
***Activity Resource
Management Document***

Grade 11
TMJ3E Manufacturing Technology
(Workplace Destination)

**Unit 1 Activity 3 & 4
Project Management:
Material Selection & Planning Production**



*This Activity Resource Management Document (ARMdoc)
was produced by the Ontario Council for Technological Education (OC TE)
to supplement the Ministry of Education's Grade 11 Course Profiles.
It may be used in its entirety, in part, or adapted.*

Activity Resource Management Document



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TMJ3E Manufacturing Technology

UNIT 1, ACTIVITY 1.3

Materials

Activity Description

Time: 120 minutes (2 hours)

Students research a variety of available materials. Materials are major resources used by the students to design, build, and evaluate their prototypes. Students decide what materials are suitable and most cost effective for their design. All students must practise environmental conscientiousness. Students respect the materials and keep environmental concerns in mind when dealing with the selection of materials, manufacturing processes to be used, and the removal of waste.

Unit 1, ACTIVITY 1.4

Planning production

Activity Description

Time: 120 minutes (2 hours)

Students explore the two key factors in production engineering, productivity, and cost. Students face situations where they are required to design and build certain items. This requires students to record their progress and achievements, as well as cost, using production flow charts. Students are made aware of the importance of the production flow charts in the designing and manufacturing of everything from day-to-day items such as toasters to high-tech items such as military aircraft. Students work primarily in groups and present their ideas clearly and honestly and with sensitivity to others.

Note:

Two activities are combined in this ARMdoc under the common heading of Project Management. (See Unit 1, starting on page 20, *TMJ3E Manufacturing Technology Course Profile*). In this combined activity, students investigate material properties and then determine a sequence of manufacturing those materials into products, a process common to establishing design criteria.

ARMdoc Contents

| | |
|------------------------------------|--|
| Teacher Resource Pack (TRP) | Pre-planning Notes, Expectations by Category, Activity Deliverables, Instructional Aid Sheets (Skill Builders), Terminology List, Career Information |
| Student Project Brief (SPB) | Project Brief, Assessment/Evaluation Checklists and Rubrics, Activity Log |
| Safety Resource Pack (SRP) | Safety Information (list of pages to be inserted from the separate Safety Resource Pack) |

This Activity Resource Document (ARMdoc) was produced to supplement the Ontario Ministry of Ontario's Grade 11 Course Profiles. These profiles can be found at:

<http://www.curriculum.org/occ/profiles/profiles.htm>

ARMdocs for several Technological Education profiles can be found at:

<http://www.octe.on.ca>

The Technological Education policy documents can be found at:

<http://www.edu.gov.on.ca/eng/document/curricul/seccurric.html>

Pre-activity Planning Notes

This document combines two activities to help students relate materials investigation to the production processes that utilize those materials. (See pages 20-40, *TMJ3E Manufacturing Technology Course Profile*). It is important that students understand the physical and mechanical properties of materials and how production processes are based on those properties. By taking the students from an understanding of how materials behave to how materials are prepared for various products, the student should be able to make more informed decisions regarding material choices in their own design projects.

Please note that teachers should follow through the profile unit from the Activity 1.1: Gathering Information, (beginning on page 20, *TMJ3E Manufacturing Technology Course Profile*) to Activity 1.2: Developing Engineering Drawings and Blueprint Reading, through these combined activities, then Activity 1.5: Cost Analysis to help students understand the flow of the product design process from analysis to synthesis.

These activities are designed to support student project building. Students learn about various materials used in the manufacturing of different products through investigation and testing. Comprehension of material properties and their environmental impact is an important part of these activities. Students learn to respect materials, the manufacturing processes used and the waste disposal methods involved with manufacturing goods. The analysis of common products and why they are made of what they are, followed by simple inquiry tasks will help students connect ideas with their own projects that follow in the course.

Beware of the time constraints. There is not enough time allocated in the profile to thoroughly examine a wide variety of materials. Teachers may concentrate their lessons on materials related to ongoing projects or local resources or needs, however it is important that students compare more than one class of materials, (i.e. metals and plastics or plastics and woods). It is suggested that teachers choose an existing product (such as a pop can, a pencil, a toy, CD case, etc.); then examine the material properties required in that product, and then the process that may be required to manufacture the item. Teachers should prearrange description of the manufacturing process of the chosen product, (and any products students may be asked to research and report on). In this ARMDoc, a research project on recyclable plastics and on a process flow chart based on simple products provides a method for addressing the expectations.

