10 Apples up on Top	Listen to this Jason Mraz-style version of the Dr. Seuss classic and then have students create a snap cube tower 20 blocks high and balance a piece of foam fruit at the top. YouTube: 10 Apples Up on Top Song in the style of Jason Mraz.										
100th day - Lego challenge	Using only 100 legos, build the tallest tower you can.										
3 Little Pigs	Listen to a read-aloud of The Three Little Pigs and then have students build two houses: one that the wolf can definitely knock down and one that they think the wolf cannot knock down. When both houses are done, test them with a hair drying with the wolf's face taped to it for 10 seconds.										
Animal camouflage	Watch the Mystery Science video, "Why are polar bears white?" and then have students color a moth so that it camouflages into the classroom (not hides, but camouflages). Students tape their moths in place and the follow week we become predators and walk the room, counting how many moths we can see.										
Animals at the Pond	Have each student pick a plastic animal figurine out as they walk into the room. Tell them that today the table is a pond and each of them are a house around the pond. The animals would like to get to one another more quickly than walking around the pond, so the table needs to build bridges and docks so they can quickly walk to each others' houses. To make this more difficult, some years I limit supplies and/or require the bridges and docks to all be the same height.										
Balance a bird	Listen to the Mystery Science mini-lesson about crazy balancing acts (I can't locate it to name it right now) and then have students build a "bird" that they can balance on their finger as they walk around the room. The bird is made from a pipe cleaner, popsicle stick, and two washers. As long as the washers are below the center of gravity, the bird will balance, but don't tell them this. Design Squad Global on YouTube also has a video about center of balance called Balance Magic.										
Building Up	Listen to the story, "Building Up" and look at the pictures for inspiration about how engineers can build. Then have some time building using whatever material inspires you.										
Bunny copters	Tie in with how seeds are designed to travel away from the parent plant. Printable here and searchable under "Bunny Copters": https://www.mos.org/sites/dev-elvis.mos.org/files/docs/education/mos_observing-air-and-flight_bunny-copter.pdf										
Chromatography butterflies	Listen to the Mystery Science mini-lesson Why are Butterflies so Colorful and then have students color two coffee filters with markers and spritz them with water. After they dry, form them into wings and add the body (either a pipe cleaner or clothespin). For older students, you can tie in the science of chromatography.										
Codespark	Programming app for grades K-5 that I usually wait until first grade to start unless a kid is really eager to start early because they have an older sibling.										
Craft stick puzzles	Before class I spell out each student's name on craft sticks, one stick per letter, at the bottom of the stick. Then I tape them together and the students draw a picture on them which they can put together and practice spelling their names.										
Curling	During the Winter Olympics we watch a video about the sport of curling and then try our hand as some homemade, laminated curling games by using colored pennies to play the game. There's a video about the game of curling that helps students: Science Friction, all about the sphysics of curling. (YouTube)										
Elf shelf/gnome home	Choose a building material and build a tower tall enough to hold the paper elf or gnome more than 12 inches off the table surface.										
Fall Legos	Design something you would see in the fall using Legos. Start by brainstorming things that we typically see only during the fall and have them pick from those.										
Free choice	The last day of class for the year I often give them as free choice so they can build with their favorite materials or repeat an activity we did earlier in the year. They often also have some times for free choice/ building/exploration during each class period after they successfully complete the challenge.										
Free choice rules	Day 1 we talk about what the students can use, where they get materials from, how to share (3 to a large bin, 1 or 2 to a small bin), how to unlatch the lids, dig through the bin rather than dump the contents on the floor, and put one thing away before getting another out. At clean-up time we talk about the signal (blink the lights) for pick-up and how to quickly and quietly clean up and return to our seats for a brief engineering video.										
Friction sleds	Introduce friction and then have students rub their hands on the table (minimal friction) and then their sneakers on the carpet (maximum friction). Have a bin of materials with high and low friction on each table for them to test. The test is rubbing each material on your sleeve. If your sleeve moves a lot, there's a lot of friction. If it doesn't, there isn't much friction. Then task them to build a sled that can go down both sledding hills in the classroom (foamboard at different angles). They must use at least 3 different items from the bin to make their sled. The sled must slide, not roll.										
Gingerbread boys centers	To prevent the gingerbread boy from running away, he needs to feel special: decorate your cut-out gingerbread boy, build a house for him out of magnatiles or Keva planks, decorate the gingerbread house on the magnet wall with magnets, and build a way for him to cross the river so that he doesn't need to get a ride on the fox.										
Gravity Glue	Watch the YouTube video "Gravity Glue 2014: Short Version" and then challenge students to stack 10+ rocks using nothing but gravity and balance										
Halloween centers	Play doh monsters, play doh pumpkins, 5 Little Pumpkins Sitting on the Gate, etc. as different centers.										

How I Met My Monster	Listen to the story, How I Met My Monster, and then sketch a monster you think would scare you into staying in bed. When the students are mostly done sketching, I tell them to then grab a building material and build a 3D model of their monster that matches their picture and we compare features on them.										
Humpty's Wall	Listen to the read-aloud, "After the Fall" about how Humpty has developed a fear of heights after falling off the wall. Design a better wall for Humpty in which he can't fall off even if a gust of wind hits him (hair dryer for 10 seconds).										
Ice cube challenge	Design something that will slow down how quickly an ice cube melts. We only did this once and outdoors because it got so many materials wet, but the students had to build some sort of shade structure to protect the ice cube from the sun.										
If I Built a House/Car/School	Read one of these Chris Van Dusen books and then have the students either sketch what they would design or build with their choice of building materials. I allow them to work in groups of 1-4, but each person has to bring a different material into the structure.										
Keva Plank - Tallest Tower II	In the spring, have the students repeat the tallest tower exercise from the fall and talk about how much their teamwork has improved.										
Keva plank - tallest tower I	Working with a partner, design the tallest tower you can using only the blocks in your bin. This video will help you understand what will happen in the fall with this lesson. Repeat it in March to see how far the students have come with working together! https://www.youtube.com/watch?v=dXb0CYzlZcs&ab_channel=ElementarySTEMwithMs.Crosman										
Keva Planks - Boxitects	Since the pandemic many students haven't come in with the SEL necessary to start with Keva Plank Towers I, so I've been reading Boxitects to them and then just having them build with a partner, sharing the same box of supplies as a soft intro to partners and teamwork.										
Lego - fairy tale setting	Another variation on a lesson plan for a substitute, students are tasked with designing the setting of a famous fairy tale. I generally offer 3-4 choices and try to pick at least one well-known fairy tale.										
Lego bridges - K version	Build a Lego bridge that goes over the water (a 1/4 sheet of blue construction paper) that is wide enough for a little piggy to walk over and tall enough for the piggy to walk under.										
Lego cars	Design a Lego car that will roll independently down the 8-foot ramp.										
Lego cars - wind-powered	Design a Lego car and then attach a sail to it. See if it can travel 8 feet using only the power of the fan. I put out some great sail materials and some lousy choices: coffee filters, tissues, tinfoil, construction paper, copy paper, card stock, and paper plates cut in half.										
Lego Challenge Cards	I've printed and laminated several free Lego Challenge Cards that I found online and often use these as a sub plan. With the youngest students, I offer 4 choices while the older students get a stack of them on the table and can go through.										
Lego symmetry	Place a row of Legos down the center of each baseplate and then challenge students to build something with symmetry, which is identical in shape and size on each side of the line.										
Lego symmetry II	Repeat the lesson in older grades but challenge them to build a 3D model that has at least one line of symmetry.										
Leprechaun traps	Design a trap that you think will trap the leprechaun. We've never been successful, but sometimes we find a trail of glitter the leprechaun has left behind.										
Magnet centers	This varies depending upon the materials, but I have students find 10 things in the room that a magnet sticks to, decorate the whiteboard with magnets, have a magnet wall, glue magnets to matchbox cars and have students try to "push" the cars without touching them, build sculptures with magnets, see which items in the box stick to a magnet, etc.										
