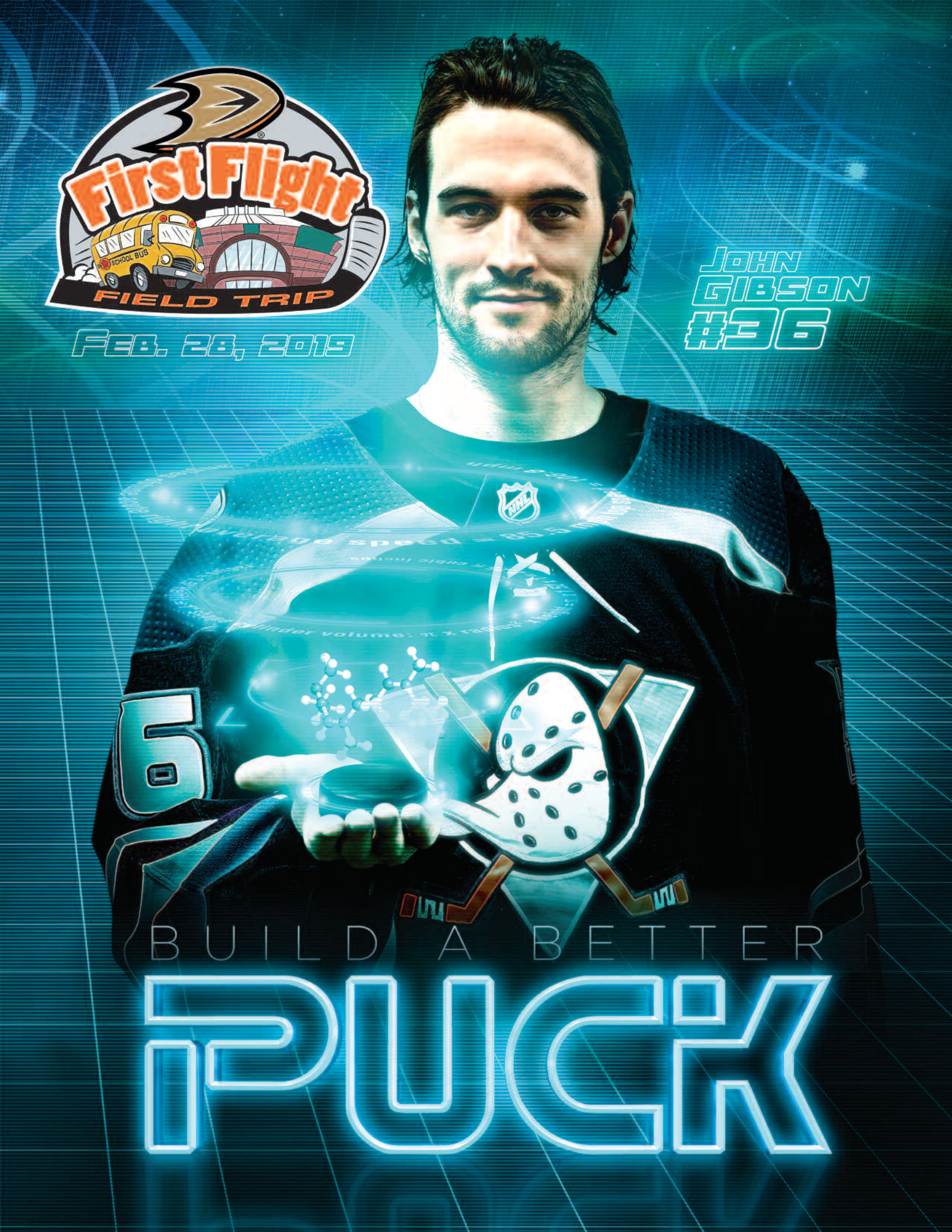
First Flight
SCHOOL BUS
FIELD TRIP
Feb. 28, 2019
John Gibson #36
BUILD A BETTER
PUCK

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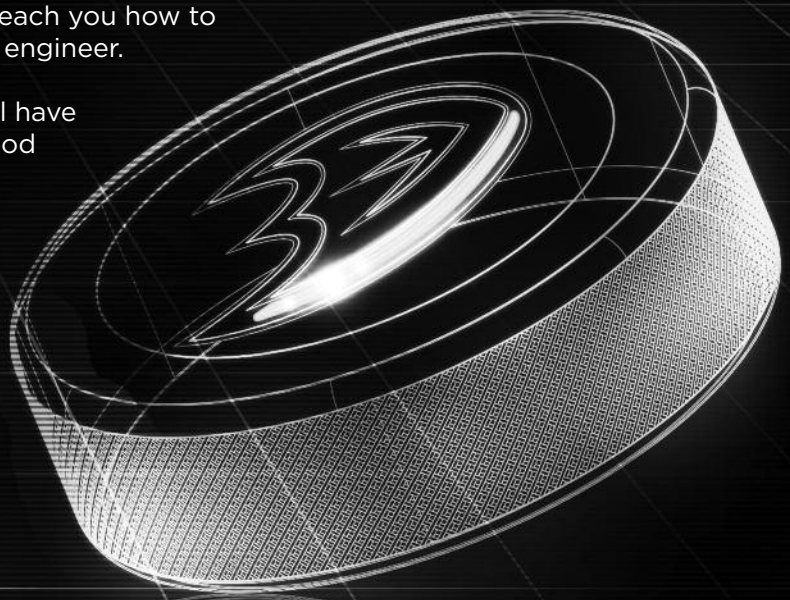
BUILD A BETTER PUCK

THE GAME OF HOCKEY IS INCREDIBLE!
Like most things though, it is much different than what was originally imagined by its creators. The game is so much faster, more physical, and more skilled than its earlier eras. A big reason why is thanks to technology. From the protective equipment we wear, the sticks we hold, and the way we care for our bodies, technology has impacted almost every part of the game and the people who play it. However, there is one very important object that has almost entirely remained unchanged.
THAT'S RIGHT...THE PUCK!

For such a small piece of the game, it sure does command a lot of attention. Players and fans alike follow its every movement. A rubber disc with a little paint can make crowds cheer or players wince in pain. Sounds like something we should learn a little more about...don't you think? As someone who's very familiar with the puck, I want you to come along with me as we learn more about it. Let's discover its history, learn how and why it was made, and, most importantly, how we can improve it!

Imagine a puck that can keep up with speedy players like Rickard Rakell, let us know when it crosses the goal line with some assistance from a Ryan Getzlaf slapshot, or help your favorite goaltender save it more easily. Not sure how to make it better? Don't worry, we've got you covered. The information in this workbook will teach you how to think, design, and build like an engineer...a puck engineer.

By the time you reach the end of the book you'll have what it takes to "Build A Better Puck". That's good because we're going to ask you to do just that. Those of you up to the task might even see your new and improved puck featured on ice at Honda Center on **February 28th** for the First Flight Field Trip. Asks lots of questions, read, take notes, watch some hockey, and have some fun.

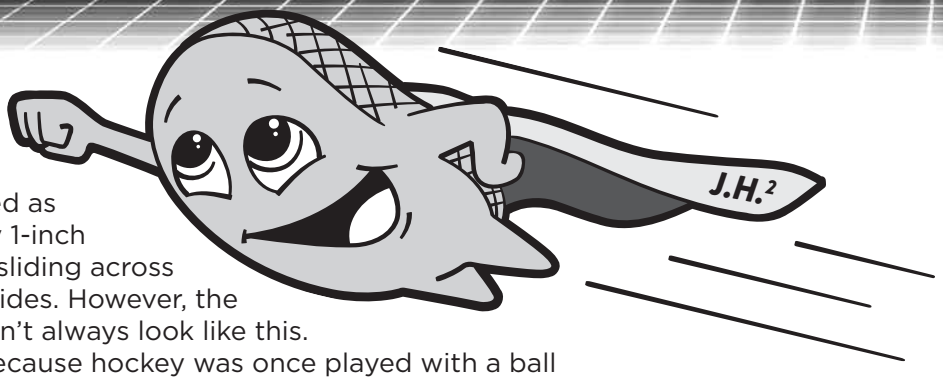


READY TO GET STARTED? WE ARE TOO! LET'S "BUILD A BETTER PUCK"!

