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First Flight Field Trip

Turn up the Energy

On behalf of the Anaheim Ducks, I'd like to welcome you to the First Flight Field Trip. While your actual visit to Honda Center might not be for a few days or weeks, your journey begins now. This workbook was put together to introduce you to the exciting science concepts you'll see come to life on the ice on March 2nd. Until then, the principles of energy that make the game of hockey the best sport in the world can also be found right in your classroom. All you need is to know where to look.

My job is to understand the potential of our players' abilities, how their equipment performs, and the movements of our opposition to think of strategies that will result in a Ducks victory. Really, hockey is a simple game. You just have to score more goals than the other team. That's why my coaching staff and I spend the vast majority of our time thinking about creating more offense and engineering goals.

To that end, our problem or question is quite obvious. How can the Ducks score more? The solution is not an easy one! We take notes, draw diagrams, and train our team in an effort to give each player the best chance to put the puck in the back of the net. We need to know how sticks work, players move, pucks travel from stick to stick, and how all these things work together within the confined space of an ice rink. Simply put, it takes energy!

You have a job to do! Before coming to Honda Center, the challenge before you is to learn about the science of energy and apply this knowledge for a final task at the end of this workbook. Our goal is take you on a journey that not only teaches you about the sport of hockey but makes a connection to the game I love with the science that surrounds us all. Energy isn't just a word that sits quietly in your textbook. It moves, it roars, and it radiates throughout our daily lives. Knowing how to harness it can light your classroom or it can bring 17,000 fans to their feet.

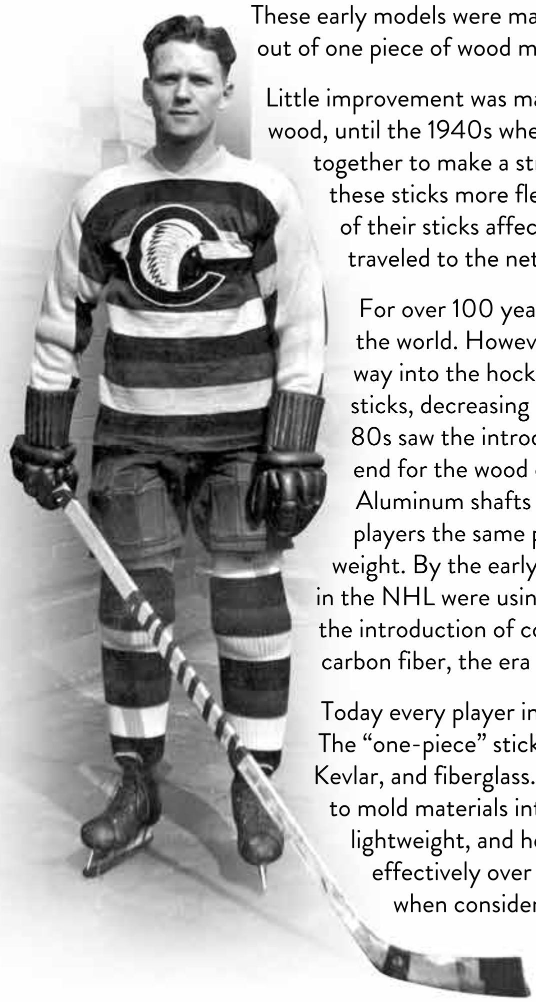
Let's Turn Up The Energy!

Pat Verbeek
Anaheim Ducks
General Manager

This book is dedicated to J.H.2, Jonah Hwang and Joseph Hwang. Superheroes of science.

TURN UP THE ENERGY

The stick is to hockey as cheese is to pizza. No, not delicious, important! In hockey, the stick is the best tool to consider as we examine the relationship between types of energy and the goals we want to accomplish. While various forms of the game have existed for hundreds of years, it wasn't until the early 1800s that the "modern" hockey stick came into existence. The Mi'kmaq, a group of indigenous peoples native to the Nova Scotia region of Canada, are credited with creating the closet relatives of today's twig (a nickname for the stick). These early models were made from hardwood trees abundant in the area. Sticks were carved out of one piece of wood making them perfect for knocking pucks around a frozen sheet of ice.



Little improvement was made on this original design, outside of trying different types of wood, until the 1940s when stick manufacturers began to laminate thin sheets of wood together to make a stronger, lighter stick. The glues and thin sheets of wood also made these sticks more flexible. This flexibility allowed players to begin curving the blades of their sticks affecting both the types of shots they took and the path the puck traveled to the net. (It went higher and harder)

For over 100 years the wood stick remained the chosen tool for goal scorers around the world. However, beginning in the 1960s, new materials began to find their way into the hockey stick. Fiberglass began to replace some wood in laminated sticks, decreasing their weight, while maintaining their strength. The 1970s and 80s saw the introduction of metal sticks and with them the beginning of the end for the wood once coveted by players. Aluminum shafts with wood blades gave players the same performance with less weight. By the early 1990s very few players in the NHL were using wood sticks and with the introduction of composite materials, mainly carbon fiber, the era of the wooden stick ended.

Today every player in the NHL uses a composite stick. The "one-piece" sticks are made of materials like carbon fiber, Kevlar, and fiberglass. These materials allow manufacturers to mold materials into a singular piece that is durable, lightweight, and helps them perform consistently and effectively over and over again. Why is that important when considering energy? Let's find out!

A stick is a pretty important tool to a hockey player. Let's check out the tools you'll need to Turn Up The Energy!

JOURNAL

Engineers, even the coaches that design plays, 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 energy 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

TURN UP THE ENERGY

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 cubes to the best of your ability. Come back to this page anytime you need some guidance, especially when you take on The Big Assist.

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 AND 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?**

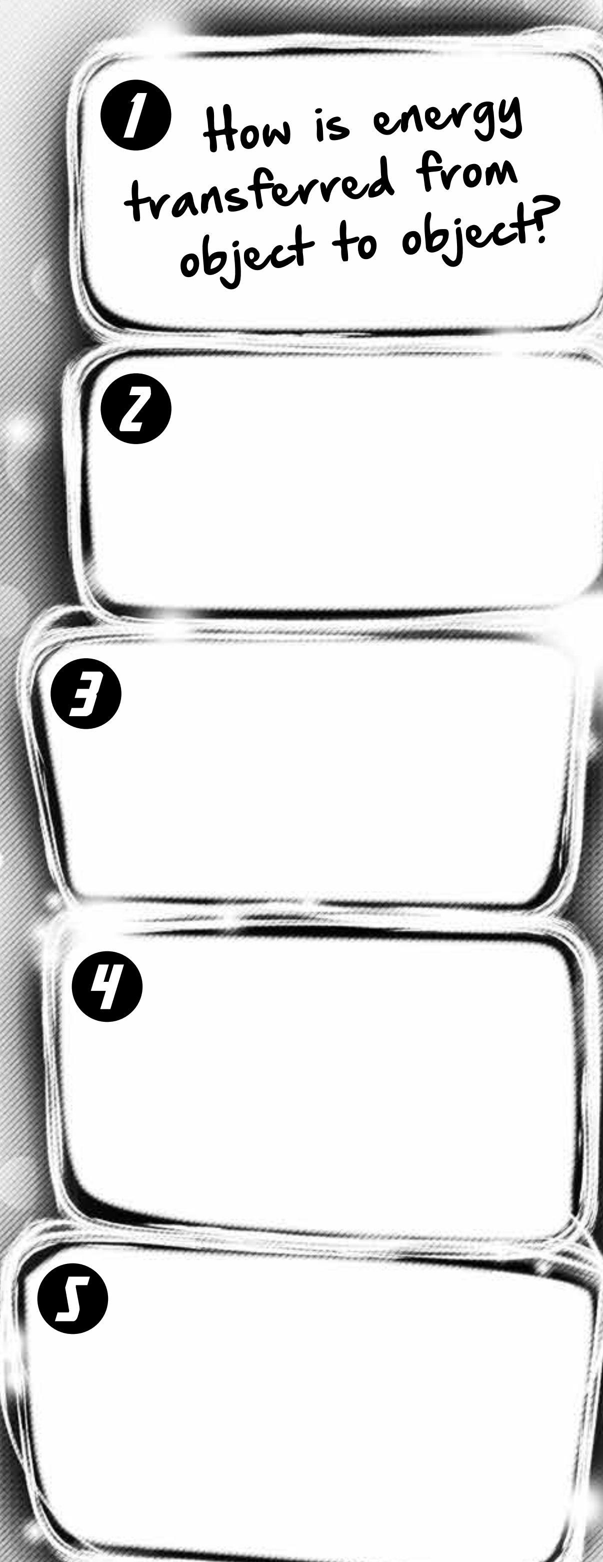
4. BUILD, TEST, & REDESIGN

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 "Turn Up The Energy" photos and videos on social media using **#ducksfirstflight** or tag us on Instagram **@ducks_score**. We can't wait to see your projects and share them throughout the event on March 2nd!



