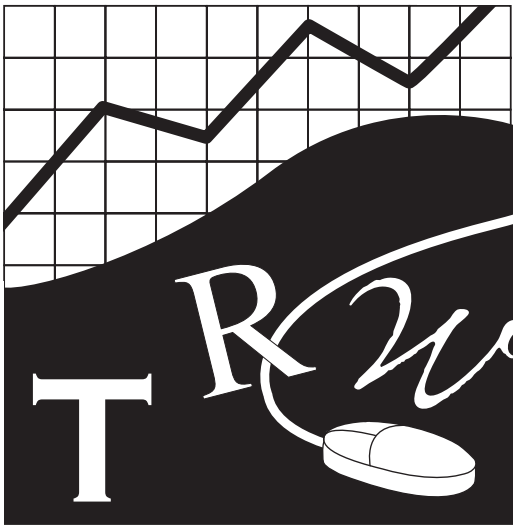
NOVA SCOTIA
Department of Education
English Program Services

Technical Reading and Writing 11

CURRICULUM

Draft
March 2000



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Acknowledgments

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Table of Contents

Introduction

Background

In keeping with its commitment to provide broad-based, quality education to Nova Scotia's public school students, the Department of Education has developed Technical Reading and Writing 11 to address a need experienced by some students for more focussed learning experiences in reading and writing technical text, or technical communication. *Technical communication* refers to the delivery of technical information to readers, listeners, or viewers. This may include communication specifically applicable to scientific, medical, engineering, and industrial contexts but may also extend to other areas that have a technical dimension, such as the home. Technical communication has several important features:

- an attention to the requirements of the audience; for example, the car owner's manual provides a level of information about the servicing of the car different from that provided to the service technician actually doing the work
- a complete lack of ambiguity; for example, technical texts do not have multiple meanings or use figurative language that may obscure meaning
- frequent integration of print and visual text; for example, graphics are often used to elaborate on processes in manuals or to support proposals and reports

The technological resources in our homes and workplaces demand an ever-increasing level of competence in technical communication. Technical text requires specialized skills of its readers and creators, and Technical Reading and Writing 11 offers an introduction to and practice in those skills.

Rationale

Consultation with representatives of the technical work community and post-secondary technical education has confirmed the importance of ensuring that high school graduates enter the workforce or post-secondary institutions with adequate technical communication skills. While some of this need is addressed through the English language arts curriculum, specifically through the outcomes pertaining to information text and through the curriculum of other subject areas, a more narrowly focussed course provides learning experiences with text that has been created to serve a technical task. Technical Reading and Writing 11 also provides opportunities for students to carry out tasks that have a technical aspect, thus embedding the attitudes and behaviours that will make students successful technical communicators.

As we embrace an increasingly technological world view and as the tools and processes in our work and personal lives become more technologically complex, the need for more specialized skills to handle technical tasks will become greater. Technical Reading and Writing 11 provides learning experiences that will enable students to function more confidently and efficiently in the technical aspects of their personal and employment worlds. For those students pursuing post-secondary studies, this course will provide a solid foundation for the technical communication tasks they will encounter.

The Nature of Technical Reading and Writing 11

Technical Reading and Writing 11 is a half-credit elective course that may be taken after completion of English 10 and concurrently with other English language arts courses. Students enrolled in either English 11 or English/Communications 11 will find that this course helps develop specialized technical communication skills. Students have a variety of opportunities to demonstrate their achievement of the outcomes, and they are encouraged to choose those that best suit their educational and career goals.

A key feature of the course is an emphasis on active learning. Students are expected to learn how to read and view technical text and how to create it, both individually and in small group contexts, thus emulating the reality of the work world, which demands that its employees be both capable independent workers as well as effective team players. Technology also plays an important role in that students are expected to make use of the best technology available to them to complete required tasks. The course also offers ample opportunities for students to refine their speaking and listening skills, and a class presentation serves as the main formal assessment for the course.

Features of Technical Reading and Writing 11

Technical Reading and Writing 11 is characterized by the following:

- a connection to the essential graduation learnings
- a focus on practical tasks of a technical nature
- a commitment to providing multiple, varied opportunities for students to demonstrate achievement of curriculum outcomes
- a strong connection to the communication demands of the technical workplace and post-secondary technical education and training
- a commitment to the principles of team work and group learning

Curriculum Outcomes

Curriculum outcomes are statements articulating what students are expected to know, be able to do, and value in particular subject areas. These statements describe the knowledge, skills, and attitudes students are expected to demonstrate as a result of their learning experiences in a course of study. Through achievement of curriculum outcomes, students demonstrate the essential graduation learnings.

Essential Graduation Learnings and Technical Reading and Writing 11

The Department of Education, in collaboration with its Atlantic Provinces Education Foundation partners, has identified six areas of learning in which students should develop across subject areas and throughout their years in public school. Curriculum outcomes provide the direction for students in their courses as they work toward the essential graduation learnings. Details may be found in the document *Public School Programs.*

The essential graduation learnings are given below with examples of the ways Technical Reading and Writing 11 helps students attain those learnings.

Aesthetic Expression

Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Interpreting and creating visual technical text provide an aesthetic element to the course and opportunities for students to consider artistic form and balance. Developing appreciation of the artistic quality of a schematic or a diagram used to illustrate a technical process, for example, contributes to students' personal growth. Technical Reading and Writing 11 distinguishes between literary text and technical text, and in so doing, enhances students' critical appreciation of the features of literary text, as well as those of technical text.

Citizenship

Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

While the ability to work independently is highly valued in the workplace, most workplaces expect employees to work together frequently in teams or partnerships to complete tasks. As students work through Technical Reading and Writing 11, they are required to develop the skills and attitudes of collaboration and consultation that are an integral part of today's workplace and community. The course provides multiple opportunities to complete tasks in collaborative work settings. Such learning experiences prepare students not only to function effectively in the workplace but also to better participate in the democratic processes of their nation.

Communication

Graduates will be able to use the listening, viewing, speaking, reading, and writing modes of language(s) and mathematical and scientific concepts and symbols to think, learn, and communicate effectively.

Technical Reading and Writing 11 provides opportunities for students to carry out effective written, oral, and visual communication tasks in technical contexts. Emphasis is placed on careful planning of technical texts and on developing the skills that foster clear thinking, writing, and representing in technical contexts. Since the workplace requires many employees to present effectively in oral contexts, presentation skills form a component of the course.

Personal Development

Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Technical Reading and Writing 11 offers opportunities for students to pursue areas of interest to them in technical contexts and to attain success in tasks they design for themselves. Learning experiences promote independent thinking and open-mindedness, as well as appreciation for the efforts and inventiveness of others. This course provides students with opportunities to take learning risks and realize new levels of self-confidence as they explore ways of expressing themselves effectively using technical texts. The presentation element of Technical Reading and Writing 11 encourages the development of students' self-confidence as speakers and presenters in public contexts. Skill development in this area prepares students to take on leadership roles in their communities and in their private lives.

Problem Solving

Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language and mathematical and scientific concepts.

In addition to using language, students in Technical Reading and Writing 11 have opportunities to explore mathematical and scientific situations as they relate to the creation and interpretation of technical texts. Many technical projects in both the home and the workplace have a problem-solving element to them, sometimes involving scientific and/or mathematical concepts. Technical Reading and Writing 11 equips students to work through instructions, for example, to complete tasks such as programming the VCR or to decipher poorly written technical text to complete the tasks the text describes.

Technological Competence

Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

The nature of Technical Reading and Writing 11 suggests delivery in a technological milieu. In the course, students use a variety of technological tools and processes to complete tasks. This experience will serve them well in the workplace and in their personal lives by providing them with a range of technological possibilities from which to choose when they have tasks of a technical nature to do.

Technical Reading and Writing 11 Curriculum Outcomes

1. *Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.*

Students will be expected to

1.1 distinguish between technical text and literary text
1.2 apply appropriate strategies to read a range of technical text
1.3 interpret flow charts, schematics, graphs, charts, tables, drawings, illustrations, videotext, and Web sites
1.4 complete tasks that require interpretation of technical text

2. *Students will be expected to create and present technical documents.*

Students will be expected to

2.1 use planning tools, such as graphic organizers, in carrying out technical communication projects
2.2 write summaries, reports, and articles
2.3 write correspondence, including letters, memos, and e-mail
2.4 prepare instructions, lists, and descriptions
2.5 create graphs, charts, and tables
2.6 create flow charts
2.7 prepare drawings, illustrations, diagrams, and schematics
2.8 integrate print and visual text in technical documents and present them
2.9 revise, edit, and evaluate the effectiveness of their own and others' technical documents

3. *Students will be expected to collaborate and consult with others, as well as work independently, in completing technical communications tasks.*

Students will be expected to

3.1 work in assigned roles in teams to perform technical communication tasks
3.2 demonstrate the behaviours expected in small group work to perform technical communications tasks

4. *Students will be expected to speak and listen in small group, whole class, and presentation contexts.*

Students will be expected to

4.1 use appropriate speaking behaviours when presenting technical text orally
4.2 apply their understanding of audience, purpose, and situation in technical speaking situations
4.3 apply listening skills in both small- and large-group technical communications

Connections: English Language Arts Curriculum

The curriculum outcomes for Technical Reading and Writing 11 have natural connections with the general curriculum outcomes of English language arts (see *Atlantic Canada English Language Arts Curriculum, Grades 10–12*). The language arts outcomes pertinent to the Technical Reading and Writing 11 outcomes are shown below with the appropriate connections made.

Students will be expected to communicate information and ideas effectively and clearly, and to respond personally and critically. (Technical Reading and Writing 11, Curriculum Outcome 4)

Students will be expected to interact with sensitivity and respect, considering the situation, audience, and purpose. (Technical Reading and Writing 11, Curriculum Outcome 4)

Students will be expected to select, read, and view with understanding a range of literature, information, media, and visual texts. (Technical Reading and Writing 11, Curriculum Outcome 1)

Students will be expected to interpret, select, and combine information using a variety of strategies, resources, and technologies. (Technical Reading and Writing 11, Curriculum Outcome 1)

Students will be expected to create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes. (Technical Reading and Writing 11, Curriculum Outcomes 2 and 3)

Students will be expected to use a range of strategies to develop effective writing and other ways of representing and to enhance their clarity, precision, and effectiveness. (Technical Reading and Writing 11, Curriculum Outcome 2)

Course Organization

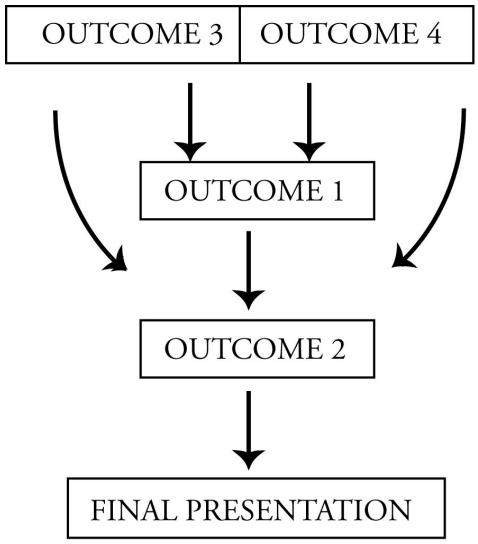
Students are expected to achieve the specific curriculum outcomes described in this guide. While the outcomes are organized in such a way that reading and viewing technical text are distinct from writing and creating technical text, the teacher may wish to integrate those processes. For example, when working on the outcome related to the reading/viewing of schematics, the teacher may wish to have students create schematics of their own.

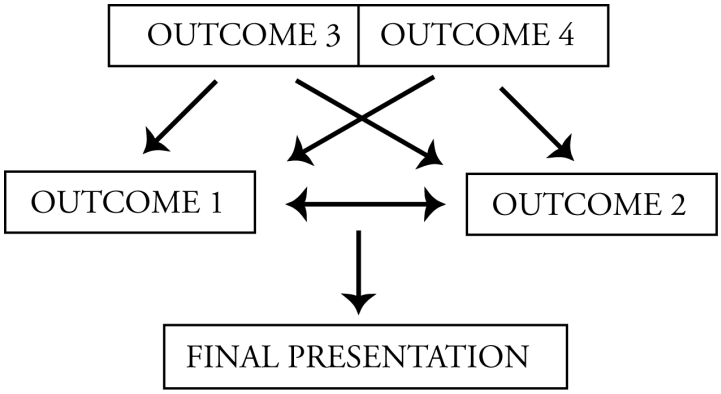
The outcomes pertaining to collaborative group work and presentations are described as separate outcomes to define clear expectations for student achievement in this aspect of the course; in practice, they should be processes that occur throughout the course. Development of skills and attitudes appropriate for teamwork and making presentations should begin early in the course, and throughout the course, students should be required to apply what they are learning.

The final project is a team presentation of a technical nature, a technical proposal or explication, as outlined under Outcome 2.8 in the Elaboration of Curriculum Outcomes section. Students should prepare for this project throughout the course; therefore, planning for the project can begin early, and students can collect data, ideas, etc., and form teams as the course proceeds. Work relating to Outcomes 1 and 2 should be completed in sufficient time to allow students adequate class time to plan, prepare, and practise for their presentation.

The following diagrams represent possible configurations for the course.

Course Configurations





Elaboration of Curriculum Outcomes

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Outcomes

Students will be expected to

1.1 distinguish between technical text and literary text

Suggestions for Teaching and Learning

Students should have opportunities to examine pieces of both technical and literary text to differentiate between the types of text (see chart below for key features of each kind of text). Students should work in groups or pairs to consider the following:

- What is the subject matter of each kind of text?
- What is its purpose?
- Who is the intended audience for each kind of text?
- What is the layout/style of each text? Are there headings, subheadings, lists, and graphics?
- What prior knowledge must the reader have to understand/interpret each text?

Students should generate lists of characteristics of both literary and technical text to demonstrate a clear understanding of the difference between them. Students also need to understand that there is always a purpose for reading technical text. For example, a person would not read about creating spreadsheets, changing a tire, or sending a fax unless the person was actually going to do these things or wanted to know about those procedures.

Key features of technical text and literary text

Technical text	Literary text
informs or describes a task to be done	may inform but primarily entertains
uses mainly short, simple sentence structures	uses sentences of varying length and complexity
may incorporate lists or graphics	may be illustrated but rarely contains lists
never uses figurative language	often uses metaphor, irony, or other figurative language
intends only one interpretation	may elicit many interpretations

Working in groups or pairs, students can examine short passages of literary text and rewrite them in a style appropriate for technical text (see chart above and samples in Appendix A). The most effective pieces would be passages using figurative language to describe actions, events, or places or passages that could have multiple meanings.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Suggestions for Assessment

- For an assessment activity, students could compare/contrast the types of text using a grid like the one below.

	Literary Text	Technical Text
	Title:	Title:
	Source:	Source:
1. Purpose		
2. Intended audience		
3. Layout/Style		
4. Subject matter		
5. Necessary background of the reader		

  In small groups, students could read a set of text samples and then discuss their table entries within their group. Students could place the tables in their portfolios. See Appendix D for an example of a portfolio evaluation rubric.

- Students could search for examples of technical text found in their homes and describe how they understand the purpose of the text to be technical rather than literary. Examples of technical text found in the home may include VCR manuals, microwave manuals, reference manuals for home computers and/or printers, and articles from magazines such as *Popular Mechanics*, *PC Magazine,* or *Discover*. Students may include responses in their learning logs showing their understanding of the features of the texts they have selected.

  Students could either present their examples of technical text to the whole class or present them in a jigsaw activity. For the activity, students could form small groups based on the different types of examples of technical text. Individuals in these small groups could share their technical text examples and describe how they read them to understand the purpose of the text. The teacher could move from group to group assessing discussions using an observational checklist for group participation similar to the one provided in Appendix D.

Notes and Resources

Technical text refers to written and visual text used to communicate information of a technical nature, such as description, a set of rules, or a procedure, to a particular audience. Technical text describes a specific technique, a concept, or a process. For example, technical text may give instructions on how to erect a tent, load software on a PC, or program a CD player.

Literary text has both narrow and broad definitions. Literary text may serve an intellectual and an entertainment purpose. It may contain a message or meaning from which the reader gains insight about life. Examples of literary text include poetry, fiction, drama, and essays.

Scientists, members of the medical profession, architects, computer programmers, carpenters, plumbers, lab technicians, and engineers, for example, use technical text. However, with recent advances in home electronics and technology, people outside technical careers must also be able to read and understand technical text. People need to be able to decode and understand technical manuals, such as the VCR or microwave manuals, found in their homes.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Outcomes

Students will be expected to

1.2 apply appropriate strategies to read a range of technical text

Suggestions for Teaching and Learning

Teachers should help students develop specific strategies for reading technical text. To achieve this purpose, teachers should provide activities based on a series of strategies. Students should practise these strategies with a wide range of technical text.

