

Grade 11 Chemistry (30S)

A Course for
Independent Study

Field Validation Version



GRADE 11 CHEMISTRY (30S)

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GRADE 11 CHEMISTRY (30S)

Introduction

GRADE 11 CHEMISTRY COURSE INTRODUCTION

Introduction

Welcome to Grade 11 Chemistry. Chemistry is the fascinating study of the interactions between matter and energy. While you have already been studying some chemistry in every science course from Kindergarten to Grade 10, this will be your first full course dedicated to the study of chemistry.

Why Study Chemistry?

Not only is chemistry interesting, but it also helps you to understand the world around you and how things work. *Everything* is made up of chemicals, and chemistry helps to explain how everyday things like medication, adhesives (glues), gasoline, concrete, hair colouring, paint, lipstick, and deodorant work. Chemistry explains how soap removes dirt, how food gets cooked faster in a pressure cooker, and why salt is put on icy roads. If you know some chemistry, you can make better choices in your everyday life.

Who Uses Chemistry?

Everybody does. Fire fighters, artists, nurses, truck drivers, doctors, dentists, plumbers, pharmacists, environmentalists, physical therapists, hairdressers, chefs, and veterinarians learn about chemistry and then use that knowledge in their jobs. So, when you start researching different programs of study at universities and colleges, you'll find that you need Grades 11 and 12 Chemistry in order to be admitted to many of them!

What Will You Need?

Required Resources

- **Molecular Model Kit:** You will need to have access to this kit in Module 6 in order to construct models of molecules. You can purchase it through the Manitoba Text Book Bureau at 1-866-771-6822 or <www.mtbb.mb.ca>. Ask for stock item number 7765.
- **Camera:** You will need access to either a film camera or a digital camera to take pictures of the molecules that you construct in Module 6. If you are using a digital camera and have access to email, then you could email the pictures.

- **Scientific or Graphing Calculator:** You will need access to either a scientific or graphing calculator throughout the course and at the examinations.
- **Notebook:** You will need one in which to answer the questions from your learning activities.

Optional Resources

- **Photocopier:** It would be very helpful if you had access to a photocopier. That way, you could make a copy of your assignments before sending them in so that if your tutor/marker wants to discuss an assignment with you over the phone, each of you will have a copy. It would also allow you to continue studying or complete additional lessons while your original work is with the tutor/marker.
- **Computer with Internet Access:** There are some lessons where website links are offered as sources of information or for supplementary reading. However, if you do not have access to a computer, you can still complete the course.

You do *not* need access to a textbook. All of the content is fully developed in the Grade 11 Chemistry Independent Study course.

How Will You Know How You're Doing?

You will know how well you are learning the course material by how well you complete the following components of the course:

Learning Activities

Learning activities have been designed to let you assess how well you are learning by answering questions and comparing your answers to the answer keys at the end of each module. If your answers are correct, you can continue with the lesson. If they aren't, it means that you did not learn the things that you were supposed to. Therefore, you need to go back and learn them. If you don't learn the information, then you won't understand the lessons that follow.

Make sure that you complete each learning activity. Besides giving you feedback, they will help you practice what you have learned and prepare you to successfully complete your assignments and exams. Many of the questions on the exams will be similar to the questions in the learning activities. *Do not mail learning activities to your tutor/marker.*

Assignments

Every module contains assignments that you will be sending to your tutor/marker for assessment. The assignments are worth 50% of your final mark. In order to do well on your assignments, you should complete all learning activities first and check your answers against the answer keys that are provided. Remember to keep all assignments that have been marked and returned to you until you have finished the course, so that you can use them to study from in preparation for your exams.

Midterm and Final Exams

The course contains a midterm exam and a final exam. You will write them both under supervision. You are allowed to use a scientific or graphing calculator during the examinations. The midterm exam is based on Modules 1 to 3, and is worth 20% of your final mark in the course. You will write the midterm when you have completed Module 3. In order to do well on the midterm exam, you should review the work that you completed during Modules 1 to 3, including all of the learning activities and assignments.

