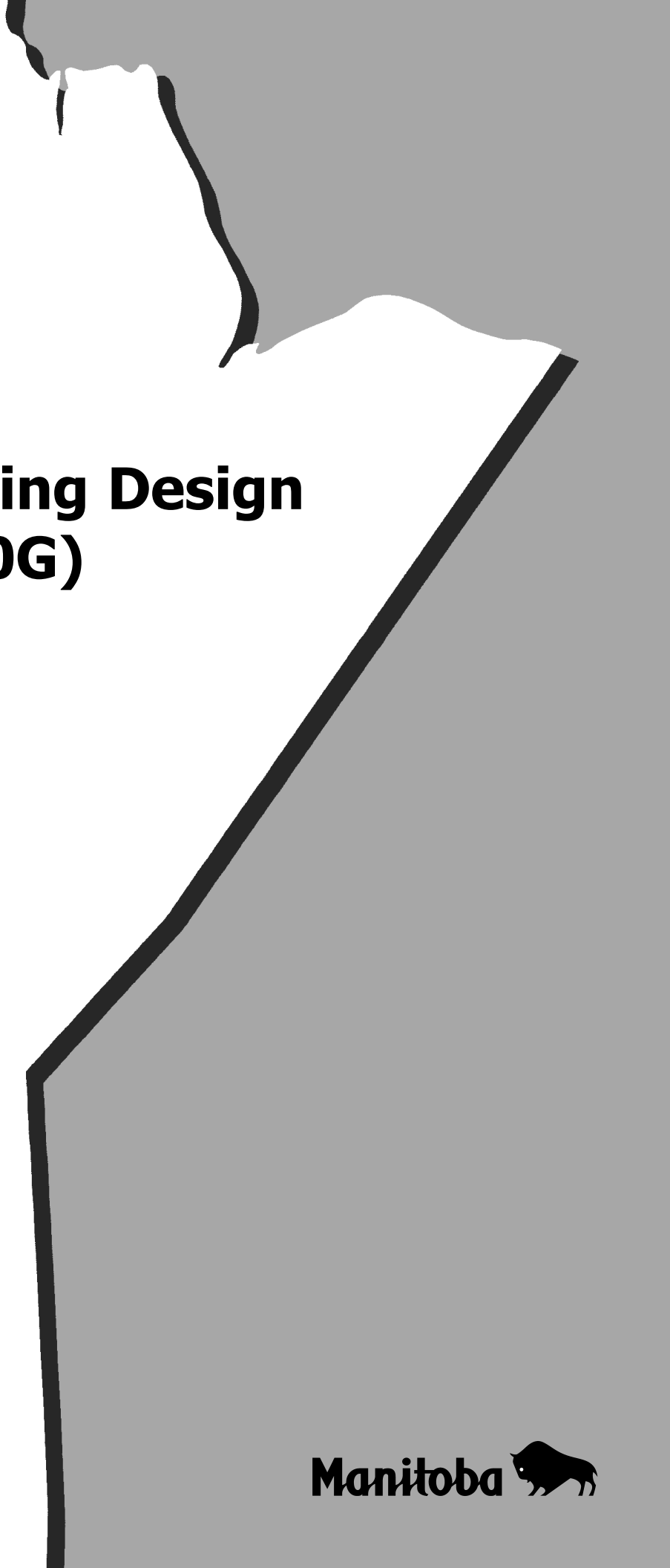
# Grade 10 Drafting Design Technology (20G)

A Course for
Independent Study



Manitoba

# *GRADE 10 DRAFTING DESIGN TECHNOLOGY (20G)*

*A Course for Independent Study*

***2009***

Manitoba Education

**Manitoba Education Cataloguing in Publication Data**

604.24 Grade 10 drafting design technology (20G) : a course for independent study.

ISBN-13: 978-0-7711-4460-8

1. Mechanical drawing—Programmed instruction.
2. Mechanical drawing—Study and teaching (Secondary).
3. Mechanical drawing—Study and teaching (Secondary)—Manitoba. I. Manitoba. Manitoba Education.



Manitoba Education
School Programs Division
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## Acknowledgements

Manitoba Education gratefully acknowledges the contributions of the following individuals in the development of *Grade 10 Drafting Design Technology (20G)*: *A Course for Independent Study*.

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# Contents

# Introduction

Welcome to *Grade 10 Drafting Design Technology: A Course for Independent Study*. You are about to begin a course that will enhance your knowledge about the world of design drafting. This course is designed around the assumption that you have either completed *Grade 9 Drafting (10G)* or have a good understanding of basic drafting concepts and practices.

As in *Grade 9 Drafting*, you have a dual role—that of a student and a teacher. As a student, you are responsible for reading each module, working through each practice assignment, and completing all assignments to be sent in to your tutor/maker. As a teacher, you are responsible for checking your work carefully and correcting any errors that you find.

Part of your responsibility as a student means that when you work through each practice assignment, you must record your progress on the log sheet provided with each module. The log sheets give you the opportunity to explain any difficulties you encounter and to document your learning outcomes per module.

**Note:** It is important to complete each log sheet. These sheets will be used by your tutor/marker to calculate part of your final grade.

## Course Organization

This course is divided into four modules. Each module contains information that will assist you in working through the course successfully. It is important that you read each module carefully and make sure you understand the information in each module. The knowledge that you gain in the first module is expanded and built upon in the next module, until you have completed the four modules.

Each module contains **projects**, **pull-out sheets**, and/or **drawings** that are to be sent in to your tutor/marker for grading.