Strategies for helping students learn how to read technical text may be grouped as follows:

Pre-reading strategies

- determine a purpose for reading the text
- preview the text. Previewing a technical document will allow students to get the general idea of the document and identify sections of the text to focus on. This process involves
  - skimming through the text quickly
  - looking at the table of contents, glossary, appendices
  - looking at each page for headings, graphics, and numerical values, and framing questions about them
- activate prior knowledge of the subject

During-reading strategies

- select text passages relevant to the students' purpose
- read relevant passages slowly while
  - making notes or graphic organizers
  - looking up unfamiliar terms
  - reading all graphics and numerical values
  - asking questions to understand ambiguous passages
- re-read as required

Post-reading strategies

- confirm, clarify, and integrate what was read
- ask questions about text
- reflect on what has been read
- create a product or complete a task described in the text

Students should examine models of different print technical text, including various forms of correspondence, lists, instructions, descriptions, summaries, proposals, reports, and expository text noting their characteristics and uses. Students should note the use of graphics, headings, and captions supporting the print text.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Suggestions for Assessment

- The teacher could create lists of unfamiliar terms encountered in various technical texts and their definitions in a technical communication dictionary for the class. The students in the course could then contribute to the dictionary throughout the course as they read a variety of technical texts and find obscure terms. Students may reflect on their contributions to the technical communications dictionary in their learning logs.

- Technical text that students research could be added to their portfolios, shared with the class, or placed in a technical text examples binder for students to use throughout the course.

- In small groups, students could select and review examples of technical text using K-W-L charts, which would help them learn to focus on their prior knowledge and their purpose in reading about a technical topic. K-W-L charts may be added to students' portfolios (see Appendix E for a K-W-L chart).

- Students should have the opportunity to reflect on the strategies most effective for them and to develop a repertoire of reading practices they can use when faced with unfamiliar or difficult technical text. In their learning logs, students should note their strategies and their progress as readers of technical text.

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, section 6 (Developing Document Reading Skills) provides information on reading different types of technical print text. Section 7 (Document Complexity) describes the degree of complexity and gives examples for each category of technical text.

Secondary Science: A Teaching Resource, chapter 5, contains useful details about reading strategies, such as using reciprocal teaching, graphic outlines, reading for meaning techniques, ReQuest, question-answer relationships (QAR), and note taking.

Samples of technical text may be found in Appendix A.

Examples of assessment forms may be found in Appendix D.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Outcomes

Students will be expected to

1.3 interpret flow charts, schematics, graphs, charts, tables, drawings, illustrations, videotext, and Web sites

Suggestions for Teaching and Learning

Students should become aware of the purposes different graphics can serve and the situations in which they may most effectively be used.

Strategies for viewing visual forms of technical text include

- observing the labels on the graphic
- relating the graphic to the content of the written text
- observing the position of the graphic in relation to the written text
- evaluating the appropriateness of the graphic used

Students could determine which type of graphic would be most appropriate to illustrate particular types of information, for example,

- how to record a television show on a VHS tape
- the roads to follow when driving from one place to another (e.g., from Halifax to Moncton)
- the forces present when pushing or pulling an object
- the improvement in productivity over a period of time of a manufacturing company which has implemented a new computer system

Students should be able to survey and interpret samples of flow charts, diagrams, pie charts, or other graphics. They should also be aware that some graphic technical text cannot stand alone but requires print text to make its meaning clear.

Students could bring to class samples of technical text containing graphics.

Students could find examples of documents from their other courses, their homes, or the Internet which contain a pie chart, bar graph, schematic, flow chart, or diagram (or some combination of these) and answer the following questions:

- What is the purpose of the document?
- Is the graphic necessary for the document?
- Would a different type of graphic be as effective?

In small groups or as a class, the students could present and discuss the examples and answers to questions. Work could be placed in students' portfolios.

Students could read and interpret stock market graphs, tables, and charts obtained from either the newspaper or the Internet.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Suggestions for Assessment

- The activities in this section lend themselves to performance-based assessment, allowing students to demonstrate their level of understanding of the task in a non-threatening context. Assessment of student learning in this section could be based on
  - portfolio entries
  - small-group assessment
  - self-assessment
  - whole-class or small-group discussions
  - rubrics

  Appendix D provides specific examples of assessment forms. This appendix also includes a generalized scoring rubric that could be adapted for individual performance tasks. Teachers may also wish to design their own rubrics specific to the performance tasks completed by the students in their classes.

- Students could evaluate a technical document without graphics to determine which type(s) of graphics would enhance their understanding of the document. Students could discuss the document in small groups and then participate in a whole-class discussion on the optimum use of graphics. Group, peer, or presentation assessment would be appropriate for this task. Students could also write a reflection in their learning logs.

- Students could summarize the information viewed in some form of videotext, for example, laserdisc demonstrations from the science department, or a computer program (e.g., *Saunders Interactive General Chemistry*). Summaries could be included in student portfolios.

- Students could design a graphics board and display it in the classroom. This graphics board would display samples of the types of graphics and diagrams viewed by the students as they read technical texts. Students could add brief descriptions of the purpose and usefulness of the graphic. Students could reflect on their graphics board in their learning logs or evaluate the boards using a presentation evaluation form found in Appendix D.

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 4 and pp. 107–9

The Language of Documents: A Guide to Information Display in the Workplace, section 5

Writing in Engineering: A Guide to Communicating, chapter 5

Technical Communication, chapter 3

A table describing the types of graphics and providing examples may be found in Appendix C.

Examples of assessment forms may be found in Appendix D.

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Outcomes

Students will be expected to

1.4 complete tasks that require application of technical text

Suggestions for Teaching and Learning

Students should become familiar with the various types of instructions in technical texts and be able to follow them.

Students may read technical documents and apply directions or information present in the text. Numerous examples of performance tasks exist in curricular areas such as science, math, technology education, and social studies, as well as in students' homes, including

- following the directions to tape a television program or a series of programs using the VCR
- following a set of keystrokes for performing a regression analysis on the TI-83 graphing calculator (see Appendix F)
- using a map to find a place, highway, or some other designated landmark
- preparing a simple visual presentation in Hyperstudio or PowerPoint for a given topic
- going on-line and using a search engine to narrow a search
- building a model car or plane (or some other object) from directions provided in a kit
- using directions to erect a tent, load software, set up surround sound, or sign up for on-line banking

1. Students will be expected to read and interpret written and visual technical text, applying appropriate strategies and responding in ways that indicate understanding of the text.

Suggestions for Assessment

- Since the activities presented here require students to read a technical text and complete the related task, assessment should be based on performance rather than on paper and pencil problem solving. Appendix D provides some specific examples of rubrics to assess performance. The teacher may also wish to design a rubric or checklist specific to the performance tasks completed by the students.

- Other means of assessing activities in this section include
  - small-group or whole-class discussions
  - teacher-student interviews
  - project displays
  - written reflections on students' learning in their learning logs
  - self-assessments written for student portfolios

- A key concept that students may reflect on in their learning logs is the connection between the ease of completing a task and the quality of the technical information provided. Understanding this connection should help students write clearly and directly in their own technical documents.

Notes and Resources

Samples of technical text may be found in Appendix A.

Examples of assessment forms may be found in Appendix D.

Examples of activities requiring application of technical text may be found in Appendix F.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.1 use planning tools, such as graphic organizers, in carrying out technical communication projects

Suggestions for Teaching and Learning

Students should have the opportunity to explore various graphic organizers to determine which are appropriate for them to use in their technical communication projects (see Appendix B for samples). Students may also explore a graphic organizer program, such as Inspiration, for the computer.

Students could work in pairs or small groups to prepare graphic organizers for text they have written for brief excerpts from their science texts so that they can study the relationship between a piece of written text and the graphic organizer that may have preceded it. (Note: Students might use one of the graphic organizers from Appendix B for this activity. If using graphic organizer software, students should be encouraged to use either a diagram or a map rather than the outlining feature.)

Students should also choose a topic of interest on which to prepare a technical document. Then they should

- list the ideas to cover in their documents
- determine the type of organizer most appropriate for their writing
- begin constructing the graphic organizer

After students have completed their first draft of their organizer, they could form small groups to discuss these graphic representations and evaluate their usefulness in clarifying the major and minor points of their documents.

Students should begin working on their own technical documents by

- identifying the main ideas of their document
- preparing to write the first draft by creating the graphic representations
- revising and editing their graphic organizers

A variation of the story board might be used for planning both small- and large-scale presentations. Materials include a large sheet of paper and Post-it® Notes. The components of the document or presentation are written or drawn on the Post-it® Notes and then manipulated on the sheet of paper until the writer is satisfied with the order.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Students could
  - put samples of graphic organizers they have created in their portfolios
  - write a reflection for their learning logs about the organizers they find most helpful to them

- Assessment of organizers could be based on
  - layout
  - logic of arrangement
  - neatness

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators

The Language of Documents: A Guide to Information Display in the Workplace

Secondary Science: A Teaching Resource, chapter 3

Visual Tools for Constructing Knowledge

Examples of assessment forms may be found in Appendix D.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.2 write summaries, reports, and articles

Suggestions for Teaching and Learning

Summaries
Students should be aware of the following types of summaries and their purposes

- abstract: a brief description of document contents without any details
- précis: a condensation of material from papers or texts
- paraphrase: a translation of complex material for a general audience
- executive summary: a one-page condensation of a report for managers
- note-taking: documentation of work, meetings, observations

Students might select and summarize, using one of the forms listed above

- short passages of technical text of interest to them
- passages of technical text from other subject areas, for example, technology education, physics, chemistry, or biology
- events that occurred during a science or technology education class period

Reports
Students should be familiar with the structure of a report and with three different kinds of reports: proposals, progress reports, and feasibility reports.

Students should prepare a proposal before they begin the research and preparation for their final project. They might write a proposal for a science or technology project due in another subject. Students should prepare a progress report at least once during the preparation period.

Students could write a feasibility report about

- buying one model of car, motorcycle, computer, cell phone package, chain saw, stereo system, or washing machine instead of another
- attending one post-secondary school instead of another
- pursuing one career option instead of another

Articles
Students should review samples of technical articles or essays in a variety of journals and magazines, then research a technical topic that is of interest to them and write an article about it.

Teachers should encourage students to select authentic writing tasks that are interesting and relevant to them.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Students could place summaries, reports, and articles they have written in their portfolios.

- Assessment criteria for summaries could be based on
  - accuracy of facts
  - clarity of language
  - appropriateness of summary type for the material summarized

- Students should have a clear understanding of the difference between the kinds of reports and how they should be used.

- Criteria for assessing reports and articles should include
  - accuracy
  - attention to format
  - unambiguous language
  - inclusion of necessary details
  - logical organization
  - awareness of audience
  - appropriate tone
  - clarity
  - conciseness

Notes and Resources

Technical Communication, chapters 7 and 8

Writing in Engineering: A Guide to Communicating, chapters 3, 10, 12, 13, and 15

Secondary Science: A Teaching Resource, chapter 7

Examples of assessment forms may be found in Appendix D.

Teachers may wish to explore other forms of written technical presentations, such as brochures or manuals.

An overview of types of technical print text may be found in Appendix A.

2. Students will be expected to create and present technical documents.

Outcomes

Student will be expected to

2.3 write correspondence, including letters, memos, and e-mail

Suggestions for Teaching and Learning

Letters
Students should have opportunities to read and edit letters about technical matters written by other people, and to write and edit their own letters.

Students could write a letter to a company about a product that broke, malfunctioned, or was missing a part. In the letter, students should refer to the invoice number and indicate what they want done about the problem.

In small groups, students could select different types of letters to write. Examples include

- requesting information about an Internet conference
- applying for a grant to do research or start a technical project
- registering a complaint about a problem with your motorcycle
- acknowledging an inquiry into or application for a summer science workshop
- thanking an organization for donating a laptop to a school

Memos
As a class, students should discuss the appropriate use of letters versus memos and come to a consensus on when to use each form of communication.

Students should have many opportunities to read and write memos. The teacher should provide each student or small groups of students with sample memos to use as examples when constructing their own. A sample memo may be found in Appendix A.

E-mail
Students may e-mail the teacher

- requesting a meeting regarding their technical projects and indicating the time and place, the purpose, and the suggested length of the meeting
- indicating their progress with the technical documents they are currently working on

The teacher may e-mail students an ambiguous message. Students can revise the message so it is clear and easy to interpret.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Teachers could formally assess letters, memos, and e-mail written by students. Students could place drafts of their documents in their portfolios to show progress.

- Students could discuss in their learning logs the importance of proper format and style.

- Students could make overhead transparencies of letters they write and present them to the class. When all presentations are complete, the class could discuss the similarities (e.g., the format) and differences (e.g., tone) among them. Students might present this information in a compare/contrast matrix.

- Students could prepare a memo to
  - outline a new policy, such as a policy for composting in the cafeteria or for a new dress code for the school/workplace
  - respond to a memo or fax regarding a meeting date for the naturalists' club
  - write a trip report providing an assessment of the quality of a field trip
  - write an incident report addressed to your immediate superior regarding a fire that broke out in the main lobby of the local inn where you were on duty as the night clerk

- Students could e-mail the teacher (in the role of businessperson) requesting information or brochures about technical products such as hair dryers, VCRs, camcorders, skill saws, or computer peripherals.

- Correspondence should be assessed using the following criteria:
  - proper format for the type of correspondence
  - clarity and conciseness of writing style
  - organization of main point and supporting details
  - appropriateness of tone
  - correctness (spelling, punctuation, sentence structure)

- Teachers should coach students as they work on their technical documents, helping them to think through their organization and execution and offering them opportunities to rework products that require it.

- Students should be encouraged to write their correspondence using word processing software, paying attention to the conventions of form, language, and mechanics.

Notes and Resources

Writing in Engineering: A Guide to Communicating, chapter 7

Technical Communication, chapters 5 and 6

More details about technical print text may be found in Appendix A.

Examples of assessment forms may be found in Appendix D.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.4 prepare instructions, lists, and descriptions

Suggestions for Teaching and Learning

Instructions
In pairs or in small groups, students could construct a list of characteristics of clear instructions. The class might brainstorm a set of rules for writing instructions and post them for further reference.

Students could write a set of instructions, using graphics if needed, that describe how to

- parallel park a car
- play a sport (assuming the reader knows nothing about the game and its rules)
- change the paper in the photocopier
- set the alarm for a clock-radio
- prepare a concept map for a section of a textbook

When the sets of instructions are completed, they should be redistributed among the groups. Students could evaluate and improve them, where necessary.

Lists
Students could write a simple "to do" list of

- assignments and homework
- things they need to do to prepare a final draft of their technical documents

In small groups, students could search for a variety of topics, both easy and more difficult, in the yellow pages of the telephone directory. One person from the group could record the search process for each of the topics. Then the class as a whole could discuss the search process.

Descriptions
In small groups, students could select a topic and brainstorm the necessary parts for a description of it. For example, students interested in sports could describe the rules of soccer or a soccer game. Examples of other topics or items students could describe include

- the Hubble telescope
- the floor plans for their home (including graphics)
- the difference between a 747 and an airbus
- a stereo system
- the operation of the first light bulb

Student groups could present their descriptions to the whole class.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Assessment of activities could be based on rubrics or the contents of student portfolios. If small groups are completing different tasks, they could present their activities and observations to the larger class.
- Students could submit their prepared lists for formal assessment.
- Group work on descriptions could be assessed using observational checklists and oral presentations could be assessed using presentation assessment forms (see Appendix D).
- Students could submit descriptions of technical documents for formal assessment, or they could submit a brief description of a technical document they are composing.
- Teachers should assess instructions, lists, and descriptions using the criteria of clarity, brevity, and accuracy.
- In their learning logs, students should indicate their understanding of the nature of instructions, lists, and descriptions, their purpose, and the need for clarity and accuracy when preparing them.
- Students could place in their portfolios their lists, instructions, and descriptions created using word processing software. Preparing lists and instructions would give students the opportunity to learn the bullet function of word processing software.

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 1

The Language of Documents: A Guide to Information Display in the Workplace, section 1

Technical Communication, chapter 2

A sample document containing lists may be found in Appendix A.

Examples of assessment forms may be found in Appendix D.

An additional activity may be found in Appendix F.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.5 create graphs, charts, and tables

Suggestions for Teaching and Learning

Students should have the opportunity to understand how graphs, charts, and tables can help them manage and display data.

As an activity, student groups could construct two milk cars, one with full-width wheels and the other with its wheels reduced by one-half. Students could design an experiment to test the variable of wheel width and its effect on distance travelled. After designing the experiment, students should test each car at least three times, record the data in a table, and analyse it. (See milk car design below.)

Students could also collect sample data to construct a table, chart, or graph, whichever is most appropriate. Students could construct two types of visual representations of the data. Data could include

- Environment Canada data on temperatures for parts of Canada over the past 10 years to show the variation in average yearly temperature
- stock market data on a technology company or index to graph showing changes over a period of time
- the amount of time students spend working with a computer in a day or week
- the distances from capital to capital in Canada
- the percentage of Nike's total sneaker production allocated to producing each type of sneaker

Small groups of students may conduct a survey from a sample of the school population about technology they use in their daily lives. With the data, students can construct tables, charts, or graphs summarizing the information. Students can present findings in a whole-class discussion to compare data from different samples of the school population. The class can then compile the data into one table or chart.