Turn up the Energy

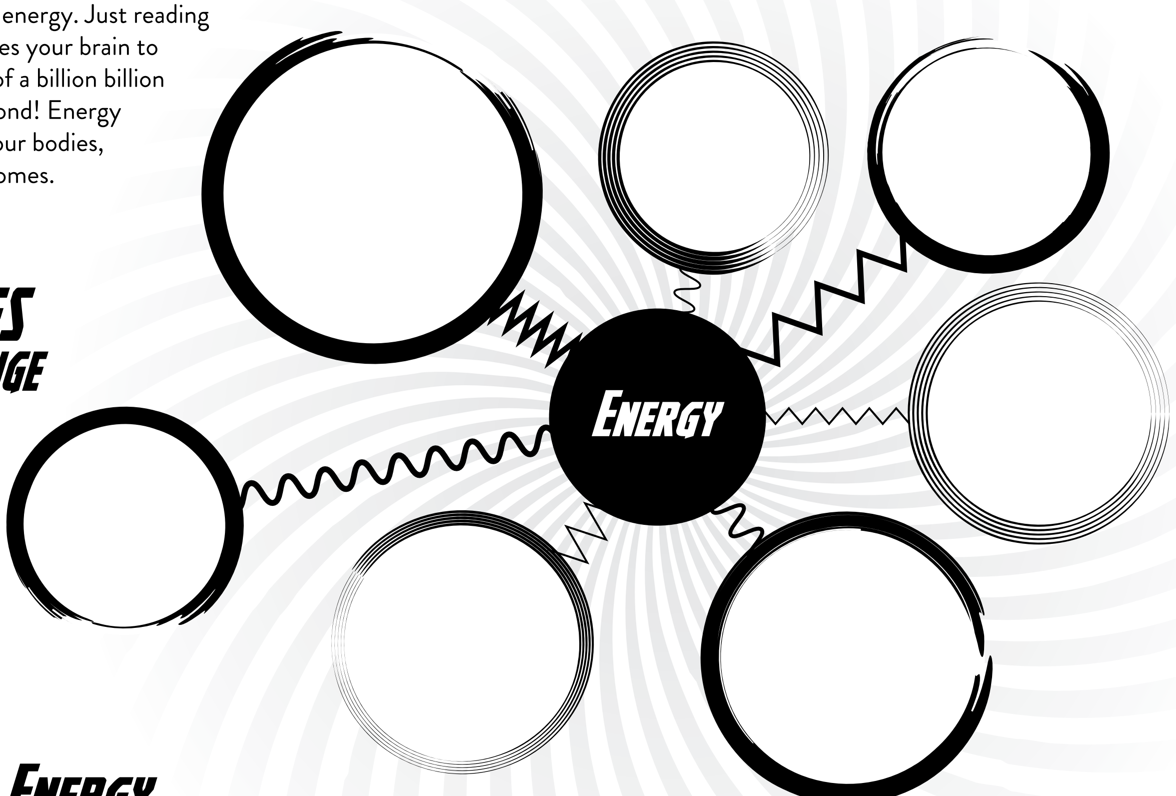
Turn up the Energy

In hockey, what's more important than goals and assists? It's energy! Before the Ducks step out on the ice, the head coach goes over a game plan. Simply put, he tells them to **TURN UP THE ENERGY!** That's because when the Ducks play with more energy against the league's best, good things always happen. But, it starts with each player understanding energy and how it works. Knowing their potential, Ducks players can make it work for them. This leads to more assists, more goals, and more victories.

Energy is the ability to do work. It's everywhere. You can't smell it or taste it and most of the time you can't see it. But as hidden as it may seem, energy is at work all around us. It only takes a keen eye. The is not a single item on this planet that doesn't store or use energy. Just reading this sentence requires your brain to process at the rate of a billion billion calculations per second! Energy moves cars, warms our bodies, and brightens our homes.

Coaches Challenge

When you think about energy, what are the words that come to you to describe it? Using energy, write them down inside the circles.



Potential Energy

Potential energy is the energy stored within an object so that it can do something useful later. With more potential energy, objects have the ability to do more work. You can think of this as why rockets need to store huge amount of fuel (energy) in their tanks to travel to far away planets and moons. This also can be seen in the "spring" elastic items possess when they are pushed or pulled. They "hold" onto energy right before you let them go, snapping back like a rubber band or shooting forward like a hockey stick.

Kinetic Energy

Kinetic energy is simply, moving energy. Since all things, from large planets to microscopic atoms, move in myriad ways, there is a classification for all the kinetic energy moving around us. This includes a burning fire, a honking horn, or the steam rising from a kettle. There are even descriptions for the types of movements we make and the actions we impart onto other things.

All energy is either potential or kinetic energy. There are a variety of classifications for each, with different "jobs", that always team up to help us do work.

Coaches Challenge

Identify and circle the different examples of kinetic energy in the pictures below. Use the **"Forms of Kinetic Energy"** index to help you identify objects on the move. (***HINT:** Look for moving things!)*

FORMS OF KINETIC ENERGY

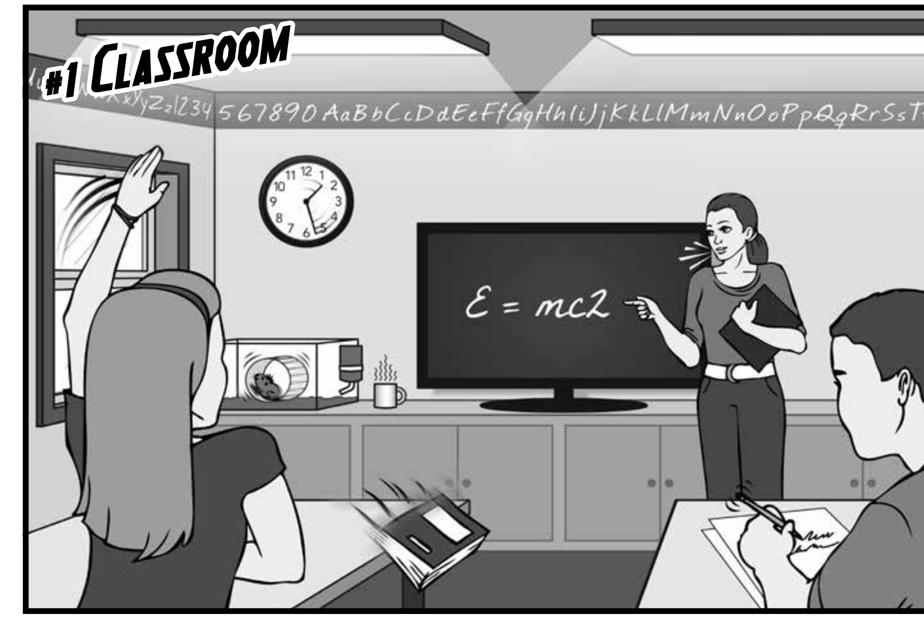
Mechanical Energy is the energy from physical motion. Objects that are pulled, pushed, twisted, or turned has energy.