The final exam is based on Modules 1 to 6, and is worth 30% of your final mark in the course. You will write the final exam when you have completed Module 6. In order to do well on the final exam, you should review all of the work that you completed during Modules 1 to 6, including all of the learning activities and assignments. Please note that 80–85% of the final exam is concentrated on Modules 4 to 6.

You are responsible to apply to write your exams. That will prompt staff from the Independent Study Option office to send them to your proctor. Here is how you can do that:

If you are attending school, ask your school's ISO Facilitator to add your name to the ISO exam eligibility list. Do this at least three weeks prior to the next scheduled exam week.

If you are not attending school, check the *Examination Request Form* for options available to you. The Examination Request Form was mailed to you with this course. Fill in this form and mail or fax it in three weeks before you are ready to write your exam. The address is:

ISO Registration
555 Main St.
Winkler, MB R6W 1C4
Fax: 204-325-1719
Phone: 1-800-465-9915

Practice Exams and their Answer Keys

To be successful on your midterm and final exams, you need to complete the practice exams found at <http://www.edu.gov.mb.ca/k12/dl/downloads/index.html>.

These exams are very similar to the actual exams that you will be writing. They also include answer keys, so that when you have finished writing them you can check your answers. This will give you the confidence that you need to do well on your exams. If you do not have access to the Internet, contact the Independent Study Option at 1-800-465-9915 to get a copy of the practice exams.

How is This Course Organized?

This course contains the following six modules:

- Module 1: Physical Properties of Matter
- Module 2: Gases and the Atmosphere
- Module 3: Chemical Reactions
- Module 4: Stoichiometry
- Module 5: Solutions
- Module 6: Organic Chemistry
- Appendix A to H: These are a series of appendices that contain helpful information. As you read through the course, you will be asked to refer to these.

Please note as you read through the course that the definitions of bolded terms may be found in the course glossary (which is Appendix A), and that italicized words represent very important information.

What if You Need Help?

The following resource people are available to help you successfully complete this course:

Your Tutor/Marker

The first person who can help you is your tutor/marker. Tutor/markers are experienced teachers who tutor ISO students and mark both assignments and exams. If you are having difficulty *at any time* during this course, be sure to contact your tutor/marker. He or she is there to help you. If you are not sure how to contact your tutor/marker, phone the Independent Study Option at 1-800-465-9915.

Your Learning Partner

The next person who can help you with your course is your learning partner. A learning partner is *someone you choose* who will help you learn. It may be someone who knows something about chemistry, but it doesn't have to be. A learning partner could be someone else who is taking this course, a teacher, parent, sibling, or a friend. Most importantly, a learning partner should be someone you feel comfortable with and who will support you as you work through this course.

Your learning partner can help keep you on schedule, check your work, help you make sense of assignments, read through your course with you, or look at your learning activities and respond to them. You may even study for your exam with your learning partner.

How Much Time Will You Need?

Learning through independent study has several advantages over learning in the classroom. You are in charge of how you learn and can choose how quickly you will complete the course. You don't have to wait for your teacher or classmates, and you can work as quickly as you want. You can also complete as many lessons at a time as you want. Read the next few pages to get an idea of how to pace yourself.

Chart A: Semester 1

Here is a suggested timeline that you can follow if you start your course in September, and need to complete it by the end of January:

Module	Completion Date
Module 1	September 15
Module 2	October 20
Module 3 and Midterm Examination	November 20
Module 4	December 5
Module 5	December 20
Module 6 and Final Examination	January 15

Chart B: Semester 2

Here is a suggested timeline that you can follow if you start your course in January, and need to complete it by June:

Module	Completion Date
Module 1	February 15
Module 2	March 10
Module 3 and Midterm Examination	April 5
Module 4	April 25
Module 5	May 10
Module 6 and Final Examination	May 31

Chart C: Full School Year (Not Semestered)

Here is a suggested timeline that you can follow if you have registered for this course in September, and would like to complete it by June:

Module	Completion Date
Module 1	September 30
Module 2	November 10
Module 3 and Midterm Examination	December 15
Module 4	February 15
Module 5	April 5
Module 6 and Final Examination	May 31

Do not wait until the last minute to complete your work, since your tutor/marker may not be available to mark it. Make sure that you leave enough time for your work to travel through the mail, as it might take over a week. It may also take a few weeks for your tutor/marker to mark everything and send the marks to your school.