Students could survey a sample of students from the class or the school about suggestions for a new menu item for the cafeteria. Once data are collected, students could prepare a pie chart or a bar graph of the results.

Students should design the tables, charts, and/or graphs for their own technical documents.

Students may use computer software such as ClarisWorks, Microsoft Office, Corel, or Lotus Suite to prepare graphs, charts, and tables.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Students working on the milk car project could submit tables and descriptions for evaluation. A general scoring rubric may be found in Appendix D.
- Students could place the charts, tables, and graphs they create, along with brief descriptions and/or self-assessments, in their portfolios for evaluation.
- Students could submit for assessment copies of the tables, charts, and/or graphs they design as part of their technical documents.
- Students should demonstrate understanding of the value of charts, graphs and tables as devices for managing and displaying large amounts of data.
- Criteria for assessment of student products should include
  - appropriateness of form to display type of data
  - accuracy and precision of presentation
  - neatness of presentation
  - appropriateness of labels

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 3

The Language of Documents: A Guide to Information Display in the Workplace, section 3

Technical Communication, chapter 3

Additional information about types of graphs, charts, and tables may be found in Appendix C.

Examples of assessment forms may be found in Appendix D.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.6 create flow charts

Suggestions for Teaching and Learning

Students may research information to design flow charts for such information as

- instructions for disposing of hazardous waste
- the procedure to shut down the school for the weekend
- a description of the use of a fax machine
- instructions to program the answering machine and telephone
- instructions for use of a microwave oven, a clothes washer, a scanner, a camera, a battery charger, or a voltmeter
- a description of the launching sequences for a NASA mission
- a description of the process of recycling, composting, and garbage disposal

Students can prepare a flow chart showing the process for writing a technical document. These flow charts may include

- brainstorming ideas
- researching material and obtaining references
- planning the layout
- writing the draft
- revising content
- checking grammar and spelling
- adding graphics to support the text

Once students have completed drafts of the flow charts for their writing process, they can work in small groups to describe and edit them.

Student groups can design hierarchical flow charts for a business or organization. Examples could include

- the hierarchy of the school
- the organization of a local business
- a family tree

Once students have designed the flow charts, they may present the charts to the class.

Students can design flow charts, if appropriate, as part of their technical documents.

Students may use computer software, such as Inspiration, to create and manipulate the components of their flow charts.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- In the classroom, students can display the flow charts they have designed and place copies in their portfolios.

- Students can submit copies of the flow charts from their technical documents for formal assessment or place them in their portfolios for evaluation.

- Assessment of flow charts should include the following criteria:
  - appropriateness of flow chart design for the task
  - clarity of text
  - accuracy of representation of the process or hierarchy
  - neatness and balance of the layout

Teachers should provide opportunities for students to revise and edit graphic technical texts so they understand that quality of technical documents is important in the workplace. Students could place copies of their edited work in their portfolios.

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 6

The Language of Documents: A Guide to Information Display in the Workplace, section 5

Technical Communcication, chapter 2

Writing in Engineering: A Guide to Communicating, chapters 1 and 5

Examples of evaluation forms may be found in Appendix D.

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.7 prepare drawings, illustrations, diagrams, and schematics

Suggestions for Teaching and Learning

Students need to understand that drawings and illustrations depict the dimensions and actual appearance of objects, whereas diagrams and schematics show how they function.

Students could choose technical texts and prepare drawings, illustrations, or schematics appropriate to one or several of them. Examples of technical text might include

- a description of the weather patterns across Canada for a specific day or period
- a description of the electrical circuits in a series circuit found in Christmas lights
- a description of the students' community roads/streets or their home property
- a description of the floor plan for the students' houses or apartments

Students should design the drawings, illustrations, diagrams, and schematics for their own technical documents.

Students may use computer software, such as Painter, Adobe Photoshop, or Paintshop Pro to create graphics for their technical documents.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Students could use peer review sheets to assess drawings, illustrations, diagrams, and schematics presented to the class.
- The teacher could use observational checklists (see Appendix D) to assess in-class work and student presentations.
- Students should make entries in their learning logs of the procedure they use to design appropriate graphics; they should reflect on the usefulness of various visual representations to enhance print text.
- Students should present their drawings, illustrations, diagrams, and schematics to the class for peer review and/or place them in their portfolios for evaluation.
- Assessment of visual representations of technical text should include the following criteria:
  - appropriateness of representation for the technical task
  - accuracy of the representation
  - adequacy and accuracy of labels
  - appropriateness of scale
  - neatness of representation

Notes and Resources

Writing in Engineering: A Guide to Communicating, chapters 1 and 5

Technical Communication, chapter 3

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 4, provides useful details distinguishing drawings, illustrations, diagrams, and schematics from one another and includes examples of these kinds of visual representations.

The Language of Documents: A Guide to Information Display in the Workplace, section 5

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.8 integrate print and visual text in technical documents and present them

Suggestions for Teaching and Learning

In the course of planning their technical documents, students should make decisions about

- who the audience will be
- which form of technical writing would be most appropriate and effective
- what style of graphics would be most useful
- where graphics should be situated

Teachers should provide opportunities for students throughout the course to present both their finished documents and works in progress. Presentations may involve submitting work informally and formally to

- the teacher
- a peer
- a small group
- the whole class

The final project for the course should be a formal presentation to the class and/or invited members of the community. The project should

- involve a technical topic that is of interest to the student
- take the form of a report (proposal, progress report, feasibility study) or a paper (article or technical essay) that is presented orally
- be a team effort
- integrate graphics with print text
- make use of available technology in the presentation (overheads, multimedia software such as Power Point or Hyperstudio)

Students should begin planning for this project early in the course. Groups should be formed early and a project proposal developed and presented for approval.

Students may wish to create Web sites to showcase technical communications projects they have excelled in. They need to be aware of the importance of accuracy and excellence of presentation if they wish to display their work in public venues.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Teacher assessment of student presentations could include
  - anecdotal notes
  - checklists in reference to
    - the appropriateness of the chosen format for the content
    - features of writing style, such as conciseness, unambiguous language, and appropriate tone
  - rubrics specific to the style of presentation

- Students should be encouraged to assess their own work using rubrics and checklists they have helped to generate themselves. They should learn what constitutes a high quality presentation of any type and be encouraged to work toward achieving a standard of excellence.

- Students should reflect on the characteristics of effective feedback, response, and criticism, and apply their understanding in responding to and assessing others' work.

- Students should write responses to and assessments of their own and others' work.

- For formal presentations such as project proposals or technical papers, teachers might invite people employed in technical workplaces to receive the presentations and offer helpful criticism and constructive feedback.

- Assessment of the final project should be a multifaceted one that considers
  - indicators of good teamwork
  - the print and graphic content of the presentation
  - the use of the technology available to students
  - the elements of oral presentations, including those listed under Outcome 4.1 in this section

Notes and Resources

Technical Communication, chapter 9

Writing in Engineering: A Guide to Communicating, chapter 11

2. Students will be expected to create and present technical documents.

Outcomes

Students will be expected to

2.9 revise, edit, and evaluate the effectiveness of their own and others' technical documents

Suggestions for Teaching and Learning

Students need to understand that revising, editing, and proofreading their work is a process and not an event, including, in general, the following steps:

- reading the whole document for organization and content
- revising content, organization, and language for clarity and conciseness
- editing at the sentence level for clarity of expression and meaning, for example, checking sentence structure and punctuation
- proofreading at the word level for errors in capitalization, spelling, and usage

Students should have opportunities to use the spell check and grammar check features of word processing software and to become aware of the limitations of these features.

In small groups, students could construct some questions to accompany the steps in the revision and editing process. Questions could include, for example,

- Does the document flow in such a way that the reader will not become confused or lost?
- Is the style of writing appropriate for the audience?
- Does the document achieve its purpose?
- Is the information clear, complete, and accurate?
- Are there any vague expressions, clichés, or wordy sentences?
- Are there any grammatical or spelling mistakes?
- Are visual representations clear, interesting, and in appropriate places?

Throughout the course, students should examine a variety of well-written technical texts and poorly written texts to evaluate their strengths and weaknesses. Students could find samples of poorly written and well written technical text at home or in school and present them for discussion in small groups.

A class scrapbook could be maintained to which students could contribute samples of poorly written technical text they locate from various sources.

2. Students will be expected to create and present technical documents.

Suggestions for Assessment

- Students should record in learning logs the processes they use to revise and edit their technical documents.
- Students should submit revised drafts of technical documents for formal assessment or place them in their portfolios along with first drafts.
- Teachers should provide feedback to students to help them improve their drafts. Students should also be encouraged to monitor their own progress toward quality work. They need to learn to critique their own work and make judgments about what to do to improve it. Students' self-assessment and peer-assessment forms for improving technical documents to make the text/instructions/diagrams clearer for readers may be added to the portfolios.
- Students could create a class Web site displaying samples of good technical text they have produced themselves.
- Checklists for a variety of text formats may be found in writing resources; however, in general, students should consider the following when they are creating their technical documents:
  - accuracy of information
  - use of precise, concrete language
  - logical organization of main points and supporting details
  - appropriateness of document format to content
  - adherence to the chosen format
  - suitability of graphic supports for print text
- Students should recognize the need, within the context of their own and their peers' work, to
  - simplify phrases and sentences
  - eliminate ambiguities
  - eliminate redundancies
  - make passive voice verbs active
  - proofread their documents

Notes and Resources

A Canadian Writer's Reference covers all elements of the composing and revising process, document design, effective sentence construction, usage, and mechanics.

Writing in Engineering: A Guide to Communicating, chapter 4

Document Literacy: A Guide for Workplace Trainers and Educators, pp. 61–72

Atlantic Canada English Language Arts Curriculum Guide, Grades 10–12, Appendix 5

Technical Communication, Appendix A

Secondary Science: A Teaching Resource, sections 7.8 and 7.9

Students need opportunities to use various resources effectively for revision, editing, and proofreading, such as a variety of writers' references, dictionaries, and thesauri.

3. Students will be expected to collaborate and consult with others, as well as work independently, in completing technical communications tasks.

Outcomes

Students will be expected to

3.1 work in assigned roles in teams to perform technical communication tasks

Suggestions for Teaching and Learning

Students need to understand that many technical communication tasks are completed as team efforts; therefore, throughout the course, students should have multiple opportunities to work in a variety of roles within teams. Teachers may use and adapt such co-operative learning group roles as

- leader/facilitator
- reader
- reporter
- observer
- materials manager
- time manager
- presenter

Different technical communication projects may pose different role requirements; all students should have a chance to undertake and develop their skills in a variety of roles, including leadership roles.

Students need to learn to assign group tasks so that the work load is evenly distributed.

Students working in teams should have the opportunity to develop a strategy for presentations. Students need to decide who will speak and when, who will run video or computer equipment, who will set up displays in the room, and who will answer which questions that arise as a result of the presentation.

3. Students will be expected to collaborate and consult with others, as well as work independently, in completing technical communications tasks.

Suggestions for Assessment

- A possible activity for assessment involves students working in groups of four. Two students sit back to back. One student has a small puzzle (7–10 pieces). The second student has a picture of the completed puzzle. The student with the picture describes how the puzzle must be put together. The remaining two students record the description provided to the puzzle builder. When completed, all four students participate in a debriefing session to discuss the directions given, the difficulties encountered, and ways to improve the directions.

  Students could write a reflection on their experience with the puzzle activity. They should include their role in the activity and their analysis of the debriefing session.

- Students could be provided with equipment to perform a computer-based laboratory activity (CBL). Working in small groups, students could assign specific tasks to each member of the group. Tasks could include
  - completing a flow chart for the procedure
  - acting as a materials manager
  - carrying out the procedure with the CBL
  - acting as a facilitator
  - analysing data and writing a report

  Students should submit
  - formal reports of CBL activity for assessment
  - a peer- and a self-assessment of the CBL exercise

- Teachers could use observational checklists for the puzzle activity and the CBL exercise.

- In their learning logs, students should record their role in the presentations they make to the class.

Notes and Resources

Technical Communication, chapter 7

Kelly, G.J. & Crawford, T. "Students' interaction with computer representations: Analysis of discourse in Laboratory groups." *Journal of Research in Science Teaching, 33*(7), 1996, pp. 693–707

Pontecorvo, C. "Forms of discourse and shared thinking." *Cognition and Instruction, 11*(3&4), 1993, pp. 189–196

3. Students will be expected to collaborate and consult with others, as well as work independently, in completing technical communications tasks.

Outcomes

Students will be expected to

3.2 demonstrate the behaviours expected in small group work to perform technical communication tasks

Suggestions for Teaching and Learning

In the technical workplace, personal attitudes toward fellow employees have little bearing on who works with whom. Consequently, teachers should provide opportunities for students to work on projects with different combinations of team members so that they may develop the skills required to work with a wide range of personalities.

Collaborative skills include

- leadership
- decision-making
- trust building
- communication
- conflict management

Appropriate team behaviours include

- staying on task/managing time effectively
- completing agreed-upon tasks
- encouraging team members
- asking others for assistance
- praising the efforts of others
- criticizing ideas, not other team members
- working toward consensus
- arguing constructively

To facilitate positive interactions within student groups, students should begin with an activity such as a putdown/encourage activity. In small groups, students brainstorm which kinds of words, expressions, and body language are putdowns and which are encouragements. Each group writes its list on a piece of paper for discussion within the group.

While the ability to work effectively in teams is important in today's technical workplace, teamwork would not be effective if individual team members were incapable of completing the tasks they agreed to do. Teachers need to encourage team members to self-monitor their productivity and develop their time management skills to ensure they meet the deadlines the team agreed upon.

3. Students will be expected to collaborate and consult with others, as well as work independently, in completing technical communications tasks.

Suggestions for Assessment

- A possible activity for assessment involves students working in small groups and assuming group roles (facilitator, leader, reporter, observer, materials manager, time manager, presenter) to discuss the following situations:
  - The group is working on a presentation for the class. Of all the group members, only two seem to be doing the work. Describe how group members can deal with this situation before any bad results occur.
  - The facilitator's job is to make sure all of the group members are involved in the assignment. Make a list of all the ways a facilitator could try to accomplish this goal.

  Self- and peer-assessment at the end of the activity should focus on student demonstration of appropriate behaviours.

- Students could read controversial articles and discuss/debate in groups. Examples of topics might include
  - human cryonics
  - reproductive technologies
  - xenotransplants
  - humans versus robots in space

  Students should demonstrate positive interactions while completing these activities. Students could complete checklist assessments of their behaviours during the discussion and reflect in their learning logs on how they might improve.

- Teachers could assess group work using observational checklists found in Appendix D.

- After any team effort, students should reflect in their learning logs on their progress toward becoming effective team workers and consider ways in which they may improve their skills. As they assess one another's contributions, they should practise constructive criticism coupled with honest praise, for example, "I really liked . . . ." and "An area you need to work on is . . . ."

Notes and Resources

The Communications Handbook, chapter 7

English Language Arts: Language and Technical Communication Senior 4, section 6.7

Decisions Based on Science, National Science Teachers Association

Real Science, Real Decisions, National Science Teachers Association

Examples of evaluation forms may be found in Appendix D.

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Outcomes

Students will be expected to

4.1 use appropriate speaking behaviours when presenting technical text orally

Suggestions for Teaching and Learning

Students need to understand that, in the technical workplace, formal and informal occasions will arise when employees will be required to speak effectively. For example, employees are often required to

- instruct a fellow employee or group of employees
- report a procedure followed
- present a proposal to management or other interested party

Teachers should provide sufficient opportunities for students to speak in front of their class, both formally and informally, so they will develop a level of comfort in presenting their ideas for a variety of purposes, including

- reporting information
- presenting proposals for discussion
- arguing ideas
- persuading others to support a point of view or process

Students should be aware of and practise features of effective speaking, such as

- knowing subject matter thoroughly
- using cue cards appropriately
- exhibiting confidence and sincerity
- speaking at an appropriate pace, pausing appropriately
- using appropriate volume and pitch
- maintaining eye contact with individuals in the audience when this is culturally appropriate
- attending to posture and use of gestures
- using visual aids appropriately and competently

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Suggestions for Assessment

- Students could write a brief summary of a presentation they have observed to submit for assessment of listening skills.
- Teachers could use observational checklists for presentations to evaluate speaking skills. Teachers and students could use presentation rubrics to evaluate presentations.
- Teachers should provide students with assessment forms using the criteria for effective speaking and encourage students to assess their own and their peers' performance frequently to monitor their growth in becoming confident speakers. Students should include these assessments in their portfolios.

Notes and Resources

Document Literacy: A Guide for Workplace Trainers and Educators, chapter 1

The Language of Documents: A Guide to Information Display in the Workplace, chapter 1

Technical Communication, chapters 2 and 9

The Communications Handbook, chapter 7

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Outcomes

Students will be expected to

4.2 apply their understanding of audience, purpose, and situation in technical speaking situations

Suggestions for Teaching and Learning

Students should have the opportunity to speak to the class or other audiences in a number of venues, including the classroom, other areas of the school, or the community. Students should

- prepare themselves by learning all they can about their topic
- anticipate questions and arguments
- know whether the purpose of their presentation is to inform or persuade
- know their audience to know what language to use
- know the situation, formal or informal, to decide how to present the information
- use visual and audio aids to enhance the presentation
- practise the presentation using the visual aids
- practise speaking speed to reach between 120 and 140 words per minute

In presentations, students must learn to avoid gender bias. Students could look for examples of gender bias in television programs, advertisements, and newspapers. They could rephrase articles or describe how to rework programs and advertisements to eliminate bias. Students may display their examples and the amended versions on posters for the class.