Finally, each module contains a mail-in cover sheet or sheets, a log sheet or sheets, and mark sheets. When you have completed a module, these forms must be completed and sent in to your tutor/marker, along with any assignments, projects, or pull-out sheets from that module identified for grading.

## Review Material

As you read and work through the course, you will notice that some sections are more of a review while others contain new information. The review material (covered in the Grade 9 course) is meant for you to reacquaint yourself with the basic concepts of drafting technology. All new material should be read carefully, paying close attention to the information that allows you to build on your existing knowledge.

The course is written using technical language and technical writing is not the most exciting text to read. It is much more difficult to read a technical manual than a work of fiction. With this in mind, the amount of text in this course is limited and illustrations are provided to help you understand the concepts.

**Note:** You may have to read the text in each module more than once to understand the concepts completely.

## Measurements

The measurements in this course will be expressed in both metric and imperial units. The metric system is based on the millimetre, centimetre, and metre. Module 2: Reference Tools and Constructions (review material) and Module 3: Mechanical Drafting use this system of measurement.

The imperial system is based on feet, inches, and parts of inches or fractions. Since this unit of measure may be new to you, there are measuring assignments associated with this system. Module 4: Architectural Drafting is based on this measuring system.

## Design/Redesign

The theme of this course is design and redesign. Since you either have completed the Grade 9 Drafting course or have some basic drafting knowledge, the assumption is that you have a good understanding of how to lay out and draw in the various forms of drafting. With that in mind, this course concentrates on how to "design or redesign." The assignments and projects reflect this concept. Being able to draw technically is one thing, but being able to design something new or improve on something already manufactured (redesign) is quite different. You know the basics on how to sketch, measure, lay out, and complete some of the required drawing principles or how to draw in a technical form. Now, you are going to learn how to build on that knowledge and start to design.

## Coursework

Since drafting is a visual form of communication, all the assignments in this course are sketches, drawings, or both. An outline of each module detailing your responsibilities is provided later in this introduction.

It is recommended that you follow the log sheets and complete the assignments in the order they are assigned. Your log sheet for each module indicates which assignments are to be sent in to your tutor/marker for grading. These assignments are marked on the log sheet as "SI" for "send in."

## Course Supervisor

To help you stay on track and overcome difficulties, you must find someone to act as a "supervisor" for the course. The supervisor's role is to verify that the required work has been completed and to indicate this by signing all the log sheets. Remember, it is your responsibility to do all the assignments in the course. The role of the supervisor is to witness and confirm that you have completed the required work. Your supervisor should be a responsible adult from your community or school.

Ask your supervisor to complete the "Supervisor Declaration" form found at the end of this introduction, and send it to the address on the form before you begin the coursework.

## Tutor/Marker Address

At the end of each module, you will send in your cover sheet, log sheet(s), mark sheet(s), and all relevant module work (assignments and projects) to your tutor/marker. Send your packages to the following address:

ISO Tutor/Marker
555 Main Street
Winkler, MB R6W 1C4

## Equipment List

If you did not complete the Grade 9 Drafting course, you need to purchase a drafting kit (MTBB #8978), or obtain the following equipment (or its equivalent), before you begin this course:

24″ Wooden Centre: T-Square
Staedtler #964-12-60° Set Square
Staedtler #964-10-45° Set Square
Staedtler #987-19-SI Metric Scale
Staedtler #120-2H Pencils (2)
Staedtler #100-6H Pencils
Staedtler #259-50 Erasing Shield
Selectum White Vinyl Eraser
Berol #R-2140 Circle Template
Berol #R-2123 Isometric Template
Pico #B20/00-6" Master Bow Compass

## New Equipment Required

Mechanical Pencils (2) (Pentel P205, 5 mm, with 2H + 6H lead)
(You could also use the pencils listed above.)
20′ measuring tape
Architect's scale (Staedtler #987 18-31 or equivalent)
Bond paper stock, 8½″ x 11″ (white photocopier paper)
Bond paper stock, 11″ x 17″ (white photocopier paper)

You will also need access to the following:

a pencil sharpener
a roll of masking tape
a glue stick
a pair of scissors

## Modules

The modules and the work they encompass are set out below along with the total marks for each shown in brackets.

### Module 1: Design

- Log Sheet ( /15)
- Assignment Questions ( /25)
- Projects 1–4 ( /158)

### Module 2: Reference Tools and Construction

- Log Sheet (/15)
- Assignment 1: Sheets 1–6 (/66)
- Assignment 2: Orthographic Sketch (/16) and Drawing (/20) for a total of (/36)

### Module 3: Mechanical Drafting

#### Part 1: Auxiliary Views

- Log Sheet (/15)
- Assignment 1: Auxiliary Views (/12)
- Assignment 2: Auxiliary Drawings (/82)

#### Part 2: Single View/Orthographic/Isometric Drawings

- Log Sheet (/15)
- Project 1: Cell Phone Design (/30)
- Project 2: Classic Radio Design (/30)
- Project 3: Futuristic Music Player (/60)
- Project 4: Orthographic (/105)/Isometric (/42) Drawing/Sketches for a total of (/147)

### Module 4: Architectural Design

#### Part 1: The Architect Scale

- Log Sheet (/15)
- Assignment 1: Measuring Sheets 1–7 (/72)
- Assignment 2: Reading Sheets 7–10 (/100)

**Part 2: Architectural Drafting**

- Log Sheet (/15)
- Project 1: Isometric House (/35)
- Project 2: Wall Cross Section (/30)
- Project 3: House Cross Section (/20)
- Project 4: House Plans (/60)
- Assignment 1: Home Discovery (3 sheets) (15 + 45 + 28) for a total of (/88)
- Assignment 2: Cottage Redesign Sketches (/30) and Drawing (/20) for a total of (/150)

## Evaluation

Your final mark in this course will be based on the results of your assignments, projects, and drawings, along with your log sheets. The breakdown is shown below:

| | |
|---|---|
| Log Sheets | 10% |
| Assignments and Projects | 90% |
| Total | 100% |

**Note:** Your tutor/marker may request that you send in additional assignments, so please keep all your work in a safe place. A binder, notebook, or portfolio-type folder is ideal for storing your work.

