

SENIOR YEARS

Metalwork Technology



Fundamental Skills

General Learning Outcome

GLO F1 **Technical Communication:** Communicate technical ideas and designs effectively and appropriately.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.F1.1 Use several presentation programs using existing formats to digitally communicate a technical idea.	IA10.F1.1 Design a simple presentation using a presentation program to communicate a technical idea.	IA11.F1.1 Apply an advanced presentation program effectively to communicate a technical idea visually.	IA12.F1.1 Apply an appropriate combination of digital, graphic, oral, and written techniques to effectively communicate a technical idea.
IA9.F1.2 Interpret a graphic presentation of a technical idea.	IA10.F1.2 Adapt a graphic presentation of a technical idea.	IA11.F1.2 Create a graphic presentation of a technical idea.	
IA9.F1.3 Recognize technical language and terms.	IA10.F1.3 Use technical language and terms in the correct context.	IA11.F1.3 Create a set of steps using correct technical writing techniques to effectively describe a technical process.	
IA9.F1.4 Effectively use technical reading skills to follow a set of instructional steps.	IA10.F1.4 Adapt a set of instructional steps using appropriate technical writing skills.		

Fundamental Skills



General Learning Outcome

GLO F2 **Problem Solving:** Apply effective decision-making, problem-solving, and design strategies to a project. (Refer to Appendix B for a sample design/problem-solving process.)

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.F2.1 Demonstrate an understanding of the problem-solving process in designing and producing a product.	IA10.F2.1 Identify problems and apply appropriate problem-solving skills to solve them.	IA11.F2.1 Transfer problem-solving skills to real-life situations.	IA12.F2.1 Research and articulate a problem that can be solved through technological means.
IA9.F2.2 Identify criteria for making and evaluating choices.	IA10.F2.2 Apply a decision-making strategy to practical situations.	IA11.F2.2 Use a variety of critical thinking skills to evaluate situations and make decisions.	IA12.F2.2 Apply problem-solving and design skills to develop a technological solution to a problem.
IA9.F2.3 Demonstrate an understanding of the qualities of good design.	IA10.F2.3 Modify an existing design to meet specified criteria.	IA11.F2.3 Create a design to meet a set of specifications.	IA12.F2.3 Analyze critically and act logically to evaluate situations and make decisions.

Fundamental Skills

General Learning Outcome

GLO F3 **Information Management:** Effectively manage information.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.F3.1 Acquire and organize information using appropriate technology and information systems.	IA10.F3.1 Apply specialized information and skills in real-life situations.	IA11.F3.1 Transfer and apply specialized information and skills in a variety of situations.	IA12.F3.1 Acquire, analyze, and apply specialized information and skills from various disciplines in a variety of realistic circumstances.
IA9.F3.2 Demonstrate the appropriate use of information as directed.	IA10.F3.2 Access and use a range of relevant information, material, and human resources with limited direction.	IA11.F3.2 Acquire and use a range of relevant information, material, and human resources, and recognize when additional resources are required.	IA12.F3.2 Support and enhance basic information requirements by using a wide variety of information, material, and human resources.

Personal Skills



General Learning Outcome

GLO P1 **Time Management:** Demonstrate responsibility in time management, task completion, and in meeting project criteria. (Note: based on the Conference Board of Canada's Personal Management Skills)

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.P1.1 Demonstrate responsibility in time management.	IA10.P1.1 Demonstrate responsibility in time management.	IA11.P1.1 Demonstrate responsibility in time management.	IA12.P1.1 Demonstrate responsibility in time management.
IA9.P1.2 Demonstrate responsibility in being accountable for one's actions.	IA10.P1.2 Demonstrate responsibility in being accountable for one's actions.	IA11.P1.2 Demonstrate responsibility in being accountable for one's actions.	IA12.P1.2 Demonstrate responsibility in being accountable for one's actions.
IA9.P1.3 Arrive at class prepared with materials and completed assignments.	IA10.P1.3 Arrive at class prepared with materials and completed assignments.	IA11.P1.3 Arrive at class prepared with materials and completed assignments.	IA12.P1.3 Arrive at class prepared with materials and completed assignments.
IA9.P1.4 Complete all assigned tasks within stated deadlines.	IA10.P1.4 Complete all assigned tasks within stated deadlines.	IA11.P1.4 Complete all assigned tasks within stated deadlines.	IA12.P1.4 Complete all assigned tasks within stated deadlines.
IA9.P1.5 Complete all projects according to specified criteria.	IA10.P1.5 Complete all projects according to specified criteria.	IA11.P1.5 Complete all projects according to specified criteria.	IA12.P1.5 Complete all projects according to specified criteria.

