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ESSENTIAL SKILLS CHECKLIST

Reading Text, Document Use, Writing

Thinking Skills: Decision Making, Critical Thinking

As mentioned in your Student Notes, you will have time at the end of each class to identify the Essential Skills you used during the class. You will be asked to work individually to complete your own checklist.

We recommend keeping your checklist at the front or back of your Student Notes so that it will be easy to find.

TASK STEPS

YOU WILL NEED:

- ✓ a pen/pencil
- ✓ your individual Essential Skills Checklist

- Work independently
- Review your own Essential Skills Checklist
- Assess all of the Essential Skills you demonstrated in class today
- Complete the checklist

Essential Skills provide the foundation that makes it possible for people to learn all other skills. These are the skills that will help you find and keep a job and manage change at work.

Essential Skills Checklist – Blacksmithing

Reading Text – Read sentences or paragraphs. Scan for information, skim for overall meaning and read a full text to understand, learn, critique or evaluate

Read Student Notes ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Find information using the Table of Contents and/or scan your notes for information and answers to questions ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Read and follow the step-by-step instructions in a task Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____ Task #: _____	Read material from other books, manuals and websites - identify those resources below.
Other, please list:	

Essential Skills Checklist – Blacksmithing

Document Use – Read signs, labels or lists, interpret information on graphs or charts and enter information on forms

Complete an attendance/sign-in sheet ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Read bulleted lists in your Student Notes and in the tasks ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Read and understand a document Material Safety Data Sheets (MSDS): ☐ _____ ☐ _____ Quiz ☐ ☐ ☐ ☐ ☐ Other Documents: ☐ _____ ☐ _____	Read and understand labels on product containers ☐ Product: _____ ☐ Product: _____ ☐ Product: _____ ☐ Product: _____
Read and understand a chart ☐ Avoiding Injuries Summary ☐ Carbon Content Chart ☐ Burn Summary ☐ Imperial and Metric Reference Chart ☐ Safety Checklist ☐ Temperature and Colour Other_____	Complete a chart Essential Skills Wall Chart ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ This Essential Skills Checklist: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Other Charts: ☐ _____ ☐ _____
Other, please list:	

Essential Skills Checklist – Blacksmithing

Writing – Write text and fill in forms. Organize, record or document, inform or persuade and request information	
Make notes in your Student Notes ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Record notes to track your research ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Record notes when you are completing a task ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Record notes in a group discussion ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Other, please list:	
Numeracy – Use numbers and think in quantitative terms. Numerical estimation and numerical calculations including money math, scheduling or budgeting and accounting, measurement and calculation and data analysis.	
Arrive on time and finish tasks on time ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Move between SI (Metric) and Imperial measurements or Fahrenheit and Celsius ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Use a ruler or tape measure ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Move between fractions and decimals ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Measure metal ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Use a square and/or calipers ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Essential Skills Checklist – Blacksmithing

Measure and/or identify angles ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Use a calculator ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Track time in minutes and/or hours ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Read a diagram ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Add two measurements e.g. 1 mm + 1 mm = 2 mm ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Other, please list:

Oral Communication – Use speech to give and exchange thoughts and information. Greet people, reassure, or persuade, seek or obtain information, resolve conflicts, facilitate or lead a group.

Talk with others as you worked ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Present on behalf of your group ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Ask questions of the instructor and/or discuss your progress ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Talk with your work partner ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Give or receive feedback (help, advice, ideas, opinions) ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participate in group brainstorming activities and/or discussions ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Report an accident, spill, injury or problem with equipment ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Listen to and follow directions ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Other, please list:	

Essential Skills Checklist – Blacksmithing

Thinking Skills – A process of evaluating ideas or information to reach a rational decision. Problem solving, decision making, critical thinking, job task planning and organizing, significant use of memory, finding information (each Thinking Skill is outlined below)

Problem Solving (Thinking Skills) – A problem requires a solution

Fix metal that has a bend in the wrong place ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Fix metal that has bowed out ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Fix metal that has hammer marks ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Fix metal that has been overheated ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Adjust the forge when it's the wrong temperature ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Fix problems as you work ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Troubleshoot equipment problems ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Other, please list:

Decision Making (Thinking Skills) – Make a choice among options

Select/ wear appropriate clothing ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Decide on steps for doing a task ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Make a group decision ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Decide which project to work on ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Decide on the tools you will use ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Decide on the techniques you will use for a project ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Essential Skills Checklist – Blacksmithing

Decide on the techniques you will use for a project ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Deciding on a technique for protecting your finished piece ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Deciding on a process for hardening/tempering ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Decide who to work with on a project or task ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Decide to pursue training in blacksmithing ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Other, please list:

Critical Thinking (Thinking Skills) – Evaluate ideas or information using a rational, logical, thought process and refer to objective criteria to reach a rational judgment about value or to identify strength and weakness (judge, assess, evaluate, consider, review)

Assess your surroundings for safety and cleanliness before starting and ending your work ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Evaluate tools before using them ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Assess the forge for safety ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Assess the job and select the tools and materials ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Assess your work and identify problems and strengths ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Evaluate your work and assess your progress and skill development ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Assess the work of others ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Assess your techniques and make necessary adjustments ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate angles ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Assess metal temperature ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Essential Skills Checklist – Blacksmithing

Evaluate metal for each project: is it the right size, and shape? ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Other, please list:
Job Task Planning and Organizing (Thinking Skills) - Plan and organize your own job tasks.	
Organize activities in your day, within the structure of the course ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Identify an overall plan for completing a project ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Have all tools, equipment and materials ready before you start ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Plan your steps before you begin heating metal ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Schedule your work so you finish the project on time ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Identify your next steps, after this course has ended ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Other, please list:	
Significant Use of Memory (Thinking Skills) - Over and above things you need to remember on a day-to-day basis	
Remember solutions to common blacksmithing problems ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Remember the Essential Skills and Technical Skills you demonstrated in class ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Other, please list:	

Essential Skills Checklist – Blacksmithing

Finding Information (Thinking Skills) – Use a variety of sources for information	
Find additional blacksmithing information and resources ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Search for information required to complete the tasks ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Find information to share with the others in the group ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Find answers to a quiz or question ☐ ☐ ☐ ☐ ☐
Other, please list:	

Working with Others – Work independently, jointly with a partner, as a member of a team or as a supervisor or leader.	
Work with others to solve problems ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Work with others to generate a list through brainstorming ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Work independently on your project ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Work with one other person on a task or project ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Work with others in small and large groups to complete tasks ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Take a leadership role ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Other, please list:	

Essential Skills Checklist – Blacksmithing

Continuous Learning – Ongoing process of gaining new skills and knowledge through others, on the job or through formal training	
Research and/or sign up for another course or workshop ☐ ☐ ☐ ☐ ☐	Other, please list:

Computer Use – Use the internet, word processing software, email or create spreadsheets	
Open a web browser ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Enter a URL into the address bar on your computer ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Use a search engine to find blacksmithing information ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Follow links to blacksmithing websites ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Watch online videos about blacksmithing ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Send an email to a friend, another student or the instructor about the class ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Print information or a file ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Other please list:

ESSENTIAL SKILLS PROFILE REVIEW

Reading Text, Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

As mentioned in your Student Notes, there are nine Essential Skills needed for success in almost every job.

Essential Skills Include:

- Reading
- Document Use
- Numeracy
- Writing
- Oral Communication
- Working with Others
- Thinking Skills
    - Problem Solving, Decision Making, Critical Thinking, Job Task Planning and Organizing, Significant Use of Memory, Finding Information
- Continuous Learning
- Computer Skills

Note: We are not assuming that you will want to be a forging machine operator or that this course will prepare you to work as one.

