TEMPLATE: Contextualized Learning Activities (CLAs)

For the "other required credits" in the bundle of credits, students in a Specialist High Skills Major program must complete learning activities that are contextualized to the knowledge and skills relevant to the economic sector of the SHSM. Contextualized learning activities (CLAs) address curriculum expectations in these courses.

This template must be used to describe the CLAs. The completed form must be submitted to the Ministry of Education for approval.

Submit all material in Microsoft Word.

Contact Information	
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Development date	**August 2010**
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Specialist High Skills Major	Transportation
Course code and course title	SPH4C, Grade 12 College Physics
Name of contextualized learning activity/activities	Constructing a Hydraulic Brake System
Brief description of contextualized learning activity/activities	Students will explore hydraulic and pneumatic systems and applications in real world applications, with an emphasis on hydraulic braking systems. Specifically applied to the fields of transportation relating to practical aspects including but not limited to hydraulic braking systems, lift assemblies, farm and heavy construction equipment assemblies, etc.

Duration	Lesson 1 – 1 period Lesson 2 – 1 period Lesson 3 – 1 period Lesson 4 – 1 period Lesson 5/6 – 2 periods
Overall expectations	F1. analyze the development of technological applications related to hydraulic and pneumatic systems, and assess some of the social and environmental effects of these systems; F2. investigate fluid statics, fluid dynamics, and simple hydraulic and pneumatic systems; F3. demonstrate an understanding of the scientific principles related to fluid statics, fluid dynamics, and hydraulic and pneumatic systems.
Specific expectations	F1.1 research the historical development of a pneumatic or hydraulic system used in a specific technology (e.g., the hydraulic system in aircraft or other vehicles or in precision machining; the pneumatic system in an air motor or robotics), analyze the original design, and determine why the technology was developed and how it has been improved [IP, PR, AI, C] F1.2 analyze some of the social and economic consequences of the use of robotic systems for different kinds of operations (e.g., in the manufacturing of computers, for lifting and maneuvering heavy objects on assembly lines, for handling hazardous materials, for activities under water and in space) [AI, C] F2.1 use appropriate terminology related to hydraulic and pneumatic systems, including, but not limited to: *density, atmospheric pressure, absolute pressure, laminar flow, turbulent flow, static pressure, pressure, volume,* and *flow rate* [C] F2.4 conduct a laboratory inquiry or computer simulation to demonstrate Pascal's principle [PR] F2.6 solve problems related to the relationships between force, area, pressure, volume, and time in hydraulic and pneumatic systems (e.g., the force exerted on the wheel of a motor vehicle by the hydraulically operated brake pad; the time required for a robotic system to complete one cycle of operation) [AI] F3.2 state Pascal's principle, and explain its applications in the transmission of forces in fluid systems F3.3 describe common components used in hydraulic and pneumatic systems (e.g., cylinders, valves, motors, fluids, hoses, connectors, pumps, reservoirs), and explain their function
Catholic graduate expectations (if applicable)	**CGE2b** -reads, understands and uses written materials effectively; **CGE2c** -presents information and ideas clearly and honestly and with sensitivity to others; **CGE2d** -writes and speaks fluently one or both of Canada's official languages;

	CGE3b -creates, adapts, evaluates new ideas in light of the common good; **CGE3c** -thinks reflectively and creatively to evaluate situations and solve problems; **CGE4a** -demonstrates a confident and positive sense of self and respect for the dignity and welfare of others; **CGE4b** -demonstrates flexibility and adaptability; **CGE4e** -sets appropriate goals and priorities in school, work and personal life; **CGE4f** -applies effective communication, decision-making, problem-solving, time and resource management skills; **CGE5b** -thinks critically about the meaning and purpose of work; **CGE5e** -respects the rights, responsibilities and contributions of self and others; **CGE7b** -accepts accountability for one's own actions; **CGE7j** -contributes to the common good

Essential Skills and work habits	• Reading Text
	• Writing
	• Computer Use
	• Oral Communication
	• Numeracy
	  o Measurement and Calculation:
	  o Data Analysis:
	  o Numerical Estimation:
	• Thinking Skills
	  o Decision Making
	  o Problem Solving .
	  o Finding Information
	• Teamwork
	• Reliability
	• Working Independently
	• Initiative
	• Self-advocacy

Instructional/Assessment Strategies

Teacher's notes

Online Resources:

http://auto.howstuffworks.com/auto-parts/brakes/brake-types/brake3.htm
http://en.wikipedia.org/wiki/Hydraulic_brake
http://www.familycar.com/brakes.htm - In many cases some of your students may know more about the physical application of hydraulic braking systems, this website provides concise information on the topic

Youtube Videos:

http://www.youtube.com/watch?v=VxLTDtaRCZk – Pascal's Law and Hydraulic Brake System
http://www.youtube.com/watch?v=d66EiKwySt4 – Principles of Operation (Drum Brakes)

The teacher is encouraged to take advantage of the transportation and manufacturing departments within the school. These departments have many physical, real world and real world simulating resources including hydraulic braking systems, hydraulic lifts, pneumatic and hydraulic presses, and scores of pneumatic tools that can be shown to the class and should further illustrate real world applications of this theory and practice.
Any students struggling with the physical application components of this unit should have the opportunity to visit the transportation or manufacturing departments and see a real world application of the system they are trying to build.

