**Activity Planning Template**

**Technological Education Discipline: Manufacturing TMJ-4M**

**Activity Name:** Machining a two-piece injection mold.

**Unit:** Automotive Industry Production Molds

**Activity #:** 2

**Description:** Students will be constructing a two-piece injection mold that will use the injected plastic process. The mold will create plastic washers that can be used for a portable washer game. The material will be 6061 aluminum with hardened dowel pins for alignment. Students will learn about different styles of molds with the video links. The automotive electric vehicle industry uses this technology in their current production process.

**Assessment and Evaluation:** (which form of assessment and assessment tool will you use to evaluate the students work, **For, As, or Of** **Learning, using Rubric, Checklist etc.**)(List the skill areas which will be assessed; Knowledge/Understanding, Thinking /Inquiry/Problem Solving, Communication and Application/Making Connections)(Note: Summative or Culminating activities should include many of the above skill areas)

This assignment will be assessed as a summative project as part of the term mark. There will be a rubric for assessment of learning.

**Overall Curriculum Expectations:** (Which overall curriculum expectations will be assessed at the end of the activity?)

A1.describe the business operations associated with manufacturing and explain their role in product development;

A2.demonstrate an understanding of how to optimize individual or mass production systems by improving material flow, factory design, product layout, labour productivity, and quality control;

A4.apply relevant mathematical skills, scientific concepts, and technological literacy and communication skills in planning and implementing manufacturing processes.

B2.demonstrate an understanding of the management of a manufacturing enterprise and the interrelationships among its major areas of activity such as marketing, cost control, quality assurance, production, and inventory control;

B3.demonstrate the safe and effective use of tools, equipment, and materials in the production of a product or the development of a production process;

D1.demonstrate an understanding of and compliance with health and safety legislation, standards, and practices, including methods to address deficiencies, as they relate to the manufacturing industry;

**Specific Curriculum Expectations**: (List the Specific Curriculum Expectations which need to be taught before the students attempt this activity)

A1.2 describe and explain activities associated with product development in manufacturing (e.g.,product research,product testing,product improvement

A1.4 identify factors to be considered in estimating the cost of manufacturing a product (e.g., labour and materials,capital equipment,process costs,location/transportation)and explain their importance.

A2.4 plan in collaboration with others a detailed manufacturing process for production (e.g.,a process plan for part routing,a process plan that includes the use of robotics).

A4.2 apply scientific concepts to manufacturing related processes (e.g.,properties of materials for selection purposes,work energy theorem for energy consumption measurements,non-destructive material testing to measure material quality and safety);

B2.5 analyse the results of a production process, and modify operations, systems, and tooling as necessary.

B3.1 demonstrate the skills required to safely operate machine tools and equipment (e.g.,engine lathe,milling machine,drill press; equipment for gas tungsten arc welding [GTAW] and gas metal arc welding [GMAW])in the assembly or fabrication of a product;

B3.6 use advanced measuring tools (e.g.,precision level,coordinate measuring machine,laser levels, optical comparators)to calculate measurements in both metric and US customary/British imperial units;

B3.7 operate computer numerical control equipment (e.g.,CNC milling machine,CNC lathe, CNC plasma cutter)in the assembly or fabrication of a product

**Prior Learning:**

Students will have basic operational knowledge of:

-CNC mill, conventional mill, and the metal lathe.

-Review [Fundamentals of CNC Machining](https://academy.titansofcnc.com/files/Fundamentals_of_CNC_Machining.pdf) for basic milling and CNC concepts

-They will need to have general knowledge of tooling for these machines.

-When inspecting and planning the parts, students will require knowledge of precision measuring tools.

-Part Drawing interpretation.

**New Pedagogy for Deeper Learning (NPDL)** (How will you Embed the 6C’s into your Activity Plan)

(Collaboration, Citizenship, Character, Creativity, Critical thinking, Communication)

This lesson will tie into Critical Thinking. The mold build will have the students thinking about the process for machining and building a part from a drawing. Students will use communication skills through the finished product. Analyzing the part and comparing it to the drawing.