Essential Skills Website: http://srv108.services.gc.ca/english/general/home_e.shtml

TASK STEPS

YOU WILL NEED:

- ✓ a pen/pencil or highlighter

STEP ONE:

- Work independently to scan the Forging Machine Operator Profile on the pages following this task
- Decide which three of the nine Essential Skills you would consider to be the most important for someone in this field
- Circle or highlight to mark your three choices

STEP TWO:

- Discuss the profile as a group
    - How could reading Essential Skills profiles help you make a career decision or help you with your job search?
- Discuss your three Essential Skills choices

The following information has been gathered from the Essential Skills Profile for Welders found at the Human Resources and Skills Development Canada website: http://srv108.services.gc.ca/english/profiles/215.shtml. This site has the full, detailed Welder profile as well as many other occupational profiles.

FORGING MACHINE OPERATORS

NOC 9512

INTRODUCTION

Forging machine operators operate forging machines to form and shape metal into various shapes and sizes and impart desired strength, hardness or other characteristics. They are employed primarily in the fabricated metal products, machinery, and transportation equipment industries.

READING TEXT

- read routine memos and notices about safety posted around work areas to stay up-to-date on related company policies and recommended practices
- read routine memos and notices about safety posted around work areas to stay up-to-date on related company policies and recommended practices
- may read a newsletter to stay informed about industry trends
- may read reports from head office to obtain information on production problems and corresponding set up changes which need to be implemented
- read various manuals to find information about operating forging machines or about quality assurance

DOCUMENT USE

- may complete checklist forms to provide standardized orientation for new workers
- read labels on gas pipes and water lines to operate furnaces
- read Workplace Hazardous Materials Information System (WHMIS) labels to obtain safety information
- read work orders to obtain such product information as quantity, dimensions and type and gauge of steel to use
- interpret sketches, drawn by co-workers, to learn how to set up machines for a specific order

- read tables to obtain data such as the temperature requirements for forging pipes, die code numbers and corresponding shelf numbers indicating where they are stored
- interpret isometric drawings to bend metal according to the customer's specifications and blueprints to set up the machine for the required tolerances
- complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported
- read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported
- read tables, schedules or other table-like text (e.g., read work shift schedules)
- recognize common angles such as 15, 30, 45 and 90 degrees
- draw, sketch or form common shapes such as circles, triangles, spheres, rectangles, squares, etc
- interpret scale drawings (e.g. blueprints or maps)
- take measurements from scale drawings
- read assembly drawings (e.g. those found in service and parts manuals)
- make sketches
- obtain information from sketches, pictures or icons (e.g., computer toolbars)

WRITING

- write brief comments on a work order, such as an explanation of why a customer's order cannot be met in full
- maintain log books to record production data including product numbers, quantities produced, dates, shifts and the number of each drawing used
- may complete progress report forms after every 100 pieces produced to comply with quality control procedures set by the International Standards Organization (ISO)

- complete rejection tags or nonconformance reports of up to a paragraph in length to describe why defective materials do not meet quality control standards
- may prepare accident investigation forms requiring more than one paragraph to record the results of accident investigations

ORAL COMMUNICATION

- speak to suppliers to make sure that the required sizes of pipes are available
- communicate with other forging machine operators to co-ordinate shared access to machines, to give instructions to junior operators and to exchange job-related information
- may communicate with partners to jointly accomplish tasks or with helpers to provide information and oversee their work
- may interact with co-workers in the capacity of group leader to provide explanations and assist workers who are having problems
- interact with their supervisors to obtain work assignments, provide progress reports and discuss production problems
- interact with millwrights to discuss the symptoms of equipment problems
- interact with workers in other departments, such as engineering and quality control, to exchange information and to obtain feedback
- Needs to manage noise from equipment, such as furnaces and forging machines, coupled with the use of hearing protection, makes verbal communication difficult.

NUMERACY

- measure dimensions, such as the diameter and length of pipes, and measure furnace temperatures to perform routine job tasks. (Measurement and Calculation Math)
- take a variety of measurements to ensure that pipe dimensions are as specified. (Measurement and Calculation Math)
- calculate the number of steel rods needed to make 600 18-inch steel bolts. (Measurement and Calculation Math)

- take precise measurements, using callipers and micrometers, to obtain some of the data needed for identifying whether the item is within tolerance limits. (Measurement and Calculation Math)
- may calculate how much pipe will be required to complete bends, which are given as degrees of rotation around a circle with a fixed radius. (Measurement and Calculation Math)
- estimate how many pieces are in a box or on a lift, in case they need to make set up adjustments such as splitting up a lot. (Numerical Estimation)
- estimate heating times for metal to ensure that it reaches the correct temperature, considering such variables as the size of steel and complexity of the dies. (Numerical Estimation)

For example:

- reading whole numbers shown on blueprints or subtracting the number of parts made from the number ordered to calculate the outstanding number of parts to be made, or counting 250 blanks into boxes and multiplying (250) (number of boxes) to get a daily count of products produced
- reading metal rod sizes, such as 7/16 inch, or dividing a pipe's diameter in two to calculate its radius
- taking measurements using callipers or other metric instruments or calculating whether a measurement is within prescribed tolerance limits
- identifying the decimal equivalent of a fraction, using equivalency tables, to use tools interchangeably
- applying formulae to calculate the perimeter of a circle or to calculate the length of steel needed for a bolt, given its shank and head dimensions and the length of a steel rod
- converting between the metric and imperial measurement systems, such as between inches and centimeters
- calculating the perimeter of circles, or calculating a part circumference of a circle and its corresponding sector angle

Measuring Instruments:

- Time – clock or watch
- Dimensions - using a measuring tape, ruler, micrometer or calipers
- Temperature - using a forging gauge, temperature helical coil or optical pyrometer.
- Pressure – using a gauge
- Electrical potential – volt meter
- Wattage – wattage meter
- Angles – protractor or square
- Measurement – SI (metric) or Imperial Measurement System

THINKING SKILLS

Problem Solving

- may notice that metal "brightens up" when going by on the line, a sign of a particular problem. They address the problem, measuring edges and making welds
- may notice temperature fluctuations in the furnace which threaten the quality of the final product. They make temperature adjustments to the furnace at various intervals, drawing on their experience to time the adjustments so that an even temperature is consistently maintained
- may deal with defective materials, such as faulty pipe seams which break when bent. They identify whether they should modify the bending process to perform a more gradual bend or whether the pipe needs to be upgraded to a heavier type
- may observe that a machine was running too hot, scarring the eye nuts under production. They use their judgement in recommending whether the scarred pieces are in conformance with quality control standards and, if not, write a non-conformance report. They then identify the cause of the problem, using a process of elimination, and make the necessary corrections, such as removing a piece of metal stuck in the machine

- may be informed that stress tests show cracks in the weld. They collaborate with their foreperson to assess the probable cause of the problem, which may relate to whether the pipe was formed correctly. Together they decide on what corrective measures to take, such as changing the angle of a fin, and have a second stress test taken to determine the success of the actions taken

Decision Making

- decide when the colour of metal indicates proper forging temperature
- decide whether to obtain a new die or improvise with a similar die when it is worn out or missing, justifying their actions to their supervisor
- decide what constitutes safe working practices at all times to protect the well being of themselves and others
- decide whether the metal products that they have produced meet quality assurance standards

Critical Thinking

Not available for this profile

Job Task Planning and Organizing

- own job planning and organizing
- perform repetitive tasks but the content of the tasks may vary depending on the work at hand. Work priorities and related deadlines are tied to customer demand and forepersons provide most forging machine operators with work order assignments detailing this information. Forging machine operators whose companies have adopted team principles may allocate work as a team at the beginning of each shift. Most forging machine operators have wide scope to determine the order of tasks, sequencing multiple tasks for efficiency by, for example, ensuring that machines, equipment and supplies are available when needed. Some co-ordinate with the work plans of other machine operators to arrange shared access to machines and to arrange for assistance in performing heavy job tasks.

