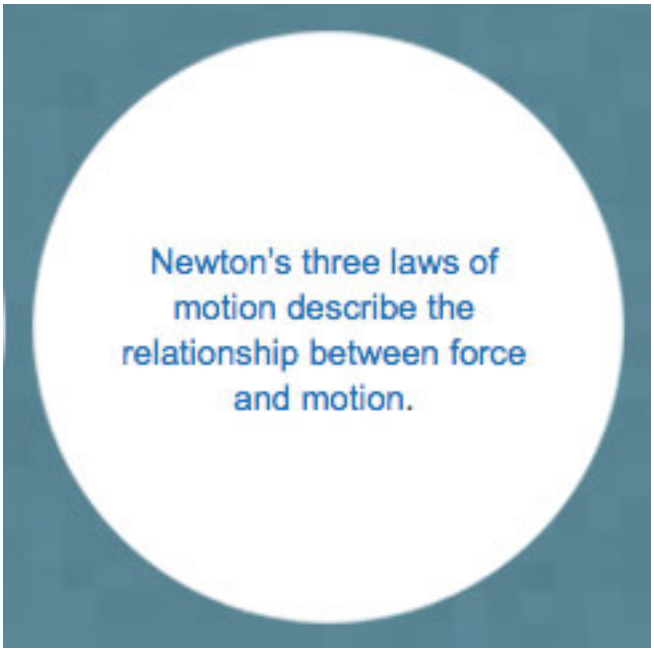
Physics

Grade 6

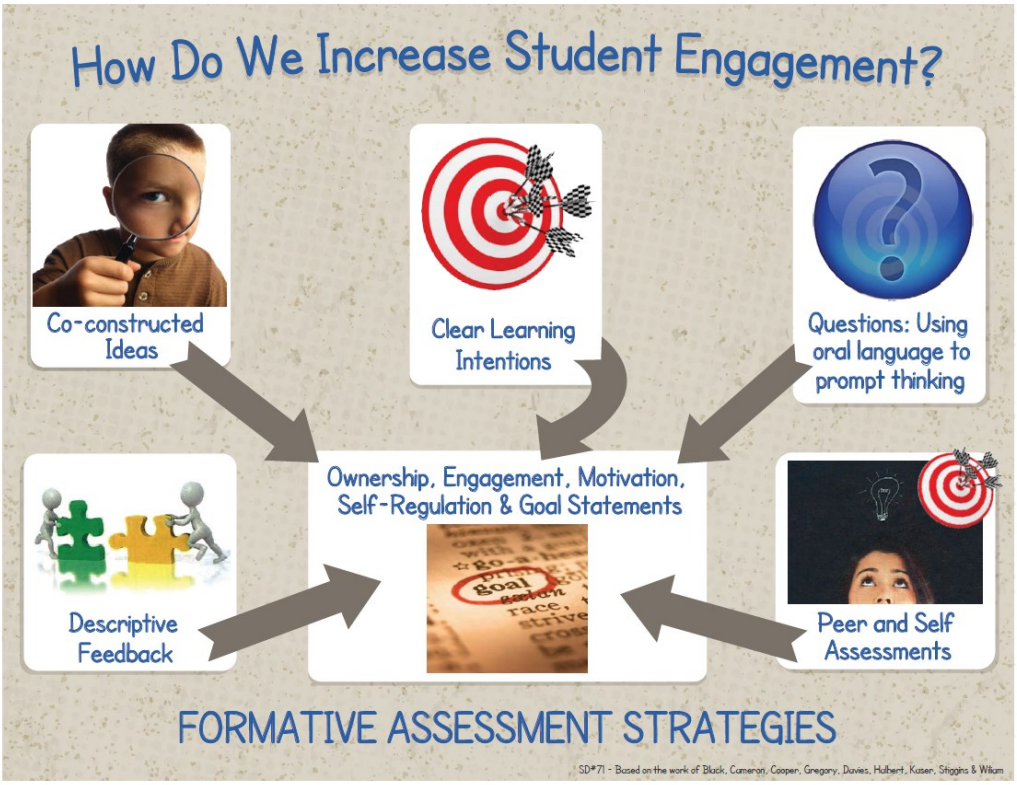
Grade 6 Science - Physics

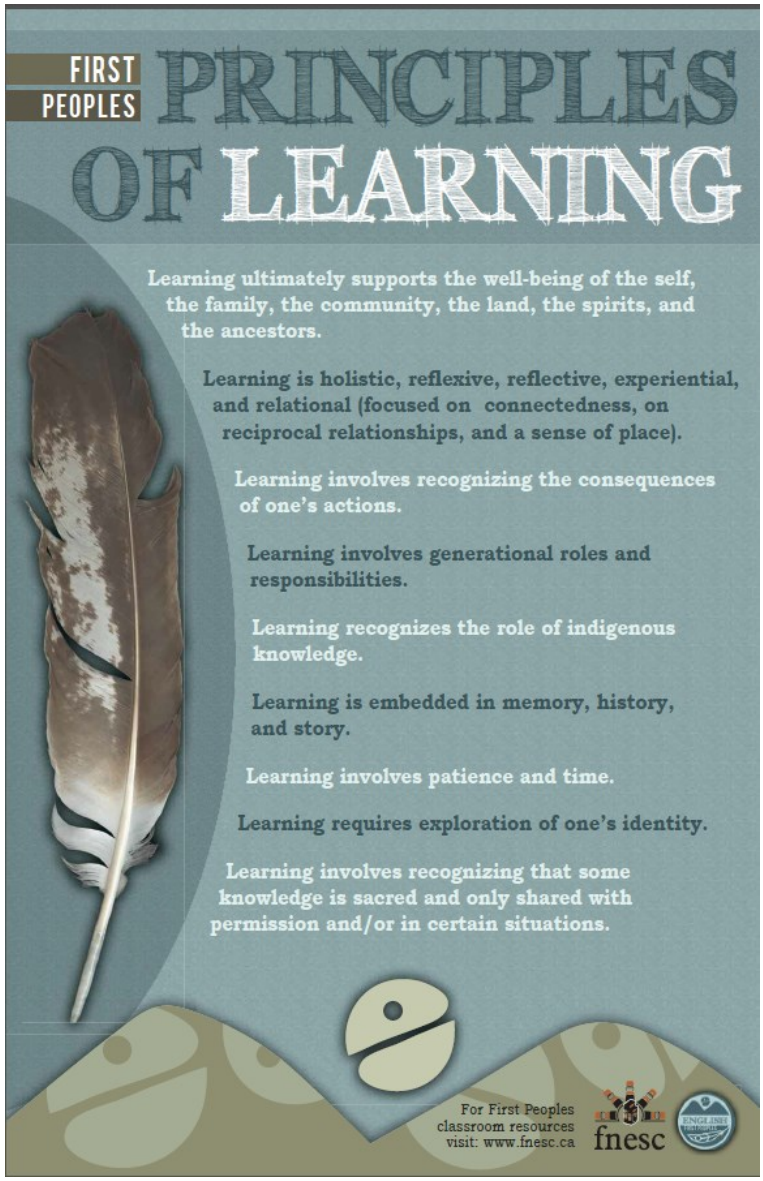
Big Idea



Content

- Newton's three laws of motion
- effects of balanced and unbalanced forces in daily physical activities
- force of gravity


How Do We Increase Student Engagement?
Co-constructed Ideas
Clear Learning Intentions
Questions: Using oral language to prompt thinking
Ownership, Engagement, Motivation, Self-Regulation & Goal Statements
Descriptive Feedback
Peer and Self Assessments
FORMATIVE ASSESSMENT STRATEGIES
SD#71 - Based on the work of Black, Cameron, Cooper, Gregory, Davies, Hulbert, Kaser, Stiggins & Wiliam


FIRST PEOPLES
PRINCIPLES OF LEARNING
Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
Learning involves recognizing the consequences of one's actions.
Learning involves generational roles and responsibilities.
Learning recognizes the role of indigenous knowledge.
Learning is embedded in memory, history, and story.
Learning involves patience and time.
Learning requires exploration of one's identity.
Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.
For First Peoples classroom resources visit: www.fnesc.ca
fnesc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A framework for Inquiry

Significant Content: A focus on important knowledge and concepts derived from standards. Students should find the content to be significant in terms of their own lives and interests.

A need to Know: Activate learner curiosity. Engage student interest and initiate questioning with an entry event: this could be a story, a video clip, a photograph...

A Driving Question: A question that captures the heart of the inquiry in clear, compelling language, giving students a sense of purpose and challenge.

Authentic Purpose: Establishing an authentic purpose for the tasks we invite our learners to explore, enriches learning opportunities.

Voice and Choice: Guided by the teacher, learners have voice and choice in terms of design, what resources they will use and how they structure their time.

Revision and reflection: Learners go through a process of seeking feedback from their peers to think in-depth about their inquiry. Students learn that revision and reflection are frequent features of real-world work.

In-depth Inquiry: Learners follow a trail that begins with their own questions, leading to a search for resources and the discovery of answers and ultimately leads to generating new questions, testing ideas and drawing their own conclusions.

21st Century Competencies: Collaboration, communication, creativity, critical thinking, problem solving and social responsibility.

Adapted from: *Larmer, J. & Mergendoller, J. (2012). 8 essentials for project-based learning. Originally published in 2010 in Educational Leadership, 68(1), 34.*

Teaching Science:

The Art of our Professional Practice

Core competencies are at the centre of the redesigned curriculum. We invite you to look to the competencies and what we know as wise practice (AFL, inquiry, Aboriginal Ways of Knowing) to artfully design learning opportunities for our students.

