How does *Nelson Chemistry 11* help teachers assess and evaluate student achievement?

Assessment Standards for Nelson Resources

1. Curriculum Congruency

Assessment strategies and tools are matched to the Ontario curriculum with respect to performance standards (such as Achievement Levels) and content standards (such as Curriculum Expectations).

2. Manageability

Each resource provides teachers with an efficient and manageable approach to assessment that includes diagnostic, formative, and summative components.

3. Variety of Tools

Teachers receive a variety of assessment tools, including: rubrics, checklists, tracking sheets, and answer keys.

4. Clear Criteria

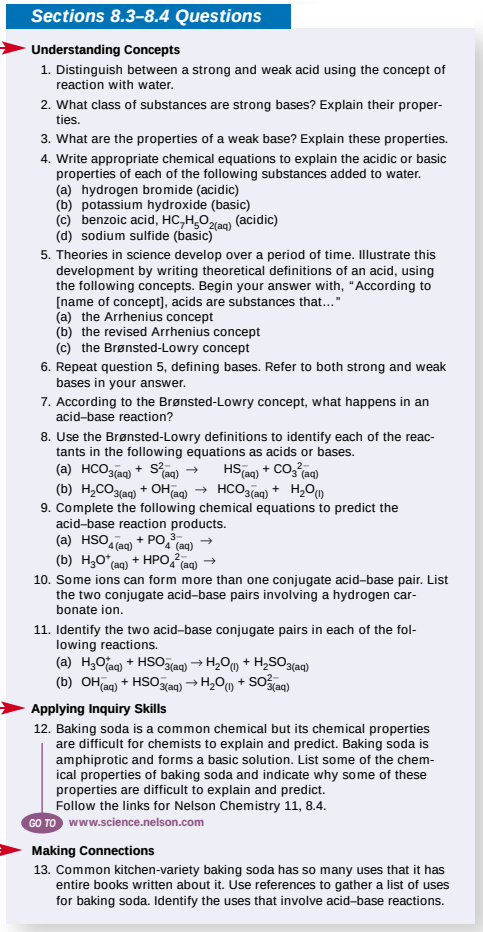
Assessment criteria are clearly indicated so that teachers and students know what is expected in each assessment task.

5. Opportunities for Self-Assessment

Clear directions are provided to involve students and, where appropriate, parents in the assessment process.

Questions Reflect the Achievement Chart Categories

A balance of Understanding Concepts, Applying Inquiry Skills, and Making Connections questions appear throughout the text.



Sections 8.3–8.4 Questions

Understanding Concepts

1. Distinguish between a strong and weak acid using the concept of reaction with water.
2. What class of substances are strong bases? Explain their properties.
3. What are the properties of a weak base? Explain these properties.
4. Write appropriate chemical equations to explain the acidic or basic properties of each of the following substances added to water.
   (a) hydrogen bromide (acidic)
   (b) potassium hydroxide (basic)
   (c) benzoic acid, $HC_7H_5O_{2(aq)}$ (acidic)
   (d) sodium sulfide (basic)
5. Theories in science develop over a period of time. Illustrate this development by writing theoretical definitions of an acid, using the following concepts. Begin your answer with, "According to [name of concept], acids are substances that…"
   (a) the Arrhenius concept
   (b) the revised Arrhenius concept
   (c) the Brønsted-Lowry concept
6. Repeat question 5, defining bases. Refer to both strong and weak bases in your answer.
7. According to the Brønsted-Lowry concept, what happens in an acid–base reaction?
8. Use the Brønsted-Lowry definitions to identify each of the reactants in the following equations as acids or bases.
   (a) $HCO^-_{3(aq)} + S^{2-}_{(aq)} \rightarrow HS^-_{(aq)} + CO^{2-}_{3(aq)}$
   (b) $H_2CO_{3(aq)} + OH^-_{(aq)} \rightarrow HCO^-_{3(aq)} + H_2O_{(l)}$
9. Complete the following chemical equations to predict the acid–base reaction products.
   (a) $HSO^-_{4(aq)} + PO^{3-}_{4(aq)} \rightarrow$
   (b) $H_3O^+_{(aq)} + HPO^{2-}_{4(aq)} \rightarrow$
10. Some ions can form more than one conjugate acid–base pair. List the two conjugate acid–base pairs involving a hydrogen carbonate ion.
11. Identify the two acid–base conjugate pairs in each of the following reactions.
    (a) $H_3O^+_{(aq)} + HSO^-_{3(aq)} \rightarrow H_2O_{(l)} + H_2SO_{3(aq)}$
    (b) $OH^-_{(aq)} + HSO^-_{3(aq)} \rightarrow H_2O_{(l)} + SO^{2-}_{3(aq)}$

