Students complete Grade 8 Science Standards for Understanding Structures and Mechanisms.

Unit	Hours
Starting with Workforce Skills	5
Building and Programming a Basic Robot	10
Designing for the Game	5
Machines and Mechanisms	10
Iteration and Redesign, I	5
Industry 4.0 and Your Community	5
Project Sprints and Competition	5

Note: The curriculum is designed to provide students with a two-eyed seeing approach to learning. Online content provides the knowledge base or Western science approach to provided content necessary to do experimentation. The team activities in each unit provide more of the Indigenous approach to the discovery of learning through doing. Each module contains lessons with standards aligned content that then is put into practice in team activities applying the content in the online curriculum.
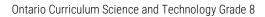
Starting with Workforce Skills

Lesson Outcomes	Strand	Specific Expectations	Addressed
Core Values Lesson 1 - Explore *FIRST* Core Values and their relationship to developing teamwork. - Understand the importance of *Gracious Professionalism®* and *Coopertition®*. - Develop a team identity and use it for communicating expectations as a team using *FIRST* Core Values and *Gracious Professionalism*. - Utilize *Engineering Notebook* templates to improve written communication as a team while practicing discovery and innovation.	STEM Skills and Connections	**A1.2** use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	x
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related field	X
	Understanding Structures and Mechanisms	**C1.1** assess the social, economic, and environmental impacts of automating systems	X
		C1.2 assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration	X
Project Management Lesson 2 - Explore how to make what you learn more impactful. -Understand the tools available for project management. - Turn expectations into the goals you would like to accomplish. -Determine the tools and methods your team will use to manage a project. - Develop a safety plan for your team.	STEM Skills and Connections	**A1.4** follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
	Structures and Mechanisms	**C1.1** assess the social, economic, and environmental impacts of automating systems	X
		C1.2 assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration	X
Problem Solving Skills Lesson 3	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X

- Discover the engineering design process and tools for computational thinking. -Understand how computational thinking tools can help you improve the engineering design process. - Turn expectations into the goals you would like to accomplish. - Use engineering design and computational thinking to solve a design problem. -Use computational thinking in the testing process to improve iterations in the design cycle.		**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	x
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	x
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	x
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	
	Structures and Mechanisms	**C2.3** identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	x

Building and Programming A Basic Robot

Lesson Outcomes	Strand	Specific Expectations	Addressed
Inside a Robot Lesson 1 - Discover what robot is and how are they used in industry. - Discover the parts of a *FIRST* Tech Challenge robot and how its technology is transferrable to the workforce. - Decompose a robot into how it can plan, sense, and act and the relationship of its systems and distinctions that allow it to achieve a task. - Develop design criteria for your robot using the Engineering Design Process.	STEM Skills and Connections	**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	x
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	x
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	x
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	x
	Structures and Mechanisms	**C1.1** assess the social, economic, and environmental impacts of automating systems	x
		C1.2 assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration	x
		C2.1 identify various types of systems	x
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
		C2.10 identify social factors that influence the evolution of a system	X
Chassis and Drive System Lesson 2 - Discover different types of chassis configurations and how they achieve different functions. - Discover principles of speed, torque, the center of gravity, and structural integrity. - Experiment with principles of chassis speed, torque, and center of gravity using the robot physics lab. - Use understanding the problem, brainstorming, and decision-making to determine a chassis design.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
	STEM Skills and Connections	**A1.4** follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X

- Build a robot chassis that best meets your design criteria.		**A3.3** explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
	Structures and Mechanisms	**C1.2** assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration	X
		C2.1 identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
		C2.10 identify social factors that influence the evolution of a system	X
Electrical Wiring and Configuration Lesson 3 - Explore basic electrical theory and its importance in wiring the robot. - Decompose the robot hardware and its importance in robot communication. - Wire a robot using a wiring diagram and preventative measures to limit electrostatic discharge on the robot. - Establish wireless communication pathways between the robot and the robot controller. - Configure the hardware according to the electrical diagram using consistent naming conventions. - Use a given template in the IDE to test configuration and wiring.	STEM Skills and Connections	**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	x
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
	Grade 6 Science Matter and Energy	**D2.1** explain commonly observed electrostatic phenomena, using the principles of static electricity	X
		D2.2 describe dynamic electricity, and compare and contrast dynamic electricity with static electricity	X
		D2.3 identify materials that are good conductors of electric current and materials that are good insulators	X
		D2.4 describe how technologies transform various forms of energy into electrical energy	X
		D2.5 describe ways in which electrical energy is transformed into other forms of energy	X
		D2.6 explain the functions of the components of a simple electrical circuit	x
Programming Lesson 4		**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X