This science kit was created by SD 71 educators. Within these pages you will find hands-on experiments, activities, lesson ideas, web links, and place-based experiences to engage the curiosity of our learners.

Curriculum Model

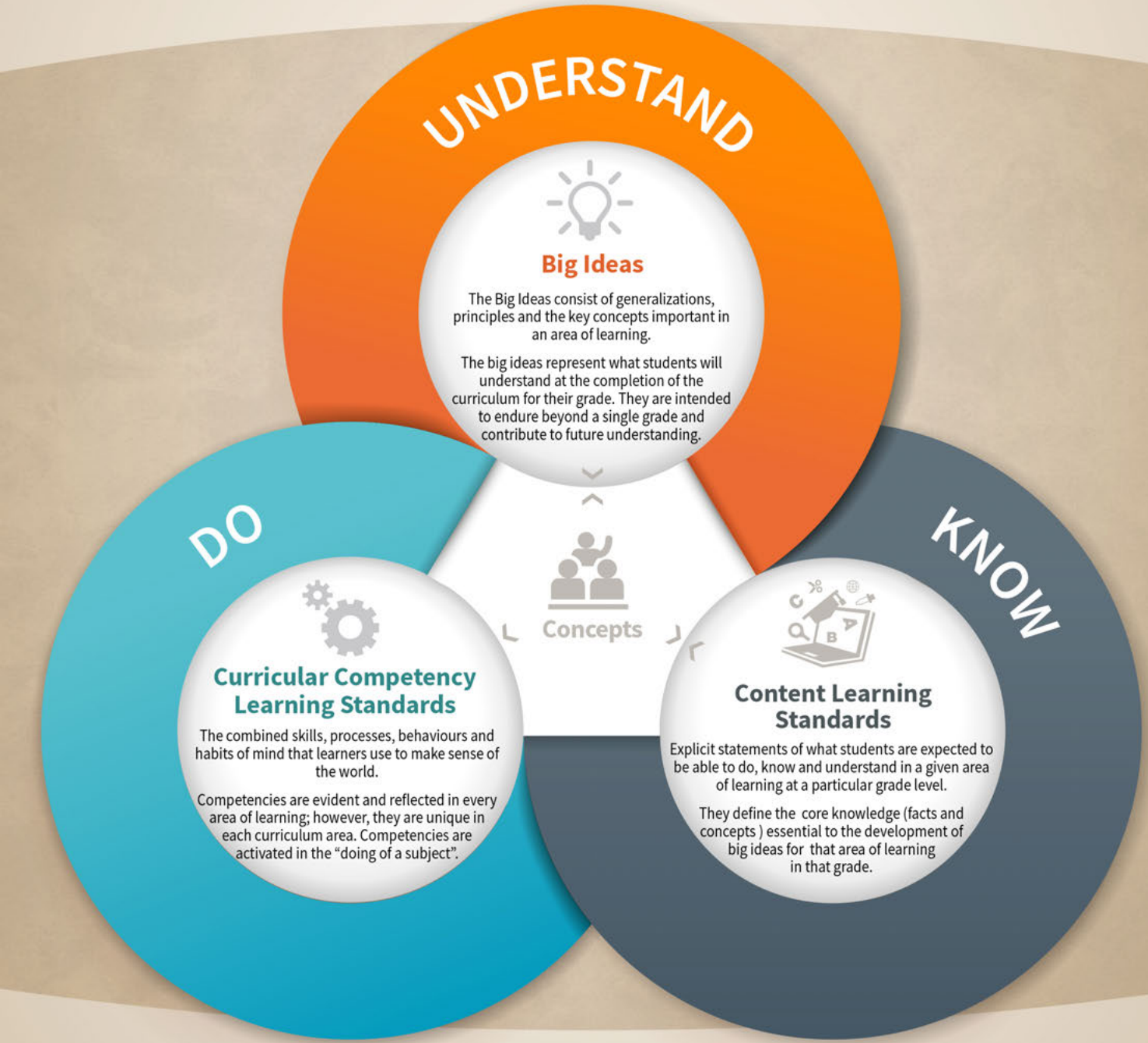
CONCEPT-BASED COMPETENCY-DRIVEN APPROACH TO LEARNING

The redesigned curriculum develops around key content, concepts, skills and big ideas that foster the higher-order thinking demanded in today's world.

The approach will facilitate development of citizens who are competent thinkers and communicators, and who are personally and socially competent in all areas of their lives.

Core competencies are the sets of intellectual, personal, and social - emotional proficiencies that all students need to develop to engage in deeper learning and to support lifelong learning.

In BC, the core competencies are communication, creative thinking, critical thinking, positive personal and cultural identity, personal awareness and responsibility, and social responsibility.



