

**Ministry of Education
Grade 12 Subject Specific Training Sessions
Workshop Materials**

Grades 12 Science Sessions

**Science Session I: Assessment and Evaluation
University and Workplace
Preparation Courses**

**Science Session II: College and University/College
Preparation Courses**

Presenter's/Participants Package

Grade 12 Science Training Sessions

Session I Agenda

Greetings and Introductions

On Track With Assessment and Evaluation

University Preparation Courses Workshop

Workplace Preparation Courses Workshop

Session II Agenda

Greetings and Introductions

College Preparation Courses Workshop

University/College Preparation Courses Workshop

Closing Comments

Session I: Grade 12 Subject Specific Training – Science

Part 1 – On Track With Assessment and Evaluation

Diagnostic Assessment Activity – Can you match the terms?

Copies of assessment and evaluation overheads

Teacher Self-Reflection on Assessment and Evaluation Practices

Assessment and Evaluation Practices – Achievement chart categories

Assessment and Evaluation Practices Activity (see Appendix A for additional materials)

Assessment and Evaluation Methods, Strategies and Tools

Unit Assessment and Evaluation Planner Activity (see Appendix B for Planner)

Assessment and Evaluation

Diagnostic Activity - Can you match the terms?

Connect the assessment term with the appropriate definition by drawing a line to connect the term with the assessment or by placing the number of the term at the end of the definition

TERMS	DEFINITIONS
1. Learning Expectations	Samples of student work that demonstrate each level of achievement.
2. Rubric	Determines student achievement at the end of a cluster of expectations, at the end of a unit, course, term, semester or year. It provides teachers with information for making formal judgments about student achievement to be used in reporting results in relation to expectations.
3. Criterion-Referenced	Descriptions of the degree of achievement of the expectations in the Ontario Curriculum defined for four levels of achievement. These achievement levels establish the performance standards for the curriculum.
4. Formative Assessment	Assigning a number or letter to be placed on the report card at the end of a period of time as a summary statement of student performance.
5. Category	A statement of performance in terms of the expected range of achievement for specific learning expectations. When a criterion-referenced standard is used student achievement is evaluated in relation to predetermined criteria that describe what students are expected to know and be able to do. Achievement Level 3 in the Ontario Curriculum is an example of a criterion-referenced standard.
6. Performance Assessment	The statements of the knowledge and skills which students are expected to develop and to demonstrate in their class work, on tests, and in various other activities on which their achievement is assessed and evaluated.
7. Achievement Levels	The collection of information that occurs throughout the school year, term or unit that enables teachers to track, support and guide students' continuous progress.
8. Exemplars	A cluster of knowledge and skills that represents a major component of a subject area in the Ontario Curriculum. Four categories are identified for each subject area, and four achievement levels are described for each category.
9. Summative Evaluation	Requires students to demonstrate directly the specific skills and knowledge being assessed. Assessments that have an emphasis on real life tasks as well as occurring, in a real life context are sometimes referred to as authentic assessments.
10. Grading	A set of guidelines for assigning- scores (e.g., marks, levels of performance, ratings), which provides descriptions for all the dimensions being assessed. These guidelines include a scale describing a range of performance from low to exemplary.


Assessment and Evaluation
Diagnostic Activity - Can you match the terms?
(ANSWER SHEET AND PRESENTER NOTES)

Connect the assessment term with the appropriate definition by drawing a line to connect the term with the assessment or by placing the number of the term at the end of the definition

TERMS	DEFINITIONS
1 Learning Expectations	Samples of student work that demonstrate each level of achievement. (8)
2 Rubric	Determines student achievement at the end of a cluster of expectations, at the end of a unit, course, term, semester or year. It provides teachers with information for making formal judgments about student achievement to be used in reporting results in relation to expectations. (9)
3 Criterion-Referenced	Descriptions of the degree of achievement of the expectations in the Ontario Curriculum defined for four levels of achievement. These achievement levels establish the performance standards for the curriculum. (7)
4 Formative Assessment	Assigning a number or letter to be placed on the report card at the end of a period of time as a summary statement of student performance. (10)
5 Category	A statement of performance in terms of the expected range of achievement for specific learning expectations. When a criterion-referenced standard is used student achievement is evaluated in relation to predetermined criteria that describe what students are expected to know and be able to do. Achievement Level 3 in the Ontario Curriculum is an example of a criterion-referenced standard. (3)
6 Performance Assessment	The statements of the knowledge and skills which students are expected to develop and to demonstrate in their class work, on tests, and in various other activities on which their achievement is assessed and evaluated. (1)
7 Achievement Levels	The collection of information that occurs throughout the school year, term or unit that enables teachers to track, support and guide students' continuous progress. (4)
8 Exemplars	A cluster of knowledge and skills that represents a major component of a subject area in the Ontario Curriculum. Four categories are identified for each subject area, and four achievement levels are described for each category. (5)
9 Summative Evaluation	Requires students to demonstrate directly the specific skills and knowledge being assessed. Assessments that have an emphasis on real life tasks as well as occurring, in a real life context are sometimes referred to as authentic assessments. (6)
10 Grading	A set of guidelines for assigning- scores (e.g., marks, levels of performance, ratings), which provides descriptions for all the dimensions being assessed. These guidelines include a scale describing a range of performance from low to exemplary. (2)


Presenter's Note: Distribute sheets to each table. Have participants match terms and pair -share answers. Taking up the answers will serve as an introduction to assessment purposes, terms, and the Powerpoint presentation.

Assessment and Evaluation Overheads




Grade 12 Subject Specific
Ministry Training Sessions

SCIENCE
ASSESSMENT & EVALUATION



The primary purpose of assessment
and evaluation is to improve
student learning


(Program Planning and Assessment policy document, page 13)



Assessment and Evaluation

- Determines students strengths and weaknesses in achieving course expectations
- Guides teachers in adapting curriculum and instructional approaches to students' needs
- Assesses the overall effectiveness of programs and classroom practices

(Program Planning and Assessment policy document, page 13)



Program Planning and Assessment
Policy Document (page 13)

Assessment is the process of gathering information from a variety of sources that accurately reflects how well a student is achieving the curriculum expectations in a course.

Evaluation refers to the process of judging the quality of student work on the basis of established criteria, and assigning a value to represent that quality. In Ontario secondary schools, the value assigned will be in the form of a percentage grade.



Improving student learning

Assessment and evaluation strategies:

- are fair to all students;
- accommodate the needs of exceptional students, consistent with the strategies outlined in their Individual Education Plan;
- accommodate the needs of students who are learning the language of instruction;

(Program Planning and Assessment policy document, page 13)



Improving student learning

Assessment and evaluation strategies:

- ensure that each student is given clear directions for improvement;
- promote students' ability to assess their own learning and to set specific goals;
- include the use of samples of students' work that provide evidence of their achievement;
- are communicated clearly to students and parents at the beginning of the course and at appropriate points throughout the course.