Muncha Muncha Muncha	Listen to the story, "Muncha Muncha Muncha," and then design a way to keep the bunnies out of Mr. McGreely's garden. Have the kids explain their solutions to you because their answers are wild and not easily interpreted by just looking.										
My Dream Playground	Listen to the story, My Dream Playground, and then either sketch a playground you're like to design or build a few pieces of playground equipment using Legos. We put these on display and include several classes' worth of pieces.										
Paper chain challenge	Using only a single sheet of paper, scissors, tape or a stapler, construct the longest chain you can in 20 minutes. I often use colored paper and give each student at the table a different color so they don't mix up their pieces.										
Peaceful gardens	Using keva planks, each person at the table designs two structures as part of a peaceful park or garden, and then the table connects them with pathways. This lesson was inspired by the YouTube video "How to build an Asian inspired garden" on the Keva Plank channel.										
Perfect Square	Listen to the story "Perfect Square" and have students create a collage using 1-4 pieces of colored paper that they glue onto a sheet of white paper. I cut construction paper into 1/4 sheets to reduce waste for this project.										
Play & Learn Science	A free pbskids app about weather, friction, contraptions, shadows, etc. that is a great introduction to the iPads.										

Pumpkin Palooza	Several centers all themed around pumpkins: estimation station where you guess the pumpkin's weight, estimation station where you guess which of three pieces of yarn would go exactly around the pumpkin's middle, build a model to show "Five little pumpkins sitting on a gate," complete "Pick a Pumpkin" on Starfall on a Chromebook, using a die and a glyph create a jack-o-lantern, put together a pumpkin puzzle, practice using tools by using a mallet to pound golf tees into a pumpkin.									
Room on the Broom	Listen to the story and then design a Lego broom with room for all the characters in the story.									
Scavenger Hunt	Provide a visual scavenger hunt list of 16-20 items on a clipboard for students to go out and explore. They should cross off items as they find them. I tie this in with thinking like a scientist by looking closely at the world around us.									
Shadows	Learn about how the sun "moves" throughout the day, causing your shadow to also move. Go outside and, with a partner, trace your partner's shadow. Outline their shoes and later color them in so that later in the day/ week they can put their feet back on the shoe outline and see how their shadow has moved.									
Shape Monsters	Create a monster by gluing pattern block shape paper cut-outs onto a sheet of paper. When done, count how many of each shape you used and put that number on your shape counting sheet.									
Snap cube spinners	Formulate a hypothesis about whether a small snap cube spinner or a large one will spin longer. Build one of each and compare them three times. Add your name to the graph to show which one spun longer.									
Snowflake geometry	Watch the video about how snowflakes form, then build a snowflake on the table using pattern blocks. https://www.youtube.com/watch?v=-M48RfaWcWA&ab_channel=SciShowKids									
Snowflake tinker trays	After learning about how snowflakes form and how many sides they have, provide materials to design a snowflake on the table (gemstones, popsicle sticks, cotton balls, q-tips, beads, etc.) for students to explore.									
Sorting and classifying	We talk about how scientists like to group items into large categories and then smaller categories, for example living things, animals, and horses. Then I give them a collection of random items and ask them to group them with their partner into categories that they make up. They might put things together by color, texture, shape, size, purpose, or whatever categories they wish.									
Spiders	Listen to the Mystery Science mini-lesson, What is the Biggest Spider in the World? Have students pay attention during the video to how many legs and eyes a spider has, and after the video have them build an accurate model of a spider using any classroom building supplies.									
Starfall	Early literacy and math website, kind of confusing because a lot of it isn't free anymore and the games are very short (2 minutes) but a good introduction to using a trackpad or mouse.									
Thanksgiving Tables	Build a Thanksgiving table large enough to fit all 5 cut-out pictures of food without them overlapping, standing up, or hanging over the edge of the table. When they have that done, test them for weight using two cans of food.									
Tinfoil boats	Students designed boats using tinfoil that could float and then tested their strength by placing pennies or gemstones in them until they sank.									
Tippy Hide	The three bunnies on Mr. McGreely's farm want to come in for the winter. After listening to the story, Tippy Tippy Tippy Hide, design a way to keep the bunnies out of the house for the winter. Try to get the kids to think creatively on this one and not just build a wall: a dog, a robot, a hutch for the bunnies, their own house, laser-activated catapults are all acceptable answers.									
Turkey Traps	Read "How to catch a turkey" and then talk about things we know about turkeys. Using that information, design a trap that will capture the runaway turkey but not harm it.									
Why do leaves turn colors in the fall?	We watch the Mystery Science video, "Why do leaves turn colors in the fall?" and then I have a bunch of leaves for each table to observe closely with magnifying glasses. After a few minutes, I distribute black and white print-outs of leaves that they color to match their favorite leaf and we display them on the bulletin board for the month.									

100th Day of School	Build the tallest tower possible using 100 legos multiplied by your grade level. In the 2nd grade, work in groups of 2; in the 5th grade work in groups of 5, etc. Other years I've put 100 of something in a bin and had students build whatever they wanted with the 100 things in that bin.										
24" Keva plank tower that can support weight	Build a tower that is at least 24" inches tall and see if it can support the weight of a brick. You must build straight up for this to work, so look at all 4 sides as you're building.										
3 Keva Plank Challenges	Design three Keva plank structures: 1) a structure that moves a ping pong ball 12 inches horizontally using only gravity, 2) a structure that makes the ping pong ball turn a corner, and 3) a structure that allows the ping pong ball to bounce into the cup										
40 planks, 5 ways	Design the tallest tower you can using only up to 40 planks. Then design four more with the same constraints, only each way needs to look different from the previous ways.										
Amazing Alex	An engineering app that is no longer on the Apple store but on some of our older iPads at PES. Other engineering apps include TinkerBox, Brain It On!, and										
Animal adaptations	Mystery Science lesson about how birds' beaks are designed to help them with the type of food they eat. After watching the video, "Why do birds have beaks," students completed the extension activity and used straws and paper cups to mimic two types of beaks and pick up macaroni or dried beans but not both.										
Animal habitats	A youtube video I posted about areas around my home where I discovered unexpected wildlife during our remote learning period. *Elementary STEM with Ms. Crosman, Animal Habitats Lesson*. After the video we went outside to observe evidence of animal habitats at PES.										
Apple Picker Engineering	Mystery Science mini-lesson, "What's the biggest apple in the world?" with a follow-up activity to engineer a construction paper apple picker that will scoop up paper apples.										
Balance a bird	Mystery Science mini-lesson about balance with a follow-up activity of designing a bird that you can balance on your finger as you walk around the room. The bird is made using a pipe cleaner, popsicle stick, and two washers. I haven't been able to find the mini-lesson on MS's website lately, so another video that works to anchor the lesson is Design Squad Nation's video on YouTube, Balance Magic.										
Breakout game reviewing teamwork & taking turns	I created a breakout game to help students practice and refine our teamwork skills and make sure they were taking turns (4 puzzles, 4 partners). However, I built it based on a classroom I had 4 classrooms ago and I'm not sure if the clues for where to find the next clue will still work. I believe there's a copy of the game in my filing cabinet at PES.										
Brick towers	Using Legos, build a tower that is at least 10" tall and can support the weight of a brick. Again, we're focusing on building straight up and not out to the side which causes a point of weakness in the structure.										
Building Up	Listen to the story, Building Up, and design something that was inspired by a page in the book. We use this in kindergarten and it's probably a little young for 1st and 2nd graders.										
Chromatography / Why are butterflies so colorful?	Watch the Mystery Science mini-lesson, *Why are butterflies so colorful?* Then color two coffee filters using markers and spritz them with water. When they're dry, use them as the wings for a colorful butterfly and either use a clothespin or half a pipe cleaner as the body of the butterfly.										