Students will research the market and find cost effective materials to use in the design and development of a project. This involves products such as plastics, woods, metals, ceramics and/or and hybrid materials such as carbon fibre.

While the profile activities on which this document is based are written with a focus toward discussion and Socratic lessons, teachers should plan on time for allowing students to experience and test various materials as well as the related fabrication processes. For example, following a lesson or discussion on foam plastics, students should be given a simple task that involves hot wire foam cutting.

Please note that this ARMDoc lists a variety of “Skill Builders”. These are lesson plans that will help the teacher to develop and reinforce the key concepts required for student’s demonstration of the activity’s expectations. Some of these Skill Builders can be used before initiating the activity, while others can be used throughout the activity or course as reinforcement and assessment tools. Generally, the time required to complete these Skill Builders exceeds that allocated in the profile activity, (see the TMJ3E Course Profile), therefore the teacher can use their discretion as to when and how they present these tasks.

Expectations by Category (from Course Profile)

Knowledge

- TFV.02** identify the physical and mechanical characteristics of the materials and processes required to produce a product or process;
- TF2.01** identify the physical, mechanical, thermal, chemical, electrical, magnetic, optical, and acoustical properties of materials;
- TF2.02** describe the following physical properties of materials: appearance, density, moisture, content, porosity, size, surface texture, weight;
- TF2.07** describe the advantages of using a variety of materials, such as different species of woods, metals and alloys, plastics, earth materials, and composite materials;

Inquiry

- TFV.01** apply the design process to develop solutions, products, processes, or services in response to challenges or problems in manufacturing technology
- TF1.02** apply the following steps of the design process to solve a variety of manufacturing technology challenges or problems:
- gather and record information, and establish a plan of procedures;
 - brainstorm a list of as many solutions as possible;
 - evaluate the solutions (e.g., by testing, modeling, and documenting results) and choose the best one;.
- TF2.05** identify the factors that affect material selection;
- SPV.03** identify and choose the most appropriate power and control systems to develop a product.
- SP1.04** develop an operational plan for drawing procedures and production methods;
- SP2.03** use the most appropriate material for a particular product by considering the intended use, customer specifications, quality control processes, and the environment that the product will be subjected to.
- SP3.01** use a number of quality control processes when making products;
- SP3.02** design and use inventory and production control systems;

Communication

- SP3.03** use quality control methods (e.g., statistical process control) correctly and monitor the efficiency of the processes using tools such as spreadsheets;
- SP4.01** produce process control charts that clearly outline stages of the production process.

Application

- ICV.01** explain the environmental impact of using particular materials and processes when making products;
- IC1.01** explain the importance of the proper disposal of waste products.

Assessment/Evaluation

Students will be assessed and evaluated on the following deliverables. See the Student Project Brief for assessment/evaluation instruments.

| | Deliverable | Notes | Suggested Time (hr) |
|---|---------------------------------------|--------------|----------------------------|
| 1 | Written report on material properties | Individual | 1.5 – 2 |
| 2 | Operation Sheet (process flow chart) | Group of two | 1.5 - 2 |
| | | | |
| | | TOTAL | 4 |

Terminology List

| | |
|---------------------------|---|
| Stress | application of force to a physical object |
| Strain | the amount of yielding of a material due to stress |
| Aluminum: | Silvery light material which can be machined and is malleable. Is non-magnetic. |
| Brass: | Yellow alloy made from copper and zinc. Used in manufacture of musical instruments, door hardware and decorative ornaments. |
| Bronze: | Alloy of copper and tin used for bearing liners and artistic work |
| Cold rolled Steel: | product of steel fabricated using cold roll process, is usually accurate to nominal size; examples are 1 inch, 1.5 inches 2 inches exactly |
| Copper: | Soft malleable material, reddish brown in colour used for coinage, pipe and cooking pot manufacturing. Has high conductivity and is used for electrical wiring. |
| Hot rolled Steel: | a product of steel fabricated using hot roll process, not usually to an exact size. |
| Sheet metal: | steel sheets with a thickness of less than 3/16 of an inch and usually given in a gauge size |
| Stainless Steel: | Chrome coloured metal which resists tarnishing or rusting |
| Plastic polymers: | synthetically made material that can be molded into various products. |
| Thermoset plastic | plastics such as Bakelite that cannot be re-melted |
| Thermoplastics | plastics that can be re-melted, such as polyethylene |

