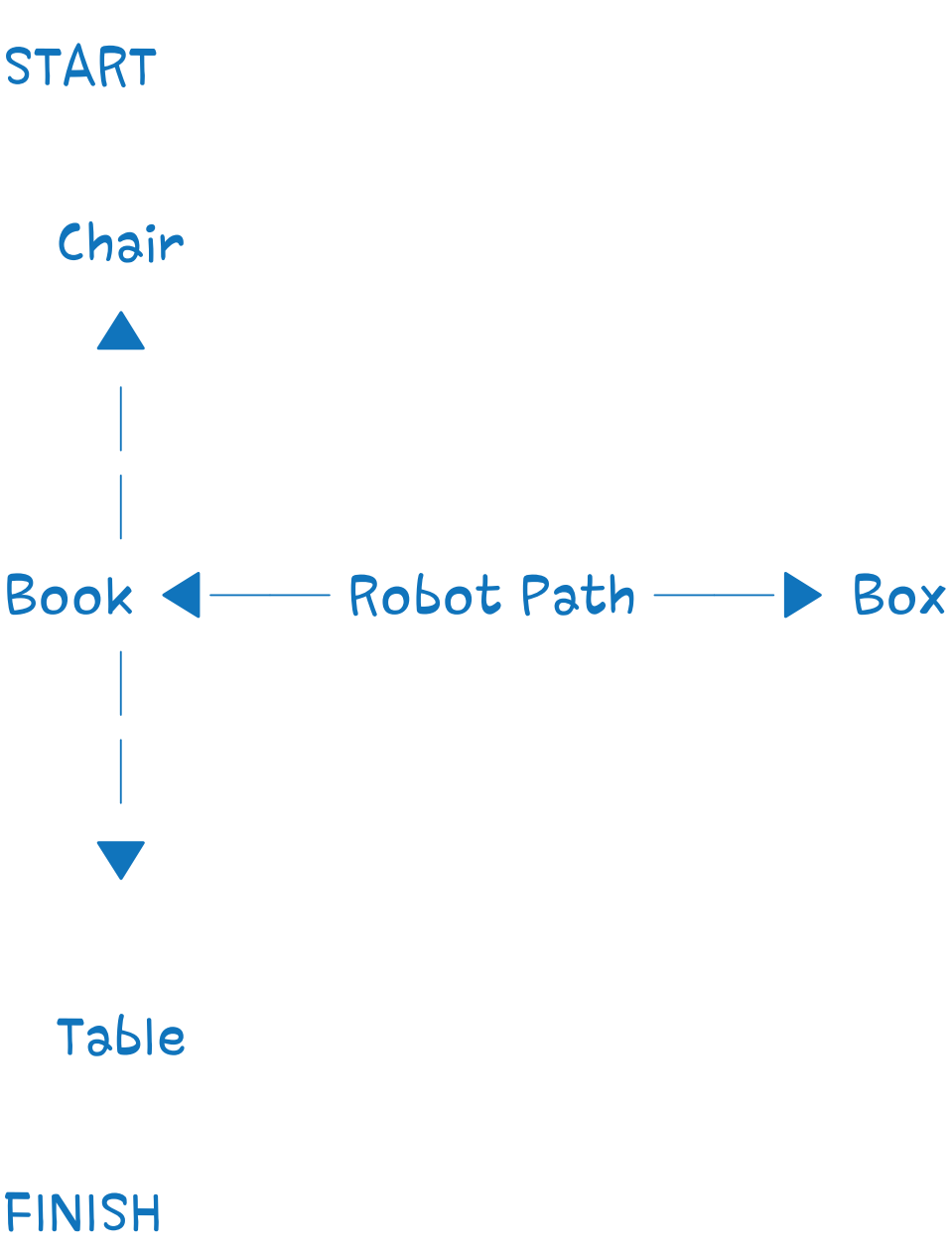
Step 4: Try Again

Switch roles and repeat the challenge. The robot’s success depends on clear commands from the sensor.

Engineering Tip

Real robots often combine several sensors at the same time. For example, warehouse robots use distance sensors and cameras to move safely around people and shelves.

Example Obstacle Course Layout



Course **Advanced Manufacturing**
Section: **Robotics Engineering**

James Rumsey Technical Institute

Design a Robot to Solve a Problem

What You Will Do

- Choose a real world problem.
- Design a robot that could solve the problem.
- Sketch your robot and label its parts.
- Explain how your robot would work.

Materials You Will Need

- Paper (graph paper if you have it)
- Pencil
- Colored pencils or markers (optional)

Robotics Design

Robotics engineers design machines that solve real problems. Engineers often begin with simple sketches before building prototypes.

1) Identify a Problem

- Cleaning trash in a park.
- Delivering supplies in a hospital.
- Helping firefighters search buildings.
- Exploring another planet.

2) Movement

How will your robot move? That will depend on its environment.

- **Wheels** are the fastest method for moving over land and floors that don't have too many obstacles.
- **Tracks** are slower but better for handling rough terrain.
- **Legs** may be the best option for stepping over obstacles.
- **Impellers** can push a robot through water.
- **Rotors** are used for flying robots.

3) Guiding the Robot

Sensors and cameras are used to detect obstacles and tell the robot where it is in its environment. See the descriptions for different types of sensors on the next page. Which ones will your robot need?

4) Manipulation

Once your robot moves into position, how will it perform its tasks? Will it use special tools built into the robot? If it needs to manipulate objects or tools, claws or human-like hands might be better.

5) Sketch Your Robot and Explain How it Works

Draw your robot. Label the parts including sensors. Include notes that explain how the robot will move, what sensors it will use, and how it will perform its tasks.

Engineering Tip

Engineers rarely build a robot perfectly the first time. They create prototypes, test them, and improve the design many times before the robot works well.

Robot Sensors

Robot sensors are vital components that enable machines to perceive their environment and internal state, facilitating autonomous operation, navigation, and interaction.

Proximity and Distance Sensors

Detect nearby objects and measure distance for obstacle avoidance, including Ultrasonic, Infrared (IR), and LiDAR (Light Detection and Ranging).

Vision Sensors (Cameras)

Capture visual data for object recognition, navigation, and 3D mapping. Examples include 2D cameras, stereo vision cameras, and thermal cameras.

Position and Displacement Sensors

Measure the robot's position and movement. Examples include GPS (for outdoor navigation), potentiometers, and encoders to track motor shaft rotation.

Environmental Sensors

Monitor environmental conditions, such as temperature, gas, or humidity, for safety, as explained on Standard Bots.

Motion and Orientation Sensors

Monitor acceleration and orientation. Examples include Accelerometers (for tilt/acceleration) and Gyroscopes (for rotational movement).

Force/Torque Sensors

Measure the pressure or force applied by the robot, essential for manipulating objects and, in industrial settings, handling materials.

Tactile/Touch Sensors

Detect physical contact, touch, or pressure. This includes simple switches (limit switches) and complex, artificial "skins" that detect object shape, size, or hardness.

Next Level Challenge

Do your drawing as a planar and orthographic blueprint. See the "Draw a Blueprint" activity in the Aerospace Engineering lesson to learn how.

Course **Advanced Manufacturing**
Section: **Welding**

James Rumsey Technical Institute

Weld with Chocolate

What You Will Do

See how materials, even chocolate bars, can be made stronger by welding them into a box.

Materials You Will Need

- 4 small chocolate bars like Hersheys Miniatures or Andes Mints
- Paper plate
- Wax paper
- Microwave safe drinking glass or glass jar
- Water
- Objects for weight
- Kitchen or bathroom scale
- Refrigerator or freezer

Fusion Welding

There are many different types of welding. In this activity, you will fuse four pieces of flat stock (chocolate bars) together by melting their edges and joining them together. Once the chocolate is cooled, the bond will be strong.

Flat bars of steel aren't always strong enough on their own. Welders often create box welds to increase their strength.

Compressive Strength

Compressive strength is a measurement of how much weight or downward force a structure can hold without failing.

Step 1: Get Set Up

Gather your materials. Set out the paper plate and unwrap the chocolate. Fill the glass or jar most of the way. Leave a couple of inches at the top to make it easy to move without spilling.

Step 2: Heat the Water

Place the water in the microwave. If you are using a jar, do not put the lid on the jar. Microwaving water in a closed container can be dangerous. Microwave the water for about two minutes. Chocolate melts at a low temperature. The water does not need to be boiling. It only needs to be as hot as you would need for a cup of tea or cocoa.

Step 3:

1. Carefully remove the hot water from the microwave and move it to the paper plate.
2. Using both hands, press one edge each of two chocolate bars against the side of the glass or jar. The sides of the glass are warm from the hot water.
3. Once the heat has melted the chocolate edges, press those two edges together. This creates two sides of a box.
4. Place these fused bars onto the paper plate with one bar laying flat and the other sticking straight up. You might need to use something to prop up the bar that is standing up. The chocolate is still soft and will need to set before if becomes strong.
5. Repeat the process with two more chocolate bars.

Step 4: Cool the Box Sections

Remove the glass or jar from the plate. Place the plate with the two box sections into the fridge or freezer.

Step 5: Create a Box

Repeat steps two and three to weld the box sections together. Place the plate with the completed box into the fridge or freezer.

Step 6: Test the Strength of the Box

1. Put a sheet of wax paper on a scale. Use wax paper to keep everything clean. This way you can eat the chocolate when you're done!
2. Place your box on its side on the paper. Put another sheet of paper on top of the box.
3. How much weight do you think this little chocolate box can hold? Carefully place weights, such as books, on top of the box one at a time.
4. Check the weight each time you add an object.

How did you do?

How close was your guess? If you haven't eaten all of the miniature bars yet, try repeating this experiment by fusing three of them together into an I-beam. How can welding a vertical bar between 2 horizontal bars increase its strength? Will two I-beams next to each other hold more weight than one welded box?

Course **Advanced Manufacturing**
Section: **Welding**

James Rumsey Technical Institute

Welding Joints

What You Will Do

Build crane arms with different types of joints and test them to determine which joint type is the strongest.

Materials You Will Need

- Cardboard box you can cut into strips
- Glue or tape
- Small objects for weight
- String
- Ruler
- Pencil
- Scissors

Welding Joints

Welders join peices of metal together in a way that makes those two peices act like one solid piece. To do this, you have to understand the best way to create a joint that will withstand the stress that might be applied to it. Think of a crane lifting a few thousand pounds a hundred feet in the air. The welds holding those parts together have to be very strong.

Flexural Strength

Flexural strength is how much load (weight) a material can hold before it gets deformed or breaks. Cardboard usually has very little flexural strength. Let's see how welders join materials together to strength them.

Tensile Strength

Tensile strength is the maximum stress a material can withstand while being stretched or pulled before breaking

Step 1: Create Slats

Use the scissors to cut the box into sheets of cardboard. Then use the ruler, pencil, and scissors to cut the sheets into several slats that each measure 2 inches wide by 6 inches long.

Step 2: Build a Crane Arm

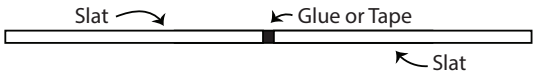
Use glue or tape to join three slats together into a crane arm that is little over a foot long. Steel is heavy and expensive. Keep in mind that it is the goal of every welder to build the strongest structure possible without using too much material.

Build three crane arms. Each one will use a different joint type to connect the slats:

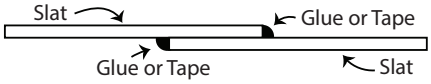
- **Butt joint** (end-to-end)
- **Lap joint** (overlapping pieces)
- **T-joint** (one piece attached perpendicularly)

If using glue, let it dry before moving to the next step.

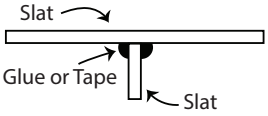
Butt Joint

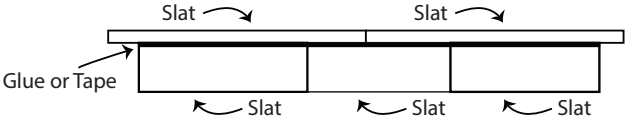


Lap Joint



T-Joint





Step 3: Attach the Load

Cut a length of string about as long as your arm. Tie one end of the string around your weight.

Attach the other end of the string to the first crane arm.

Step 4: Lift the Weight

Hold the end of the crane arm opposite the weight and slowly lift the weight. How high were you able to lift it before the arm bent or twisted? If it lifted without any problem, add more weights until it does.

You won't know which joint type is the strongest until you test each one until the arm fails. Repeat this test with each joint type and compare how each performs.

ARTS & COMMUNICATION

- **Graphic Design**
  - » Design a Blueprint
  - » Paper Airplane Design & Flight Test
- **Multimedia Publishing**
  - » Robot Sensors Challenge
  - » Design a Robot

Course **Arts & Communication**
Section: **Graphic Design**

James Rumsey Technical Institute

Design a Logo

What You Will Do

Create a modern-looking logo for a sports team with an animal mascot.

Materials You Will Need

- Pencil
- Eraser
- Paper (3 sheets recommended)
- Colored pencils or markers
- Ruler (optional)

Important Terms

Abstraction – The process of simplifying ideas or characteristics, removing details to focus on the general concept. For example, a stick figure is recognizable as a person but doesn't look realistic at all. It just has a circle for a head but you know it's a head. An abstract representation is more like the idea of something rather than a realistic portrayal of it. Logos usually use abstract representations. Think of Apple's logo.

Color Palette – A specific, limited selection of colors used in a design.

Critique – The process of evaluating a design to make sure that it is effective.

Step 1: Realistic Sketch

Draw the animal as realistically as you can.

Focus on details like:

- Eyes
- Fur/feathers
- Teeth/beak
- Legs/wings
- Tail

Spend 5–10 minutes on this drawing.

Step 2: Abstraction

On a new sheet of paper:

Look at your realistic drawing.

Simplify your animal drawing using only:

- Basic shapes
- Lines
- Curves
- Triangles
- Circles

Remove small details.

Example:

- Feather details become one curved wing shape
- Fur becomes a smooth outline
- Teeth become one triangle shape

Step 3: Choose a Color Palette

Select a color palette that is limited to two or three colors. The colors are an important part of the branding. Every sports team is identified by their colors as much as the image in the logo.

Will your colors be related to the animal depicted? Arizona Cardinals use red and black because those are the colors of the real animal. The same is true of the Cincinnati Bengals (orange and black). However, the Detroit Lions use blue and white. Will you choose a color palette based on what you think is attractive or to support the recognition of the animal?