Now is a good time to determine who your course supervisor will be and to ask him or her to complete the "Supervisor Declaration" form.

Good luck and good learning! Enjoy the course!

# Supervisor Declaration

**Students:** Please ask your course supervisor to complete this form and return it to:

ISO Grade 10 Drafting Design Technology
555 Main Street
Winkler, MB R6W 1C4

Surname _____ Given Name _____

Address _____

_____

(City) (Province) (Postal Code)

Telephone _____ _____

(Home) (Work)

Occupation _____

I hereby declare that:

1. I meet the stipulations in accordance with the Independent Study Option supervision policies, in that I am a teacher, retired teacher, instructor, university professor, priest, minister, or commissioner of oaths, or other (please circle one). If other, please indicate _____ .
2. I agree to supervise the student noted below and will maintain strict and adequate supervision throughout the student's course term.
3. I will maintain adequate supervision to ensure that the work is completed by the student noted below.

Name of Student _____

Course _____ Level _____

_____ Date _____

(Signature of Supervisor)

Approval _____ Date _____

(Independent Study Option Advisor)

# Grade 10 Drafting
# Design Technology (20G)

Module 1

Design

Module 1

# Design

## Learning Outcomes

After working through this module, you should be able to

- understand the basic principles of design
- understand how products are developed and manufactured
- understand the importance of research and development
- understand that a design may have several solutions
- identify the qualities of a good design

## Terms To Remember

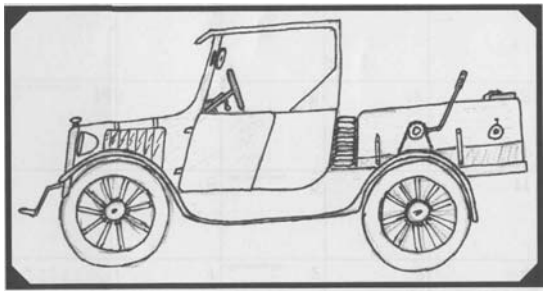
| | |
|---|---|
| function | models |
| design | appearance |
| R & D | industrial designers |
| reliability | product design |
| solution | prototypes |
| refinements | |

## Module Objectives

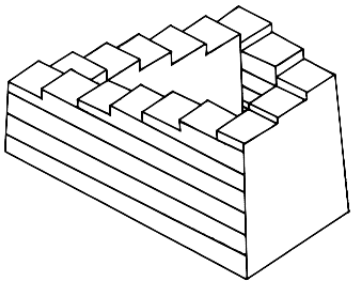
This module explains the principles and steps in the design process. You will learn the various elements that make up a good design. Understanding the importance of the many variables of each element is crucial to a good design. A successful designer will have experience and knowledge in manufacturing and in the various materials used.

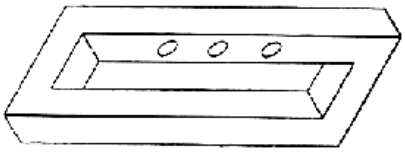
## What Is Designing?

Designing is an activity that uses a wide range of experiences, knowledge, and skills to find the best solution to a problem. Designing involves identifying a problem, coming up with a variety of solutions to the problem, and creating and testing the solutions to see which one solves the problem with the best results. It is this testing and evaluating the solutions that results in the process starting over again (redesign). The important thing to remember is that there is no such thing as a wrong design. Some designs may be more successful than



others, but they should all have the ability to solve the problem at hand. An example of this can be seen in almost all manufacturing industries—from watches, dishes, and running shoes, all the way to bridges, planes, and automobiles.