FIRST EDUCATION

FIRST TECH CHALLENGE

- Apply computational thinking to plan algorithms using pseudocode and flow charts. -Develop algorithms to control motors, servos, and sensors with increased program flow. -Learn how abstraction occurs in programming tools and how it can help you troubleshoot and understand problems. - Use programming templates to program your robot in Driver Controlled Mode. - Develop a basic algorithm for autonomous programming: drive and park.	STEM Skills and Connections	**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	x
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	x
	Structures and Mechanisms	**C2.2** describe the purpose, inputs, and outputs of various systems, including systems related to food processing	x
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	x
Manipulators Lesson 5 **-** Explore what a manipulator is. - Understand how to choose an actuator. - Choose an actuator to complete a task. - Use a gear ratio to affect torque and speed to achieve a task. - Utilize Engineering Notebook Templates to improve written communication as a team.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
	Structures and Mechanisms	**C2.4** use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	x
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F × \Delta d$)	x
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	x

Designing for the Game

Lesson Outcomes	Strand	Specific Expectations	Addressed
Game Plan Lesson 1 -Explore the components of a FIRST® Tech Challenge Game. - Understand where to find details that are abstracted in the Game Rules. - Explore details of the game using measurements and algorithms. - Brainstorm ideas for competing in the game. - Use a decision matrix to determine a game plan	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
Robot Plan Lesson 2 - Brainstorm ideas to achieve the robot actions determined in your game strategy. - Research ideas to understand processes others have used to achieve similar strategies. -Use the physics lab to test out ideas to achieve the game strategy. - Develop prototypes from the ideas. -Test prototypes to gain an understanding of system development that will be needed to achieve the game strategy	Understanding Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
Game Challenges		*- These are specific to other expectations covered in other lessons.*	X

Machines and Mechanisms

Lesson Outcomes	Strand	Specific Expectations	Addressed
Simple Machines Lesson 1 - Explore simple and compound machines and how they are used in robot manipulators. - Understand how forces transfer to motion and increase machine efficiency. - Consider the scalar and vector forces that affect how manipulators accomplish work. - Design a manipulator, and analyze the forces involved. Include essential calculations of the manipulator to achieve the desired output. *** In this unit students use the fundamentals of simple machines to and then to develop more complex machines. The remaining lessons and standards covered are based upon student choice of mechanisms in their robot design.* *** It contains physics labs for students to conduct analysis to fully understand the work, force, displacement and mechanical aspects of mechanical advantage. Teachers will need to use the graphs in the simulation to demonstrate the point where energy is not efficiently used in relation to mechanical advantage.*	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	
Levers, Cams and Linkages Lesson 2 - Explore ways you can transform motion and develop mechanisms with linkages and cams. - Understand degrees of freedom and geometry when designing mechanisms that involve linkages.	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X

-Discover linkages from history and how they are used to transform motion. - Analyze your team game strategy and robot and determine if linkages and cams can increase the efficiency of your robot. - Prototype linkages and cams that could help you achieve your game strategy.		**C2.5** explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
		C2.10 identify social factors that influence the evolution of a system	X
Conveyance, Intakes, and Object Trajectory **Lesson 3** - Explore how machines and mechanisms in the industry gather objects and understand important design principles to an intake mechanism. - Discover design principles needed for intake or shooting systems. - Explore ways to use the REV parts to develop intakes and shooters. - Explore ways to expand your kit of parts with 3D printing and other supplies you might have access to. - Experiment with trajectory, speed, and velocity to propel objects.	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	x
Linear Motion Lesson 4 - Know how to calculate mechanical advantage for a pulley system. - Apply your knowledge of calculating speed to a pulley system. - Gain a better understanding of how to design linear slides and pulley systems. - Understand different ways of achieving linear motion through worm gears and rack and pinions.	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X

		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X

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Improving through Iteration I

Lesson Outcomes	Strand	Specific Expectations	Addressed
Iteration and the Product Life Cycle **Lesson 1** - Explore problem-solving strategies such as improving reliability, functionality, and craftsmanship. - Explore how increasing the functionality and optimality of a design can increase reliability. - Use design criteria to evaluate project needs and priorities for improvement. - Understand productive struggle and the product life cycle and its effect on the design and iteration process. - Use design criteria and project management to make robot improvements and track those improvements.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
Mechanism Improvement Lesson 2 - Explore machines that operate with reliability and precision. - Research ways that other mechanisms in the industry complete similar tasks. - Identify the shortest path for the object to be transported from point A to point B. - Prototype and improve your mechanism design. ** *Students should use the physics labs test, explain and defend their improvements to their design.*	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
Algorithm Improvement Lesson 3 -Explore the steps to add hardware and what data is needed for the hardware.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X