(Program Planning and Assessment policy document, page 13)



Improving student learning

Assessment and evaluation strategies:

- address both what students learn and how well they learn;
- are varied in nature, administered over a period of time, and designed to provide opportunities for students to demonstrate the full range of their learning;
- are appropriate for the learning activities used, the purposes of instruction, and the needs and experiences of the students;


(Program Planning and Assessment policy document, page 13)




Achievement Chart

The expectations must be assessed and evaluated across four levels according to the four science categories:

- knowledge/understanding
- inquiry
- communication
- making connections




Diagnostic Assessment
Formative Assessment
Summative Assessment




Diagnostic Assessment

Usually occurs at the beginning of the school year or before a unit of instruction.



Purposes of diagnostic assessment

- identify whether students have the prerequisite knowledge, understanding, or skills;
- provide information to assist in planning appropriate learning opportunities;
- identify student interests;
- identify misconceptions.



Formative Assessment

Is ongoing assessment that keeps students, parents and educators informed of students' progress.



Purposes of formative assessment

- provide direction to students in how to improve their learning;
- encourage students to take responsibility for their own progress;
- provide teachers with information upon which instructional modifications can be made;
- help teachers understand the degree to which students are achieving the learning expectations.



When the cook tastes the soup, that's formative. When the guests taste it, that's summative!

Robert Stake




Summative Assessment

Occurs at the end of a cluster of expectations, at the end of a unit and at the end of the course.




Purposes of summative assessment

- evaluate what has been learned;
- summarize student progress;
- report on progress relative to curriculum expectations to students and parents.




It is important that students are informed and clear about the purpose of assessments.



Program Planning and Assessment Policy Document (page 15)


- Seventy percent of the grade will be based on evaluations conducted throughout the course.
- Thirty percent of the grade will be based on a final evaluation in the form of an examination, performance, essay and/or other method of evaluation suitable to the course content and administered towards the end of the course.



Assessment and Evaluation Planning Phases

Planning for assessment and evaluation involves a continuous process of four phases.

- Preparation
- Assessment
- Evaluation
- Reflection




Preparation Phase

Decisions are made identifying:


- what is to be assessed and evaluated;
- the purpose of the assessment (diagnostic, formative, or summative);
- the criteria by which student learning will be assessed;
- appropriate assessment strategies and tools.

The teacher's decisions in this phase forms the basis for the remaining phases.




Assessment Phase

- use information-gathering strategies to collect information on student learning;
- use appropriate assessment tools;
- identify and eliminate bias (such as gender and culture bias) from assessment strategies;
- determine where, when, and how assessments will be conducted.



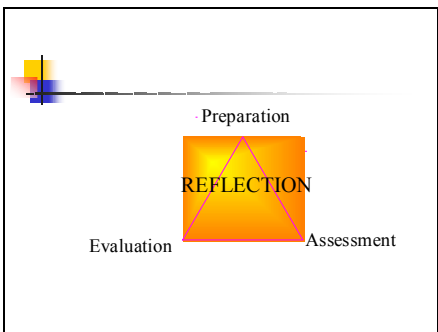
Evaluation Phase

- use professional judgement to interpret assessment information about student achievement;
- assign a grade;
- report on achievement to students, and parents



Reflection Phase

- reflect on how successful the assessment plan was to improve student learning;
- make decisions concerning improvements to subsequent teaching, and assessment and evaluation practices.





Teacher Self-Assessment

- ✓ Reflection on day-to-day classroom instruction
- ✓ Professional self-assessment



Assessment and Evaluation

- Strongly influences both teaching and learning
- Promotes learning
- Builds confidence in students and teachers
- Develops students' understanding of themselves and how they learn

Teacher Self Reflection on Assessment and Evaluation Practices

Criteria for Reflection	Comment & Observations	Action to be taken
Does my assessment plan address: <ul style="list-style-type: none"> • Knowledge/Understanding • Inquiry • Communication • Making connections • Overall expectations • Specific expectations • SIS (science investigation skills) 		
Did the students' assessment / evaluation plan allow me to make efficient use of time?		
Did my assessment/ evaluation plan make use of a variety of assessment strategies?		
Did the range of my strategies allow me to make interpretations and evaluate my students' progress?		
Did I consider the appropriateness of my assessment in conjunction with the instructional approaches used?		
Were the assessment strategies appropriate for the information I required?		
Were my assessment tools fair, and were they used fairly?		
Did the assessment task that I used involve students in transferring their knowledge and skills into life experiences?		
Did I involve students in self-appraisal (self assessment & reflection)?		
Did I communicate my evaluation plan to students in advance?		
Was my evaluation plan destination appropriate?		
Did I regularly communicate evaluation information to students and to their parent(s)/guardian(s)?		
Were my reporting procedures meaningful to students and to their parent(s)/guardian(s)?		

Presenter's Note:

This handout should follow the Power point presentation on assessment and evaluation. This handout can be a template for teachers to use for self-reflection. It should be used following a unit of study and upon the completion of a course. Teachers are encouraged to use their reflections when designing, modifying and developing their assessment and evaluation plans for new and existing courses.

ASSESSMENT & EVALUATION PRACTICES

- Assessment and evaluation need to align with curriculum expectations, achievement chart categories and instructional strategies
- Achievement Chart: the expectations must be assessed and evaluated according to the categories of knowledge and skills outlined in the Achievement Chart across all four levels

Science Achievement Chart Categories and Criteria

Knowledge/Understanding

- Understanding of concepts, principles, laws and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations)
- Knowledge of facts and terms
- Transfer of concepts to new contexts
- Understanding of relationships between concepts

Inquiry

- Application of the skills and strategies of scientific inquiry (e.g., initiating and planning, performing and recording, analyzing and interpreting, problem solving)
- Application of technical skills and procedures (e.g., procedures in using microscopes)
- Use of tools, equipment, and materials

Communication

- Communication of information and ideas
- Use of scientific terminology, symbols, conventions, and standard (SI) units
- Communication for different audiences and purposes
- Use of various forms of communication (e.g., reports, essays)
- Use of information technology for scientific purposes (e.g., specialized databases)

Making Connections

- Understanding of connections among science, technology, society, and the environment
- Analysis of social and economic issues involving science and technology
- Assessment of impacts of science and technology on the environment.
- Proposing of courses of practical action in relation to science-and technology-based problems

CATEGORIES	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
<i>KNOWLEDGE/UNDERSTANDING</i>				
<i>INQUIRY</i>				
<i>COMMUNICATIONS</i>				
<i>MAKING CONNECTIONS</i>				

ASSESSMENT & EVALUATION PRACTICES

- Assessment must provide information on what students write, say, and do
- Assessment and evaluation methods and strategies should be appropriate for the expectations and course destination

Assessment and Evaluation Methods

- paper and pencil;
- personal communication;
- performance task.