Codespark	Great free coding app where you can set up multiple classes and have students learn to code and design their own games.										
Craft stick bridges	Using craft sticks, clothespins, paper binders, and blocks or snap cubes students build three different bridges across the river (blue bulletin board paper running down the length of each teable) and test each for strength. They are given a data sheet to track how many gemstones each bridge style holds (small paper cups and gemstones from the floral section of Dollar Tree work well). They need to build a bridge shaped like the letters I, X, and Y. The bridge fails when it touches the water or the data sheet cannot be smoothly slid under the bridge where the weights are.										
Creature catchers	This activity is a little tricky for 1st and 2nd graders and might be better for 3rd or 4th. Using pipe cleaners and string, design a web that will catch the creatures as the teacher drops them onto the web. Students lift up their creature catcher to see how many were actually caught. In the past, I've used plastic ring spiders from the dollar store for this activity. It's based on a lesson by Kerry Tracy on youtube: Halloween STEM Challenge, Creature Catchers.										
Curling	During the Olympics I create a curling rink using Powerpoint and print it out on the largest paper our color printer will take and then laminate it. Students watch a video about the physics of curling, *Science Friction, All About the Physics of Curling.* Then we try our hand at it using pennies I've put stickers on to make them different colors for the two members of each team. The scoring gets tricky for these kids, so I tell them the winner for our class version is whoever's penny is closest to the center of the target.										
Disaster Island	Using Legos, have students design an island for 10 minutes. Then draw some disaster cards out of a bucket and tell them they now must design for that impending disaster. The disaster cards are printable on The Lego Librarian's website.										
Does weight affect how far a Lego car will travel?	Students design a Lego car that will roll down the 8-foot ramp we have in the classroom (don't have a ramp? Foamboard works as well!). They measure how far the car rolls by placing a post-it on the floor where the car stops. Then they add weights to the car and test again, moving the post-it if it travels farther. They test one last time, doubling the amount of weight on the previous car. We have data sheets and they circle which car went the farthest (no weights, x-weights, or 2x weights) and then explain in writing why they think that one rolled the farthest. At the end of class we come together as a group and compare how many of each type of car went the farthest and have members from those groups share their thinking about why it rolled the farthest.										
Elf shelf/gnome home	Design a shelf or home that will keep an elf or gnome at least 24" off the work surface.										
Engineering the slow fall	Create several different paper leaves using paper and bobby pins and test them to see which will fall the slowest. I have a video explaining this lesson: *Elementary STEM with Ms. Crosman, Engineering the Slow Fall.*										
Fall Legos	This is a sub plan. Using Legos design something you would see in the fall (Halloween, football, Thanksgiving, soccer, parades, leaves turning color, etc.).										
Flying spiders	Using 5 things from makerspace, design a catapult that will fling a plastic spider at least 10 feet across the room.										
Free choice	When students are done with the daily challenge they can choose from any of our building materials on the shelves and free build.										
Gingerbread boy bridges	Design a bridge over the shoebox tote that will allow your gingerbread boy to cross the long way without falling into the river. You may use 5 strips of construction paper plus five items from makerspace. Your creation must support the weight of two 1" blocks of wood.										
Heavy hearts	Print copies of large paper hearts for each pair of students (use legal-sized paper). Have students fill the heart in with pattern block pieces. Each piece is worth 1 unit of weight. The idea is to get students to understand that six triangles fit into the same space of one hexagon and would be worth more.										
Hoop Gliders	Design two different hoop gliders designs to see which one flies the farthest. Honestly, this lesson flopped the last time it was tried with 2nd graders. It might've been the quality of the straws, I don't know.										
How I Met My Monster	Read the story, *How I Met My Monster,* and then have students sketch a monster that would be scary enough to keep them in bed at night. Then use building materials in the classroom to build a 3D model of your monster.										
Humpty's Wall	Read the story, *After the Fall*, about how Humpty developed a fear of heights after falling off the wall. Challenge students to create a wall that Humpty (an Easter egg) cannot fall off from and test their creations with 10 seconds of a hair dryer blowing on them.										
Icy sledding slope	Using Keva Planks, design a slope that will roll a ball from one end of the table to the other. Bonus points if you have a ramp/jump in it.										
If I Built a House/School/ Car	Read one of these stories by Chris Van Dusen and then have the kids build their own designer house, school, or car. If they team up, have each person bring a different material and incorporate it into what they're building.										

Insulation roller coasters	Get a bunch of insulation tubes from Home Depot and a bag of marbles from Dollar Tree in the floral section (they're slightly smaller than regular marbles and work better for this). Cut the insulation tubes in half and have students design "roller coasters" to explore potential and kinetic energy. They can also tape tubes together to make longer runs or just have teammates holding the ends together. Have different challenges like the longest roll across the floor, or doing a loop-de-loop, or having a hill in the middle of the run.										
Keva plank - tallest tower	Build the tallest tower you can using a bin of Keva Planks. At first, don't talk to students about how you can lay them flat, or on their sides, or on their ends. Let them build for 10-15 minutes and then start building at a table with them on their sides and later on their ends to demonstrate different ways of doing it.										
Keva plank sub plans	An easy sub plan is to have students complete two of several challenges with the planks, for example: build a Keva plank run that will roll the ball the length of your body, design a Keva plank contraption that will drop the ball onto the table and have it roll off the table and into your shoe, build a Keva plank run the length of the table that turns the marble in a different direction, etc.										
Keva planks - horizontal force	Build a Keva plank tower at least 24" tall that can withstand the force of my fan blowing on it for 10 seconds.										
Keva planks - something in nature	Build something you would find in nature using the Keva planks.										
Keva planks - vertical force	Build a Keva plank tower at least 24" tall that can support the weight of a brick.										
Kodable	Coding app that I typically start in second grade. This used to be a great app, and while they're leaving it free for teachers, it's more obvious that there is paid content we don't have access to, which makes the flow of play a bit confusing.										
Leaf collage	Collect fall leaves and do a leaf rubbing. Watch a video such as the Sci Show Kids, *Why do leaves turn colors in the fall*.										
Leaf Man	Collect fall leaves before class and have students arrange them on a piece of construction paper to make a person. Photograph them and put them on display in the room.										
Lego - design fairy tale setting	Another sub plan during a year of COVID quarantining: design a fairy tale setting using Legos for a fairy tale such as Jack and the Beanstalk, The Three Little Pigs, Rapunzel, etc. This helps if it's done during the same timeframe or shortly after the library teaches about fairy tales.										
Lego bridges - 20 rocks	Design a bridge using Legos that crosses over but doesn't touch the water (I cut blue bulletin board paper into about 12" wide rivers that run down the length of each table). Test its strength with small rocks with a goal of supporting the weight of 20 rocks.										
Lego challenges - maitre'd	Pick one of the following and build it using Legos: zombie apocalypse, fairy tale castle, or an animal. Give students 25-30 minutes to build before sharing. Share using the maitre'd approach when you ask students to meet in in a group of (2 or 3, your pick) and have each person explain their creation. Then they move on and form another group and explain and continue until it's time to pick up.										
Lego hearts & groundhogs	During the second week of February have students design a heart or a groundhog to put on display in the classroom.										
Lego marble mazes	I have a video of this that explains it better than I can write here: *Elementary STEM with Ms. Crosman, Lego Marble Mazes*.										
Lego puzzles	This lesson plan is located at https://frugalfun4boys.com/lego-brain-puzzles/. I ask students to make a challenging puzzle by making at least 3 different letter shapes (C, E, F, H, I, L, S, T, U). Older students get larger grids. Make sure they understand that the puzzle pieces should not have to come apart and snap together when you're assembling the finished puzzle. I always have a kid or three who makes that mistake. When they're done, they have you test it to make sure it works and then leave it at their seat as they go and try others' puzzles.										
Lego towers w/brick	Design a Lego tower 10-12" tall that can then support the weight of a brick. If it breaks, look at where it broke and assess why there is a weakness there and then start over.										