Step 4: Turn It Into a Logo

On a third sheet:

- Make the image bold and clean.
- Use thick lines or fill shapes with solid colors.
- Make sure it is recognizable from far away.
- Add optional:
  - Circle badge
  - Shield
  - Initial letter
  - Team name

Erase any sketch lines. Make the image as clean and polished as possible.

Step 5: Critique the Logo

Show your logo to a friend and ask them:

- Can you easily tell what the animal is?
- What adjectives come to mind when you see it (strong, modern, fast, scary)?
- Would you wear it on a shirt?
- Is it simple enough to remember?

Course **Arts & Communication**
Section: **Graphic Design**

James Rumsey Technical Institute

Design a Font

What You Will Do

Create your own unique typeface and then use a website to convert it to a font file. Think about how you want to use this font. Will it be appropriate to use in a Halloween Party flyer design? How about speech lettering for a comic book?

Materials You Will Need

- Computer with internet access
- Paper, pencil, and pen or computer drawing app

Body or Display Font

Body fonts are typefaces designed for legibility. The font used for this text is Helvetica, a font that is very popular because of how modern it looks and how easy it is to read. Display fonts are designed to be creative and attention getting. Since they're used mostly for titles and headlines which use small amounts of text, egibility isn't as important for display fonts. Some display fonts are just symbols. These are call dingbat fonts.

Serif or Sans Serif

Serifs are the decorations at the ends of lines on a letter. Sans Serif (like the one you are reading) don't have serifs.

Serif

Pro Tip

The key to typeface design is consistency. Be as creative as you want, but make sure your design elements are consistent throughout. This is especially true for line weights. Once you type a line of text with your font, differences in elements like line weights will be very distracting.

Important Terms

Glyph: Every character in a font is called a glyph. These include numbers, punctuation, and symbols.
Baseline: This is the invisible line that the letters sit on.
x-height: The height of a lowercase x. This is where the tops of most lowercase letter reach.
Ascender: The part of lowercase letters like "d" that rise above the x-height.
Descender: The part of lowercase letters like "q" that sink below the baseline.

Instructions

Option 1: Draw glyphs by hand

With a pencil and ruler, lightly draw a grid like the one on the next page. Use lines to indicate where your baseline and other measurements go. Draw your glyphs withing these lines. Go back over your drawings with ink. Once the ink is dry, carefully erase any remaining pencil marks.

Use a phone, tablet, or laptop camera to take a picture of the finished glyphs.

Option 2: Draw glyphs in a graphics app

Import the grid into an app like Illustrator or Canva. You might need to take a picture of it and upload that if you can't import page 3 from this PDF. Use the grid as a background layer to draw over.

Pro Tip

Avoid using any color other than black. Your drawing should have sharp edges, no shading. Your art will be converted into vectors so that it can be used as type.

Convert Your Art to a Font

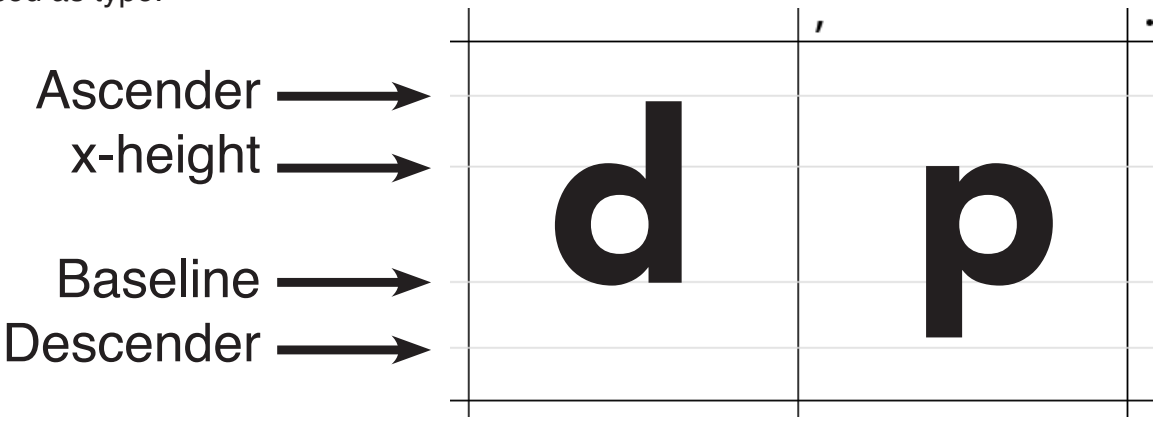
Once you have your font artwork finished, download an image or take a picture of your glyphs laid out on the supplied Calligraphr grid. Make sure the four square registration marks are in the image. Their app will use these to straighten and square up the image before converting it.

Go to this website: **www.calligraphr.com**

Create a free account. With a free account, you are limited to how many glyphs your font can contain. Follow their instructions for uploading your art and converting it to a font you can download.

You final font will be a ".ttf" file (True Type Font) that can be installed on a computer. If you are on a school computer, talk to the teacher before trying to install your font. It may not be allowed.

How to position your letters in the grid:



calligraphr

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;	?	A	B	C	D		
E	F	G	H	I	J	K	L
M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	a	b
c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r
s	t	u	v	w	x	y	z

← Include all those four markers untrimmed on your photo or scan.

Course **Arts & Communication**
Section: **Multimedia Publishing**

James Rumsey Technical Institute

Create a Flipbook Animation

What You Will Do

Create an animated walkcycle of a character using paper and traditional drawing tools.

- Create 24 frames
- Show a full walk cycle (left step and right step)
- Maintain consistent character proportions
- Include arm swing opposite leg motion
- Demonstrate visible weight shift
- Ensure the cycle loops seamlessly
- Finish the drawings by adding backgrounds and additional motion

Materials You Will Need

- Stack of index cards, drawing paper, or printer paper (at least 24 sheets cut to 3x5 inches)
- Pencil (no pen for initial drawings)
- Eraser
- Binder clip or rubber band

Optional but recommended

- Lightpad - A lightpad is a thin LED light panel that allows you to trace.

Walk Cycle

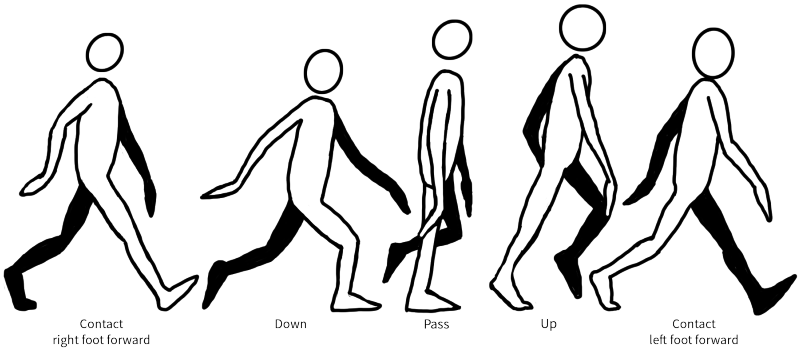
A walk cycle is a type of character study that animators do to explore how a character moves. It is something short that can play in a loop. This means that the movement ends in the same position it starts in. In other words, if the character's left leg is forward at the start, it should be forward at the end.

Important Terms

Frame Rate - Each still image is a frame. The frame rate (FPS) is the number of frames per second. The more frames you have, the smoother the motion will be. Film is usually 24 FPS and video is 30 FPS. Since animation requires so much work, it is usually 12 FPS (12 drawings for one second of animation).

Key Frame - A key frame is a frame that marks the beginning of a movement. Think of a ball bouncing. The key frames might be the ball in the air, the ball hitting the ground, and the ball flying up. The motion is then filled in between these frames.

Onion Skinning - Onions are made of lots of thin layers, so is animation. Animators place a new sheet of paper over the previous couple of drawings on a light table. This way, they can see where the motion was previously.



Step 1: Key Frames

- Sketch a simple character (a stick figure is acceptable for beginners).
- Draw each of these key frames:
  - ◊ Contact
    - ◊ Mid-stride, one leg is behind the body with heel up and toes touching the ground. The other leg is ahead of the body with the heel of the foot touching the ground.
  - ◊ Down
    - ◊ Both feet still touching the ground, knees bent, arms starting to swing.
  - ◊ Passing
    - ◊ One leg straight under the body, arm swung in close to the body.
  - ◊ Up
    - ◊ Body leans forward and is raised up on the toes of one foot.
  - ◊ Contact
    - ◊ Return to the contact position but with the opposite arm and leg forward.

Step 2: In-Between Frames

- Add motion between the keyframes.
- Maintain consistent spacing for smooth motion.
- Use light pencil pressure for clean corrections.

Step 3: Timing & Spacing Adjustments

- Flip pages rapidly to check motion.
- Adjust spacing to show:
  - ◊ Slower movement = closer spacing
  - ◊ Faster movement = wider spacing
- You can also add in-between frames to slow down and motion and make it smoother. Remove in-between frames to speed up motion.
- Ensure vertical bounce is visible but subtle.

Step 4: Loop Test

- Bind your drawn frames together with a binder clip or rubber band.
- Flip the animation repeatedly.
- Confirm final frame transitions smoothly into first frame.
- Make corrections as needed.

Step 5: Finish the Drawings

Once you're satisfied with your drawings, add some polish

- Add backgrounds. You can add more life to your animation with some simple motion in the background like a bird in the sky.
- Add life to your character by adding more motion like hair and clothes moving when they walk.

Course **Arts & Communication**
Section: **Multimedia Publishing**

James Rumsey Technical Institute

Create a Webpage

What You Will Do

Create a webpage with a basic text editor app. Writing HTML doesn't require special software. All you need is a simple text editor. On a Mac, use the app TextEdit. On a Windows computer, use the app Notepad. Check the app's preferences to make sure that "rich text" editing is turned off.

Create a folder to keep all the files you will use on your webpage including images. Then create a new webpage file and save it in this folder. Replace the default file extension, which will probably be ".txt", with the HTML extension ".htm". Open this file in a web browser like Chrome, Safari, or Edge. As you work on your code, save your file. Go to the browser and refresh the window to see your updates.

Materials You Will Need

- Computer with a text editor app and web browser

HTML Basics

HTML is a markup language that tells the web browser where to put things. It organizes the page in a logical way that any computer can understand. Placing instructions between brackets indicates that it is a tag (a type of code). This way, it's separate from the rest of the text. This method of adding instructions to a document is called markup.

Most tags come in pairs, the opening and closing tags. For example, to make one specific word bold, you would put an opening tag before the word and a closing tag after it. This way, the computer knows when to start making the text bold and when to stop.

```
<p>The SR-71 spy plane can fly
at speeds up to mach 3.3 or
<strong>242 miles per hour</
strong>.</p>
```

What it looks like:

> The SR-71 spy plane can fly at speeds up to mach 3.3 or **242 miles per hour**.

Notice that the closing tag is identical to the opening tag except that there is a slash before the instruction.

For your text file to be read as a webpage when opened in a browser, it has to have the extension ".htm" at the end of the file name and these tags inside the file:

```
<!DOCTYPE html>
<html>
   <head>
   </head>
    <body>
    </body>
</html>
```

Here's what these tags mean:
<!DOCTYPE html> Tells the browser that it is an HTML document. Note that there is no closing tag for this.

<html></html> Everything between these tags will be read as HTML. Everything outside of these tags will be ignored.

<head></head> Metadata is stored between these tags. This is useful information that isn't displayed on the webpage itself. For example, the title of the page will be placed here. It will be displayed on the browser tab instead of on the page.

<body></body> Everything that will be displayed on the page will be put between these tags.

Links

HTML stands for HyperText Markup Language. What is hypertext? Hypertext is text that does more than just convey words. Usually that means that it links to something else. The whole reason HTML was created was so scientists could link to documents that they referred to in their papers. This is how you turn regular text into a link:

```
<a href="https://jamesrumsey.
com/">Click here to visit our
website.</a>
```

The <a> tags makes it a link. The href attribute tells it where to link to. You can use this same tag to turn an image into a link.

Email Links

You can also use the <a> tag to create an email link. When the user clicks on it, their email app will open. Use the "mailto:" attribute for the destination.

Example:

```
<a href="mailto:potterfan1@gmail.
com">Send me an email</a>
```

Absolute vs. Relative Links

Absolute links include the full address. Use this when linking to something on a different website.
Example:

```
<a href="https://jamesrumsey.
com/"></a>
```

Relative links are used to link to a file that is on the same website. Instead of including the protocol and domain name, you just point to the file and the folder it is in.
Example:

```
<a href="/mystuff/bestbands90s.html">
```

In a file address, a slash indicates a folder. "/mystuff/things/goofy.jpg" indicates that within the folder I am currently in, there is another folder called "mystuff" and inside that folder is another folder called "things". The "goofy.jpg" image is inside the "things" folder. To go up a folder, use three dots like this <a href=".../mystuff/bestbands90s.html">

Instructions

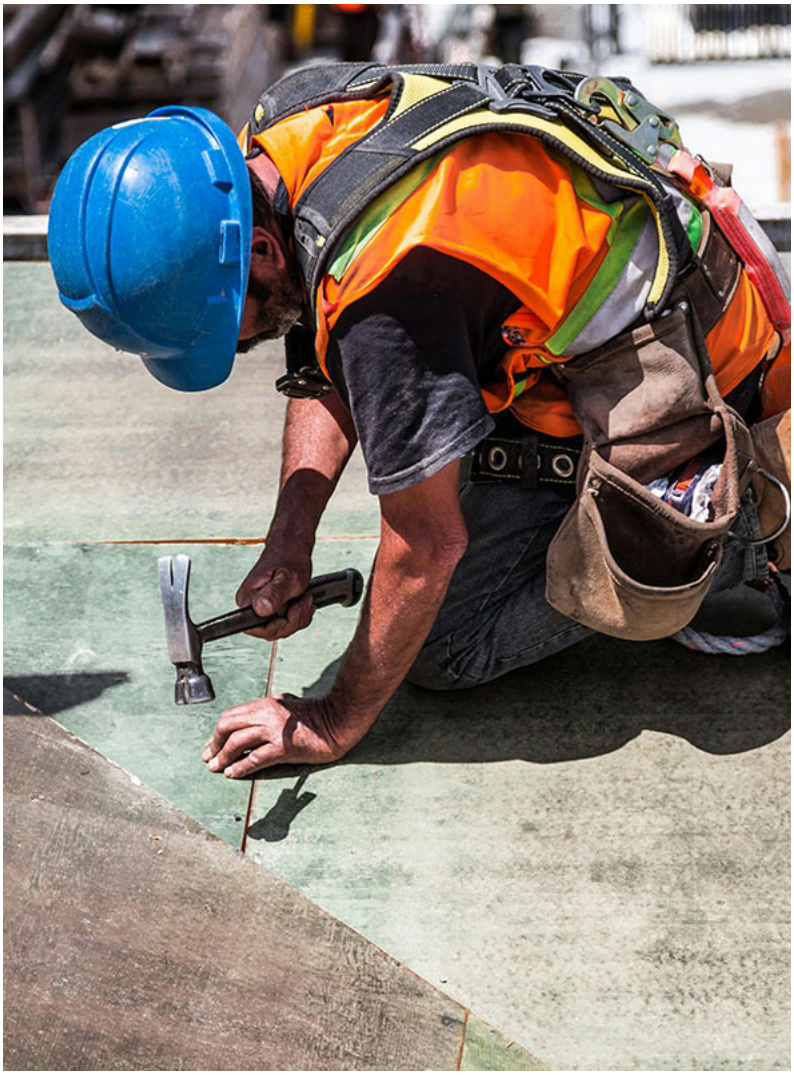
Create a webpage that contains images and links to other pages or websites.