Personal Skills

General Learning Outcome

GLO P2 **Ethical Decision Making:** Make ethical decisions concerning the impact of one’s activities and the use of technology.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
<p>IA9.P2.1 Make personal judgments whether certain behaviours/actions are right or wrong.</p> <p>IA9.P2.2 Demonstrate an understanding of technological impact on the environment, society, lifestyles, etc.</p>	<p>IA10.P2.1 Assess how personal judgments affect peer members and/or community members.</p> <p>IA10.P2.2 Demonstrate an understanding of the impact of technological choices.</p>	<p>IA11.P2.1 Assess the implications of personal/group actions within the broader community.</p> <p>IA11.P2.2 Develop and implement risk management strategies for a variety of technological activities.</p>	<p>IA12.P2.1 Analyze the implications of personal/group actions within the global context.</p> <p>IA12.P2.2 State and support a personal code of ethics as required.</p> <p>IA12.P2.3 Demonstrate responsible leadership in managing current and future technologies on the environment and on society.</p>

Personal Skills



General Learning Outcome

GLO P3 **Career Planning:** Develop an action plan relating personal aptitudes and abilities to occupational opportunities.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.P3.1 Identify critical skills needed for employability in today's workplace.	IA10.P3.1 Evaluate employability profiles for a variety of workplaces and careers.	IA11.P3.1 Develop strategies to assess personal technological literacy and capability.	IA12.P3.1 Assess specific personal skills, interests, and abilities (career portfolio).
IA9.P3.2 Demonstrate an awareness of the technologies of specific occupations and workplaces.	IA10.P3.2 Outline skills required for a specific career path.	IA11.P3.2 Perform an assessment of personal strengths and weaknesses (career portfolio).	IA12.P3.2 Develop a plan for acquiring the technological capabilities required to achieve a career vision (career portfolio).

Personal Skills

General Learning Outcome

GLO P4 **Safe Practices:** Demonstrate safe practices with tools, machines, materials, and related processes. (Refer to: Keeping Your Facilities SAFE: A Support Document for Industrial Arts Teachers, Manitoba Education and Youth, 2003.)



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.P4.1 Follow personal and environmental health and safety procedures.	IA10.P4.1 Recognize and follow personal and environmental health and safety procedures.	IA11.P4.1 Establish and follow personal and environmental health and safety procedures.	IA12.P4.1 Transfer and apply personal and environmental health and safety procedures to a variety of environments and situations.
IA9.P4.2 Identify immediate hazards and their impact on self, others, and the environment.	IA10.P4.2 Identify immediate and potential hazards and their impact on self, others, and the environment.	IA11.P4.2 Identify immediate and potential hazards and assess their impact on self, others, and the environment.	IA12.P4.2 Identify immediate and potential hazards and assess their impact on self, others, and the environment, and recommend safe procedures.
IA9.P4.3 Identify and follow appropriate emergency response procedures.	IA10.P4.3 Identify and follow appropriate emergency response procedures.	IA11.P4.3 Identify and follow appropriate emergency response procedures.	IA12.P4.3 Identify and follow appropriate emergency response procedures.

Personal Skills



General Learning Outcome

GLO P5 **Positive Attitude:** Demonstrate positive attitudes to learning in Industrial Arts facilities.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.P5.1 Listen, in order to understand and learn.	IA10.P5.1 Listen and respond, in order to understand and learn.	IA11.P5.1 Listen and respond, in order to understand, learn and teach.	IA12.P5.1 Listen and respond, in order to understand, learn, teach, and evaluate.
IA9.P5.2 Demonstrate a willingness to continuously learn.	IA10.P5.2 Assess personal learning needs (i.e., personal learning style).	IA11.P5.2 Identify learning sources and opportunities.	IA12.P5.2 Set learning goals and develop a personal learning plan.
IA9.P5.3 Actively participate in a positive manner.	IA10.P5.3 Actively participate in a positive manner.	IA11.P5.3 Actively participate in a positive manner.	IA12.P5.3 Actively participate in a positive manner.

Personal Skills

General Learning Outcome

GLO P6 **Teamwork:** Adapt strategies to work effectively, independently, or as a team member to complete a project.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.P6.1 Demonstrate an understanding of the role of members of a team.	IA10.P6.1 Contribute to a team to achieve its mandate.	IA11.P6.1 Identify the need to lead and/or support in a team situation, in order to achieve the team mandate.	IA12.P6.1 Understand and work with others on a "job" to achieve the best results.
IA9.P6.2 Acknowledge the opinions and contributions of all team members.	IA10.P6.2 Respect the opinions and contributions of all team members.	IA11.P6.2 Seek and appreciate the opinions and contributions of all team members.	IA12.P6.2 Lead and/or support as appropriate to motivate a team for high performance.
IA9.P6.3 List and define team objectives.	IA10.P6.3 Contribute to the development of team objectives and goals.	IA11.P6.3 →	IA12.P6.3 Develop and/or refine a team approach based on needs and benefits.