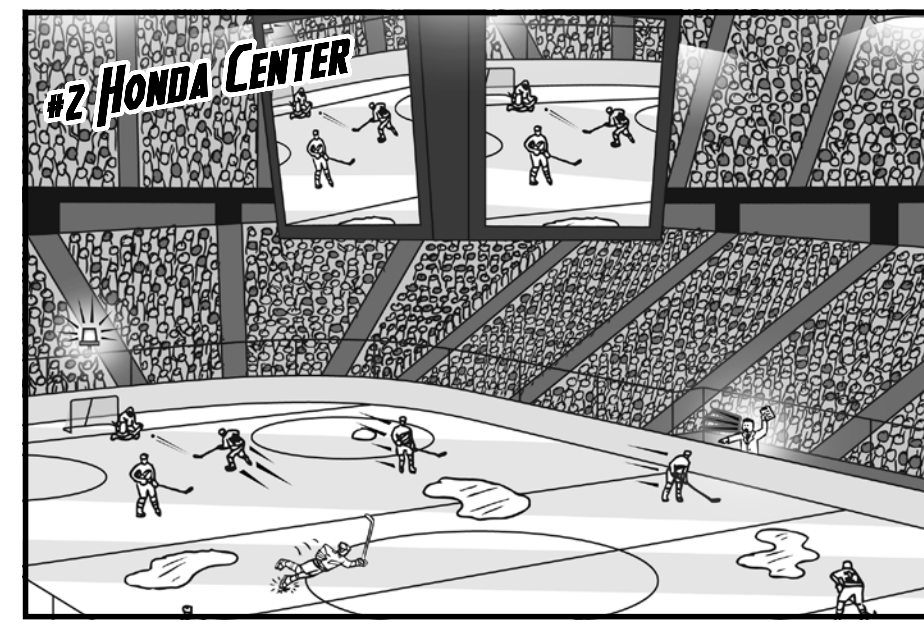
Heat Energy is energy from heat or a change in temperature. Have you ever seen ice melt? That's heat energy at work.

Electrical Energy is energy that comes from moving electrons. Each time you flip a light switch from off to on, it completes a circuit so that electricity can move through the wire to turn on the light bulb.

Gravitational Energy is motion that is caused by gravity. What happens when you throw something up? It falls, thanks to gravity.

Sound Energy is the motion from sound. Have you ever turned up the car radio so loud that it shook the windows?





1: ____________ **2:** ____________ **3:** ____________ **4:** ____________

5: ____________ **6:** ____________ **7:** ____________ **8:** ____________

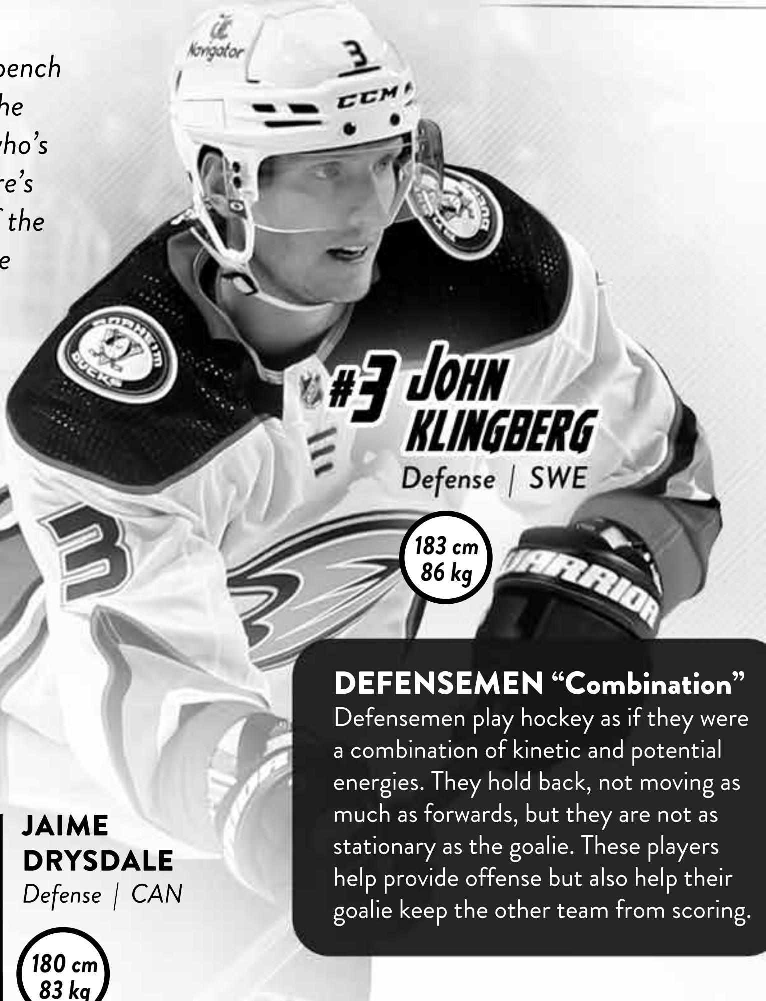
Take a look around your classroom. Jot down three types of kinetic energy you see. Sketch a picture of one of them.

YOU'VE GOT POTENTIAL

Presented by CHOC
LONG LIVE CHILDHOOD

Each night, the Ducks will put 20 skaters onto the bench ready to play a game. Combine those players with the opposing team and it can be hard to keep track of who's on the ice! Well, with your knowledge of energy there's an easy way to follow them as they move on and off the ice. The positions on a hockey team have very unique characteristics, much like the qualities that make potential and kinetic energy unique from one another. Each has a special job to do and by working together they can help the team win!

Anaheim Ducks Roster as of January 1st, 2023.



#3 JOHN KLINGBERG
Defense | SWE
183 cm
86 kg

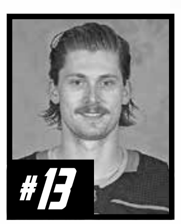
DEFENSEMEN "Combination"
Defensemen play hockey as if they were a combination of kinetic and potential energies. They hold back, not moving as much as forwards, but they are not as stationary as the goalie. These players help provide offense but also help their goalie keep the other team from scoring.

CAMERON FOWLER
Defense | USA
185 cm
98 kg

URHO VAAKANAINEN
Defense | FIN
185 cm
91 kg

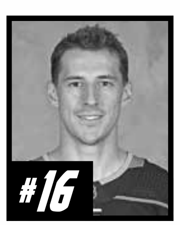
JAIME DRYSDALE
Defense | CAN
180 cm
83 kg

TREVOR ZEGRAS
Forward | USA
183 cm
84 kg

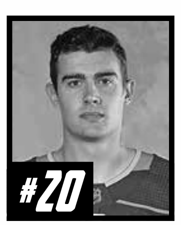


SIMON BENOIT
Defense | CAN
190 cm
92 kg

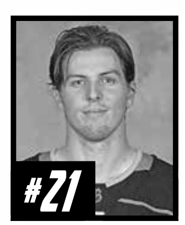
ADAM HENRIQUE
Forward | CAN
183 cm
88 kg



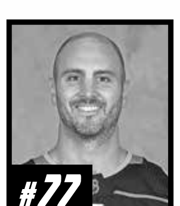
RYAN STROME
Forward | CAN
184 cm
86 kg



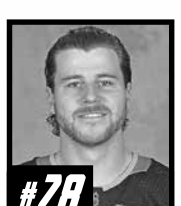
BRETT LEASON
Forward | CAN
196 cm
99 kg



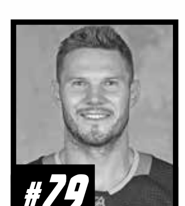
ISAC LUNDERSTROM
Forward | SWE
183 cm
88 kg