Use this website to look up tags and to learn more about writing HTML: **www.w3schools.com**

Image file formats that work on websites:
JPG, PNG, GIF, SVG

Things to try

- Turn an image into a link.
- Create multiple pages and make a navigation menu to connect them.
- Add a CSS style sheet and get creative with the design of your pages. See the W3Schools website to learn how.



BUILDING CONSTRUCTION

- **Carpentry**
  - » Make and Use a Plumb Bob
  - » Check for Square
- **Masonry**
  - » Build a Wythe
  - » Build an Arch
- **Plumbing**
  - » How a P-Trap Works
  - » How a Hammer Arrestor Works

Course Building Construction
Section: Carpentry

James Rumsey Technical Institute

Make and Use a Plumb Bob

What You Will Do

Make a plumb bob (a weighted string) from household items to find a perfectly vertical line.

Materials You Will Need

- String
- Washers, nuts, keys, or small weights
- Tape
- Pencil
- Paper taped to wall

What is a Plumb Bob?

A plumb bob is a pointed, weighted tool (usually metal for the weight) hung from a string to establish a perfectly vertical line, known as “plumb”. It uses gravity to ensure accuracy in construction, carpentry, and surveying for aligning walls, columns, and studding. It works because no matter how you hold it, gravity will always make it point toward the center of the Earth.

Part 1: Make a Plumb Bob

- Tie a weight to the end of string. The weight should be fairly heavy so it can’t be moved by wind.
- Hold top of string against wall.
- Let weight hang still.
- Trace the string line on paper.

Part 2: Measure for Plumb

Check if:

- Door frame looks plumb
- Bookshelf side is vertical
- Wall corner is straight

Part 3: Calculate Total Deviation

Hold the end of the string against the wall or other surface. Let the weight hang freely. Measure the gap between the string and the wall at the bottom to determine the deviation. If the bottom measurement is 1 inch from the string the wall is out of plumb by 1 inch.

Course Building Construction
Section: Carpentry

James Rumsey Technical Institute

Check for Square

What You Will Do

Create a square and use the Pythagorean Theorem to test to see if it is square.

Materials You Will Need

- Pencil
- Paper
- Ruler

What is Square?

Square means that a corner is exactly 90 degrees. Carpenters and builders primarily use the Pythagorean Theorem ($a^2+b^2=C^2$) to ensure structural accuracy, primarily by creating perfect 90-degree right angles (squaring) and calculating diagonal lengths. This mathematical principle is used to establish that if the legs of a triangle are squared and added, they equal the square of the hypotenuse.

Important Terms

- **Pythagorean Theorem** – A fundamental geometric rule stating that for any right triangle, the square of the hypotenuse equals the sum of the squares of the legs. Used to calculate unknown side lengths. It applies only to right-angled triangles.
- **Hypotenuse** – The longest side of a right-angled triangle.
- **Squared Number** – When a number is multiplied by itself ($3^2=9$).

Carpenters use the 3-4-5 triangle:

- If one side = 3 units
- Other side = 4 units
- Diagonal = 5 units

Then the corner is square. Because: $3^2 + 4^2 = 5^2$

How to Do It

1. Draw a large rectangle on a sheet of paper.
2. In one corner, measure 4 inches along the bottom and make a mark.
3. In the same corner, measure vertically 3 inches and make a mark.
4. Use the ruler to draw a line that connects your marks.
5. Measure that line. If it equals 5 inches, your corner is square.

Course Building Construction
Section: Masonry

James Rumsey Technical Institute

Build a Wythe

What You Will Do

Learn what a wythe is in masonry and how masons build walls in straight, level rows.

Materials You Will Need

- Books, dominoes, Jenga blocks, soap bars, toy blocks, or small boxes (to use as blocks)
- Paper strips or cardboard (to represent mortar)
- Ruler
- String

What Is a Wythe?

A wythe is one vertical layer of masonry units (brick, block, or stone) that is one unit thick.
Examples:

- A single row of bricks = one wythe
- Two side-by-side layers tied together = two wythes

Masons use wythes to build strong walls.

Step 1: Make a Foundation Line

- Lay a string straight on floor/table.
- This is the wall line.
- Masons use lines to keep walls straight.

Step 2: Lay the First Course

- Place blocks in one row along the line.
- Leave small equal spaces or use paper strips between them for mortar joints.
- This row is called a course.

Step 3: Check Alignment

- Use a ruler to make sure the row is straight.
- Adjust blocks until even.

Step 4: Build the Second Course

Place the second row on top, but stagger the joints (offset the seams.).

Example:

- Bottom row: [brick][brick][brick]
- Second row: [brick][brick][brick]

This is called running bond.

Step 5: Build One Wythe High Wall

Continue stacking 3–5 courses high.

- Keep it:
- Straight
- Level-looking
- Joints staggered

Step 6: Two-Wythe Challenge

Build a second layer beside the first.

Now compare:

- One wythe wall
- Two wythe wall

Which feels stronger?

Reflection Questions

- Why are staggered joints stronger than stacked seams?
- Why do masons use string lines?
- Why is a two-wythe wall stronger?
- Why do small alignment mistakes matter as walls get taller?

Course Building Construction
Section: Masonry

James Rumsey Technical Institute

Build an Arch

What You Will Do

Build a paper arch to learn how arches support weight, why they are strong, and what the keystone does in an arch structure.

Materials You Will Need

- Pencil
- Paper
- Ruler
- Scissors
- Tape
- Computer with printer (optional)

What Is an Arch?

An arch is a curved structure that spreads weight outward and downward instead of straight down. Arches are used in:

- Bridges
- Doorways
- Windows
- Tunnels
- Historic buildings

What Is a Keystone?

The keystone is the center top stone or block placed last. It locks the other pieces together and helps the arch carry weight.

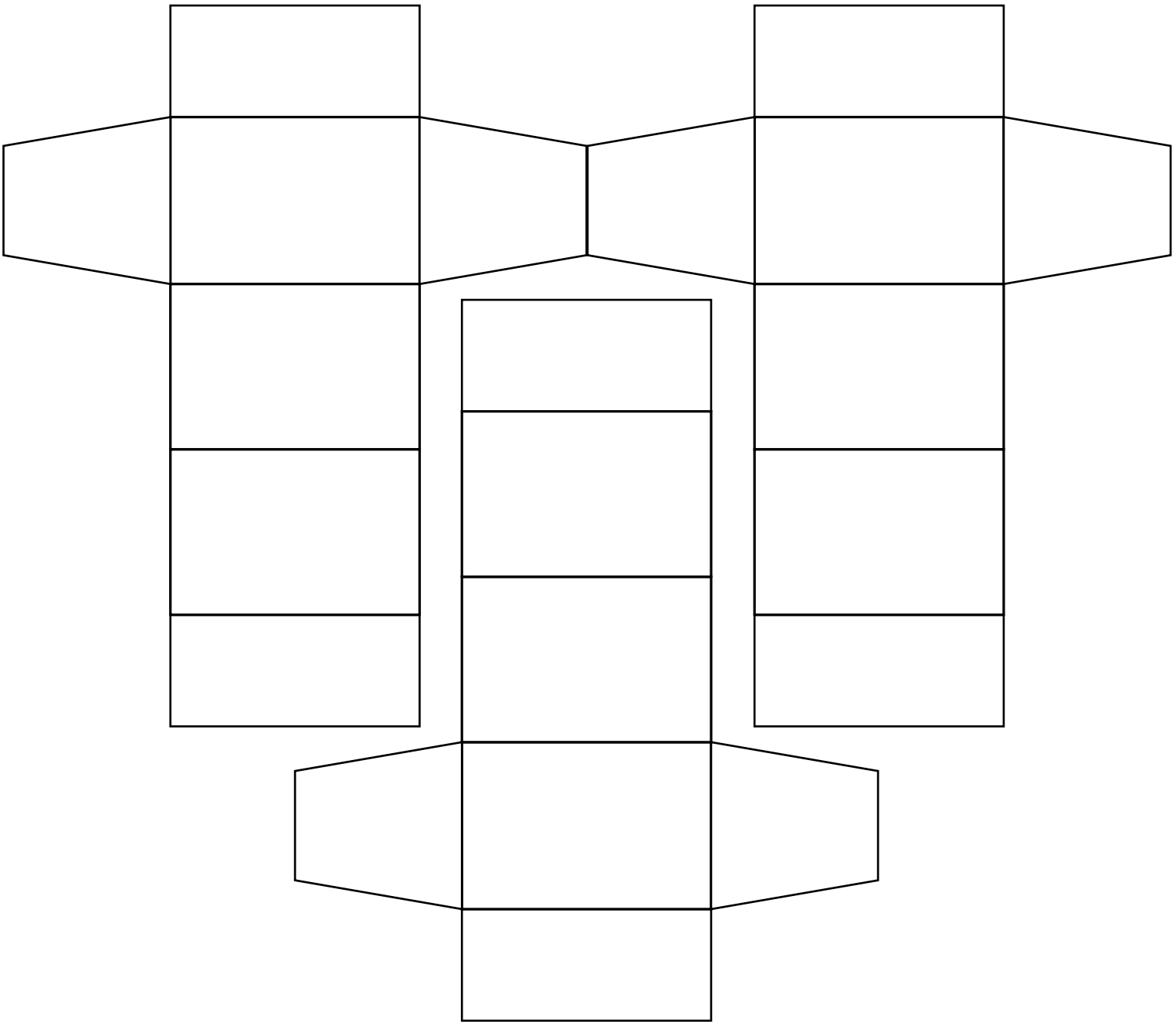
Part 1: Create Paper Blocks

If you have a computer with a printer, print 2 copies of the template included in this activity. If you can't print the template, use a ruler to draw similar shapes on a sheet of paper. The goal is to create 6 blocks that slightly taper on one end and 1 more that tapers a little more. The block that tapers more will be the keystone.

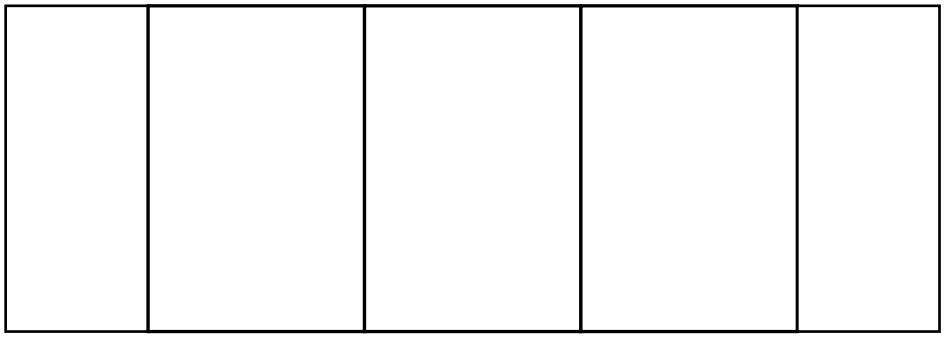
Part 2: Build the Arch

Stack the blocks with tapered sides touching each other. Have a helper hold the blocks in place while you stack them. When you get to the center, add the keystone. Tape the 2 bottom blocks to the table. All of the blocks are now pushing inward on the keystone. This is where the arch's gets its strength

Arch Template



Keystone



Course Building Construction
Section: Plumbing

James Rumsey Technical Institute

How a P-Trap Works

What You Will Do

Build a simulation of a P-trap used in plumbing.

Materials You Will Need

- Clear flexible tubing or clear plastic bottle(s)
- Funnel (optional)
- Water
- Food coloring (optional)
- Tape
- Small bowl or cup

What Is a P-Trap?

A P-trap is the curved pipe found under sinks.
It is designed to:

- Hold a small amount of water
- Block sewer gases and odors
- Catch small dropped items
- Allow wastewater to drain

Common places:

- Bathroom sinks
- Kitchen sinks
- Laundry tubs

Step 1: Build the Trap Shape

Make a curved pipe shape like the illustration shows. The shape should look like a letter P from the side.

Step 2: Add Water

1. Pour water through the “sink drain” side.
2. Watch some water remain in the curved bottom section.

This standing water is the seal.

Step 3: Test the Drain

Pour more water in.

Observe:

- New water pushes old water through
- Trap still keeps some water behind

Step 4: Why It Matters

Pretend the outlet side leads to a sewer line.

The water sitting in the trap blocks:

- Bad smells
- Sewer gases
- Bugs from entering through pipes

Step 5: Dry Trap Test

1. Empty the trap and leave it dry.
2. Now imagine no water seal exists.

What could come back through the pipe?

Step 6: Lost Ring Challenge

1. Drop a coin or washer into the model.
2. Where does it collect?

Often the trap catches small items before they go farther into the plumbing.

Reflection Questions

- Why does water stay in the curved section?
- Why are sewer gases a problem?
- Why might a sink smell if unused for a long time?
- Why do plumbers sometimes remove traps?

Course Building Construction
Section: Plumbing

James Rumsey Technical Institute

How a Water Hammer Arrestor Works

What You Will Do

Learn what water hammer is, how it works, and why plumbers install them in homes.

Materials You Will Need

- Plastic bottle with cap
- Drinking straw or flexible tubing
- Water
- Bowl or sink
- Tape
- Spoon

What Is Water Hammer?

Water hammer is the banging or thumping sound that can happen when flowing water suddenly stops. Moving water inside pipes suddenly stops and creates a pressure shock wave.

