

Woodworking, Intermediate

Exam Information	Description
Exam number 522 Items 33 National Career Cluster Manufacturing Architecture & Construction Certification available Yes	The Woodworking, Intermediate industry certification exam is designed to build upon the skills learned in beginning woodworking. Through project construction and hands-on learning, candidates will gain a deeper understanding of wood as a material and in planning and estimating. Value is placed on developing craftsmanship, a production sense, and design principles.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Safety*	17%
2. Explore Careers*	0%
3. Wood Products*	24%
4. Automated Manufacturing Processes*	19%
5. Project Cost*	26%
6. Advanced Joinery and Install Hardware	14%

*Includes performance skill evaluation

Standard 1 - Safety (17% of exam score)

Candidates will develop safe woodworking habits

Objective 1 Candidates will be aware of physical hazards present in a woodshop.

1. Heavy objects and crushing hazards.
2. Kickback and potentially airborne objects.
3. Moving parts of machinery and applicable safety zones.
4. Excessive noise present in a woodshop.

Objective 2 Candidates will be aware of chemical hazards present in a woodshop.

1. Common chemicals found in a woodshop (glue, finish, etc.).
2. Candidates will be aware of the dangers of sawdust.
3. Candidates will know what a Safety Data Sheet (SDS) is and where to find it.

Objective 3 Candidates will understand the importance of cleaning and organization in a woodshop and how that relates to safety.

Objective 4 Candidates will know what Personal Protective Equipment (PPE) is and when it should be used.

Objective 5 Candidates will be aware of clothing hazards present in a woodshop.

1. Loose or dangling items or pieces (including hair, draw strings, baggy clothing, etc.)
2. Open toed shoes
3. Jewelry

Performance Skill

1. Candidates will complete a basic safety test without errors (100%) before using any tools or equipment.
2. Consult with your school division's risk management department for specific policies or procedures.
3. Candidates will keep woodshops and classrooms clean and organized while working, after completing work, and when storing materials and projects.
4. Candidates will always wear safety glasses inside the woodshop.

Optional: Standard performance evaluations on the final page of this document

Standard 2 - Explore Careers (0%)

Candidates will explore careers in woodworking and manufacturing.

Objective 1 Candidates will understand how this course fits into a Manufacturing Pathway.

Objective 2 Candidates will learn about woodworking jobs and careers in their local area, including how many jobs are available, how much they pay, and what education and training they require.

Objective 3 Candidates will learn about jobs and careers in different fields that use similar skills as the woodworking industry, such as job prospects, wages, and required education.

Objective 4 Learn about higher education opportunities for woodworking.

Objective 5 Learn about licensing requirements tied to the woodworking and manufacturing industry

Optional: Standard performance evaluations on the final page of this document

Standard 3 - Wood Products (24%)

Candidates will learn the properties of solid wood and engineered wood products and their applications in building cabinets and furniture.

Objective 1 Learn about the following engineered wood products:

1. Plywood
 - a. Alternating layered veneers
2. MDF
 - a. Wood fibers and resin pressed into sheets
3. Particle board
 - a. Wood chips and resin pressed into sheets
4. Melamine
 - a. Engineered wood core with plastic-like face

Objective 2 Learn the advantages and disadvantages of using engineered wood.

Advantages	Disadvantages
Dimensionally Stable High strength across length and width Minimal or no milling required Can be purchased pre-finished	Susceptible to moisture Limited thicknesses and sizes available Harder to repair dents, scratches, and chips Appearance of edges

Objective 3 Understand the grading system for plywood.

1. Hardwood Plywood
 - a. Face veneer graded A-D with A being the highest quality
 - b. Back veneer graded 1-4 with 1 being the highest quality

Objective 4 Differentiate between hardwood and softwood

Objective 5 Identify the following domestic hardwoods.

1. Maple
2. Cherry
3. Walnut
4. Alder

Objective 6 Identify the following domestic softwoods:

1. Cedar
2. Pine

Performance Skill

1. Candidates can identify the following:
 - a. Plywood
 - b. MDF
 - c. Particle Board
 - d. Melamine
2. Candidates can appropriately use engineered wood as part of the course project
3. Candidates can identify the following:
 - a. Maple
 - b. Cherry

- c. Walnut
- d. Alder
- e. Cedar
- f. Pine

Optional: Standard performance evaluations on the final page of this document

Standard 4 - Automated Manufacturing Processes (19%)

Candidates will become familiar with computer-aided design (CAD) and computer-aided manufacturing (CAM)

Objective 1 Candidates will understand how to use computer-aided design (CAD) software to create the following:

- 1. Basic 2D geometry
- 2. Simple 3D geometry such as
 - a. Cubes
 - b. Rectangular Prisms
 - c. Cylinders
- 3. Simple joinery

Here are some CAD software packages that have web-based versions that will work on a Chromebook:

- 1. Sketchup
- 2. Fusion 360
- 3. Onshape

Objective 2 Candidates will understand computer-aided manufacturing (CAM) software.