The curriculum must be learner- centred, flexible and maintain a focus on literacy and numeracy, while supporting deeper learning through concept-based and competency-driven approaches.

Concept-based learning and the development of competencies engage students in authentic tasks that connect learning to the real world.

@gfussell | printshop@sd71.bc.ca

BIG IDEAS

Multicellular organisms rely on internal systems to survive, reproduce, and interact with their environment. *(Questions to support inquiry with students: How are internal systems necessary for survival? What do your body systems require for survival? How do your body systems interact with one another?)*	Everyday materials are often homogeneous (solutions) and heterogeneous mixtures. *(Questions to support inquiry with students: What is a heterogeneous mixture? How does it compare to a homogeneous (solution) mixture?)*	Newton's three laws of motion describe the relationship between force and motion. *(Questions to support inquiry with students: What is the difference between motion caused by balanced forces and motion caused by unbalanced forces? How are balanced and unbalanced forces evident in your life and activities?)*	The solar system is part of the Milky Way, which is one of billions of galaxies. *(Questions to support inquiry with students: What are the relationships between Earth and the rest of the universe? What is an extreme environment? What extreme environments exist on Earth or in our galaxy?)*

Learning Standards

Curricular Competencies

Students are expected to be able to do the following:

Questioning and predicting ***(**Change is making the form, nature, content or future course of something different from what it is or what it would be if left alone. For example, Newton's third law, the idea that for every action there is an equal and opposite reaction describes the changes that occur in response to pushes and pulls. Key questions about change: How has our solar system changed over time? What is the exploration of extreme environments on Earth and in space changed in the last decade?)*

- Demonstrate a sustained curiosity about a scientific topic or problem of personal interest
- Make observations in familiar or unfamiliar contexts
- Identify questions to answer or problems to solve through scientific inquiry
- Make predictions about the findings of their inquiry

Planning and conducting

- Explore and pose questions that lead to investigations
- With support, plan appropriate investigations to answer their questions or solve problems they have identified
- Decide which variable should be changed and measured for a fair test
- Choose appropriate data to collect to answer their questions
- Observe, measure, and record data, using appropriate tools, including digital technologies
- Use equipment and materials safely, identifying potential risks

Processing and analyzing data and information

- Experience and interpret the local environment
- Construct and use a variety of methods, including tables, graphs, and digital technologies, as

Content

Students are expected to know the following:

- the basic structures and functions of body systems:
  - **musculoskeletal**
  - **reproductive**
  - **hormonal**
  - **nervous**
- **heterogeneous mixtures** ***(**suspensions (eg., salad dressing), emulsions (e.g., milk), colloids (eg., aerosols))***
- **mixtures** ***(**separated using gravity (eg., centrifuge or settling, silt deposits in a river delta, tailings ponds, Roman aqueduct settling sections) separated using particle size (eg., sieves, filters) historical and current Aboriginal use of separation methods (eg., eulachon oil))*** — separated using a difference in component properties
- **Newton's three laws of motion** ***(**first law: objects will stay stopped or in constant motion until acted upon by an outside force; second law: only an unbalanced force causes acceleration; third law: every force has an equal and opposite reaction force)***
- effects of **balanced and unbalanced forces** ***(**balanced forces are equal and opposite forces (eg., sitting in a chair); unbalanced forces are unequal; one force is larger (eg., race cars on different***

appropriate, to represent patterns or relationships in data • Identify patterns and connections in data • Compare data with predictions and develop explanations for results • Demonstrate an openness to new ideas and consideration of alternatives	*ramps, mousetrap cars, rockets)* in **daily physical activities** • **force of gravity (***gravity is the force of attraction between objects that pulls all objects toward each other; on Earth, gravity pulls objects toward the centre of the planet (eg., falling objects, egg drop))* • the overall scale, structure, and age of the universe • the position, motion, and **components of our solar system** in our galaxy • **extreme environments (***places with severely limiting factors (e.g., lack of light, lack of oxygen, extreme pressure, extreme radiation); place-based Aboriginal perspectives; obstacles that are unique to exploration of a specific extreme environment (eg., extreme heat or cold); contributions of Canadians to exploration technologies (eg., Canadarm, Newt Suit, VENUS and NEPTUNE programs))* exist on Earth and in the solar system

Learning Standards (continued)	
Curricular Competencies	**Content**
Evaluating • Evaluate whether their investigations were fair tests • Identify possible sources of error • Suggest improvements to their investigation methods • Identify some of the assumptions and given information in secondary sources • Demonstrate an understanding and appreciation of evidence • Identify some of the social, ethical, and environmental implications of the findings from their own and others' investigations **Applying and innovating** • Contribute to care for self, others, and community through personal or collaborative approaches • Co-operatively design projects • Transfer and apply learning to new situations • Generate and introduce new or refined ideas when problem solving **Communicating** • Communicate ideas, explanations, and processes in a variety of ways • Express and reflect on personal, shared, or others' experiences of place	

Big Idea : Newton's three laws of motion describe the relationship between force and motion.