If you need this course in order to graduate this school year, remember to schedule and complete your final exam by June 1.

When and How Do You Send in Your Assignments?

You'll be sending in your assignments seven times during this course. You will send in the first assignment (Assignment 1.1) as soon as you have completed it. From then on, you will send in all of the other assignments when you have completed each module. Each time you send in a set of assignments, you must complete and attach the appropriate Cover Sheet, found at the end of this Introduction.

Prior to mailing your completed assignments, it is recommended to make a photocopy of them. You will then have a copy in case it goes missing and/or your tutor/marker calls you about your assignment. Place the appropriate assignments and Module Cover Sheet in an envelope, and send to:

ISO Tutor/Marker
555 Main St.
Winkler MB R6W 1C4

Emailing Photographs in Module 6

In Module 6 there are three assignments (6.4, 6.5, and 6.6) that require photographs to be forwarded to the Distance Learning Unit. Instructions are provided in Module 6 for the option of emailing digital pictures electronically to the Distance Learning Unit.

What are the Guide Graphics For?

Graphics have been placed inside the margins of the course to identify specific tasks. Each graphic has a specific purpose to guide you. A description of each graphic is described below:



Assignment

This icon indicates an assignment that you complete and send to your tutor/marker. You will be sending in your assignments at the end of every module.



Learning Activity

This icon indicates a learning activity that will help you review or practice what you have learned and prepare for your assignment and exam. You will not send learning activities to your tutor/marker.



Mail-in

This icon indicates when it is time to mail in your assignments.



Learning Partner

This icon indicates a part of the lesson when your learning partner could really help you learn or do something.

A Note about SLO Numbers

In each lesson introduction, you will find SLO numbers (for example, SLO 1.1.1, SLO 1.1.2, etc.). These numbers have been placed here for teachers. Therefore, if you are a student, you can ignore them.

A Note to Teachers Using This Course as a Classroom Resource

Please note that this course includes three features that have been developed for teachers using this course as a classroom resource:

1. We have written the Specific Learning Outcome (SLO) numbers (SLO 1.1.1, SLO 1.1.2, etc.) in the lesson introductions to indicate which SLO is being taught.
2. We have included a list of the animation and video links referred to in each lesson in Appendix B at the back of the course.
3. We have included a list of the SLOs taught in each lesson in Appendix H at the back of the course.

NOTES



GRADE 11 CHEMISTRY (30S)

Module 1: Physical Properties of Matter

MODULE 1: PHYSICAL PROPERTIES OF MATTER

Introduction

Have you ever wondered what is really going on inside a plasma television? How does the evaporation of a liquid in a closed container compare with that of a liquid in an open container? Maybe you have seen the label on a tank of compressed gas (like the one attached to your barbeque) and wondered why it matters how the tank of gas is stored. As you work through these five lessons, these (and many other) questions will be answered.

In this module, you will learn about the four states of matter and how to describe the size, motion, and energy of particles in each. You will revisit phase changes and find out how particles behave during these changes, as well as the role kinetic energy plays in the process. Next, you will focus specifically on one phase change, evaporation, and variables that affect the vapour pressure created by this process. Finally, you will put your graphing skills to use when you learn how to plot and interpret a Vapour Pressure Curve.

General Notes

Here are a few items to be aware of as you work through this course:

- Assignments and learning activities are numbered sequentially. This means that their numbers will not always be the same as the lesson number.
- Not every lesson has both an assignment and a learning activity.
- The timelines given in the Introduction of each lesson are only guidelines; the lesson may take you less time or more time.

From time to time you will see a text box in the margin. These text boxes contain interesting information that pertains to the lesson. You will not be assessed on this information, which means you will not be asked about it in learning activities, assignments, or exams.

Assignments in Module 1

You will be assessed on how well you complete the following assignments, which are found within the lessons themselves.

Lesson	Assignment Number	Assignment Title
1	Assignment 1.1	Substance Investigation
2	Assignment 1.2	Properties of Gases, Liquids, and Solids
3	Assignment 1.3	Dynamic Equilibrium and Phase Changes
4	Assignment 1.4	Vapour Pressure Problems
5	Assignment 1.5	Analyzing a Vapour Pressure Graph

Once you have completed Assignment 1.1, you will immediately mail that work to your tutor/marker. You will wait until you have worked through the rest of Module 1 before you mail in Assignments 1.2, 1.3, 1.4, and 1.5. The instructions for mailing in assignments are found in the Summary at the end of this module.