Leprechaun traps	Using cereal boxes and construction paper, build Leprechaun traps to leave out over St. Patrick's Day. We haven't caught one yet, but they often leave a trail of green or gold glitter behind to let us know they were there. *How to Catch a Leprechaun* pairs nicely with this activity.										
Little Red's Basket	Read the Epic! Story, *Super Red Riding Hood*, and then challenge students to build a basket that can carry 10 rocks around the classroom when carried by the handle. Students are limited to 2 sheets of paper, tape, and scissors for each design attempt. I have this as a read-aloud on my YouTube channel as well.										
Market Bay	Great app for grades 1-3 learning about using money. Market Bay is free for teachers, but you have to set up your classes and go around to every single iPad and log students into their class's account. You'll need a separate email address for each account, so let classroom teachers know you'll set it up but under their email addresses. And I choose the same password for every class just to make it easier. Students buy and sell items to decorate their bedrooms with, working with dollars and coins. As they play it unlocks more areas to keep it interesting.										
Mitten clothesline	This is a Teachers Pay Teachers lesson plan in which students use paper, yarn, and string to create a clothesline that will support the weight of a few paper mittens taped to it.										
Monster Glyph I	Using a self-created glyph, students choose one of two traits to design two monsters. The traits they're choosing are body shape (triangle or oval), eyes (blue googly eyes or purple with lashes), mouth (3 teeth or 2 vampire teeth), hair (spiky or curly), arms (2 or 4), legs (short or long), fur (polka dotted or striped), and fur color (any color from the rainbow). Week 1 students draw two monsters on the page and you save it.										
Monster Glyph II	Week 2, take out the pictures of those two monsters that each student created. Talk about how traits are inherited from parents and have them create a child that could be the child of each of these two monsters. Explain dominant traits, that if both parents have the same hair color, there are higher odds that the child will have that same hair color; and recessive traits, that if one parent has stripes and the other has polka dots, the child will have one or the other but not both. Put the parents and children posters up on display but mixed up and see if kids can match which child goes with which set of parents as an added challenge.										
My Dream Playground	Read the story, *My Dream Playground*, about the Kaboom! Program that brings playgrounds into inner cities. Have the students brainstorm what they might wish for if someone built a new playground in our neighborhood, and then have them build two things for that playground. I like to have students put their pieces on display until we start running out of Legos so that other classes can add to them, making it a very large and elaborate playground.										
Mystery Science - bridges	Mystery Science used to have a lesson about the strength of bridges called *What makes bridges so strong?* As part of their 2nd grade curriculum, but they moved it into the 3rd grade curriculum. It has a follow-up activity that involves making paper bridges, but when they moved it into 3rd grade, I came up with my own lesson on paper bridges: *Elementary STEM with Ms. Crosman, Paper Bridges STEM Challenge*.										
Mystery Science - gliders	Mystery Science mini-lesson with a Valentine's Day theme, but I like to use it in spring so we can go outside and test our gliders: *Why can't airplanes fly into space?*										
Mystery Science - spiders	Mystery Science mini-lesson: *What is the biggest spider in the world?* Have students pay close attention to characteristics of spiders: how many legs and eyes. Then have them create a 3D model of a spider using classroom building materials that shows those features.										
Paper airplane day	One year we had a 2nd grade indoor field day and the STEM rotation was building paper airplanes. I had three tables set up with instructions for three different types of airplanes: glider, copter, and traditional airplane.										

Paper Chains	Design the longest paper chain using a single sheet of paper, tape, scissors, and staples. I like to give each student at the table their own color paper so that everyone knows whose is whose. Sometimes I do this lesson and have them cut strips the narrow way on the paper vs. the long way and see which is different. Other times we might have a challenge of, "If we put all our chains end to end, how far down the hallway can we go?"										
Peaceful gardens	This lesson came from the Keva Plank YouTube channel with the video called *How to build a peaceful garden with Keva planks*. I don't show the students the video, but just a few screenshots of it. There are also peaceful Asian garden videos you can run while students are building that are set to music. Each student at the table is responsible for building two structures and then connecting what they've built to their neighbor's with walking paths.										
Perfect Square	We listen to the story *Perfect Square* and then design something using just 2 or 3 pieces of construction paper that are pre-cut into 1/4 sheet sizes which are then glued down onto a sheet of copy paper.										
Polluted Pond	This is a beginning of year team building exercise. Pour a bin of pattern blocks onto each table and explain to students that their table is a pond that has become polluted with some toxic water. But there are valuable things in the water, diamonds and gold, that need to be removed. However the other pattern blocks are toxic and shouldn't be touched. Their job is to build a device using Legos that will allow them to remove the valuable items without touching the toxic ones. Give them 10 minutes to build a device and then time them for two minutes to see how many they can remove. I tried to give a penalty that if you touch a toxic item you have to put back two of your valuable items, but in first and second grade there are kids who can't follow a penalty rule. It did work with older students. After round 1 give them a few minutes to redesign their tool and launch into round 2, and repeat the process for round 3.										
Pompom pass	Another beginning of year team building exercise. Give each student a paper towel tube cut in half the long way and tell them that today's challenge will be to work together to move a pompom from one person to the next. Starting with table groups, students try to pass the pompom through everyone's tube twice. When you have the pompom, you CANNOT MOVE YOUR FEET. Once you pass the pompom onto the next person, you move to the end of the line to receive it again. Practice this for a few minutes and then double the size of the teams and challenge them to pass the pompom from one end of the classroom to the other. This is not a whole-class activity and takes about 15 minutes.										
Pool noodle boats & rivers	For field day one year we went to the beach and rotated through different stations. The STEM station was to make rivers using tinfoil, and then students could build a boat using pre-cut pool noodle circles, skewers, and foam sails (foam craft pieces from Dollar Tree cut in half). This was a 20-minute station and we did discover that because of the wind we had to collect rocks to weigh the tinfoil rivers down. Younger students (PreK & K) didn't build rivers but built boats and had fun hauling water in jugs to each river.										
Pullback motor cars	In our Lego kits we have about 20 pullback motors. Before class I put specific pieces into ziploc baggies for each pair to build a very basic stock car. Then they can exchange different tires for each time they test their car. One year I took them outside and had them try three different sizes of tires on the bus path to see whether the larger tires or smaller tires worked best. Another year I had them just try to get their car to go from one end of the room to the other (if it could they got to test it in the hall and see if it could reach a certain spot away from our classroom door).										
Pumpkin Jack	We listen to the story *Pumpkin Jack* and then put a pumpkin pie pumpkin in an Utz Cheez balls container for the winter and watch him rot. You're supposed to add a handful of soil every few weeks and Pumpkin Jack will sprout new pumpkin plants. It didn't work for us, but there were extenuating circumstances. Also, when listening to the story I try to get students to find the two mistakes because the science is a little sketchy in this book!										
Pumpkin Palooza	One year I set up several centers around the room related to pumpkins: estimation station (pick up the pumpkin and write how many pounds you think it weighs on the whiteboard), estimation station 2 (choose which of three lengths of string you think will go exactly around the pumpkin's middle, recreate *5 Little Pumpkins Sitting on a Gate*, put together a pumpkin puzzle, color in a paper pumpkin by rolling the dice and using a jack-o-lantern glyph, play a game which had a paper with pumpkins in a triangle and you had to cross out an odd number of pumpkins in a single row for each turn with the goal of being the last person to cross out a pumpkin, and practice using tools by using a mallet and punching holes in a pumpkin using golf tees.										
Rescue the witch from the cauldron / stuffy from the pool	Design something using no more than 5 items from makerspace in each turn that will allow you to retrieve a cotton ball from the bucket of water (or trick or treat pail). At one school we could talk about Halloween so it was a witch and a cauldron; at the other school we couldn't so it was a stuffy that fell into the pool.										