Reference Resources

Publications

Daiber, Robert A. **Manufacturing Technology Today and Tomorrow**. United States of America: Glencoe/McGraw-Hill Company, 1991. ISBN 0-02-675757-5
Introductory text describing the field of manufacturing and material processes.

Gordon, J.E. **The New Science of Strong Materials**. Markham, Ontario: Penguin Books, 1999. ISBN 0-306-80151-5
Gordon, J.E. **Structures, or Why Things Don't Fall Down**. Markham, Ontario: Penguin Books, 1999. ISBN 0-306-80151-5
These two books by Gordon describe material, structural properties and the underlying physics and chemistry. Concepts such as stress, strain, mechanical strength and the science of structures are described. This is very important information to have as background knowledge when designing structures and determining materials to use in projects.

Hutchinson, John and John Karsnitz. **Design and Problem Solving in Technology**. Glencoe, McGraw-Hill, 1994. ISBN 0-8273-5244-1
Describes design processes and the use of technology to solve design problems.

Komacek, Stanley A. **Production Technology**. United States of America: Delmar Publishers Inc., 1993. ISBN 0-8273-4837-1
Introductory text describing manufacturing processes and technology.

Todd, R., K. Todd, and D. McCrory. **Introduction to Design and Technology**. Thomson Learning Tools, 1996. ISBN 0-538-64465-6 (Student Text), ISBN 0-538-64466-4 (Teacher's Resource Guide), ISBN 0-538-64465-6 (Portfolio & Activities Resource)
Introductory text describing basic principles of designing, technological problem solving and present and future state of the art in such areas of technology as manufacturing, communications, etc.

Websites

<http://www.matweb.com/>

The Online Materials Information Database. This site contains all one needs to know about a very wide range of materials and their properties. Includes materials database, conversion tables, supplier information, and trade names.

<http://www.asm-intl.org>

American Society for Materials (ASM) Materials Information Society website. Gives news on new materials and products. Has links to websites heat-treating and subscriptions.

<http://www.geocities.com/CapeCanaveral/1320/>

This site features information on carbon-fibres, an important "recent" development in

materials. Here you will find how they are made, the chemical combinations used to produce different carbon-fibres and where and what they are used for in today's industries.

<http://www.plasticsnet.com/content/homepage/default.asp>

PlasticsNet: available products, technical data sheets, technical forum and an education centre, as well as links to related sites are all found here.

<http://www.woodworking.org/WC/woodsampler.html>

Woodworker's Website Association lists examples of a variety of woods available for woodworking. Examples include types of light woods, redwoods, brown woods and dark woods classifications.

<http://www.atlassteels.com/>

Atlas Specialty Steels homepage describes their companies steel products available in Canada. They offer a comprehensive range of specialty steel products including Stainless Steels, Tool Steels, Vacuum Arc Re-melted (VAR) Steels, Mining Steels and Engineering Alloys.

Video

New Steel, Doorway to the Future. CSTE (Canadian Steel Trade and Employment Congress), Youth Employment Strategy. 10 min.

This video illustrates opportunities for youth towards employment in the steel industry.

Heat treating videos from ASM

Videos on heat-treating processes, available from ASM

Resource Note:

The URLs for the websites were verified by the writers prior to publication. Given the frequency with which these designations change, teachers should always verify the websites prior to assigning them for student use.