Example:
Washing machine valve closes quickly
Dishwasher shuts off
Faucet closes fast

A hammer arrestor is a small plumbing device containing an air cushion or sealed chamber that absorbs the shock when water suddenly stops.

It helps:

- Reduce banging noises
- Protect pipes
- Protect valves/appliances
- Reduce vibration

Important Concepts

- **Momentum –** Moving water wants to keep moving.
- **Pressure Shock –** Sudden stop creates a force wave.
- **Cushioning –** Air chamber compresses and absorbs force.

Step 1: Understand Moving Water

1. Fill bottle halfway with water.
2. Quickly stop and shake it.
3. Feel the water slam forward inside.

That sudden movement is similar to water hammer in pipes.

Step 2: Build a Simple Arrestor Model

1. Put straw through cap opening (or tape straw to bottle opening).
2. Keep some air trapped in bottle above water.
3. Seal loosely enough to demonstrate movement.

Now shake again and notice the trapped air cushions movement.

Step 3: Compare Two Systems

Bottle A:

Filled almost completely with water

Bottle B:

Part water, part trapped air

Shake both quickly.

Which one feels harsher?

Usually the trapped air model softens the shock.

Step 4: Fast Valve Demonstration

1. Run water from faucet into a cup.
2. Shut it off quickly.

Imagine water rushing through pipes and suddenly stopping.

That pressure wave can cause noise.

Where Arrestors Are Commonly Used

- Washing machines
- Dishwashers
- Ice makers
- Quick-closing valves
- Commercial plumbing systems

Reflection Questions

- Why does moving water create force when stopped quickly?
- Why does trapped air reduce shock?
- Why might pipes bang more in older homes?
- Why would appliances need hammer arrestors?

EDUCATION

- **Early Childhood Classroom Assistant Teacher**
  - » Design a Lesson
  - » Build Your Dream Classroom

Course Education
Section: Early Childhood Classroom Assistant Teacher

James Rumsey Technical Institute

Design a Lesson

What You Will Do

Design a lesson that teaches a basic concept in a way that will be engaging for preschoolers.

Materials You Will Need

- Paper
- Crayons/markers
- Glue
- Safety scissors
- Recyclable materials

Lesson Planning

Effective lesson planning involves defining clear learning objectives, creating engaging activities, and aligning assessments to measure understanding. Key components include an introduction, objectives materials, procedures (introduction, instruction, practice), differentiation, and assessment.

Important Terms

- **Learning Objectives:** Specific goals of what students will know or do.
- **Materials:** Resources, tools, or technology needed.
- **Procedures:** Step-by-step instructions, including introductions, direct instruction, and guided practice.
- **Assessment:** Methods to check for understanding.
- **Differentiation:** Strategies to support diverse learner needs.
- **Reflection:** Evaluating the lesson afterward to improve future instruction.

Preschool Students

The goals a teacher aims for are determined by the age group of the students. For preschool students (ages 3 to 5), the goals are:

Social and Emotional Goals

- Emotional Regulation: Teaching children to manage feelings, verbalize wants/needs, and handle frustrations without outbursts.
- Social Competence: Developing sharing, turn-taking, conflict resolution, and cooperative play skills.
- Independence & Responsibility: Fostering independence in self-care, such as putting on coats, cleaning up, and using the bathroom.
- Trust & Safety: Building a secure classroom environment to encourage positive relationships with peers and adults.

Cognitive and Academic Goals

- Early Literacy & Language: Recognizing the alphabet, writing their own name, and increasing vocabulary through stories and songs.
- Numeracy Skills: Introducing basic counting, shape recognition, and sorting skills.
- Critical Thinking: Encouraging curiosity by asking questions, making predictions, and solving simple problems.

Physical Development Goals

- Fine Motor Skills: Developing hand-eye coordination through activities like drawing, cutting with scissors, threading beads, and manipulating playdough.
- Gross Motor Skills: Improving balance and coordination through running, jumping, climbing, and organized movement games.

Write a Lesson Plan

Objective

Write one sentence that sums up what you want the students to learn.

Choose one of these topics:

- Colors
- Numbers
- Animals
- Feelings

Introduction

Write down how you will introduce the topic. How can you get the students excited and curious about the topic? Getting them sharing and interacting will ensure engagement in the activity. Try posing a question or sharing a fun fact that will spark their curiosity.

Instructions

Write easy step-by-step directions that a preschooler could follow. Be sure to break the process down into short, simple steps.

Test Your Instructions

Complete the craft yourself while pretending you are teaching it step-by-step. Did you leave out any steps?

Evaluate Your Lesson

Think about how you would help students who need assistance. What could you change about your lesson plan to make sure all students can complete it. Does it effectively teach the topic?

Course Education
Section: Early Childhood Classroom Assistant Teacher

James Rumsey Technical Institute

Build Your Dream Classroom

What You Will Do

Design your own preschool classroom by choosing learning areas and deciding how children will use them.

Materials You Will Need

- Posterboard or large sheet of paper
- Pencil or pen
- Ruler
- Colored pencils or markers (optional)
- Scissors
- Tape or glue
- Internet connected computer and printer (optional)

Planning the Space

Designing a preschool classroom requires creating clearly defined, safe, and engaging learning centers. It also needs to be decorated and stocked with materials that encourage creativity, curiosity, and responsibility.

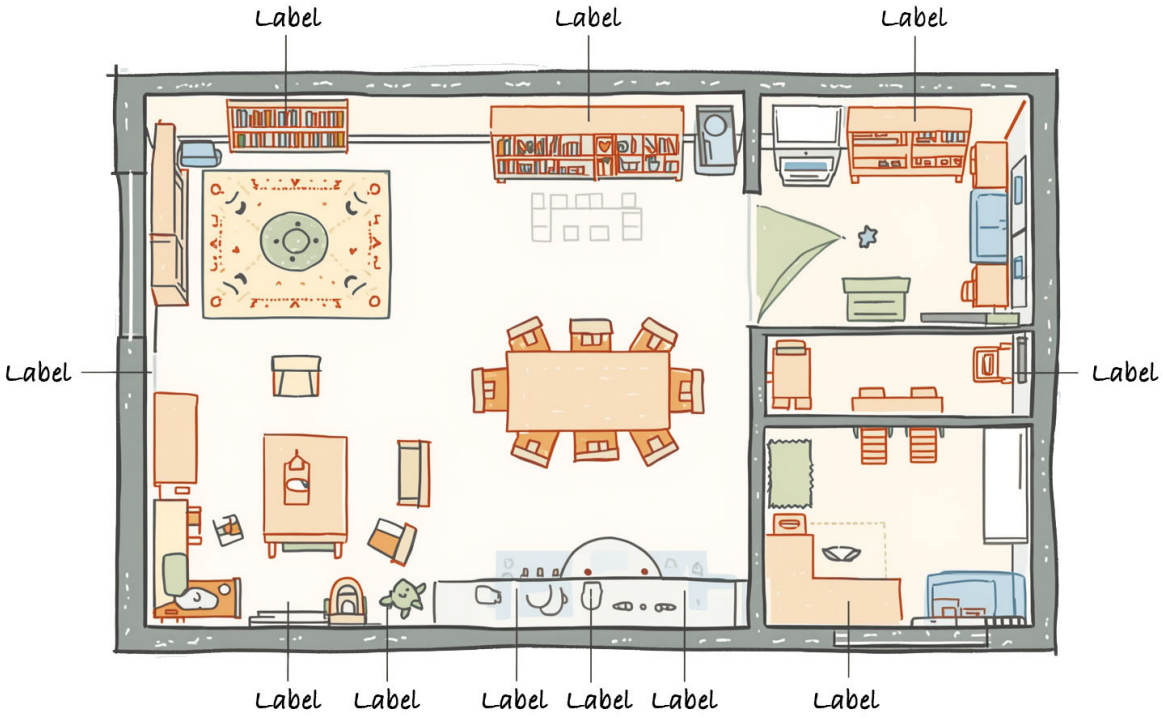
Important Considerations

- **Learning Centers –** Areas in the room set up for specific activities. Example learning centers include art, reading, blocks, dramatic play, sensory, music, and science.
- **Key Zones –** Think about how the class will use the room when working as a group and independently.
  - Group time will need a large area that is carpeted or has a rug for sitting on the floor.
  - Quiet spaces are necessary for when an emotional or misbehaving child needs to be apart from others.
  - Art should be done in an area near a sink since these activities tend to get messy.
- **Safety –** Clutter is a safety hazard. The space needs to be organized to ensure the safety of the children. This includes:
  - Using child-accessible storage so that the children can independently retrieve items and store them out of the way when not in use.
  - Using flexible furniture so that spaces can be rearranged easily to suit the current activity.
  - Reducing large open areas to prevent running.
  - A place to store personal items like jackets and bags to prevent a tripping hazard.

Floor Plan

Draw a floor plan for your classroom. Indicate each learning center area and key zone. These spaces can be named in your classroom. Include those names on your floorplan. For example, you might have an area dedicated to learning about animals filled with picture books and toys of animals. If you want the children to refer to this area as “The Zoo”, include that title on your drawing.

Indicate what the students will learn in each area and include one rule they must follow in each area.



Mood Board

Graphic designers collect images that have elements such as fonts, colors, and mood or style that they want to replicate in one of their projects. This collage is called a “mood board” and helps stimulate their creativity.

You should do something similar. Find images in magazines or on the internet that match the mood and style you want for your classroom. Cut them out and glue or tape them around your floor plan.

ELECTRICAL

- **Electrical Technician**
  - » Build a Simple Circuit
  - » Breaker Panel Simulation
- **HVAC Technician**
  - » Home Energy Inspection
  - » How a Heat Pump Moves Heat

Course: Electrical
Section: Electrical Technician

James Rumsey Technical Institute

Build a Simple Circuit

What You Will Do

Build a circuit to control the flow of electricity from a battery, through a light bulb, and back to the battery.

Materials You Will Need

- 1 AA battery
- Small flashlight bulb
- Aluminum foil
- Tape

What is a Circuit?

An electric circuit is a closed, continuous path that allows electric charge (current) to flow from a power source, through components, and back again. It consists of a power source (battery or power plant), conductive pathways (wires), and a load (light bulb or appliance) that uses the electrical energy.

Electricity needs a complete path. This path is called a circuit. If there is a break in that path, electricity stops flowing. Switches, like light switches, complete or break that path. Power goes to the switch but can't flow until the switch is thrown completing the circuit.

Safety

Working with electricity is very dangerous. Never attempt to work with live electricity unless it is very low voltage. AA batteries are low voltage (between 1.2V and 1.5V). Handling anything 50V or higher is dangerous. The outlet your living room lamp is plugged into is 120V.

Create a Circuit

1. Tear two strips of aluminum foil and twist them into thin, sturdy "wires".
2. Tape one end of the first foil strip to the positive (+) end of the AA battery.
3. Tape one end of the second foil strip to the negative (-) end of the battery.
4. If using a lightbulb, touch one wire to the bottom tip and the other to the metal side.
5. When both foil pieces connect to the bulb simultaneously, the light will turn on.

Can you picture the path the electricty is flowing through this circuit?
Will it still work if you reverse where the wires are connecting to the bulb?

Course: Electrical
Section: Electrical Technician

James Rumsey Technical Institute

Breaker Panel Simulation

What You Will Do

Learn how a breaker panel distributes power and why circuits trip when overloaded.

Materials You Will Need

- Paper
- Pencil
- Scissors
- Computer with printer (optional)

What is a Breaker Panel?

A breaker panel is what creates all the circuits in your house. Every light and appliance is connected to it. Each circuit is designed to handle a specific amount of power measured in amps. If a circuit is overloaded (like when too much is connected to it), it can start a fire. Breakers are designed to automatically break a circuit to stop the flow of electricity when a circuit is overloaded.

Setup

1. Write the names and amps for each appliance on a sheet of paper.
2. Cut them out so that you have a small strip of paper for each appliance.
3. On another sheet of paper, draw a breaker panel.
4. Label each breaker with the room name that it connects to and the maximum amount of amps that circuit can handle.

Breaker Panel

- Kitchen – 20 amps
- Bedroom – 15 amps
- Living Room – 15 amps
- Bathroom – 20 amps
- Laundry – 20 amps
- Garage – 15 amps

Appliance Cards

- Microwave = 12 amps
- Toaster = 8 amps
- Hair Dryer = 12 amps
- TV = 2 amps
- Lamp = 1 amp
- Vacuum = 10 amps
- Washer = 10 amps
- Space Heater = 13 amps
- Gaming Console = 3 amps

Directions

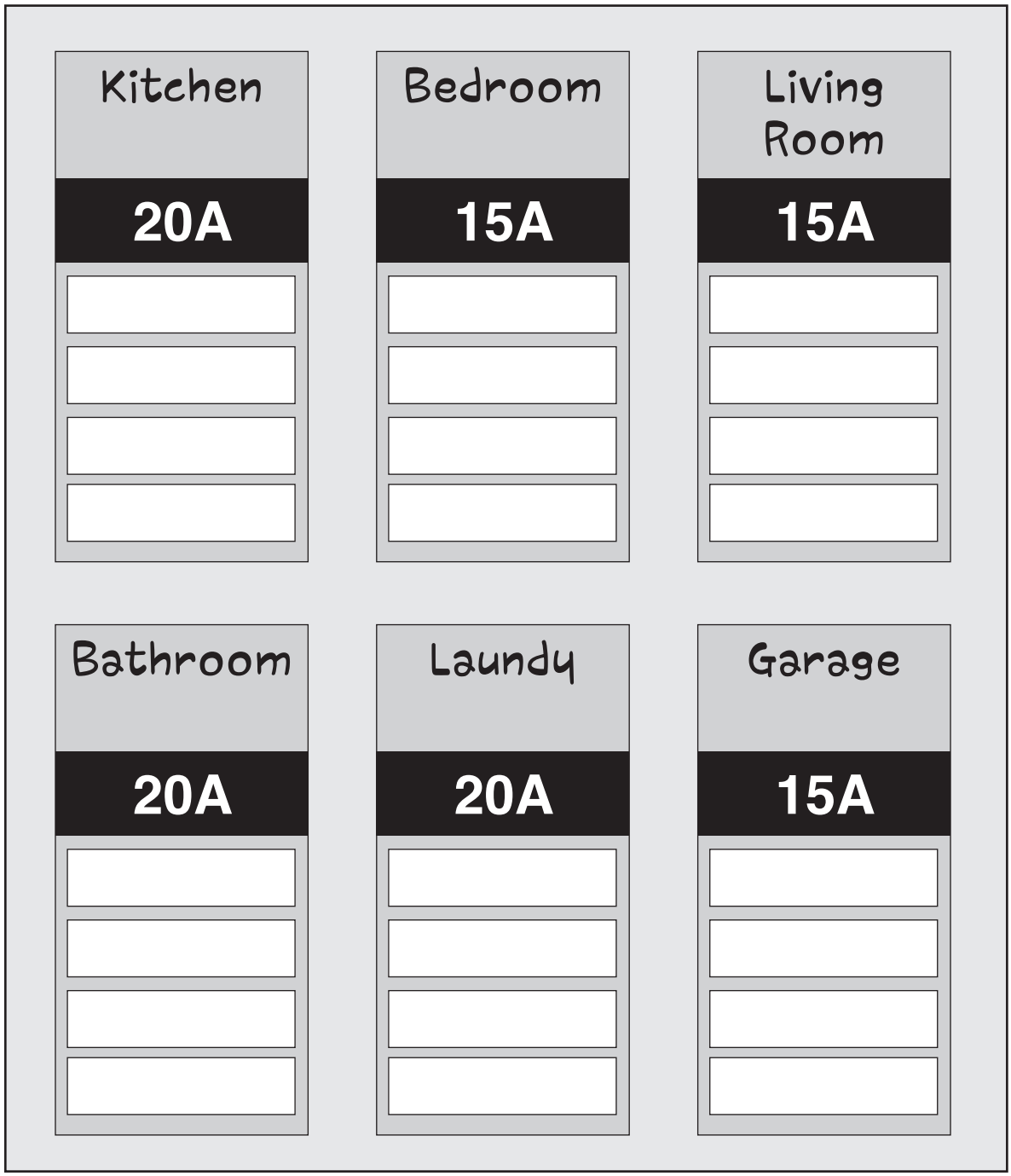
1. Assign appliances to each circuit.
2. Add up the amps for all of the appliances assigned to each circuit.
3. If the total exceeds the breaker size, the breaker trips. If not, you're safe.