A PUCK-STORY

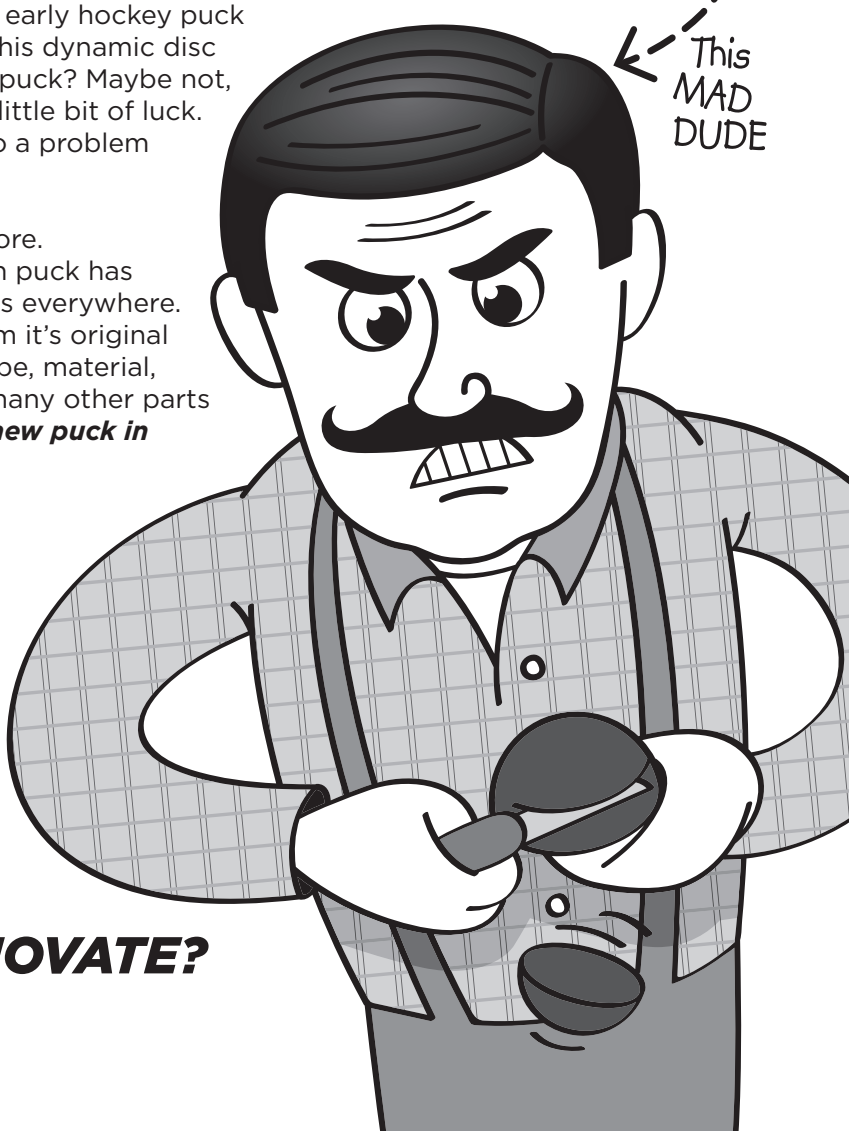
A DYNAMIC DISC

There are few objects in all of sports that are as dynamic and oddly shaped as the hockey puck. This 3-inch wide by 1-inch thick object spends most of its time sliding across an ice surface on one of its two flat sides. However, the puck didn't always look like this.

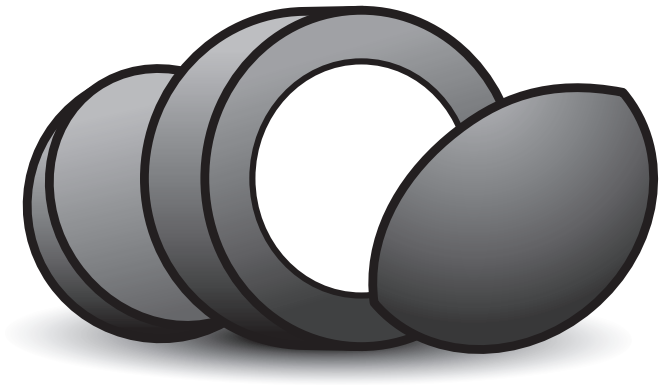


That's because hockey was once played with a ball back in the early 1800's when the game was first introduced to the world. By the mid-1800's, small slabs of stone, pieces of wood and leather, a rubber ball, and even cow droppings were used. So, how did the puck finally slide into the game? It took an angry Canadian rink owner, bad bounces, and some broken glass to make hockey history.

In 1875, the owner of the newly built indoor Victoria Skating Rink in Montreal, Canada was fed up with the rubber bouncing ball causing hundreds of dollars in broken windows at his beautiful facility. Taking matters into his own hands, he grabbed the rubber hockey ball during a game, took out his pocket knife, and sliced the ball into three sections. Genius or dumb luck? Either way, no more windows were shattered that day and the concept for the early hockey puck was born. Did this raging rink owner know that this dynamic disc would be the inspiration for the modern hockey puck? Maybe not, but inventors like Thomas Edison also needed a little bit of luck. This new puck changed hockey forever thanks to a problem and someone who tried to solve it.



Pucks aren't made by cutting rubber balls anymore. Manufacturing has come a long way so that each puck has the same quality and durability for hockey games everywhere. That said, today's puck isn't too far removed from it's original form. They have remained roughly the same shape, material, size, weight, texture, and color even though so many other parts of the game have changed. ***Is there room for a new puck in hockey? Let's find out!***

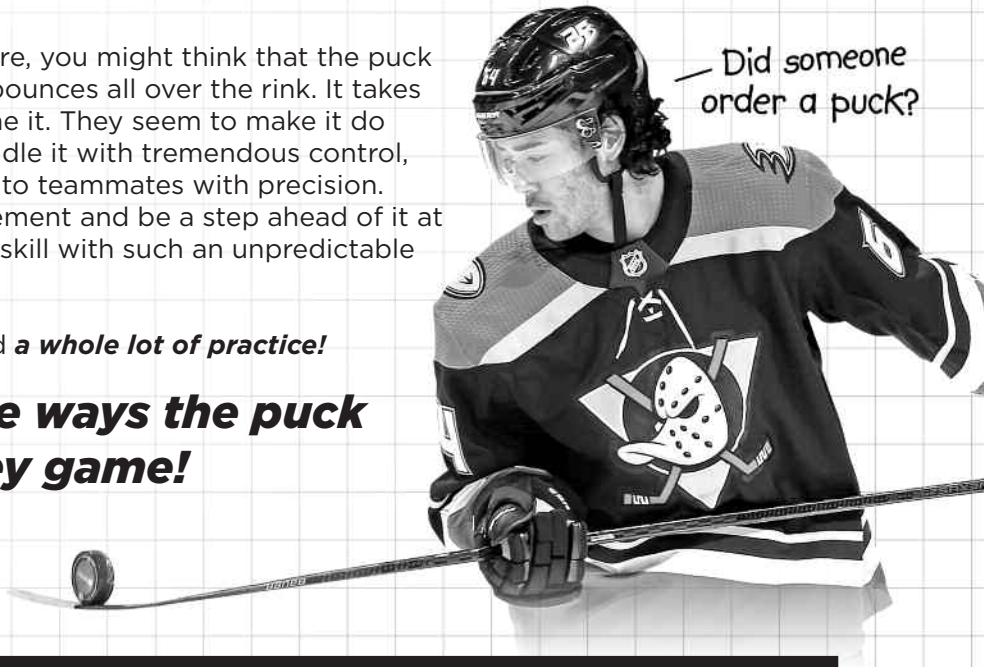


ARE YOU READY TO INNOVATE?

A PUCK-STORY

There are many things that separate the sport of hockey from other games. You play it on a large sheet of ice in the center of the arena for one thing. And, you move around on that ice by essentially standing on boots strapped with knives to the bottom of them. Weird! So, when it comes to the puck, you might ask, "What's so special about that?".

Well, if you've never seen hockey before, you might think that the puck has a mind of its own as it slides and bounces all over the rink. It takes players like the Anaheim Ducks to tame it. They seem to make it do anything they want. They can stickhandle it with tremendous control, shoot it at blazing speeds, and pass it to teammates with precision. Plus, they can predict the puck's movement and be a step ahead of it at all times. How do players exhibit such skill with such an unpredictable object? Is it magic?



Not really. They use math, science, and ***a whole lot of practice!***

Let's explore the three ways the puck moves during a hockey game!

BUT FIRST...

NEVER WATCHED HOCKEY BEFORE? NOT TO WORRY!
Watch this clip of the puck (and Ducks) in action on your smartphone or tablet! With an adults help, follow these instructions.

1. Access your phone or tablet app store
2. Search and download a free mobile bar code scanner
3. Open the scanner
4. Aim your phone at the bar code so that it's in the middle of the screen
5. Watch what happens!