Students could research cultural and ethnic protocols to observe when making presentations to cross-cultural audiences.

Small student groups could write and present brief technical proposals to present to the class. Students should present as if they were members of a company writing the proposal and arguing its viability.

To explore the difference in speaking situations, students could choose a picture of an object from a technical context and a medium to work within, for example, a game show, talk show, meeting of senior managers, discussion at the lunchroom table, or science conference. After a brief preparation time, students could present to the class simulations or role plays of the language they would use in the situation.

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Suggestions for Assessment

- Students could host open house poster sessions for the school and local community members presenting their technical documents and showcasing samples of their technical presentations. Visitors might complete forms assessing student displays.

- Students should make entries in their learning logs regarding the presentations done in class. Entries may entail an assessment of their performance and suggestions for improvement, as well as strategies for developing a presentation.

- Students could form small groups. Groups could draw numbers from a hat with each number representing a different type of speaking engagement. Examples could include
  - a technical conference on the development of a new product or procedure
  - a fundraiser for the school's environment club
  - a community meeting to discuss a proposed video arcade for the area
  - a campaign presentation for president of the school's computer club
  - a conference on current developments in science or technology

- On occasion, the technical reading and writing class could be conducted as a business meeting. Students should be instructed on how business meetings operate and could take turns conducting the meeting. Students should have the opportunity to set and follow an agenda, construct minutes, and discuss old and new business. Each time, several members of the class should write a summary of the events during the meeting, indicate good points and bad points about the organization, and make suggestions for improvement.

- Teachers could assess students' speaking practices using a rubric based on the desirable behaviours presented under Outcome 4.1 in this section. Students should save these assessments in their portfolios and use the information they provide to improve their speaking.

Notes and Resources

The Communications Handbook, chapter 7

Technical Communication, chapter 9

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Outcomes

Students will be expected to

4.3 apply listening skills in both small-group and large-group technical communications

Suggestions for Teaching and Learning

Students should learn and apply the main steps for effective listening. Examples of the main steps for effective listening include

- tuning out distractions
- showing interest by keeping eyes focussed on the speaker
- taking notes on the main ideas
- listening with a purpose, to understand, to gather information, and to help construct an opinion
- paying attention to the speaker's signals, body language, gestures, and special phrases that indicate a series of points or what is next in the presentation

Students could listen to an interview, speech, or presentation. In small groups, they could record a summary of the presentation, including the purpose, the main points, and the intended audience. As a whole class, they could compare the main points each group decided on. From here, a discussion could centre on the steps for effective listening.

4. Students will be expected to speak and listen in small group, whole class, and presentation contexts.

Suggestions for Assessment

- Students could submit brief summaries of presentations for formal assessment.
- Students could record a self-reflection in their learning logs regarding their listening skills and suggestions for improvement.
- Teachers should use observational checklists for classroom activities (see Appendix D).

Notes and Resources

Secondary Science: A Teaching Resource, chapter 3, section 5

The Communications Handbook, chapter 7

Technical Communication, chapter 9

Examples of evaluation forms may be found in Appendix D.

Contexts for Learning and Teaching

Principles of Learning

The public school program is based on principles of learning that teachers and administrators should use as the basis of the experiences they plan for their students. These principles include the following:

1. *Learning is a process of actively constructing knowledge.*

   Therefore, teachers and administrators have a responsibility to

   - create environments and plan experiences that foster inquiry, questioning, predicting, exploring, collecting, educational play, and communicating
   - engage learners in experiences that encourage their personal construction of knowledge, for example, hands-on science and math, drama, creative movement, artistic representation, and writing and talking learning activities
   - provide learners with experiences that actively involve them and are personally meaningful

2. *Students construct knowledge and make it meaningful in terms of their prior knowledge and experiences.*

   Therefore, teachers and administrators have a responsibility to

   - find out what students already know and can do
   - create learning environments and plan experiences that build on learners' prior knowledge
   - ensure that learners are able to see themselves reflected in the learning materials used in the school
   - recognize, value, and use the great diversity of experiences and information students bring to school
   - provide learning opportunities that respect and support students' racial, cultural, and social identities
   - ensure that students are invited or challenged to build on prior knowledge, integrating new understandings with existing understandings

3. *Learning is enhanced when it takes place in a social and collaborative environment.*

   Therefore, teachers and administrators have a responsibility to

   - ensure that talk, group work, and collaborative ventures are central to class activities
   - see that learners have frequent opportunities to learn from and with others
   - structure opportunities for learners to engage in diverse social interactions with peers and adults
   - help students to see themselves as members of a community of learners

4. *Students need to continue to view learning as an integrated whole.*

   Therefore, teachers and administrators have a responsibility to

   - plan opportunities to help students make connections across the curriculum and with the world outside and structure activities that require students to reflect on those connections
   - invite students to apply strategies from across the curriculum to solve problems in real situations

5. *Learners must see themselves as capable and successful.*

   Therefore, teachers and administrators have a responsibility to

   - provide activities, resources, and challenges that are developmentally appropriate to the learner
   - communicate high expectations for achievement to all students
   - encourage risk taking in learning
   - ensure that all students experience genuine success on a regular basis
   - value experimentation and treat approximation as signs of growth
   - provide frequent opportunities for students to reflect on and describe what they know and can do
   - provide learning experiences and resources that reflect the diversity of the local and global community
   - provide learning opportunities that develop self-esteem

6. *Learners have different ways of knowing and representing knowledge.*

   Therefore, teachers and administrators have a responsibility to

   - recognize each learner's preferred ways of constructing meaning and provide opportunities for exploring alternative ways
   - plan a wide variety of open-ended experiences and assessment strategies
   - recognize, acknowledge, and build on students' diverse ways of knowing and representing their knowledge
   - structure frequent opportunities for students to use various art forms—music, drama, visual arts, dance, movement, crafts—as a means of exploring, formulating, and expressing ideas

7. *Reflection is an integral part of learning.*

   Therefore, teachers and administrators have a responsibility to

   - challenge their beliefs and practices based on continuous reflection
   - reflect on their own learning processes and experiences
   - encourage students to reflect on their learning processes and experiences
   - encourage students to acknowledge and articulate their learnings
   - help students use their reflections to understand themselves as learners, make connections with other learnings, and proceed with learning

Cross-Curricular Connections

Visual Arts

The visual component of Technical Reading and Writing 11 provides a strong connection to the visual arts program. A background in interpreting and creating drawings and illustrations in visual arts studies, for example, can give a student in Technical Reading and Writing 11 a decided advantage when planning visual supports for technical print text or preparing a schematic or a flow chart for a process.

Entrepreneurship Education

A fundamental necessity for entrepreneurs is skill in presenting themselves to potential clients or financial supporters. The presentation element in Technical Reading and Writing 11 provides practice in such skills. Also, the course provides learning

experiences in reading and creating effective technical text, a necessity in planning entrepreneurship ventures.

Mathematics

The connections between Technical Reading and Writing 11 and mathematics are strong because technical tasks frequently have a mathematical component, often in the form of mathematical data, such as measurements, that have to be translated into a product or a process. In addition, the charts and graphs often found supporting technical text reflect data management components of mathematics and the sciences.

Science

Science has a significant connection with Technical Reading and Writing 11 in that technical tasks are frequently grounded in some aspect of science, such as physics, chemistry, biology, or geology, and the types of tasks performed in such disciplines are technical tasks. Following instructions for a laboratory activity, preparing a subsequent report, or reading a chapter in a science text are tasks requiring the skills and strategies of an effective reader of technical text.

Technology Education

The tasks students are required to undertake in courses such as Exploring Technology 10, Design 11, Electrotechnologies 11, and Production Technology 11 and 12 are technical ones requiring that students use technical text to follow instructions. In addition, many of the skills and processes students learn in Communication Technology 11 and 12 form a strong basis for the tasks performed in Technical Reading and Writing 11.

Learning Styles and Needs

Learners have many ways of learning, knowing, understanding, and creating meaning. Research into links between learning styles and preferences and the physiology and function of the brain has provided educators with a number of helpful concepts of and models for learning. Howard Gardner, for example, identifies eight broad frames of mind or intelligences: linguistic, logical/mathematical, visual/spatial, body/kinesthetic, musical, interpersonal, intrapersonal, and naturalistic. Gardner believes that each learner has a unique combination of strengths and weaknesses in these eight areas, but that the intelligences can be more fully developed through diverse learning experiences. Other researchers and education psychologists use different models to describe and organize learning preferences.

Students' ability to learn is also influenced by individual preferences and needs within a range of environmental factors, including light, temperature, sound levels, availability of food and water, proximity to others, opportunities to move around, and time of day.

How students receive and process information and the ways they interact with peers and their environment in specific contexts are both indicators and shapers of their preferred learning styles. Most learners have a preferred learning style, depending on the situation and the type and form of information the student is dealing with, just as most teachers have a preferred teaching style, depending on the context. By reflecting on their own styles and preferences as learners and as teachers in various contexts, teachers can

- build on their own teaching-style strengths
- develop awareness of and expertise in a number of learning and teaching styles and preferences
- identify and allow for differences in student learning styles and preferences
- identify and allow for the needs of students for whom the range of ways of learning is limited
- organize learning experiences to accommodate the range of ways in which students learn

Learning experiences and resources that engage students' multiple ways of understanding allow them to become aware of and reflect on their learning processes and preferences. To enhance their opportunities for success, students need

- a variety of learning experiences to accommodate their diverse learning styles and preferences
- opportunities to reflect on their preferences and the preferences of others to understand how they learn best and how others learn differently
- opportunities to explore, apply, and experiment with learning styles other than those they prefer, in learning contexts that encourage risk taking
- opportunities to return to preferred learning styles at critical stages in their learning
- opportunities to reflect on other factors that affect their learning, for example, environmental, emotional, sociological, cultural, and physical factors
- a flexible time line within which to complete their work

Meeting the Needs of All Students

Learners require inclusive classrooms, where a wide variety of learning experiences ensure that all students have equitable opportunities to reach their potential.

In designing learning experiences, teachers must accommodate the learning needs, preferences, and strengths of individuals, and consider the abilities, experiences, interests, and values which they bring to the classroom.

In recognizing and valuing the diversity of students, teachers should consider ways to

- create a climate and design learning experiences to affirm the dignity and worth of all learners in the classroom community
- consider the social and economic situations of all learners
- acknowledge racial and cultural uniqueness
- model the use of inclusive language, attitudes, and actions supportive of all learners
- adapt classroom organization, teaching strategies, assessment practices, time, and learning resources to address learners' needs and build on their strengths
- provide opportunities for learners to work in a variety of contexts, including mixed-ability groupings
- identify and apply strategies and resources that respond to the range of students' learning styles and preferences
- build on students' individual levels of knowledge, skills, and attitudes
- use students' strengths and abilities to motivate and support their learning
- provide opportunities for students to make choices that will broaden their access to a range of learning experiences
- acknowledge the accomplishment of learning tasks, especially those that learners believed were too challenging for them

The curriculum outcomes designed for Technical Reading and Writing 11 provide a framework for a range of learning experiences for all students, recognizing that technical communication occurs in a range of workplace and educational contexts requiring various knowledge and skill levels.

Teachers must adapt learning contexts, including environment, strategies for learning, and strategies for assessment, to provide support and challenge for all students, using curriculum outcomes to plan learning experiences appropriate to students' individual learning needs. When these changes are not sufficient for a student to meet designated outcomes, an individual program plan may be developed. For more detailed information, see *Special Education Policy Manual (1996*), Policy 2.6.

A range of learning experiences, teaching and learning strategies, motivation, resources, and environments provide expanded opportunities for all learners to experience success as they work toward the achievement of designated outcomes. Many of the learning experiences suggested in this guide provide access for a wide range of learners, simultaneously emphasizing both group support and individual activity. Similarly, the suggestions for a

variety of assessment practices provide multiple ways for students to demonstrate their achievements.

The Role of Technology

Vision for the Integration of Information Technologies

The Nova Scotia Department of Education has articulated five outcome areas for the integration of information technologies in learning across the curriculum:

Basic Operations and Concepts: concepts and skills associated with the safe and efficient operation of a range of information technologies

Productivity Tools and Software: information technologies that students select and use to engage in learning activities, for example, to explore ideas, manipulate data, discover patterns and relationships, solve problems, and represent their learning

Communications Technology: interactive technologies that support student and teacher communication, collaboration, and sharing of curriculum ideas, problems, and solutions

Research, Problem Solving, and Decision Making: processes involving organization, reasoning, and evaluation by which students rationalize their use of information technology

Social, Ethical, and Human Issues: understanding associated with the use of information technology that encourages in students a commitment to work towards a personal and social good, especially to build and improve their learning environments and strengthen relationships with their peers and others who support their learning.

The Role of Technology in Technical Reading and Writing 11

Technical Reading and Writing 11 presupposes certain levels of technology in or available to classrooms where it is offered, and references are made throughout the suggestions for teaching and learning to various technologies that support learning experiences. Schools offering Technical Reading and Writing 11 should recognize that the course provides experiences for students to learn and practise skills they will need for success in the technical workplace or in post-secondary education and training leading to the technical workplace. If technology is not available in the classroom, students should have scheduled access to a computer lab.

Learning experiences in Technical Reading and Writing 11 require access to technology, including

- word processing software, such as ClarisWorks, Microsoft Office, Corel, or Lotus Suite
- database software, such as any in the above suites
- spreadsheet software, such as any in the above suites

Learning experiences are also described that require, as available,

- the Internet
- planning software, such as Inspiration
- graphics software, such as Painter, Adobe Photoshop, or Paintshop Pro
- publishing software, such as Adobe Pagemaker
- multimedia presentation software, such as Hyperstudio or presentation programs in any of the word processing suites above
- Web writing/publishing software, such as programs in the word processing suites listed above or AOLPress (free download from the Web), or Netscape Composer
- scanners
- video cameras
- digital cameras

While Technical Reading and Writing 11 is not designed to provide instruction in the use of the above technologies, students should have opportunities to use technologies they have learned to use in other courses and to learn new applications as needed to complete assigned tasks. Teachers should make use of student expertise by having students teach and mentor other students within the context of the projects they are working on for the course.

Principals may wish to consider scheduling Technical Reading and Writing 11 with a half-credit course in Communications Technology, which includes the development of technological skills that would be useful in Technical Reading and Writing 11. However, principals should not feel that the school may not offer Technical Reading and Writing 11 if the school has not yet attained the level of technology presumed by the above list. While exposure to learning activities requiring a high level of technology is desirable, many of those activities can be completed using less complex technology. For example, a PowerPoint-style presentation may be made using overheads.

Assessing and Evaluating Student Learning

Assessment is the systematic process of gathering information on student learning.

Evaluation is the process of analysing, reflecting upon, and summarizing assessment information, and making judgments or decisions based upon the information gathered.

Using a Variety of Assessment Strategies

When teachers make decisions about what learning to assess and evaluate, how to assess and evaluate, and how to communicate the results, they send clear messages to students and others about what learning they value; for example, teachers can communicate that they value risk taking or lateral thinking by including these elements in determining marks or grades.

Assessment involves using a variety of methods to gather information about a wide range of student learning to develop a valid and reliable snapshot of what students know and are able to do. The assessment process provides information about each student's progress toward achieving learning outcomes. Teachers can use this information to assign grades, to initiate conversations with students, or to make decisions in planning subsequent learning experiences.

Teachers align assessment and evaluation practices with student-centered learning practices when they

- design evaluation and assessment tasks that help students make judgments about their own learning and performance
- provide evaluation and assessment tasks that allow for a variety of learning styles
- individualize evaluation and assessment tasks to accommodate specific learning needs
- work with students to describe and clarify what will be evaluated and how it will be evaluated
- provide students with feedback on their learning that is regular, specific, frequent, and consistent

Assessment activities, tasks, and strategies include, for example,

anecdotal records
artifacts
audiotapes
certifications
checklists
conferences
demonstrations
dramatizations
exhibitions
holistic scales
interviews (structured or informal)
inventories, investigations
learning logs or journals
media products
observations (structured or informal)
peer-assessments

portfolios	seminar presentations
projects	sorting scales (rubrics)
questioning	surveys
questionnaires	tests
reports	videotapes
reviews of performance	work samples
self-assessments	written assignments

Involving Students in the Assessment Process

When students are aware of the outcomes for which they are responsible and the criteria by which their work will be assessed or evaluated, they can make informed decisions about the most effective ways to demonstrate what they know, are able to do, and value.

Students should participate actively in the assessment and evaluation of their learning, developing their own criteria and learning to judge a range of qualities in their work. Students should have access to models in the form of scoring criteria, rubrics, and work samples.