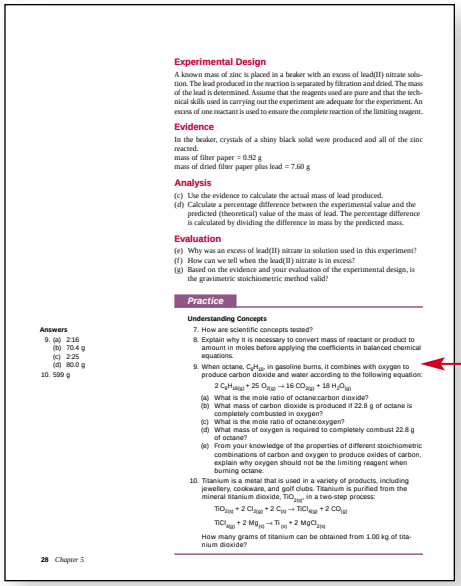
Applying Inquiry Skills

12. Baking soda is a common chemical but its chemical properties are difficult for chemists to explain and predict. Baking soda is amphiprotic and forms a basic solution. List some of the chemical properties of baking soda and indicate why some of these properties are difficult to explain and predict.
    Follow the links for Nelson Chemistry 11, 8.4.

GO TO www.science.nelson.com

Making Connections

13. Common kitchen-variety baking soda has so many uses that it has entire books written about it. Use references to gather a list of uses for baking soda. Identify the uses that involve acid–base reactions.



Section Questions

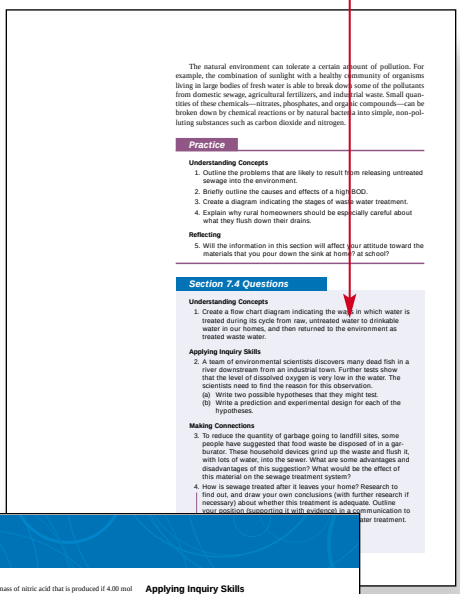
Section Questions are presented when it is convenient to assess a cluster of expectations that are "finished" in their development. They are intended to be used largely for formative or summative assessment and are categorized to reflect the Achievement Chart.

NOTE: Answers to Section Questions are not presented anywhere in the Student Text. Solutions and sample written answers are presented in the Solutions Manual.

Practice Questions

Practice Questions are presented in the middle of a section, offering students the opportunity to practise working with the terms, mathematical or problem-solving techniques, skills, or concepts presented in the text. These questions often follow a *Sample Problem* and are intended to be used largely for formative assessment.