Suggested questions to support the inquiry: What is the difference between motion caused by balanced forces and motion caused by unbalance forces? How are balanced and unbalanced forces evident in your life and activities?

(Understand)

Core Competencies (collaboration, communication, creativity, critical thinking, problem solving and social responsibility): **I can**

I can communicate ideas, explanations, and processes in a variety of ways. (Communication)
I can engage with others to share and develop ideas. (Communication)

Criteria- Teacher and student assessment

DS	*GS*	*I*	*Teacher*
With Direct Support	*With Guided Support*	*Independently*	*Teacher initials for verification*

Legend

* Student assessment

√ Teacher assessment

Criteria: Curricular Competency (Do)	**DS → GS → I**	**Evidence and date accomplished:**	**Teacher (initials)**
I can identify questions to answer or problems to solve through scientific inquiry.			
I can plan appropriate investigations to answer their questions or solve problems they have identified.			
I can transfer and apply learning to new situations.			
I can compare data with predictions and develop explanations for results.			

Criteria: Science Content (Know)	**DS → GS → I**	**Evidence and date accomplished:**	**Teacher (initials)**
I can describe Newton's three laws of motion.			
I can describe the effects of balanced and unbalanced forces.			
I can describe how Newton's laws explain how the important forces in the universe work (including gravity).			

Student Voice:

Teacher Feedback:

Cheryl.Adebar@sd71.bc.ca

Student Name _____ **Learning Map - Grade Science**

Big Idea : _____

_____ (Understand)

Criteria for Successful Learner Traits/ Core Competencies	Student Reflections:
I can	
I can	

Criteria- Teacher and student assessment

DS	GS	I	Teacher
With Direct Support	With Guided Support	Independently	Teacher initials for verification

Legend

* Student assessment

√ Teacher assessment

Criteria for Curricular Competency (Do)	DS → GS → I	Evidence and date accomplished:	Teacher (initials)
I can			
I can			
I can			
I can			

Criteria: Science Content (Know)	DS → GS → I	Evidence and date accomplished:	Teacher (initials)
I can			
I can			
I can			

Student Voice:

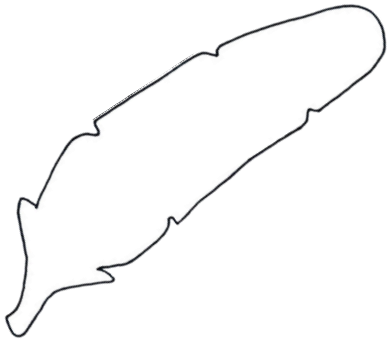
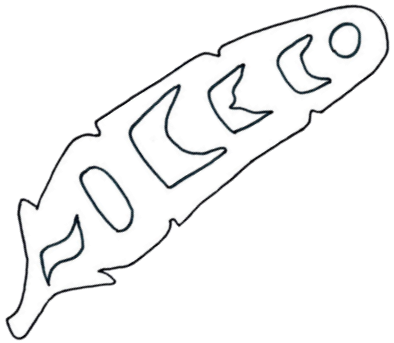
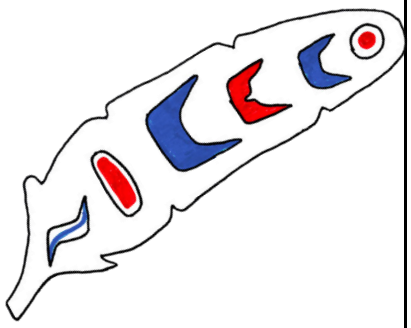
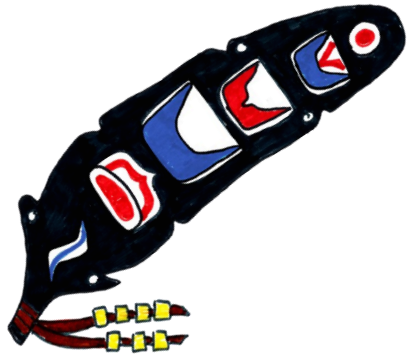
The Successful Learner Trait that I used the most was _____ when I_____.

To improve an inquiry project next time, I will _____

_____.

Teacher Feedback:

Cheryl.Adebar@sd71.bc.ca

Images by Nelson Wesley Arden Elementary, S.D. 71 (2016) Coast Salish Prince Rupert	 ***… direct support***	 ***… guided support***	 ***… independent***	 ***…applying innovatively***

Name(s): _____ Date: _____

STRIVING FOR SUCCESS

…applying innovatively!