Production Skills



General Learning Outcome

GLO MW1 **Metalurgy:** Demonstrate an understanding of metallurgy—science and processes.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW1.1 Identify common metals and their classification.	IA10.MW1.1 →	IA11.MW1.1 →	IA12.MW1.1 Select metal for projects and applications based on its physical and mechanical properties.
IA9.MW1.2 Interpret the SAE and AISI coding systems of metal	IA10.MW1.2 →	IA11.MW1.2 →	IA12.MW1.2 →
IA9.MW1.3 Describe a variety of common heat-treating processes including annealing, hardening, tempering, normalizing, case hardening, flame hardening, induction hardening, and laser hardening.	IA10.MW1.3 →	IA11.MW1.3 →	IA12.MW1.3 Apply appropriate hardening processes based on project requirements.
IA9.MW1.4 Explain the powder-metal process and advantages.	IA10.MW1.4 →	IA11.MW1.4 →	IA12.MW1.4 Devise appropriate uses for the powder-metal process.

Production Skills

General Learning Outcome

GLO MW2 **Measurement and Layout:** Use metalworking measurement and layout tools correctly and efficiently.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW2.1 Recognize and apply common measurement standards used in metalworking, including CSA, ANSI, ISO, metric, imperial...	IA10.MW2.1 →	IA11.MW2.1 →	IA12.MW2.1 →
IA9.MW2.2 Identify and use several common measurement tools used in metalworking, including rules, micrometers, dial indicators, gauges...	IA10.MW2.2 →	IA11.MW2.2 →	IA12.MW2.2 Identify and use most common measurement tools used in metalworking, including rules, micrometers, dial indicators, gauges...
IA9.MW2.3 Identify and use several common layout tools used in metalworking, including callipers, dividers, squares...	IA10.MW2.3 →	IA11.MW2.3 →	IA12.MW2.3 Apply appropriate layout techniques to the creation of a metalwork project.

Production Skills



General Learning Outcome

GLO MW2 **Separation:** Apply separation processes to metal.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW3.1 Identify several common metal separation processes such as cutting, drilling, grinding, turning, milling, and the use of electrical arc and gas torch...	IA10.MW3.1 →	IA11.MW3.1 →	IA12.MW3.1 Explain and demonstrate most common metal separation processes.
IA9.MW3.2 Apply several sheet and bench metal separation processes to a metal product.	IA10.MW3.2 Apply several common machine, gas torch, and electrical arc separation processes to a metal product.	IA11.MW3.2 →	IA12.MW3.2 Determine and apply the appropriate metal separation processes required to safely create a metal product.

Production Skills

General Learning Outcome

GLO MW4 **Fastening:** Apply fastening processes to metal.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW4.1 Identify several common metal fastening processes such as using threaded fasteners, riveting, welding, gas torch fastening, electric arc fastening...	IA10.MW4.1 →	IA11.MW4.1 →	IA12.MW4.1 Explain and demonstrate most common metal fastening processes.
IA9.MW4.2 Apply several mechanical, common gas torch and electrical arc metal fastening processes to a metal product.	IA10.MW4.2 →	IA11.MW4.2 →	IA12.MW4.2 Determine and apply the appropriate metal fastening processes required to safely create a metal product.

Production Skills



General Learning Outcome

GLO MW5 **Forming and Casting:** Apply forming and casting processes to metal.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW5.1 Identify several common metal forming and casting processes such as sheet metal forming, wrought-iron forming, forging, foundry...	IA10.MW5.1 →	IA11.MW5.1 →	IA12.MW5.1 Explain and demonstrate most common metal-forming processes.
IA9.MW5.2 Apply several mechanical-forming processes to a metal product.	IA10.MW5.2 →	IA11.MW5.2 →	IA12.MW5.2 Determine and apply the appropriate metal-forming processes required to safely create a metal product.

Production Skills

General Learning Outcome

GLO MW6 **Finishing:** Apply finishing processes to metal considering their environmental impact.



Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW6.1 Identify several common metal-finishing processes such as painting, peening, plating, polishing...	IA10.MW6.1 →	IA11.MW6.1 →	IA12.MW6.1 Explain and demonstrate most common metal-finishing processes.
IA9.MW6.2 Apply several common metal-finishing processes to a metal product.	IA10.MW6.2 →	IA11.MW6.2 →	IA12.MW6.2 Determine and apply the appropriate finish to a metal product.
IA9.MW6.3 Explain the environmental impact of most common metal-finishing processes.	IA10.MW6.3 →	IA11.MW6.3 →	IA12.MW6.3 →

Production Skills



General Learning Outcome

GLO MW7 **Current Innovation:** Demonstrate an understanding of current innovation in metalwork processes, applications, and emerging new technologies.

Grade 9 Specific Learning Outcome(s)	Grade 10 Specific Learning Outcome(s)	Grade 11 Specific Learning Outcome(s)	Grade 12 Specific Learning Outcome(s)
IA9.MW7.1 Identify several current innovations in metalworking such as Computer Numerical Control, jewellery fabrication...	IA10.MW7.1 →	IA11.MW7.1 →	IA12.MW7.1 Research, explain, and demonstrate several current innovations in metalworking.