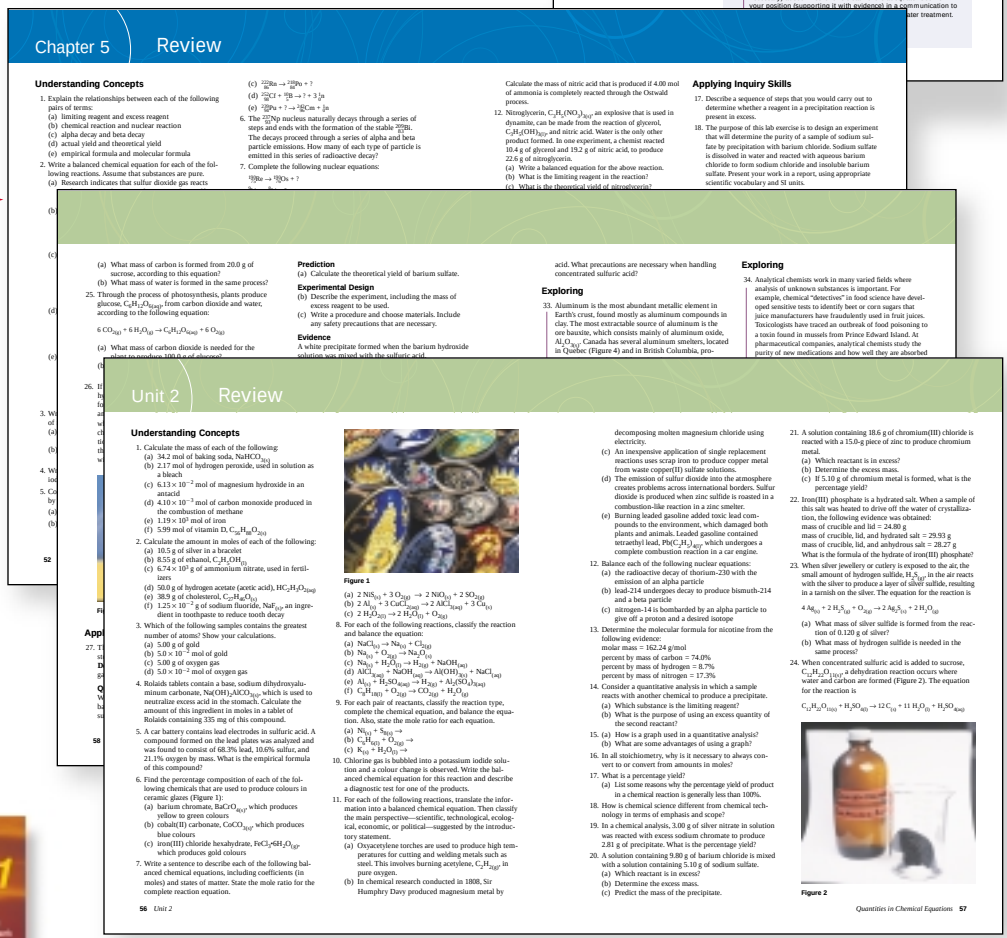
NOTE: Answers to Practice Questions, when they are numerical, are presented in the margin beside the questions. Solutions and sample written answers are presented in the Solutions Manual.

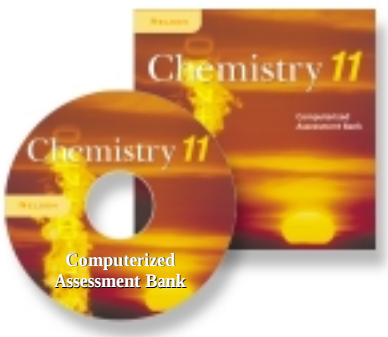


Chapter and Unit Review Questions

Chapter and *Unit Review Questions* can be used for more formative assessment, and questions are categorized to reflect the Achievement Chart.

NOTE: Answers to *Chapter* and *Unit Review Questions*, when they are numerical, are presented in Appendix D at the back of the student text.