Assessment and Evaluation Strategies

- paper and pencil
 - tests, quizzes, concept maps, essay, written report/lab reports, research paper, examinations, standardized tests;
- personal communication
 - instructional question and answers, interviews, conferences, journals, classroom discussions;
- performance task
 - individual presentations, plays/skits, lab performance, project, role playing, exhibition, science fair.

Assessment and Evaluation Tools

- anecdotal comment;
- checklist;
- rating scale;
- marking scheme;
- portfolio
- rubric
- Contracts

ASSESSMENT & EVALUATION PRACTICES ACTIVITY

CAN YOU PUT THE ACHIEVEMENT CHART CATEGORIES INTO PRACTICE?

Identify specific assessment strategies and tools and group them into relevant achievement chart categories.

**ASSESSMENT & EVALUATION PRACTICES ACTIVITY
(ANSWER SHEET AND PRESENTER NOTES)**

CAN YOU PUT THE ACHIEVEMENT CHART CATEGORIES INTO PRACTICE?

Identify specific assessment strategies and tools and group them into relevant achievement chart categories.

1. Each participant picks several assessment terms from the set that has been prepared (see Appendix A).
 2. Using the handout provided classify each term as a strategy or as a tool.
 3. Decide and place each term under the most relevant achievement chart Category.
- NOTE: Strategies and tools may apply to more than one category.

Presenter's Notes:

Organize the terms so that each table of participants has a complete set of terms.

Place chart paper with the achievement chart headings at each of the four tables.

- Table 1: Knowledge/Understanding Category
- Table 2: Inquiry Category
- Table 3: Communication Category
- Table 4: Making Connections Category

Divide each chart paper into two subheadings - strategies and tools (see below). Provide markers at each table.

Sample Chart Paper Headings:

KNOWLEDGE/ UNDERSTANDING	
<u>Strategy</u>	<u>Tool</u>

Materials needed for activity:

- Chart paper
- Markers
- Handout of terms (see Assessment Methods, Strategies, and Tools)
- Assessment terms cut into single items – see Appendix A

Assessment Methods, Strategies, and Tools

“The primary purpose of assessment and evaluation is to improve student learning. Information gathered through assessment helps teachers to determine students’ strengths and weaknesses in their achievement of the curriculum expectations in each course. This information also serves to guide teachers in adapting curriculum and instructional approaches to students’ needs and in assessing the overall effectiveness of programs and classroom practices.”

Program Planning and Assessment Policy document (page 13)

METHODS:

- paper and pencil;
- personal communication;
- performance task.

- Portfolios

STRATEGIES:

- Directed observation
- Questionnaires
- Charts
- Group discussion
- Logs
- Content/concept
- Interview
- Journal
- Tests
- Case conference
- Audio biographies
- Scrapbooks
- Newspaper files
- Collections
- Creative writing
- Flow chart
- Learning centres
- Newspaper
- Concept map
- Venn diagrams
- Model building
- Time-line charts
- Seminars
- Glossary
- Artistic expression
- Survey
- Test Stations
- Projects
- Written Reports
- Laboratory Reports
- Science Fair

- Case Studies
- Test Questions: Short Answer
- Test Questions: True/False
- Test Questions: Essay
- Test Questions: Matching
- Test Questions: Multiple Choice
- Oral Testing
- Lab Test
- End of unit Culminating Activity
- End of Course Culminating Activity

TOOLS:

- Checklists
- Contracts
- Rating Scales
- Marking Scheme
- Rubric
- Anecdotal Comments (Informal Observation)

UNIT ASSESSMENT AND EVALUATION PLANNER ACTIVITY

Teachers should be encouraged to reflect on their assessment and evaluation practices.

Presenter's Notes:

Distribute the Unit Assessment and Evaluation Planner to each participant (see Appendix B).

Use this as a means of summarizing the morning session by having participants cluster expectations, and determine the most appropriate assessment strategies and tools for the cluster.

This handout should be referred to and used by the participants in other sessions to check that there is balance and variety of assessment strategies and tools that allow students to demonstrate their learning in all four categories.

Course Profiles: Teachers should be encouraged to use the Ministry Course Profiles for each course to assist them while planning their course of study.

Session I: Grade 12 Science

Part 2 – University Preparation and Workplace Preparation Courses Workshops

Overview of all courses

- Grade 12 Science Courses Destination Activity
- Prerequisite and Transfer Courses for Grade 12 Science Courses

University Preparation Courses

- copies of overheads
- curriculum comparison charts for 12U and OAC
 - Physics
 - Chemistry
 - Biology

Workplace Preparation Course

- copies of overheads
- workplace preparation course activity

GRADE 12 SCIENCE COURSES DESTINATIONS ACTIVITY

What are the characteristics and emphases of the different preparation courses?

1. Form groups and have each group focus on one of the different science preparation courses to examine the course characteristics and emphases.
2. In each group brainstorm the following questions and record the ideas on chart paper:
 - i. What is the destination (e.g., university, workplace)?
 - ii. What are the expected levels of skills and knowledge for students entering the course?
 - iii. Which skills will students need to develop and refine the most for the course?
 - iv. How are safety and the SIS's applicable and different for this destination?
3. Report your ideas to the larger group.

Presenter's Notes: Organize the group into 4 tables (each with the same number of chairs). Each table is assigned a specific preparation course, e.g.

Table 1:	University
Table 2:	College
Table 3:	Workplace
Table 4:	University/College

Once the groups have recorded their ideas ask a representative from each group to summarize their ideas. Facilitate a large group discussion for each preparation course(s).

- † Alternate presentation involves each group performing a skit to illustrate the qualities of the students expected in each destination.

Materials needed for this activity
4 pieces of chart paper
4 markers

**PREREQUISITE & TRANSFER COURSES FOR
GRADE 12 SCIENCE COURSES**

Table 1: Prerequisite Courses


PREREQUISITE	DESTINATION
	UNIVERSITY
Biology: SBI 3U →	Biology: SBI 4U
Chemistry: SCH 3U →	Chemistry: SCH 4U
Physics: SPH 3U →	Physics: SPH 4U
Science: SNC 2D →	Earth & Space: SES 4U
	COLLEGE
Science: SNC 2D → SNC 2P →	Chemistry: SCH 4C Physics: SPH 4C
	UNIVERSITY/COLLEGE
Science: SNC 3M →	Science: SNC4M
	WORKPLACE
Science SNC 3E →	Science: SNC 4E

TRANSFER COURSES are partial credit courses that bridge the gap between courses of two different types. They enable students to achieve the expectations not covered in one type of course but required by another.