DUCKS

WHAT'S A QR CODE?

A ***quick response (QR)*** code uses a picture to hold information that's usually represented by letters and numbers. It's much easier to scan a code with a smartphone or tablet than it is to type a website address or a bunch of numbers. Using a QR code is like using a secret code! You can make your own code by going to **qrstuff.com**.

No smartphone or tablet? No problem!
Enter **bit.ly/2019FFFTresources** into a computer browser to access all First Flight Field Trip multimedia.

TRY IT TODAY!

THINK LIKE AN ENGINEER

The puck is essential for the game of hockey. In order to think like an engineer you'll also need some equipment.

JOURNAL

Engineers use journals or notebooks to record their ideas, collected data and calculations to read them again later. Each time you see this icon, write down some notes or any observations about the puck in your journal. If you like to draw, sketching plans and diagrams is encouraged.

PENCIL & ERASER

Engineers and scientists like to take notes that are very neat. That's why they use pencils and erasers for the best results. It's important to keep your ideas or notes, no matter how wild and crazy they are. Erase mistakes, not ideas!

DON'T HAVE A JOURNAL?
Scan the QR CODE and find the PROJECTS link to learn how to make one.

JOURNAL

CHOO CHOO???

What do you think of when you hear the word engineer? If you thought of science and not the person who drives a train you're on the right track. The men and women who design, create, and build many of the things that help us each day is the best way to think of it. That chair you're sitting on? It was created by an engineer. Like to play video games? An engineer did that. The car or bus that took you to school? Yes, that car and the roads we drive on are here thanks to engineers. Simply put, engineers are expert problem solvers. That's a good thing because there are a few puzzles we've yet to figure out!

COACHES CHALLENGE

There are many types of engineers. Match the objects in the box to the engineer who mostly likely worked on it. Use other resources (internet search, books, dictionary, etc.) on this topic to help you complete the activity. Can you think of other things these types of engineers might design? Write down additional objects for each engineer in your journal.

- Electrical Engineer
- Mechanical Engineer
- Civil Engineer
- Chemical Engineer
- Aerospace Engineer
- Software Engineer
- Structural Engineer

THINK LIKE AN ENGINEER

ENGINEERING DESIGN PROCESS

The engineering design process is another tool engineers use to accomplish their tasks and improve upon the things they use daily. Read about the design process below and fill in the stack of pucks to the best of your ability. Come back to this page anytime you need some guidance, especially when you take on the **"Build A Better Puck Challenge"**.

1
Ask a Question

Thinking big always starts with a big question. **What problem do you want to solve or what object do you want to build and improve upon?**

2
Gather Information

You don't need to memorize every fact or formula. Instead, what's important is how you research and use the information that's out there. **Where are you going to look?**

3
Brainstorm & Plan

Work alone or with a large group to create a list of ideas and supplies you'll need to answer the question. **What ideas do you have in your head?**

4
Build, Test, & Redesign

Make your best ideas and solutions come to life! Create a model and see if it accomplishes the task that you set out to do. If it doesn't, don't worry, even the best engineers have to go back to the drawing board. **How will you build, test, and improve your design?**

5
Share!

Don't keep that design a secret! Imagine a world where no one shared their ideas. There wouldn't be life-saving medical equipment or spacecraft to explore the universe. **How will you share your work with others?**

Share your "Build A Better Puck" photos, videos, and designs on social media using **#ducksfirstflight** or upload them to **bit.ly/2019FFFTresources**. We can't wait to see your projects and share them throughout the event on **February 28!**

ON THE MOVE

MOVEMENT ONE: STICKHANDLING

Moving the puck with a hockey stick is called **stickhandling**. Players use this skill to keep control of it. It's done by "cradling" the puck continuously from a stick blade's forehand to its backhand. National Hockey League players are so good at stickhandling the puck they can do it while skating at fast speeds, during a sharp turn, or when stopping on a dime. You're in for a treat any time a player "dangles" the puck to get around an opponent.

COACHES CHALLENGE

If you don't have a hockey stick and puck, you can replicate stickhandling moves using an object with a flat side and your hand. Let's try it!

STEP 1 Cup your right hand like the diagram to the right. Hockey players use a curved stick blade to help them control the "puck" better.

STEP 2 Place your hand and object on a table. Position the "puck" so that it sits inside the cup of your hand.

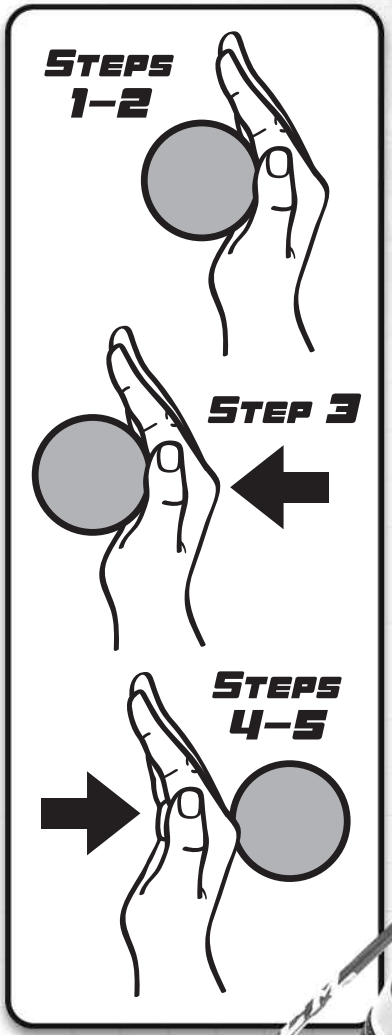
STEP 3 Now slide the "puck" forward *(to the left)* with your hand.

STEP 4 Lift your hand and position the back of your hand so that it's touching the "puck".

STEP 5 Slide the "puck" towards the opposite direction *(to the right)*.

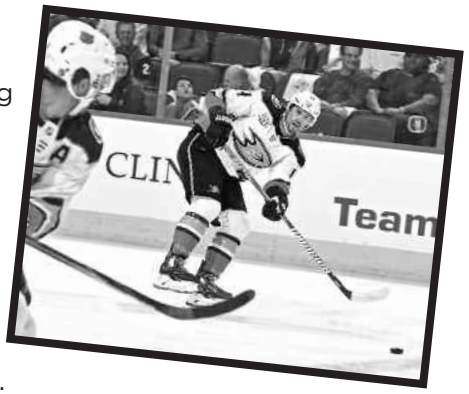
STEP 6 Repeat steps 3-6 until you get the hang of it. Increase your speed until you can do it without looking down at your hand.

NOW YOU'RE STICKHANDLING!



STICKHANDLING

MOVEMENT TWO: PASSING

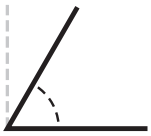


Passing is one of the most important skills in hockey. The Ducks can make sliding the puck to a teammate a work of art. A direct pass, moving in a straight line, is the quickest way to get the puck to another player... but it's also the easiest for an opponent to steal. That's why hockey players rely on math to get the job done right.

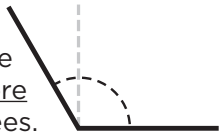
Players use their knowledge of angles and a little help from the boards that surround the ice to make passes around opponents. So what's an **angle**? It's the amount of space at the spot where two lines meet. Angles are everywhere and can be used to form shapes. You can make all sorts of shapes using three types of angles – **acute**, **obtuse**, and **right**.

A **right** angle is <u>exactly</u> 90 degrees.

An **acute** angle measures <u>less than</u> 90 degrees.



An **obtuse** angle measures <u>more than</u> 90 degrees.



IN SHAPE

Find and label the angles (acute, obtuse, or right) in each shape. Then, write down the number of angles needed to make it.

