2025 FIRST FLIGHT FIELD TRIP EDUCATIONAL CURRICULUM STANDARDS for "COOL LIKE ICE!" @ HONDA CENTER ON MARCH 3, 2025

****Please note that the workbook lessons listed below are still in development. There is a small possibility that they may be altered in the final/printed workbook.****

Theme: "Cool Like Ice" will get your students thinking about the very thing that makes Anaheim Ducks hockey possible. It's the ice! While it's a common part of our everyday life, ice is still a mysterious object for many of us. What makes it cold and slippery to the touch? How does it transform into its solid state? These are some of the questions that ice engineers need to answer as they create and maintain playing surfaces at arenas around the world... including Honda Center.

The First Flight Field Trip will place your students in the role of ice engineer. Using their official workbook, they will embark on a five-lesson journey to understand ice and its amazing properties. Each lesson will introduce "ice-inspired" educational concepts reinforced with fun and engaging student activities. By the end of the fifth lesson, students will have created, decorated, and maintained their own miniature ice rink using the same process a Honda Center ice engineer employs when preparing the rink for the Ducks. After completing the workbook, the First Flight Field Trip event will provide students access to an exciting exhibits area and live demonstrations from Ducks players while reinforcing concepts from the workbook. " Cool Like Ice" will help your students gain an appreciation for ice and discover how great an engineering achievement making an ice rink really is.

Science and Engineering Practices ("Habits of Mind"): The use of technology provides many challenges to both students and teachers due to the diversity of educational standards, computer experience, and access to technology. However, we believe that this curriculum will offer tremendous educational benefit that aligns to the Next Generation Science Standards and the STEM (or STEAM) movement. This field trip will lean heavily on scientific and engineering practices, also known as "habits of mind" (see Appendix A). Students will be placed in situations where they will use the same strategies as an engineer or scientist to answer (or even ask) the essential questions posed by the First Flight Field Trip theme and engage in the disciplinary core ideas covered in each lesson.

LESSON #1: "COOL LIKE ICE"

Objective: This lesson will introduce the Honda Center ice engineer and the challenges this person faces each day, especially in Southern California, to create and maintain a high-quality ice surface for an NHL game. Students will be given the title of ice engineer and the task of creating their own ice rink. They will encounter the same fundamental challenges as a Honda Center ice engineer such as maintaining ice strength, circumventing the properties of heat transfer, and minimizing the friction force that negatively impacts a hockey game.

- Definition of thermodynamics as the study of heat, temperature, and energy
- Impact of thermodynamics on everyday life and activities such as hockey
- The role of an ice engineer who utilizes the concepts of heat and temperature to create a playing surface for the Anaheim Ducks
- The engineering design process as a model for problem solving

LESSON #2: "STATE THAT MATTERS"

Objective: Understanding the science behind the transformation of a liquid, such as water, into a solid is the first step ice engineers must know before laying the foundation of a hockey rink. Students are introduced to the states of matter (liquid, solid, and gas) and their physical and molecular properties. The way molecules move within an object determines whether it is a liquid, solid, or gas. The molecules in a solid are sedentary (do not move much), liquid are active, and gas are vigorously active. Just as people, like Anaheim Ducks players, generate heat when they move; molecules also behave in a similar fashion. Students will conclude that liquid objects turn back to a solid state when heat is lost as molecules slow down to a sedentary state.

Educational Topics Covered:
- Definition of matter and its three common states (liquid, solid, and gas)
- Subatomic particles such as atoms and the molecules they form
- Heat is generated through movement as energy is conserved

LESSON #3: "BEAT THE HEAT (TRANSFER)"

Objective: Today, ice engineers have many advanced tools to help them transform water into ice. But even with all this technology, the basic laws of thermodynamics still apply as heat tries to undo the work of creating a perfect ice rink for the Ducks. Students will be introduced to concepts like freezing and boiling point of water, and the attributes of heat. Heat, as stated by the 2nd Law of Thermodynamics, naturally flows from warmer objects to cooler objects until all objects are the same temperature. These principles can best be seen during the activity of making ice cream. Students will transfer the heat between two objects, a dairy-based mixture and a salt-ice mixture. By placing the bag of a dairy-based mix into a bag containing salt and ice, it will eventually turn into a sweet treat thanks to the property of heat transfer. The science used to make ice cream in this manner is very much like the method that is used to freeze the ice surface at Honda Center.