Table 2: Transfer Courses

Prerequisite + Transfer courses (0.5 credit)	University Preparation
SBI 3C + SBI 3K	SBI 4U
SCH 4C + SCH 3K	SCH 4U
SPH 4C + SPH 3K	SPH 4U
SNC 2P + SNC 2H	SES 4U


University Preparation Courses Overheads



Science Grade 12

University Preparation Courses


1



University Preparation Courses

- Biology (SBI4U)
- Chemistry (SCH4U)
- Physics (SPH4U)
- Earth and Space Science (SES4U)

2



University Preparation Prerequisites


Prerequisite courses

- Science Grade 9 Academic for all University preparation courses, and
- Science Grade 10 Academic for all University preparation courses

In addition

- Grade 11 SBI3U for SBI4U
- Grade 11 SCH3U for SCH4U
- Grade 11 SPH3U for SPH4U

3



Biology Strands (SBI4U)

- Metabolic Processes
- Molecular Genetics
- Homeostasis
- Evolution
- Population Dynamics

4



Chemistry Strands (SCH4U)

- Organic Chemistry
- Energy Changes and Rates of Reaction
- Chemical Systems and Equilibrium
- Electrochemistry
- Structure and Properties

5



Physics Strands (SPH4U)

- Forces and Motion: Dynamics
- Energy and Momentum
- Electric, Gravitational, and Magnetic Fields
- The Wave Nature of Light
- Matter- Energy Interface

6



Earth and Space Science Strands (SES4U)

- The Earth as a Planet
- Introduction to Earth Sciences
- Earth Materials
- Internal and Surficial Earth Processes
- Earth History

7



OSS 12U and OS:IS OAC Curriculum Comparison Activity

Compare OSS expectations and OS:IS objectives.

8



OSS 12U and OS:IS OAC Curriculum Comparison Activity

Use the curriculum comparison sheets

- mark all of the common objectives /expectations with a green highlighter;
- mark all of the other expectations in the OSS 12U course with a yellow highlighter;
- mark all of the other objectives in the OS:IS OAC course with a red highlighter.

9



Think-Group Share

Using the highlighted curriculum comparison charts:

- Think of implementation issues that may have to be addressed.
- Share these with your group.
- As a group choose three issues and be prepared to share these with other groups.

10



Solutions

Using chart paper list possible solutions to the issues that were identified.

11



Design Down

Form groups according to subject disciplines.

- Cluster a related set of expectations from one of the courses;
- Complete the Unit Assessment and Evaluation Planner sheet for this cluster;
- Develop a lesson that will assess student achievement of these expectations.

12

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Physics Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Standardization of Content	
<ul style="list-style-type: none"> ○ Maintains the content of the OAC Physics and its level of difficulty over a 4-year period ○ Provides a range of hours per strand ○ <u>No</u> optional strands ○ Does not describe attitudes to be achieved 	<ul style="list-style-type: none"> ○ OAC Physics is taken at the end of a 5-year program ○ Provides a number of hours for each unit ○ Optional units described ○ Specifies attitudes students are expected to develop
Force and Motion: Dynamics	
<ul style="list-style-type: none"> ○ In the Grade 11 U course ○ Quantitative treatment of linear motion of objects in horizontal, vertical and inclined planes ○ Quantitative treatment of projectile motion and circular motion, in horizontal and vertical plane and forces involved ○ Inertial and no-inertial frames of reference ○ Analyse planetary and satellite motion ○ <u>Not</u> in Grade 12 U ○ Some of this has been moved to Gr. 11 ○ In Grade 11 U ○ Analyse experimental data on the motion of objects in 2 dimensions including motion ○ Analyse experimental data to determine the net force acting on an object and its resulting motion 	<ul style="list-style-type: none"> ○ Displacement, velocity and acceleration and the solution of relevant problems ○ Analysis of motion of an object undergoing circular motion at constant speed ○ Analyse horizontal and vertical components of projectile motion in order to solve problems ○ Inertial and non-inertial frame of reference ○ Forces acting on planets and satellites ○ Proportionality and graphing techniques ○ Newton's laws of motion and related problems ○ Determine experimentally acceleration of an object moving in a straight line ○ Solve problems on the kinematics of circular motion involving constant speed ○ Determine and verify experimentally the net force causing an object to accelerate down an inclined plane
Energy and Momentum	
<ul style="list-style-type: none"> ○ Qualitative/quantitative study of concepts and units related to momentum, energy and work ○ Laws of conservation of momentum and motion energy ○ Work and energy, the work-energy theorem ○ Not done in Grade 12U ○ Describe/analyse planetary and satellite motion in terms of energy and energy transformations ○ Experimentally determine laws of conservation of momentum and energy in 1 and 2 dimensions ○ Demonstrate experimentally the conservation of energy in a system involving various forms of energy 	<ul style="list-style-type: none"> ○ Define terms such as momentum, impulse, work, elastic and inelastic collision ○ State the law of conservation of momentum, Hooke's law, law of conservation of energy ○ Derivation of kinetic energy formula from definition of work and Newton's 2nd law ○ Solve problems involving conservation of mechanical energy in a gravitational field ○ Investigate momentum and energy changes in 1 and 2 dimensional collisions ○ Investigate energy transformations involved when a mass attached to a spring undergoes simple harmonic motion

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Physics Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Electric and Magnetic Fields	
<ul style="list-style-type: none"> ○ Study of concepts and units related to electric, gravitational and magnetic fields ○ Comparison of properties of magnetic, gravitational and electric fields ○ Electric fields that exist on the surface of and inside a charged conductor ○ Analyse electric fields and electric forces produced by point charges and oppositely charged parallel plates ○ Qualitative and quantitative analysis of forces acting on a moving charge and on an electric current in a uniform magnetic field ○ Experimentally determine the net force and motion of objects and charged particles in electric, gravitational and magnetic fields 	<ul style="list-style-type: none"> ○ Explain terms related to electric fields ○ Comparison of properties of electric fields to gravitational fields <u>only</u> ○ <u>Not</u> done in OAC ○ Describe electric fields created by point charges and oppositely charges parallel plates and the formulas applicable to each field ○ Not done in OAC ○ Determine the charge on an electron ○ Investigate electric field lines for different charge distributions
The Wave Nature of Light	
<ul style="list-style-type: none"> ○ Electromagnetic radiation as a form of energy, its production, transmission and reception ○ Qualitative and quantitative treatment of phenomenon of wave interference ○ <u>Not</u> done in Grade 12 U ○ Describe and explain quantitatively wave diffraction as it applies to light ○ Collect and explain experimental evidence for the wave model of light ○ Investigate experimentally the diffraction and interference of light 	<ul style="list-style-type: none"> ○ Taken from <u>Optional Unit #3, Electromagnetic Radiation in OAC</u> ○ Explain interference patterns produced for light and solve related problems ○ Derive equations for constructive and destructive interference of light for double-slit ○ Describe diffraction pattern of light passing through single slits of various widths ○ Provide explanations by means of the wave model of light to account for its characteristics ○ Determine the wavelength of light from and interference pattern of diffraction grating pattern