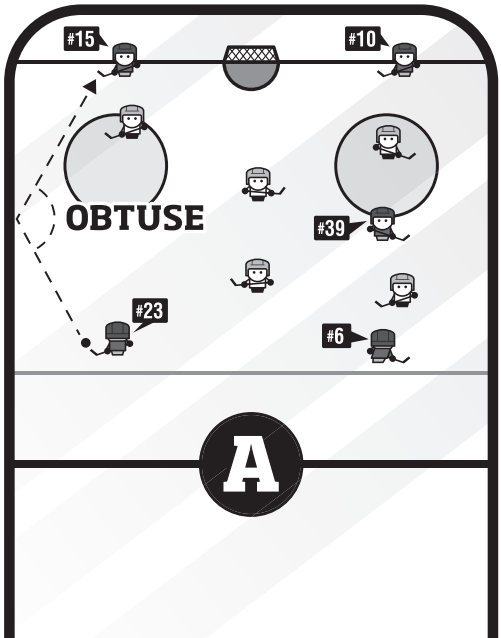
Shape ➡	*Square*	*Triangle*	*Octagon*
Number of Angles ➡	_____	_____	_____

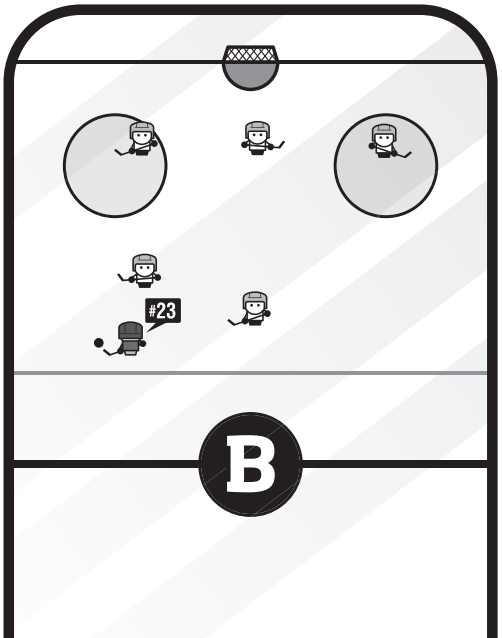
COACHES CHALLENGE

Now it's your turn to help the Ducks pass the puck! In Picture A, make a pass by drawing lines to teammates and labeling the angles you use. For Picture B, you'll need to place the Ducks in the right spot before making the pass. Here's the challenge. Use all three angles!

LEGEND

- **Pass** – – – ▶
- **Puck** ●
- **Ducks**
- **Opponent**
- **Goal**





MOVEMENT THREE: SHOOTING

Hockey is one of the fastest sports in the world, thanks to the puck! There are many ways to shoot the puck but the hardest type of shot is called a **slapshot**. It gets its nickname because of the "slap" that's heard during this shot. After the stick blade makes full contact with the puck's edge, it's sent towards the goalie at rocket-like speeds. The fastest slapshot ever recorded travelled 108.8 miles per hour (or 160 feet per second). A shot like this doesn't give the goalie much time to react. So, how fast do goalies need to be? **We can find out by using a little more math!**

STEP 1

GET THE FACTS

Formula: d = r x t

Distance [d] = 80 feet

Rate [r] = 160 feet/second

Time [t] = ???

STEP 2

SUBSTITUTE

Place the values into the equation:

d = r x t

80 feet = 160 feet/second x t

STEP 3

DIVIDE!*

80 feet = 160 feet/second x t

÷

Time [t] = 0.5 seconds

*If you don't know how to do this by hand, think about what tool you could use to help you.

Because **t = 0.5** seconds, Ducks goalie John Gibson knows he has half a second to get his glove or blocker ready to stop the puck from a slapshot taken 80 feet away from him.

COACHES CHALLENGE

Complete the chart below. You'll need to first circle the correct function (+,-, x, or ÷) that will help you find the time [t] Gibson has to stop a slapshot traveling at an NHL average of 85 miles per hour (or 125 feet per second).

Distance [d] From the goal	Function (Circle one)	Rate [r] Speed of puck		Time [t] To reach Gibson
5 feet	+ - x ÷	125 feet/second	=	0.□□ Seconds
25 feet		125 feet/second		0.□□ Seconds
50 feet		125 feet/second		0.□□ Seconds
75 feet		125 feet/second		0.□□ Seconds

SHOOTING

THE THIRD DIMENSION

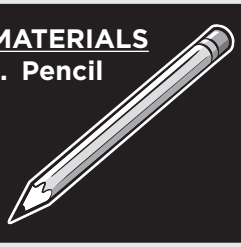
Designing objects like a puck requires looking at things differently. A puck in a photo and one in front of you might look identical, but they're off by a **dimension**. It should be a familiar word because it's often used at the movie theater. So, what's the difference between two-dimensions (2D) and three-dimensions (3D) besides the extra "D" and a pair of weird glasses?

COACHES CHALLENGE

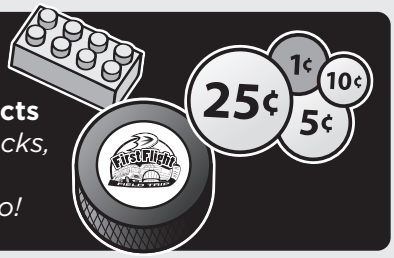
Find the difference between a 2D and 3D object.

MATERIALS

1. **Pencil**



2. **Small and simple objects** *Building blocks, coins, and pucks will do!*



STEP 1 Place your item on the space marked A. Make sure this workbook is on a flat surface like a table or floor.

STEP 2 Trace the object with your pencil and remove it once you're done.

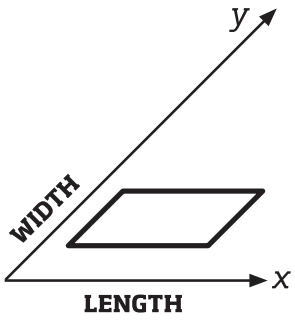
STEP 3 Place your item on the space marked B.

A

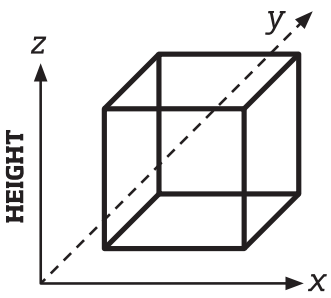
Question: What shape does it resemble the most? Choose between a circle, triangle, square, rectangle, or other shapes you know.

B

Question: What's the difference between the traced object and the one above? This is the extra dimension! *(**HINT:** Think tall!)*



A **dimension (D)** is a way to describe an object. A shape like a square is in 2D because its two parts, **length** and **width**, can be drawn on two axis. If you've ever drawn a chart or graph before, you probably used a coordinate system made up of an **x-axis** and **y-axis**. Objects in 3D have 2D parts, but they also have a third dimension called **height**. It's represented by a **z-axis**. This is the thing that turns flat shapes into actual objects like a cube!



THE THIRD DIMENSION

Did you know that building a puck and building a hockey team like the Anaheim Ducks are similar tasks? It's because a hockey team with three dimensions is important for a complete team. Instead of **length**, **width**, and **height**, Ducks General Manager Bob Murray builds his team with three positions called **forwards**, **defense**, and **goalies**.

The Three Dimensions of a Hockey Team

Forwards

Their main focus is to score the puck.

*Roster as of 1/14/19

THE THIRD DIMENSION

Defensemen

Their main job is to keep the other team from scoring by playing defense.

42 Josh Manson

Goalies

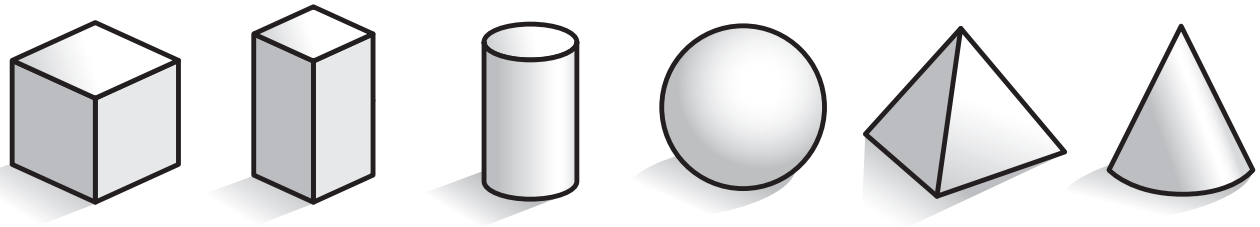
The goalie's main objective is to keep the puck out of the net.

36 John Gibson

THE THIRD DIMENSION

Two-dimensional and three-dimensional shapes are important because they're all around us. These shapes can be found in nature, food, and even in hockey. All objects are made of shapes. They can be simple objects made of a single shape or a complicated one, made up of many, put together. ***What would happen if the things we use every day were shaped differently?*** Would macaroni pasta be tastier as a pyramid or would the ride to school be smoother if tires were cubes?

Changing a puck's shape also changes the way it moves during a hockey game. In order to design a better puck, it's going to take the basic knowledge of 3D shapes to make the right changes!