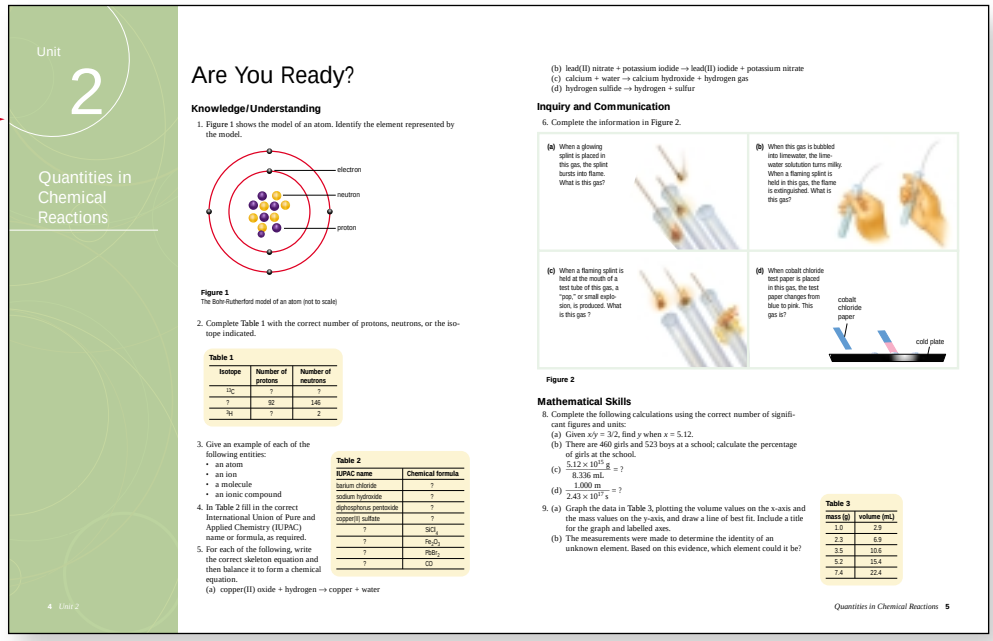




The *Nelson Chemistry 11 Computerized Assessment Bank* includes 1500 questions, each correlated to a specific expectation(s) in the curriculum and categorized to reflect the Achievement Chart categories.

Are You Ready? and Unit Performance Task

The Are You Ready? section is a diagnostic "pre-test" presented at the beginning of each unit. It can be used by students and teachers to help identify areas where students may have misconceptions about concepts or skills or have forgotten key learnings from earlier grades. In this feature, students are asked questions, usually in a visual format, about prerequisite concepts or skills (including math and lab safety) for each unit.



Unit 2

Quantities in Chemical Reactions

Are You Ready?

Knowledge/Understanding

1. Figure 1 shows the model of an atom. Identify the element represented by the model.

Figure 1
The Bohr-Rutherford model of an atom (not to scale)

2. Complete Table 1 with the correct number of protons, neutrons, or the isotope indicated.

Table 1

Isotope	Number of protons	Number of neutrons
$^{12}_{6}C$	?	?
?	92	146
$^{3}_{1}H$	?	2

3. Give an example of each of the following entities:
   - an atom
   - an ion
   - a molecule
   - an ionic compound
4. In Table 2 fill in the correct International Union of Pure and Applied Chemistry (IUPAC) name or formula, as required.
5. For each of the following, write the correct skeleton equation and then balance it to form a chemical equation.
   (a) copper(II) oxide + hydrogen → copper + water

Table 2

IUPAC name	Chemical formula
barium chloride	?
sodium hydroxide	?
diphosphorus pentoxide	?
copper(II) sulfate	?
?	$SiCl_4$
?	Fe_2O_3
?	$PbBr_2$
?	CO

   (b) lead(II) nitrate + potassium iodide → lead(II) iodide + potassium nitrate
   (c) calcium + water → calcium hydroxide + hydrogen gas
   (d) hydrogen sulfide → hydrogen + sulfur