As lifelong learners, students assess their own progress, rather than relying on external measures, for example grades, to tell them how well they are doing. Students who are empowered to assess their own progress are more likely to perceive their learning as its own reward. Rather than asking, What does the teacher want? students need to ask questions such as, What have I learned? What can I do now that I couldn't do before? What do I need to learn next?

Effective assessment practices provide opportunities for students to

- reflect on their progress toward learning outcomes
- assess and evaluate their learning
- set goals for future learning

Assessment in Technical Reading and Writing 11

In Technical Reading and Writing 11, assessment should be an ongoing process during which students set goals for themselves and negotiate standards with the teacher, perhaps through contracts for blocks of work. This course does not lend itself to testing or examinations. In the technical workplace, success is measured by contracts won and promotions achieved, so students need to learn how to assess the results of their efforts themselves and how to improve them.

Overall evaluation of students' work maybe achieved using

- portfolios of best work, the requirements for which may be determined collaboratively by teacher and student at the beginning of the course and then revised as appropriate

- learning logs in which students reflect on their progress
- final presentations by teams on a technical topic assessed by a rubric designed collaboratively by teacher and students. (This presentation serves as the main formal assessment of the course.)

Portfolios

A major feature of assessment and evaluation in Technical Reading and Writing 11 is the use of portfolios. A portfolio is a purposeful selection of a student's work that provides evidence of the student's efforts, progress, and achievement.

Portfolios engage students in the assessment process and allow them to participate in the evaluation of their learning. Portfolios are most effective when they provide opportunities for students to reflect on and make decisions about their learning. The students and teacher should collaborate to make decisions about the contents of the portfolio and to develop the criteria for evaluating the portfolio. Portfolios should include, along with student work,

- the guidelines for selection
- the criteria for judging merit
- evidence of student reflection

Portfolio assessment is especially helpful for the student who needs significant support. Teachers should place notes and work samples from informal assessment in the portfolio and use the portfolio to collaborate with the student in identifying strengths and needs, selecting learning experiences, and selecting work that best reflects the student's progress toward achievement of designated learning outcomes.

Students should share their portfolios with other students so that all may see exemplars that represent a range of strategies for technical communication.

Outlines and other evidence of planning, along with multiple revisions of their documents, allow students to examine their progress and demonstrate it to teachers, parents, and others.

Portfolio Contents for Technical Reading and Writing 11

Students may negotiate with the teacher regarding kinds and quantities of artifacts to be included in the portfolio. The following should be considered:

- comparisons of technical text and literary text
- K-W-L charts
- summaries of technical documents
- samples of students' graphic organizers
- samples of documents students have created

- peer-assessments
- self-assessments
- teacher rubrics, checklists, and other assessment

Where the opportunity exists, teachers might encourage students to maintain an electronic portfolio. At the end of the course, students could submit their work on CD for final evaluation.

Appendix A

Sample Memo from an Engineering Firm

(Adapted with permission from a memorandum from Jacques Whitford)

Memorandum

TO: XYZ Engineering FROM: J. D. Rossway

OFFICE: Dartmouth DATE: March 30, 2000

SUBJECT: Mystic Valley Landfill (MVL)

I have reviewed both Alice White's and Jim Dunn's reports for this site. At first glance, identification of landfill leachate migration from this small landfill site seems to be a straight-forward problem. However, both the site disposal history and geologic/hydro geologic conditions are complex. I have several comments that I hope you will find helpful and that are based on the existing reports.

1. Are there two or three disposal areas? We have the Mystic Valley Landfill and an older landfill beneath nearby debris. But construction plans also show a "dump" area east of the gravel pit area. This area does not seem to be discussed by either report (or else I am not seeing it). Does this area have any significance with respect to leachate generation, or does this area just host surface debris?

2. MVL was very lucky to have positioned the three MWs where they did, thus narrowing the geologic contact to within an area of about 100m. Actually, since the municipality was involved, I am sure MVL gave a lot of thought to where those MWs should be placed.

   We should determine whether NSDNR have undertaken any recent bedrock geologic mapping in that area. Boehner & Giles completed a relatively recent geologic map in 1986, but it extends only as far as the swampy area. We should contact them to see if more recent work exists closer to the proposed site. Based on Boehner & Giles' work, faults are present in the adjacent area, and these presumably will extend into the MVL area.

3. An examination of historic air photos should be undertaken for this site. This examination should attempt to determine

   - evidence of waste burial north of MVL and its extent
   - shape of original topography beneath MVL (Are Streams 1 and 2 evident in these historic photos?)
   - progression of waste disposal in this area

4. I agree with Alice White that it is not possible to determine whether groundwater quality differences between MWs 1 and 2/3 are due to bedrock differences or leachate. However, I believe the differences in MVL groundwater quality data are more likely associated with bedrock changes than leachate.

5. I don't believe continued sampling of existing MWs for hydrocarbons or a wide variety of organics will provide much useful information at this point. Until we have "found" leachate in groundwater, we may be just sampling in the "wrong" places and will not be collecting leachate representative quality data.

MVL's future analytical efforts should focus first on major ions and metals in water and metals in surface water sediment (if possible to collect). In addition, we will need RCAp-MS analyses to get detection limits sufficiently low enough to compare lead, nickel, and cadmium concentrations to the CCME aquatic criteria — "<" values are not adequate.

I also think our sampling of surface waters needs to consider collection of storm event samples (i.e., periods when there is lots of run-off from the site and potential for leachate being flushed into surface streams).

If we have the opportunity to resample surface waters, we should also plan to collect some field parameters (e.g., conductivity, pH, temperature, and estimate of stream discharge). The former can help with leachate identification, while the latter can allow us to calculate loadings to downgradient streams–-should this be necessary.

6. I am not yet convinced that further deep drilling at locations MWs 2 and 3 is the next investigative step downgradient of the Mystic Valley Landfill. According to the maps, faults in the area are very steeply dipping, and it may not be practical to think in terms of vertical interception. MVL needs to better consider the site geology before jumping into the next subsurface program. Is there bedrock outcrop along Stream 1?

   Jim Dunn's report indicated that fracture frequency decreased with depth. Looking at well depths for MWs 2/3, I wonder if the shallow fractured zone (i.e., upper bedrock surface) would be a better drilling target.

   As previously stated, the fault lies within 100m interval (approximate) between MWs 1 and 3. Given that it is a major regional fault, it is likely to be several 10s of metres wide. Therefore, it seems reasonable to expect that a MW closer to the landfill, northwest of MW3, might intersect this fault.

   MW2 may be too far sidegradient to warrant installation of a second well at that location. The topography suggests to me that groundwater flow is more likely to be sub-parallel to the site than the way MVL has presented it. If flow is sub-parallel to the site, I would be inclined to look for one or two additional locations closer to the road. Logistically, it would also make sense to co-ordinate installation of these MWs with MWs north of the road that would more specifically address the old disposal area beneath the school debris.

7. You are the best judge of how much flexibility we have in scoping future work, based on our recent work. In general, it seems to me we need to step back somewhat and develop a conceptual geologic/hydro geologic model of what is going on at this site, then based on that model, target additional MW locations. Hopefully, we are still able to back away from further analytical monitoring of existing locations. I don't think this is of any benefit at this time. Jim and I discussed use of geophysics to help define potential leachate migration pathways. However, until we *find* some leachate and assess whether it has sufficient contrast with the groundwater to be detectable, it is premature to propose it. For the present, we need more wells closer to the landfill and the gravel pit as previously indicated.

Technical Text

(Excerpt from a report. Used with permission from Jacques Whitford)

4.3 Exposure Assessment

The exposure assessment evaluates the likelihood that the potential hazards can come into contact with the potential receptors. The likelihood of exposure is determined through consideration of the properties of individual hazards which control chemical mobility, and the various pathways through which the hazard could move to contact the receptor, or through which the receptor could move to contact with the hazard. The exposure analysis also considers the possible mechanisms through which a hazard can be introduced to a human receptor (i.e., ingestion, dermal contact, inhalation).

4.3.1 Fate and Transport Properties of Hazards

The relative mobility of a hazard is typically determined through review of the physical properties of the hazards. The fate and transport properties of the identified hazards are summarized in Table 4.2.

Table 4.2 Summary of Fate and Transport Properties of Identified Hazards

Potential Hazards		Solubility	Volatility	Sorption Potential	Reactivity/ Biodegradability	Conditions for Persistence	Fate Assessment
Petroleum Hydrocarbons	Benzene	moderate	high	low	moderate to high	anaerobic	highly mobile, not persistent
	Toluene	moderate	high	low	moderate to high	anaerobic	mobile, not persistent
	Ethyl benzene	moderate	high	low	moderate to high	anaerobic	mobile, not persistent
	Xylenes	moderate	moderate	moderate	moderate	anaerobic	mobile, persistent
	TPH-Gasoline/ Fuel Oil	low to moderate	moderate	moderate	low	anaerobic	immobile, persistent

NOTE: Mobility and persistence are described qualitatively relative to benezene.

4.3.2 Potential Transport Pathways

The principal pathways through which environmental hazards can typically contact a receptor include

- direct contact (with soil, dust, liquid product phase hazards, or water)
- transport of liquid product phase contaminants
- transport in groundwater
- transport in surface water
- air borne transport (as dust)
- transport as a vapour

4.3.3 Potential Exposure Mechanisms

The mechanisms by which receptors typically become exposed to hazards include

- inhalation
- ingestion
- dermal contact
- uptake by plants

Samples of Literary Text

These texts may be photocopied and used to demonstrate the characteristics of literary text and may be re-written as technical texts.

Excerpt from *Lydia Bailey*

by Kenneth Roberts (p. 72)

Haiti, the French part of San Domingo, is like the back of a man's right hand when he holds it before his face, forefinger and little finger extended to the left, the two middle fingers folded against the palm, and the thumb pressed out of sight against the hidden fingers. The knuckles are the dividing-line between the French part of the island and the Spanish part. The space between the two fingers is the seventy-mile-wide, pale green, pale blue Bight of Leogane. The extended little finger, almost touching the outstretched nose of Cuba, is the Great North Plain, with the capital city of Cap François at the upper edge of the large joint. The depression between the down-folded middle fingers is the valley of the Artibonite, walled by mountain chains whose names are as fantastic as their shapes. At the base of the index finger, where it joins the folded-down second finger, is Port-au-Prince, a hundred miles south of Cap François across a stormy sea of mountains. And between the knuckle and the first joint of the outstretched index finger are the rich sugar, rum, and coffee sections of Leogane, Jacmel, and the Cul de Sac.

Excerpt from "David"

by Earl Birney

The dawn was a floating
Of mists till we reached to the slopes above timber, and won

To snow like fire in the sunlight. The peak was upthrust
Like a fist in a frozen ocean of rock that swirled
Into valleys the moon could be rolled in. Remotely unfurling
Eastward the alien prairie glittered.

Overview of Types of Print Technical Text

Type of Text	Characteristics	Format
Proposal (report)	• formal suggestion with necessary persuasive documentation to support it • may be solicited or submitted "on spec"	• introduction • proposed program or project • qualifications and experience • budget
Progress report	may take the form of • telephone calls • brief memos • letters • formal reports	• objectives of the project • brief survey of complete project • work completed to date • work yet to be done • problems or situations that may come up • predictions concerning meeting budget and time lines • overall assessment of progress
Feasibility report	• assesses two or more courses of action • makes a recommendation	• title page • abstract • table of contents • list of illustrations • executive summary • glossary • appendices

Article	an essay written for
	
	• publication in a technical journal or magazine
	• presentation at a conference
		• abstract
		• body
		  ▸ introduction
		  ▸ background
		  ▸ situation/problem
		  ▸ solutions
		  ▸ conclusions
		• bibliography

Letter	• provides an official record of communication
	• types include
	  ▸ order
	  ▸ inquiry
	  ▸ response to inquiry
	  ▸ sales
	  ▸ claim
	  ▸ adjustment
	  ▸ cover
		• elements include
		  ▸ heading
		  ▸ inside address
		  ▸ salutation
		  ▸ body
		  ▸ complimentary close
		  ▸ signature
		  ▸ copy notation
		• standard formats are
		  ▸ full block
		  ▸ modified block
		• most important points appear at beginning

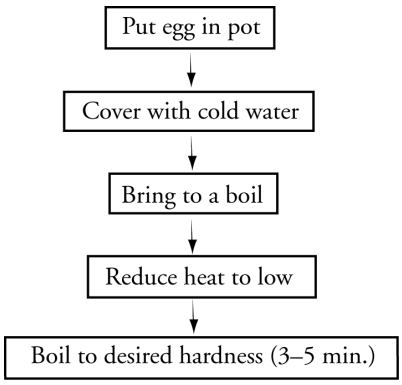
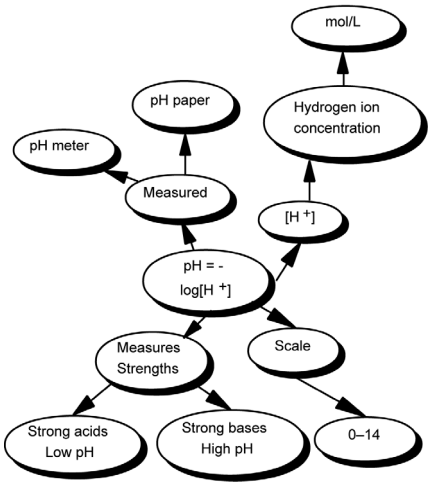
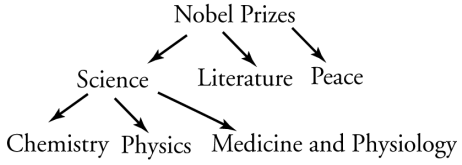
Type of Text	Characteristics	Format
Memo *	• used for routine communication within business offices • may be less formal than letters • types include ▸ directive ▸ trip report ▸ incident report ▸ field/lab report	• heading with "To," "From," "Subject," "Date" • body ▸ statement of purpose ▸ summary ▸ discussion ▸ action • key points appear early in body
E-mail	• used for rapid communication • less formal than other types of communication • in business offices, is saved permanently in the network archives	• format is similar to memo format • users should observe netiquette guidelines to avoid embarrassing situations
Instructions	used to complete processes	• background information • materials required • step-by-step procedure • concluding summary • graphics may be included
Lists**	types include • simple lists • combined lists (two or more simple lists = a table) • intersecting lists (combination of three lists, using two lists to find information in the third) • nested lists (three related lists with rows and columns modified to indicate a hierarchy)	examples include • telephone book yellow pages • workplace log sheets • job assignment schedules • equipment maintenance charts • weather charts

* An excellent article on communication through memos appears in the journal *Teaching English in the Two-Year College* ("The Student as Translator in the Technical Writing Classroom: The *Challenger* Disaster as Heuristic" by Teresa Kynell, May 1993). The article cites interoffice memos concerning the potential for O-ring problems that were not attended to and considers the language and positioning of critical detail in the memo as a cause of the disaster. Memos are included.

** The following text represents data from a car dealership. There are eight salespeople in this business with experience ranging from 1 year to 20 years. Carol has only 5 years' experience but has sold 14 cars this month. Al, with 11 years' experience, has sold 10 cars. Both Eric and Marty have 8 years' experience and have sold 9 and 7 cars, respectively. Pete has 15 years' experience and has sold 12 cars. Sharon has 20 years' experience and has sold the most cars this month—15. Curt has sold 9 cars this month with only 1 year on the job. Finally, Warren, with 15 years' experience, has sold 11 cars. Decide which kind of list would best present these data and construct it.