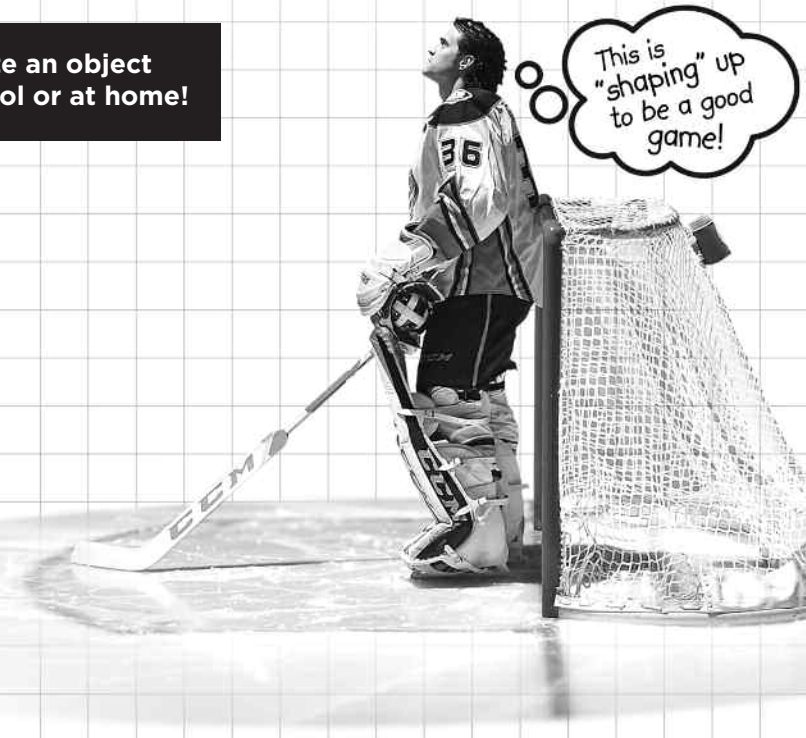


CUBE **CUBOID** **CYLINDER** **SPHERE** **PYRAMID** **CONE**

What everyday objects are made of these shapes? Write down some examples of items found around your home or at school.

Pucks are flat, solid, and circular. What kind of shape do you think it is? Circle the shape above that looks similar to a hockey puck.

Combine shapes to create an object you've seen around school or at home!



THE THIRD DIMENSION

COACHES CHALLENGE

It's time to put these 3D shapes to the test! How will the puck change the game if it were shaped like the ones on page 12? **Stickhandle**, **pass**, and **shoot** your way to the answer.

MATERIALS

1. **Collect objects that resemble each of the shapes on page 12**
2. **Your hand**
3. **Masking tape** *(colored tape is best!)*
4. **A book or a wall**

SHAPES

Stickhandling

Use the stickhandling activity found on page 6.

1. Which shapes were easy to stickhandle? How did their shape help you?

2. Which shapes were difficult to stickhandle? Why did their shape make it more difficult?

Passing

How will these shapes affect passing?

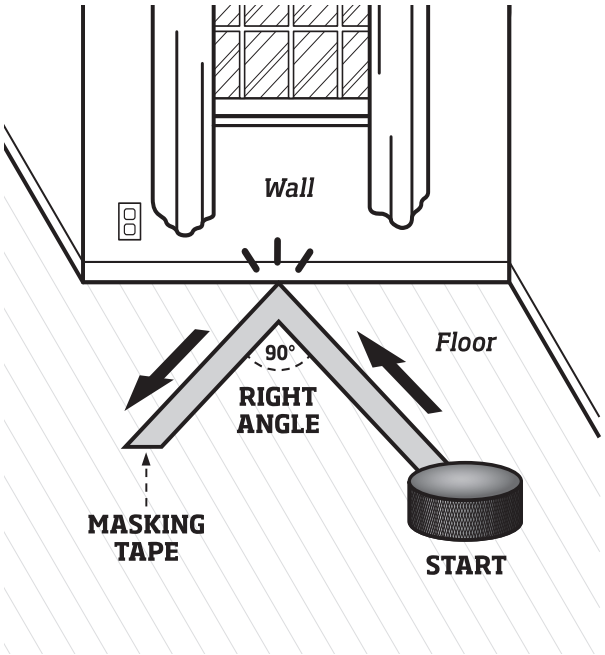
STEP 1 Place some tape on the floor to form a right angle like the picture to the right.

STEP 2 Take your first object and place it at the starting point.

STEP 3 Slide your puck into a book or wall so that it follows the path of the tape.

STEP 4 Did the shape follow the path? Record the results in your journal.

STEP 5 Repeat steps 2-4 for the other shapes.



1. Which shapes allowed you to pass the puck accurately? Why do you think they passed the test?

2. Which shapes didn't pass the test? Why did they fail?

Shooting

What would happen if Ducks forward Ryan Kesler took a slapshot with pucks of these shapes? Remember, in order to shoot the puck at rocket like speeds, the curved stick blade must make full contact with it!

RUBBER PUCKY

Materials matter. So what are they, exactly? They're the stuff that all things are made from. **Materials** can be hard, soft, or anything in between. It can be natural like wood or, man-made, like plastics. Designing objects isn't just about getting the size and shape right. You have to choose the right material. Building a car out of pillows might seem like a great idea to keep everyone comfortable. But what happens when it rains? Materials are important. Especially for a puck!

Hockey pucks are made with vulcanized rubber. It's a special type of rubber that's durable enough to withstand the hardest of slapshots from NHL players like Ducks defensemen Cam Fowler. But what would happen to the puck if it was made from something else? Are there materials that will help a puck's movement? Are there ones that will hurt it? Let's investigate the properties of different materials to find out!

MATERIALS

COACHES CHALLENGE

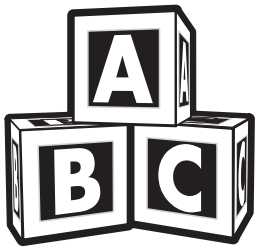
Put the following materials through a rigorous test. You're going to drop, bend, dunk, and squeeze your way through this activity. Use your journal and the chart on page 15 to record all the interesting things you see!

STEP 1

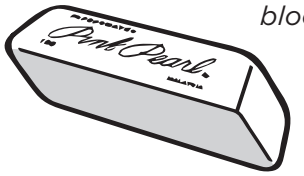
Gather Materials
You'll need to find objects made from the following materials:

Vulcanized Rubber
(hockey puck, sneaker soles, or tires)*

On second thought, no tires!

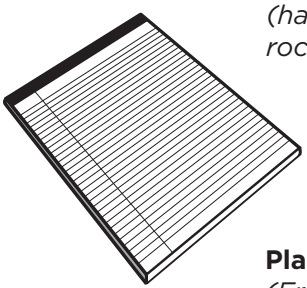


Wood
(pencil, alphabet block, etc.)

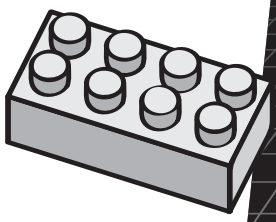


Soft Rubber
(racquet ball, eraser, etc.)

Sugar
(hard candy, rock candy, etc.)



Paper
(cardboard, drink coaster, etc.)



Plastic
(Frisbee, building block, etc.)

Bowl of Water

PROPERTIES OF MATERIALS

QUESTIONS TO ASK YOURSELF:

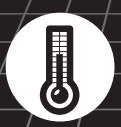
DURABLE
Will it break?
Try doing a drop test.

HARDNESS
Will it keep its shape?
Try to dent it.

ELASTIC
Will it return to form?
Bend, stretch, and bounce your object.

WATERPROOF
Will it stay dry?
Dunk it in water.

WEIGHT
Is it heavy? *Compare its weight with others.*



TEMPERATURE
Will it change when hot or cold? *Leave it out in the sun and in the freezer.*

STEP 2 Investigate the Materials

Test the properties of the materials and write down your observations in the chart.

	Durable	Hard	Elastic	Waterproof	Weight	Temperature	Your Choice!
Vulcanized Rubber							
Wood							
Soft Rubber							
Sugar							
Paper							
Plastic							
Your Choice!							

STEP 3 Add a Material and a Material Property

Great job! Now, it's your turn to add a new material and property to test. Use the blank spaces on the chart to experiment with your choices.

REFLECTION

What would happen if we played hockey with the materials from your investigation? How would it affect:

Stickhandling *(**HINT:** Do the activity from page 6 with objects made from different materials.)*

Passing *(**HINT:** Do the activity from page 13 with objects made from different materials.)*

Shooting *(**HINT:** How will these different materials affect speed?)*

Based on your investigation, which materials would make the best hockey puck?