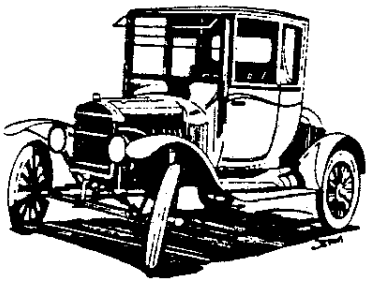


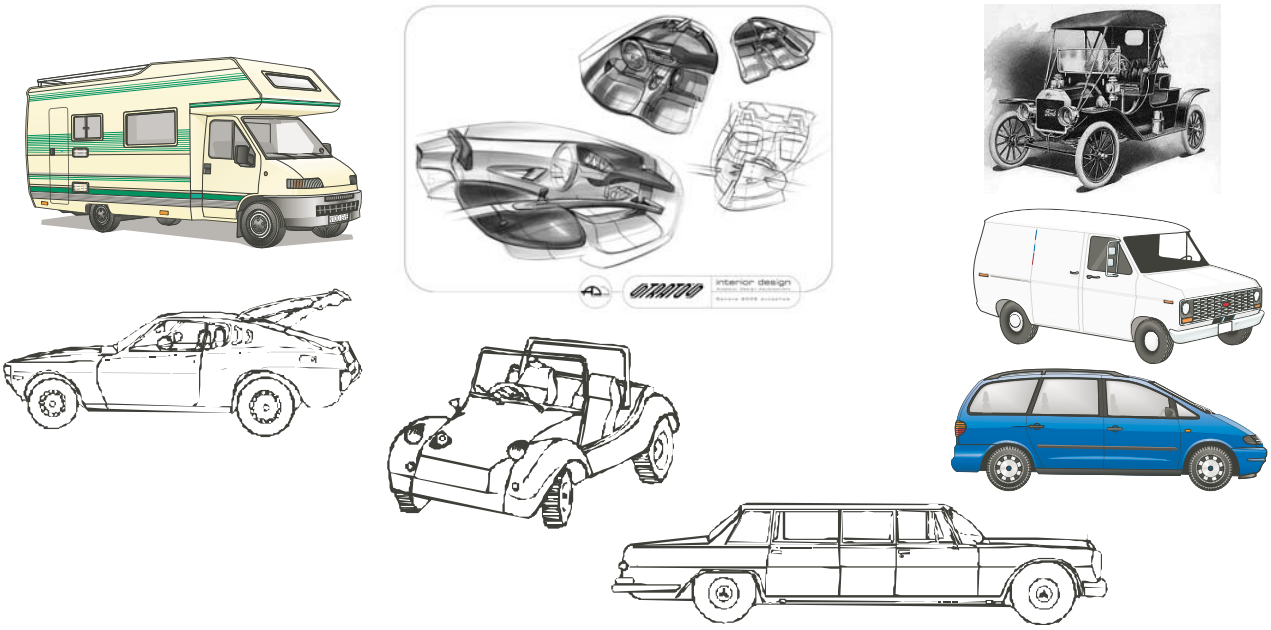
The ability to design is a more creative skill than a technical one. Designing is more than solving a problem; it involves the entire process of producing a solution for the initial idea all the way to creating final product, and finally the constant enhancement of the product. The product never ceases to evolve; it is always in the redesign phase.

Designers work in every area of life, including clothing design, graphic design, interior design, jewellery design, all the way to product engineering and environmental design. It is important to understand that although each of the these areas has its own unique type of knowledge, they all follow the same design process.

## Why Designs Change

There are a number of reasons why designs change, from different needs of society, more modern products, to new materials and technologies. If you take the automobile industry, you can see the many unique designs that have evolved over the years. There is not just one type of car. There are cars that serve hundreds of different applications, from two seaters all the way to multi-passenger vehicles. There are also a variety of sizes, shapes, and engine designs.





The whole idea is to improve the quality of life for people through new and improved products. Besides the automobile, other everyday items that have changed noticeably over time include the telephone, television, kitchen appliances, and home electronics. The basic function of most products does not change dramatically, but every changing technology allows for designs to evolve constantly.

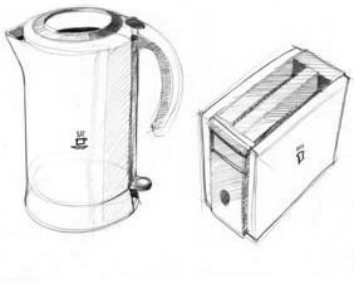
## What Makes A Good Design

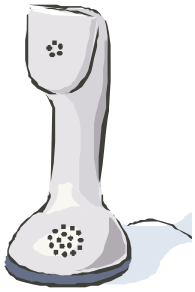
A good design is usually a simple and direct solution to a technical problem. A well-designed product needs to be functional, efficient, and dependable. The new product generally replaces a more expensive item that either does not function properly or is not durable.

People who do this type of planning are called industrial designers. These men and women must have a creative imagination and a strong knowledge of engineering principles, production techniques, tools, machines, and materials, in order to design a new product for manufacture.

Research and development companies are the backbone of design. These companies spend a large amount of time and money on research and development in order to produce new products. Design concepts need to be studied, tried, refined, retired, then either produced or discarded. When a design fails in the trying or testing phase, you hear the familiar quote “back to the drawing board.” This means that the initial problem was not solved efficiently. The problem needs to be reworked or redesigned.

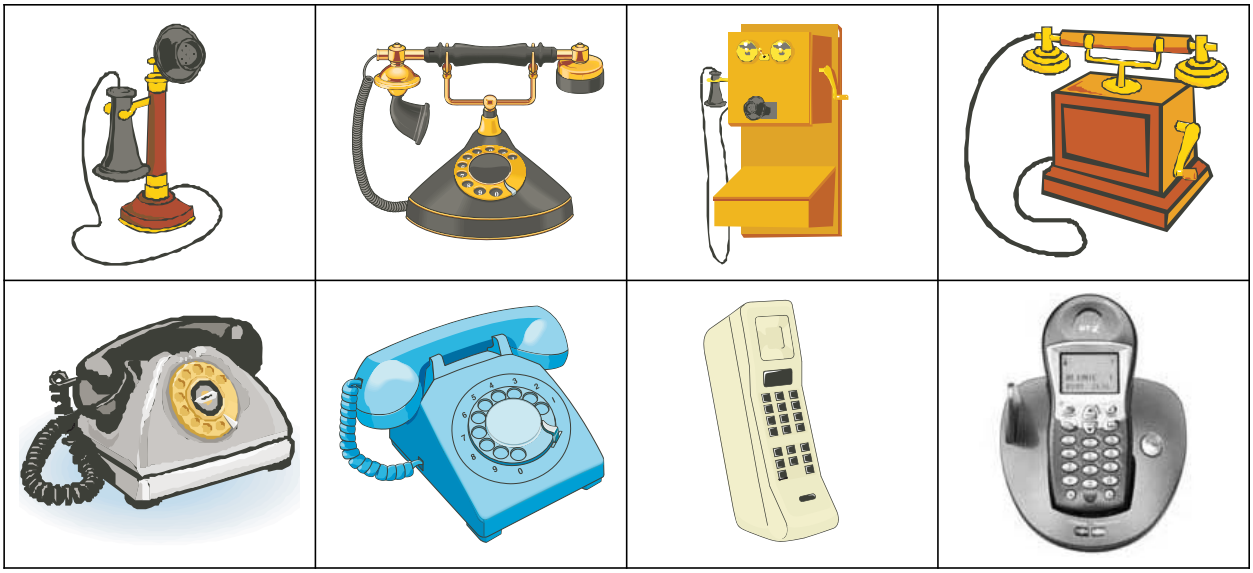
Remember the design process is not an exact science and there is no special formula to follow. However, if designers follow the process of tried, tested, refined, and retried, there is a strong likelihood of producing a well-designed product.