Room on the Broom	Read the story, *Room on the Broom*, and then use Legos to design a broom that has seats for all the characters in the book. Bonus points if you also build the characters.										
Rubber band cars	There are a few videos about building a rubber band car on YouTube you can show the class, but the basic idea is that you have to attach a rubber band to an axle and then when you roll the car backward, it winds up and can release that energy on its run forward. We did this once and then I dropped it in favor of the pullback motor cars because the elastics kept breaking.										
Silence a bell	Put a variety of materials on the table (string, pompoms, shoe laces, shredded paper) and give students the task of silencing a jingle bell. They have to make it so you cannot hear a single bit of sound when you shake it. This is harder than it seems.										
Slowest Marble Run	Using the classroom marble run kits, design the slowest marble run you can. Time how long it takes the marble to go from the start to the end. Post best times for each group on the board so they know what they're working to beat.										
Slowest Snowflake	Introduce the concept of air resistance and then challenge students to build a snowflake using a coffee filter and scissors that takes the longest time to drop from standing on a chair holding your arms above your head to hitting the floor. Use the iPads to have a partner time it. Then build what you think will be the fastest snowflake and test it. Have students drop the coffee filters like an upside down bowl to prevent them from folding on the way down.										
Snap circuits/marble runs	This is a two-class project because I divide the class in half and have half work on challenges #1, #2, and #3 on the snap circuits while the other half of the class designs two marble runs using Lego Jr. and pool noodles cut in half and cut to different lengths. The two challenges are the longest run they can, and a run that changes the direction of the marble onto a second path. The second class they switch parts so they get turns at both activities.										
Snow shovels	This lesson comes from Kerry Tracy's *Winter STEM Challenge: Snow Scoop* video on youtube. Students use makerspace items to build a snow shovel that can remove mini marshmallows from a tray in a limited amount of time.										
Snowflake geometry	We watch the SciShow Kids video, *Where do snowflakes come from?* and then build models of snowflakes using pattern blocks.										
Snowman glyph	One year I took students outside to build snowmen using a glyph that would tell me things about them, such as 1) If you are an odd number of years old, build a snowman with 3 snowballs. If you are an even number of years old, build a snowman with 2 snowballs. 2) If you have green or blue eyes, make two eyes for your snowman. If you have brown or hazel eyes, make 3 eyes. 3) If you have pets, make a scarf for your snowman. If you don't have pets, make a hat. 4) If you have 2 or less siblings, make a snowman with 2 arms. If you have 3 or more siblings, make a snowman with 2 arms and 2 legs. 5) If you like to play in the snow, give your snowman a smiley face. If you would rather be inside, give him a frown. You really have to have ideal snow for this and we had rather dry snow the day we tried it.										

Stop Motion - names	Using the Stop Motion app on the iPads, create a Stop Motion movie in which you build your name using Legos and then have something come along and destroy your name (shark attack, explosion, horses eating it, etc. using our plastic figurines.										
Thanksgiving tables	Using Keva planks, design a Thanksgiving table that is large enough that all the printed food items (in the filing cabinet) can be laid down horizontally without overlapping each other or the edge of the table, and that is strong enough to support the weight of two cans of veggies. You can only have 3 planks that touch the table. You may not have double-decker or bunkbed style tables, and you may not have a slanted table. It needs to have a flat surface.										
The Girl Who Never Made Mistakes	Read the story, *The girl who never made mistakes* to introduce the idea that it's okay and expected to fail in STEM. Failure is the point where you recognize the weakness in what you made and use that knowledge to build better the next time. When STEM was originally created, the instructions given to the STEM teachers were to come up with projects that students would have to fail at once or twice before having success so that students learn this skill and perseverence. Then I give students a handout with 16 black circles and challenge them to use their creativity like the character in the story did to find 16 different ways to make those circles into something else by coloring them.										
Tinfoil Boats	Design a boat using a sheet of tinfoil and then test it with gemstones to see how many it can support before it sinks. Have lots of extra tinfoil squares (but not the perforated kind from Sam's Club!!) so they can test several different models. SciShow Kids has a video called *Why do ships float?* that helps explain some of the concepts.										
Turkey Traps	Read the story *How to catch a turkey* and brainstorm what we know about turkeys. Then have students use what they know about turkeys to build a humane trap for them if we had a runaway turkey in our school. Go on a museum walk to see how each person interpreted this challenge and have them explain their solution.										
What if there were no windows? Mystery Science	Mystery Science lesson about transparent, semi-transparent, and opaque materials (first grade unit). I have teachers save for me that 12" of throwaway lamination at the beginning of each project and cut these into paper-sized pieces. Students then do the extension activity of designing a flower (or whatever they want; I give them a lot of choice in this) by gluing cut-up pieces of tissue paper and making a collage that we can hang in the windows or they can take home.										
Why do leaves turn colors in the fall?	We watch the SciShow kids video, *Why do leaves turn colors in the fall?* And then we spend some time observing leaves that I collected and brought into the classroom with magnifying glasses (and microscopes if you want to). Students are then given a paper outline of a leaf and are asked to color it in as accurately as they can to match their favorite leaf on the table. We put these up on the bulletin board for a month.										
Wrecking Ball/May the 4th be with you	Students are given a baseplate and Legos and asked to build a tower at least 10" tall and a way to have the force of a ball absorbed or deflected so that their tower won't get knocked down. If I have a minifig I like to put on on top of their tower to see if he's still standing. Using the 8' ramp, I line the sides with shoebox-sized totes to keep the ball rolling straight. Students can place their baseplate in the line of the ball but angle it however they want. Three balls are rolled down: a beach ball, a nerf ball, and a basketball (each increasing in force). They have to keep rebuilding until their tower isn't damaged. However, it is okay if something they built to deflect or absorb the force is damaged (like a fence or ramp) as long as the tower itself is still standing.										
Zipline rescue	Students design conveyances using paper, staples, straw, yarn, and paperclips that can fit a stuffy and some weights. They then clip into the zipline using a caribbeaner and see how far it travels with no weights, then with three weights, and finally with six weights to see how weight affects the distance it will travel. The weights are a few ounces each and can be small stones. Students need to design their vehicles so that the weights won't fall out. The stuffies we use are small, lightweight ones about the size of a beanie baby, but without the weight (again, from Dollar Tree).										
Zoom & ReZoom	These are two books that have been pulled apart and the pages laminated. The goal is to work together as a group to put the pages of one book back in order when only the first two and last page have been labeled. Each picture zooms out slightly from the previous picture and you have to look closely to figure out the order. This is a good teamwork activity because you have to be willing to lay out all the pictures and not hold/hide them so that everyone can see everything. Otherwise it takes a long time to put the pieces together. I wouldn't use more than 4 kids in a group for this task, although older classes could go as large as half a class trying it.										

12" paper bridges	Using two sheets of paper that are 8.5x11 and some blocks for the end piers, design a 12" long bridge and test it with gemstones to see how much weight it can hold. *Elementary STEM with Ms. Crosman, 12 Inch Bridge Challenge*										
3-wheeled cars	Using K'nex, design a 3-wheeled car that, when rolled down the 8' ramp, will travel to the other side of the classroom.										
Adaptive equipment	Study how toys like Legos and K'nex have been used to design adaptive equipment for animals. Bring in several stuffed animals and have students design adaptive equipment for a dog or cat that can't use either its front or back legs.										
Apple picker engineering	*Elementary STEM with Ms. Crosman, Apple Picker STEM Engineering.* I wouldn't go higher than 3rd grade with this lesson because it may be too easy. Students design a paper tool to reach apples (crumpled balls of paper) on an adjacent desk to "pick" them.										
Balloon powered cars	Using Legos, students design a car that can be powered by a balloon. We tried this once and it wasn't great because after a few attempts, the balloon didn't have enough force to really move the car anymore. I would favor pullback motor cars over balloon powered cars.										