LESSON 1: STATES OF MATTER (2 HOURS)

Lesson Focus

SLO C11-1-01: Describe the properties of gases, liquids, solids, and plasma.

Include: density, compressibility, diffusion

Lesson Introduction

Since Grade 7 you have been continuing your exploration of several chemical principles that will help you in this course. You have already learned something about chemical and physical properties, as well as the states of matter. For example, water, ice, and steam are all words that can be used to describe water, depending on the circumstances. In this lesson, you will take things a step further and describe some specific chemical properties of solids, liquids, gases, and plasma. Learning more about the properties of matter can help us to identify unknown substances and use them appropriately.

Chemical and Physical Properties

Let's assume that everyone needs a bit of review before we go any further. There are some important terms that you need to know in order to understand this lesson and the ones that follow.

When we discuss terms like gases, liquids, solids, and plasma, we are really talking about matter. Do you remember what matter is? Why does it matter? **Matter** is anything that takes up space (has a volume) and has a mass. In other words, everything that makes up our physical and chemical world is matter.

A **property** is a characteristic that we can use to help us identify a person, place, or thing. This is not only a term used in chemistry, but one that is used commonly in other areas. Describing how your room looks requires referring to the properties of your room, such as blue carpet and red walls. In chemistry, there are two types of properties we use – chemical properties and physical properties.

Chemical Properties

Chemical properties describe how a substance reacts with other substances. As the substance changes, these types of properties can be observed. Examples include rusting and creating gas bubbles. Remember that chemical properties can be either **qualitative** (descriptive information based on an observation of physical characteristics) or **quantitative** (numerical information). An example of a qualitative chemical property is when a pyrotechnic colorant like calcium chloride is added to a firecracker to make an orange flame. An example of a quantitative chemical property is how much time it takes for gas bubbles to form when baking soda and vinegar are mixed together (which may take six seconds).

Physical Properties

Physical properties are ones that we can observe without chemically changing a substance. For example, the hardness and colour of a substance are both physical properties. No new substances are formed when we make these observations. Remember that physical properties can also be either **qualitative** (such as the colour of gold being yellow or copper metal being shiny/lustrous) or **quantitative** (such as the density of H₂O being 1.0 g/cm³ and the melting point of H₂O being 0° C).

There are three physical properties that we will study in more detail: density, compressibility, and diffusion.

Density

You probably have some knowledge about **density** and perhaps have even done some density calculations. We often try to demonstrate the idea of density by using comparisons such as this one:

Two identical boxes have the same volume but contain different materials. Box A contains lead (think of the heavy apron the dentist uses before taking your x-rays) while Box B contains feathers. You could predict that the box of lead would have a greater mass. Having a greater mass for the same volume tells us that lead is a denser material than feathers. Sometimes, simple language such as “it’s heavy for its size, or, it is very light for its size” provides a good way of thinking about high and low density.

It is important to note that every substance has its own density. Since we can use this characteristic to help us identify a substance, it is therefore a property. For example, aluminum (Al) has a density of 2.7 g/cm^3 (that is, 2.7 grams of mass for one cubic centimetre of volume, which is about the size of a sugar cube). If density is a property of aluminum, this means that every sample of pure aluminum should have the same density. Likewise, if we have a sample of an unknown metal and calculate its density to be 2.7 g/cm^3 , we could determine that the metal is probably aluminum. This assumes, of course, that no other metals have a density close to 2.7 g/cm^3 .

Compressibility

The term **compressibility** contains a couple of words that you probably recognize. The words “compress” and “press” might give you an indication of squeezing. Reducing the space between particles allows us to fit more particles in the same space. Some materials compress easily, like most gases, if they have lots of space between their particles. Solids and liquids have very little space between their particles and are therefore more difficult to compress.

Diffusion

Have you ever noticed that you can smell the lunch special from the cafeteria even though you are on the second floor of the school? Thanks to diffusion, smells can spread easily through the air. What is diffusion?