Significant Use of Memory

- remember procedures to operate heaters and forging machines and to troubleshoot minor problems

- memorize tool codes to identify when the use of various hand tools is specified

Finding Information

- refer to blueprint books to verify the product specifications for a particular job
- speak with their supervisor to find information needed to troubleshoot process problems
- refer to manuals to find information on how to set up forging machines for various jobs. This may be deemed mandatory as a quality assurance measure
- speak with journeypersons working in the plant, such as electricians and millwrights, to seek electrical or mechanical information needed to troubleshoot quality control problems which may be equipment related

WORKING WITH OTHERS

Most forging machine operators work independently to form and shape metal under the direction of a supervisor. Some forging machine operators, working for companies which have adopted team principles, work independently as a team under the direction of a group leader. They co-ordinate with: supervisors or group leaders to troubleshoot production problems; co-workers to exchange/arrange shared access to machines; quality control staff to ensure that products meet quality assurance standards; and, workers in other classifications, such as millwrights to provide information about machine problems. They may work with another forging machine operator or a helper to complete large or complex tasks.

COMPUTER USE

- use computer or computer-controlled machinery or equipment with no knowledge of software required. For example, they may use computer-controlled forging machines or they may use customized programs for just-in-time (JIT) inventory systems

CONTINUOUS LEARNING

Forging machine operators have a need for ongoing learning to acquire information about new products, machining procedures, quality assurance and to maintain safety skills and knowledge. Some forging machine operators may have an additional need for ongoing learning to operate computer-controlled forging machines. New learning is acquired through informal means as part of regular work activities and by participating in training sessions primarily offered in the workplace.

OTHER INFORMATION

In addition to collecting information for this Essential Skills Profile, our interviews with job incumbents also asked about the following topics.

Physical Aspects

Forging machine operators stand, walk, bend and stretch to operate furnaces and forging machines.

Attitudes

The forging machine operators interviewed felt that forging machine operators should be patient, hard working and willing to work in extreme heat. They should be safety conscious.

Future Trends Affecting Essential Skills

More companies may decide to seek International Standards Organization (ISO) certification to gain a competitive edge. As a result, forging machine operators may be required to read text and write more frequently to find and record information for ISO documentation. They may also require more complex numeracy skills to maintain Statistical Process Control (SPC) standards. These changes may place more emphasis on continuous learning requirements.

GIVING AND RECEIVING FEEDBACK

Document Use, Writing, Oral Communication

TASK STEPS

YOU WILL NEED:

- ✓ flipchart paper or a blank sheet of paper
- ✓ marker

Brainstorming: a technique where all ideas are listed before you move on to the critical thinking and decision making stages. Each member of the group shares their ideas. No idea is discussed or disregarded. It is usually done in a group but can be done independently.

STEP ONE:

- Work as a group
- Discuss the difference between feedback and criticism

STEP TWO:

- Appoint a recorder for the group
    - The recorder will:
        - divide a piece of paper in half
        - write "Giving" on one side and "Receiving" on the other side
        - record the group discussions
- Brainstorm the things that you think are important to remember when giving feedback
- Post the list you have created so you can use it throughout this course

USING THE INTERNET

Reading Text, Document Use, Computer Use

Thinking Skills: Decision Making, Finding Information

There may be times in this course when you want or need to use the internet to search for information about blacksmithing. You may also want to use the internet to find blacksmith videos. This task will introduce you to the basics of using a browser and a search engine to find information. However, before you complete the task, take a few minutes to read the following definitions.

Desktop: The screen you will see when you turn on your computer. You will see icons for the software programs you have on your computer. Double clicking on the icons will open the software program.

Desktop Icon: An image or graphic that provides a link to software, often called a Shortcut.

Web Browser: Software used to access information on the World Wide Web. Most people are familiar with the browser called Windows Internet Explorer; however Mozilla Firefox, Apple Safari, Google Chrome and Opera are examples of other web browsers you can use.

Log on: Connecting to the internet using a web browser.

URL: URL stands for Uniform Resource Locator. This is the address that tells your computer where to find the file on the internet. It usually starts with http://www.

Address Bar: This is the area at the top of your screen where you enter a URL or web site address.

Web Search Engine: A tool designed to help you search for information on the World Wide Web. When you enter the information you are searching for (e.g. a word, a term or a phrase) and click search, a list of related websites will display on your screen. From there you can visit any web site that looks like it will provide you with the information you need.

Bookmarks: When you are visiting a web site that you want to return to at a later date you can bookmark the site. This allows you to store the URL on your computer. When you open the web browser in the future and click on "Bookmarks", you will see all of your bookmarked sites. If you click on the site name you will return to the web site without having to complete another search or remember the URL.

Note: If you look at the menu at the top of the Firefox web browser you will see the word "Bookmarks" and in Internet Explorer you will see the word "Favorites".

TASK STEPS

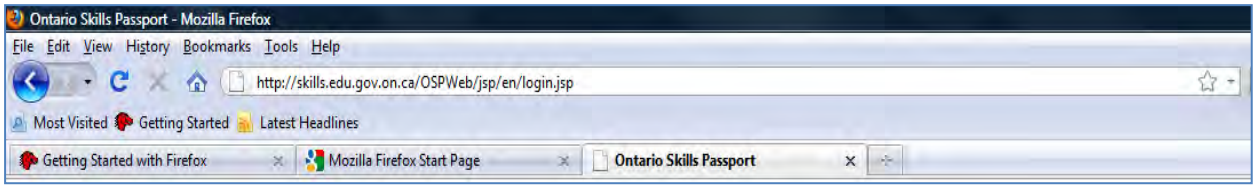
YOU WILL NEED:

- ✓ a computer with internet access
- ✓ access to a web browser
- ✓ a search engine

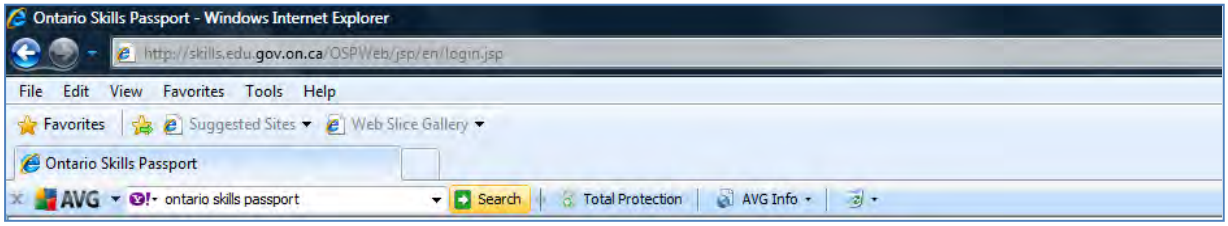
STEP ONE:

- Work independently to complete this task
    - You will need access to the classroom computer
    - You may also want to work on this task at home
- Log onto the internet using a web browser
- Locate the Address Bar at the top of the page of your web browser
- Enter the following URL into the Address Bar: http://skills.edu.gov.on.ca/OSPWeb/jsp/en/login.jsp

The following is an example of the Firefox Web Browser



The following is an example of the Internet Explorer (IE) Web Browser



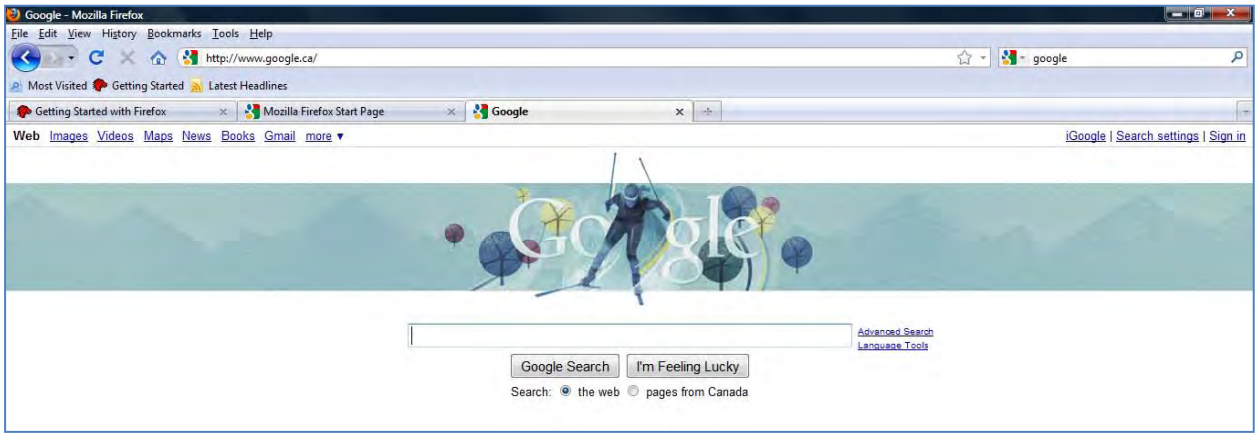
Note: Once you have logged on, stay logged on until you have completed all of the steps in this task.