Cargo airplanes	Design a paper airplane that can carry cargo (coins). *Elementary STEM with Ms. Crosman, Cargo Planes.*										
Chain reactions	Mystery Science 4th grade lesson: Can you build a chain reaction machine?										
Chair lift challenge	Chair Lift Challenge at Try Engineering: https://tryengineering.org/teacher/chair-lift-challenge/ Students design a chair lift that can move a weight successfully to the top of the mountain.										
Code.org	We start digital programming at this site with a choice of three favorite activities: Flappy Bird (easiest), Dance Party, or Minecraft programming. After the first class, students can choose any activity on the Hour of Code page: https://code.org/hourofcode/overview										
Codespark/Market Bay	Codespark is popular from 1st-5th grade. Market Bay focuses on math skills and is best for 1st-3rd grade.										
Cookie mining	This activity has students focus on the costs of mining. On a budget, students decide which mining implements they wish to purchase to remove as many chocolate chips from a Chips Ahoy cookie in a limited time as they can. https://www.earthsciweek.org/classroom-activities/cookie-mining										
Costume CSI	Teachers Pay Teachers forensic science and logic activity to help figure out who stole the costume just before a school costume contest. Halloween Crime Scene Investigation by Snowdust Creations										
Country study	At PES the whole school studied a different country or region and each class made models that went along with their country using Legos.										
Disaster Island	Using The Lego Librarians lesson plan, students design an island for about 10-15 minutes. Then they draw a couple disasters from a bowl and choose one to incorporate into their design. Printable disaster sheet is available at https://legolibrarian.com/2017/03/11/lego-challenge-disaster-island/										
Does weight affect how far a car will travel?	Students design a lego car and measure how far down the hallway it will roll when released at the top of the 8' ramp. Track that number, then add weights to a the vehicle and test it again. Track that number and double the amount of weights in the previous test and test it again. Have students predict which they think will go the farthest before testing (tie into the scientific process) and then come together at the end of class to discuss what happened and if it differed from their hypothesis.										
Egg transport car	Design a Lego car that can transport a raw egg (in a ziploc!) down the ramp and across the room safely. If the egg falls out, even if it doesn't break, it is not a successful run.										
Engineering the slow fall	Consider drag and test several different leaf designs and see if you can slow down the speed of a falling construction paper leaf. *Elementary STEM with Ms. Crosman, Engineering the Slow Fall*										
Floating flowers	*Kerry Tracy, Pandemic STEM Challenge Makeover: Floating Flowers.* Students create a tissue paper flower and then use makerspace items to come up with a way that the flower can float without getting wet for a certain length of time.										
Game with no rules	An unplugged lesson at code.org, students practice computational skills by looking at a partially-played game with no rules and figure out the patterns to the way the game is played. They then fill in the blanks to create a complete set of rules and play the game they created. https://code.org/curriculum/course3/1/Teacher										
Grow a crystal	Using a borax and water solution, students grow a crystal on a pipe cleaner.										
Halloween centers											
Hess truck loader challenge	We received a dozen Hess Truck educational toys in 2017. The printable curriculum for that year can be found at https://hesstoytruck.com/stem/ if you scroll down to the 2017 truck.										
Hess truck simple machine identification	We received a dozen Hess Truck educational toys in 2017. The printable curriculum for that year can be found at https://hesstoytruck.com/stem/ if you scroll down to the 2017 truck.										
Home Alone battleplan	Class #2 List the simple machines on the board. Go over the different booby traps that Kevin set and identify which simple machines each used. Then have the students design 5 booby traps on their blueprints that use and identify at least 3 different simple machines. Add color and label like Kevin did.										
Home Alone blueprint	Class #1 students sketch a blueprint floorplan of their houses. We watch a short clip from Home Alone on youtube (Home Alone (1990) - 'Setting the Trap' scene) to see the booby traps Kevin set up as preparation for the next lesson.										
Hot Wheels lesson 1 & 2	We have a class set of Hot Wheels tracks and cars that go along with Mattel's Speedometry STEM Curriculum, available at https://smv.org/documents/216/Hot_Wheels_educator_guide.pdf										
Icy Sledding Slopes	Using Keva Planks and blocks, design a slope that will create enough energy to allow a ball to travel down the slope, over a ramp, and continue the length of the table. The ball must remain on the Keva planks track the entire length of the table.										
If I Built a House	Listen to the read-aloud on youtube and then have students build a dream home. Students work in groups of 1-4 but have each student joining a group bring along a different building material.										
Interland	This is an online internet safety/digital citizenship game in 4 parts at the Be Internet Awesome website: https://beinternetawesome.withgoogle.com/en_us/interland This site is the teacher side with supplemental lesson plans: https://beinternetawesome.withgoogle.com/en_us/educators										
Internet Safety	Digital citizenship was mostly taken over by the librarian after computer classes became STEM classes in the district, but it never hurts to talk a little when introducing new technology about the responsibilities that come along with using technology and the expectations of using devices in school. Common Sense Media has an entire curriculum on digital citizenship for K-5 students at https://www.commonsense.org/education/digital-citizenship/curriculum										
Kahoot	Great website for reviewing concepts in a gameshow-like way. You can create your own Kahoot for the students, use another teacher's Kahoot, or make a copy of another teacher's Kahoot and modify a few questions to make it more pertinent to what you're studying in class.										
Keva planks - ping pong ball challenges	Using Keva planks, design a contraption that will move the ping pong ball 12 inches using only gravity. Then design a contraption that will make the ping pong ball turn a corner. Make a third contraption that will cause the ball to bounce once and land in a cup. Then design one final contraption that will do all three things.										
Keva planks 40x6	Build the tallest tower you can using up to 40 Keva planks and measure its height. Repeat five more times, each time building a different way with the planks so that each tower looks different.										

Lego challenges	This is the go-to sub plan. There are Lego challenge cards for seasons, holidays, or just in general that can be used to make an open-ended building activity. For 3rd-5th grade I like to pick a few crazy topics they might get very engaged in, such as a zombie apocalypse, and one or two more straight-forward topics like a medieval castle.										
Lego ornaments	One year we participated in an online fundraiser. For each Lego ornament that a student built and a photo was uploaded to the site, a donation of Legos was made for a family in need. I believe it has been continued each year, but the phrase you want to search in early November for that year's challenge is "Lego Build to Give."										
Lego pompom catapults	Design a working catapult that can catapult a pompom 10 feet across the room. We typically release these all at the same time each time we run a test to make sure if any pieces go flying off the catapults by accident that everyone is behind the line and wearing goggles.										
Lego tiny houses	Construct a tiny house using a single baseplate. Make sure you have at least the basic rooms: kitchen, living room, bedroom, and bathroom. I had students calculate the area of each room as well for a little math practice.										
Let me tell you what I built	A game influenced by a student that became a class lesson. Borrow a set of cardboard testing barriers from a classroom teacher and set them up so that students sitting across from each other can't see one another's workspace. Then have partners sit across from each other and create a project using between 5 and 10 pattern blocks. When both are done with their creations, they take turns describing what they built to their partner as their partner tries to recreate the same project. When both have had a turn to hear and build the other's project, they remove the barrier and see how close they came. Repeat several times. This lesson is all about effective communication.										
Let's make squares	Using a dozen popsicle sticks, students in teams try to use all the popsicle sticks to make a specific number of squares. https://mathequalslove.net/lets-make-squares/										
Monster coding	Computational Thinking with Monsters (an unplugged coding activity at code.org). Students learn the four stages of computational thinking (decompose, patterns, abstraction, and algorithms) to then write an algorithm about a monster that another student can then sketch. https://studio.code.org/unplugged/unplug2.pdf										
My Dream Playground	Listen to the story *My Dream Playground* and then try to build a working piece of playground equipment using Legos to create a Lego playground.										
Mystery Science - Skeletons	Watch *Why do our skeletons have so many bones?* and then have students create a model of their skeletons using q-tips, glue, and black paper. This one is fun to do leading up to Halloween and then put them on display in the hallway. I leave a picture of a human skeleton up on the projector for students to reference as they're building.										
