

# Chemistry 11 / Advanced Chemistry 11

## General Curriculum Outcomes

### STSE

1. Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

### Skills

2. Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

### Knowledge

3. Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

### Attitudes

4. Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

## Specific Curriculum Outcomes

Students in Advanced Chemistry 11 will be expected to achieve the outcomes for Chemistry 11 as well as those for the advanced course.

Students will be expected to

### Stoichiometry (40%) (Advanced, 30%)

#### THE MOLE AND MOLAR MASS

- define molar mass and perform mole-mass inter-conversions for pure substances (323-1)
- explain how a major scientific milestone, the mole, changed chemistry (115-3)

**CALCULATIONS AND CHEMICAL EQUATIONS**

- identify mole ratios of reactants and products from balanced chemical equations (323-10)
- identify practical problems that involve technology where equations were used (214-13)
- state a prediction and a hypothesis based on available evidence and background information (212-4)
- perform stoichiometric calculations related to chemical equations (323-11)

**STOICHIOMETRIC EXPERIMENTATION**

- design stoichiometric experiments identifying and controlling major variables (212-3)
- use instruments effectively and accurately for collecting data (213-3)
- identify and explain sources of error and uncertainty in measurement using precision and accuracy (214-10)
- communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others (215-1)
- identify various constraints that result in trade-offs during the development and improvement of technologies (114-4)

**APPLICATIONS OF STOICHIOMETRY**

- identify various stoichiometric applications (323-12)
- predict how the yield of a particular chemical process can be maximized (323-13)
- explain how data support or refute the hypotheses or prediction of chemical reactions (214-12)
- compare processes used in science with those used in technology (114-7)
- analyze society's influence on science and technology (117-2)

**From Structures to Properties (30%) (Advanced, 25%)****PROPERTIES OF IONIC AND MOLECULAR COMPOUNDS AND METALLIC SUBSTANCES**

- select and integrate information from various print and electronic sources or from several parts of the same source (213-7)
- identify and describe the properties of ionic and molecular compounds and metallic substances (321-7)

**CLASSIFYING COMPOUNDS**

- classify ionic, molecular, and metallic substances according to their properties (321-9)
- identify consumer products and investigate the claims made by companies about the products (212-5)

**BONDING**

- illustrate and explain the formation of ionic, covalent, and metallic bonds (321-4)

**STRUCTURAL MODELS OF BONDING**

- explain the structural model of a substance in terms of the various bonds that define it (321-11)
- explain how knowledge of bonding evolves as new evidence and theories are tested and subsequently revised or replaced (115-7)

- analyze examples of Canadian contributions to bonding (117-11)
- analyze and describe examples where technologies were developed based on bonding (116-4)
- analyze, from a variety of perspectives, the risks and benefits to society and the environment of applying bonding knowledge or introducing a particular technology (118-2)

### **BOND ENERGIES**

- identify limitations of categorizing bond types based on differences in electronegativity between the elements and compounds (214-2)
- explain the evidence from a bonding experiment and from collected data in the development of bond energies (114-2)
- describe how the different types of bonds account for the properties of ionic and molecular compounds and metallic substances (321-8)

### **POLAR AND PURE COVALENT BONDING**

- illustrate and explain hydrogen bonds and van der Waals' forces (321-5)
- use library and electronic research tools to collect bonding information (213-6)
- select and integrate information from various print and electronic sources or from several parts of the same source (213-7)
- compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, and graphs (214-3)

## **Organic Chemistry (30%) (Advanced, 25%)**

### **SO MANY COMPOUNDS**

- explain the large number and diversity of organic compounds with reference to the unique nature of the carbon atom (319-4)

### **INFLUENCES OF ORGANIC COMPOUNDS ON SOCIETY**

- explain how synthesizing organic molecules revolutionized thinking in the scientific community (115-3)
- explain how organic chemistry has evolved as new evidence has come to light (115-6)
- identify various constraints that result in trade-offs during the development and improvement of technologies (114-4)
- provide organic chemistry examples of how science and technology are an integral part of their lives and their community (117-5)
- analyze natural and technological systems to interpret and explain the influence of organic compounds on society (116-7)

### **CLASSIFYING ORGANIC COMPOUNDS**

- classify various organic compounds by determining to which families they belong, based on their names or structures (319-7)

### **NAMING AND WRITING ORGANIC COMPOUNDS**

- write the formula and provide the IUPAC name for a variety of organic compounds (319-5)

**APPLICATIONS OF ORGANIC CHEMISTRY**

- identify limitations of the IUPAC classification system and identify alternative ways of classifying to accommodate anomalies (214-2)
- distinguish between scientific questions and technological problems (115-1)
- select and use apparatus and material safely (213-8)
- provide a statement that describes the relationship between bonding and organic chemistry investigated in light of the link between data and the conclusion (214-11)
- evaluate the design of a technology and the way it functions, on the basis of a variety of criteria that they have identified themselves (118-4)
- identify and apply criteria, including the presence of bias, for evaluating evidence and sources of information on an organic topic (214-9)

**ISOMERS IN ORGANIC CHEMISTRY**

- define isomers and illustrate the structural formulas for a variety of organic isomers (319-6)

**WRITING AND BALANCING CHEMICAL EQUATIONS**

- write and balance chemical equations to predict the reactions of selected organic compounds (319-8)

**POLYMERIZATION**

- define problems to facilitate investigation of polymers (212-2)
- design an experiment identifying and controlling major variables (212-3)
- describe processes of polymerization and identify some important natural and synthetic polymers (319-9)

**RISKS AND BENEFITS OF ORGANIC COMPOUNDS: STSE PERSPECTIVES**

- communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others (215-1)
- describe and evaluate the design of technological solutions and the way they function using scientific principles (116-6)
- analyze from a variety of perspectives the risks and benefits to society and the environment of applying organic chemistry knowledge or introducing a particular technology (118-2)
- develop, present, and defend a position or course of action on organic chemistry based on findings (215-5)
- select, integrate, and synthesize information from multiple sources including various print and electronic sources, and make inferences on this information (213-7, 215-3)
- debate the merits of funding specific scientific or technological endeavours and not others (117-4)

# Advanced Chemistry 11 Outcomes

## IN-DEPTH TREATMENT (COMPLETED WITHIN THE UNITS)

- perform stoichiometric calculations related to chemical equations (323-11)
- predict how the yield of a particular chemical process can be maximized (323-13)
- design stoichiometric experiments identifying and controlling major variables (212-3)
- use instruments effectively and accurately for collecting data (213-3)
- illustrate and explain the formation of ionic, covalent, and metallic bonds (321-4)
- explain the structural model of a substance in terms of the various bonds that define it (321-11)
- identify limitations of categorizing bond types based on differences in electronegativity between the elements and compounds (214-2)
- analyze natural and technological systems to interpret and explain the influence of organic compounds on society (116-7)
- develop, present, and defend a position or course of action on organic chemistry based on findings (215-5)
- define isomers and illustrate the structural formulas for a variety of organic isomers (319-6)
- write and balance chemical equations to predict the reactions of selected organic compounds (319-8)
- describe processes of polymerization and identify some important natural and synthetic polymers (319-9)

## LITERATURE SEARCH AND REPORT (5%)

- develop the nature of bonding through a time line (AC-01)
- outline the past/present scientific discoveries and match these with the previously developed time line (AC-02)

## INVESTIGATION OF A PHYSICAL CONCEPT (15%)

- gain information through modelling and guidance on the processes involved in scientific research and development (AC-05)
- conduct a hands-on, minds-on, self-directed experience and generate a report for public presentation (AC-06)