Inquiry and Communication

6. Complete the information in Figure 2.

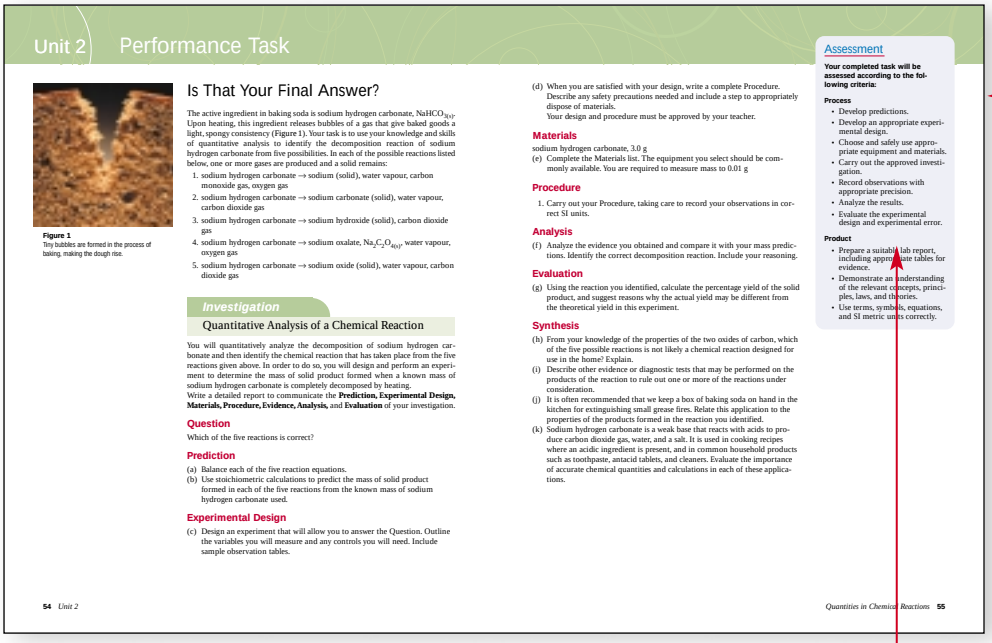
Figure 2

Mathematical Skills

8. Complete the following calculations using the correct number of significant figures and units:
   (a) Given $x/y = 3/2$, find y when $x = 5.12$.
   (b) There are 460 girls and 523 boys at a school; calculate the percentage of girls at the school.
   (c) $\frac{5.12 \times 10^{15}\ g}{8.336\ mL} = ?$
   (d) $\frac{1.000\ m}{2.43 \times 10^{17}\ s} = ?$
9. (a) Graph the data in Table 3, plotting the volume values on the x-axis and the mass values on the y-axis, and draw a line of best fit. Include a title for the graph and labelled axes.
   (b) The measurements were made to determine the identity of an unknown element. Based on this evidence, which element could it be?

Table 3

mass (g)	volume (mL)
1.0	2.9
2.3	6.9
3.5	10.6
5.2	15.4
7.4	22.4



Unit 2 Performance Task

Figure 1
Tiny bubbles are formed in the process of baking, making the dough rise.

Is That Your Final Answer?

The active ingredient in baking soda is sodium hydrogen carbonate, $NaHCO_3$(s). Upon heating, this ingredient releases bubbles of a gas that give baked goods a light, spongy consistency (**Figure 1**). Your task is to use your knowledge and skills of quantitative analysis to identify the decomposition reaction of sodium hydrogen carbonate from five possibilities. In each of the possible reactions listed below, one or more gases are produced and a solid remains:

1. sodium hydrogen carbonate → sodium (solid), water vapour, carbon monoxide gas, oxygen gas
2. sodium hydrogen carbonate → sodium carbonate (solid), water vapour, carbon dioxide gas
3. sodium hydrogen carbonate → sodium hydroxide (solid), carbon dioxide gas
4. sodium hydrogen carbonate → sodium oxalate, $Na_2C_2O_4$(s), water vapour, oxygen gas
5. sodium hydrogen carbonate → sodium oxide (solid), water vapour, carbon dioxide gas

Investigation

Quantitative Analysis of a Chemical Reaction

You will quantitatively analyze the decomposition of sodium hydrogen carbonate and then identify the chemical reaction that has taken place from the five reactions given above. In order to do so, you will design and perform an experiment to determine the mass of solid product formed when a known mass of sodium hydrogen carbonate is completely decomposed by heating.
Write a detailed report to communicate the **Prediction, Experimental Design, Materials, Procedure, Evidence, Analysis,** and **Evaluation** of your investigation.

Question

Which of the five reactions is correct?

Prediction

(a) Balance each of the five reaction equations.
(b) Use stoichiometric calculations to predict the mass of solid product formed in each of the five reactions from the known mass of sodium hydrogen carbonate used.

Experimental Design

(c) Design an experiment that will allow you to answer the Question. Outline the variables you will measure and any controls you will need. Include sample observation tables.
(d) When you are satisfied with your design, write a complete Procedure. Describe any safety precautions needed and include a step to appropriately dispose of materials.
Your design and procedure must be approved by your teacher.

Materials

sodium hydrogen carbonate, 3.0 g
(e) Complete the Materials list. The equipment you select should be commonly available. You are required to measure mass to 0.01 g

Procedure

1. Carry out your Procedure, taking care to record your observations in correct SI units.

Analysis

(f) Analyze the evidence you obtained and compare it with your mass predictions. Identify the correct decomposition reaction. Include your reasoning.

Evaluation

(g) Using the reaction you identified, calculate the percentage yield of the solid product, and suggest reasons why the actual yield may be different from the theoretical yield in this experiment.

Synthesis

(h) From your knowledge of the properties of the two oxides of carbon, which of the five possible reactions is not likely a chemical reaction designed for use in the home? Explain.
(i) Describe other evidence or diagnostic tests that may be performed on the products of the reaction to rule out one or more of the reactions under consideration.
(j) It is often recommended that we keep a box of baking soda on hand in the kitchen for extinguishing small grease fires. Relate this application to the properties of the products formed in the reaction you identified.
(k) Sodium hydrogen carbonate is a weak base that reacts with acids to produce carbon dioxide gas, water, and a salt. It is used in cooking recipes where an acidic ingredient is present, and in common household products such as toothpaste, antacid tablets, and cleaners. Evaluate the importance of accurate chemical quantities and calculations in each of these applications.