KEVIN SHATTENKIRK
Defense | USA
183 cm
96 kg



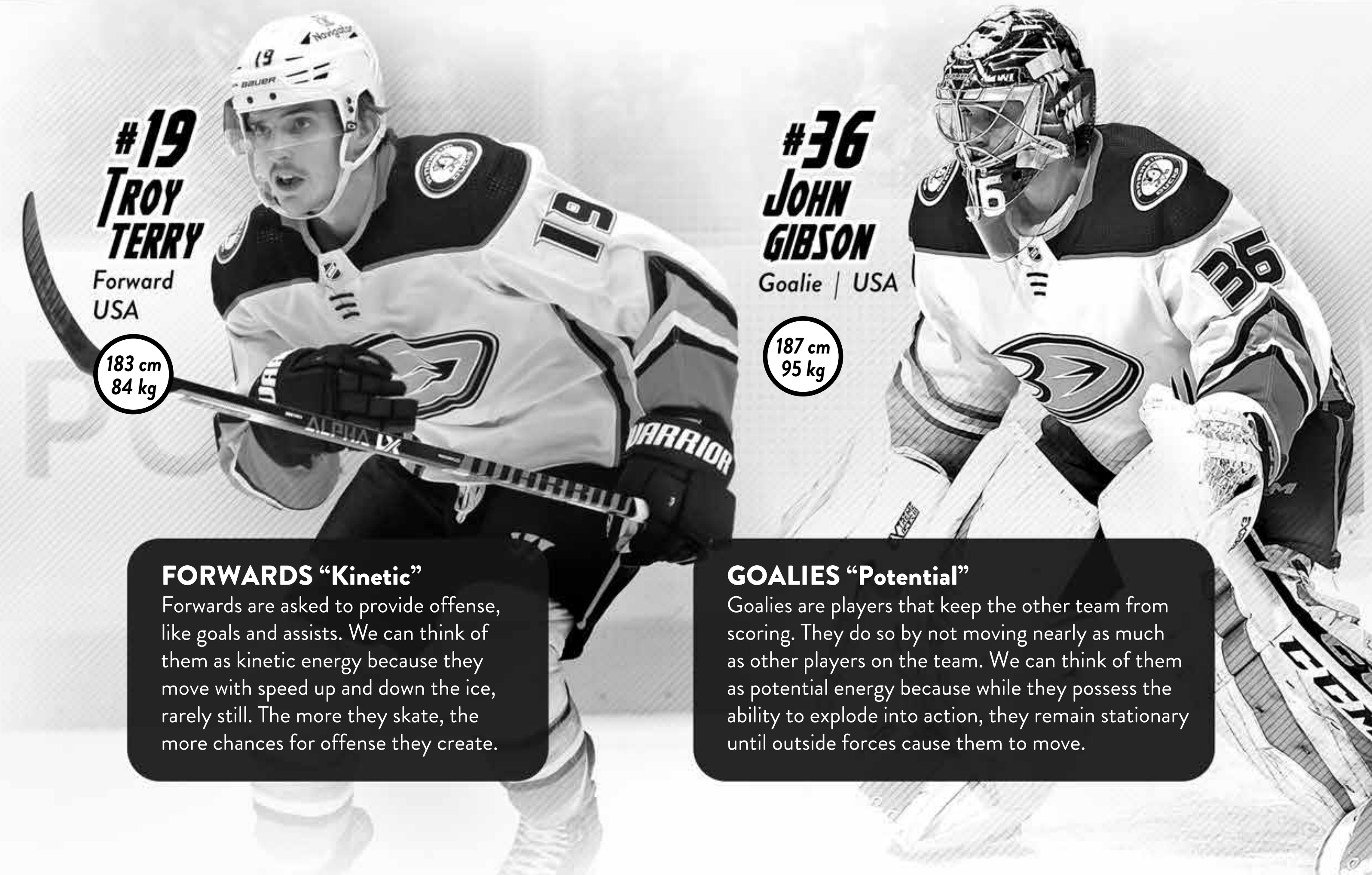
NATHAN BEAULIEU
Defense | CAN
187 cm
91 kg



DMITRI KULIKOV
Defense | RUS
184 cm
91 kg

YOU'VE GOT POTENTIAL

Presented by CHOC
LONG LIVE CHILDHOOD



#19 TROY TERRY
Forward
USA
183 cm
84 kg

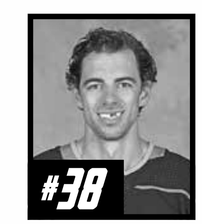
#36 JOHN GIBSON
Goalie | USA
187 cm
95 kg

FORWARDS "Kinetic"
Forwards are asked to provide offense, like goals and assists. We can think of them as kinetic energy because they move with speed up and down the ice, rarely still. The more they skate, the more chances for offense they create.

GOALIES "Potential"
Goalies are players that keep the other team from scoring. They do so by not moving nearly as much as other players on the team. We can think of them as potential energy because while they possess the ability to explode into action, they remain stationary until outside forces cause them to move.

JAKOB SILFVERBERG
Forward | SWE
184 cm
94 kg

MASON MCTAVISH
Forward | CAN
183 cm
96 kg



DEREK GRANT
Forward | CAN
190 cm
95 kg

PAVOL REGENDA
Forward | SVK
193 cm
96 kg

ANTHONY STOLARZ
Goalie | USA
198 cm
112 kg

MAXIME COMTOIS
Forward | CAN
187 cm
95 kg

COLTON WHITE
Defense | CAN
184 cm
85 kg

MAX JONES
Forward | USA
190 cm
95 kg

FRANK VATRANO
Forward | USA
180 cm
90 kg

SLAP SCIENCE

The slapshot is a type of shooting action used in hockey to make the puck fly at incredible speeds. While the hardest slapshot on the Ducks currently belongs to Assistant Captain, Cam Fowler (103 mph!), every player on the team must master this shot. So how can we "Turn Up The Energy" and make these shots harder? That depends on the player and the stick.

SLAPSHOTS

Scan here to watch the Anaheim Ducks defensemen score with a slaphot!

BREAK IT DOWN

1. **Wind-up** – The player will raise and rotate the stick to shoulder height or higher, transfer their weight from the back skate to the front skate, and then swing the stick forward while shifting their body weight.
2. **Flex** – During the swinging motion, the player will target the area directly behind the puck to make contact with the ice. The contact with the ice will cause the stick blade and shaft to bend back, increasing the potential energy in the stick.
3. **Release** – All the player's weight moves to the front skate as they move the stick into the puck and off the ice, releasing the potential energy of the stick. The moving or kinetic energy from the stick and body is transferred to the puck, sending it flying through the air.
4. **Return** – After the puck is shot, the stick will return to it's original, rigid, position even as the player continues to move. The flying puck may strike a number of things (other players, boards, glass, the net) once again transferring the energy it received from the player and stick.

Kinetic Energy
Moving energy can be observed in the movements of the player, stick, and puck.

Cameron Fowler
Defense

Shaft
Each player can select how rigid this part is to suit their personal playing style and shot preference.

Blade
The blade's curve will determine whether a player is a left or right handed shooter. The curve can also be adjusted to suit the players personal playing style.

Potential Energy
The flexing stick represents an increase of elastic potential energy, much like a rubber band.

Law of Conservation of Energy
Energy is transfered where the blade of the stick meets the puck.

YOU'VE GOT POTENTIAL Presented by CHOC LONG LIVE CHILDHOOD

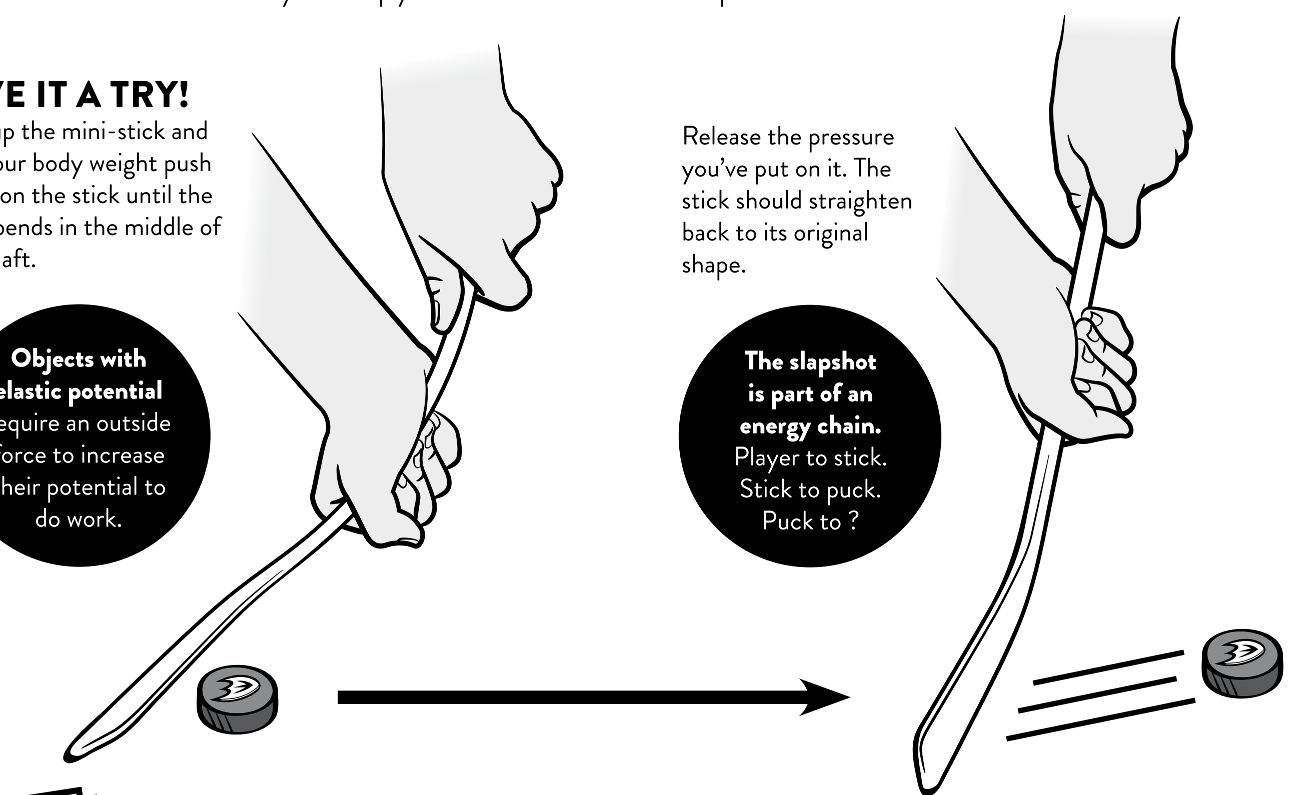
FLEXIN'