Appendix B

Graphic Organizers

<table>
<tr><th>Type of Organizer</th><th>Description</th><th>Visual</th></tr>
<tr><td>Sequence of Events</td><td>Used to describe stages or steps in a linear procedure. Example: the process for boiling an egg.</td><td> 
</td></tr>
<tr><td>Comparison/Contrast</td><td>Used to show the similarities and differences between two or more things. Example: a comparison and contrast of a North American and a Japanese car.</td><td>
<table>
<tr><th></th><th>Chrysler Neon LE</th><th>Honda Civic</th></tr>
<tr><td>Price</td><td>$17 995</td><td>$16 900</td></tr>
<tr><td>Acceleration (0–50 km/h)</td><td>4.1 s</td><td>4.0 s</td></tr>
<tr><td>Fuel Consumption (L/100 km)</td><td>8.8</td><td>7.4</td></tr>
</table>
</td></tr>
<tr><td>Concept Map</td><td>Used to describe a central idea and its related parts.</td><td> 
</td></tr>
<tr><td>Hierarchy Diagram</td><td>Used to link topics by subordinate relationships and group items into categories. Example: a breakdown of the Nobel prizes.</td><td> 
</td></tr>
</table>

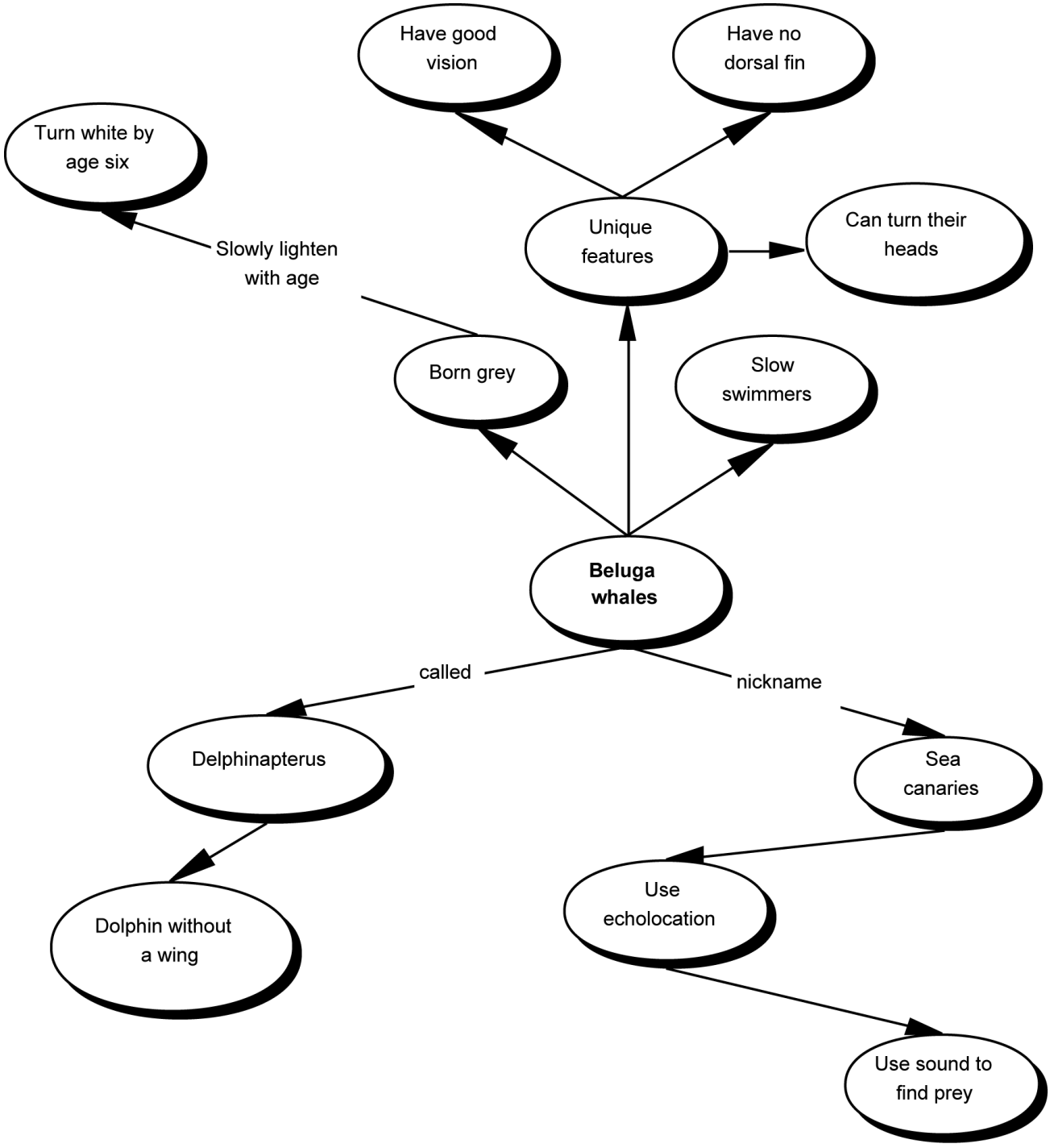
Beluga Whales

Beluga whales have the name Delphinapterus because of the absence of a dorsal fin. Delphinapterus means "dolphin without a wing." Some refer to beluga as white whales because of their adult colour. They are born grey and, as they age, lighten to turn completely white by the age of six. They have a thick layer of blubber insulating their bodies, which makes up about 40 percent of their body weight. Beluga swim in Arctic waters, frequently in depths barely covering their bodies. They have a slow swimming speed of about three to nine kph. They can swim forwards and backwards but are unique among whale species because they can turn their heads. Another unique feature of beluga is that they have good vision.

Beluga whales make a variety of sounds and are actually very loud when swimming in pods. For this reason, they are nicknamed "sea canaries." Beluga use sound in the form of echolocation to find their prey. Echolocation is a process that enables toothed whales to locate and differentiate among objects by listening to echoes. For the beluga whale, echolocation also helps with navigation through ice fields and the location of breathing holes in the ice.

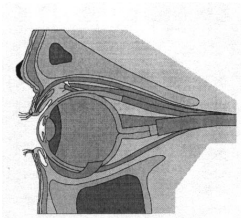
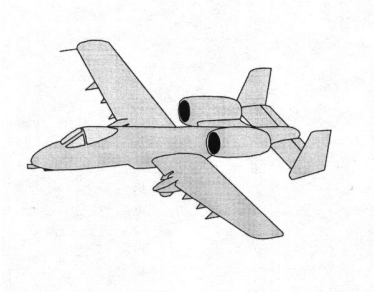
Graphic Organizer for Beluga Whales

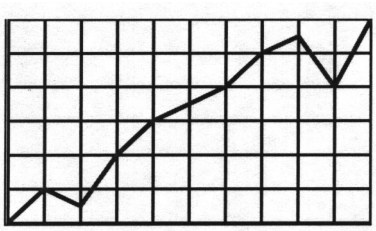
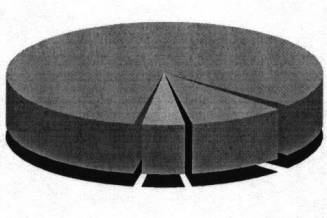
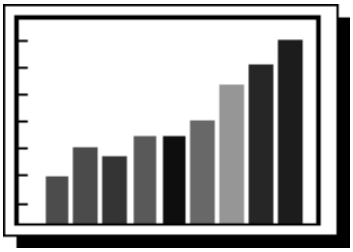
(made using Inspiration)



Appendix C

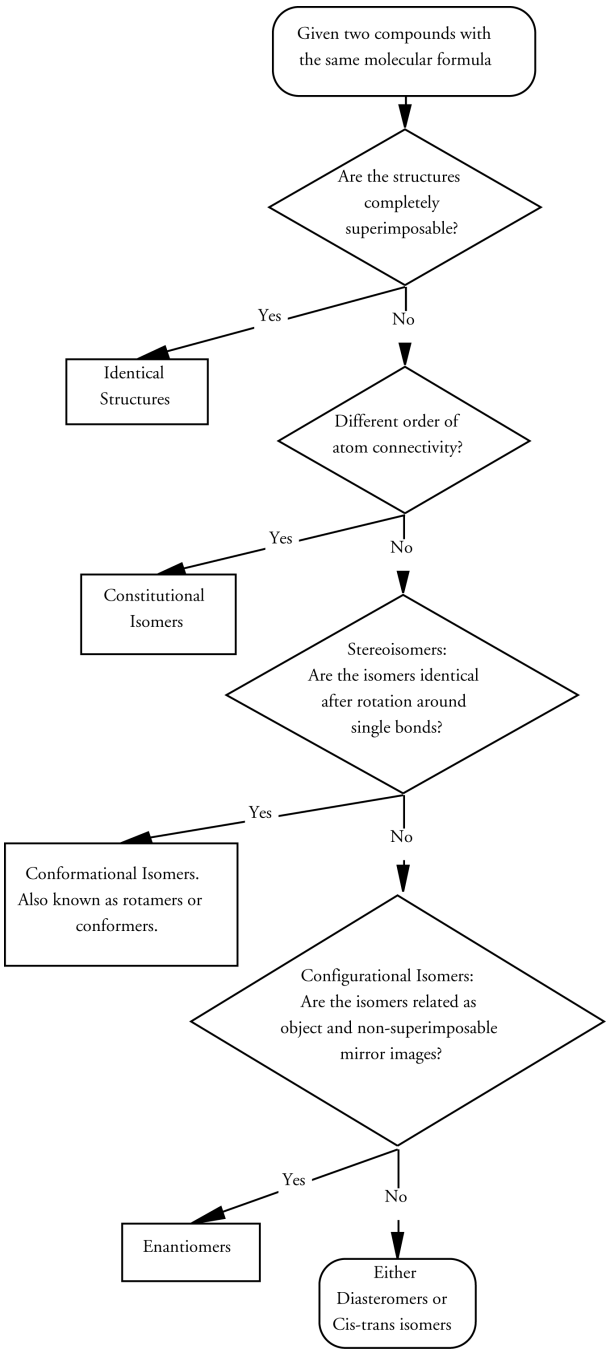
Types of Graphics Used in Technical Documents

Type of Graphic	Description	Example
Flow charts	Flow charts indicate a sequence of steps or relationships between steps. They have specific symbols, arrows, and lines indicating difference meanings (see pp. 101–102 of *The Language of Documents: A Guide to Information Display in the Workplace*). Flow charts are read from the top down, following the arrows until the stop symbol.	In Appendix C, you will find a flow chart from the Xerox Docutech Network Support Services *Service Diagnostic Manual* (pp. 1-4 to 1-9). Appendix C provides a second example of a flow chart from an Acid/Base unit. This flow chart was developed using Inspiration. A third example shows a flow chart comparing compounds with the same molecular formula.
Schematics	Schematics illustrate structural qualities of things or processes. Schematics do not provide actual representations of the process because they depict aspects of the process usually invisible to the naked eye. Therefore, text usually accompanies the schematic to enhance understanding. Schematics are read holistically with the aid of the accompanying text.	This appendix includes a schematic used by the Xerox company.
Diagrams	Diagrams show the function or operation of an object and can reveal aspects not normally seen in a schematic or a photograph. Similar to schematics, diagrams are read holistically with the aid of the accompanying text.	Diagram of the eye 
Pictures and Drawings	Pictures and drawings illustrate the appearance and dimensions of an object. Illustrations do not indicate function, just appearance. Some illustrations do have accompanying text but most stand alone in a technical document. Illustrations, whether they are drawings, pictures, or photographs, should be read holistically.	Picture  A-10 Thunderbolt (Warthog)

Type of Graphic	Description	Example
Tables	Tables show large amounts of information with greater accuracy than figures or diagrams. Although tables may include information in word format, presentation of numerical data is the most common use for tables. They can provide lists of data in a very concise format. The design of a table is in a row-by-column format, and the reader views the individual cells as a relationship between the row heading and the column heading.	Table 1: Specific Heat Capacities Element | Specific Heat (25°C) Aluminum | 0.90 J/g•°C Gold | 0.13 J/g•°C Iron | 0.45 J/g•°C
Graphs	Graphs are a specific type of diagram used to illustrate relationships in numerical data. They are read using the concept of slope (the change in the y axis as it relates to the change in the x axis).	y  x
Pie Charts and Bar Charts	Pie charts divide the whole into its representative parts using variables such as percentage or fractions. Bar charts can use a variety of variables and describe differences in values among sets of data for a given variable. Like graphs, bar charts are read by viewing the relationship between the x and y axes. Pie charts are read holistically. Text usually accompanies both types of charts to enhance understanding.	Pie Chart  Bar Chart 

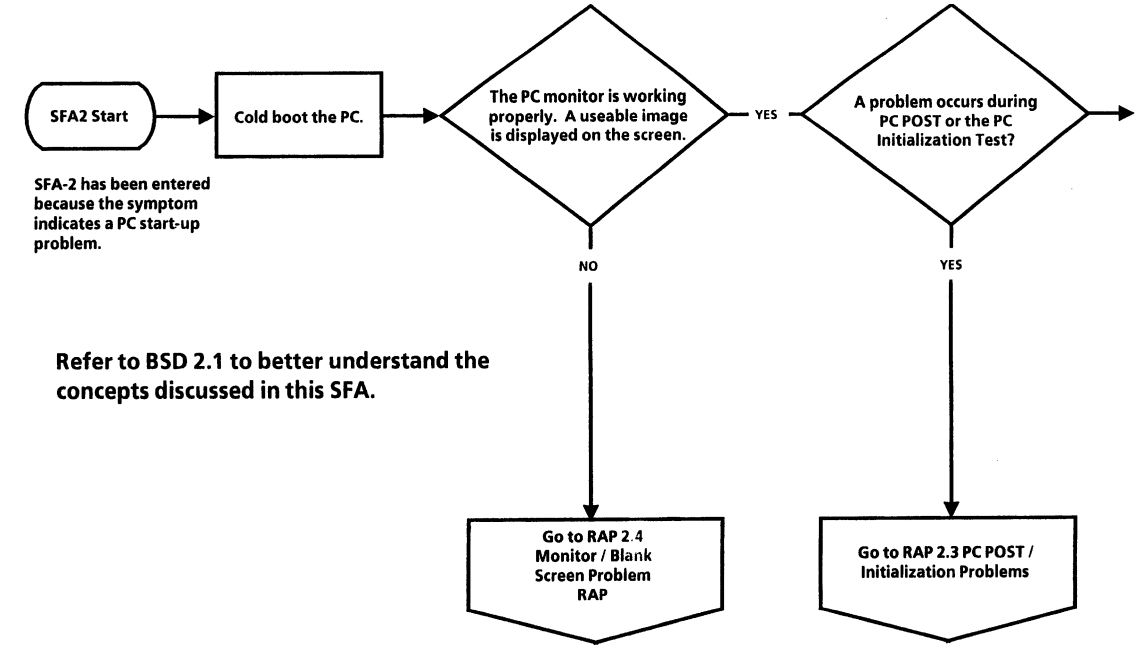
Type of Graphic	Description	Example
Web Sites	Web sites compete with millions of other sites for the attention of the reader. For this reason, most readers scan Web sites rather than read them. The design of Web pages includes highlighted key words, meaningful subheadings, bulleted lists, a single idea per paragraph, and half the number of words one would find in written text. This design strategy promotes scanning rather than reading. The reader will search for applicable material and ignore unneeded text.	Examples of Web sites are available on the Internet.
Videotext	Videotext, like Web sites, provides a concise form of information that the reader can easily scan. CD-ROMs contain some combination of text, graphics, animation, audio, and video to maximize understanding of the topic.	Examples include SIMLife and Saunder's Interactive Chemistry. Many other examples are available.

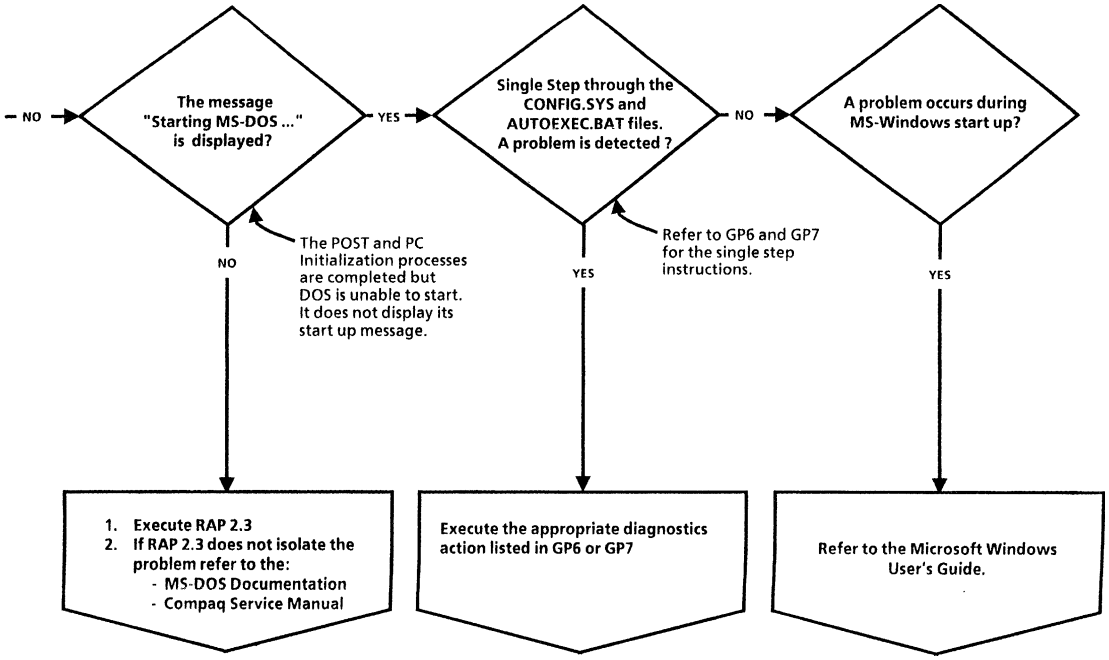
Flow Chart for Comparison of Compounds with the Same Molecular Formula