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Physics Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Matter – Energy Interface	
<p><u>Note:</u> This strand combines essential course material from the current Grade 12 Physics Advanced Level (core unit on Nuclear Physics) and the OAC Physics (core unit on Early Quantum Theory and optional units on Special Relativity and Elementary Particles).</p>	
<ul style="list-style-type: none"> ○ Concepts and units related to nature of the atom and elementary particles ○ Describe principle forms of nuclear decay ○ State Einstein’s 2 postulates for special theory of relativity ○ Apply Einstein’s mass-energy equivalence ○ The Standard Model of elementary particles ○ Collect experimental evidence of Bohr’s model of the atom ○ Analyse trajectories of elementary particles in images to determine mass versus charge ratio 	<ul style="list-style-type: none"> ○ Explain the meaning of quantum, photon, photoelectric effect, work function ○ Write nuclear equations for alpha & beta decay ○ State the 2 postulates of Einstein’s special theory of relativity ○ Solve problems that involve the energy-mass relationship developed by Einstein ○ Distinguish between elementary and composite particles ○ Explain the contribution of some scientists to the development of the early quantum theory ○ State some characteristics of elementary particles such as their mass and charge

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Chemistry Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Standardization of Content	
<ul style="list-style-type: none"> ○ Maintains the content of the OAC Chemistry and its level of difficulty over a 4-year period ○ Provides a range of hours per strand ○ <u>No</u> optional strands ○ Does not describe attitudes to be achieved 	<ul style="list-style-type: none"> ○ OAC Chemistry is taken at the end of a 5-year program ○ Provides a number of hours for each unit ○ <u>No</u> optional units described ○ Specifies attitudes students are expected to develop
Organic Chemistry	
<ul style="list-style-type: none"> ○ Names (IUPAC system) and structural formula of different classes of organic compounds including non-systematic names ○ Physical properties of organic compounds ○ Describe different types of organic reactions and predict their products ○ Diversity and importance of organic compounds in living organisms ○ Build molecular models of organic compounds ○ Synthesize organic compounds in the laboratory ○ Not in Grade 12 U but in Grade 11 U Chemistry course 	<ul style="list-style-type: none"> ○ Name (IUPAC system) and draw structural formulas of different hydrocarbons and common organic functional groups ○ Physical and chemical properties of various organic series ○ Identify organic reactions from formulas of reactants and products ○ Listed <u>only</u> as an application in OAC ○ <u>Not</u> required in OAC ○ Prepare a condensation polymer, and an ester <p>NOTE: structure of isomers, properties of saturated and unsaturated hydrocarbons, and heats of combustion are in Grade 11U of OSS</p>
Energy & Rates of Reactions	
<ul style="list-style-type: none"> ○ Compare energy changes from physical changes, chemical reactions, and nuclear reactions ○ Use collision theory and potential energy diagrams to analyse chemical reactions and explain factors affecting rate of reaction ○ Explain Hess's law and solve related problems including the use of experimental data ○ Identify entropy changes associated with chemical and physical processes ○ Determine heat of reaction experimentally and measure factors affecting rate of reaction ○ Calculate heats of reaction from tables of enthalpies of formation 	<ul style="list-style-type: none"> ○ Compare the magnitudes of the energy involved in physical, chemical, and nuclear changes ○ Use collision theory to explain factors affecting reaction rate and interpret potential energy diagrams ○ Define Hess's law, illustrate it experimentally, calculate heat of reaction by summation given appropriate equations and their heats of reaction ○ In unit on Equilibrium, relates only to tendency of reactions to achieve maximum entropy ○ Calculate heat of reaction from calorimetric data and determine experimentally factors affecting reaction rates ○ Calculate heat of reaction using standard heat-of-formation tables

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Chemistry Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Chemical Systems & Equilibrium	
<ul style="list-style-type: none"> ○ Concept of equilibrium, law of chemical equilibrium, Le Chatelier's Principle ○ Behaviour of ionic solutes in unsaturated, saturated, and supersaturated solutions ○ Solve problems using concentrations of reactants and products and the following quantities: K_{eq}, K_a, K_b, pH, pOH ○ Molar solubility of a solute in water or a solution of a common ion using K_{sp} ○ Compare strong and weak acids and bases and predict qualitatively whether a solution of a specific salt will be acidic, basic, or neutral ○ Confirm experimentally how various factors affect a chemical system at equilibrium ○ Determine experimentally equilibrium constants ○ Solve problems involving acid-base titration data and pH at the equivalence point ○ Describe characteristics, components of buffers ○ <u>Not</u> in Grade 12U 	<ul style="list-style-type: none"> ○ List conditions necessary for equilibrium, define law of chemical equilibrium, state Le Chatelier's Principle and apply it to systems at equilibrium ○ <u>Not</u> in OAC ○ Solve qualitative and quantitative problems involving equilibrium constants and pH and pOH ○ Solve qualitative and quantitative problems involving K_{sp} but <u>only</u> in water and <u>not</u> in solution of a common ion ○ Determine experimentally the K_a value for a weak acid, explain and predict the pH values of salt solutions other than 7 ○ Observe the effects of different factors on a system in equilibrium ○ Determine K_a and K_{sp} experimentally ○ Solve problems involving pH and calculate changes in pH during titration ○ <u>Not</u> in OAC ○ Choosing indicators for acid-base titration
Electrochemistry	
<ul style="list-style-type: none"> ○ Oxidation, reduction, oxidation numbers ○ Balancing chemical equations for redox systems including half-cell reactions ○ Describe electrochemical cells in terms of oxidation and reduction half cells and overall cell potential ○ Describe components in galvanic and electrolytic cells and determine their characteristics experimentally ○ Analyse experimentally oxidation-reduction reactions and predict their overall cell potentials ○ Solve problems based on Faraday's law ○ Measure experimentally the mass of metal deposited by electroplating 	<ul style="list-style-type: none"> ○ Oxidation, reduction, and rules for determining oxidation numbers ○ Balance redox reactions given half-cell reactions used ○ Estimate voltage required to perform various electroplating experiments ○ Construct electrochemical cells and measure the voltages produced ○ Predict the spontaneity of redox reactions using half-cell potentials ○ <u>Not</u> in OAC ○ <u>Not</u> in OAC but do construct electrolytic cells, and examine results of electroplating