## The Evolution of a Product

The pictures above and below are examples of how two products have been redesigned over the years. This redesign or evolution was a result of a number of factors, including new technologies, new materials, new trends, new styles, plus a more efficient and practical approach or look. All these factors had an effect on these products. It should be noted, however, that the main function of these items did not change one bit. The toasters all made toast and the phones all allowed you to communicate. It was the appearance, style, and efficiency that evolved.



## Design Elements

### 1 Function

A well-designed product "works" or functions when it does what it was designed to do and does it efficiently. A problem may have several solutions but each solution may not work or "function" in the same manner.

### 2 Honesty

Honesty applies to the quality of the materials used. In a well-designed product, one material should not be made to look like another material. (Plastic should not be made to look like wood.) When designing, materials play an important role in the finished product. Good and well thought-out designs call for quality materials.

### 3 Appearance

Another important element when it comes to designing is the final appearance. The product could be completely functional and honest in its use of material, but if its appearance is poor nobody will want it.

### 4 Reliability

This can be considered one of the most important elements. A well-designed product that performs its function, but is always breaking down or is in need of a lot of maintenance will not be successful. It must be reliable, easy to service, and economical to maintain.

### 5 Safety

The product when properly designed must be completely safe. Safety features that protect the user from injury must be part of the basic design.

### 6 Quality

This element of design is often confused with "reliability." Quality, however, is what brings a well-designed product together in combination with all the other elements. It is something that cannot be added, it is a by-product of everything that goes into a design and assembly of the product. Quality is not something that you can see or feel.

## Steps In The Design Process

When you go about solving a problem, which is the same as designing a solution, you should always follow the same basic steps used by most professional designers.

### 1 The Idea

By identifying a problem, you develop various design solutions. Try to keep the ideas simple to begin with. An example here could be how to keep a door from swinging shut. The simple solution would be some type of door stop.

Simple—a rock in front of the door; a floor wedge

Complex—a mechanical latch

### 2 Develop Your Ideas

This can be thought of as the testing and rethinking stage. Here your solutions can be put to the test and evaluated. Pros and cons of each solution need to be considered. This stage may require simple sketches to illustrate your solutions. Have people critique your ideas.

### 3 Make Models

This is where prototypes are constructed. A prototype is generally a full-scale model of the product to be made. It is often handcrafted and, in most cases, fully functional. This allows testing that results in a more accurate evaluation of the design. With today's sophisticated 3D computer software, more and more prototype models are being constructed in virtual space, at a fraction of the cost of a life-like model. Virtual space is the space inside a computer's software files. The product only exists in the software. A problem with virtual space is that it cannot be touched or handled, and does not allow the designer to have a real "feel" for the product.

### 4 Production Drawings

Once the design is seen to be the best solution to the problem, working drawings are prepared. These are the drawings that the interested industry require in order to manufacture the product. These drawings range from simple single view drawings to detailed assembly of exploded view drawings.

## 5 Product Production

Production is where the product is produced in numbers that allow it to be cost efficient. As more units are manufactured, the cost per unit comes down. The cost of designing the product from the initial idea to the research and development, as well as the material and labour costs, are spread out over the number of units produced.

### Example Of Production Costs

If the total cost of running a factory is $1000 a day and it produces one item, that one item would cost $1000. If two items are produced, then they would cost $500 each. If the factory produces 1000 items, then each item would cost $1.

# Module 1: Design Assignment

# Module 1: Design
# Pull-out Assignment

**Total Marks: 25**

**(pull out and send in to your tutor/marker when you have completed Module 1)**

1. Briefly explain what design, test, and redesign means.

   Design: _____

   _____

   Test: _____

   _____

   Redesign: _____

   _____

   _____ / 3

2. List the six elements of design. (Give two examples for each element.)

   1. _____

      _____

   2. _____

      _____

   3. _____

      _____

   4. _____

      _____

   5. _____

      _____

   6. _____

      _____

   _____ / 6

## Module 1: Design
## Pull-out Assignment

**(page 2)**

3. What is the difference between a well-designed item versus a poorly designed item.

_____ / 2

4. Why is it important to have knowledge of the different manufacturing processes if you are a designer?

_____ / 3

## Module 1: Design
## Pull-out Assignment

**(page 3)**

5. List the steps that you would follow to solve a design problem. Use an example of a household product. Briefly describe each step.