- Identify the data needed for the added hardware and how the data will need to be processed to achieve additional functionality.		**A1.4** follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
- Use the engineering design process to understand what will be needed from an algorithm standpoint to add functionality to the robot		**A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
Have students utilize FTC sims activities:		**A2.2** identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	x

Project Sprints and Competition

Lesson Outcomes	Strand	Specific Expectations	Addressed
Conducting a Project Management Sprint Lesson 1 - Understand and apply the process of a project management sprint. - Use a time crunch with deadlines to tackle many tasks quickly. - Identify priorities for completion. - Monitor and ensure that we make progress. - Use workforce skills to prepare for our competition day.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
	Structures and Mechanisms	**C2.2** describe the purpose, inputs, and outputs of various systems, including systems related to food processing	x
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F × \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	X
Communication and Presentation Lesson 2 - Explore presentation elements including an elevator pitch, business pitch, and bringing an idea to an audience. - Explore things you should and shouldn't do in a presentation. - Understand how to identify your strengths and weaknesses. - Explore ways to communicate about strengths and weaknesses. - Develop and present your team to an audience.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
Learning Portfolio Lesson 3 -Identify and communicate about your career and technical skills using your strengths. - Develop a portfolio that demonstrates the skills you have acquired in the course. - Gain feedback from your team on how well you have communicated your skills.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X

		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
	Structures and Mechanisms	**C2.2** describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	X

Industry 4.0 and Your Community

Lesson Outcomes	Strand	Specific Expectations	Addressed
Industry 4.0 and Your Robot **Lesson 1** - Understand Industry 4.0 technology and where I can find it in my daily life. - Discover big data and how it influences the ability to increase innovation. - Discover the Internet of Things and how it could change your future career. - Understand what artificial intelligence and machine learning are and how they apply to your robot. - Consider how you could use augmented reality to improve your own education and collaboration on your robot. ***This unit can be supplemented with any specific regional innovations and contributions that would exist in Canada.* *** To fully cover C2.2 you could include prompts have students research how Industry 4.0 is used in then food industry.*	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	x
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	X
	Structures and Mechanisms	**C1.1** assess the social, economic, and environmental impacts of automating systems	X
		C1.2 assess the impact on individuals, society, and the environment of alternative ways of meeting needs that are currently met by existing systems, taking different points of view into consideration	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	X
Industry 4.0 and Your Community **Lesson 2** - Explore audiences to share your impact with. - Brainstorm the best method to share your learning in your community. - Develop a project management plan for sharing your learning.	STEM Skills and Connections	**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X

		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	
Community Impact Project - Explore ethical concerns around Industry 4.0. - Explore ways you can make an impact on others. - Develop a plan to make an impact in your community through a project, awareness, or education of Industry 4.0 and the future. **** Additional expectations from other strands may be included as the focus of the project.**	STEM Skills and Connections ***** Additional Strands may be covered**	**A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	

Sensors, Machine Learning, and Java

Lesson Outcomes	Strand	Specific Expectations	Addressed
Sensors and Feedback Lesson 1 - Understand touch, color, and encoder capabilities for providing feedback to the robot. - Decompose sensor data to determine how it collects and receives data. - Develop algorithmic thinking through utilizing Boolean data, program flow, and decisions to improve the robot. - Utilize decision trees to understand program flow and decisions that are made. - Develop a robot program that includes increased program flow with compound Boolean data, operators, and functions. FTC Sims: Sensors ** Color sensors reinforce Grade 4 Matter and Energy standards utilizing light and wavelengths of light.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	x
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	X
	Structures and Mechanisms	**C2.7** identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	
Developing Functions and States Lesson 2 - Explore the machine states and how they provide feedback for robot control.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X

- Explore ways of creating abstraction in code through functions. - Use the robot Inertial Measurement Unit to improve robot navigation through functions. - Consider autonomous states of your robot and use abstraction to create functions using states for an autonomous program FTC Sims Movement; Half- Moon		**A1.4** follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	
	Structures and Mechanisms	**C2.1** identify various types of systems	
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	
Developing Robot Machine Learning Lesson 3 - Explore decision trees and how they help a robot make decisions. - Understand what machine learning is and the process used to develop machine learning modules. - Discover the prebuilt machine learning models using TensorFlow and Vuforia. - Decompose a machine learning template and use it to perform robot actions.	Structures and Mechanisms	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X