THE PUCK STOPS HERE

The Ducks face a resisting force every time they take the ice. Opponents play defense throughout the game to keep the Ducks from scoring at will. For objects, **friction** is a resisting force as well. It occurs when two objects are in contact with each other. Sometimes, the push back from friction can be helpful. It can keep car tires from slipping on a wet road and allows us to grip a smartphone as we flick angry birds at their targets. Most of the time, friction isn't welcome, especially when you need objects to move with speed. Friction affects us all in different ways so you'll need to know how it works when building your puck.

Texture and pressure are two things that affect the amount of friction between two objects. **Texture** is the feel of a surface. It can be rough, smooth, hairy, bumpy, and even sticky. How does texture change friction? It's time to test the texture of different surfaces to find out!

COACHES CHALLENGE

Measure the friction from different surfaces.

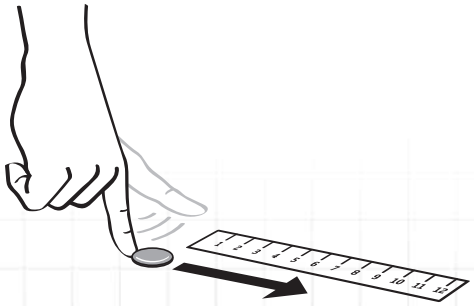
MATERIALS

1. **Any small flat object**
2. **Smooth surface** *(A table top)*
3. **Rough surface** *(Carpet)*
4. **A one-foot ruler**

STEP 1 Set the ruler on the smooth surface like the diagram to the right.

STEP 2 Place your object at the start of the ruler and with your finger, flick the object away from you. Record your distance in the chart and circle the number that best describes the friction you saw. (0 – no friction; 10 – lots of friction)

STEP 3 Now, repeat steps 1 and 2 on the rough surface. Be sure to flick the object with the same force!



Trial	Surface	Distance	Friction
Smooth			0 1 2 3 4 5 6 7 8 9 10
Rough			0 1 2 3 4 5 6 7 8 9 10

Questions:

1. According to your results, which surface had more friction force?

_____

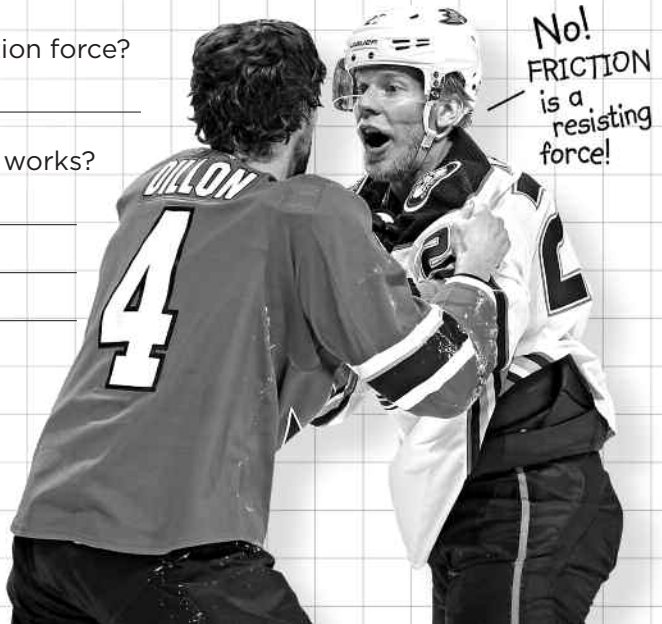
2. What does this tell you about how texture and friction works?

_____

_____

_____

Pressure is not just the feeling you get from taking a test. It's also what you get when you push two objects together. You can change friction by changing pressure. We've got a simple activity on the next page to show you how this works!



COACHES CHALLENGE

Pay attention to friction each time you add pressure or weight to the objects.

MATERIALS

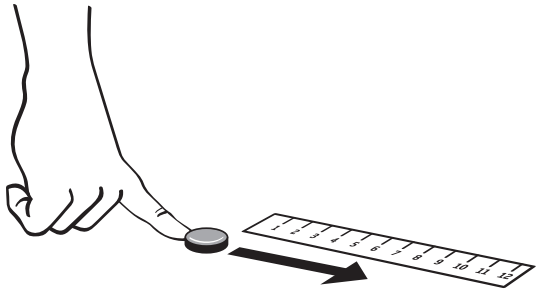
1. **Three identical flat objects** *(books, coins, building blocks, etc.)*
2. **Any surface**
3. **A one-foot ruler**

STEP 1 Set the ruler on your surface like the diagram to the right.

STEP 2 Place your item near the start of the ruler. Push the object with your finger and stop when you reach the end of the ruler. Was there any push back? Use the chart below to record your observations.

STEP 3 Bring the item back to the start of the ruler and stack the second object on top of it. Repeat step 2.

STEP 4 Bring the stacked objects back to the start of the ruler and add the third object. Repeat step 2.



Objects	Friction
1	0 1 2 3 4 5 6 7 8 9 10
2	0 1 2 3 4 5 6 7 8 9 10
3	0 1 2 3 4 5 6 7 8 9 10

1. What happened to the friction force when you stacked more objects on top of each other?

_____

_____

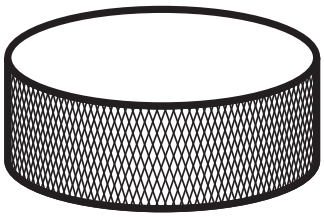
2. What does this tell you about how weight and friction works?

_____

_____

REFLECTION

Pucks are 6 ounces in weight and made with different textures. The top and bottom are smooth while it's knurling, the side with a diamond-shaped pattern, is rough. What would happen if hockey was played with a puck made of different textures and weights? Predict how it would affect **stickhandling**, **passing**, and **shooting**.



Stickhandling *(**HINT:** Complete the **Coaches Challenge** from page 6 with different textures and weights.)*

Textures _____

Weights _____

Passing *(**HINT:** Complete the **Coaches Challenge** from page 13 with different textures and weights.)*

Textures _____

Weights _____

Shooting *(**HINT:** How will these textures and weights affect speed?)*

Textures _____

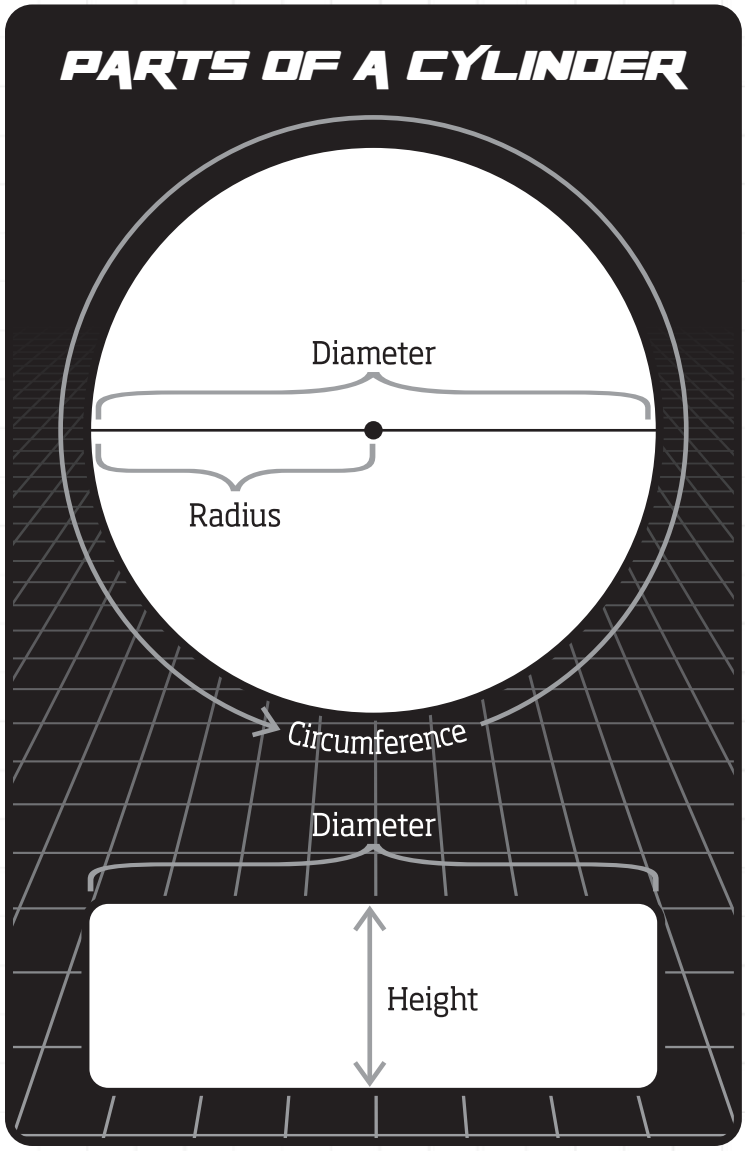
Weights _____

TURN UP THE VOLUME

Have you ever read the story of "Goldilocks and the Three Bears?" It's about a girl who walked into a house belonging to three bears after a long journey through the forest. She needed a rest and saw three chairs of three different sizes. While the first two chairs were too big and too small, the third one was "just right" for her. The size of this chair gave her the comfort she needed!