STEP TWO:

- Enter the address of any search engine into the Address Bar at the top of your screen
    - Common search engines include:

        www.google.com
        www.yahoo.com
        www.bing.com

In the image below http://www.google.ca can be seen in the address bar. This has opened the Google Search Engine Page.

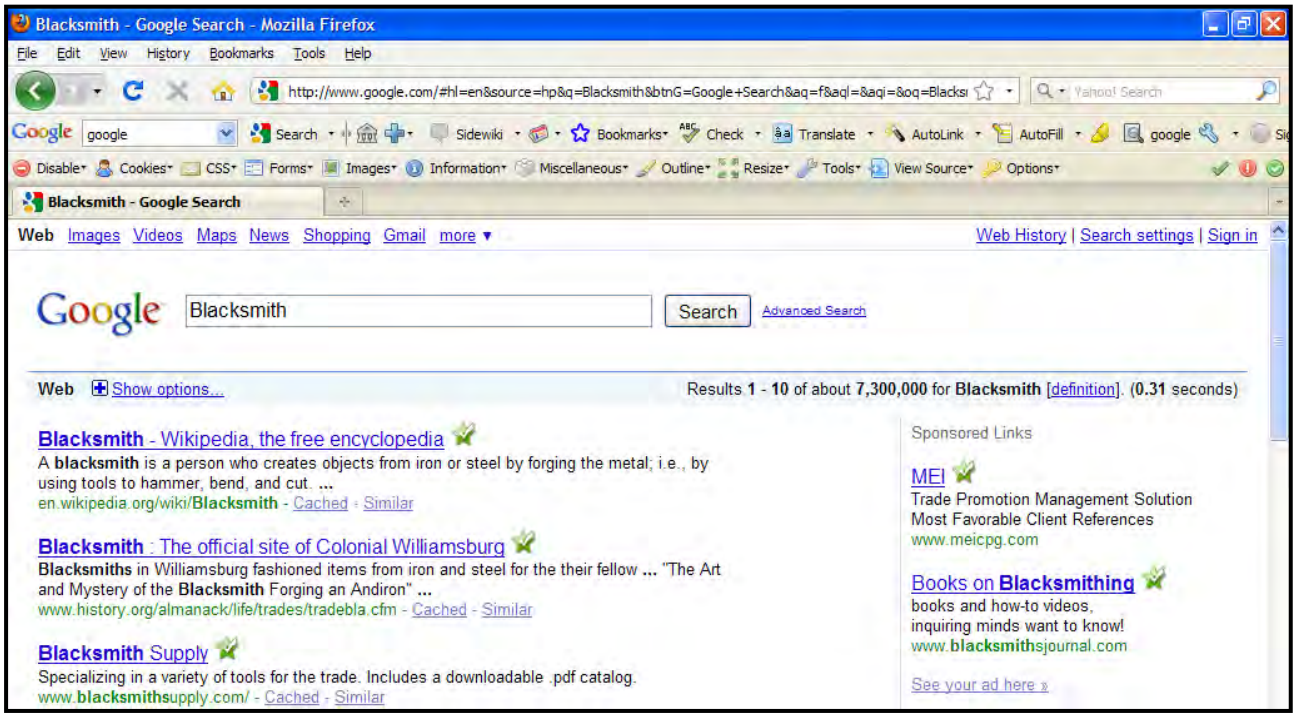


STEP THREE:

- Type the word “Blacksmith” into the search area
- Click “Search”
    - In the example above you would click “Google Search”
    - You can also select “pages from Canada”
- Click on one of the websites listed (blue letters with a blue underline)
    - Visit a few sites before moving on to the next step

Note: Your screen will look similar to the one below.

Example of a page listing websites you can visit:



STEP FOUR:

- Visit the site http://www.anvilfire.com
- Bookmark this site
- Look at the menu at the top of your screen and locate the:
    - "Bookmark" menu if you are using Firefox
    - "Favorites" menu if you are using Internet Explorer
- Click the word "Bookmark" or "Favorites"
    - This will open a drop down menu
- Click:
    - "Bookmark this page" if you are using Firefox
    - "Add to favorites" if you are using Internet Explorer
- Look at your bookmarks to see where this link is displayed
- Spend some time visiting this site

STEP FIVE:

- Look at the list of bookmarked sites on your computer
- Select an existing bookmarked site you would like to visit
- Click to open that site

Note: If you have an electronic file (e.g. a Word Document or PDF) that contains a link to a web site, you can access the site by completing the following steps:

- Open the file
- Find a web site address
    - The link will be blue and underlined
- Place your cursor over the link
- Hold the control - CTRL - key on your keyboard
- Use your cursor to click on the blue underlined URL
    - This will take you directly to the site

SCANNING

Reading Text, Document Use, Writing

Thinking Skills: Decision Making, Critical Thinking

The Essential Skill called Reading Text covers many different types of reading. Reading Text includes reading word for word in order to learn, scanning to find information or skimming to get the gist of the information being presented.

In this course you will be asked to read the Student Notes. This requires that you read the text in detail in order to learn about blacksmithing. You will also be required to read the Essential Skills tasks presented in the course.

Some of the tasks in this course will ask you to scan for information. Scanning means that your eyes will run over the text looking for specific information rather than reading every word. It involves quickly locating keywords and finding specific information. If you are looking for information to help you complete the task or to help you make a decision, you are most likely scanning.

Note: There have been many studies done to track the eye movement of people looking at web sites. It has been found that most people scan rather than read web pages.

The following article is the type of article you might scan if you were interested in learning more about the history of blacksmithing.

TASK STEPS

YOU WILL NEED:

- ✓ a pen/pencil/highlighter

STEP ONE:

- Work independently
- Complete the five questions below by scanning the "**Find a Need and Fill It**" article on the pages following this task
    - Try to complete this exercise by scanning the text only
    - Record your answers in the space available under each question or highlight your answers directly in the article

QUESTIONS

1. In what field did John Deere complete his apprenticeship?

2. Why did cast iron plows not work in the Mid West?

3. What was John Deere's vow?

4. How many plows did John Deer produce in 1868?

5. What year did John Deer die?

http://www.anvilmag.com/smith/tjndrstr.htm

Find a Need and Fill It

published in ***Anvil Magazine*** April, 1996.

John Deere. Today this name is associated with Deere & Company, the world's leading producer of farm equipment. One hundred and fifty years ago it was John Deere, blacksmith.

He grew up in Vermont where he received a common school education and served a four-year apprenticeship learning the blacksmith's trade. In 1825, he began his career as a journeyman blacksmith and gained considerable recognition for his careful workmanship and ingenuity. His highly polished hay forks and shovels especially were in great demand.

As business conditions in Vermont worsened in the mid-1830s, many Vermont natives emigrated to the West, and the tales of golden opportunity that filtered back stirred John Deere's enthusiasm to go west. He left his pregnant wife and four young children behind and moved to Grand Detour, Illinois. His family, which eventually grew to nine children, followed him the next year.

The need for a blacksmith was so great that two days after his arrival in 1836 he had built a forge and gone to work shoeing horses and oxen, and repairing plows and other equipment for the pioneer farmers. From them he learned of the serious problem they encountered in trying to farm the fertile soil of the Midwest. The cast-iron plows they had brought with them from the East were designed for the light, sandy New England soil. The rich midwestern soil clung to the plow bottoms, and every few steps it was necessary to stop and scrape the soil from the plow. Plowing was a slow and laborious task, to the point of discouraging many pioneers, who were seriously considering moving on or heading back east.