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Chemistry Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Structure & Properties	
<ul style="list-style-type: none"> ○ Explain development of Bohr-Rutherford model of the hydrogen atom ○ Describe quantum-mechanical model of atom ○ List characteristics of including the electron configurations of the s, p, d, and f elements using the Pauli exclusion principle and Hund's rule ○ Explain properties of solids or liquids by describing their intramolecular and intermolecular forces ○ Using Valence Shell Electron Pair Repulsion (VSEPR) model to predict molecular shape ○ Predict the polarity of substances using molecular shape and the electronegativity values of its elements ○ Experimentally determine the physical properties of different substances and hence the type of bonding present 	<ul style="list-style-type: none"> ○ Describe evolution of atomic theory from Aristotle to the quantum-mechanical view ○ Differentiate between Bohr-Rutherford view of the atom and the quantum-mechanical view ○ Electron configurations for 1st twenty elements using schematic orbital diagrams <p style="margin-left: 20px;"><u>NOTE</u>: d and f elements <u>not</u> required in OAC</p> <ul style="list-style-type: none"> ○ Explain properties of substances using Van der Waals and dipole forces, and ionic, metallic, and hydrogen bonds ○ Predict shape or structure of simple molecules using a bonding theory such as VSEPR ○ Use ionization energies or electronegativities to identify polar molecules ○ Compare experimentally the properties of liquids and solids that can be explained by the various types of bonding

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Biology Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Standardization of Content	
<ul style="list-style-type: none"> ○ Maintains the content of the OAC Biology and its level of difficulty over a 4-year period ○ Provides a range of hours per strand ○ <u>No</u> optional strands ○ Does not describe attitudes to be achieved 	<ul style="list-style-type: none"> ○ OAC Biology is taken at the end of a 5-year program ○ Provides a number of hours for each unit ○ Optional units described ○ Specifies attitudes students are expected to develop
Metabolic Processes	
<p><u>NOTE</u>: this review of material is covered in earlier grades in biology and chemistry (Grade 11 U) but is <u>not</u> in Grade 12 U</p> <ul style="list-style-type: none"> ○ Functional groups in biological molecules, how they contribute to the function of each molecule ○ Describe major types of biochemical reactions ○ Transformation of energy in the cell with respect to respiration and photosynthesis ○ Function of enzymes in cellular metabolism ○ Describe the role of molecules such as glucose, ATP, and pyruvic acid in cellular respiration ○ Interpret qualitative and quantitative observations of products of cellular metabolism and photosynthesis ○ Carry out procedures on a cell process such as enzyme activity or membrane transport to find optimal conditions such as PH, concentration and temperature 	<ul style="list-style-type: none"> ○ Describe the formation of bonds of different types, explain bond energy, and examples of oxidation and reduction in living organisms ○ Describe key subgroups and main functions in living organisms of carbohydrates, lipids, proteins, and nucleic acids ○ Describe how light energy is converted into chemical potential energy during photosynthesis ○ Relationship among glycolysis, the citric-acid (Krebs) cycle, and the electron transport (respiratory) chain ○ Release of energy and production of ATP that results from the anaerobic (glycolysis) and the aerobic (citric-acid cycle) catabolism of glucose <p style="margin-left: 20px;">NOTE: more in OAC on plant physiology</p> <ul style="list-style-type: none"> ○ Investigate the effects of various factors on the movement of materials through differentially permeable membranes ○ Investigate experimentally the effects of factors such as temperature, pH on enzyme activity

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Biology Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Molecular Genetics	
<ul style="list-style-type: none"> ○ Structure and function of RNA and DNA ○ DNA replication and methods of repair ○ Explain steps involved in protein synthesis ○ Change in genetic material in cells by mutagens ○ Genetic manipulation and its applications ○ Analyse experimentally the cell components involved in protein synthesis ○ Examine/analyse a segment of DNA ○ Major findings of the Human Genome Project 	<ul style="list-style-type: none"> ○ Structural and functional relationship between DNA and RNA ○ Process of DNA replication how proteins are synthesized in the cell ○ How proteins are synthesized in the cell ○ How mutagens can change genetic material in cells by causing mutations ○ Describe one or more techniques of genetic research that make genetic engineering possible ○ Use molecular models to demonstrate aspects of protein synthesis ○ <u>Not</u> in OAC ○ Report on one or more aspects of current genetic research
Homeostasis	
<ul style="list-style-type: none"> ○ Anatomy/physiology of the endocrine and nervous systems and their roles in homeostasis ○ Action of hormones on the male and female reproductive systems ○ Homeostatic processes involved in maintaining water, ionic, thermal and acid-bade equilibrium ○ Mammalian immunological response to a viral or bacterial infection ○ Construct a model which illustrates the essential components of the homeostatic process ○ Effect of environmental factors such as allergens on homeostatis within an organism ○ Experimentally study the response of invertebrates to external stimuli ○ Demonstrate experimentally a feedback system e.g., monitor heart rate after exercise 	<ul style="list-style-type: none"> ○ Structural relationships among, and the role of components of the nervous system ○ Describe the source and the role of any two inter-related hormones e.g., sex hormones ○ Demonstrate experimentally homeostatic mechanisms in humans ○ <u>Not</u> in OAC ○ Design a model demonstrating the essential components of a control system ○ Examine experimentally with invertebrates the internal effects of such external factors as heat ○ Demonstrate biological regulatory systems ○ Use the body's reaction to a stimulus such as physical exercise to describe how the nervous and endocrine systems interact

OSS 12U and OS:IS OAC Curriculum Comparison Activity

Comparison of the Biology Curricula

OSS Curriculum: Grade 12U	OAC Curriculum
Evolution	
<ul style="list-style-type: none"> ○ Evidence and arguments relating to the origin, development, and diversity of living organisms on Earth ○ Analyse evolutionary mechanisms such as natural selection and genetic variation and their effects on bio diversity and extinction ○ Concept of speciation and its mechanisms ○ Process of adaptation of an individual to their environment ○ Solve problems related to evolution using the Hardy-Weinberg equation ○ Develop appropriate sampling procedures e.g., to determine hereditary characteristics of a given population 	<ul style="list-style-type: none"> ○ Lines of evidence from areas of biology that support and are explained by the theory of biological evolution ○ Describe 3 or more mechanisms that can lead to genetic variation in a population e.g., mutation, natural selection, genetic drift ○ Relationship between genetic variation and speciation; postulate how new species can result ○ Explain the concept of adaptation by describing an example ○ State the Hardy-Weinberg law and explain its significance in terms of the development of evolutionary theory ○ Measure, record, and graph continuous and non-continuous variation in a population
Population Dynamics	
<p>Not in Grade 12U but in Grade 10 Science</p> <ul style="list-style-type: none"> ○ Concepts of interaction such as competition, predation, and symbiotic relationships between different species of animals and plants ○ Characteristics of a population such as growth, density, distribution and carrying capacity ○ Explain the fluctuation of a population of a species using factors such as carrying capacity ○ The energy pyramid and the production, distribution, and use of food resources ○ Use conceptual and mathematical models to determine growth of population of species ○ Determine experimentally the characteristics of population growth of two populations ○ Use the ecological hierarchy for living things to evaluate how the change in one population can affect the entire hierarchy 	<p>NOTE: the OAC covers ecological concepts, biogeochemical cycles, and other related material</p> <ul style="list-style-type: none"> ○ Describe terms such as food we, trophic levels, community, population, symbiotic relationship ○ Compare and explain the fluctuations in a population of a species including such factors as carrying capacity, fecundity, competition ○ Flow of energy through ecosystem and the biomass at each of the trophic levels ○ <u>Not</u> in OAC ○ Analyse and account for the variety, size and distribution of populations in an ecosystem ○ Interpret data obtained experimentally on effects of environmental factors on populations of organisms