PC Platform Problem Analysis

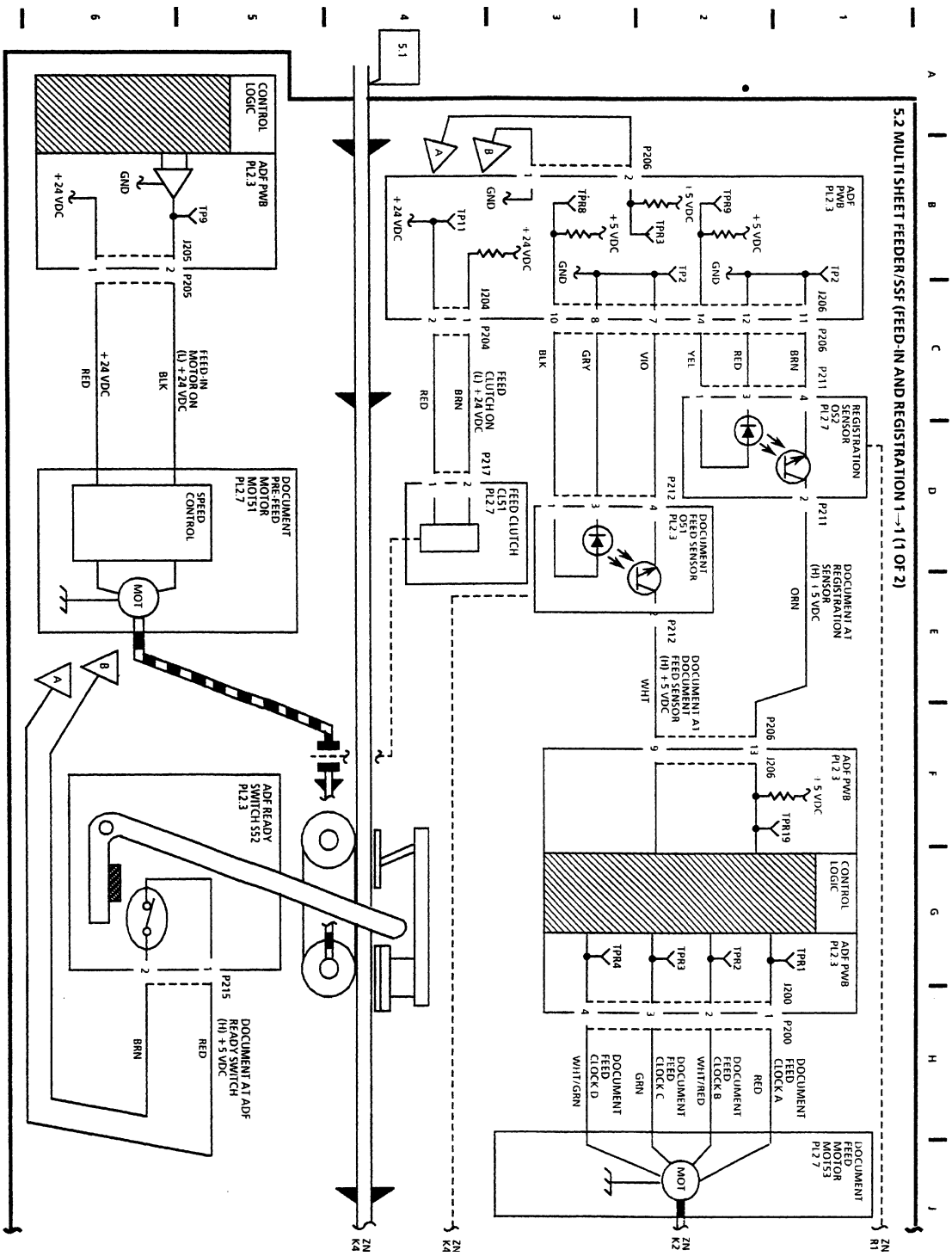
(Used with permission from Xerox Docutech Network Support Services.)





Scanner Wiring Schematic

(Used with permission from Xerox Docutech Network Support Services.)



Appendix D

Generalized Scoring Rubric

Response	Criteria	Rating
Exemplary	Clear, concise, and complete responses; includes graphical representation of data; shows understanding of processes; proposes hypotheses and analyses in terms of those hypotheses; draws correct conclusions from data.	6
Competent	Fairly clear, concise, and complete responses; includes some graphical representation of data; shows understanding of major processes; proposes hypotheses and analyses results with or without reference to the hypotheses; draws acceptable conclusions from data.	5
Satisfactory	Completes the assignment satisfactorily, but the explanation given may be ambiguous; graphical representations, hypotheses, analyses and conclusions may be incomplete, inappropriate, or unclear, or may show incomplete understanding of processes.	4
Nearly Satisfactory	Begins the assignment satisfactorily but omits significant parts or fails to complete; graphical representation may be inappropriate or absent; understanding of the processes is limited; hypotheses, analyses and/or conclusions may incorrect or incomplete.	3
Incomplete	Explanations are unclear or inaccurate; major flaws are present in concept mastery; use of terms is incorrect; hypotheses are inappropriate or omitted; shows little understanding of the processes; conclusions are incorrect or omitted.	2
Unsatisfactory	Graphical representations, explanations, hypotheses, and analyses do not reflect the assignment given; copies procedures without attempting a solution; does not indicate the information necessary for completion of the assignment.	1
No Attempt Made	Does not begin the assignment.	0

Group Activity Assessment Form

Rating: *2: Always* *1:Usually* *0: Never*	Names of Group Members					
Followed instructions clearly						
Actively participated in the activity						
Completed all tasks						
Helped clean up						
TOTAL MARK						

Form completed by _____

Activity:_____Date:_____

Group Activity Assessment Form

Rating: *2: Always* *1:Usually* *0: Never*	Names of Group Members					
Followed instructions clearly						
Actively participated in the activity						
Completed all tasks						
Helped clean up						
TOTAL MARK						

Form completed by _____

Activity:_____Date:_____

Oral Presentation Group Evaluation Form

Group Members_____ _____

_____ _____

In completing this form, it is extremely important that you are honest and fair. Try your best not to overrate or underrate the presentation. *Exceptional* should indicate a flawless presentation. *Good* should indicate a high standard of quality. *Weak* should indicate that there are some problems that need to be addressed.

Please place a check mark in the centre of the appropriate boxes.

ELEMENTS	Exceptional	Very Good	Good	Adequate	Weak
Background description					
Sources of information, types of resources					
Thoroughness; depth of coverage					
Extent; breadth of coverage					
Organization of presentation					
Clarity of presentation					
Usefulness of handouts (if any)					
Usefulness of activities (if any)					
Usefulness of content and other information					
OVERALL RATING					

Areas needing improvement:

Portfolio Evaluation Rubric

Student Name: _____

Category	Score	Description
Contents	4	All required items are included in the portfolio and reflect an excellent level of work; significant improvements seen over term; strong effort to learn from previous errors can be seen; items are corrected or redone for evaluation.
	3	Most items are included in the portfolio and show a satisfactory level of work; improvements seen over term; effort to learn from past errors is evident; most items are corrected or redone for evaluation.
	2	The items included in the portfolio show a satisfactory level of work; some effort is made to improve over the term with minimal effort to learn from past errors; few items are corrected or redone for evaluation.
	1	The items included in the portfolio show a barely satisfactory level of work; little effort is made to improve over the term or to learn from past errors; very few items are corrected or redone for evaluation.
	0	The items included in the portfolio show a poor level of work; no effort is made to improve over the term with no effort to learn from past errors; no items are corrected or redone for evaluation.
Self-Evaluation	4	Responses show insightful thinking and significant understanding of items discussed.
	3	Responses show clear thinking and understanding of items discussed.
	2	Responses show some thinking with faulty understanding of items discussed.
	1	Responses show little thinking with little understanding of items discussed.
	0	No effort is made to complete a self-evaluation.
Aggregate	4	Portfolio is complete and well-organized.
	3	Portfolio has all items required.
	2	Portfolio has most items required.
	1	Portfolio has several items missing.
	0	Portfolio has a large number of items missing and is therefore incomplete.

Student comment:

Teacher comment:

Presentation Evaluation Form

Student Name:_____

RATING CATEGORY	Exceptional (5)	Proficient (4)	Satisfactory (3)	Limited (2)	Weak (1)
Content	Relevant to topic	Relevant to topic	Generally relevant	Limited relevance	Not relevant
	Appropriate for audience	Appropriate for audience	Generally appropriate	Not very appropriate	Inappropriate
	Organized and easy to follow	Logical sequence with minor flaws	Occasionally off topic	Fails to follow a logical sequence	No logical sequence evident
	Explicit introduction and conclusion	Explicit introduction and conclusion	Good introduction but weak conclusion or vice versa	Weak introduction and conclusion	Poor introduction and conclusion
	Excellent attempt to engage and hold the audience attention	Good attempt to engage and hold audience attention	Satisfactory attempt to secure audience attention	Limited attempt to secure audience attention	No attempt to gain audience attention
Presentation	Confident stance	Mostly confident	Satisfactory but nervous mannerisms apparent	Very nervous, little confidence	Extremely nervous, little confidence
	Voice audible and animated	Voice audible but may not be animated	Presentation is clearly understood	Frequently inaudible	Inaudible
	Does not use notes to any extent	Uses notes occasionally	Uses notes frequently	Uses notes extensively	Reads from notes
	Invites audience questions and answers them effectively	Addresses all audience questions	Addresses some audience questions, but not always with understanding	Limited attempt to answer audience questions	Does not respond to audience questions
	Excellent awareness of audience; appropriate tone and language choices	Good awareness of audience; appropriate tone and language choices	Usually aware of audience, but does not always use the appropriate language or tone	Little awareness of audience and the need to adapt language and tone	No awareness of audience
	Excellent choice in and effective presentation of visual supports	Good choice of visual supports and their presentation	Reasonable use of visual supports, but perhaps with over-reliance on them	Visual supports not all well-prepared or presented effectively	Inadequate or no visual supports

Observational Checklist: Group Participation

Evaluation Key **2: Always/Usually** **1: Sometimes** **0: Seldom/Never** **Name of Student**	Contributes helpful ideas	Adds useful explanations	Supports ideas with facts/research	Reconsiders ideas willingly	Engages in activities	Listens to others' ideas	Questions with tact and respect	Shows respect for group members

Appendix E

K-W-L CHART

Date _____ **Name** _____

Topic: **Resource:**

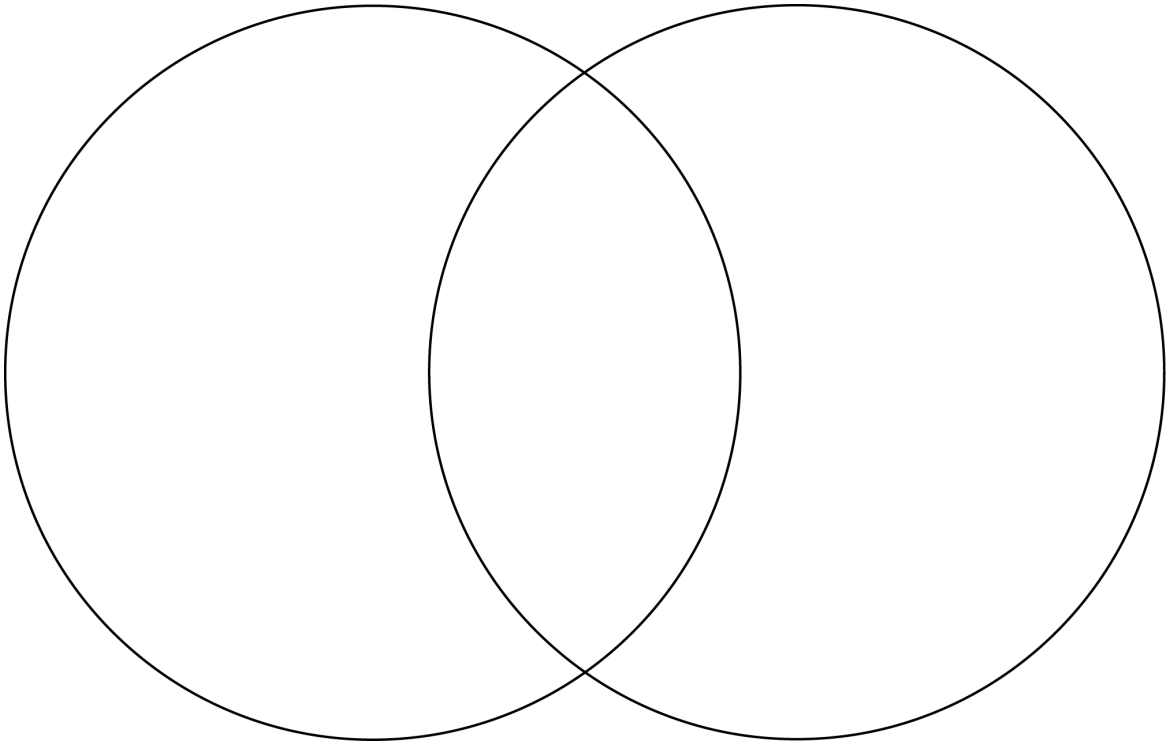
KNOW (prior knowledge)	WANT TO KNOW (questions I want answered)	LEARNED (what my reading/ research has uncovered)

VENN DIAGRAM

Date _____ Name _____

Topic:

Different **Alike** **Different**



Appendix F

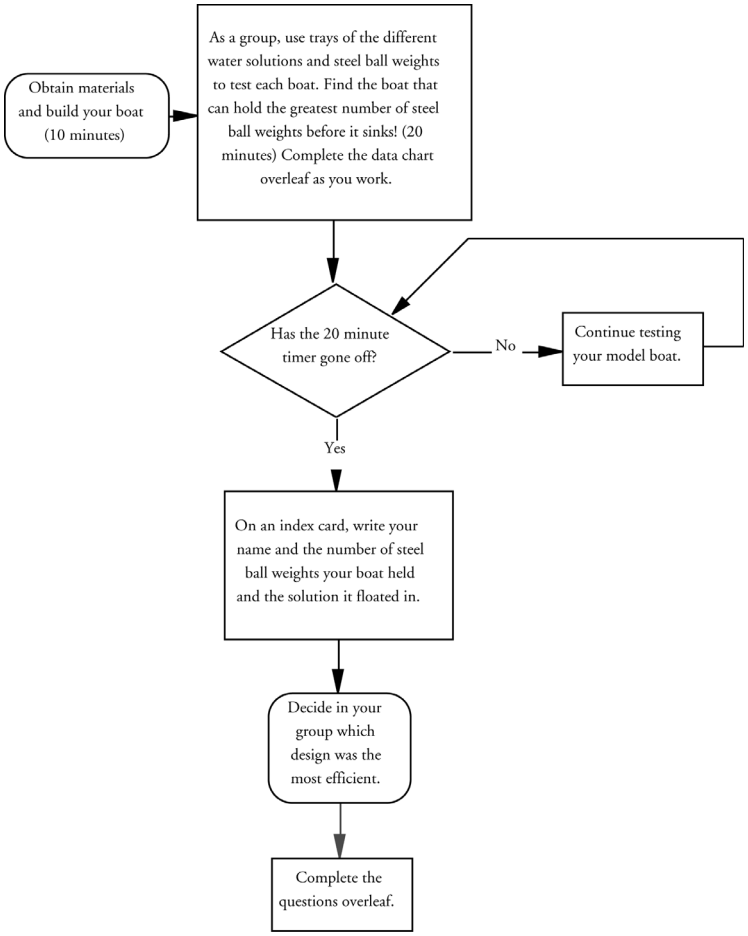
Building an Aluminum Boat

Materials (for groups of four)

4 x 15 cm square pieces of aluminum foil (1 per person)
4 3x5" index cards (1 per person)
3 trays containing different solutions (water, 20% salt solution, and 20% sugar solution)
paper towels
75 steel ball weights
timer

Directions

Read through the flow chart and the questions before you begin. The design of the aluminum foil boat is individual. Once the design is complete, your group of four will be placing steel ball weights in each boat to see which boat floats the longest. When testing is complete, individually answer the questions at the end of the lab.



Questions

1. Make a data table (recording the average number of steel ball weights each boat can hold before it sinks) that displays all the information you gathered when you did your group testing.

Table 1: Average Number of Ball Weights

Boat #	Solution 1	Solution 2	Solution 3

2. Describe the variables that influenced how each boat floated.

3. Describe how placing the boat in the three different solutions affected the boat's ability to float. Explain why these differences occur.

4. If you were to use modelling clay instead of aluminum, describe how you would design your boat. Explain your design fully.