Educational Topics Covered:
- Definition of the words "heat" and "cold"
- Introduction of thermodynamics regarding heat transfer and between objects
- Principles of freezing point and boiling point of water
- The effect that a typical household item such as salt when combined with ice changes its properties for fun applications such as making ice cream

LESSON #4: "BENEATH THE SURFACE"

Objective: There are many reasons ice engineers focus on ice clarity when creating their playing surface for hockey. Ice clarity is great for hockey fans because it allows spectators in-arena and on television to see all the lines, spots, and circles that are painted underneath the top layers of ice. Also, ice clarity is the indicator for ice strength. This attribute is important because the ice rink must endure all the weight and physical play from the world's best hockey players. Students will learn the same tactics that ice engineers use when creating their own miniature ice rink. They will use a special type of water and apply a "slow freeze" to yield the clearest ice possible. This process will force students to engineer and re-engineer their rink based on the key findings they receive from previous builds.

Educational Topics Covered:
- Factors that affect ice clarity such as time to freeze and directional "slow" freezing
- The physics of light reflection off an object
- Geometry terms and calculations for concepts such as area and perimeter

LESSON #5: "SLIDE SCIENCE"

Objective: There are many challenges that ice engineers face when creating and maintaining an ice rink, but the most difficult challenge is repairing, or resurfacing, the ice during the intermission of a hockey game. The quality of the ice surface is important for hockey players because it allows them to play the game at a fast pace. Ice has a "quasi" layer on its surface that makes it almost frictionless. This characteristic of ice allows a hockey puck or skate blade to slide quickly on it. However, after each period of play, the ice surface quality deteriorates from the starting and stopping motions from hockey players. Students will learn how ice engineers restore the ice back to its slippery state by simulating this process using the ice rink that was created in lesson 4. Students will slide everyday objects across the smooth ice surface. Then, they will rough up their rink and slide the same objects across it.

Educational Topics Covered:

- The concept of force including friction, a force that opposes motion
- Effect that friction has on various objects

NEXT GENERATION SCIENCE STANDARDS

The workbook relates to the following Next Generation Science Standards that were adopted by the California Department of Education (CDE) in 2013.

Grade 3

3-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- *3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object*
- *3-PS2-2.*
- *Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion*

3-ESS2 EARTH'S SYSTEMS

- 3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

K-ESS3 EARTH AND HUMAN ACTIVITY

- K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

Grade 4

4-PS3 ENERGY

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another

4-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Grade 5

5-PS1 MATTER AND ITS INTERACTIONS

5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen
5-PS1-3. Make observations and measurements to identify materials based on their properties.
5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

5-PS3 ENERGY

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun

3-5-ETS1 ENGINEERING DESIGN

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Grade 6

MS-PS1 MATTER AND ITS INTERACTIONS

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
*MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. **

COMMON CORE STATE STANDARDS FOR MATHEMATICS

Grade 3

3.MD Measurement and Data

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

5. Recognize area as an attribute of plane figures and understand concepts of area measurement.
    a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.
    b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.
6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
7. Relate area to the operations of multiplication and addition.
    a. Find the area of a rectangle with whole-number side lengths by tiling it and show that the area is the same as would be found by multiplying the side lengths.
    b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems and represent whole-number products as rectangular areas in mathematical reasoning.
    c. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems.

Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

8. Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Grade 4

4.G Geometry

Draw and identify lines and angles and classify shapes by properties of their lines and angles.

1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles. (Two-dimensional shapes should include special triangles, e.g., equilateral, isosceles, scalene, and special quadrilaterals, e.g., rhombus, square, rectangle, parallelogram, trapezoid.)
3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Grade 5

5.MD Measurement and Data

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
   a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.
4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
5. Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume.
   a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
   b. Apply the formulas V = l x w x h and V = b x h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
   c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.

5.G Geometry

Classify two-dimensional figures into categories based on their properties.

3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.

Grade 6

6.RP Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems.