Example:

Kitchen 20A:

Connect the (microwave 12A) plus the (toaster 8A) = 20A *safe*

Then add the (coffee maker 8A) to that same breaker = 28A *TRIPPED*



Course: Electrical
Section: HVAC Technician

James Rumsey Technical Institute

Home Energy Inspection

What You Will Do

Inspect your home and estimate how much electrical power your family would use if all lights and appliances were running for an entire day.

Materials You Will Need

- Pencil
- Paper
- Calculator (optional)
- Access to light bulbs/appliances in home
- Flashlight for reading labels if needed

What is Wattage?

Wattage – the amount of electrical power an appliance or device consumes or generates. High-wattage devices, like heaters, use more energy faster than low-wattage ones like light bulbs.
Voltage – the electrical pressure or potential difference pushing electricity through a circuit.
Amperage – the unit of measurement for electrical current, representing the rate of electron flow.

Think of someone spraying you with a hose. The volts are the water pressure in a hose and amps are the volume of water flowing.
Volts: The water pressure pushing through the hose.
Amps: The amount of water moving through the hose.
Watts: The total power/work (how hard the water hits you)

Part 1: The Inspection

Walk through your home and list as many electrical items as you can find.
Look for:
Lamps and ceiling lights – bedroom, kitchen, hallway, porch, etc.
Appliances – refrigerator, microwave, hair dryer, washer, dryer, toaster, etc.
Electronics – gaming system, TV, computer, etc.

Part 2: Find the Wattage

Look for labels on appliances or bulbs. Write down wattage. Multiply the number of an item by its wattage to get the total watts. Add everything in the Total Watts column to get the total power usage for your home.

Example Table:

Item	Number in Home	Watts Each	Total Watts
LED Bulb	8	9W	72W
TV	2	120W	240W
Microwave	1	1000W	1000W
Refrigerator	1	700W	700W
			2012W

1000W = 1kilowatt (1kW). The sample above is 201.2kW.

Part 3: Calculate Cost

The total watts above is how much power your home would use in one hour if everything was on at the same time. Electricity is billed by kWh (kilowatt hours). The average cost for power in West Virginia is 15 cents per kWh.

How much would it cost to run everything in your house for an entire day?

Total Watts x $0.15 = Cost per Hour
Cost per Hour x 24 hours = Total Cost for a Day

_____ x 0.15 = _____

_____ x 24 = _____

Reflection Questions

What could your family do to reduce the amount of money you spend on electricity?
How could adding a renewable energy generator to your home reduce your electric bill?

Course: Electrical
Section: HVAC Technician

James Rumsey Technical Institute

How a Heat Pump Moves Heat

What You Will Do

Inspect your home and estimate how much electrical power your family would use if all lights and appliances were running for an entire day.

Materials You Will Need

- A thick rubber band

What is a Heat Pump?

A furnace creates heat by burning fuel or using electric resistance. A heat pump moves existing heat, which often uses less energy. A heat pump uses electricity and refrigerant to transfer heat:

Winter: Moves heat from outside into the house

Summer: Moves heat from inside the house to outside

Even cold outdoor air contains some heat energy.

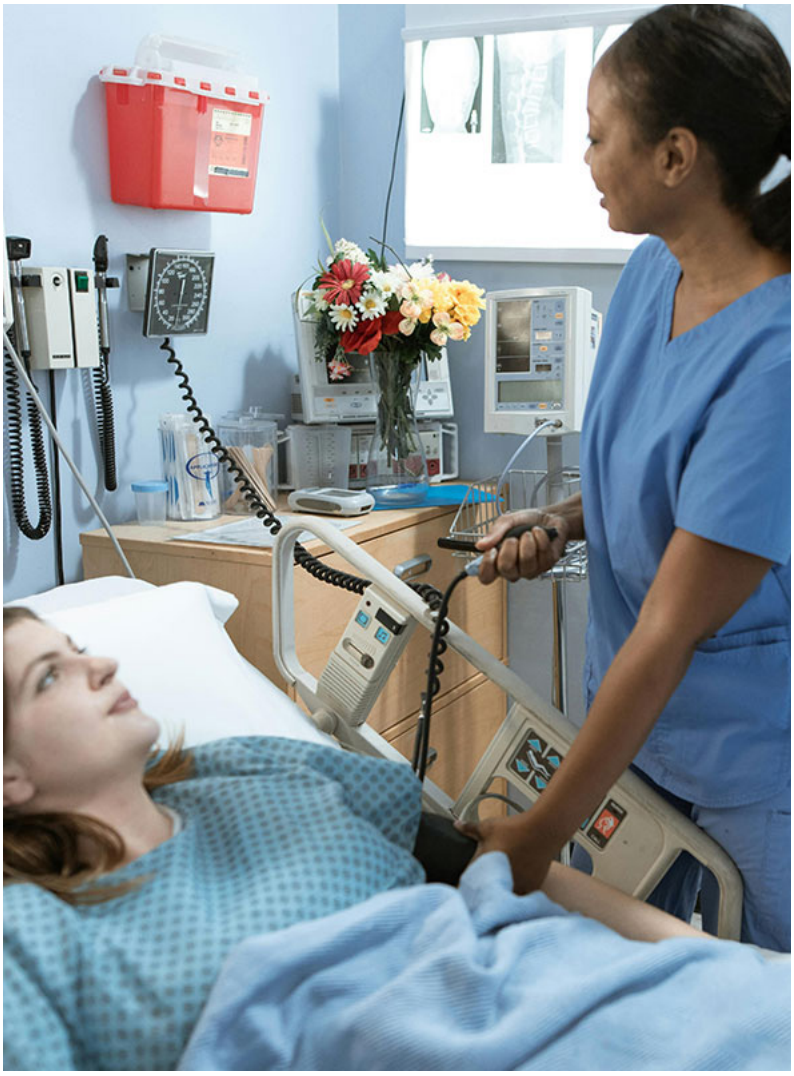
How Does Refrigerant Transfer Heat?

Refrigerant is a gas that is compressed to a liquid. It transfers heat by continuously circulating through a closed system, changing from liquid to gas and back again to absorb and release energy. It absorbs heat from an indoor space by evaporating into a gas. Then it goes to a condenser, where it releases the heat and condenses back to a liquid, driven by a pump called a compressor.

Heat Pump Simulation

1. **Compression** – Quickly stretch a thick rubber band and touch it to your lips or forehead to feel the heat.
2. **Heat transfer** – Hold the stretched rubber band for a minute. The heat generated by changing the rubber band's state (stretching it) is being transferred to the cooler air around it.
3. **Expansion** – Let it relax, and touch it again to feel how much cooler it is than when you started.

This demonstrates how compressing and expanding a material changes its temperature, which is the foundational principle of a heat pump.



HEALTHCARE

- **Allied Health**
  - » Phlebotomy Skills Simulation
  - » Medical Lab Technician Investigation
- **Therapeutic Services**
  - » Vital Signs Health Check
  - » CNA Skills Challenge

Course Healthcare
Section: Allied Health

James Rumsey Technical Institute

Phlebotomy Skills Simulation

What You Will Do

Learn the skills phlebotomists use such as patient identification, preparation, labeling, steady hand control, sanitation, and safe specimen handling without using needles.

This is a simulation only. No needles, blood draws, or skin punctures should be used.

Materials You Will Need

- Small cups or containers (sample tubes)
- Water with food coloring or juice
- Labels or sticky notes
- Marker
- Spoon, straw, eyedropper, or turkey baster
- Paper towels
- Gloves (optional)

What is Phlebotomy?

Phlebotomy is the medical practice of drawing blood from a patient, typically via venipuncture, for diagnostic testing, transfusions, donations, or research. Performed by trained phlebotomists, it is crucial for monitoring health conditions and treating specific diseases.

Part 1: Patient Check-In Simulation

Correct identification is one of the most important steps in phlebotomy.

1. Create 3 pretend patients.
2. Example:
   - Alex Smith – CBC test
   - Jordan Lee – Glucose test
   - Taylor Brown – Lipid panel
3. Write names on paper.
4. Match the correct patient name to the correct sample tube label.

Part 2: Steady Hand Transfer Challenge

Phlebotomists need steady hands and attention to detail.

1. Fill one cup with colored water (“blood sample”).
2. Use spoon, straw, or eyedropper to transfer liquid into labeled tubes.
3. Try not to spill. Your goal is to move liquid accurately and carefully.

Part 3: Labeling Accuracy Test

Mislabeling can cause serious mistakes.

1. Create labels with:
   - Patient Name
   - Date
   - Time
   - Test Type
2. Place labels on correct cups.

Part 4: Order of Draw Sorting Game

1. Use colored paper to represent different tube tops.
2. Sort tubes by order given by teacher/parent or simplified sequence.

Example:

- Blood culture
- Blue
- Red
- Green
- Lavender

Part 5: Infection Control Check

Write 5 steps a phlebotomist should follow:

Examples:

- Wash hands
- Wear gloves
- Clean workspace
- Use sterile equipment
- Dispose safely

Reflection Questions

- Why is patient identification so important?
- Why must labels be accurate?
- Why do phlebotomists need calm behavior?
- What could happen if samples get mixed up?

Course Healthcare
Section: Allied Health

James Rumsey Technical Institute

Medical Lab Technician Investigation

What You Will Do

Learn how medical laboratory technicians test samples, organize data, observe carefully, and help doctors diagnose patients.

This is a safe simulation using household materials only. No real bodily fluids or medical samples are used.

Materials You Will Need

- Helper
- 3 clear cups
- Water
- Food coloring
- Salt
- Sugar
- Spoon
- Labels or sticky notes
- Paper
- Pencil
- Flashlight (optional)

What Is a Medical Lab Technician?

Medical lab technicians work behind the scenes in healthcare. They test samples such as blood, urine, and other specimens to help doctors understand what is happening in the body.

They use:

- Careful observation
- Accurate labeling
- Measuring tools
- Data recording
- Microscopes and machines

Part 1: Sample Identification

Label cups:

- Sample A
- Sample B
- Sample C

Fill each with water.

Then secretly add:

- Cup A = plain water
- Cup B = salt water
- Cup C = sugar water + food coloring

(Student can have another person set this up, or set it up themselves and later test without looking.)

Part 2: Observation Testing

Examine each sample.

Record:

Sample	Color	Clear/ Cloudy	Smell	Notes
A				
B				
C				

Use flashlight to inspect clarity.

Part 3: Conductivity/ Residue Test (Optional)

Place one drop of each sample on separate paper towel spots.

Let dry.

Observe residue left behind.

- Salt water leaves crystals
- Sugar water may leave sticky residue

Part 4: Diagnosis Challenge

Based on evidence, decide:

- Which sample was plain water?
- Which contained salt?
- Which contained sugar/coloring?

Write your conclusions.

Part 5: Importance of Labeling

- Switch labels accidentally and discuss:
- What problems could happen in a real lab?

Reflection Questions

- Why must lab workers be careful with labels?
- Why are observations important?
- Why do doctors rely on lab results?
- Why should scientists record data clearly?

Course Healthcare
Section: Therapeutic Services

James Rumsey Technical Institute

Vital Signs Health Check

What You Will Do

Measure vital signs and learn what those measurements can indicate about the body.

Materials You Will Need

- Paper
- Pencil
- Stopwatch, clock, or timer
- Thermometer (optional)
- Blood pressure cuff (optional)
- Pulse oximeter (optional)

What are Vital Signs?

Vital signs are basic body measurements that help show how someone is doing.
Common vitals include:

- Heart rate (pulse)
- Breathing rate
- Temperature
- Blood pressure (if equipment available)
- Oxygen level (if pulse oximeter available)

Part 1: Measure Pulse (Heart Rate)

Directions:

1. Sit quietly for 2 minutes.
2. Place two fingers on wrist (thumb side) or side of neck.
3. Count beats for 30 seconds.
4. Multiply by 2 for beats per minute (BPM).

Record:
Resting Pulse = _____ BPM

Then Repeat After Activity:
Do 20 jumping jacks or walk briskly for 1 minute.

Pulse After Exercise = _____ BPM

What It Means

- Lower resting pulse can mean efficient heart function.
- Higher pulse after exercise is normal because the body needs more oxygen.
- Pulse should begin slowing during rest.

Part 2: Measure Breathing Rate

Directions:

1. Sit quietly.
2. Count breaths for 30 seconds (1 breath = inhale + exhale).
3. Multiply by 2.

Breathing Rate = _____ breaths/minute

What It Means

- Breathing may increase after exercise, stress, or excitement.