5. If you needed to carry 300 steel ball weights, describe how you would alter the design of your boat.

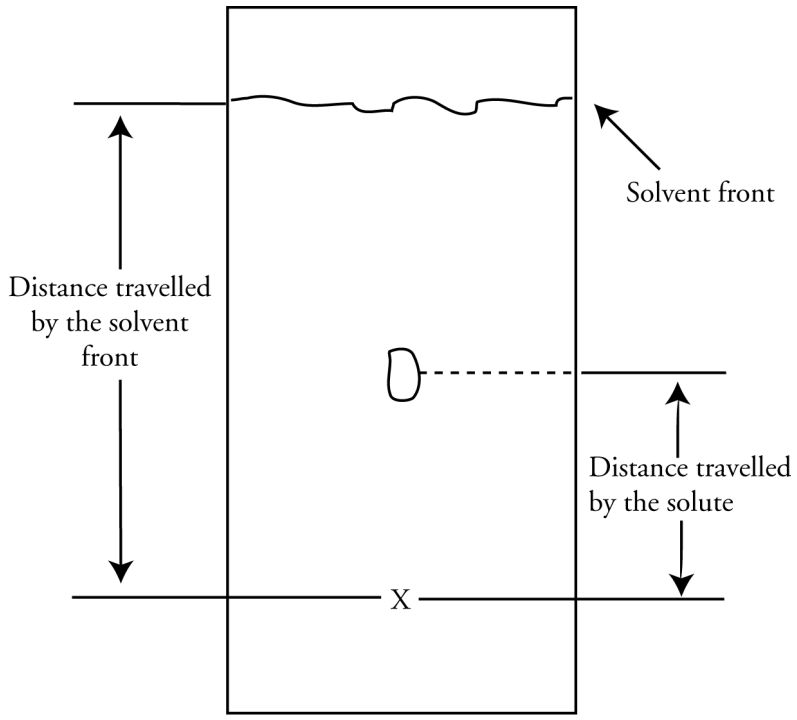
Paper Chromatography

Introduction

Paper chromatography is a separation technique with a variety of applications. This type of chromatography is favourable because it uses very small quantities of substances and requires very little time to observe separation. Paper chromatography experiments can test all types of mixtures of solutions, such as food colouring, plant pigments, blood, inks, antibiotics, and urine. In this experiment, you will use paper chromatography to determine the types of dyes used to prepare food colouring.

In paper chromatography, an unknown substance separates from the solution as the solvent carries the separate parts up the paper at different rates. When the solvent, also called the mobile phase, reaches within 1 to 2 centimetres of the top of the paper, the chromatogram is fully developed and ready for analysis. Analysis of the chromatogram involves the determining of R_f values. The R_f (retention factor) value, along with visible evidence, provides an identification of the unknown in the sample. The R_f value is calculated as follows:

$$R_f = \frac{\text{distance traveled by the substance (solute)}}{\text{distance traveled by the solvent}}$$



Materials

250 ml beaker	filter paper
paper towels	watch glass
rulers	food colouring mixture from your teacher
pencil	glass capillary tube

solvent (ethyl acetate, 2-butanol, 1-propanol, ethanol, water - equal parts of each)

Procedure

1. Fold opposite sides of a 12.5cm piece of filter paper so that the folded strip is as wide as the beaker is high.

2. Draw a line across the bottom of the filter paper approximately 1.0 cm from the bottom of the long side.

3. Place about a 5mm layer of solvent at the bottom of the beaker. Cover the beaker with the watch glass.

4. Using a thin glass capillary tube, or a micropipet, place a small amount of the food dye mixture in the middle of the line on the filter paper.

5. To develop the chromatogram, place the filter paper upright in the beaker, cover, and observe what happens.

6. When the solvent is about one centimetre from the top, remove the strip and use a pencil to mark the solvent front.

7. Determine the R_f value for each of the spots on the chromatogram.

Regression Analysis using TI-83 Graphing Calculator: Pendulum Activity

Regression analysis on the TI-83 is performed by selecting the statistics menu. Before entering new data, clear any previously entered data by resetting the TI-83.

Reset Memory

To reset the memory of the TI-83, press

2nd + and then select **5:Reset**. On the next screen, select **1:All Memory** then **2:Reset**, and the calculator will be reset. It may be necessary to brighten the screen by pressing

2nd and holding the cursor up key ▲ until the desired brightness is reached.

The message *Mem Cleared* is displayed.

The above resets the TI-83 to the default settings and destroys all variables and programs previously entered. Another method is to clear the lists that are required.

Clear Lists

Press STAT and then cursor down to **4:ClrList**. Push ENTER to accept the menu selection. Select the lists to erase (**L1** and **L2**) by pressing 2nd 1 , 2nd 2 to produce **ClrList L1,L2**. Activate by pressing

ENTER.

The above procedure clears the lists **L1** and **L2** and the message ***Done*** is displayed.

Another way to clear lists is to select the statistics menu by pressing

STAT and then selecting **1:Edit**. The cursor will appear in list **L1**; move the cursor up to highlight the list name **L1** and press

CLEAR followed by ENTER to accept. This will clear the list **L1.** Then move to each list that is to be cleared and repeat the process.

The table below gives data collected by a physics class relating the period of a pendulum and the length.

Period	Length	Period	Length	Period	Length	Period	Length
0.53	6	0.88	20	1.29	38	1.55	56
0.54	7	0.89	22	1.30	40	1.66	58
0.56	8	1.00	24	1.35	42	1.60	60
0.57	9	1.03	26	1.24	44	1.64	62
0.60	10	1.05	28	1.46	46	1.67	64
0.70	12	1.12	30	1.48	48	1.69	66
0.79	14	1.20	32	1.47	50	1.70	68
0.84	16	1.19	34	1.48	52	1.85	70
0.86	18	1.08	36	1.53	54	1.78	72

Create a scatter plot of your data and generate an equation.

Enter Data in Lists

To enter data in lists, press

STAT

and select **1:Edit** by pressing 1 or ENTER . The cursor should appear in the list **L1**. Type each entry for the period followed by

ENTER

Once all data for the period is entered, cursor right to the list **L2** by pressing

▶

and enter data for the length.

To display a scatter plot, make sure that the function list is empty.

Clear Functions

To clear functions, select the function list by pressing

Y= .

The function list will be displayed. Clear any functions previously stored by moving to each function in the list and pressing CLEAR .

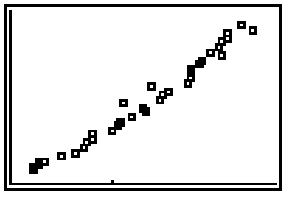
Now create and display the scatter plot.

Display a Stat Plot

	To display a scatter plot, press
2nd Y=	and turn off all STAT PLOTS by selecting 4↓ **PlotsOff**. Then press
ENTER	to activate (or move to each plot that is turned on and manually turn off the plots required).
	Now define the required plot. Select **STAT PLOT** by pressing
2nd Y=	and then select **1:Plot 1**. Highlight **On** and press ENTER and cursor down. This will highlight the scatter plot symbol. Press ENTER and cursor down and select the **Xlist** as **L1**, then the **Ylist** as **L2**. Select the **Mark** of your choice.
	Set the proper range to display the scatter plot by pressing
ZOOM	and then select **9:Zoomstat** by cursoring down to it and pressing ENTER, or press ZOOM and 9 and the scatter plot will be displayed.

Does there appear to be a relationship? _____

What type of graph may best match your data? _____



One way to check for a relationship is through regression analysis. The TI-83 allows for experimentation with many different models to arrive at the "best model" to represent the data. One model is linear regression. It is possible to obtain the "best-fit" line by different methods; this work sheet will outline the method referred to as *LinReg(ax+b).*

The linear model or best-fit line is represented by the formula Y = aX + b, where

a is the rate of change, growth factor or the slope
b is the Y-intercept and r is the correlation coefficient.

The correlation coefficient r is a useful measure of how well the data fits a straight line, but it should not be overused. The graph should be examined as a visual way of checking how good the fit is. The coefficient is greatly affected by a few extreme points. If the data is a good fit, the value of r will be close to +1.00 or -1.00.

What does your value of r tell you about the model?_____

_____

_____

What would a correlation of zero represent or tell you about a relationship?_____

_____

_____

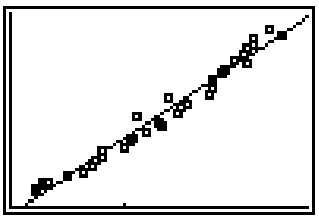
Linear Regression

Work out the linear regression by pressing

STAT and cursoring right to **CALC**. Select **4:LinReg(ax+b)** and press L_1 (**2nd 1**) **comma** L_2 **comma** and Y_1 (**VARS**, cursor to **Y-VARS**, select **1:Function**, **1:**Y_1), then press

ENTER and the following will be calculated and displayed. Your values will differ. Record your answers in the space provided.

LinReg	*Your values:*
y=ax+b	*y=ax+b*
a=50.855	*a* = _____
b= -23.706	*b* = _____
r=.9884	**r** = _____



To graph the best-fit line, the equation of the function is on the function screen at Y_1= so, just press **ENTER**.

Observe that the line is a reasonable fit.
Is it possible to arrive at a better model?_____
If so, how?_____

Note that the data seem to have a curved shape. The data points at the ends are above the line, and the middle is below. This suggests straightening the curve of the data is possible by manipulating the axis mathematically or using another regression model.

The TI-83 offers other regression models that can be used to arrive at a mathematical model. Use power regression to model the data stored in **L1** and **L2**.

Fit a curve to this data by doing a **A:PwrReg** on **L1** and **L2**, and store the equation on Y_2 =.

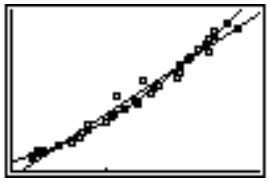
Work out the power regression by pressing

STAT	and cursoring right to **CALC** and then down to select **A:PwrReg**. The cursor is waiting to know which list your data is in to do the regression on. Enter **L1**, **L2**, Y_2, if appropriate, then press
ENTER	and the following will be calculated and displayed. Record your results.

PwrReg	***Your values:***
*y = a*x^b*	*y = a*x^b*
a=24.184	***a*** = _____
b=1.9014	***b*** = _____
r=.9938	**r** = _____

The power model is represented by the formula **Y = a X** ^{b} and **r is the correlation coefficient.**

Press **GRAPH** to graph the power model which is already displayed on the function screen at **Y2=**.



Compare the correlation coefficients from your two analyses.
Which is the better representation of your data? _____

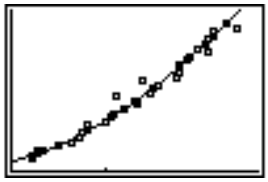
To generate a graph of the power model without the linear regression displayed, **Y1** must be turned off.

Turn Off a Function

To turn off a function in the function list, select

Y=	and the function list will be displayed. Move the cursor onto the = sign of any function that is to be turned off and press
ENTER.	Move the cursor to the right and note the change in the appearance of the = sign. Highlighting indicates that the function is on and a lack of highlighting indicates that the function is turned off.

To view the scatter plot and the "power regression best-fit curve," press GRAPH, and both will be displayed on the screen.



The mathematical model generated may be used to predict outcomes. One method is to use the **TRACE** feature of the TI-83. To activate **TRACE,** press

TRACE and observe the cursor and the X=, Y= co-ordinates at the bottom of the viewing screen. Cursoring right/left moves along the curve, and cursoring up/down toggles between curves and stat plots. The upper left corner of the screen labels the function or stat plot that you are tracing. The function will change depending on stat plots and functions turned on and being traced.

Use **TRACE** to complete the following table:

Period	Length
.5	
.75	
1	
2	

Another method that can be used to evaluate a function is the table feature. Select table setup by pressing **2nd** **WINDOW** and defining **TblMin** and the increment (**▲Tbl**).

To view the table of values for the functions turned on in the function list, select table by pressing **2nd** **GRAPH**. Scroll through the table to complete the following:

Period	.25	.75	1.25	1.75	2.25
Length					

Functions can be manipulated to arrive at a table of values. One method is to use the spreadsheet-like ability of the TI-83 to manipulate a list.

Manipulating a List

To perform the necessary calculations to manipulate a list, select

STAT

and then **1:Edit**. This will display the lists **L1**(**Period**) and **L2**(**Length**).

To take the **ln**(**Period**) and store in **L3**, move the cursor right to column **L3** and then up to highlight **L3**. Now define this column to be equal to **ln**(**L1**) by
LN 2nd 1.

This produces **L3=Ln L1**. Then press ENTER to calculate the values that will appear in column **L3**.

To take the **ln**(**Length**) and store in **L4**, move the cursor right to column **L4** and then up to highlight **L4**. Now define this column to be equal to **ln**(**L2**) by
LN 2nd 2.

This produces **L4=Ln L2**. Then press ENTER to calculate the values that will appear in column **L4**.

Writing Instructions to Complete Tasks

The purpose of these activities is to have students write effective instructions. The information given below is to provide sufficient background for teachers.

1. Building a Rocket

Provide students with the following materials:

- 5 balloons (same size)
- string
- straws
- tape
- markers
- scissors

With these materials, ask students to build a rocket and test it. The design of the rocket might take the following form:

Blow up the balloon and secure the end with tape, or have a group member hold it but not tie it. Take the straw and tape the balloon to it. Draw the string through the straw and tape the string on either end to two tables or to the walls (if the room allows for this length of test). Release the balloon. The air will expel from the balloon and make the rocket travel along the string. Mark the distance traveled with the marker. Students should test their rocket to determine that the amount of air in the balloon is relevant to the distance the rocket travels. Students should design a set of instructions to describe the construction process and design an appropriate graphic.

2. Building a Can Crusher

Give students

- design paper
- cardboard
- clay
- pencils
- 500 ml milk cartons
- cardboard tubes from paper towels
- aluminum foil to make model aluminum cans approximately one-third the size of actual beverage cans

Using principles of simple machines, construct a prototype can crusher that can effectively crush the model cans. The design of the can crusher might take the following form:

Cut one milk carton such that one long side is removed and the milk carton now resembles a small rectangular dish. The second milk carton should be able to lie inside the first milk carton "dish." If not, try shaping the container to make it fit. You may want to use the cardboard, scissors, and tape to help "reshape" your container.

Take this second milk carton and fill it with the clay (sand may be used as well). The paper towel tubes will act as the inside of the aluminum can. Cut the paper towel tubes to the desired length for your beverage cans. Make sure they will fit inside the milk carton crusher. Wrap the aluminum foil around the can. To finish, you can decorate your can with the design paper.

Place the beverage can prototype inside the milk carton dish and try crushing it by lowering the second carton into the first. You can even create a hinge for the two milk cartons with cardboard and tape. After testing the prototype, present a demonstration to the class. Students should provide a set of instructions for constructing and testing their models, including a scaled diagram of the can crusher devices.

Appendix G

Resources

Introduction

Listed below are print, Web, and media resources that support Technical Reading and Writing 11. Teachers should refer to the Web site (www.trw.EDnet.ns.ca) for any additions or deletions.

Because the students who take Technical Reading and Writing 11 will have diverse technical interests and career goals, teachers should bring in, and encourage students to bring in, technical text resources from the public domain.

Print Resources

Atlantic Canada English Language Arts Curriculum, Grades 10–12. Department of Education, 1997. (ISBN 0888714602)

Evetts, Julian. *Document Literacy: A Guide for Workplace Trainers and Educators*. Burnaby, BC: SkillPlan—BC Construction Industry Skills Improvement Council, 1996. (ISBN 0969728891)

Fownes, Lynda. *The Language of Documents: A Guide to Information Display in the Workplace*. Burnaby, BC: SkillPlan—BC Construction Industry Skills Improvement Council, 1999. (ISBN 0968502709)

Hacker, Diana. *A Canadian Writer's Reference*, *2d ed.* Toronto: Nelson Canada, 1996. (ISBN 0176042113)

Hyerle, David. *Visual Tools for Constructing Knowledge*. Alexandria, VA: Association for Supervision and Curriculum Development, 1996. (ISBN 0871202662)

Markel, Mike. *Technical Communication*. Toronto: Nelson Canada, 1996. (ISBN 0176055657)

Mavrow, Cecilia. *Writing in Engineering: A Guide to Communicating*. Toronto: McGraw-Hill Ryerson, 1994. (ISBN 0075517159)

Porter, Carol and Janell Cleland. *The Portfolio as a Learning Strategy*. Toronto: Irwin, 1995. (ISBN 087609348X)

Secondary Science: A Teaching Resource. Nova Scotia Department of Education and Culture. 1999. (ISBN 0888715498)

Web Sites

A variety of Web site URLs can be accessed by going to the Technical Reading and Writing 11 Web site at www.trw.EDnet.ns.ca.
Web sites include information on

- writing technical text
- graphic organizers and flow charts
- information literacy
- making presentations
- online resources for writers, such as dictionaries

Videos

Several videos have been identified as useful supports to Technical Reading and Writing 11. As they become available, they may be obtained through loan or dubbing from

Media Library, Learning Resources and Technology
3770 Kempt Road
Halifax, B3H 4X8
Telephone: (902)424-2440
Fax: (902)424-0633
mediacir@nshpl.library.ns.ca

Available titles will be posted on the Technical Reading and Writing 11 Web site.

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English Language Arts: Language and Technical Communication Senior 4. Manitoba Education and Training, 1994.

Kelly, G.J. and T. Crawford. "Students' Interaction with Computer Representations: Analysis of Discourse in Laboratory Groups." *Journal of Research in Science Teaching, 33*(7) 1996, 693–707.

Kynell, Teresa. "The Student as Translator in the Technical Writing Classroom: The *Challenger* Disaster as Heuristic." *Teaching English in the Two-Year College*. May, 1993, 145–151.

Pontecorvo, C. "Forms of Discourse and Shared Thinking." *Cognition and Instruction, 11*(3&4), 1993, 189–196.

Real Science, Real Decisions, National Science Teachers Association, No date.

Roberts, Kenneth. *Lydia Bailey*. New York: Doubleday, 1947.