Size is an important property to think about when designing things. An object's size has to be "just right" because, if it's not, there's a good chance it won't work correctly. There's no historical evidence that a puck's size was designed with stickhandling, passing, or shooting in mind. It's up to you to think about it. What if the puck were tall like a soup can or flat like a pancake? Volume is the tool you can use to make objects larger or smaller.

Volume is the amount of space an object takes up. Whether it's a mountain range or thin sheet of paper, **volume can determine an object's actual size**. To find it, match the object with its closest 3D shape and then use it's formula. Let's find the volume of an NHL puck.



COACHES CHALLENGE

Measure the parts of the official puck (to the right) using a ruler and calculate its volume by using the formula for a cylinder.

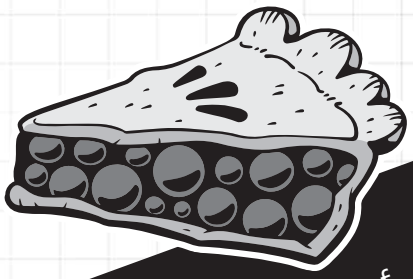
volume of a cylinder = pi x radius x radius x height

Radius _____ inches **Diameter** _____ inches

Height _____ inches

VOLUME:

VOLUME



WHAT'S PI (π)?

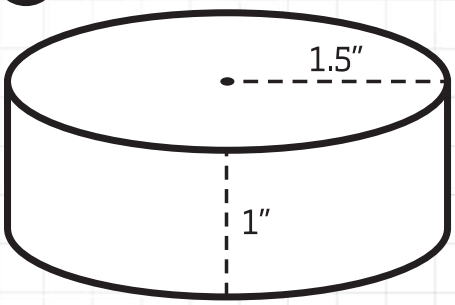
Pi is represented by the numerical value of 3.14. It is best known by its symbol π. It's okay to give π the value of 3 when calculating volume.

TURN UP THE VOLUME

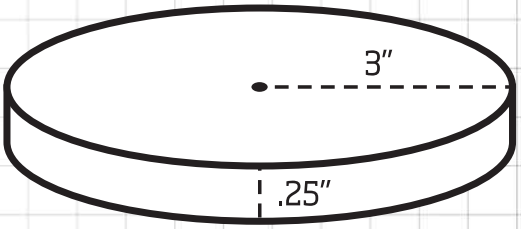
Understanding volume allows you to compare and contrast the size of objects correctly. Two items that appear to look different in size can actually have the same volume. ***Don't believe it? Let's test it out!***

COACHES CHALLENGE

A OFFICIAL PUCK



B FLAT PUCK



1a. Calculate the volume for PUCK A and PUCK B. Which one do you think is larger?

"I think PUCK ☐ *is larger."*

(A or B)

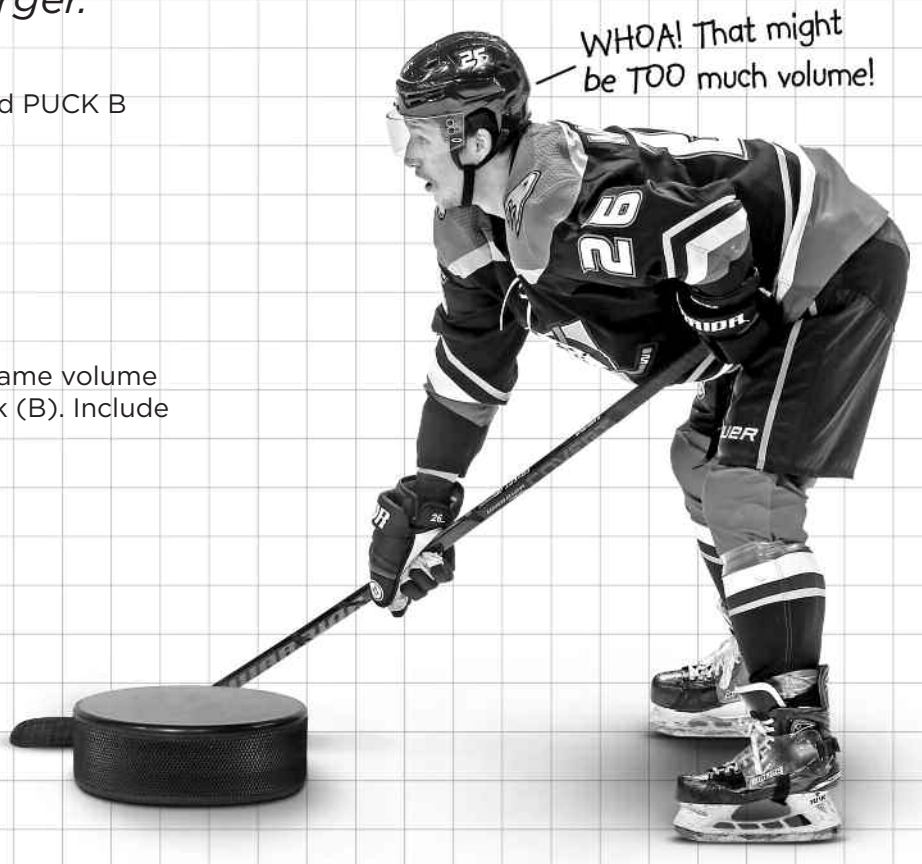
1b. Calculate the volume for PUCK A and PUCK B by using the formula for a cylinder.

PUCK A:

PUCK B:

2. Draw a tall puck (C) that shares the same volume as the official puck (A) and the flat puck (B). Include your measurements.

C TALL PUCK



TURN UP THE VOLUME

3. Draw two pucks that are smaller (D) and larger (E) than the official NHL puck (A). Include measurements for each.

D **SMALL PUCK**

E **LARGE PUCK**

REFLECTION

What do you think would happen if we played hockey with pucks B, C, D, and E? How would it affect:

Stickhandling *(**HINT:** How will these pucks affect stick control?)*

Passing *(**HINT:** How will these pucks affect passing angles?)*

Shooting *(**HINT:** How will these pucks affect speed?)*

GIANT PUCK

Based on your investigation, explain which puck sizes would make the best hockey puck.

BUILD A BETTER PUCK

It's time to build a better puck! You're prepared to take on this challenge because you completed all the activities in the workbook. You learned about the puck's history, how it moves, and even put many shapes, materials, weights, textures, and sizes to the test. **You. Are. Ready!**

Let's review where you're at in the design process.
Go to page 5 to review this helpful guide.

STEP 1 **Ask a question** ☑

STEP 2 **Gather Information** ☑

STEP 3 **Brainstorm**
Using the information you gathered from the workbook lessons, **which shapes, materials, weights, textures, and sizes do you think will improve the puck?** Work on your own or with a group and list all the good and bad qualities you found from the activities in this workbook. Go back and look at the notes in your journal to help you with this task.

PUCK PLAY

	Good Qualities	Bad Qualities
Shape		
Material		
Weight		
Texture		
Size		

BUILD A BETTER PUCK

STEP 4 **Plan**

Sketch out some cool puck design ideas in your journal. If you're working with others, take the best ideas and design something everyone can agree upon. Plus, you'll need to figure out how you're going to build it. What materials are you going to use to make this creation come to life? Once you're ready, sketch out a detailed version of your design on graph paper.

No graph paper? Scan the QR code and print out all the sheets you need!

GRAPH PAPER

STEP 5 **Build, Test, & Re-design**

Build It! It's time to build it! Use paper maché, modeling clay, or combine items found around the house with tape or glue. If you can't find any of these items, that's okay, just work with something that's similar and easy to use.

Test It! Test It! Put your puck through a rigorous test and record observations in your journal. Use the activities from the workbook to help you test your puck's size, shape, and texture. How will your design affect stickhandling, passing, and shooting?

Re-design It! Things don't always work on the first try. Take what you learned from testing your puck and use this new information to re-design your puck.

STEP 6 **Share It!**

Share your puck with the world through a report, presentation, or technology tools such as a slideshow or video.