ARMdocs make reference to the use of specific texts, magazines, films, videos, and websites. Teachers need to consult their board policies regarding use of any copyrighted materials. Before reproducing materials for student use from printed publications, teachers need to ensure that their board has a Cancopy licence and that this licence covers the resources they wish to use. Before screening videos/films with their students, teachers need to ensure that their board/school has obtained the appropriate public performance videocassette licence from an authorized distributor, e.g., Audio Cine Films Inc. Teachers are reminded that much of the material on the Internet is protected by copyright. The copyright is usually owned by the person or organization that created the work. Reproduction of any work or substantial part of any work on the Internet is not allowed without the permission of the owner.

NOTE: This “skill builder” instructional aid sheet is to help instructors teach important topics and challenges to students. These skill builders may be used before conducting the activity to provide prior knowledge or skills required to successfully complete the activity.

Skill Builder # 1

Type of Learning:

Material properties

Topic:

Mild Steel products

Skills and Knowledge: Students will:

- identify the various types of manufactured steel products
- identify schedule 20, 40 and 80 pipe
- identify round tubing
- identify square tubing
- identify plate steel
- identify angle iron

Key Concepts:

- mild steel sizes and shapes
- structural uses for mild steel products

Challenge questions:

- What are some of the uses for mild steel?
- What lengths are standard pipe shipped to the consumer?
- What is the difference between plate and sheet metal?
- What are some uses for square tubing, round, plate, etc.?
- Where was the first steel structure built?

Teacher notes:

Teachers should prepare handouts/overheads and/or samples before activity. Discuss and ask students to list the physical and mechanical properties of the material. Discuss the wholesale or retail manufactured form, and the types of processes used in manufacturing products. Research and list the types of products made with this material. If time permits, students should practice working with the material. If the students are involved with oxy-acetylene cutting or welding of steel, safety guidelines should be followed and safety passports issued.

NOTE: This “skill builder” instructional aid sheet is to help instructors teach important topics and challenges to students. These skill builders may be used before conducting the activity to provide prior knowledge or skills required to successfully complete the activity.

Skill Builder # 2

Type of learning:

Materials

Topic:

Alloys

Skills and Knowledge: Students will be able to:

- identify copper, brass, aluminum, bronze and their respective properties and uses in manufactured products
- identify the types of processes used in cutting, joining and forming alloys

Key Concepts:

- uses of alloys in industry today
- recycling of alloys

Challenge questions:

- Where is copper used in today’s market?
- What are the differences between brass and bronze?
- Describe some products that use alloys.

Teacher notes:

Teachers should prepare handouts/overheads and/or samples before activity. Discuss and ask students to list the physical and mechanical properties of the material. Discuss the wholesale or retail manufactured form, and the types of processes used in manufacturing products. Research and list the types of products made with this material. Students should practice working with the material to become familiar with their properties.

NOTE: This “skill builder” instructional aid sheet is to help instructors teach important topics and challenges to students. These skill builders may be used before conducting the activity to provide prior knowledge or skills required to successfully complete the activity.

Skill Builder # 3

Type of learning:

Materials

Topic:

Plastics

Skills And Knowledge: Students will:

- identify the physical and mechanical properties of plastic
- identify the types of plastics (foam, thermoplastics, thermoset, composites)
- Identify the uses of plastics in industry
- Identify recyclable plastic goods

Key Concepts:

- Injection molding
- Uses for plastics
- Plastic benders
- Vacuum molding

Challenge questions:

- How is plastic shaped and molded?
- How are dies and molds made?
- What plastics are recycled?
- What are some new products that are made with plastics?

Teacher notes:

Teachers should prepare handouts/overheads and/or samples before activity. Discuss and ask students to list the physical and mechanical properties of the material. Discuss the wholesale or retail manufactured form, and the types of processes used in manufacturing products. Research and list the types of products made with this material. If time permits, students should practice working with the material. As the students may be working with plastics at high temperatures inclusion of safety lessons and use of safety passports are necessary.

Note: Shop should have vacuum forming and plastic extrusion equipment to help enhance the students learning during this lesson.

NOTE: This “skill builder” instructional aid sheet is to help instructors teach important topics and challenges to students. These skill builders may be used before conducting the activity to provide prior knowledge or skills required to successfully complete the activity.