Assessment

Your completed task will be assessed according to the following criteria:

Process

- Develop predictions.
- Develop an appropriate experimental design.
- Choose and safely use appropriate equipment and materials.
- Carry out the approved investigation.
- Record observations with appropriate precision.
- Analyze the results.
- Evaluate the experimental design and experimental error.

Product

- Prepare a suitable lab report, including appropriate tables for evidence.
- Demonstrate an understanding of the relevant concepts, principles, laws, and theories.
- Use terms, symbols, equations, and SI metric units correctly.

Unit Performance Task

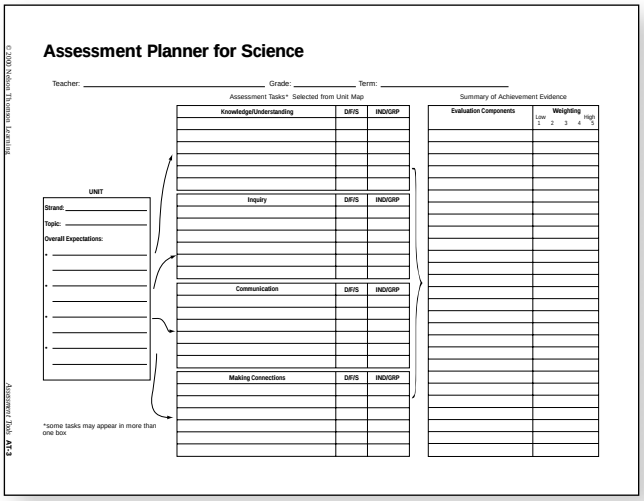
Each unit ends with a performance task that can be used for evaluating a significant "chunk" of the achievement expectations addressed in the unit. It can be a design-and-do investigation; a design-and-build activity; or a case study presenting a real-world process or system with STSE implications.

Clear Criteria

Assessment criteria are clearly indicated so that teachers and students know what is expected in each assessment task.

Assessment Tools and Manageable Strategies

The Assessment Planner is a manageable tool for teachers to use for planning the unit to ensure students have an opportunity to give evidence of learning for each category of the Achievement Levels Chart. The teacher can identify which learning experiences are to be used for diagnostic, formative, and summative assessment purposes, which assists in identifying the tasks that will be used for reporting.



Assessment Planner for Science

Teacher: _____ Grade: _____ Term: _____

Assessment Tasks* Selected from Unit Map

Summary of Achievement Evidence

UNIT

Strand: _____

Topic: _____

Overall Expectations:

Knowledge/Understanding | Inquiry | Communication | Making Connections

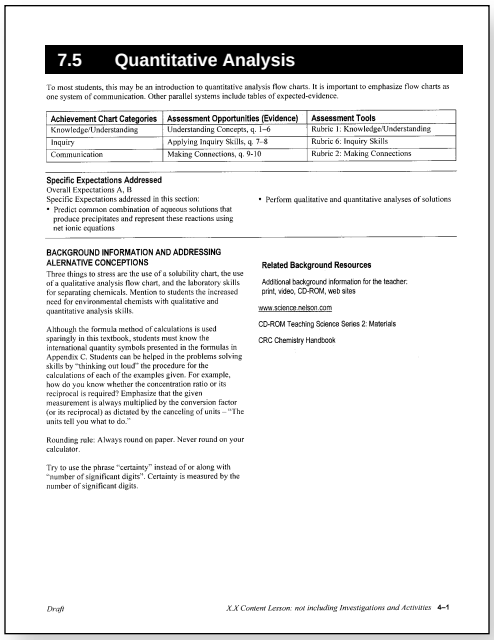
DIF/S | IND/GRP

Evaluation Components | Weighting (Low 1 2 3 4 5 High)

*some tasks may appear in more than one box

Assessment Tools AT-3

Each Teacher's Resource lesson begins with a chart that lists the specific expectations being developed in the lesson. The evidence of student learning and assessment tools used are referenced here.



7.5 Quantitative Analysis

To most students, this may be an introduction to quantitative analysis flow charts. It is important to emphasize flow charts as one system of communication. Other parallel systems include tables of expected-evidence.