Part 3: Temperature (Optional)

Use thermometer according to directions.

Temperature = _____ °F or °C

What It Means

- Body temperature can change with activity, environment, or illness.

Part 4: Blood Pressure (Optional Adult Help Recommended if Available)

If a home monitor is available:

Blood Pressure = _____ / _____

What It Means

- Blood pressure measures how hard blood pushes on artery walls.

Part 5: Oxygen Level (Optional)

If pulse oximeter available:

Oxygen Saturation = _____ %

What It Means

- Shows how much oxygen is being carried in the blood.

Reflection Questions

- Which vital sign changed the most after activity?
- Why does exercise raise pulse and breathing?
- Why do healthcare workers check vitals first?
- Why should trends over time matter more than one number?

Course Healthcare
Section: Therapeutic Services

James Rumsey Technical Institute

CNA Care Skills Challenge

What You Will Do

Learn the skills phlebotomists use such as patient identification, preparation, labeling, steady hand control, sanitation, and safe specimen handling without using needles.

This is a simulation only. No needles, blood draws, or skin punctures should be used.

Materials You Will Need

- Pillow
- Blanket or sheet
- Chair
- Notebook
- Timer or clock
- Stuffed animal or doll (optional)
- Paper and pencil

What Does a CNA Do?

Certified Nursing Assistants (CNA) help patients with daily needs and comfort. They often assist with:

- Taking vital signs
- Helping patients move safely
- Making beds
- Reporting changes to nurses
- Personal care assistance
- Communication and support

Part 1: Bed Making Challenge

CNAs keep patient spaces clean, comfortable, and safe.

- Use a bed, couch, or blanket on floor.
- Make the bed neatly and safely.
- Smooth wrinkles and organize pillows.

Part 2: Safe Mobility Simulation

CNAs help patients move safely to prevent falls.
Use a chair as a “wheelchair” or bedside chair.
Practice giving clear instructions to a stuffed animal, doll, or imaginary patient:

- “Scoot forward.”
- “Place feet on floor.”
- “Stand slowly.”
- “Turn carefully.”
- “Sit back gently.”

Part 3: Observation Skills Check

CNAs notice changes and hazards quickly.
Look around a room for 30 seconds.
Write down:

- Hazards (cords, clutter, spills)
- Comfort needs (blanket, pillow placement)
- Safety issues

Part 4: Compassion Communication Practice

Kind communication builds trust.
Write or say responses to these situations:

Situation A:
Patient feels nervous.

Response: _____

Situation B:
Patient is cold.

Response: _____

Situation C:
Patient needs help getting comfortable.

Response: _____

Part 5: Intake & Output Organizer

CNAs may record patient intake/output.
Use pretend data:

- Water drank: 8 oz
- Juice: 6 oz
- Soup: 10 oz

Total intake = _____ oz

Reflection Questions

- Why is patience important for CNAs?
- Why must rooms stay free of hazards?
- Why should changes be reported to nurses?
- Why is kindness part of healthcare?

HOSPITALITY

- **ProStart Restaurant Management**
  - » Recipe Remix
  - » Design a Food Truck

Course: Hospitality
Section: ProStart Restaurant Management

James Rumsey Technical Institute

Recipe Remix

What You Will Do

Create new version of a recipe to accommodate different dietary needs.

Materials You Will Need

- Paper and pencil
- Recipe cards or printed simple recipes

Optional

- Kitchen with stove/oven and utensils
- Recipe ingredients
- Family members willing to taste your dish

Food Allergies and Preferences

Food allergies occur when the immune system mistakenly identifies a food protein as harmful, triggering reactions like hives, swelling, vomiting, or breathing issues within minutes to two hours. The most common allergens are milk, eggs, peanuts, tree nuts, fish, shellfish, soy, wheat, and sesame. Some of these allergies are so dangerous that even preparing food with the same equipment that touches those foods is dangerous. It is very important for people with these allergies to know what is in the food you are serving them and whether those ingredients are used at all in your kitchen.

Food preference include specialized diets based on health concerns like weight loss and ethical or religious standards. As a matter of trust, it is also important to let your customers know if your dishes meet these requirements.

Choose a Recipe

What is your favorite food? Is it pizza, tacos, pasta, pancakes, sandwiches, mac and cheese, or cookies? Use the internet or dig through a family member's recipe box.

Remix

Find ingredient substitutes and try to create a version that will work for someone with one of the dietary requirements listed on the next page. The more of these requirements your recipe adheres to, the more people will be able to enjoy it, but the less it will be like the original.

Dietary Requirements

Vegan – Avoids meat, poultry, fish, eggs, dairy (milk, cheese, butter, yogurt), honey (many vegans avoid it)

Eats: Fruits, vegetables, grains, beans, nuts/seeds, plant-based substitutes

Example: Bean burrito with vegetables and dairy-free cheese

Vegetarian – Avoids beef, chicken, pork, fish (for most vegetarians)

May Eat: Dairy, eggs, fruits/vegetables, grains, beans

Example: Cheese pizza or vegetable omelet

Dairy-Free – Avoids milk, cheese, butter, yogurt, ice cream

Eats: Almond milk, oat milk, soy milk, dairy-free cheese/yogurt

Example: Pasta with olive oil sauce instead of cream sauce

Gluten-Free – Avoids wheat, barley, rye, many breads/pastas/crackers

Eats: Rice, corn, potatoes, gluten-free oats, gluten-free breads/pastas

Example: Rice bowl instead of pasta

Nut-Free – Avoids almonds, walnuts, pecans, cashews, pistachios, peanuts (technically legumes, but often included for safety)

Important: Often required because of severe allergies.

Example: Sunflower seed butter instead of peanut butter

Egg-Free – Avoids scrambled eggs, mayo (usually contains egg), many baked goods

Uses Replacements: Applesauce, flaxseed mixture, commercial egg replacers

Ingredient Substitutions

Substitutes are used because they act similar to the original. However, they rarely have the same flavor and/or effect in the recipe. For example, pizza crust relies on kneadng the dough to create gluten. The gluten gives the baked dough a pleasant chewiness. Gluten-free dough can't act the same because it is missing the gluten.

Common substitutes

Original Ingredient	Replacement
Milk	Oat milk
Butter	Vegan butter
Eggs	Applesauce / flax egg
Wheat flour	Gluten-free flour
Cheese	Vegan cheese

Bonus Challenge

Ask your family to be your test subjects. Make your remixed recipe and get them to try it.

Reflection Questions

- Which dietary need would be the easiest to design for?
- Which would be the most difficult?
- Why do restaurants offer allergy-friendly foods?
- How can chefs keep substitutions delicious?

Course: Hospitality
Section: ProStart Restaurant Management

James Rumsey Technical Institute

Design a Food Truck

What You Will Do

Create your own food truck concept including a restaurant name and menu.

Materials You Will Need

- Paper
- Colored pencils/markers
- Ruler
- Computer with design software (optional)

Mobile Food Stands

Food trucks have been around since the days of selling workers lunch out of a horse-drawn cart. Chuck wagons were a common sight in wagon trains and among cowboys in the old west. Sometimes it's easier to bring the restaurant to the people than it is to expect them to come to you. Food trucks have become very popular in recent years. You can move around and reach customers who might not have come across town for lunch. Workers don't have to go far from their job to get food. Food trucks also let you sell food at events like festivals.

Things to Keep in Mind

- **Space:** Space is very limited in a food truck. It's best to keep your menu simple so you don't have to stock a lot of different ingredients or tools.
- **Speed:** Food trucks serve fast food. People want to get their order quickly. Anything that needs a lot of time to prepare needs to be done before you start serving. For example, barbecue takes hours to cook. You can do that the day before and reheat the food in the truck. If you're selling pizza, make the dough in advance.
- **Uniqueness:** What will set your truck apart from all the others? It's best to specialize. Rather than selling pizza, tacos, and burgers, just pick one style of food. Your menu and branding will set you apart. Food trucks typically have catchy names that people will remember.

Decide on a Menu

- **Main Dish** – Think about one dish as your specialty. That is going to be your main attraction.
- **Side Dishes** – What sides go well with that main dish? Think of two or three options.
- **Drinks** - What drinks will your customers want?
- **Alternatives** – You can't offer a huge menu that appeals to everyone. However, you can offer a range of items by varying some ingredients. For example, if you're selling hotdogs, you can offer several options for toppings. You could also offer a version of a hotdog that will appeal to vegans and vegetarians.

Branding

This is just as important as your menu. You're doing more than selling food. You're selling an experience. Branding is the image you create for your business. The business name and image tell people what to expect.

Think of a couple of adjectives you want people to associate with your food truck (fast, friendly, spicy, comforting, etc.) What imagery might help communicate that?

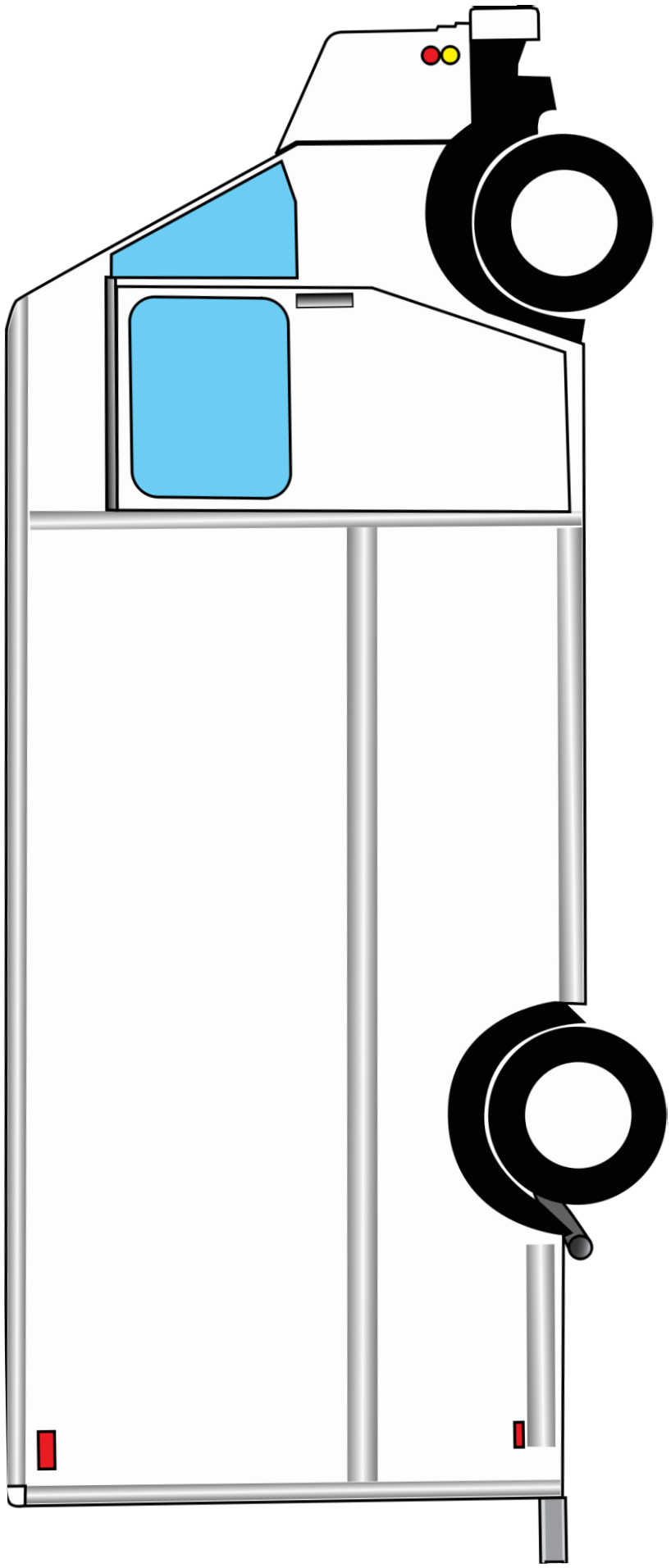
Another approach would be to give your business a theme. If you plan to sell Hawaiian food, use that as your theme. Give it a name that evokes the Hawaiian culture. Make the truck and menu look Hawaiian. Give you menu items names that tie in with the theme. This will make it very clear to customers of what to expect.

Design

Now that you know what you are going to sell, what the business will be called, and how to brand it, design your menu and truck.

Menu – Start with the information your customers need such as names of the dishes, brief descriptions of each, and pricing. Next, create a design that matches your branding concept. Keep in mind that legibility is more important than artistic flare. Designers follow the adage "form follows function". In other words, useful is better than pretty.

Truck Design – You can print the truck template on the next page to draw on or use it as a reference to draw a truck outline. Decide where and how big the serving window will be on the side of the truck. Where will the menu board go? What graphics will make the truck attention-getting and recognizable?



INFORMATION TECHNOLOGY

- **Coding, AI & Game Design**
  - » Create a Turn-Based Game
  - » Design a Chat Bot
- **Cybersecurity/Cisco**
  - » Write an Encoded Message
  - » Design a Smart Home

Course Information Technology
Section: Coding, AI & Game Design

James Rumsey Technical Institute

Create a Turn-Based Game

What You Will Do

Draw a game map and write an algorithm to move through the maze.

Materials You Will Need

- Graph paper or plain printer paper
- Colored pencils or markers
- Ruler
- Small objects to represent the player and monsters

What is an Algorithm?

An algorithm is a clear set of steps used to solve a problem or complete a task. Algorithms are used in computer coding, video games, apps, GPS directions, robots, and search engines. Computers do exactly what programmers tell them. Bad instructions = bugs.

Create a Game Map

1. If you don't have graph paper, use a ruler to draw a grid of equally spaced horizontal and vertical lines.
2. Draw a maze on your grid with a starting point and exit.
3. Draw a couple of prizes like coins that award the player points or money.

Plot Paths for the Monsters

1. Create paths for the monsters to move through the map.
2. Count each square of the grid as a move.
3. Write down each move they make. The number of moves forward, which direction to turn, etc.

Write the Algorithm

1. Write down each monster's moves as a list of instructions.
2. Write a set of rules for adding or subtracting points.

Example of an algorithm used in video game code:

```
If player touches coin:
   Add 1 point
If monster touches player:
   Subtract 1 point
If health = 0:
   Game Over
```

Alpha Test

An alpha test is performed by the developers to work out bugs and general game mechanics.