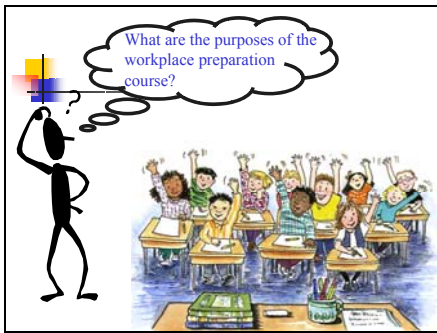
Workplace Preparation Course Overheads

Science Grade 12

Workplace Preparation Course
SNC4E

SNC4E Prerequisites

- Science Grade 9 Academic or Applied and
- Grade 11 Science Workplace (SNC3E)



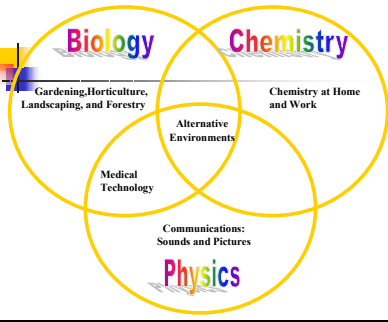
Purposes of SNC4E

- to develop scientific literacy in students who will not be specializing in science at university or college;
- to understand basic science concepts;
- to develop skills of inquiry and communication;
- to relate science to technology, society and the environment;
- to provide a science option for senior students who are interested in going directly to the workplace upon graduation.



SNC4E Strands

- Chemistry at Home and Work
- Communications: Sounds and Pictures
- Medical Technology
- Gardening, Horticulture, Landscaping, and Forestry
- Alternative Environments





Goals of All Secondary Science Programs

- To understand the basic concepts of science
- To develop the skills, strategies, and habits of mind required for scientific inquiry
- To relate science to technology, society, and the environment



Overall expectations

Every strand has 3 overall expectations that relates to one of the goals:

- KNOWLEDGE
- SKILLS
- STSE

Gardening, Horticulture, Landscaping, and Forestry

Overall expectations

KNOWLEDGE demonstrate an understanding of the conditions required for plant growth, and of the techniques used in gardening, horticulture, landscaping and forestry;

SKILLS investigate experimentally the effect of various conditions on the growth of plants, and demonstrate skills in the use of tools and techniques associated with either gardening, horticulture, or landscaping;

STSE demonstrate an understanding of the importance of cultivated and wild plants to society, the economy and the environment.

Building a Resource Base

- ✓ Divide into five groups
- ✓ Each group will work on the specific expectations for one SNC4E strand

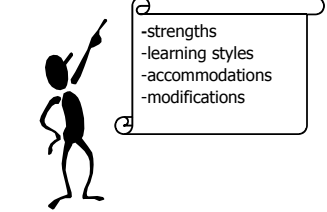
Activity

1. Brainstorm possible resources related to your designated strand.
2. Use chart paper to record your answers and be prepared to present them to the whole group.

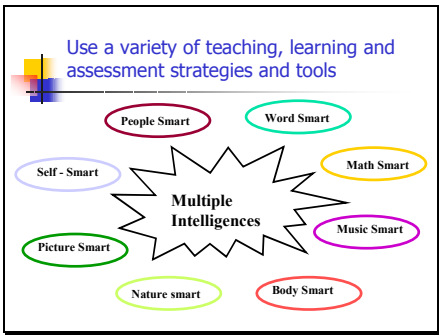
Building a Resource Base - Examples

- Local community establishments (e.g., garden centers, hospitals, electronics stores)
- Industry and trade (e.g., research companies, drug companies)
- Volunteer organizations
- Universities and Colleges (e.g., mentorship programs, guest speakers)
- Government offices (e.g., city hall)

Planning, instruction and assessment must account for students':



- strengths
- learning styles
- accommodations
- modifications



Information Technology

Computers and telecommunication networks are commonplace in education and the workplace

Provide opportunities for students to acquire the knowledge, skills, and attitudes that will allow them to use computer technology effectively, confidently and ethically.

A small icon of a desktop computer with a monitor, keyboard, and mouse is located at the bottom right of the text area.

Workplace Preparation Course SNC4E Activity
Compare Grade 12 University Preparation and Grade 12
Workplace Preparation courses

List teaching and learning strategies that you would use in these courses.

University Preparation	Workplace Preparation

Identify ways in which you would assess and evaluate students' achievement in these courses.

University Preparation	Workplace Preparation

Session II: Grade 12 Science

College Preparation and University/College Preparation Courses Workshop

College Preparation Courses


- copies of overheads
- College Programs Prerequisites Activity
- Implementation Challenges Activity

University/College Preparation Course

- copies of overheads

Summarizing Grade 12 Courses Activity


College Preparation Courses Overheads



Science Grade 12


College Preparation Courses

Chemistry SCH4C
Physics SPH4C



College Preparation Prerequisites

- Science Grade 9 Academic or Applied
and
- Science Grade 10 Academic or Applied




Destinations of College Preparation Courses

Group according to subject disciplines.

Activity

- Use the college course calendars to record which college programs require SCH4C or SPH4C as a prerequisite for entry.
- Share your findings with the whole group.



Chemistry Strands SCH4C

- Matter and Qualitative Analysis
- Organic Chemistry
- Electrochemistry
- Chemical Calculations
- Chemistry in the Environment



Physics Strands SPH4C

- Mechanical Systems
- Electrical Circuits
- Micro-organisms
- The Immune System and Human Health
- Human Impact on the Environment



Goals of All Secondary Science Programs

- To understand the basic concepts of science
- To develop the skills, strategies, and habits of mind required for scientific inquiry
- To relate science to technology, society, and the environment



Overall expectations

Every strand has 3 overall expectations that relates to one of the goals:

- KNOWLEDGE
- SKILLS
- STSE



SCH4C Matter and Quantitative Analysis Strand

Overall expectations

- KNOWLEDGE** - demonstrate an understanding of the basic principles of qualitative analysis and underlying theories
- SKILLS** - carry out qualitative analyses, using flow charts and appropriate laboratory equipment and instruments
- STSE** - describe the role and importance in society of some of the applications of qualitative analysis



SPH4C Electricity and Electronics Strand

Overall expectations

KNOWLEDGE

▪ demonstrate an understanding of common applications of electrical and electronic circuits, and the function and configuration of the components used

SKILLS

▪ construct, analyze, and troubleshoot simple electrical circuits by using schematic diagrams and appropriate electrical tools and measuring equipment, and by examining familiar electrical devices

STSE

▪ investigate the development and application of electrical technologies and their impact on local and global economies and the environment



Science Investigation Skills (SIS)

- **What** are they?
- **Where** can they be found?
- **Why** have they been placed here?
- **What** do they have **in common** from one course to another?
- **When** are they to be addressed?