Diffusion is the movement of one substance through another. Diffusion is not limited to gases though. It also occurs commonly in liquids and sometimes in solids. That is why you can be lazy and not stir the drink crystals into your glass of water. Come back later and diffusion will have helped the colour and flavour of the drink crystals move through the water.

One rule to remember when it comes to diffusion is that substances diffuse from areas of high concentration to areas of low concentration. Also, lighter particles diffuse more quickly than heavier particles.

Now that we have refreshed our memories, let's describe the **states of matter** and their physical properties in more detail.

Characteristics of the 3 Common States of Matter

Characteristics			
	Solid	Liquid	Gas
Shape	definite shape	takes the shape of its container	takes the shape of its container
Volume	definite volume	definite volume	takes the volume of its container
Density	usually very dense	usually less dense than solids	usually much less dense than solids and liquids
Compressibility	not easily compressed	not easily compressed	easily compressed
Diffusion	does not easily diffuse	easily diffuses	diffuses very easily

The Fourth State of Matter

A *fourth* state of matter? That's right! You are most likely familiar with the three most common states of matter (solid, liquid, and gas), but there is also one uncommon state of matter. This fourth state of matter is called **plasma**, and while some of you may know the word you may not know much about its characteristic properties.

What is Plasma?

Plasma can be defined as a gaseous mixture of positive ions and electrons. Perhaps you could imagine this as a large number of atoms of a substance having had some of their electrons stripped away. Plasma temperatures and densities range from relatively cool to very dense and hot. On Earth, this special mixture can only be created at very high temperatures in a laboratory (over 100 million degrees Celsius) and then carefully contained for use in objects like plasma TVs. Other types of plasmas, such as the aurora borealis (Northern Lights) at -170 degrees Celsius, can be quite cool.

The universe is made up of 99% plasma, but there is very little to be had here on Earth. For this reason, we call plasma an uncommon state of matter. You and I could observe some of the universe's plasma by watching lightning bolts and the stars in the night sky (whose plasmas are heated to very high temperatures by nuclear reactions inside the stars). Ordinary solids, liquids, and gases are generally too cool or dense to be in a plasma state.

To help you review what you have just learned about the four states of matter and their properties, you will now complete Learning Activity 1.1. Like all other learning activities in the course, it will help you prepare for your assignments and exams. Learning activities are not to be sent in to your tutor/marker for assessment. Check your answers in the Learning Activity Answer Key found at the end of this module.



Learning Activity 1.1

Characteristics of Matter

1. For each statement, determine if it is true or false. Try to correct all statements you think are false.
 - a) Liquids are easier to compress than solids.
 - b) Solubility is a chemical property.
 - c) Flammability is a chemical property.
 - d) Density is a ratio that compares the mass of an object to its volume.
 - e) The density of a substance changes as the substance changes state.
 - f) A chemical property does not involve a substance combining with or changing into other substances.
 - g) Granulated sugar is a solid form of matter with a definite shape but no definite volume.
2. Can you think of any specific examples where substances are compressed?
3. Using your knowledge of compression, why does a tank of compressed oxygen allow scuba divers to stay underwater for long periods of time?

Right after you read the lesson summary, you will complete Assignment 1.1. It will help you apply your knowledge of the states of matter and their properties. This assignment (along with all other assignments) is worth marks. Unlike all other assignments in this module, you will submit it to your tutor/marker immediately after you have finished rather than at the end of the module.

Lesson Summary

In this lesson, you learned about the four states of matter, including concepts such as density, compressibility and diffusion. In the next lesson, you will learn about the Kinetic Molecular Theory (which was introduced to you way back in Grade 7) and how it explains the properties of gases.

Submitting Assignment 1.1

Normally, you will send in your assignments once you have completed each module. Assignment 1.1 is unique in that you will send it in now. That way, you will get some feedback on how you are doing. Please organize your material in the following order:

- Cover Sheet for Module 1 (Assignment 1.1), found at the end of the Course Introduction
- Assignment 1.1

Place all of these materials in an envelope and address it to:

ISO Tutor/Marker
555 Main St.
Winkler MB R6W 1C4

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