Deere recognized a need and, in 1837, through trial and error, built a plow with a uniquely designed polished steel that successfully *scoured* itself clean as it moved through the soil. His first plow was fashioned from a discarded mill saw blade.

He did not abandon his regular blacksmith work at first, but built plows as a sideline. In 1839 he built and, more importantly, sold ten of them. As demand for his plows increased, he gradually devoted all of his effort to their design, manufacture and sale.

It was the practice of that day for blacksmiths to build tools on order for customers. But John Deere took a bold step: He built the plows before he had orders for them. He then took them to the country to be sold - an entirely new approach to manufacturing and selling in those early pioneer days. Word quickly spread of John Deere's *self-polishers*.

There were many problems involved in attempting to operate a manufacturing business on the frontier - a scarcity of steel, few banks, poor transportation, among others. John Deere's first plows had to be produced with whatever pieces of steel he could locate. In 1843, he arranged for a shipment of special rolled steel from England. This steel had to be shipped across the Atlantic Ocean by steamship, up the Mississippi and Illinois Rivers by packet boat, and overland by wagon 40 miles to the little plow factory in Grand Detour.

In 1846, the first slab of cast plow steel ever rolled in the United States was made especially for John Deere and shipped from Pittsburgh to Moline, Illinois, where it was ready for use in the factory Deere opened there in 1848. Moline was well located near water power and transportation offered by the Mississippi River.

In those early years of his business, Deere laid down several precepts that have been followed faithfully since then by the company he founded. Among them was his insistence on high standards of quality. John Deere vowed: "I will never put my name on a plow that does not have in it the best that is in me."

One of his early partners chided him for constantly making changes in design. His partner said his work was unnecessary because the farmers had to take whatever they produced. Deere replied: "No, they don't have to take what we produce. If we don't improve our product, somebody else will."

In 1868, Deere's business was incorporated under the name Deere & Company. By then, the company was producing over 13,000 plows per year in the largest plow factory in the western states. Manufacturing processes were modernized and the product line expanded: walking plows in variations of five sizes, three sizes of breaking plows, as well as double plows, shovel plows, cultivators and harrows. Deere's son, Charles, who was later to succeed him as president, was elected vice president and treasurer. Charles was an outstanding businessman who established marketing centers (called branch houses) to serve the network of independent retail dealers. The business flourished, as it does today.

John Deere's increasing success allowed him to leave the actual operation of his factory to his assistants so that he could fine tune his products and improve their quality. The concept of the interchangeability of parts was a relatively new one, and Deere adopted it with enthusiasm. During this time, he began patenting some of his ideas, securing his first one (molds for casting steel plows) in 1864. He continued until his death in 1886.

ONTARIO SKILLS PASSPORT

Document Use, Oral Communication, Computer Use

Thinking Skills: Decision Making, Finding Information

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil
- ✓ computer and internet

STEP ONE:

- Log onto the internet using a web browser
- Locate the Address Bar in your web browser
- Enter the following URL into the Address Bar:

  http://skills.edu.gov.on.ca/OSPWeb/jsp/en/introduction.jsp
- Spend 10 minutes exploring this site

STEP TWO:

- Remain logged onto the internet
- Enter the following URL into the Address Bar:

  http://www.jobbank.gc.ca/
- Find a job posting that identifies the Essential Skills necessary for the position

STEP THREE:

- Work as a group
- Discuss what you found in your search
  - How could you use the information in these sites?

- How will your knowledge of Essential Skills help you with your job search?

CONTEST

Reading Text, Document Use, Writing,

Thinking Skills: Critical Thinking

This contest is designed to run the length of the course. A draw will be made during the final class.

During the course we ask that you watch for things in the community that could have been made by a blacksmith, for example, park benches, fences, or a sculpture.

Record what you find on a ballot – one ballot for each thing you find.

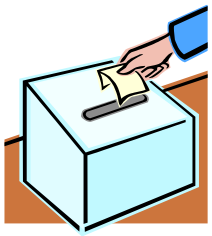
Enter as many times as you want. The more times you enter the better your chances are of winning.

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil
- ✓ a ballot

- Ask your instructor for a ballot
- Fill out a ballot
  - Include your name, what you saw and the location
- Drop your completed ballot into the ballot box



BLACKSMITH - QUIZ ONE

1. Essential Skills provide the foundation that makes it possible for people to learn all other skills.
    a. True
    b. False

2. Essential Skills are made up of three skills: Reading, Writing and Numeracy.
    a. True
    b. False

3. Which of the following jobs is not related to metal work?
    a. Boilermaker
    b. Welder
    c. Die Setter
    d. Ergonomic Designer

4. Even though you will not finish this blacksmith course prepared to work as a Forging Machine Operator, there are some related Essential Skills.
    a. True
    b. False

5. Metal heated in a forge can reach temperatures of up to 1,260 degrees Celsius (2,300 degrees Fahrenheit)
    a. True
    b. False

6. If you heat metal to 1,000 degrees Celsius, what temperature is that in Fahrenheit?
    a. 1,389 Fahrenheit
    b. 2,750 Fahrenheit
    c. 1,832 Fahrenheit
    d. 1,250 Fahrenheit

7. First degree burns are the most serious types of burns and need emergency treatment.
    a. True
    b. False

8. Ergonomics is the science of:
    a. financing a hobby
    b. designing things to meet our human needs
    c. setting the distance between the forge and anvil
    d. welding

9. MSDS stands for:
    a. Mechanical Stress Demonstrated Systems
    b. Manufacturers Safety Data Sheets
    c. Material Safety Data Sheets
    d. Market Stability Demand Stability

10. Hand hammer injuries are in the top five injuries experienced by people working in the metal industry.
    a. True
    b. False

BLACKSMITH - QUIZ TWO

1. Blacksmithing is one of the oldest crafts.
    a. True
    b. False

2. Match the three ages of development with the timelines.

a. Stone Age	Beginning 3300 - 1200 BC
b. Bronze Age	Beginning 2.5 million years ago
c. Iron Age	Beginning 1200 – 550 BC

3. In which technological age was fire not used in tool making?
    a. Bronze Age
    b. Stone Age
    c. Iron Age

4. The carbon content of wrought iron is very low.
    a. True
    b. False

5. The first iron bridge was built in Ironbridge, England. (You may need to guess)
    a. True
    b. False

6. An alloy is:
    a. the study of metals
    b. an early, unscientific form of chemistry where people tried to do things like change metals into gold
    c. a term used when a metal is mixed with another metal or a non-metallic substance
    d. a metal used for making car wheels

7. If you mix copper and tin what alloy do you produce?
    a. Bronze
    b. Gold
    c. Silver
    d. Magnesium

8. In the 1800's, how many nails could a blacksmith make in one minute? (You may need to guess.)
    a. 1
    b. 10
    c. 20
    d. 200

9. How many nails did they need to build a typical Victorian house? (You may need to guess.)
    a. 100
    b. 400
    c. 1,000
    d. 4,000

10. John Deere was a Blacksmith who made the first steel plow in 1838, replacing the hand forged iron plow. (You may need to guess.)
    a. True
    b. False

BLACKSMITH - QUIZ THREE

1. The higher the carbon content the more brittle the metal.
    a. True
    b. False

2. It was believed that Blacksmiths could find witches in the community.
    a. True
    b. False

3. Bloomeries were:
    a. the name for a type of safety clothing worn in the 1700's
    b. an early stone oven-like structure made of clay
    c. tool for adding oxygen to the fire to increase the temperature
    d. a type of anvil tool

4. Ideally, the top of your anvil will be:
    a. about knee height
    b. about waist height
    c. level with the knuckles of your fist if your arm is hanging straight down
    d. level with your elbow, so you have more leverage

5. The horn of an anvil is used with metal if you want to:
    a. round it
    b. bend it
    c. fold it
    d. stretch it
    e. all of the above