Not sure what to share? Here are some ideas!

- What was your plan to design and test your puck?
- How is your puck different from an NHL hockey puck?
- How did you get the ideas to design your puck?
- What were the pros and cons about your puck design?
- What challenges did you face?
- How would you change your design if you could build another puck?

CONGRATULATIONS, YOU DID IT!

YOU BUILT A BETTER PUCK!

COACHES CHALLENGE

Can't Find Anything to Use? Make Your Own Play Clay!

Made with three simple ingredients, this Play Clay provides virtually unlimited creative possibilities for making objects like your puck. And best of all, the ingredients are right in your kitchen.

MATERIALS

1. **Corn Starch**
2. **Cold Water**
3. **Food Coloring** *(optional)*
4. **Sauce Pan**
5. **Measuring Cup**
6. **Plate**
7. **Paper Towel**

STEP 1 Combine ingredients into saucepan.

- 2 cups baking soda
- 1 cup corn starch
- 1 ¼ cups cold water
- Food coloring (for color)

STEP 2 Stir until mixed.

STEP 3 Cook over medium heat. Keep stirring until you get it to look and feel like mashed potatoes. It should take 10-15 minutes.

STEP 4 Remove mixture to a plate and cover with a damp cloth.

STEP 5 When cool to the touch, that means it's ready.

Play Clay can be stored in your fridge for up to one week if you want to reuse it. You can also dry the finished product overnight. Use with adult supervision.

Make sure you get permission from an adult before doing this activity!

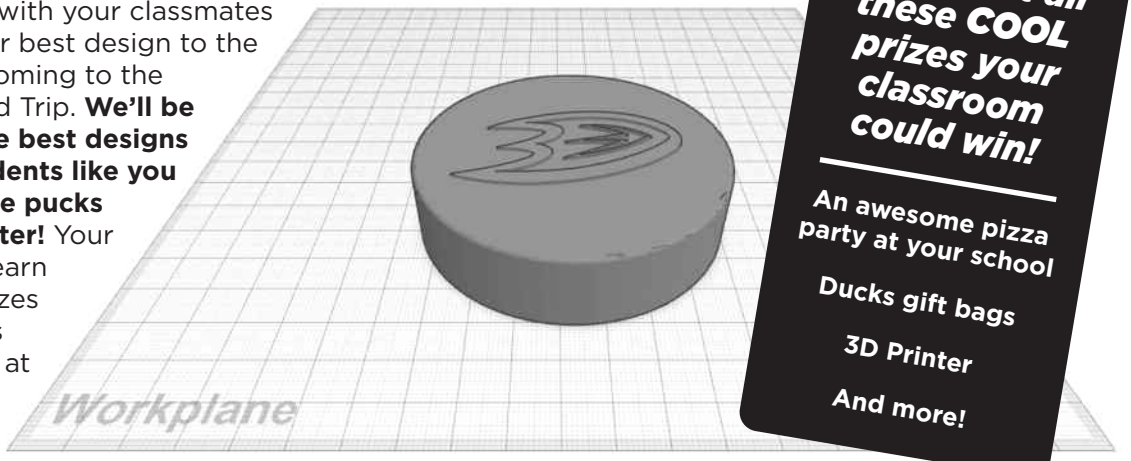
ARE YOU READY FOR THE "BUILD A BETTER PUCK" CHALLENGE?

Presented by

Orange County Department of Education · DiscoveryCube OC & LA, Part of the Discovery Science Foundation · Orange Coast College

Design a 3D computer model of your puck.

Work together with your classmates and submit your best design to the Ducks before coming to the First Flight Field Trip. **We'll be choosing all the best designs created by students like you to make real-life pucks using a 3D printer!** Your classroom will earn some sweet prizes if your design is featured on-ice at the First Flight Field Trip.



Check out all these COOL prizes your classroom could win!

- An awesome pizza party at your school
- Ducks gift bags
- 3D Printer
- And more!

Here's how to enter the "Build a Better Puck Challenge"

1. Go to tinkercad.com and create a user account. It's free to use this program, but you'll need to get your teacher or parent's approval before getting started.

2. "Tinker" around with the fun games and activities once you've logged into your account. They will teach you how to bring your design to life.

3. Work with your classmates to brainstorm ideas and come up with a puck design.

4. Place, adjust, and combine shapes to make a 3D model of the puck.

5. Share your classroom's puck by tagging your model in Tinkercad with ***#betterpuckchallenge*** or email us at **score@anaheimducks.com**.

Need more help? Scan this QR code and find the PROJECTS link for more details about the challenge.

BETTER PUCK CHALLENGE

Or visit bit.ly/2019FFFTresources

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WILD WINGERS KIDS CLUB

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MAKE ALL CHECKS PAYABLE TO
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STUDENT NAME _____

PARENT EMAIL _____

THE ANAHEIM DUCKS

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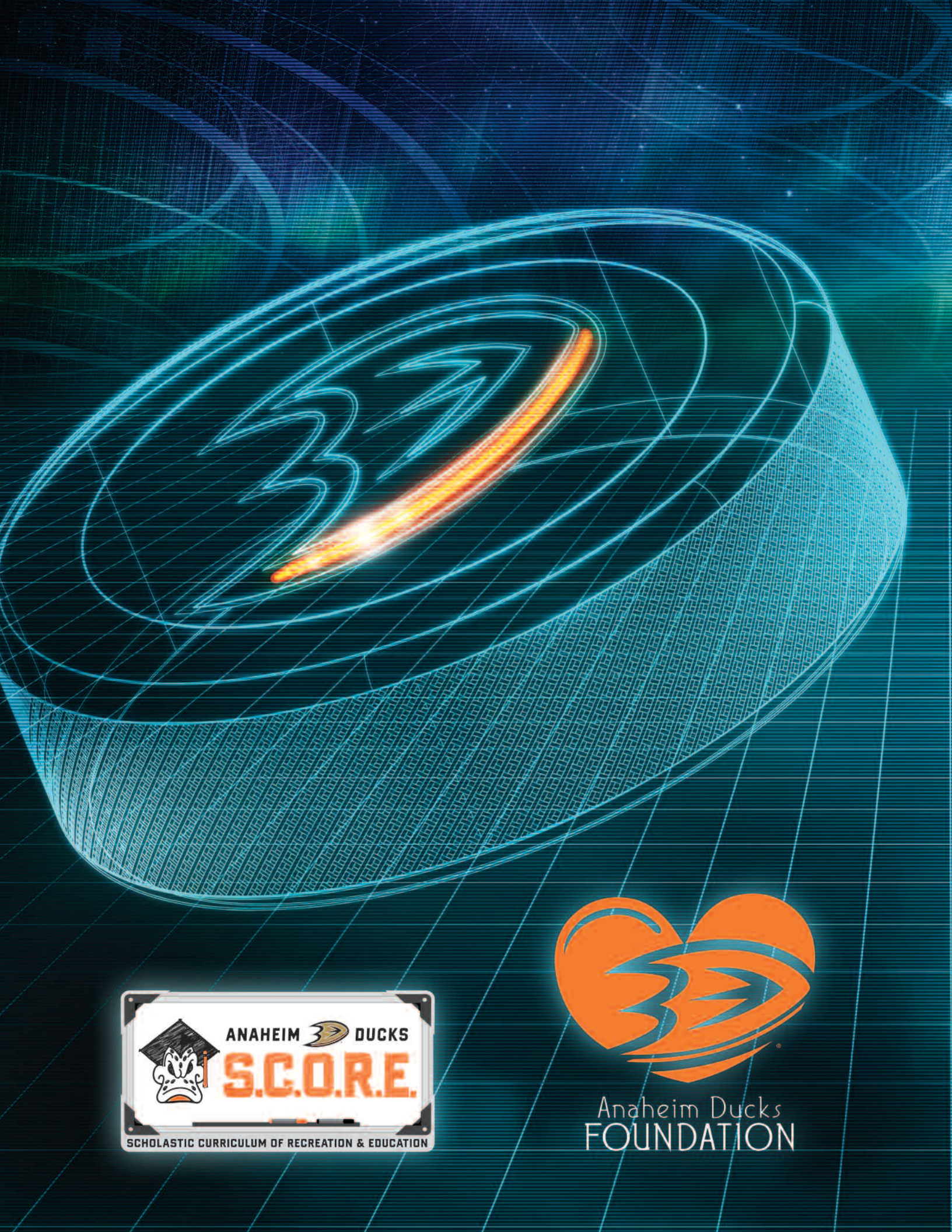
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