Ducks players understand the potential of their sticks. To use them effectively, a player shooting the puck will strike the ice behind the rubber disc, bending the stick, just before they touch it. In hockey, we call this "loading the stick". Scientifically speaking, we call this increasing the stick's potential energy; specifically, elastic potential energy. That's because once a player bends the stick it will return to its original shape or position. When they release this stored energy by moving the stick forward they can shoot the puck with much more force then if they had simply made direct contact with the puck.

GIVE IT A TRY!

Pick up the mini-stick and use your body weight push down on the stick until the stick bends in the middle of the shaft.

Release the pressure you've put on it. The stick should straighten back to its original shape.



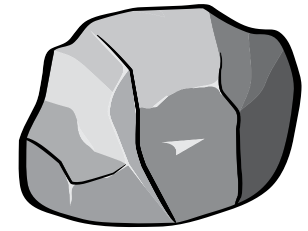
Objects with elastic potential require an outside force to increase their potential to do work.

The slapshot is part of an energy chain. Player to stick. Stick to puck. Puck to ?

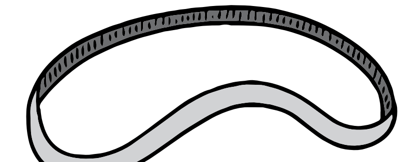
Why does the stick bend? Materials, stick thickness, and length are all important factors. Find two items of roughly the same size and weight where one is more flexible and the other less so. How are they the same? How are they different?

COACHES CHALLENGE

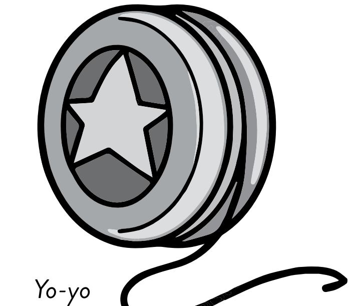
Take a look at the items below. Circle the objects you think possess elastic potential energy.



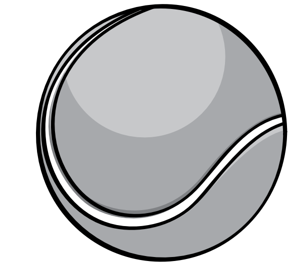
Rock



Rubber band



Yo-yo



Tennis ball

> ***A joule is one of the units we use when we express a measure of energy.*** It is a description of how much work an object may do or is doing. We use a **J** to label joules.

FACE-OFF!

Every object on earth has potential energy. While a slap shot depends on the elastic potential energy of a stick, we can increase any objects potential to do work by simply picking it up. For this activity we're going to calculate the gravitational potential energy of three different types of pucks.

Gravitational energy is dependent on both the object and earth's gravity. To calculate the gravitational potential energy each of these pucks possess, we need to know a few things.

Gravitational Potential Energy Also known as PEgrav.	=	**Mass (m)** This is the amount of matter an object possesses. Mass is often confused with the weight of an object. While weight is a factor, so is the force of gravity. This is measured in kilograms (kg).	x	**Gravity (g)** We need a number that represents the amount of acceleration an object is given by being near Earth's surface. This number is 9.8 meter per second squared. We can think of this simply as 10.	x	**Height (h)** We can think of this as the distance between two objects. For our purposes it will be the distance between the ice and the puck. It is measured in meters (m).

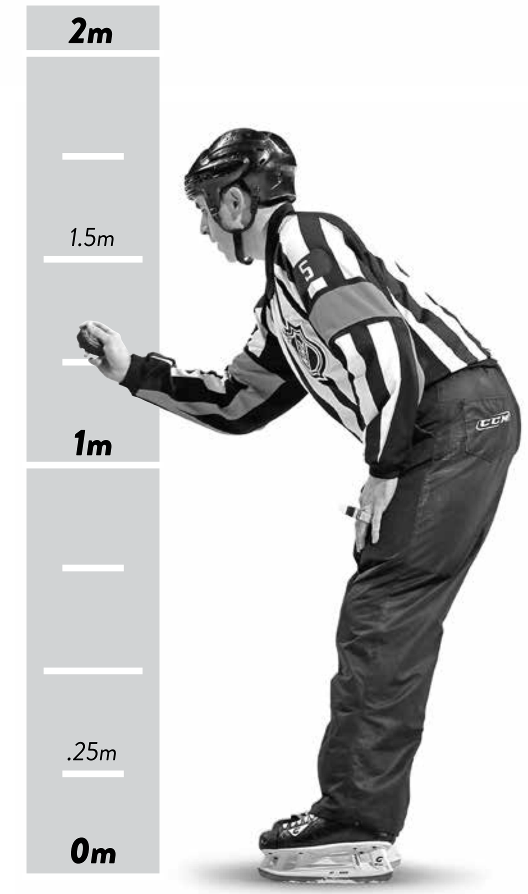
Write it down! The formula for calculating gravitational potential energy is PEgrav = mgh

YOU'VE GOT POTENTIAL Presented by CHOC LONG LIVE CHILDHOOD

COACHES CHALLENGE

The referee is about to blow the whistle calling players from each team to meet for a face-off. Calculate the gravitational potential energy for each puck below.

(3) MINI PUCKS	FOAM PUCK	REGULATION PUCK
Mass = 36g	Mass = 18g	Mass = 156g
Gravity = 10	Gravity = 10	Gravity = 10
Height = 1m	Height = 1m	Height = 1m
PEgrav =	PEgrav =	PEgrav =



GREAT JOB! You've recognized the potential of each puck!

COACHES CHALLENGE

We can change a variable in order to increase the gravitational potential of smaller and lighter pucks, what is it?

____

____

____

____

____

CHANGE IT UP

Adjust and calculate to give the mini pucks more gravitational potential energy than the regulation puck.

(3) MINI PUCKS	REGULATION PUCK
Mass = 36g	Mass = 156g
Gravity = 10	Gravity = 10
Height = m	Height = m
PEgrav =	PEgrav =

> ***A face-off is the way a hockey game starts action whenever we begin a period of play or after play was stopped.*** There are nine small red circles where opposing players will meet and wait for a referee to drop the puck to start the action.

LET'S GET MOVING

Kinetic energy is energy of all motion. Objects like a roller coaster car or an NHL player move with kinetic energy because of two important factors, mass and speed. If a player collides with the ice rink boards at a very slow speed, he doesn't do much to them. But, if he runs into them at a much higher rate of speed, you will see those boards bend like they're about to fall over! Likewise, a player that has more mass than the Captain might have as much impact on those boards even if he was moving at a slower rate of speed. Mass and speed are variables that determine the amount kinetic energy an object, or in our case players, exert. For our purposes, we'll think of mass as the weight listed next our players on page 6-7.

The Ducks are able to look at an opposing team roster and estimate the amount of **kinetic energy [KE]** the other team can play with. They use a simple formula that concentrates on **mass (m)** and **speed (s)**. You'll notice in the formula, **KE = ½(mass)(speed)²**, that speed is part of the formula not once but twice! This means that speed affects an object's kinetic energy and the joules it produces.

Write it down! The formula for calculating kinetic energy is KE = ½(mass)(speed)²

EXAMPLE

Let's find the kinetic energy of a moving car weighing 1,000 kilograms (kg) and traveling at a speed of 20 meters per second (mps).