6. Calipers are a measuring tool used for measuring:
    a. external diameter
    b. length
    c. internal dimensions
    d. right angles
    e. A and C

7. You want to select the heaviest hammer so gravity does the work for you.
    a. True
    b. False

8. The best type of forge for beginners is a gas forge.
    a. True
    b. False

9. What is the most important thing to consider when you are hitting metal with a hammer?
    a. The force of your swing
    b. Your accuracy
    c. The size of the hammer
    d. The number of times you can swing the hammer in one minute

10. Modern day Blacksmiths use power tools, which means they no longer need to worry about technique.
    a. True
    b. False

BLACKSMITH - QUIZ FOUR

1. Which type of fuel was not used in a forge?
    a. Charcoal
    b. Coal and Coke
    c. Wood
    d. Natural Gas and Propane

2. When the word forge is used as a noun it means:
    a. a furnace used to heat metal
    b. the blacksmith shop
    c. shaping metal by using force
    d. A and B

3. Before they begin to work a piece of metal, what colour does a Blacksmith look for?
    a. Orange or Yellow
    b. Cherry Red
    c. Black
    d. White

4. In most cases you don't want metal to exceed:
    a. 1,083 degrees Celsius (1,981 degrees Fahrenheit)
    b. 426 degrees Celsius (800 degrees Fahrenheit)
    c. 147 degrees Celsius (297 degrees Fahrenheit)
    d. 1,316 degrees Celsius (2,400 degrees Fahrenheit)

5. Many burns happen with black heat. This is when metal is as hot as 426 degrees Celsius (800 degrees Fahrenheit) but still looks black.
    a. True
    b. False

6. What are the two most common mistakes made by new Blacksmiths?
    a. They remove the metal from the forge before it is ready
    b. The pick advanced projects
    c. They continue hammering when the metal should be returned to the fire
    d. They forget to watch the metal in the forge

7. You can change the size and shape of metal, however, the volume will stay the same unless you cut off a piece. Therefore, if you shorten metal with hammer blows it will become:
    a. thinner
    b. thicker
    c. flatter
    d. weaker

8. Upsetting is a technique used to:
    a. bend and twist metal
    b. decrease the length and increase the diameter of metal
    c. increase the length and decrease the diameter of metal

9. A rivet is a:
    a. type of scrolling
    b. metal pin
    c. tool used for punching a hole in metal

10. What causes gouge marks in metal?
    a. Heating it to a high temperature
    b. Striking the metal with the edge of the hammer head
    c. Using the wrong anvil tool
    d. Hitting the metal after it has cooled

BLACKSMITH - QUIZ FIVE

1. Bronze is an alloy combining which two metals?
    a. Silver and Copper
    b. Copper and Tin
    c. Copper and Zinc

2. Steel is an alloy of:
    a. Iron and Carbon
    b. Silver and Copper
    c. Iron and Tin

3. Historically, a Blacksmith would start their ten year apprenticeship as young as …
    a. 7
    b. 17
    c. 27

4. Historically, Blacksmiths played a critical role in the community. In addition to making and fixing tools, it was not uncommon for a blacksmith to also hold this role. (You may need to guess.)
    a. Pub Operator
    b. Doctor
    c. Dentist
    d. Sheriff

5. If unprotected iron is exposed to oxygen and moisture, how long before it rusts to nothing? (You may need to guess.)
    a. 100 years
    b. 500 years
    c. 1,000 years
    d. 10 years

6. Years ago, the Smith family of England was well known for their work with black metal. Soon people started to call anyone doing this type of metal work a Blacksmith. (You may need to guess.)
    a. True
    b. False

7. Which words can be used to describe metal?
    a. Opaque, ductile, malleable and conductive
    b. Transparent, water soluble and fragile
    c. Heat resistant, electronegative and brittle
    d. A and C

8. Diffuse means:
    a. remove the fuse
    b. to spread something throughout something else
    c. remove the grains of the metal
    d. cool the metal quickly

9. Which of the following is not used for protecting metal?
    a. Beeswax
    b. Flux
    c. Linseed Oil
    d. Paint

10. It is important to plan your project before you begin. What is the most important planning step?
    a. Measuring and sketching
    b. Writing out step-by-step instructions
    c. Identifying all the materials you will need
    d. Identifying all the tools you will need
    e. All of the above

MATERIAL SAFETY DATA SHEETS

Reading Text, Document Use, Oral Communication, Writing

Thinking Skills: Finding Information

Material Safety Data Sheets – MSDS are documents written for people who use hazardous materials. They contain information about the physical or chemical hazards associated with using the material. They outline the safe handling, storage and disposal as well as steps for dealing with emergencies, fires, spills and overexposure.

Any material covered by the Workplace Hazardous Materials Information System (WHMIS) must have an MSDS. This means that if you are working with a hazardous substance, you must have access to MSDS in your workplace and you should be trained to work with the material safely.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil or highlighter
- ✓ Material Safety Data Sheet (MSDS) for Muriatic Acid

STEP ONE:

- Find a partner
- Scan the Material Safety Data Sheet (MSDS) for Muriatic Acid
- Work with your partner to find the answers to the questions on the following page
    - Record your answers in the space available under each question or circle or highlight your answers directly on the MSDS

Note: If your eyes are running over the text looking for specific information you are actually using a reading technique called scanning. Scanning involves glancing over the text quickly to locate keywords and find specific information.

Questions:

1. What would you do if this acid came in contact with your skin?

2. What would happen if you left it on your skin?

3. What are the ventilation requirements?

STEP TWO:

- Work as a group
- Discuss MSDS and your experience using them at work
- Discuss your answers to the questions in this task
- Discuss your experience scanning for information

MATERIAL SAFETY DATA SHEET

Revision #: 01

Section 1 - Product Identification & Use

Product Name:	Muriatic Acid
WHMIS Classification:	Class E, Corrosive Liquids
TDG Classification:	Hydrochloric Acid Solutions UN 1789, Class 8 , packing group II
Supplier:	Advance Chemicals Ltd. 2023 Kingsway Avenue Port Coquitlam, B.C. V3C 1S9 phone (604) 945-9666, fax (604) 945-9617
Emergency phone:	CANUTEC 24 hrs (613) 996-6666

Section 2 - Hazardous Ingredients

Hazardous Components	%(w/w)	C.A.S. No.	LD_{50} & LC_{50}
Hydrochloric Acid	30-33	7647-01-0	oral, rabbit 900mg/kg

Section 3 - Physical Data

Physical state: liquid
Boiling point: 80-82°C
Liquid density: 1.16g/mL
Freezing point: no data.
pH: 3% solution 0.2@ 20°C
Solubility in water: 100%
Vapour pressure: 25mmHg @ 20°C
Evaporation rate: no data

Odour & Appearance: Clear, colourless liquid solution. There is an obvious sharp acidic odour above the open liquid.

Section 4 - Fire or Explosion Hazard

Flammability: The product is not considered to be flammable.

Extinguishing media: Use an extinguishing media for surrounding the fire, or all purpose foam by manufacturer's recommended techniques for large fires. Use water to cool fire exposed containers to prevent vapour build-up and rupture. Water may also be used to flush spills away from dangerous exposures.

Hazardous Combustion Products: Wear self-contained breathing apparatus. Product reacts with most metals to produce hydrogen gas, which may accumulate to produce explosive and/or flammable mixtures with air.

Section 5 - Reactivity Data

Stability: Stable.

Incompatible substances: Metals, caustics, sulphides, cyanides, fluorides, carbides, silicates and strong oxidizing agents.

Polymerization: Will not occur.

Conditions to Avoid: Contact with metals produces hydrogen gas, which can form flammable or explosive mixtures in air. Will generate heat when mixed with alkalies. Reaction with sulphides, phosphides, cyanides, acetylides, fluorides, silicides, and carbides, releases flammable and/or poisonous gasses. May spatter upon contact with water.