- 1. Setup virtual workpiece
- 2. Draw basic geometry and text
- 3. Import simple images and graphics
- 4. Create toolpaths using appropriate bit
- 5. Understand chip load and its importance in cutting efficiency

$$\text{Chip load} = \frac{\text{Feed Rate (IPM)}}{\text{RPM} \times \text{number of flutes}}$$

- 6. Understand cutter profiles
 - a. End-mill
 - b. V-bit
 - c. Ball Nose
- 7. Identify different types of toolpaths
 - a. Engraving/V-carve

- b. Pocket
- c. Profile

Performance Skill

1. Candidates can create a simple 3D model using CAD software (ie. Small drawer, bookshelf, etc.)
 - a. This modeling does not have to be related to the projects
2. Using CAM software and a CNC router, candidates can create and cut the following toolpaths:
 - a. Engraving/V-carve
 - b. Pocket
 - c. Profile

Optional: Standard performance evaluations on the final page of this document

Standard 5 - Project Cost

Candidates will learn how to estimate the cost of a project made of wood.

Objective 1 Candidates will understand common measurements used in lumber stores, when to use each one, and how to calculate them.

1. Board Footage for solid wood

$$BF = \frac{\text{Thickness(in)} \times \text{Width(in)} \times \text{Length(in)}}{144}$$

OR

$$BF = \frac{\text{Thickness(in)} \times \text{Width(in)} \times \text{Length(ft)}}{12}$$

2. Linear Feet for moldings and sticks 1'=12"
3. Square Footage for sheets goods SF= Length' x Width'

Objective 2 Candidates will know the common dimensions of wooden materials found in lumber stores.

1. Solid Wood (lengths and widths vary)
2. 4/4 approx. 1"
3. 6/4 approx. 1 ½"
4. 8/4 approx. 2"
5. Sheet goods
6. 4'x8'
7. Thicknesses of ¼", ½", and ¾"

Objective 3 Candidates will learn how to create a materials list and cut list from a scale drawing.

1. Measurements are written in the same format
 - a. Thickness x Width x Length
2. Plan for non-wood materials
 - a. Hardware
 - b. Finish
 - c. Fasteners
 - d. Consumables
 - i. Sandpaper
 - ii. Adhesives

Objective 4 Candidates will learn how to optimize materials and minimize waste.

1. Add extra material for unavoidable waste
2. Design/plan projects to work well with common lumber dimensions

Objective 5 Learn to estimate the cost of a project from a materials list.

Performance Skill

1. Candidates can accurately measure within 1/16" of an inch.
2. Candidates can create a readable materials list and cut list.
3. Candidates can accurately calculate the cost of a project when given a materials list.

Optional: Standard performance evaluations on the final page of this document

Standard 6 - Advanced Joinery and Install Hardware (14%)

Candidates will learn how to cut advanced joinery and install hardware.

Objective 1 Candidates will learn to identify the following joints and one or more ways to cut them:

1. Mortise and Tenon
2. Miter Joint
3. Reinforced Joints (ie. Dowel, spline, biscuit, nails, screws, etc.)
4. Lap joints
5. Box Joint
6. Dovetail Joint
7. Blind Joints

Objective 2 Candidates will learn to identify the following joints and one or more ways to cut them:

1. Butt hinge
2. European hinge

Objective 3 Candidates will learn to identify the following joints and one or more ways to cut them:

1. Side mount
2. Roller Slides
3. Ball Bearing Slides
4. Undermount

Objective 4 Candidates will identify knobs and pulls and their applications.

Performance Skill

1. Candidates can cut advanced joinery
2. Candidates can install hardware

Performance Skills Evaluation

Exam name: Woodworking, Intermediate

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Standard 1 – Safety • Use safe woodworking habits	Pass:
Standard 2 – Exploring Careers • Candidates will explore careers in woodworking and manufacturing.	Pass:
Standard 3 – Wood Products • Candidates will learn the properties of solid wood and engineered wood products and their applications in building cabinets and furniture.	Pass:
Standard 4 – Automated Manufacturing Processes • Candidates will become familiar with computer-aided design (CAD) and computer-aided manufacturing (CAM)	Pass:
Standard 5 – Project Cost • Candidates will learn how to estimate the cost of a project made of wood.	Pass:

Evaluator Name: _____

Date: _____