STEP 1
GET THE FACTS

Formula: KE = s x s x m ÷ 2
Mass [m] = 1,000 kilograms (kg)
Speed [s] = 20 meters per second (mps)
Kinetic Energy [KE] = ??? joules (J)

STEP 2
SUBSTITUTE

Place the values into the equation:
KE = **s** x **s** x **m** ÷ 2
KE = **20** x **20** x **1,000** ÷ 2

STEP 3
MULTIPLY

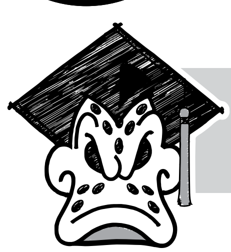
KE = 20 x 20 x 1,000 ÷ 2
KE =200,000 J

COACHES CHALLENGE

Now you know that speed and mass are the things that matter when we want to measure kinetic energy, complete the following activities!

1. Mass Matters
Rank (1-3) the following three pucks in the order of their kinetic energy. The puck with the MOST should receive a "3" and the puck with the LEAST should receive a "1". All three pucks are traveling at the same speed. (***HINT:*** *What two things matter most for kinetic energy?)*

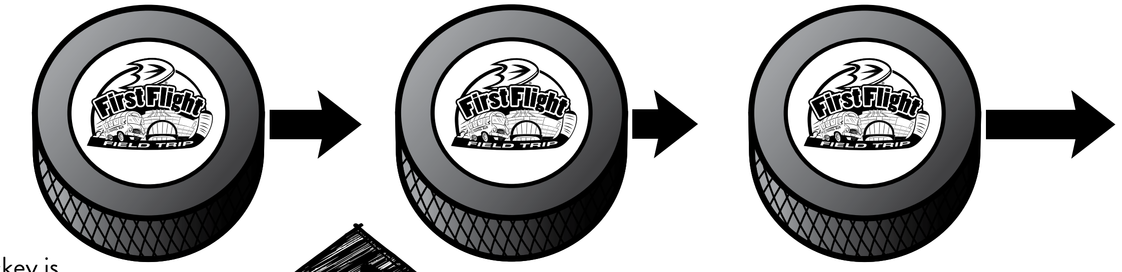
FOAM PUCK	REGULATION PUCK	MINI PUCK
s = 30 mps	s = 30 mps	s = 30 mps
m = 18 g	m = 156 g	m = 12 g
KE =	KE =	KE =



Remember, we measure the amounts of potential and kinetic energy in joules (J).

2. Speed Matters
Rank (1-3) the following three pucks in the order of their kinetic energy. The puck with the MOST should receive a "3" and the puck with the LEAST should receive a "1". All three pucks have the same mass. (***HINT:*** *What two things matter most for kinetic energy?)*

MEDIUM PUCK	SLOW PUCK	FAST PUCK
s = 30 mps	s = 20 mps	s = 40 mps
m = 156 g	m = 156 g	m = 156 g
KE =	KE =	KE =



MASS TRANSIT

The name of the game in hockey is to play with most kinetic energy. This means that players, especially forwards, need to skate hard to shoot and score goals. When the Ducks don't play with more energy than their opponents, their fans know that it's going to be a long night ahead of them. They'll be playing hockey from behind and in some cases, on the floor! It's up to the coaching staff and Coach to remind the team to "Turn Up The Energy". Since the Ducks can't change their weight during a game, it all comes down to playing with more speed!

Whether it's the speed or mass that changes, the formula stays the same.

COACHES CHALLENGE

Coach added you as a new coach to study his players' kinetic energy. During a game, you noticed that the entire team skated with a speed of 10 mps. However, not all players matched the energy of Maxime Comtois who played a great period of hockey. So which player on the team needs to turn up his energy? Identify the player who skated with the least amount of joules after the first period. Also, calculate his amount of kinetic energy. You'll need to give Coach a report of your findings. (***HINT:*** *Look at the Anaheim Ducks roster on pages 6-7.)*

1. Why did player ONE skate with less energy than player TWO?

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2. Using your results, what does player ONE need to do to "Turn Up the Energy" for the second period?

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ENERGY REPORT

Player ONE — LEAST ENERGY	*Player TWO* — MOST ENERGY
Name:	Name: Maxime Comtois
Number:	Number: 44
Mass:	Mass: 95 kg
Speed: 10 mps	Speed: 10 mps
Kinetic Energy:	Kinetic Energy: 4,750 J

Mass and Speed matter!
Scan to see how mass can effect a players speed.

ENERGY THAT MOVES

PROJECT: MAD DUCKS!

A hockey stick is a great example of potential and kinetic energy at work. It bends like a rubber band so that it can shoot a puck at a goalie after springing back into shape. Not many of us have shot a puck before but we've all seen or played a game with some furious fowl. Like the hockey stick, the game uses potential energy and kinetic energy to shoot the angry birds at their target. Using this same concept, it's your job to help some mad ducks with your knowledge of energy. They want to show their feathered cousins that they can fly!

DIRECTIONS:

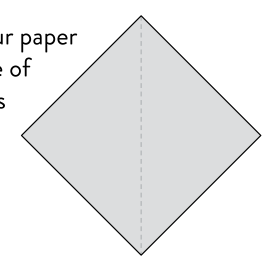
STEP 1 Gather Your Materials

- Three 3"x 3" sticky notes
- One rubber band
- Pencil
- Pen
- Ruler

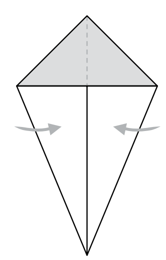
STEP 2 Make Three Mad Ducks

1. Begin by selecting one of the 3"x 3" sticky notes to fold.

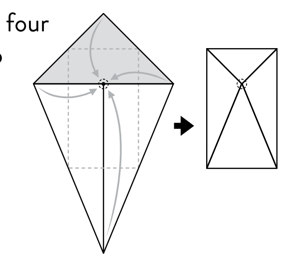
2. Turn your paper so that one of the corners is pointing upwards.



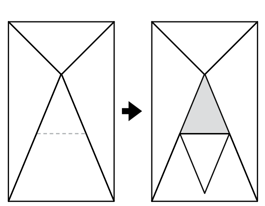
3. Fold the left and right corners until they meet in the center. Then, draw a dot where the two corners meet.



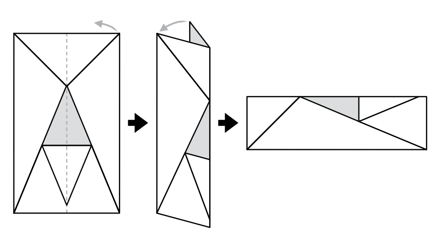
4. Fold all four corners so that they meet at the dot.



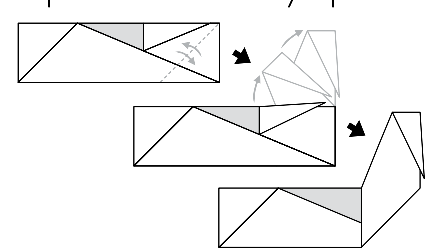
5. Fold the bottom tip down so it touches the bottom edge.



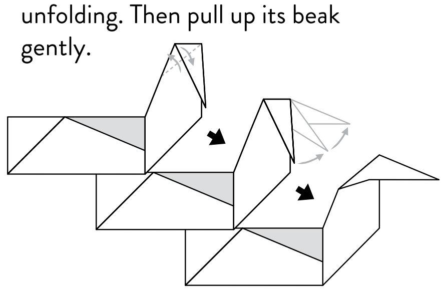
6. Fold the entire piece in half.



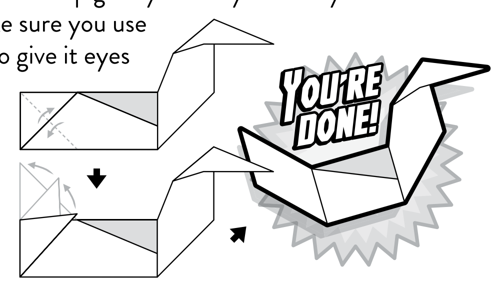
7. Fold and unfold as shown. This crease helps to make the neck as you pull it forward.



8. Form the head by folding and unfolding. Then pull up its beak gently.



9. To make the tail, fold and unfold where indicated. Then lift the tail up gently. Now you have your first duck! Make sure you use your pen to give it eyes and the number 1 on its tail.



10. Make two more ducks and number them 2 and 3.

ENERGY THAT MOVES

STEP 3 Make Them Fly!

1. Decide which hand you will place the rubber band on. If you are right handed, you will probably want to place the rubber band on your left hand or vice versa.