Context

Hydraulics is used in multiple areas within the transportation field. One obvious example is the hydraulic braking system used in nearly all consumer level vehicles. Students both inside the transportation field and outside have some understanding of the concepts and their uses. Students will first learn about the physics involved in hydraulic and pneumatic systems, and then build a physical model of a working braking system.

Strategies

How will the learning be designed?

- This unit begins with lessons on Volume, Pressure, and Density to explain the basic physics principles of fluids, both gaseous and liquid. Included in these lessons are formative assessments of the students' understanding of the principles, and mathematical expressions.
- The Pascal's Principal lesson is then taught using an activity with a pneumatic syringe system, hopefully familiar to the teacher. Formative assessment is included in this lesson again to be sure that students are developing and retaining information.
- The Investigating two and three cylinder fluid systems lab is an opportunity for students to apply their hydraulic and pneumatic understanding to theoretical and real world problems. Included is a summative assessment about the analysis of this lab.
- Mini-lesson on common hydraulics components and Summative Quiz on Pascal' Principal, Pressure and Density will assess students understanding of the theoretical concepts involved in fluid systems.

- The final lesson is a practical application of a hydraulic system. The students will build a hydraulic brake calliper assembly that will simply but effectively teach students the relationship between the theoretical and the practical. This will also be a summative assessment.
- Students are encouraged to explore the theoretical and the practical applications of hydraulic and pneumatic systems.

What adjustments must be made to the instructional and assessment strategies for those students who are not progressing?

Students struggling with the theoretical applications during the first two lessons should been given access to additional classroom resources already available from textbooks and other areas.
Students struggling with the building and understanding of the lab and the practical application of the hydraulic system should be given an opportunity to visit the transportation and manufacturing shops within the school to see the working real world applications of the basic lab and activity. This should be arranged prior to this class time.

Assessment and Evaluation of Student Achievement

Strategies/Tasks	**Purpose** *Assessment for Learning (diagnostic, formative)* *Assessment of Learning (summative, evaluation)*
1. Volume, Pressure, and Density Work Sheet #1	Assessment of Learning, formative
2. Pascal's Principle using syringes Work Sheet #2	Assessment of Learning, formative
3. Investigating Two and Three Cylinder Fluid Systems Lab	Assessment of Learning, formative
4. Mini-lesson on common hydraulics components, and Summative Quiz on Pascal's Principle, Pressure and Density	Assessment for Learning, summative
5. Braking System	Assessment for Learning, summative

Assessment tools

Safety Equipment:
Safety Goggles
Apron

Tools:

- 1 Large syringe
- 2 Small syringes
- 1 Length of short tube
- 2 Lengths of long tube
- 8" x 8" Piece of cardboard
- 1 Toy Wheel with Axle
- 2 Hand held pink erasers

- 2 Wooden Blocks
- 2 Wood connectors
- "T" Connectors

Additional Notes/Comments/Explanations

Additional Suggestion:

The transportation and manufacturing departments are excellent resources for teacher and student understanding. It may even be possible for the physics class and the technology class to work on the final problem together, depending of course on many variables. Students should learn together how the theoretical and the practical work together in the classroom as a guide to workplace applications where engineers and technologists work together to solve problems.

Resources

Authentic workplace materials
Human resources
Print
Video **Youtube Videos:** **http://www.youtube.com/watch?v=VxLTDtaRCZk** – Pascal's Law and Hydraulic Brake System **http://www.youtube.com/watch?v=d66EiKwySt4** – Principles of Operation (Drum Brakes)
Software
Websites **http://auto.howstuffworks.com/auto-parts/brakes/brake-types/brake3.htm** **http://en.wikipedia.org/wiki/Hydraulic_brake** **http://www.familycar.com/brakes.htm** - In many cases some of your students may know more about the physical application of hydraulic braking systems, this website provides concise information on the topic
Other

Accommodations

- Individual Education Plans (IEP) should be followed at all times. Be sure to consult the SERT for additional information and suggestions;
- Additional time may be needed for diagnostic, formative and summative assignments;
- The activities and lessons outlined in this CLA allow for flexibility in the delivery of the material. Alternating teaching strategies can help students who are not progressing at the appropriate level;
- Font can be increased for those students that have vision problems;
- Class rules, behaviours, and due dates should be posted in the classroom and talked about so that all students are aware of the expectations;
- If possible, more individual instruction time can be allotted to students in need;
- Account for student work habits when considering assignments;
- Provide opportunities for enrichment for exceptional students;
- Provide time for peer-to-peer teaching;
- Use audio aids if needed;
- Provide alternate assessment opportunities that are geared towards students strengths or areas of interest;
- If available, many computer programs can be used to supplement student learning.

List of Attachments

(Attach all related materials, e.g., student worksheets, tests, rubrics.)

Work Sheet #1
Work Sheet #2
Investigation – Two and three cylinder fluid systems
Lesson 4 notes
Summative Quiz – Pascal's Principle – Pressure – Density
Constructing a Hydraulic Brake System
Rubric