Hazardous Combustion Products: Wear self-contained breathing apparatus. This product is not considered flammable, but heat may cause decomposition resulting in the production of hydrogen gas, which can form flammable or explosive mixtures.

Section 6 - Toxicological Properties

Acute Toxicity: No data found.

Skin contact: Burning, inflammation, blisters.

Eye contact: Burning, watering.

Inhalation: Irritation of mucous membranes, watering of eyes, difficulty breathing, salivation, nausea.

Ingestion: Pain in swallowing, intense thirst, abdominal pain, nausea, may be fatal if swallowed.

Section 7 - Preventative Measures

Personal Protective Equipment: Avoid contact with skin and eyes. Wear chemical protective gloves, goggles and face shield, rubber apron and boots. Eye wash fountains and safety shower facilities should be provided nearby for emergency use.

Respiratory protection: For acid vapours and mist, use an NIOSH/MSHA approved air purifying, dust, mist and particulate respirator.

Ventilation Requirements: This product should be used in a well-ventilated area at all times. If the hydrochloric acid solution is to be heated or a mist will be generated during product application, then local exhaust ventilation will be necessary.

Action to take for spills & leaks: Wear chemical protective clothing, rubber gloves and suitable respiratory protection. Small spills should be wiped up with absorbent material and disposed of in government approved waste containers. The spilled product can be neutralized with soda ash or baking soda and wet down with a little water to form a slurry. The spill area may then be flushed with large quantities of water. Larger spills should be contained by diking with sand, soil or other absorbent, non-combustible material, then transferred into approved waste containers for proper disposal. Keep product out of sewers, storm drains, surface run-off water and soil. Restrict access to non-protected personnel. Comply with all government regulations on spill reporting, handling and disposal of waste.

Disposal methods: Dispose of contaminated product and materials used in cleaning up spills or leaks in a manner approved for this material. Consult appropriate federal, provincial and local regulatory agencies to ascertain proper disposal procedures.

Note: Empty containers can have residues, gasses and mists, and are subject to proper waste disposal as mentioned above.

Storage & Handling Precautions: Warning, harmful or fatal if swallowed. Causes eye, skin and respiratory irritation. Avoid contact with eyes and repeated contact with skin and clothing. Do not ingest. Keep away from sources of heat and open flame. Keep container tightly closed when not in use. Store upright in a cool, dry, well-ventilated place away from incompatible materials. Do not use pressure to empty container. Wash thoroughly after handling. Use with adequate ventilation. Tanks must be grounded and ventilated. Ensure proper electrical grounding procedures are in place during product transfer.

Repair and Maintenance Precautions: Do not cut, grind, weld or drill in, on or near this container.

Section 8 - First Aid Measures

If inhaled: Remove victim to fresh air. Give artificial respiration if not breathing. Get immediate emergency medical attention.

In case of eye contact: Immediately flush eyes with clean water for at least twenty (20) minutes, lifting the upper and lower eyelids occasionally. Get immediate emergency medical attention. Do not transport victim until the recommended flushing period has been completed, unless eye flushing can be continued during transport to the nearest emergency medical treatment facility.

In case of skin contact: Immediately flush skin with plenty of clean running water for at least fifteen (15) minutes. Remove contaminated clothing and shoes. If irritation persists after washing, get immediate medical attention. Wash clothes before re-use.

In case of ingestion or swallowing: If victim is conscious and not convulsing, give one or two glasses of water to dilute material. Immediately contact the local poison control centre. Vomiting should only be induced under the direction of a physician or poison control centre. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in the vomitus. Rinse mouth and administer more water. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS VICTIM. GET IMMEDIATE EMERGENCY MEDICAL ATTENTION.

Section 9 - Preparation Information

Advance Chemicals Limited expressly disclaims all expressed or implied warranties of merchantability and fitness for a particular purpose with respect to the product provided. The information contained herein is offered only as a guide to the handling of this specific product, and has been prepared in good faith by technically knowledgeable personnel. This M.S.D.S. is not intended to be all-inclusive, and the manner and conditions of use may involve other and additional considerations.

Revised: 7 July 2004, June 5, 2006; 23 November 2006

SAFETY CHECKLIST

Reading Text, Document Use, Oral Communication

Thinking Skills: Critical Thinking, Finding Information

When you start a new job you may be asked to read information such as Material Safety Data Sheets, Policies and Procedures, and safety information. Some employers will have you complete a checklist to ensure you have received all the information you need to work safely.

Complete the following safety checklist. If you are unable to check a box on this page, refer back to the safety section of your Student Notes or ask your instructor.

Check if you have:

- ☐ found appropriate clothing to wear to class
    - For example: long pants, shirt, boots, gloves, hat, leather apron
- ☐ read the example Material Safety Data Sheet
- ☐ read any MSDS for products you will be using in class
- ☐ learned about common blacksmith related injuries and how to avoid them

Check if you know:

- ☐ when to report accidents
- ☐ when to report equipment damage
- ☐ how to use blacksmith equipment and tools safely, including a forge
- ☐ how to lift properly and hammer safely

Check if you can:

- ☐ locate the First Aid Kit
- ☐ locate the Fire Extinguisher
- ☐ identify the various tools and equipment used in blacksmithing
- ☐ identify general safety rules for working with metal and heat
- ☐ maintain a clean, safe work area

WEB SEARCH

Reading Text, Document Use, Computer Use

Thinking Skills: Decision Making, Finding Information

If you have access to the internet and would like more information about Material Safety Data Sheets, blacksmith safety or workplace safety in general, you can use a search engine to find more information on these topics.

TASK STEPS

YOU WILL NEED:

- ✓ access to a computer with internet

- Log onto the internet using a web browser
- Open a search engine
- Enter any of the following:
  - Material Safety Data Sheets (MSDS)
  - Safety and Blacksmithing
  - Workplace Health and Safety
  - Workplace Safety and Insurance Board

WORKPLACE HEALTH AND SAFETY

Reading Text, Document Use, Computer Use

Thinking Skills: Finding Information

The Workplace Safety and Insurance Board (WSIB) have designed a web site to provide workplace health and safety information to workers between the ages of 16 and 24. We have included this site in this task because the information is useful regardless of your age.

TASK STEPS

YOU WILL NEED:

- ✓ access to a computer with internet

- Log onto the internet using a web browser
- Locate the Address Bar in your web browser
- Enter the following URL into the Address Bar:

  www.hs101.ca
- Enter the site and select Launch High Speed or Launch Low Speed
- Complete the Modules - Safety Matters, Safety Roles, Work Hazards and Staying Safe

Note: These modules could take up to an hour to complete. If you run out of time in class, you may want to bookmark this site so that you can return to it at a later date. You may also want to work on this task at home.

PROGRESS EVALUATION

Document Use, Oral Communication, Computer Use

Thinking Skills: Decision Making, Critical Thinking, Finding Information

TASK STEPS

STEP ONE:

- Evaluate the progress you are making on your blacksmith project
- Discuss your progress with your instructor
    - Work with your instructor to identify the steps you will need to take to complete your project on time
    - Set goals for the completion of your project
- Continue working on your project keeping your timelines in mind

STEP TWO:

- Work on any of the following if you have time or need a break from your project
    - Read the Student Notes that have been assigned
    - Research future projects
    - Search for and watch online blacksmith videos
    - Complete or revisit any of the assigned tasks

PRESENT YOUR WORK - DAILY

Reading Text, Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

As mentioned in your Student Notes, you will have the opportunity to present your work at the end of each day. After you present an evaluation of your own blacksmith project you will receive feedback from the others in your class. You will also have a chance to provide feedback to the other group members after they present their work.

TASK STEPS

STEP ONE:

- Present your blacksmith project
- Think about the following questions as you present your work:
    - How do you feel about your work to date?
    - What do you like the most about your work so far?
    - What has been the most important thing you've learned?
    - If you were doing it over again, what would you do the same and what would you do differently?
    - How would it be different if you had made other choices?
    - What are your plans for the next class?
        - Your next steps
- Ask the others in the group for feedback on your work

STEP TWO:

- Listen to the other members of the class as they present their work
- Offer them both positive and constructive feedback

BC AND AD

Reading Text, Document Use, Numeracy, Oral Communication

DEFINITIONS

BC: "Before Christ".