Cont. Developing Robot Machine Learning		**A2.1** write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	X
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	X
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	X
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	X
Object-Oriented Programming Lesson 3 - Explore how to enable Java to compare your Blocks programs to Java programs. - Explore the syntax of Java programming. - Discover Java as an object-oriented programming environment. - Discover the Java code repository to explore inheritance, classes, methods, and objects. - Use tutorials to develop Java programs for creating an op mode and programming a motor and a sensor. **FTC Sims have students create their code in FTC Sims and the Override it with OnBot Java.**	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
		A3.1 describe practical applications of science and technology concepts in skilled trades and various occupations and how these applications address real-world problems	
		A3.2 investigate how science and technology can be used with other subject areas to address real-world problems	
		A3.3 explore real-world issues by connecting Indigenous sciences and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach	
		A3.4 investigate contributions that people from diverse and intersecting backgrounds, cultures, and lived experiences – such as First Nations, Métis, and Inuit; Black and other racialized communities; women; people with disabilities; 2SLGBTQIA+ communities – have made to STEM-related fields	

Improving through Iteration II			
Lesson Outcomes	**Strand**	**Specific Expectations**	**Addressed**
Mechanism Improvement Lesson 1 - Explore the path the game object is taking. - Study the physics behind the design. - Research additional manufacturer ways of improving the use of materials. - Consider better fabrication of the design. - Prototype and improve your mechanism design.	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	x
Algorithm Improvement Lesson 2 - Explore the steps to add additional hardware and data needed for the hardware. - Identify the data needed for additional hardware and how the data will need to be processed to achieve additional functionality. - Use the engineering design process to understand what will be needed from an algorithm standpoint to add functionality to the robot.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	x
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	x
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
Conducting a Project Management Sprint Lesson 3 - Understand and apply the process of a project management sprint. - Use a time crunch with deadlines to tackle many tasks quickly. - Identify priorities for completion. - Monitor and ensure that we make progress.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials	X

- Use workforce skills to prepare for our competition day.		**A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.1 write and execute code in investigations and when modelling concepts, with a focus on automating large systems in action	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
	Structures and Mechanisms	**C2.1** identify various types of systems	X
		C2.2 describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.3 identify the various processes and components of a system that allow it to perform its function efficiently and safely	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	X
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F \times \Delta d$)	X
		C2.6 analyse the mechanical advantage of various mechanical systems, including simple machines, by considering the relationship between input forces and output forces	X
		C2.7 identify ways in which energy can dissipate from mechanical systems, and describe technological innovations that make these systems more efficient	X
		C2.9 describe technological innovations involving mechanical systems that have increased productivity in various industries	x

Learning Pathways and Career Exploration

Lesson Outcomes	Strand	Specific Expectations	Addressed
Learning Pathways Lesson 1 - Explore team roles on a *FIRST*® competitive team and their correlation to jobs in different industries. - Learn the benefits of being on a competitive team that can advance regionally and internationally. -Identify how opportunities on a competitive team can help you achieve scholarships, internships, and industry credentials.			
Résumé Lesson 2 -Understand the principles of writing a good résumé. -Understand the difference between an entry-level résumé and a professional résumé. - Build your own résumé that demonstrates the impact you make with your workforce and technical skills.			
Learning Portfolio Lesson 3 -Identify and communicate about your career and technical skills using your strengths. - Develop a portfolio that demonstrates the skills you have acquired in the course. - Gain feedback from your team on how well you have communicated your skills.	STEM Skills and Connections	**A1.1** use a scientific research process and associated skills to conduct investigations	X
		A1.2 use a scientific experimentation process and associated skills to conduct investigations	X
		A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems	X
		A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes	X
		A2.2 identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades	X
	Structures and Mechanisms	**C2.2** describe the purpose, inputs, and outputs of various systems, including systems related to food processing	X
		C2.4 use the scientific terms *displacement*, *force*, *work*, *energy*, and *efficiency* to describe everyday experiences	
		C2.5 explain the relationships between work, force, and displacement in simple systems, including describing the conditions that are required for work to be done, and calculate work using the formula work = force × displacement ($W = F × \Delta d$)	
		C2.8 explain how providing information and support to consumers helps to ensure that the systems they use run safely and efficiently	X