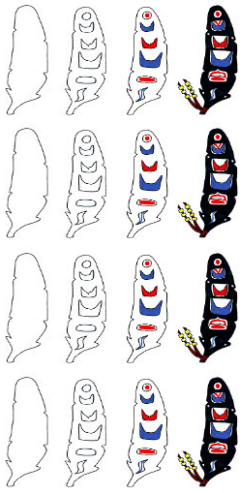
…independent

…guided support

…direct support

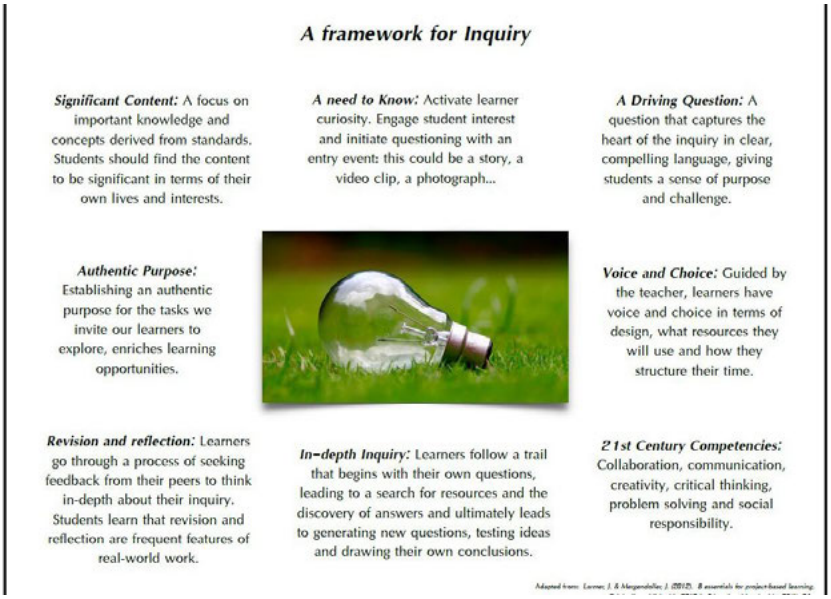
TASK TO COMPLETE:

CRITERIA:



SELF ASSESSMENT:

TEACHER ASSESSMENT COMMENTS:



Suggested Ways to Engage Students in Science Inquiry:

Driving Questions: What are Newton's 3 Laws of Motion and what can we learn from them? What is the difference between motion caused by balanced forces and motion caused by unbalanced forces?

How are balanced and unbalanced forces evident in your life and activities?

Establishing a need to know: For each of Newton's Laws, share a video clip to introduce (see links in this guide)… Share Bill Nye video clips – Force and Motion; Third Law; 100 Greatest Discoveries in Physics

In-depth Inquiry: 1. Newton's Laws in everyday sports! The Science of NHL Hockey (see link in this guide); challenge students to pick their favorite sport and explore it in terms of Newton's Laws of Motion. 2. How do airplanes fly? – explore the four forces of lift, gravity, thrust and drag (see link to resources at scienceworld.ca)

3. Forces at an Amusement Park – How does a rollercoaster work? How do bumper cars work?

For more inquiry ideas, go to the Steve Spangler Physics site (find link in this guide).

Go to http://www.scienceworld.ca/tags/newtons-laws to find engaging activities/demonstrations illustrating Newton's Laws.

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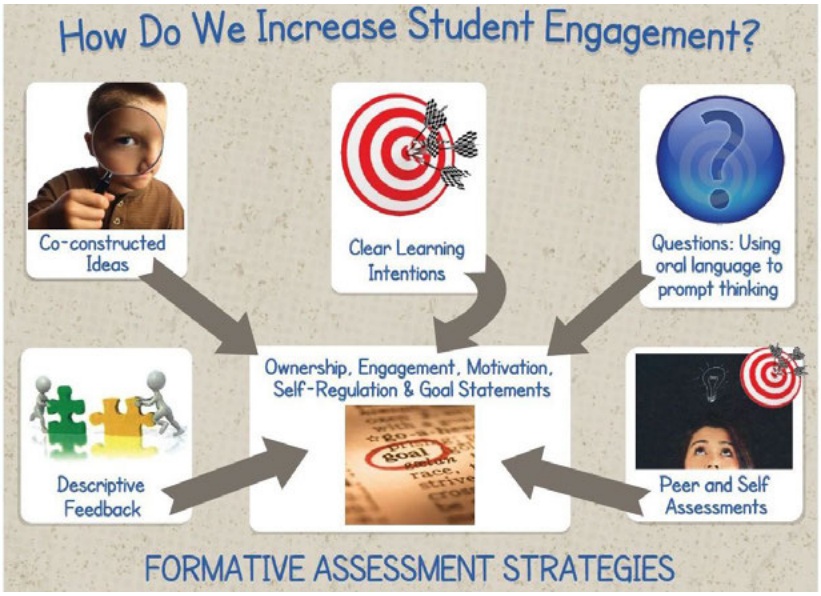
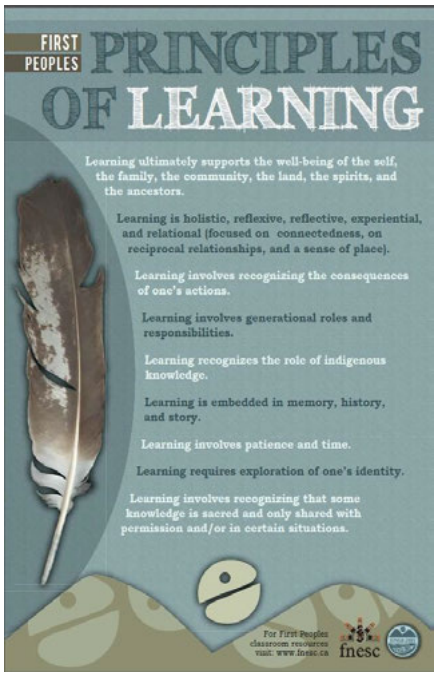