The hero character will be played by a human. They will make choices with each move. The monsters will be NPCs controlled by the “computer”. Their moves are restricted to the algorithm you wrote. The game will be turn-based. The player moves one square, then the computer moves each monster one square. Can you outmaneuver your own algorithm? Is it too easy? If so, adjust your algorithm and test it again.

Beta Test

Beta testing is done by a group of people outside the company. These are usually serious gamers who want to help the developers make the game more polished. Get a friend to play the hero while you execute the algorithm that controls the monsters.

1. Write down any bugs or issues you or the player notice.
2. Decide on the number of points the player begins the game with.
3. Create a name for the hero character, name for the game, and a story for your game.

Course Information Technology
Section: Coding, AI & Game Design

James Rumsey Technical Institute

Design a Chat Bot

What You Will Do

Design a simple question-and-answer bot with rules, choices, and conversation paths.

Materials You Will Need

- Paper
- Pencil
- Colored pencils/markers (optional)
- Index cards (optional)

What is a Chat Bot?

A chatbot is a computer program that responds to messages using rules or artificial intelligence.
Examples:

- Customer service bots
- Virtual assistants
- Help desk bots
- Game characters
- AI chat apps

Step 1: Choose a Chatbot Theme

Pick one type of bot:

- Homework Helper
- Pet Care Bot
- Pizza Order Bot
- Video Game Guide Bot
- Joke Bot
- Fitness Coach Bot
- Fantasy Wizard Bot

Step 2: Name Your Bot

Give your bot to make users more comfortable talking to it.
Examples:

- Homework Hero
- Pizza Pal
- Robo Coach
- WizardBot

Step 3: Create Conversation Rules

Write what the bot says when users type certain things. This will give it a less robotic and more relatable conversation style.

Example:

User Says	Bot Replies
Hello	Hi! How can I help?
Homework	What subject?
Math	Try solving one step at a time.
Bye	Goodbye!

Step 4: Build a Decision Tree

A decision tree is a flow chart of questions and repsonses. Draw conversation paths. This will determine how the bot repsonds to requests.

Step 5: Play the Game

Pretend to be the chatbot. Have yourself or family ask questions. You must answer using only your rules.

Step 6: Improve the Bot

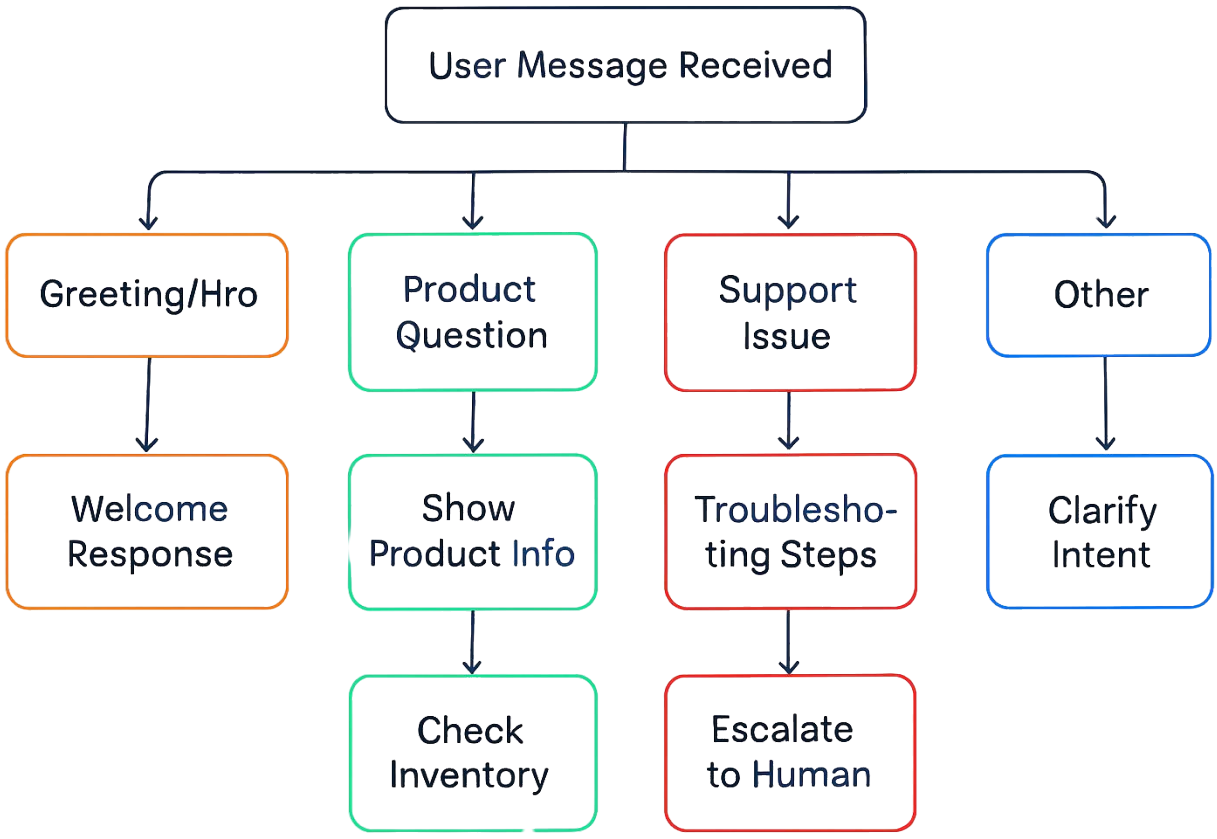
Make your bot better by improving its decision tree and adding:

- More responses
- Better greetings
- Funny replies
- Secret commands
- Multiple topics

Challenge

- Make a chatbot that can:
- Recommend movies
- Help choose dinner
- Give quiz questions
- Run a text adventure game

Sample Decision Tree



Course Information Technology
Section: Cybersecurity/Cisco

James Rumsey Technical Institute

Write an Encoded Message

What You Will Do

Write a message in binary code.

Materials You Will Need

- Paper
- Pencil
- Worksheet

What is Binary Code?

- **Binary code** is the fundamental language of computing, representing data and instructions using only two digits: 0 and 1 (bits).
- A **bit** is the smallest unit of information represented as a 0 (off) or 1 (on). This is called a digit. It controls the electrical signal moving through a computer circuit board by turning it on or off.
- A **byte** is a string of 8 digits or bits. Each byte represents a character such as a letter, number, or symbol.
- **Binary system** is a Base 2 system. That means that information is communicated with only two states (on or off). Morse code, used in the days of telegraphs, is a Base 3 or ternary system. Like binary, it relies on turning an electrical signal on or off. However, Morse code also uses spacing, or a pause between digits, as a third digit. In contrast, the Decimal system is a Base 10 number system that we use every day (0-9).

Write a Secret Message

1. Use the included worksheet to translate a message into binary code.
2. Have a friend use the chart on the worksheet to translate your secret message.

Name _____

Character	Binary Code
A	01000001
B	01000010
C	01000011
D	01000100
E	01000101
F	01000110
G	01000111
H	01001000
I	01001001
J	01001010
K	01001011
L	01001100
M	01001101
N	01001110
O	01001111
P	01010000
Q	01010001
R	01010010
S	01010011
T	01010100
U	01010101
V	01010110
W	01010111
X	01011000
Y	01011001
Z	01011010

Character	Binary Code
a	01100001
b	01100010
c	01100011
d	01100100
e	01100101
f	01100110
g	01100111
h	01101000
i	01101001
j	01101010
k	01101011
l	01101100
m	01101101
n	01101110
o	01101111
p	01110000
q	01110001
r	01110010
s	01110011
t	01110100
u	01110101
v	01110110
w	01110111
x	01111000
y	01111001
z	01111010

Character	Binary Code
!	00100001
"	00100010
#	00100011
$	00100100
%	00100101
&	00100110
'	00100111
(	00101000
)	00101001
*****	00101010
+	00101011
,	00101100
-	00101101
.	00101110
/	00101111
0	00110000
1	00110001
2	00110010
3	00110011
4	00110100
5	00110101
6	00110110
7	00110111
8	00111000
9	00111001
?	00111111
@	01000000

Letter	**Binary Code**
_____	__ __ __ __ __ __ __ __
_____	__ __ __ __ __ __ __ __
_____	__ __ __ __ __ __ __ __
_____	__ __ __ __ __ __ __ __
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_____	__ __ __ __ __ __ __ __
_____	__ __ __ __ __ __ __ __
_____	__ __ __ __ __ __ __ __

Example:

R	0 1 0 1 0 0 1

Name ____________________

Letter	Binary Code	Letter	Binary Code
____	__ __ __ __ __ __ __ __	____	__ __ __ __ __ __ __ __
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Course Information Technology
Section: Cybersecurity/Cisco

James Rumsey Technical Institute

Design a Smart Home

What You Will Do

Design your dream automated smart home.

Materials You Will Need

- Paper
- Pencil
- Colored pencils/markers
- Ruler

What is a Smart Home?

A smart home uses internet-connected devices that can be controlled automatically or through apps. These can improve convenience and security for your family. With so many devices connected to your home network, you will need a stable, high-speed internet connection with download speed of at least 300Mps. For stability, use ethernet to connect hubs and routers. Mesh router systems allow you to create even coverage around your house and avoid interference from walls.

Your router should support dual band frequencies. This reduces congestion and interference.

- **2.4 GHz**: Essential for most smart home accessories, offering better range and wall penetration.
- **5 GHz / 6 GHz**: Best for high-bandwidth devices like security cameras, video doorbells, and entertainment systems.

Examples of smart devices:

- Smart lights
- Doorbell cameras
- Smart thermostat
- Smart TV
- Smart speaker
- Security sensors
- Robot vacuum

What else would you want automated? Do they make a smart version of that device yet?

Step 1: Draw a Floor Plan

Create a simple map of a house with rooms:

- Living room
- Kitchen
- Bedroom
- Bathroom
- Garage
- Front door

Step 2: Place the Router

Choose the best location for the Wi-Fi router. If it's a mesh system, one should connect to the modem and place at least one more somewhere else in the house.

Think about:

- Central location
- Fewer walls blocking signal
- Coverage to all rooms

Step 3: Add Smart Devices

Place devices in rooms.

Example:

- Living Room = Smart TV
- Kitchen = Smart speaker
- Bedroom = Smart lamp
- Hallway = Thermostat
- Front Door = Camera
- Garage = Door sensor

Step 4: Draw Connections

Draw lines from devices to:

Router (Wi-Fi) or Smart hub (if used)

Show how commands travel.

Example:

Phone App > Router > Smart Light

Step 5: Automation Rules

Create 3 smart house rules.

Examples:

- Motion at front door = Turn on porch light
- 10:00 PM = Lock doors
- Temperature above 75°F = Start AC

Step 6: Security Challenge

Circle devices that need strong passwords.

Write 3 ways to protect the network:

- Strong Wi-Fi password
- Update devices
- Secure router settings

Reflection Questions

- Where was the best router location?
- Which devices are most useful?
- Why is cybersecurity important in smart homes?
- Could someone hack into a smart device and use that to access the rest of your network?
- What could happen if Wi-Fi goes down?

PUBLIC SAFETY

- **Firefighting**
  - » Family Emergency Plan
  - » Water Target Challenge
- **Law & Public Safety**
  - » DNA Evidence Simulation
  - » Observation and Memory Challenge

James Rumsey Technical Institute

Course: Public Safety
Section: Firefighting

Family Emergency Plan

What You Will Do

Perform a safety inspection of your house and develop an emergency plan for your family in case of fire or natural disaster.

Materials You Will Need

- Pencil or pen
- Notebook
- Colored pencils/markers (optional)

Why a Family Emergency Plan is Important

A family emergency plan is crucial to ensure safety, facilitate rapid communication, and enable quick, calm decision-making when disasters strike. It reduces fear and confusion by establishing predetermined meeting spots and evacuation routes, ensuring family members can reconnect if separated.

Safety Inspection

- Walk through your home and check each area for possible hazards.
- Create a chart and record what you find.

Areas to inspect:

- Kitchen
- Living room
- Bedrooms
- Bathrooms
- Hallways
- Garage/Basement
- Outside Exits

What to look for:

- Smoke alarms installed and working
- Clear exits and doorways
- No overloaded outlets
- Fire extinguisher location
- Safe storage of cleaners/chemicals
- Flashlights available
- First aid kit location
- Loose rugs or tripping hazards
- Emergency numbers posted

Example Chart:

Area	Hazard Found	How to Fix It
Kitchen	Towel near stove	Move towel away from heat
Hallway	Shoes blocking exit	Store shoes in closet
Kitchen	No extinguisher	Purchase fire extinguisher

Emergency Plan

Step 1: Escape Routes

Draw a map of your home with:

- Main exit
- Second exit
- Safe meeting place outside

Step 2: Emergency Contacts

- Parent/Guardian phone numbers
- Trusted neighbor or relative
- Emergency services (911)

Step 3: Emergency Supply Kit

List 5 items your family should have:

- Water
- Flashlight
- Batteries
- First aid kit
- Important documents

Step 4: Family Responsibilities

Who will:

- Help younger siblings?
- Grab emergency kit?
- Call for help?
- Check pets?

Step 5: Family Meeting

- Make a copy of the emergency plan for each member of the family.
- Call a family meeting and discuss the plan so everyone knows what to do.
- Perform a practice emergency drill. Drilling makes sure that everyone performs their repsonsibilities automatically during a real emergency.

James Rumsey Technical Institute

Course: Public Safety
Section: Firefighting

Water Target Challenge

What You Will Do

Challenge friends or family members to see who can hit the most targets.

Materials You Will Need

- People to compete against
- Water filled spray bottle with the nozzle set to spray a stream instead of a mist
- Five empty plastic cups or paper targets
- Table in an outdoor area

How Good is Your Aim?

Spraying water or foam from hoses and water cannons is the most common way to fight fires. The water is sprayed under very high pressure so that it can reach a great distance. This makes controlling the hose and hitting the intended target difficult. Firefighters have to practice this skill.

How the Game Works

1. Set up cups or targets on the table.
2. Stand a few feet away.
3. Each player gets five seconds per round. The opposing player says “Ready, set, go!” and counts down from five.
4. Use the spray bottle to spray each target. Each hit is worth one point. Knocking a target off the table is worth two points.
5. At the beginning of each round, the targets are reset and the players move farther away from the targets.

As you move further away, the targets get harder to hit and the water hits the targets with less power.

James Rumsey Technical Institute

Course: Public Safety
Section: Law & Public Safety

DNA Evidence Simulation

What You Will Do

Use DNA evidence to compare samples and identify possible matches in criminal investigations.