Skill Builder # 4

Type of learning:

Materials

Topic:

Wood

Skills and Knowledge: Students will:

- Understand the properties and uses of hardwoods
- Understand the properties and uses for softwoods
- Identify hardwoods and softwoods
- Identify types of manufactured woods

Key Concepts:

- Uses for oak, ash, hickory, maple and walnut
- Uses for pine, spruce, fir
- Medium Density Fiberboard (MDF) and other manufactured wood applications

Challenge questions:

- How does the wood industry affect the environment?
- What trades use wood products?
- Can wood be recycled?
- What are some of the major uses of hardwood? Softwood? Manufactured products?

Teacher notes:

Teachers should prepare handouts/overheads and/or samples before activity. Discuss and ask students to list the physical and mechanical properties of the material. Discuss the wholesale or retail manufactured form, and the types of processes used in manufacturing products. Research and list the types of products made with this material. If time permits, students should practice working with the material. Any students involved with the cutting of wood using power tools should have the applicable safety training and be issued a safety passport before usage. (See appropriate Safety Data Sheets)

NOTE: This “skill builder” instructional aid sheet is to help instructors teach important topics and challenges to students. These skill builders may be used before conducting the activity to provide prior knowledge or skills required to successfully complete the activity.

Skill Builder # 5

Type of learning:

Manufacturing production planning

Topic:

Manufacturing Flow Charts

Skills and Knowledge: Students will:

- Analyze, produce and complete a production flow chart

Key Concepts:

- Critical path networks
- Flow charts
- Spreadsheet programs

Challenge questions:

- Why is it important for manufacturers to have production flow charts?
- How are spreadsheets used in planning production flow?

Teacher Notes:

- Teachers show example flow charts and discuss symbols and processes (Teacher should have several samples of flow charts on hand for display)
- Students research various manufacturing production facilities and how their production system works.
- For practice, students should produce simple flow charts for manufacturing commercial items such as pencils, hats, locker doors, CD cases, etc.

Checklist for Skill Builders: Material Properties

| Student Name: | Yes | No |
|---|------------|-----------|
| Can describe mechanical strength | | |
| Can describe stress and strain | | |
| Can describe tensile strength | | |
| Can describe torsional strength | | |
| Can describe shear strength | | |
| Can describe melting point | | |
| Can describe thermal conduction | | |
| Can define "alloy" | | |
| Can define electrical conduction, insulation and semi-conduction | | |
| Can describe magnetic effect | | |
| Can describe surface properties of materials, (appearance, texture, etc.) | | |
| Is able to identify brass | | |
| Is able to identify bronze | | |
| Is able to identify aluminum | | |
| Is able to identify stainless steel | | |
| Is able to identify properties of hardwoods | | |
| Is able to identify properties of softwoods | | |
| Can describe some types of plastics | | |
| Understands various uses for mild steel | | |
| Has knowledge of various shapes of steel | | |
| Can describe uses of stainless steel | | |
| Understands and can give examples of aluminum products | | |
| Understands recycling of plastics | | |
| Can describe the processes of cutting | | |
| Can describe the processes of shaping | | |
| Can describe the processes of joining | | |

Career Information

Career Information Sites:

Human Resources Development Canada: National Occupational Classification Database-

<http://www.hrdc-drhc.gc.ca/noc>

HRDC NOC Search Engine-

<http://www.worklogic.com:81/noc/Query.htm?lang=e>

Ontario Prospects: geared to young people and students

<http://www.edu.gov.on.ca/eng/general/elemsec/job/prospect/eng/index.html>

Job Futures 2000: what's hot, what's not

<http://www.hrdc-drhc.gc.ca/JobFutures>

Job Profiles: real people profile their jobs

<http://www.jobprofiles.org/index.htm>

Canada WorkInfoNet: national and regional market info

<http://www.workinfolnet.ca>

The following activity related careers are described in the Human Resources Development Canada (HRDC) National Occupational Classification (NOC) database. Use the search engine link above to learn the main duties performed by practitioners of each trade, the education requirements for the position, and related occupations.