_____ / 8

6. Explain the statement: "Most designers sketch more than they actually draw."

_____ / 3

# Module 1: Design
# Module Projects

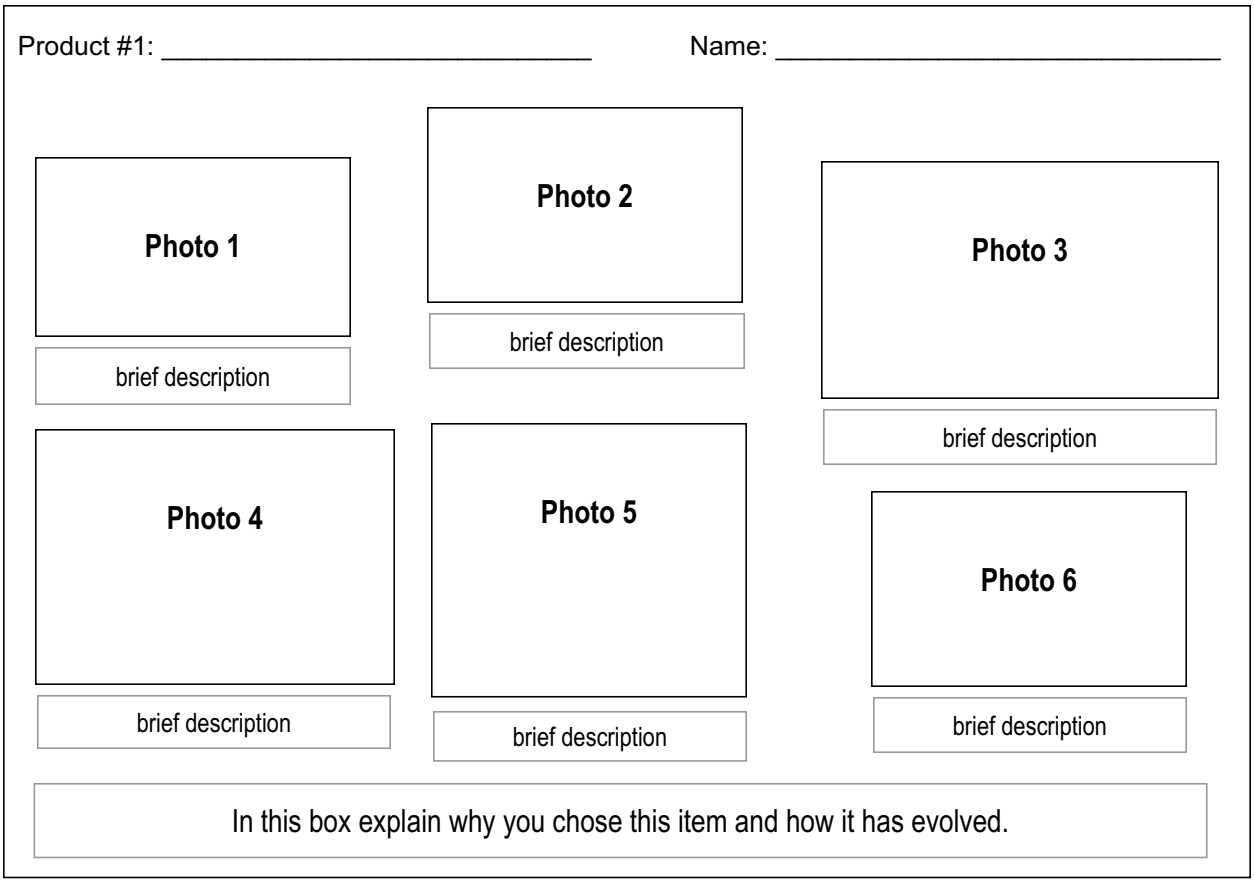
# Module 1: Design
# Project 1

**Total Marks: 75 (See mark sheet in Cover/Log/Mark Sheets section.)**

On **three** separate sheets of 11″ x 17″ paper, place a collection of pictures (5–6) that shows the evolution of a product over time. Pick **three** products and identify the production years for the product (for example, 1920, 1950, and 1970 cars versus a modern car).

Sources of pictures include magazine and newspaper clippings, photographs, drawings, or pictures downloaded from the Internet (<www.google.ca> search images).

### Sample Layout




## Instructions

The schematic above is an example of how to lay out the assignment. Paste or tape your pictures in the order of evolution. Under each image give a brief description about the item you picked and try to attach a date to each image. At the top of the sheet, list the product and your name. At the bottom or on the back of the sheet, explain why you chose this item and how the design has changed or evolved.

**Note:** This assignment requires that you do layouts for ***three different products*** on ***three separate sheets***.