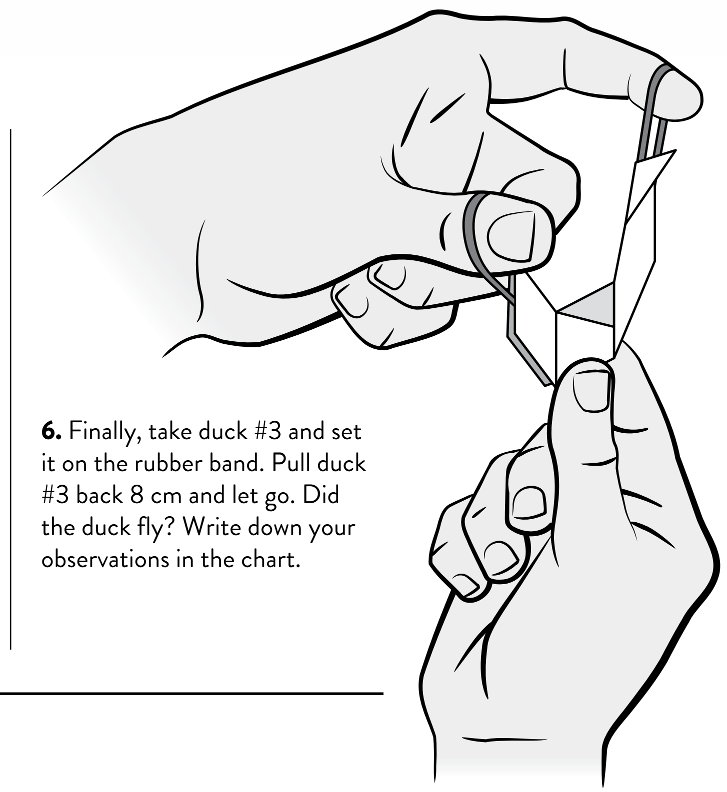
2. Place one loop around the thumb of your left hand and place the other loop around the index finger of your left hand.

3. When you spread your index finger and thumb apart, the rubber band should be pulled tight.

4. Take duck #1 and set it on the rubber band. Did the duck fly? Record your results.

5. Then, take duck #2 and set it on the rubber band. Pull the duck back 4 cm and let go. Did the duck fly? Write down your observations in the chart.

6. Finally, take duck #3 and set it on the rubber band. Pull duck #3 back 8 cm and let go. Did the duck fly? Write down your observations in the chart.



STEP 4 Record and Reflect

DUCK	PULL	DID IT FLY?	OBSERVATIONS
1	0 cm	Yes or No	
2	4 cm	Yes or No	
3	8 cm	Yes or No	

1. Which duck flew the highest? Explain why some ducks flew higher than others. (**HINT:** *Think energy!*)

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2. Explain how pulling on a rubber band and potential energy are related. When did you see the most potential energy in the rubber band? (**HINT:** *Which "pull" did the duck fly highest?*)

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3. Using your knowledge of a rubber band and some flying ducks, explain how potential energy and kinetic energy work together. (**HINT:** *How did the ducks get their energy?*)

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Look around your classroom. What other things "work" with a combination of potential and kinetic energy?

THE BIG ASSIST

YOU MAKE THE CALL!

Everything we do, whether it's eating, running, reading, or even sleeping, requires energy. Each time something moves or grows, energy is involved. So, where does all this energy come from? And, after we are done with it, where does it go? Energy is a funny thing because we can't see or feel it, but we can see and feel the effects of energy after it has helped us do work. In order to understand this and the **Law of Conservation of Energy**, or energy transfer, all we need to do is to take a look at one of hockey's fundamentals - passing!

When the puck moves from one player to another, it's called passing. **Passing** is a skill that is more important than skating or shooting because when it's done well it leads to goals. Once another player receives a pass, they can choose to hold it or pass it off to another teammate. Hockey doesn't just recognize the goal scorer. It's a game that also awards an **assist** to the two players who passed the puck right before it was scored. All these players are recorded on a **scoring summary** which describes how a goal was scored, when it was scored, and the order of the players who contributed to the goal. Not quite sure how this works? Let's take a look at an official NHL scorecard below.

Using an official NHL scorecard, scoring summary, and roster, complete diagrams for the Anaheim Ducks goals that were scored against the New York Rangers on November 23rd, 2022.

NHL Scorecard

SCORING SUMMARY

	Goal	Period	Time	Team	Goal Scorer	Assist 1	Assist 2
	1	1	12:09	NYR	Barclay Goodrow	Vincent Trocheck	Chris Krieder
A	2	1	10:32	ANA	Mason McTavish	Dmitry Kulikov	Max Jones
B	3	2	19:41	ANA	Dmitry Kulikov	Adam Henrique	Cam Fowler
C	4	2	14:35	ANA	Troy Terry	Trevor Zegras	Maxime Comtois
	5	2	1:54	NYR	Braden Schneider	Mika Zibenejad	Artemi Panarin

Legend

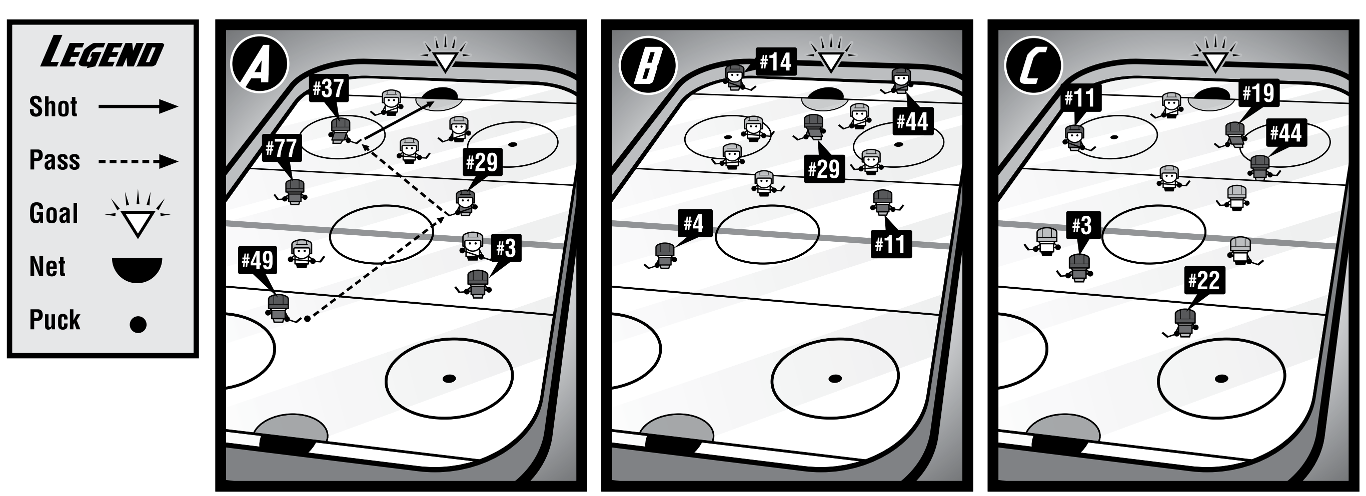
Goal Scorer – Player scoring the goal.

Assist 1 – The first assist is given to the player who made the pass to the goal scorer.

Assist 2 – The second assist is given to the player who made the pass to player who received the first assist.

Anaheim Ducks Roster

#	Player
3	John Klingberg
4	Cameron Fowler
5	Urho Vaakanainen
6	Jamie Drysdale
11	Trevor Zegras
13	Simon Benoit
14	Adam Henrique
16	Ryan Strome
19	Troy Terry
20	Brett Leason
21	Isac Lundestrom
22	Kevin Shattenkirk
28	Nathan Beaulieu
29	Dmitri Kulikov
33	Jakob Silfverberg
36	John Gibson
37	Mason McTavish
38	Derek Grant
40	Pavol Regenda
41	Anthony Stolarz
44	Maxime Comtois
45	Colton White
49	Max Jones
77	Frank Vatrano



PASS THE ENERGY PLEASE

Rube Goldberg (1883-1970) was a Pulitzer Prize winning cartoonist best known for his creative illustrations depicting complex contraptions that performed a simple task. He graduated from UC Berkeley with a degree in engineering. Soon after graduation and a brief stint designing sewer systems for the city of San Francisco, Goldberg went to work for a newspaper as a cartoonist. It was there that he began experimenting with two dimensional inventions with the ultimate purpose of making his audience laugh. His "machines" were wildly popular and soon the name Rube Goldberg was given to any intricate series of interactive devices that trapped a mouse, wiped clean a mustache, or a number of other normally ordinary everyday actions made complex by his cartoons.