1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
2. Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0 and use rate language in the context of a ratio relationship.
3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
   a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
   c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
   d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

HEALTH EDUCATION CONTENT STANDARDS

Grade 3

Standard 7: Practicing Health-Enhancing Behaviors

7.1.G Determine behaviors that promote healthy growth and development

Grade 4

Standard 1: Essential Concepts

1.1.N Identify and define key nutrients and their functions.

1.6.N Explain the importance of drinking plenty of water, especially during vigorous physical activity.
1.7.N Describe the benefits of moderate and vigorous physical activity.
1.8.N Identify ways to increase and monitor physical activity.

Standard 5: Decision Making
5.2.N Describe how to use a decision-making process to select healthy options for physical activity.

Standard 7: Practicing Health-Enhancing Behaviors
7.4.N Practice how to take personal responsibility for engaging in physical activity.

VISUAL ARTS CONTENT STANDARDS

Grade 3

Standard 2.0: Creative Expression - Creating, Performing, and Participating in the Visual Arts
Communication and Expression through Original Works of Art
2.4 Create a work of art based on the observation of objects and scenes in daily life, emphasizing value changes.

Grade 4

Standard 2.0: Creative Expression - Creating, Performing, and Participating in the Visual Arts
Communication and Expression through Original Works of Art
2.5 Use accurate proportions to create an expressive portrait or a figure drawing or painting.

Grade 5

Standard 5.0: Connections, Relationships, Applications – Connecting and Applying What Is Learned in the Visual Arts to Other Art Forms and Subject Areas and to Careers
Visual Arts-Visual Literacy
5.2 Identify and design icons, logos, and other graphic devices as symbols for ideas and information.

Grade 6

Standard 5.0: Connections, Relationships, Applications - Connecting and Applying What Is Learned in the Visual Arts to Other Art Forms and Subject Areas and to Careers
Careers and Career-Related Skills
5.5 Establish criteria to use in selecting works of art for a specific type of art exhibition.

2025 First Flight Field Trip: Appendix A

Scientific and Engineering Practices	
Asking Questions & Defining Problems	
A basic practice of the **scientist** is the ability to formulate empirically answerable questions about phenomena to establish what is already known, and to determine what questions have yet to be satisfactorily answered.	**Engineering** begins with a problems that needs to be solved, such as “How can we reduce the nation’s dependence on fossil fuels?” or “What can be done to reduce a particular disease?” or “How can we improve the fuel efficiency of automobiles?”
Developing & Using Models	
Science often involves the construction of models and simulations to help develop explanations about natural phenomena.	**Engineering** makes use of models and simulations to analyze systems to identify flaws that might occur or to test possible solutions to a new problem.
Planning & Carrying Out Investigations	
A major practice of **scientists** is planning and carrying out systematic scientific investigations that require identifying variables and clarifying what counts as data.	**Engineering** investigations are conducted to gain data essential for specifying criteria or parameters and to test propose designs.
Analyzing & Interpreting Data	
Scientific investigations produce data that must be analyzed to derive meaning. Scientists use a range of tools to identify significant features and patterns in data.	**Engineering** investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria.
Using Mathematics, Information and Computer Technology, and Computations Thinking	
In **science**, mathematics and computation are fundamental tools for representing physical variables and their relationships.	In **engineering**, mathematical and computational representations of established relationships and principles are an integral part of the design process.
Constructing Explanations & Designing Solutions	
The goal of **science** is the construction of theories that provide explanatory accounts of the material world.	The goal of **engineering** design is a systematic approach to solving engineering problems that is based on scientific knowledge and models of the material world.
Engaging in Argument From Evidence	
In **science**, reasoning and argument are essential for clarifying strengths and weaknesses of a line of evidence and for identifying the best explanation for a natural phenomenon.	In **engineering**, reasoning and argument are essential for finding the best solution to a problem. Engineers collaborate with their peers throughout the design process.
Obtaining, Evaluating, and Communicating Information	
Science cannot advance if scientists are unable to communicate their findings clearly and persuasively or learn from the finding of others.	**Engineering** cannot produce new or improved technologies if the advantages of their deigns are not communicated clearly and persuasively.

This chart is from the NSTA Reader's Guide to A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas
Author: Harold Pratt
The guide can be downloaded as a free e-book
PLEASE NOTE: For in-depth study of the "practices" go to Chapter Three in the Framework