Suggested Ways to Embed Assessment ***for*** Learning Strategies:
Co-constructing ideas: What is a scientific law? What is a scientific theory? How are a scientific law and a scientific theory different? (For supporting information, see page 5 of *Newton's Laws of Motion*).
Clear learning intentions: I can describe Newton's 3 laws of motion. I can describe the effects of balanced and unbalanced forces. I can describe how Newton's laws explain how the important forces in the universe work. I can plan investigations to answer questions and solve problems.
Deep thinking questions: What are Newton's 3 laws of motion and why are they important? Why do things fall down and not up? How do bicycles work? How does the speed of a moving object change on different surfaces? How do planes stay in the air? How can you make forces bigger? What causes friction?
Assessment ideas: Provide and gather feedback regarding Newton's Laws of Motion. Provide opportunities for students to demonstrate their understanding of Newton's 3 Laws in a variety of ways...



Suggested Ways to Weave Aboriginal Ways of Knowing within this unit:

Connecting Newton's 3 Laws of Motion to Aboriginal Ways of Knowing/culture – possible inquiry topics: drumming; dancing. Hunting - bow and arrow /Fishing – Newton's Third Law - action/reaction)
Sports (throwing an *atladal*) – contact Aboriginal Curriculum Support teachers …

Integrating First Nations, Métis, and Inuit Perspectives
www.puzzlepeace.ca/wp-**content**/uploads/2011/06/TLDSB-**Integrating**... · PDF file
iv **Integrating First Nations** Métis Inuit **Perspective** Introduction Trillium Lakelands District School Board is

Aboriginal Sports Games:
Kneel Jump: https://www.youtube.com/watch?v=k5cizbqhP1c
Push Back: https://www.youtube.com/watch?v=6Vfj_Rowufo

Sling Ball: https://www.youtube.com/watch?v=cjm0zzc4S6E

C T PS

Grade 6 Physics Web Links

You won't have to "force" your students to learn — they'll push, pull, drop, roll, and fling their way through a variety of demonstrations and activities illustrating the different forces on everything around us. https://www.scienceworld.ca/resources/units/forces

Newton's Laws of Motion (1): The Law of Inertia, video clip (6:32)
https://www.youtube.com/watch?v=Q0Wz5P0JdeU&list=PLcrcGmQRudzfyLG1K-5oaurr6QWJIMmLI

Newton's Laws of Motion (2): Force, Mass And Acceleration, video clip (6:24)
https://www.youtube.com/watch?v=WzvhuQ5RWJE&index=2&list=PLcrcGmQRudzfyLG1K-5oaurr6QWJIMmLI

Newton's Laws of Motion (3): Action And Reaction, (video clip, 5:58)
https://www.youtube.com/watch?v=cP0Bb3WXJ_k&index=3&list=PLcrcGmQRudzfyLG1K-5oaurr6QWJIMmLI

Scholastic Study Jams: Topics include force and motion, Newton's Laws, gravity and inertia.
http://studyjams.scholastic.com/studyjams/services/search-results?query=Force%20and%20Motion

Bill Nye and Newton's Third Law, video clip (7:28)
https://www.youtube.com/watch?v=NRKmJgIokxg

Bill Nye - 100 Greatest Discoveries in Physics. Full episode (44:09)
https://www.youtube.com/watch?v=Bpid0LBTqWg

Bill Nye - Force and Motion, video clip, (3:53)
https://www.youtube.com/watch?v=8iKhLGK7HGk

Newton's First Law of Motion - Science of NFL Football, video (3:51)
https://www.youtube.com/watch?v=08BFCZJDn9w