# Module 1: Design
# Project 2

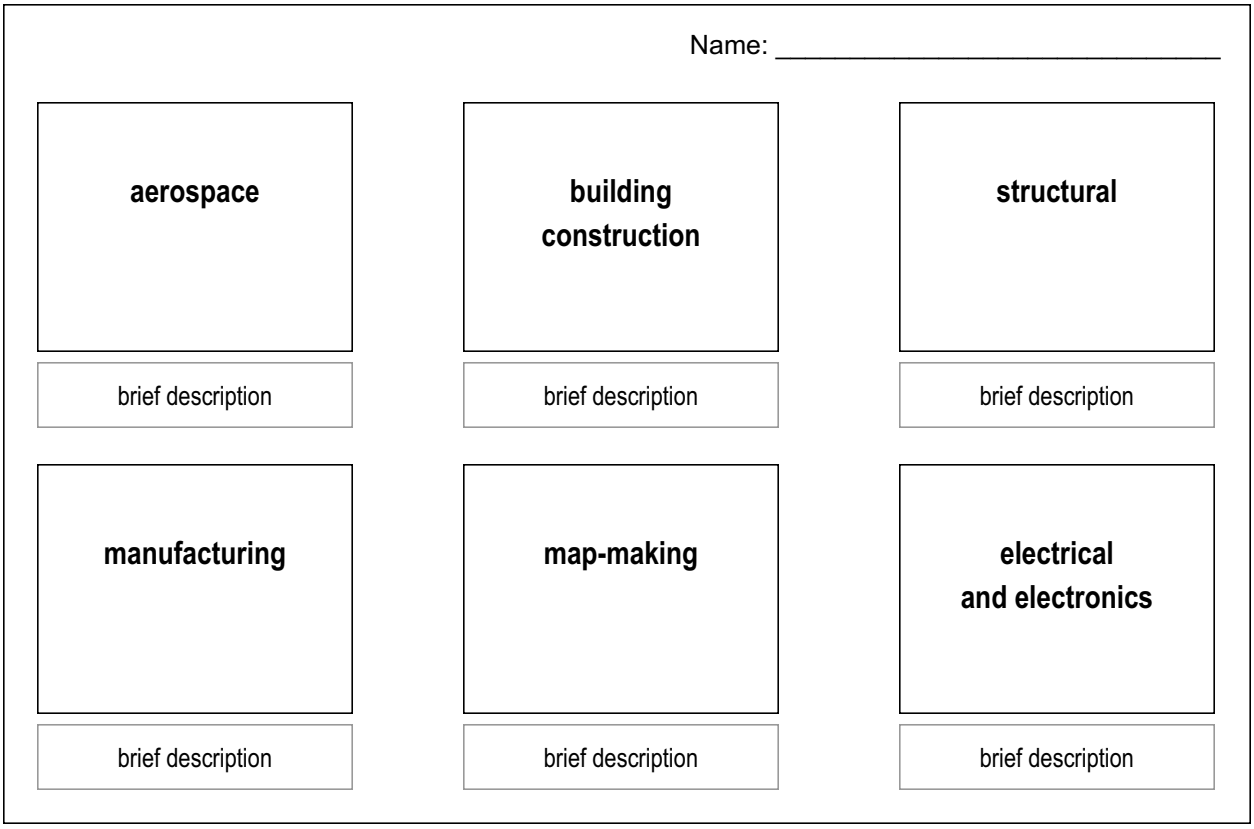
**Total Marks: 35 (See mark sheet in Cover/Log/Mark Sheets section.)**

On a sheet of 11″ x 17″ paper place a collection of pictures that show products made by the following industries:

aerospace
building construction
structural
manufacturing
map-making
electrical and electronics

Sources of pictures include magazine and newspaper clippings, photographs, drawings, or pictures downloaded from the Internet (<www.google.ca> search images).

**Sample Layout**




## Instructions

The schematic above is an example of how to lay out the assignment. Paste or tape your pictures for each industry onto the sheet of paper. Under each image give a brief description about the industry. Write your name at the top of the sheet. **Use a 11″ x 17″ sheet of paper for this project.**