**Universal Design for Learning** (How will you Embed UDL’s three principles, Multiple means of Representation, Expression and Engagement)

Students will have multiple opportunities to demonstrate their skills and how they are meeting the curriculum expectations. The assessment can be changed to meet the needs of the learner. The project is a constructed project that can be assessed as the student is creating through different assessment sources. Please see the resources with this project for more options.

**Technological Concepts** (List the Fundamental Technological Concepts (13) covered in this Lesson that the students will take away at completion of this lesson i.e.; Aesthetics, Ergonomics, Control Systems, Mechanism, Power and Energy, etc...)

Students will work with **Control Systems** to construct the mold using the CNC milling machine. They will follow the process to create injection molded parts.

Students will build **Structures** when creating the mold and when they create the finished washers.

**Enduring Understandings and Essential Skills:** (List what Enduring Understandings and Essential Skills the students will take away from completion of this activity i.e.; Foundational Knowledge and skills, Transferable skills etc.)

The essential skills covered in this lesson is critical thinking. Students will learn the concepts about mold use in the automotive industry and make connections to their work in the classroom.

<https://www.skillszone.ca/essential_skills/index.htm>

**Activity Procedure:** (List a step by step process (Planning Notes) in which you feel the activity should take, describe the process fully (All Key Information) so that any teacher supervising this activity will be able to assist students with successful completion of the activity.)

-Students will review the safety PPE for the project.

-Review machining fundamentals document.

-Review any risk involved and troubleshoot as a class.

-Look at the drawings for the project.

-Fill out the machining plan template sheet.

-Cut aluminum flat bar for the two sides of the mold.

-Machine the blocks square and flat.

-Drill and ream press fit and slide fit dowel holes 2 per assembly.

-Create drawing in Mastercam.

-Send the program to the machine.

-Machine the washer undercut using the CNC milling center and the appropriate tooling.

-Deburr the part using files and deburring tool.

-Check for mold fit and change as needed.

-Prepare for the injection molding process.

-Review the injection molding safety requirements.

-Turn on the injection press and set it to the appropriate temperature for the plastic.

-Place the mold in the injection machine and clamp it in place.

-Fill cylinder to the top with plastic pellets.

-Wait for the preheat so the plastic is ready to be injected.

-Push the actuator down and the pressure will inject the plastic into the mold.

-Wait for a short time to allow the pressure to set the material.

-Reverse the pressure cylinder and release the clamp.

-Remove the part from the mold.

-Repeat to create 4 of each colour.

**Materials:**

2 pcs. - ½”x 2 ½” x 4” 6061 Aluminum

2 pcs. – ¼” x ½” hardened dowel pins

Plastic Polyethylene Pellets

**Tools and Equipment:**

Metal Lathe

Milling Machine

CNC Milling Machine

Precision Measuring Tools

Metal Bandsaw

Hot Plastic Injection machine

Center drill

B size drill bit

.250” Reamer

.249” Reamer

Milling Cutters ⅜” 4 flute

Milling VIce

Boring head

Lathe tools

**Accommodations and Modifications:** (list any accommodations and modifications you may need to use if necessary to help students succeed, i.e.; time, scribing, organizational aid, computer or tablets, etc.)

Please review student needs in the class and make changes as necessary to meet the needs of the group or the individual. Accommodations can be made for all students and modifications will only apply for learners who require them.

**Terminology, Literacy and Numeracy:** (List all Terminology, literacy or numeracy addressed in this activity)

Terminology:

Aluminum

Mold

Injection

Pressure

Quality Control

Melting Point

Literacy

Reading drawings is a form of communication in the shop and allows students to develop this literacy skill during the project.

Numeracy

Students will measure the parts and use basic calculations to create the machined part. Material planning and price calculations will help students to learn basic cost calculating skills.

**Additional Resources:** (List and/or include, additional resources required such as; appendixes, Library, computers, books, power points, videos etc.)

Washer Toss Game

[Washer Toss Game Rules](https://publicwebuploads.uwec.edu/documents/Washer-Toss-Rules.pdf)

Using Plastics

[Plastics Related Training in Canada](https://www.canplastics.com/features/plastics-related-training-in-canada/)

Technology Student website

[Technology Student](https://www.technologystudent.com/)

**Activity Review:** (Review the activity after it has been completed by students, what could be improved?)

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