Achievement Chart Categories	Assessment Opportunities (Evidence)	Assessment Tools
Knowledge/Understanding	Understanding Concepts, q. 1–6	Rubric 1: Knowledge/Understanding
Inquiry	Applying Inquiry Skills, q. 7–8	Rubric 6: Inquiry Skills
Communication	Making Connections, q. 9–10	Rubric 2: Making Connections

Specific Expectations Addressed

Overall Expectations A, B

Specific Expectations addressed in this section:

- Predict common combination of aqueous solutions that produce precipitates and represent these reactions using net ionic equations
- Perform qualitative and quantitative analyses of solutions

BACKGROUND INFORMATION AND ADDRESSING ALERNATIVE CONCEPTIONS

Three things to stress are the use of a solubility chart, the use of a qualitative analysis flow chart, and the laboratory skills for separating chemicals. Mention to students the increased need for environmental chemists with qualitative and quantitative analysis skills.

Although the formula method of calculations is used sparingly in this textbook, students must know the international quantity symbols presented in the formulas in Appendix C. Students can be helped in the problems solving skills by "thinking out loud" the procedure for the calculations of each of the examples given. For example, how do you know whether the concentration ratio or its reciprocal is required? Emphasize that the given measurement is always multiplied by the conversion factor (or its reciprocal) as dictated by the canceling of units – "The units tell you what to do."

Rounding rule: Always round on paper. Never round on your calculator.

Try to use the phrase "certainty" instead of or along with "number of significant digits". Certainty is measured by the number of significant digits.

Related Background Resources

Additional background information for the teacher: print, video, CD-ROM, web sites

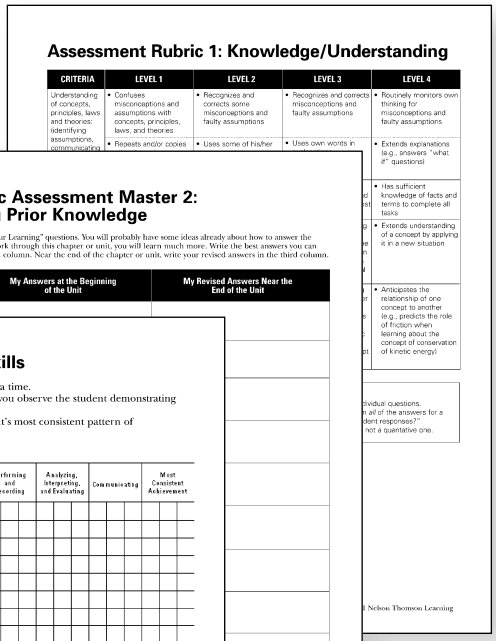
www.science.nelson.com

CD-ROM Teaching Science Series 2: Materials

CRC Chemistry Handbook

Draft *X.X Content Lesson: not including Investigations and Activities* 4–1

The *Nelson Chemistry 11 Teacher's Resource* includes a variety of assessment tools for diagnostic, formative, and summative evaluation including rubrics, tracking sheets, and self-assessment checklists.



Assessment Rubric 1: Knowledge/Understanding

CRITERIA	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Understanding of concepts, principles, laws and theories; identifying assumptions; communicating	• Confuses misconceptions and assumptions with concepts, principles, laws, and theories • Repeats and/or copies	• Recognizes and corrects some misconceptions and faulty assumptions • Uses some of his/her	• Recognizes and corrects misconceptions and faulty assumptions • Uses own words in	• Routinely monitors own thinking for misconceptions and faulty assumptions • Extends explanations (e.g., answers "what if" questions)

Diagnostic Assessment Master 2: Accessing Prior Knowledge

Read the "Reflect on your Learning" questions. You will probably have some ideas already about how to answer the questions, but as you work through this chapter or unit, you will learn much more. Write the best answers you can right now in the second column. Near the end of the chapter or unit, write your revised answers in the third column.

Question	My Answers at the Beginning of the Unit	My Revised Answers Near the End of the Unit

Tracking Sheet: Inquiry Skills

- Observe a manageable number of students at a time.
- In the cell, identify today's date and the level you observe the student demonstrating according to the rubric.
- Before reporting time, determine each student's most consistent pattern of observations.

Student Names	Initiating	Planning	Performing and Recording	Analyzing, Interpreting, and Evaluating	Communicating	Most Consistent Achievement

NOTE: The template allows for 3 observations of each student for each of the skills. This is a recommended minimum number before determining "most consistent level." A new template would need to be used for the second term.

Assessment Tools AT-17