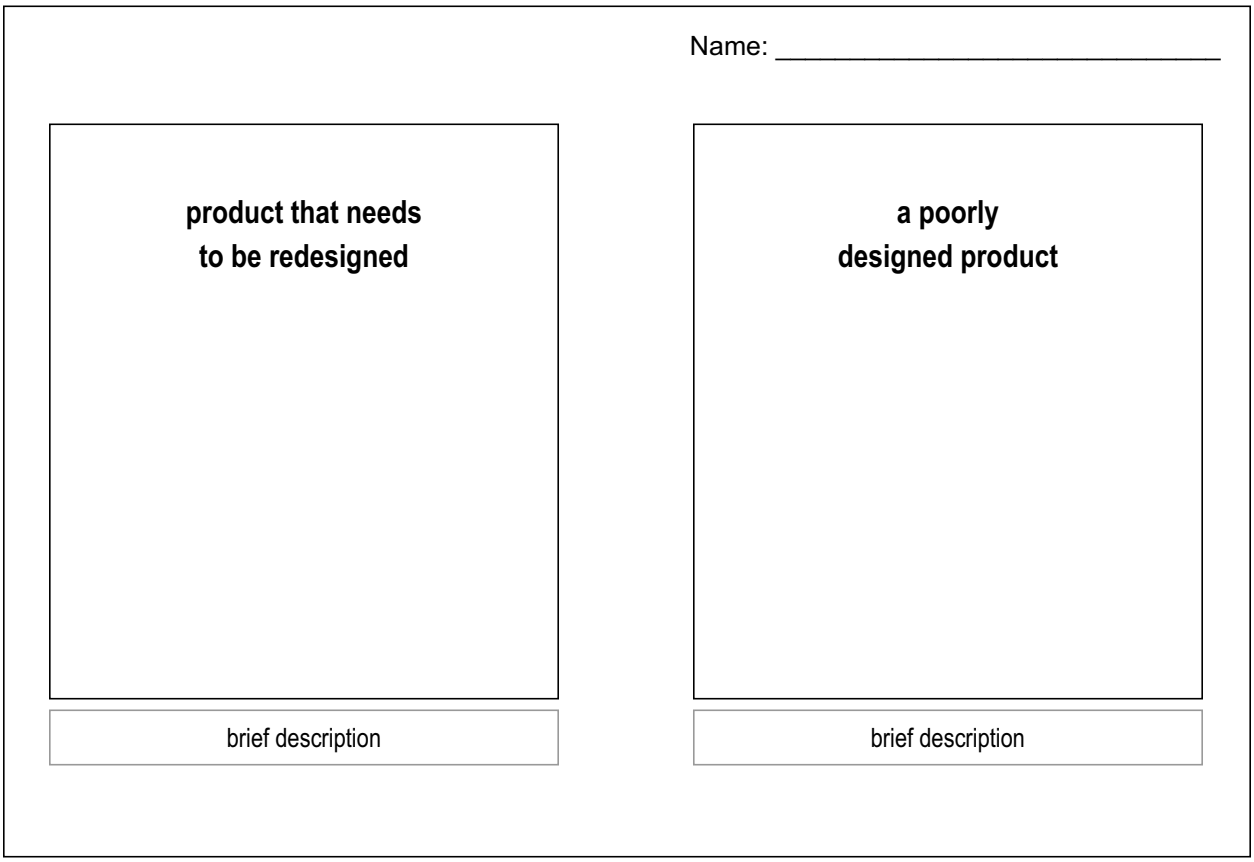
# Module 1: Design
# Project 3

**Total Marks: 20 (See mark sheet in Cover/Log/Mark Sheets section.)**

On a sheet of 11″ x 17″ paper place an example of a poorly designed item and an item that needs to be redesigned. Explain why you chose your examples and what needs to be done to make them more effective.

Sources of pictures include magazine and newspaper clippings, photographs, drawings, or pictures downloaded from the Internet (<www.google.ca> search images).

### Sample Layout




## Instructions

The schematic above is an example of how to lay out the assignment. Paste or tape your pictures for each item onto the sheet of paper. Under each image give a brief description about the item you chose and why the design requires a change. Write your name at the top of the sheet. **Use a 11″ x 17″ sheet of paper for this project.**

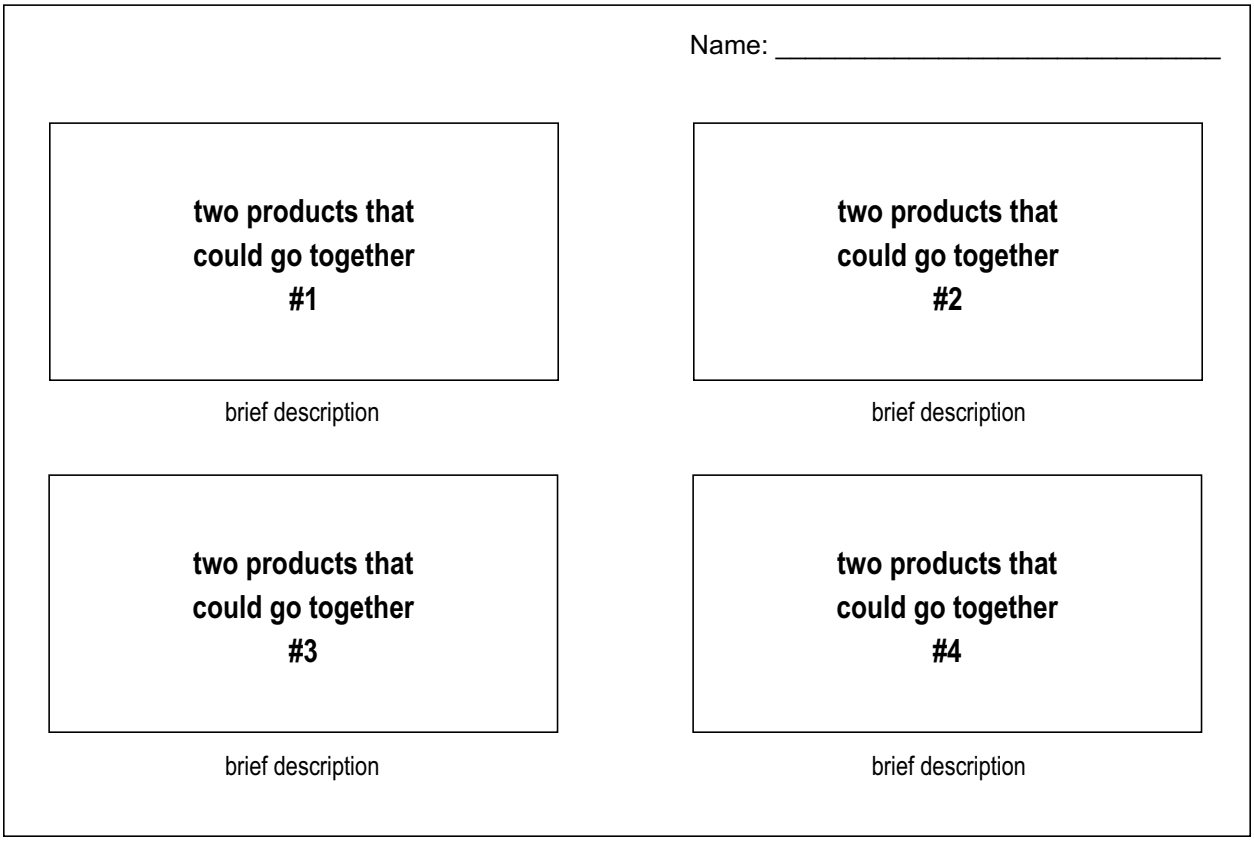
# Module 1: Design
# Project 4

**Total Marks: 28 (See mark sheet in Cover/Log/Mark Sheets section.)**

On a sheet of 11″ x 17″ paper place four pairs of items that go or could go together to form a new or improved product (examples include pencil and eraser, mop and spray bottle, tent and car).

Sources of pictures include magazine and newspaper clippings, photographs, drawings, or pictures downloaded from the Internet (<www.google.ca> search images).

**Sample Layout**




## Instructions

The schematic above is an example of how to lay out the assignment. Paste or tape your pictures for each combination product onto the sheet of paper. Under each image give a brief description about the items you chose and why the think they should go together. Write your name at the top of the sheet. **Use a 11″ x 17″ sheet of paper for this project.**