7311 Construction Millwrights and Industrial Mechanics

7271 Carpenters

7265 Welders

Student Project Brief

TMJ3E Manufacturing Technology

Unit 1 Activity 1.3 & 1.4

Project Management: Material Selection & Planning Production

Contents:

1. Project Brief Handout: Material Selection
2. Evaluation Checklist for Material Selection
3. Writing a Technical Report
4. Project Brief Handout: Production Planning
5. Producing a Manufacturing Flow Chart
6. Log Sheet Template

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| | | | |
|--|---|----------------|-----------------------------------|
| Title: | <i>Project Management – Material Selection</i> | | |
| Activity: | Unit 1 Activity 1.3 | Course: | TMJ3E Manufacturing Technology |
| Time Req'd: | 1-1.5Hrs | Date: | |
| RATIONALE | | | |
| <p>When you design products, the properties of materials are of prime consideration. What are their strengths? What are their weaknesses? How do you cut, shape, join various materials? An increasing number of products are being manufactured with new plastic and recycled plastic materials. With the critical use of plastic in today's society, an understanding of the properties of these materials and how they are processed will be useful in your decisions when you are designing your own products or purchasing commercial products.</p> | | | |
| THE ASSIGNMENT | | | |
| <p>You are challenged to research plastics and how the recycling industry utilizes plastics. Write in essay format two pages double-spaced describing typical plastic products, the properties of selected plastics and how they are recycled. Describe what happens to waste in plastic manufacturing, and the problems that may occur. Use the 5 W's to help qualify your research.</p> | | | |
| KEY CONCEPTS: You will: | | | |
| <ul style="list-style-type: none"> • Use a variety of research tools including the Internet • Describe the properties of selected plastics • Describe the properties of new and recycled plastic products • Identify processes used in manufacturing plastic products • Identify types of products using plastics | | | |
| TOOLS AND MATERIALS | | | |
| <ul style="list-style-type: none"> • Computer with Internet access and word processing capabilities • Various common plastic products or photographic images of plastics • Local recycling rules governing plastics • Checklist for marking | | | |
| NOTES | | | |
| | | | |

| EVALUATION | | | | |
|-------------------|--------------------|-----------------------------|-----------------|-------------------------|
| No. | Deliverable | Time Limit (periods) | % Weight | Notes |
| 1 | Written report | 1-1.5 hrs | 100% | Must be in essay format |
| 2 | | | | |
| 3 | | | | |
| TOTALS | | | 100% | |

NOTES

See your facilitator for approvals at all stages
 Ensure you know how to work with computer programs correctly, if in doubt...ASK!

| PROJECT PROCEDURE | |
|--------------------------|--|
| Step | Procedure |
| 1 | Your teacher will give you examples of some plastics to research. Book time for library and Internet searches to research your plastic examples. |
| 2 | Research and collect data on products using your selected plastic materials, including new as well as recycled materials. |
| 3 | Begin a rough draft of the information to use in the essay (introduction, body and conclusion.) |
| 4 | Have the teacher approve rough draft |
| 5 | Write the final report using essay format (if unsure ask your teacher) |

Checklist for Project Management: Material Selection

Use the following checklist as your guide for evaluation on this activity. Be prepared to answer the following questions:

| Student Name: | Yes | No |
|---|------------|-----------|
| Can describe mechanical strength | | |
| Can describe stress and strain | | |
| Can describe tensile strength | | |
| Can describe torsional strength | | |
| Can describe shear strength | | |
| Can describe melting point | | |
| Can describe thermal conduction | | |
| Can define electrical conduction, insulation and semi-conduction | | |
| Can describe magnetic effect | | |
| Can describe surface properties of materials, (appearance, texture, etc.) | | |
| Can describe the types of plastic (thermoset, thermoplastic) | | |
| Can describe the forms of plastics, (i.e. foams, resins, sheets, etc.) | | |
| Can describe typical uses of various plastics | | |
| Can describe how plastics can be recycled | | |
| Can describe what plastics can be recycled | | |
| Can describe how waste plastic is treated, and associated problems | | |
| Can describe the processes of cutting various plastics | | |
| Can describe the processes of shaping various plastics | | |
| Can describe the processes of joining various plastics | | |

Expectations:

TFV.02, TF2.01, TF2.02, TF2.07, TF2.05, SP2.03, IC1.01

Activity 1.3 Materials Selection Rubric

| Criteria: | Level 1 (50% - 59%) | Level 2 (60% - 69%) | Level 3 (70% - 79%) | Level 4 (80% - 100%) |
|---|--|---|---|--|
| KNOWLEDGE | | | | |
| evaluate and choose the most appropriate material for a product TF2.05, SP2.03 | evaluates and chooses the most appropriate material for a product using limited criteria | evaluates and chooses the most appropriate material for a product using some criteria | evaluates and chooses the most appropriate material for a product using considerable criteria | evaluates and chooses the most appropriate material for a product using excellent criteria |
| identify factors that affect material selection TFV.02, TF2.05 | identifies few factors that affect material selection | identifies some factors that affect material selection | identifies many factors that affect material selection | identifies a variety of factors that affect material selection |
| describe mechanical properties of materials TF2.01, TF2.02 | describes mechanical properties of materials with limited detail | describes mechanical properties of materials with some detail | describes mechanical properties of materials with considerable detail | describes mechanical properties of materials with thorough detail |
| describe the advantages of using a variety of materials TF2.07 | describes the advantages of using a variety of materials using limited critical thinking | describes the advantages of using a variety of materials using some critical thinking | describes the advantages of using a variety of materials using good critical thinking | describes the advantages of using a variety of materials using excellent critical thinking |
| INQUIRY | | | | |
| apply the design process to project work TFV.01 | applies the design process to project work with limited effectiveness | applies the design process to project work with some effectiveness | applies the design process to project work with considerable effectiveness | applies the design process to project work with excellent effectiveness |
| demonstrate ability to follow the design process in manufacturing TF1.02 | demonstrates limited understanding of the concept of the design process in manufacturing | demonstrates some understanding of the concept of the design process in manufacturing | demonstrates considerable understanding of the concept of the design process in manufacturing | demonstrates thorough understanding of the concept of the design process in manufacturing |
| Explain the importance of proper waste disposal ICV.01, IC1.01 | explains the importance of proper waste disposal with limited comprehension | explains the importance of proper waste disposal with some comprehension | explains the importance of proper waste disposal with considerable comprehension | explains the importance of proper waste disposal with thorough comprehension |

Writing a Technical Report

Name: _____

Date: _____

Activity: Writing a technical report**Group Size:** Individual**Time line:** 60 minutes**Equipment:** Computer stations with word processing program**Activity Description and Expectations:**

Communication SP4.01; Application ICV.01

Key Concepts

- Student understands the need for well written reports
- Student develops understanding of format for technical reports
- Student develops information gathering techniques

Assignment

Students research various materials, and give written report on these materials, properties, availability, costs and environmental impact.

Assessment Checklist

| Qualifiers | Yes | No |
|---|------------|-----------|
| Identifies several material properties (examples are: strengths, workability, recyclable properties) | | |
| Uses report writing format (APA Format or others) | | |
| Includes rough draft of research | | |
| Includes list of resources used | | |
| Includes properties of each product | | |
| Includes list of availability, cost and environmental impact of each product (may be in spreadsheet format) | | |

| EVALUATION | | | | |
|--|---|-----------------------------|-----------------|---|
| No. | Deliverable | Time Limit (periods) | % Weight | Notes |
| 1 | Research document | 60-90mins | 60% | Includes; all information on plastics recycling industry. Pick-up from homeowners houses, delivery process, and goods created from recycled plastics. |
| 2 | Flow Charts | 60min | 40% | Includes data on production flow of students project work |
| TOTALS | | | 100% | |
| NOTES | | | | |
| <p>Choose a typical product to develop the process flow chart: Examples include: CD case, pencil, skateboard, pop can, chair, etc. Make sure your teacher approves your choice before continuing.</p> <p>See your facilitator for approvals at all stages Ensure you know how to manipulate computer programs correctly. If you don't know, ASK!</p> | | | | |
| PROJECT PROCEDURE | | | | |
| Step | Procedure | | | |
| 1 | Choose the product to develop a process flow chart. Choose a partner. Track and keep a written journal. | | | |
| 2 | Research how the product is made, and what tools are used to create each step of the process. | | | |
| 3 | Sketch out a possible production flow chart for your product. | | | |
| 4 | Use a graphical or word processing program, reproduce your chart on the computer | | | |
| 5 | Submit your work for marking. | | | |

