

**SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE MARIE, ON**



COURSE OUTLINE

Course Title: INTRODUCTION SCIENCE

Code No.: SCI 150-3

Semester: 1

Program: PULP AND PAPER OPERATIONS

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**Approved: _____ *rffawA_mMrA/<h>* _____ *tf%A* _____ • *fij/f,?*
Dean Date**

Total Credits: 3

Prerequisite(s): NONE

Length of Course: 16 WEEKS

Total Credit Hours: 48

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I. COURSE DESCRIPTION:

This course deals with the scientific fundamentals from the chemistry and physics disciplines that are the bases for understanding the technologies used in the pulp and paper industry. The course material will be split in approximately equal portions between chemistry and physics.

Chemical fundamentals to be covered will include the following: atomic theory, elements, chemical solutions, simple reactions, factors controlling reaction rates and balancing simple chemical equations. Fundamentals to be covered from the physics discipline will include concepts of mass, volume, density, specific gravity, pressure systems, levers, gears and pulleys, energy and work, hydraulic systems, electrical basics and light.

H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

(Generic Skills Learning Outcomes placement on the course outline will be determined and communicated at a later date.)

Upon successful completion of this course the student will demonstrate the ability to:

- 1) Demonstrate a knowledge of the properties of matter.

Potential Elements of the Performance:

- define mass, volume, density and specific gravity
- calculate the above quantities from given information
- define pure substances, solutions and mixtures
- describe the three stages of matter
- explain what occurs during changes of state
- list the common chemical and physical properties of matter used to identify substances
- define the terms element and compound

- 2) Demonstrate a knowledge of atoms and molecules.

Potential Elements of the Performance:

- define what an atom is and describe its structure
- define atomic mass scale, atomic number, mass number and isotopes
- describe what is meant by the terms molecule and ion
- write the correct formula for some chemical compounds
- name simple compounds when given only the formula

H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE (Continued)

3) Demonstrate a knowledge of chemical elements and compounds.

Potential Elements of the Performance:

- describe the elements which make up the major portion of the earth's crust
- define metals, non-metals and metalloids and describe their physical and chemical properties
- describe the behaviour of gasses and the effect of pressure (Boyle's Law) and the effect of temperature (Charles' Law) on the volume of a gas
- calculate the density and specific gravity of a gas
- explain the classification of the elements as shown in the periodic table
- explain the difference between organic and inorganic compounds and the importance of carbon to carbon bonding in organic chemistry
- describe the major types of biological compounds and their chemical composition and characteristics

4) Demonstrate a knowledge of chemical reactions.

Potential Elements of the Performance:

- determine whether a reaction gives off energy (exothermic) or requires energy (endothermic)
- draw energy diagrams for a chemical reaction
- describe the factors which influence the rate at which a reaction takes place
- describe what is meant by the term heat of reaction
- write and balance chemical reactions given only the word equation
- describe the main types of chemical reactions and give examples
- describe acids, bases and salts and give the properties of each
- describe the meaning of pH or hydrogen ion concentration
- write the reaction between an acid and a base (also known as a neutralization reaction)
- calculate the oxidation number and the oxidation state of an atom
- describe the terms oxidation, reduction, oxidizing agent and reducing agent

H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE
(Continued)

- 5) Demonstrate a knowledge of mass, weight, density and specific gravity.

Potential Elements of the Performance:

- state the difference between mass and weight and calculate one when given the other in both SI and USCS units
- calculate the unknown quantity when given any two of mass, weight, volume or density
- convert from SI units to USCS units and vice-versa
- state the value of the acceleration due to gravity in both ft/s^2 and m/s^2
- calculate volumetric flow rates and convert from SI units to USCS units and vice-versa
- solve problems using weight or mass density and specific gravity

- 6) Demonstrate a knowledge of force and pressure.

Potential Elements of the Performance:

- describe the relationships between force, mass and acceleration and give the units for each
- define the units Newton and Pascal
- demonstrate by definition and example the difference between mass and weight, speed and velocity
- state Newton's Laws of Motion and give an example of an application of each law
- solve problems for force, mass or acceleration when given any two of these quantities
- define pressure and give its units
- solve problems for pressure exerted by solids and at a depth in a liquid
- state Pascal's Law and give an example of its application
- describe a simple manometer and how it is used to measure pressure in a closed vessel
- describe a simple barometer and how it is used to measure atmospheric pressure

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**H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE
(Continued)**

- 7) Demonstrate a knowledge of work, energy and power

Potential Elements of the Performance:

- write the formula for determining work and use it to solve problems
- explain the difference between potential and kinetic energy
- solve problems using the formulae for potential and kinetic energy
- write the formula for power and use it to solve problems

- 8) Demonstrate a knowledge of simple machines

Potential Elements of the Performance:

- describe a simple machine and its operation
- write the formula for determining the efficiency of simple machines and use it to solve problems
- determine both the ideal and actual mechanical advantage of a simple machine
- draw a diagram of each of the following simple machines: lever, inclined plane, wedge, gear, pulley system, wheel and axle, screw, belt drive
- write a formula for computing the mechanical advantage of each of the simple machines mentioned
- calculate the mechanical advantage and efficiency of the above machines

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H. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE
(Continued)

9) Demonstrate a knowledge of electricity.

Potential Elements of the Performance:

- name the units for a quantity of electrons, electric current and electro motive force
- derive the formulae for the definitions above and use them to solve problems
- differentiate between series and parallel circuits
- name the units of power
- name the units of electrical measurement
- solve problems using the formulae for electrical measurement including power, energy and costs

10) Demonstrate a knowledge of simple hydraulic systems.

Potential Elements of the Performance:

- write the formula for calculating the mechanical advantage of a hydraulic press in terms of input and output forces or areas
- solve problems using the above formula
- state Archimedes' Principle and use it to determine the buoyant force of an object
- write the formula for determining the rate of flow of a fluid in terms of its velocity and the cross-sectional area and use it to solve problems
- discuss the change in velocity of a fluid and fluid pressure as the cross-sectional area of a pipe changes

m. TOPICS:

- 1) Properties of Matter
- 2) Atoms and Molecules
- 3) Chemical Elements and Compounds
- 4) Chemical Reactions
- 5) Mass, Weight, Density and Specific Gravity
- 6) Force and Pressure
- 7) Work, Energy and Power
- 8) Simple Machines
- 9) Electricity
- 10) Hydraulic Systems

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IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

"Study Guide for SCI 150, Introductory Science"
Sault College of Applied Arts and Technology
Sault Ste. Marie, 1989

V. EVALUATION PROCESS/GRADING SYSTEM

Students will be graded on the basis of their performance in four tests (two each for the chemistry and physics components) given at appropriate intervals during the course. All tests will be weighted equally. The grading system will be as follows:

A+ = 90-100 A = 80-89 B = 70-79 C = 60-69 R = less than 60

Students with a final grade between 55-59 may be allowed to write a supplemental exam.

VI. SPECIAL NOTES:

- Special Needs
If you are a student with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 493, 717,491 so that support services can be arranged for you.
- Retention of Course Outlines
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other post-secondary institutions.
- Disclaimer for Meeting the Needs of the Learners
- Substitute Course Information is available at the Registrar's Office.

Any Other Special Notes appropriate to your course.

VH. PRIOR LEARNING ASSESSMENT

Students who wish to apply for advanced credit in the course should consult the instructor.