Naked egg drop	One year a parent gave me 42 identical sized boxes from a Girl Scout Cookie sale, so I had all the 3rd-5th graders design a landing surface for an egg that would prevent it from breaking. They were allowed to bring items from home or use what I had on hand in the classroom (newspaper, bubble wrap, toilet paper, scrap paper, etc.). The day we tested, the wind blew some eggs off course so it's good to have something to roll the egg down to get it to land in the right spot such as a wide PVC pipe.										
Nature scavenger hunt	Students search through the woods adjacent to the playground to complete a worksheet that asks them to sketch or list what they see that shows evidence of: animal habitats, erosion, changing seasons, decomposition, wildlife, drought, pollination, and insects who left their mark behind.										
Olympic Bobsled Trials	Students use Legos to design a bobsled that can hold all the passengers (a bottle of Elmer's glue). The top has to be partially open just like a regular bobsled and the glue can't fall out. We use foamboard placed at an angle to create the bobsled test. The bobsled has to make it to the bottom without losing the bottle of glue, flipping on its side, going backward or sideways, etc.										
Olympic Ski Jump	During the Olympics we used the Hot Wheels Speedometry sets and makerspace items to build skiers and attach them to a Hot Wheel car and launch them from the ski jump. While sticking the landing is a goal, it often isn't achieved so there were prize catgories for the longest jump that stuck the landing as well as the ones that landed on their sides or didn't even make it off the jump.										
Oobleck	Watch Science Max's *Science Max | FULL EPISODE | States Of Matter | Season 1* on youtube and then have students create oobleck samples to take home.										
Oregon Trail rafts	Have students collect small twigs from the forest and provide them with yarn to create rafts. Then have them test their rafts in buckets of water and see how many weights each can hold. What do they notice about what makes a successful raft?										
Paper bridges	Watch Mystery Science's *What Makes Bridges so Strong?* And then complete the extension activity that has students build paper bridges. Check with the 3rd grade teacher to make sure they're not doing this lesson because it's a part of their unit. If they are, show *Elementary STEM with Ms. Crosman, Paper Bridges STEM Challenge.* Same concepts without using Mystery Science.										
Paper catapult	Engineering with Paper lesson that used to be free but now I can't locate it online.										
Paper circuit valentines	There are materials to make many more paper circuits to the left of the sink. https://leftbraincraftbrain.com/light-circuit-valentines/										
Paper parachutes	Engineering with Paper lesson that used to be free but now I can't locate it online.										
Paper platform towers	Students first run tests to determine whether a paper cylinder, rectangular prism, or triangular prism supports the most weight by placing encyclopedias on it until it crushes. Then, using four sheets of paper, they use what they feel is the strongest shape to make a platform which is then tested with encyclopedias (spoiler: it can often hold the entire set of encyclopedias so we have to have a common testing area that people go to so they can use them all). There's a video lesson for this that is mainly for teachers: *Elementary STEM with Ms. Crosman, STEM Paper Bridges - Weight Test - Video Lesson Plan.*										
Peaceful gardens	Show students some clips of the video *Make Alongs // How to build a peaceful garden with Keva Planks* on the Keva Planks youtube channel. Then have them work together as a table to build a peaceful garden with each person designing two structures and then connecting their structures with pathways. The Keva Plank channel also has some other great building idea videos as well.										
Pic Collage - photo shoot	Have students go outside (natural lighting is better with iPads) and take pictures using the camera on the iPad and then import them into Pic Collage. This is useful for a project for parents around Mothers and Fathers Day, or as an end-of-year project to take home photos of their friends. Students airdrop their projects to the teacher so that they can be printed because our printers can't print things directly from the iPads.										
Pic Collage - simple machines	Show the Design Squad Global video *What are Simple Machines?* Ask the students where they've seen simple machines in the classroom and around the school. After several answers, have them take pictures of each type of simple machine they can find either in the classroom or on the playground and then import them into a Pic Collage and label the type of simple machine. It's helpful to give them a list of simple machines with a sketch of each for this lesson.										
Pinewood Derby Physics	Show Mark Rober's video *Easy Pinewood Derby Car Wins Using Science* and then have students use some of the principles in the video to design a car they think will roll the farthest down the ramp. I'd love to actually do this with pinewood derby cars some day but we lack the woodworking ability right now.										

Popsicle stick tables	This lesson is all about using the PLANNING stage of the Engineering Design Process (Ask, Imagine, Plan, Create, Test, Revise). Give pairs of students some sketch paper and have them design a popsicle stick table using tape and popsicle sticks that they think will hold the most weight. Then only give them the materials they have sketched in their plan and see if they can build it. If they omitted parts or estimated or only sketched a 2D model vs. a 3D model, they have to start over and sketch it correctly again before getting new materials. When they have built it, put a small piece of foamboard or cardboard on top of it and a plastic basket for them to add weights. When the table collapses, use the gram scale to weigh how much weight it held.									
Pullback cars	Design a car with a pullback motor that can travel the length of the classroom. All the pullback motors are at MSS so they will need to be brought over for this lesson.									
Pumpkin chariot races	Design a Lego chariot that can safely carry a pumpkin the farthest distance. I have been told that the "pumpkins" are actually gourds, but I'm not renaming the lesson. They're cute, little white pumpkins you'd put on your table for decoration at Thanksgiving.									
Rapunzel's pulley challenge	A Teachers Pay Teachers lesson called *Fairy Tale STEM (Rapunzel) Pulley Challenge*. Students use Legos to build a tower x-bricks tall and then fashion an pulley at the top so that Rapunzel doesn't have to use her hair anymore. The pulleys can be made from any of the circular technic pieces (wheel hubs, gears, etc.). Provide string and a paper cup with gemstones as the load to test the pulley's effectiveness.									
Robowheels	Design a Robowheel using the Design Squad Global video, *Robo-Wheel, Design Squad*. A robowheel is made of two paper plate bowls that are connected together at the rims to make a wheel. A loop of yarn is strung through them that can be wound up to create potential energy, then pulled and released to create kinetic energy.									
Rollercoasters (insulation)	Using foam insulation for water pipes, design roller coasters to experiment with potential and kinetic energy. Cut the foam insulation in half lengthwise and use marbles from Dollar Tree's floral section because they're smaller than regular marbles and work best for this project. Create a few challenges for the students to attempt (longest run, can you work in a loop or two, add in hills after the big drop to keep the energy higher, etc.).									