Activity 1.4: Planning Production

| Criteria: | Level 1 (50% - 59%) | Level 2 (60% - 69%) | Level 3 (70% - 79%) | Level 4 (80% - 100%) |
|--|--|---|---|---|
| INQUIRY | | | | |
| Apply the design process to project work TFV.01 | applies the design process to project work with limited effectiveness | applies the design process to project work with some effectiveness | applies the design process to project work with considerable effectiveness | applies the design process to project work with excellent effectiveness |
| demonstrate ability to follow the design process in manufacturing TF1.02 | demonstrates limited understanding of the concept of the design process in manufacturing | demonstrates some understanding of the concept of the design process in manufacturing | demonstrates considerable understanding of the concept of the design process in manufacturing | demonstrates thorough understanding of the concept of the design process in manufacturing |
| use a variety of power and control systems SPV.03 | uses a variety of power and control systems with limited effectiveness | uses a variety of power and control systems with some effectiveness | uses a variety of power and control systems with considerable effectiveness | uses a variety of power and control systems with excellent effectiveness |
| develop an operational plan for drawing procedures and production methods SP1.04 | develops an operational plan for drawing procedures and production methods with limited detail | develops an operational plan for drawing procedures and production methods with some detail | develops an operational plan for drawing procedures and production methods with considerable detail | develops an operational plan for drawing procedures and production methods with thorough detail |
| use a number of quality control processes SP3.01 | rarely uses a number of quality control processes | sometimes uses a number of quality control processes | often uses a number of quality control processes | always or almost always uses a number of quality control processes |
| design and use inventory and production control systems SP3.02 | designs and uses inventory and production control systems with limited success | designs and uses inventory and production control systems with some success | designs and uses inventory and production control systems with considerable success | designs and uses inventory and production control systems with excellent success |
| COMMUNICATION | | | | |
| create process control charts SP4.01 | creates process control charts with limited clarity | creates process control charts with some clarity | creates process control charts with considerable clarity | creates process control charts with excellent clarity |
| APPLICATION | | | | |
| describe the importance of being environmentally aware ICV.01 | describes the importance of being environmentally aware with limited information and understanding | describes the importance of being environmentally aware with some information and understanding | describes the importance of being environmentally aware with considerable information and understanding | describes the importance of being environmentally aware with complete information and understanding |

Producing a manufacturing flow chart

Name: _____

Date: _____

Activity: Producing a flow chart**Group Size:** Individual**Time line:** 60 minutes**Equipment:** drafting or classroom desks, pencils, erasers, board and markers or high-liters.**Activity Description and Expectations:**Theory and Foundation / Skills and processes Knowledge / Communication
TF1.02, SPV.03, SP1.04, SP4.01**Key Concepts**

- Student understands and can interpret flow charts
- Student develop skills required for produces flow charts

Assignment

Students research a product manufacturing process and produce a flow chart of the process.

Assessment Checklist

| Qualifiers | Yes | No |
|---|------------|-----------|
| Identifies specific parts of production flow | | |
| Identifies major components which must be kept in production to keep flow of product moving | | |
| Uses typical format of production flow charts | | |
| Understands the manufacturing process | | |
| | | |
| | | |

Safety Resource Pack

TMJ3E Manufacturing Technology

Unit 1 Activity 1.3 & 1.4

Project Management:

Material Selection & Planning Production

Contents:

1. **Safety Data Sheets:** (as necessary for Skill Builder activities...pertinent to the materials processed, i.e. plastics, wood, metals, etc.)
2. **Safety Passport** (as applicable to above)
3. **Safety Tests** (as applicable to above)

NOTE:

All personnel in a shop environment must be wearing approved safety eyewear at all times.

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INSERT THE FOLLOWING SHEETS FROM THE SAFETY RESOURCE PACK:

- **Safety Data Sheets:** (as necessary for Skill Builder activities...pertinent to the materials processed, i.e. plastics, wood, metals, etc.)
- **Safety Passport** (as applicable to above)
- **Safety Tests** (as applicable to above)