Science of NHL Hockey: Newton's three laws of Motion (lesson and video link)
http://www.nbclearn.com/portal/site/learn/lesson/777868e2a6b0b310VgnVCM10000075c1d240RCRD

Launchpad: Newton's Laws On-Board the International Space Station, video (7:15)
Join astronauts on-board the International Space Station to learn more about Newton's laws. Learn about the inverse relationship between mass and acceleration when calculating force and see what the equation f=ma has to do with rockets.
https://www.youtube.com/watch?v=KvPF0cQUW7s

To design a successful airplane, engineers had to master the balance and control of four forces: lift, gravity, thrust and drag, also known as the "four forces of flight". By adjusting these forces, pilots are able to speed up, slow down, lift off and land their aircraft. This module is designed to demystify each of these forces and examine how they all contribute to flight.
https://www.scienceworld.ca/resources/units/flight

NASA - Dynamics of Flight.
https://www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html#lawofmotion

Newton's Laws of Motion explained…
http://www.physics4kids.com/files/motion_laws.html

Steve Spangler Science experiments on forces and motion. There are many to choose from that demonstrate Newton's 3 Laws and the effects of forces.
http://www.stevespanglerscience.com/lab/categories/experiments/forces-and-motion/

SeaWorld/Busch Gardens

Physics

4-8 Classroom Activities

Newton Laws of Motion

OBJECTIVE

The student will correlate Newton's Laws to various animal behaviors.

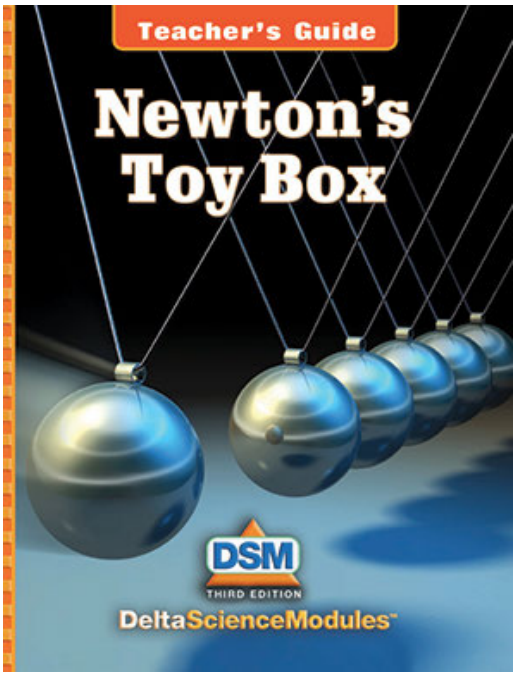
Source: http://c0026106.cdn1.cloudfiles.rackspacecloud.com/ad074251dc374c1294c721a8b5d8afc3_newton-laws-of-motion.pdf

Science of NHL Hockey: Newton's Three Laws of Motion

Source: https://www.nbclearn.com/science-of-nhl-hockey

Students will design and carry out experiments demonstrating Newton's 3 Laws through hockey…

Suggested Resources



Source: Newton's Toy Box Teacher Guide, found in kit.

In this kit there are materials to complete the following activities: Activity #1, 2, 3, 4, 5, 6, 12, 13. Teachers will need to provide a track or board for activities #7, 8, 9 to serve as a ramp. All other materials are supplied.

Simple Science Experiments: Newton's First Law of Motion

BY STEVE DAVALA

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Many years ago, Sir Isaac Newton came up with some most excellent descriptions about motion. His First Law of Motion is as follows: "An object at rest stays at rest and an object in motion stays in motion unless acted upon by an outside force." Quite a mouthful. What that means is that something that is sitting there will continue to sit there unless moved. And something moving will keep moving unless something stops it.

Still a mouthful. Just think about this: When you are at a stoplight in your car and you start moving quickly, you feel pushed back into your chair. The opposite is true if you come to a sudden stop, and you move keep moving forward, with only your seatbelt preventing you from crashing forward.

Source: http://www.metrofamilymagazine.com/July-2012/Simple-Science-Experiments-Newtons-First-Law-of-Motion/

A couple of experiments that demonstrate the law of inertia…

An electronic copy of this teacher guide can be found on Learn71 at
https://portal.sd71.bc.ca/group/wyhzgr4/Pages/default.aspx

Contributors: *Cheryl Adebar, Thea Black, Noah Burdett, Doug David, Kara Dawson, Colleen Devlin, Allan Douglas, Gerald Fussell, Nora Harwijne, Sarah Heselgrave, Debra Lovett, Kim Marks, Gail Martingale, Dale Mellish, Heather Mercier, Jane Rondow, Teri Ingram, Debbie Nelson, Joan Pearce, Stewart Savard, Laura Street, Lynn Swift, Carol Walters.*

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