Santa's sleigh	Santa wants his crew of engineers to experiment with two different sleigh designs to determine if wheels or skis make better sleigh runners. But, the sleigh still needs to be strong, safe, and deliver the packages. Design a sleigh chassis that you can attach both wheels and skis to. Then design how the wheels and skis will attach. Conduct an experiment in which you test both to determine the best sleigh. Your design needs to be an open sleigh, not a covered one. In it should be a small plastic figurine to represent Santa and four 2x2 bricks to represent the gifts which are loose and not connected to the sleigh. First, send each down the ramp onto the tiled floor in the hallway and measure how far each travels. Then push each sleigh design into a wall from a 2' distance. Next push the sleigh from one end of the room to the other and count how many pushes are required. During each test, track how many gifts are lost overboard, how many times Santa falls out, and if the sleigh breaks. Then write up your final conclusion and recommendation for Santa about which sleigh works best and why. This lesson is based on the activity on this website: https://leftbraincraftbrain.com/lego-santa-sleigh-stem-building-challenge/									
Saving Sam	Sam, a gummy worm, is stuck on a boat. He can't swim and the boat is capsized. To get to shore, Sam needs to retrieve a life jacket (a lifesaver gummy) from underneath the boat so that he can float to shore. You and your partner's job is to save Sam by retrieving the life jacket from under the boat and putting it on Sam. Unfortunately, the only tools you can use to accomplish this task are paperclips. (2 per person). You cannot touch Sam, the boat, or the life preserver with your bare hands. And you cannot poke either the life jacket or Sam with the paper clip. Get the lifejacket back on Sam, flip the lifeboat over, and get Sam back into the boat without touching anything but the paperclips. https://www.biologycorner.com/worksheets/saving_sam.html									
Ship a Chip	Students engineer the lightest possible package that will safely ship a chip without it cracking. Because postage is expensive, we ship our chips through interoffice mail to another STEM class in the district after dropping the package from arm's length to a hard floor surface 5 times to mimic actually jostling during shipping. There are some rules about what you can use for packaging materials, maximum size, and it's good to set a weight limit as well because the heavier the package, the more it would cost to ship. https://tryengineering.org/teacher/ship-chip/									
Sir Charlie - Island Hut Challenge	Sir Charlie has been shipwrecked on a deserted island! Last night he got no sleep because of high winds and lots of bugs, so he needs to build a shelter. Working in teams of two, design a shelter whose floor is no larger than 36 square inches, that is at least 5" tall, that has a working door, and that can withstand 10 seconds of the fan on high. From the lesson: https://tryengineering.org/teacher/desert-island-survival/									
Sketch blueprints of the school	The last week of school I have 5th graders sketch their idea of what the blueprints are for the school since they've been here for as many as 7 years. Partway through this activity I tell them how many rooms are in the building (including closets, bathrooms, etc.) to get them to dig a little deeper and consider more. It's okay if they talk to one another to brainstorm and share what they're missing. When done, I post what the actual blueprints look like (the fire escape plan or a hand-drawn version) and we see how close they came. Early finishers can include the outdoor play areas, parking lots, etc. Use larger paper like ledger or legal paper to give them more room and have extra sheets if they need to attach them.									
Snap circuits	Students in grades 1 & 2 have tried challenges #1, #2, and #3 in the manual, so they should have some experience with building circuits. I allow any student who has completed the first three challenges to try any challenge they want - except the one on the cover of the manual. That one isn't a working circuit.									
Snow shovels	Working in pairs, students build a snow shovel to scoop as many mini-marshmallows as they can in 3 scoops. This lesson is based on Kerry Tracy's video, *Winter STEM Challenge: Snow Scoop*. I modified it to have the snow be mini marshmallows that I leave out to go stale for a day or two and discourage students from eating them by letting them know we've been using them for several days and they've been all over the floor. Have a spare, unopened bag on hand so kids can have 5 or 10 after they've picked up if you want.									
Snowman Stretch	Using a limited amount of paper and tape, build the tallest snowman you can. Bonus points if it's free-standing. This lesson is based on Kerry Tracy's video, *Snowman Stretch*.									
Solo cup challenges	Teamwork building activity in which a group of students tries to create a pyramid of solo cups using just string and a single rubber band to move the cups. This site explains the rules, but I have also found variations of this lesson where there are 6 different challenges. https://www.mostnetwork.org/wp-content/uploads/01_Activity_Cup-Stacking.pdf									
Space landers	After watching a video about the Mars Rover Landing, students design a way to slow down something dropped from their arm's length while standing on a chair. To test their drag, a mini paper cup with two pompoms in it are attached to their space lander. This paper cup cannot be covered, nor can the aliens be taped or tied down. With a successful landing, the pompoms don't bounce out of the cup. https://www.vivifystem.com/blog/2015/1/14/touchdown-lander									

Stomp Rockets	We used PVC pipes and soda bottles to launch paper rockets we make in class and see which of three elbow angles sends the rocket the farthest. You'll want to have lots of 2-liter soda bottles to launch the rockets because they break easily. Also, to repump the soda bottles between trials, use a couple bike pumps with the needle and a few caps to the bottles with holes drilled in the top so that the needle can just barely go through it. We also discovered that a lot of air escaped through the legs of the PVC pipes even when they were pressed against the ground, so we taped these over. Another year I would suggest buying some more PVC caps. This is the video for assembling the PVC rockets: *Elementary STEM with Ms. Crosman, Adjustable PVC Rocket Launcher.*										
Stop Motion - choice	The third Stop Motion activity is for students to create their own Stop Motion video using the Stop Motion app on the iPads on any engineering activity they wish to record. Their video should tell a story, not just show the building of something.										
Stop Motion - I got a chicken for my birthday	The second Stop Motion activity we do is to listen to the read-aloud, *I got a chicken for my birthday* and then design a roller coaster using Keva Planks. Before class I printed out copies of rollercoasters on cardstock and stuck their school pictures to them using spare pictures the secretary has from the fall photo shoot. Or you can take pictures of students acting like they're on a rollercoaster and print those out and attach them. The story is about a girl who asks her grandmother for tickets to an amusement park for her birthday. Instead her grandmother gifts her a chicken. As the story progresses, you realize that the chicken is an engineer who can build anything she wants, so she gets a rollercoaster. Students create a stop motion video of their rollercoaster car going through a rollercoaster they built.										
Stop Motion - name	The first Stop Motion lesson we do is a video of each student's name. Using Legos, they slowly build their name piece by piece and then have to destroy their name somehow. Many students enjoy taking some figurines out of the bin and have a shark come eat all the pieces or a horse move them around so they can't be recognized as a name anymore. Others have an explosion come in and move all the pieces.										
Straw tables	This lesson is all about using the PLANNING stage of the Engineering Design Process (Ask, Imagine, Plan, Create, Test, Revise). Give pairs of students some sketch paper and have them design a straw table using tape and straws that they think will hold the most weight. Then only give them the materials they have sketched in their plan and see if they can build it. If they omitted parts or estimated or only sketched a 2D model vs. a 3D model, they have to start over and sketch it correctly again before getting new materials. When they have built it, put a small piece of foamboard or cardboard on top of it and a plastic basket for them to add weights. When the table collapses, use the gram scale to weigh how much weight it held.										
Support a brick with 10 3x5 cards	Give students 10 3x5 cards and either tape or staples and challenge them to build something that will support a brick at least 6" off the table surface. The solution is two triangles on their sides, stacked on top of one another, but it will take them a while to get there. Replace cards as ones get damaged, but no structure can use more than 10 cards total. Once students figure this out, challenge them to build the tallest tower they can that can support a brick. Have them build on the floor so that falling bricks don't hurt anyone or damage the table.										
Thanksgiving tables	Using Keva Planks, students design a Thanksgiving table that is large enough to fit the 5 printed copies of food (in the filing cabinet), strong enough to support two cans of food, and has only 1 plank that touches the table. They may want to study cantilevers if they get stuck on this one. Food must lie flat on the table and not overlap each other or the edges of the table. The table must look like a traditional table (no bunkbed tables, two-level tables, or slanted tables allowed).										
Unplugged code.org	Learn computational thinking skills through many different lessons: https://code.org/curriculum/unplugged										
Who borrowed my iPad?	A forensic science unit to discover the identity of the teacher who borrowed an iPad from my desk, left an unsigned note saying they'd bring it back, and then forgot to do so. Students work in teams to analyze fingerprints, hair samples, conduct a black marker chromatography experiment, use math to uncover the height of the suspect based on their footprint length, and analyze shoe prints and handwriting samples to determine who likely has the iPad. To discourage listening in on other, the hair samples are adjustable to have two possible solutions among different groups.										
Wind-powered sailboats	Using styrofoam plates and makerspace items, students design a wind-powered sailboat that can move the farthest using just the power of a box fan.										
Ziplines	A sneaky elf has become stuck on top of the tall cabinet and needs help getting down. Using boxes, paper, and other items from makerspace, help the elf travel safely down to the floor. You can make this activity tricky by using cheap yarn for the zipline because it has a lot of friction, adjusting the angle of the yarn to make it harder, and using a very lightweight elf (Dollar Tree often has lightweight elves in December). Students usually end up having to really work at reducing the amount of friction and increasing the weight of their vehicle for the elf. This can also be done using Legos if you want to save makerspace items.										