Materials You Will Need

- Colored beads, buttons, cereal pieces, or paper squares (2 colors minimum)
- Small cups or bags
- Paper and pencil
- Tweezers or spoon (optional)

What is DNA?

DNA is the genetic code found in nearly every cell of the body. It is unique to each person (except identical twins), so it can be used to help identify individuals.

Investigators may collect DNA from:

- Hair roots
- Saliva
- Blood
- Skin cells
- Sweat

Important Terms

- **DNA Marker** – Specific, identifiable DNA sequence used to track inheritance, map genomes, or identify individuals. They act as “flags” for nearby traits or genes, frequently utilized in research, agriculture, and forensics.
- **False Positive** – An error in data modeling or testing where a result incorrectly indicates the presence of a specific attribute when it is actually absent.
- **DNA contamination** – Occurs when foreign DNA is introduced into evidence during collection, handling, or analysis, potentially leading to false results or wrongful convictions

Part 1: Create DNA Profiles

Each color represents a DNA marker.

Example:

- Red = Marker A
- Blue = Marker B
- Green = Marker C
- Yellow = Marker D

Make profiles for 4 suspects and 1 crime scene sample.

Example:

Sample	**DNA Pattern**
Suspect 1	Red, Blue, Green
Suspect 2	Red, Yellow, Green
Suspect 3	Blue, Green, Yellow
Suspect 4	Red, Blue, Yellow
Crime Scene	Red, Blue, Green

Place matching colored pieces into the cups.

Part 2: Investigate the Evidence

1. Dump out the crime scene sample.
2. Compare it to each suspect sample.
3. Record which suspect matches all markers.

Part 3: Report Findings

- Which suspect matched?
- Which suspects were eliminated?
- Why must investigators test carefully?

Reflection Questions

- Why is DNA useful evidence?
- Why should one marker alone not decide guilt?
- Why must evidence be handled carefully?
- Why can DNA exclude innocent people?

James Rumsey Technical Institute

Course: Public Safety
Section: Law & Public Safety

Observation and Memory Challenge

What You Will Do

Challenge a friend to test your attention to detail, recall, and reporting skills.

Materials You Will Need

- 2 players
- Table
- 10–15 objects
- Cloth or towel
- Paper and pencil
- Timer

Why Test Your Observational Skills?

Strong observation and memory skills are essential in law enforcement

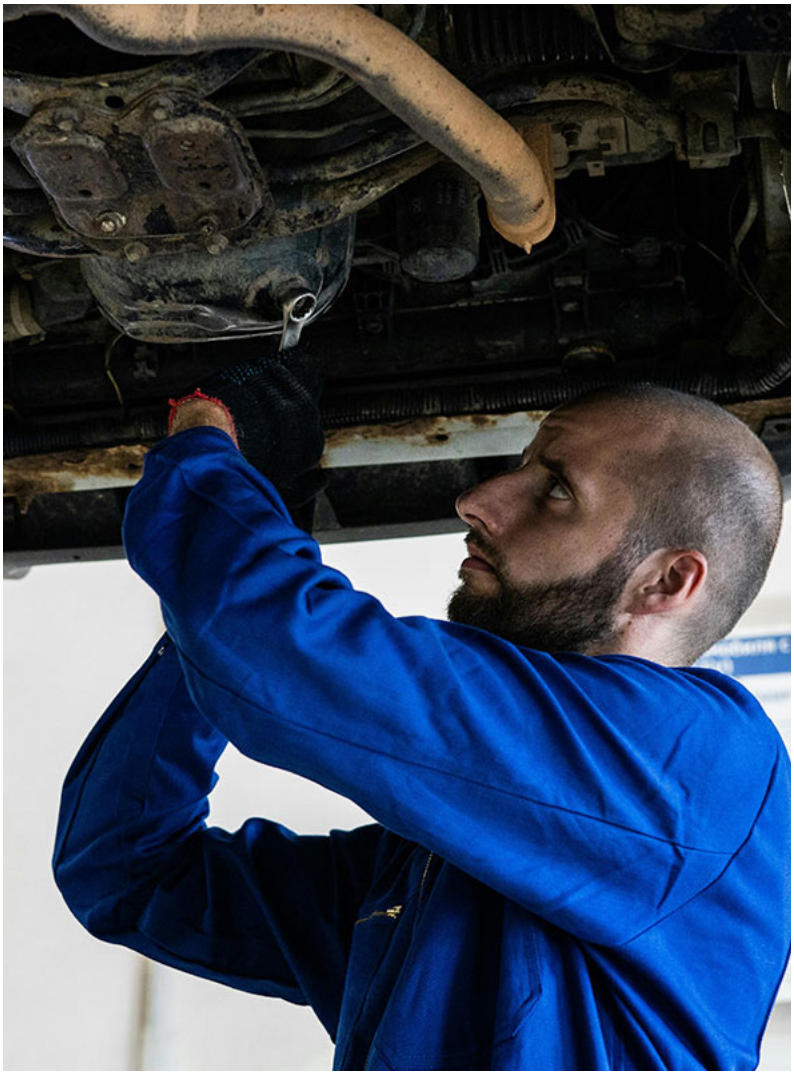
- **Accurate Evidence and Reporting** – Detailed observation helps in documenting crime scenes correctly, which is vital for the investigation process. Accurate memory ensures that reports and courtroom testimony are reliable, reducing errors that could jeopardize cases.
- **Situational Awareness & Safety** – Officers must constantly observe surroundings to spot, analyze, and react to potential threats or unusual behavior. This awareness allows officers to de-escalate situations effectively.

Setup

1. Player 1 leaves the room or covers their eyes.
2. Player 2 arranges several objects on a table (keys, coin, pen, toy car, book, etc.).
3. Player 2 covers the objects with a cloth or towel.

Play the Observation Game

1. Player 1 uncovers their eyes and approaches the table.
2. Player 2 removes the cloth and starts the timer.
3. Player 1 observes the items for 30 seconds.
4. When the time is up, Player 2 stops the timer and covers the table.
5. Player 1 draws and writes down what objects they remember seeing and their position.
6. Remove the cloth.
7. Both players check Player 1's observations for accuracy.
8. Score 1 point for each correct object and 1 point for each correct position.
9. Repeat the game for Player 2 and compare scores.



VEHICLE REPAIR

- **Automotive Technology**
  - » Tire Safety Inspection
  - » Towing Capacity
- **Diesel Technology**
  - » Torque vs RPM- Gasoline vs Diesel Engines
  - » Naturally Aspirated vs Blown Engines

Course Vehicle Repair
Section: Automotive Technology

James Rumsey Technical Institute

Tire Safety Inspection

What You Will Do

inspect tires by locating recommended tire pressure, checking tire pressure, reading tire sidewall information, and measuring tread depth.

Materials You Will Need

- Parked family vehicle
- Tire pressure gauge
- Penny
- Paper and pencil
- Flashlight (optional)

Why Tire Inspections are Important

Automotive technicians inspect tires regularly because tires affect:

- Safety
- Fuel economy
- Braking distance
- Vehicle handling
- Tire life

Step 1: Read Tire Sidewall

Look on tire sidewall for numbers like 225/65R17 102H

What those numbers mean:
225 = Tire width (mm)
65 = Aspect ratio
R = Radial tire
17 = Wheel diameter (inches)
102 = Load rating
H = Speed rating

Write your tire size: _____

Step 2: Find Recommended Tire Pressure

Read the manufacturer sticker because the sidewall shows **maximum** pressure, not usually **recommended** daily pressure.

The manufacturer sticker is usually found:

- Driver's door jamb
- Inside driver door
- Glove box
- Owner's manual

Record: Front Tire PSI: _____ Rear Tire PSI: _____

Step 3: Check Tire Pressure

The car needs to have been parked for at least a couple of hours. When you drive a car, the wheels turning causes the tires to heat up. This increases tire pressure.

1. Remove valve cap.
2. Press tire gauge firmly onto valve stem.
3. Read PSI.
4. Compare to recommended PSI.
5. Replace valve cap.

Tire	Recommended PSI	Actual PSI	Add Air?
Front Left			
Front Right			
Rear Left			
Rear Right			

Step 4: Measure Tread Depth

Insert a penny into the tread groove with Lincoln's head pointing down. If the tread is shallower than the distance from the edge of the penny to the top of Abe's head, the tread may worn. It may be time to replace the tire.

Record your findings:

Tire	Tread Good/Low
Front Left	
Front Right	
Rear Left	
Rear Right	

Report your findings to the car's owner. Try checking the tire pressure in the morning and again in the afternoon. Compare how temperature effects tire pressure.

Course Vehicle Repair
Section: Automotive Technology

James Rumsey Technical Institute

Can Your Vehicle Tow It?

What You Will Do

Determine safe towing limits by finding towing capacity, calculating trailer weight, and comparing the two.

Materials You Will Need

- Family vehicle (parked)
- Owner's manual or internet specs if available
- Paper
- Pencil
- Calculator (optional)

Important Safety Note

Real towing capacity must always come from the owner's manual, door sticker, manufacturer towing guide, and hitch rating. This activity teaches the concept only.

What is Towing Capacity?

Towing capacity = the maximum trailer weight a vehicle can safely pull.
This depends on:

- Engine size
- Transmission
- Brakes
- Cooling system
- Axle ratio
- Vehicle frame
- Hitch equipment

Part 1: Investigate the Vehicle

Find:

Year: _____
Make: _____
Model: _____
Engine size: _____

Example: 2020 Ford Explorer 2.3L

Part 2: Find Maximum Tow Rating

Use the vehicle's owner's manual or manufacturer guide.

Write: Maximum Tow Capacity = _____ lbs

Part 3: Calculate Passenger & Cargo Weight

Everything inside vehicle reduces towing ability.

Estimate the weight of the following:

- Driver: _____
- Passengers: _____
- Cooler: _____
- Luggage: _____
- Sports gear: _____

Add Total: Cargo + People = _____ lbs

Part 4: Estimate Safe Trailer Weight

Use this simplified formula:
Tow Capacity - Cargo Weight = Remaining Tow Ability

Example:
5,000 lb tow rating - Minus 700 lbs people/cargo = 4,300 lbs remaining
(Use calculator if desired: 5000-700)

Part 5: What Could We Tow?

Choose which would be safe:

- Small utility trailer 1,500 lbs
- Pop-up camper 2,500 lbs
- Boat trailer 3,800 lbs
- Large camper 6,000 lbs

Circle which ones your vehicle could tow.

Reflection Questions

- Why does passenger weight reduce towing ability?
- Why are brakes important when towing?
- Why can a trailer be dangerous even if the engine can pull it?
- Why must hitch rating match trailer weight?
- Why should you never guess towing limits?

Course Vehicle Repair
Section: Diesel Technology

James Rumsey Technical Institute

Torque vs RPM
Diesel vs Gasoline Engines

What You Will Do

You will physically model torque and RPM (Revolutions Per Minute) to understand why:

- Diesel engines produce high torque at low RPM.
- Gasoline engines require higher RPM to produce high torque.

Materials You Will Need

- Broom
- 4–6 textbooks or canned goods for weight
- Bookbag or backpack
- Pencil
- Paper

Difference Between Diesel and Gas Engines

The primary difference between diesel and gas engines is how they ignite fuel: gas engines use spark plugs to ignite a fuel-air mixture, while diesel engines use compression to heat air to extreme temperatures, causing fuel to self-ignite upon injection. Diesel engines are more fuel-efficient and create higher torque, while gas engines typically run cleaner and at higher RPMs.

Important Terms

- **Torque –** Torque is a measure of the rotational or twisting force that causes an object to spin.
- **RPM –** RPM (revolutions per minute) measures the number of full rotations an object makes around a fixed axis every 60 seconds.

To simplify this, **RPM** is how fast a shaft is turning and **torque** is how much power is applied to it.

Build the Torque Model

1. Load as much weight as you think you can handle into the bookbag or backpack.
2. Hold the broom handle near the end you sweep with.
3. Place the other end of the broom handle through a loop or handle of the bag.

Test A: High RPM / Low Torque (Gasoline-Like)

1. While holding the broom handle with one hand, quickly raise the bag off the floor.
2. Was it difficult to raise the weight?

Test B: Low RPM / High Torque (Diesel-Like)

1. Repeat the test. This time try raising it slowly. Is it easier this time? Moving slower represents lower RPM.
2. Repeat the previous step, but this time hold the broom handle with both hands. Using both hands represents higher torque.

Diesel or Gasoline?

Which type of engine do you think each of these vehicles uses and why?

Vehicle	Diesel or Gas Engine?	Why?
Family Car		
Jet Ski		
Freight Train		
Cargo Ship		
Motorcycle		
Semi Truck		
Construction Crane		

Course Vehicle Repair
Section: Diesel Technology

James Rumsey Technical Institute

Naturally Aspirated vs. Blown Engines

What You Will Do

Physically model airflow, compare engine performance, and explain the difference between:

- Naturally Aspirated (NA) engines
- Blown engines (turbocharged or supercharged)

Materials You Will Need

- 2 balloons
- Straw
- Tape
- Fan or hair dryer on cool setting
- Cotton balls or paper wadded into balls
- Measuring tape
- Pencil and paper

Important Terms

- **Naturally Aspirated –** Engines that pull in air without external devices boosting air intake.
- **Blown Engines –** Engines using forced induction to force more air into the combustion chamber, boosting power without increasing engine size.
- **Turbocharged** – A type of forced induction that uses a turbine powered by the engine's exhaust gases to compress air into the intake.
- **Supercharged** – A type of forced induction that is mechanically driven (usually by a belt) directly by the engine's crankshaft.

Advantages of a Blown Engine

By forcing more air into the combustion chamber, a turbocharger or supercharger significantly increases the engine's power output compared to a naturally aspirated version.

Test 1: Natural Aspiration Test

1. Place a cotton paper ball on a table.
2. Use a fan or hair dryer on the cool setting to try to move the ball as far as possible.
3. Measure distance moved.
4. Record results.

Test 2: Turbo/Supercharger Test

1. Inflate a balloon and pinch the end closed.
2. Tape a straw to the balloon opening.
3. Aim the straw at the ball.
4. Release the balloon air quickly.
5. Measure how far the paper ball moves.
6. Record results.

Part 3: Compare Results

How far did the ball move in Test 1? How about Test 2?

The balloon forced extra air out quickly, just like a turbocharger or supercharger pushes more air into an engine. More air allows more fuel to burn, creating more horsepower and torque than a naturally aspirated engine of the same size.