Implementation challenges for SCH4C and SPH4C

Activity

Identify implementation challenges for college preparation courses.

Discuss methods of overcoming the challenges and record your solutions on the worksheet provided.



Implementation Challenges

- Inconsistent knowledge and skills brought to course
- Inappropriate placement of students
- Lack of course specific resources
- Lack of sophisticated equipment
- Ideas for culminating tasks



A moment of reflection

Summarize the key components of the college preparation courses to

- ensure students and guidance counsellors are aware of the knowledge and skills required for the course
- ensure students and guidance counsellors understand the pathways opportunities for these courses.

Grade 12 College Preparation Courses

College Programs Prerequisites Activity


Name of College	Name of Course	Prerequisites Needed

Grade 12 College Preparation Courses

Implementation Challenges Activity


CHALLENGES	STRATEGIES TO OVERCOME CHALLENGES

University/College Preparation Course Overheads



Science Grade 12

**University/College Preparation Course
SNC4M**



SNC4M Prerequisites

Prerequisite courses

- Science Grade 9 Academic or Applied, and
- Science Grade 10 Academic or Applied, and
- Grade 11 University/College Science (SNC3M)


Students may also have taken one or more of these courses:

- Grade 11 University Biology, Chemistry and/or Physics
- Grade 11 College Biology



SNC4M Strands

- Organic Products in Everyday Life
- Pathogens and Disease
- Energy Alternatives and Global Impact
- Communications Systems
- Science and Contemporary Societal Issues



It takes a village to raise a child

Using community resources

The community offers:

- Employment for students and their families now and in the future
- Post secondary education opportunities
- Services and resources
- Recreational opportunities

It takes a village to raise a child

Using community resources

Potential resources in the community

- Business
- Industry
- Health care facilities
- Educational institutions
- Civic and community facilities

It takes a village to raise a child

Using community resources

Ways in which community resources can be utilized

- Guest speakers
- Carousels and job/career fairs
- Tours
- Job shadowing
- Co-op placements

Community Resources Activity 1

Identify community resources, either general or specific, that would support implementation of SNC4M

Brainstorm a list in your group

For example:

- Public Health nurse
- Food sanitation officer
- Fuel storage and supply

Community Resources Activity 1

Examples

Organic Products in Everyday Life

- Fuel company
- Fertilizer and pesticide sales representative
- Soap maker
- Cancer survivor
- health care professional
- Cancer society education clerk
- Pharmacist
- Experimental farm/farmer



Community Resources Activity 2

Identify teaching and learning strategies that use community resources to address a set of clustered expectations for one strand



Community Resources Activity 2 Example

Strand: Organic products
Teaching/learning strategy: Interview questions
Community resource: Weedman
Clustered expectations related to STSE

Task:
Write a set of interview questions.
Using these questions conduct an interview with Weedman, and write an article for the class summarizing your interview.



Developing Scientific Literacy

Skills for the Future

Goals of science education throughout the world:
Possession of the scientific knowledge, skills and habits of mind required to thrive in the science based world of the 21st Century



Developing Scientific Literacy

Scientific literacy is also important for non-science specialists

- Small business person
- Lawyer
- School teacher
- Office workers



Why is scientific literacy important in everyday life?

- Reading labels: drugs, pesticides
- Writing an informed letter to the editor, to a company
- Understanding science related issues in newspapers, magazine articles or other mass media reports (aural and/or oral)
- Understanding workplace health and safety issues
- Understanding instructions for operating equipment or "How to" manuals



Scientific Literacy Activity 1

Brainstorm evidence that demonstrates scientific literacy is important as a citizen of the world.



Scientific Literacy Activity 1 Example

- Know where to look for information
- Recognize the misrepresentation of scientific claims
- Identify home and garden safety practices
- Work safe/play safe
- Be knowledgeable about personal and family health issues
- Be comfortable with the use of technology
- Understand the portrayal of scientific principles in popular media



Scientific Literacy Activity 2

Cluster a set of expectations for SNC4M that supports the development of scientific literacy.

Write a learning task for this cluster.



Scientific Literacy
Activity 2 Clustered Expectations Example

Organic Products in Everyday Life

Understanding Basic Concepts, page 147

- summarize using scientific principles, the dangers of UV radiation and the role of sunscreens in protecting the skin;
- explain the action of various pharmaceuticals, and their role in personal health-care products.



Scientific Literacy
Activity 2 Learning Task Example

- Using consumers' reports, research on the most appropriate sunscreen for your age group based on your lifestyle.
- Using your research, develop a set of criteria to compare the information from sunscreen packaging and other sources of consumer information. Design and complete a comparison chart that summarizes the information.
- Based on your findings, write a report recommending a specific sunscreen product and provide rationale as to why you have made this choice.

Grade 12 Science Courses Summary

The nature of the new grade 12 courses has changed considerably. In the spaces below, record some of the ideas that have been discussed in these training sessions.

Share this information with guidance offices, students and parents until people more fully understand the nature of these courses.

SNC4E Workplace	SCH4C/ SPH4C College
SBI4U, SCH4U, SPH4U, SES4U University	SNC4M University/College

APPENDIX A: Assessment Methods, Strategies, and Tools

Presenter's Note: Cut the following terms into individual pieces to use with Assessment and Evaluation Practices Activity.

Directed observations

Questionnaires

Charts

Group discussions

Logs

Content/concepts

Interviews

Journals

Tests

Case conferences

Audio biographies

Scrapbooks

Newspaper files

Collections

Creative writing

Flow charts

Venn diagrams

Model building

Learning centres

Newspapers

Concept mapping

Time-line charts

Seminars

Glossary

Artistic expression

Surveys

Test Stations

Projects

Written Reports

Laboratory Reports

Science Fair

Portfolios

Case Studies

Test Questions: Short Answer

Test Questions: True/False

Test Questions: Essay

Test Questions: Matching

Test Questions: Multiple Choice

Oral Testing

Lab Tests

End of Unit Culminating Activity

End of Course Culminating Activity

Checklists

Contracts

Rating Scales

Marking Schemes

Rubrics

Anecdotal Comments (Informal observations)

APPENDIX B: UNIT ASSESSMENT AND EVALUATION PLANNER

Cluster of Expectations	Achievement Chart Category(ies)	Assessment Methods	Strategy	Tool	Type of Assessment			Planning Decision (Key points behind the decision)
					D	F	S	

D - Diagnostic Assessment
 F - Formative Assessment
 S - Summative Assessment