Check it out!
To see some of Rube Goldberg's incredible designs and other machines that he has inspired, scan the QR code!

THE BIG ASSIST

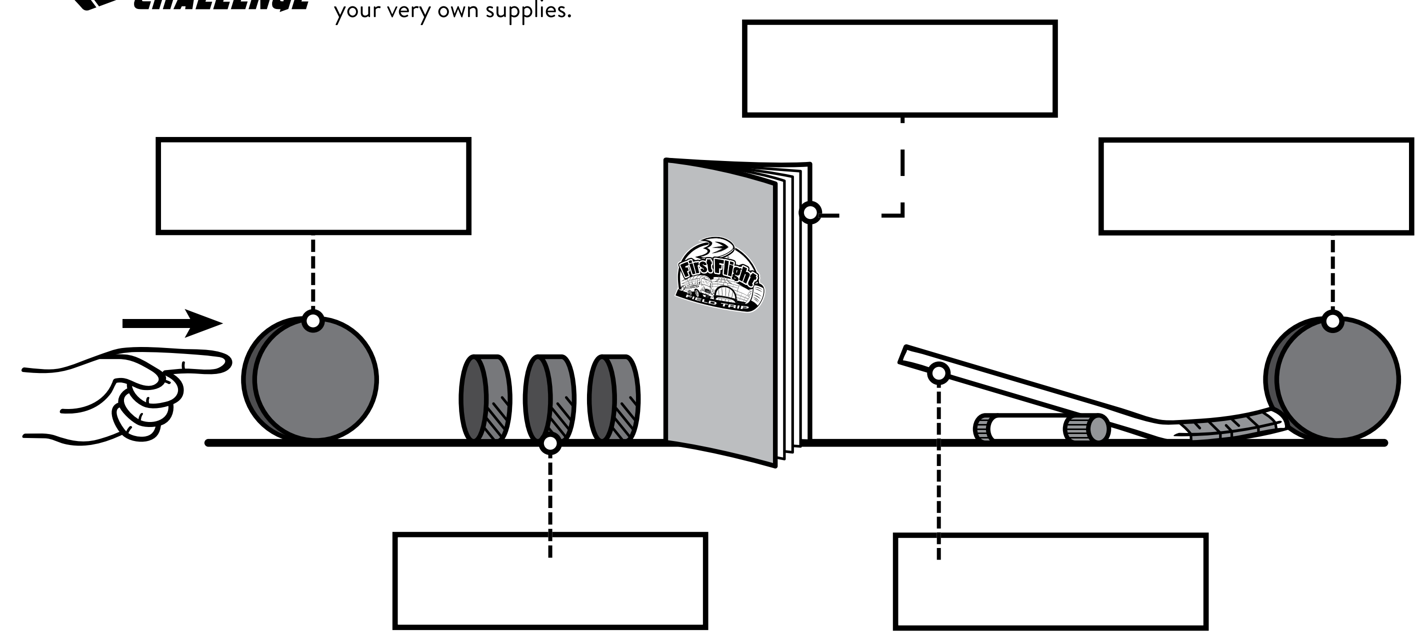
IT'S THE LAW

In the same way a player passes a puck, objects do the same when they pass energy to each other. All the energy present on Earth is here thanks to the Sun. And, the passing of energy has been going on since we received the first assist from our very own star. The transfer of energy can be explained through the **Law of Conservation of Energy**. It says we cannot create or destroy energy, only store and pass it from object to object. This might mean from stick to puck or in the case of a Rube Goldberg Machine™, anything your mind can dream up!

Remember, we can think of the energy transfer as a chain...a chain that can be traced all the way back to our sun. However, in order to get a better idea of how energy is transferred from object to object it is helpful to look at segments of that chain. For instance, the slapshot can be reduced down to three simple "transfers" of energy; player to stick, stick to puck, and hopefully...puck to the back of net, for the Ducks of course!

COACHES CHALLENGE

Take a look at the 5-step Rube Goldberg Machine™ that Wild Wing made. List the type of energy, potential or kinetic, in each of the blank boxes. Draw an asterisk (*) where energy will be transfered from object to object through the Law of Conservation of Energy. When you are done, replicate Wild Wing's machine with your very own supplies.



THE BIG ASSIST

THE WING MACHINE

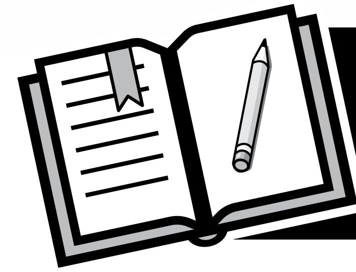
Wild Wing is known for helping "Turn Up The Energy" each night at Honda Center. That said, he knows the quickest way to get 17,000 people on their feet is an Anaheim Ducks goal. Wing wants to get in on the action by putting his new found knowledge of potential, kinetic, and the Law of Conservation of Energy to the test and he's going to need your help.

Using all the pucks and mini stick in your kit, create a 10-step Rube Goldberg Machine™ that scores a goal! Use creativity and the engineering process to help transfer that energy from your brain to the back of the net.

WING MACHINE

We want to see your creations! Share your photos and videos on social media using #**ducksfirstflight** or tag us on Instagram **@ducks_score**. We can't wait to see your projects and share them throughout the event on March 2nd!

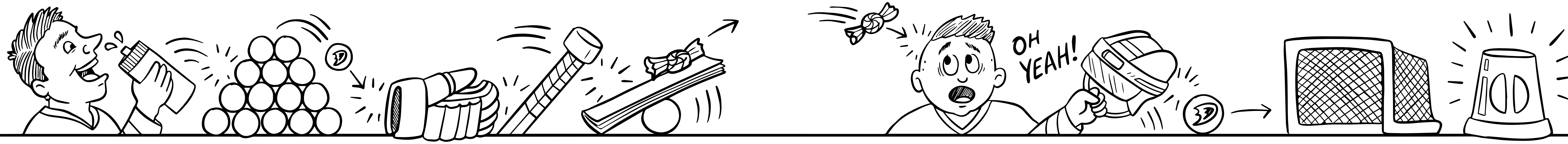
1. Gather items, including all three mini pucks, the foam puck, the regulation puck, the mini stick and other materials from your classroom or home.
2. Sketch the design for your machine in the space provided below.



When a plan fails, the Ducks and the coach don't hang their heads. They get to work! By examining what went wrong we can fix our mistakes and improve upon on our design. When one of your attempts fail, write down the cause and suggest a potential solution for the problem.

3. Label the parts of your Wing Machine that represent potential energy, kinetic energy, and the Law of Conservation of Energy (you can write LCE).
4. Build a physical prototype of your design with the materials you've gathered. You can do this alone but it's a lot more fun with friends or classmates.
5. Record your results. Keep track of your attempts, most importantly your failed passes.

The Coach knows the potential his players possess.
Whether it's putting in the right center to win the face-off, lining up the perfect defenseman for an explosive slap shot, or icing a keen-eyed forward to tip that blast, he knows it will take energy to accomplish their goal. Think of your materials like players with a job to do and engineer a solution!



RUBE GOLDBERG Machine Contest

DON'T STOP NOW!

There's another challenge waiting for you. Register for the Rube Goldberg Machine Contest at **rubegoldberg.com.**

WILD WINGERS KIDS CLUB

OFFICIAL SOUVENIR OF THE FIRST FLIGHT FIELD TRIP

FOR MORE INFORMATION, PLEASE CONTACT KIDSCLUB@ANAHEIMDUCKS.COM

TO ORDER, VISIT: ANAHEIMDUCKS.COM/FIRSTFLIGHTKIDSCLUB

THE ANAHEIM DUCKS WOULD LIKE TO THANK THE FOLLOWING

FOR THEIR SUPPORT OF THE FIRST FLIGHT FIELD TRIP

- Orange County Department of Education
- Rube Goldberg Machine Contest®
- Junior League of Orange County, California, Inc. — Women building better communities
- NHL · NHLPA Future Goals — Powered by EVERFI
- Keen Ramps
- California State University Fullerton
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- DiscoveryCube OC & LA — Part of the Discovery Science Foundation
- Warrior
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- County of Orange, California — OC Waste&Recycling — Our Community. Our Commitment.