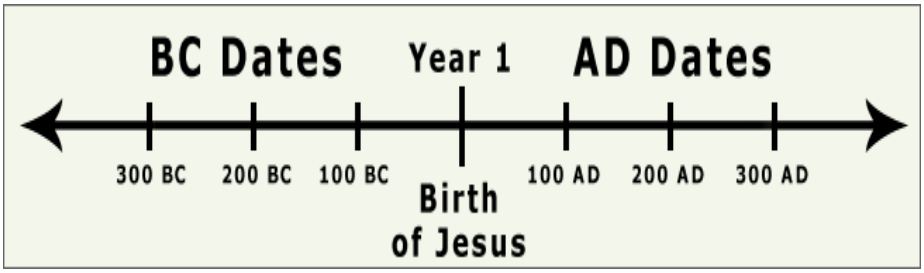
BCE: "Before the Common Era". This term is now used in place of BC, so that religion is removed from any description of historical time periods.

AD: "Anno Domini". A Latin term meaning the "year of our Lord". It represents the year Jesus Christ was born.

CE: "Common Era". This term is now used in place of AD, so that religion is removed from any description of historical time periods.

If the date of an event is followed by BC or BCE you need to add the current date to determine exactly how long ago it happened. For example, if something happened in 100 BCE and the current year is 2010 it happened 2110 years ago.

It is also important to know that an event in 300 BCE will have happened before an event that took place in 100 BCE. An example of this can be seen in the dates of the Bronze Age which started in 3,300 BCE and ended in 1,200 BCE.



TASK STEPS

- Work as a group
- Calculate the number of years since:
    - the beginning of the Bronze Age: 3,300 BCE (BC)
    - the start of the Iron Age: 1200 BCE (BC)
    - the end of the Iron Age: 550 BCE (BC)

TERMS AND DEFINITIONS MATCHING

Reading Text, Document Use, Oral Communication

Thinking Skills: Decision Making

In this task you will be given a list of words related to metal working. You will be asked to match the word with the correct definition.

Although you may come across many of these words in your course, you won't need to memorize all of these terms and definitions.

If you are not familiar with a word, guesses are fine. You can also use "the process of elimination".

For more definitions related to blacksmithing you can search "Blacksmith Terms" on the internet or visit the following site:

http://www.tudorironworks.com/blacksmithing%20spoken%20here.htm

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil

Step One:

- Find a partner
- Scan the chart on the following page
- Locate the definition on the left that matches the term on the right
  - Each definition has a number on the left
  - Record this number in the "Matching #" column beside the correct term
  - Cross out the numbers on the left when you have found the matching definition

Step Two:

- Discuss your answers with the rest of the group

Definnition	*Matching #*	*Term*
1. A term used to describe rock from which metals can be extracted.		**Alloy**
2. A piece of equipment used to heat metal.		**Metallurgy**
3. A term that describes a metals ability to be liquefied or melted together.		**Ferrous**
4. The process of melting rocks so that the metal separates.		**Ore**
5. A term that means to expand, widen or enlarge.		**Dilation**
6. This term means the study of metals.		**Contract**
7. Shrink or reduce.		**Fusible**
8. A term used to describe something that has the ability to return to its original shape.		**Welding**
9. A term used to describe something that light can't go through.		**Malleability**
10. The result of combining one metal with another metal(s) or non-metallic material(s).		**Ductility**
11. Transmit energy such as heat, light, sound or electricity.		**Elasticity**
12. Joining pieces of metal by melting the metal together.		**Smelting**
13. A substance that is made entirely from one type of atom.		**Forge**
14. A term used to describe metal that contains iron.		**Fracture**
15. To separate an object into two or more pieces by placing stress on the object.		**Element**
16. The ability of something to change shape without breaking or cracking.		**Opaque**
17. The ability of something to stretch without breaking – hammered into thin sheets or drawn into wire.		**Conduct**

BLACKSMITH RESEARCH ASSIGNMENT

Reading Text, Document Use, Oral Communication, Writing, Computer Use

Thinking Skills: Decision Making, Critical Thinking

When you start a new job it is possible that you will come across unfamiliar words or techniques. It is important to ask questions and ask for clarification at work. However, it is also important to know how to search for this information using the internet.

If you decide to pursue blacksmithing as either a career or a hobby, you will need to learn more about the craft. This task will introduce you to the steps for gathering this type of information.

Note: You will be asked to make a one or two minute presentation so you won't need to do hours of research.

You can save the other members of your class a lot of research time if you share the information you find. Therefore we ask that you make a short 1-2 minute presentation to the other group members after you have finished your research.

Developing your oral communication skills will also be helpful if you decide to pursue blacksmithing as a career. Blacksmiths regularly present information to customers.

Note: You will need to complete part of this task outside of class.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil
- ✓ computer with internet access
- ✓ printer

STEP ONE:

- Work as a group
- Find a recorder for the group
- Brainstorm a list of possible research topics related to blacksmithing

STEP TWO:

- Review the list your group has developed
- Decide who will research each of the topics
    - Record your name beside a topic
        - The goal is to have each member of the group present a different topic

STEP THREE:

- Brainstorm a list of possible research methods

STEP FOUR:

- Work independently
- Complete the following research steps:
    - Find at least two resources
    - Assess the information you find by asking yourself:
        - is it accurate?
        - is it consistent?
        - is it from a reliable source?
    - Consider who you will be sharing this information with
        - What information will they find helpful?
    - Decide how you will present the information

STEP FIVE:

- Work independently
- Talk with your instructor and schedule a time to present your research
- Talk to your instructor if you need help with this task
- Write or type a few notes to help you with your presentation

STEP SIX: In Class Presentation

- Present your research to the class
- Tell the class:
    - about the research methods you used
    - about any resources you would recommend
    - what you found
        - you may want to include images or printed information

GRAMMAR

Reading Text, Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

In blacksmithing the word forge can be used as a noun or a verb.

Forge: as a noun means "a furnace used to heat metal" (the thing)

Forge: as a noun also means "the blacksmith shop" (the thing).

Forge: as a verb means "shaping metal by using force" (the action)

The word "Forge" is a homonym. It is spelled and pronounced the same in all three cases, but in each case it has a different meaning. The English language is filled of words like this, which is one of the reasons English is a difficult language to learn.

Noun: In grammar, a noun is a word that is used to name a person, place, thing or idea.

Verb: In grammar, a verb is a word used to show an action, event or a state of being.

Often, you need to think about the entire sentence to be able to understand the message. For example if someone said:

1. "Heat the metal in the forge."
    - You would know that they meant forge as in "the fire" rather than forge as in "the building housing the blacksmith shop".
2. "The metal you just heated will now need to be forged."
    - You would know that they mean "work the metal", because it has already been heated.

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil

STEP ONE:

- Work as a group
- Review the "**Definition Chart**" on the following page
  - This chart outlines the difference between homonyms, homophones and homographs

STEP TWO:

- Locate the "**Answer Chart**"
- Read each example
- Identify whether the "common word" is a homonym, homophone or homograph
- Place an X in the box beside the correct answer
  - The first one is done for you

DEFINITION CHART:

Type	*Spelling*	*Pronunciation*	*Meaning*	*Examples:*
Homonym	Spelled the same	Pronounced the same	Has different meanings	She finished her first **shift** at work. If she didn't **shift** her position, she wouldn't be able to see. She saw a **shift** in her attitude.
Homophone (type of homonym)	Spelled different	Pronounced the same	Has different meanings	They have **two** cars. They have **too** many cars. They want **to** give me a car.
Homograph (Heteronyms are also a type of homograph)	Spelled the same	Pronounced differently	Has different meanings	They stood in the **bow** of a ship. He used the **bow** to shoot the arrow. He tied a **bow** on the present. He had to **bow** when he met the queen.

ANSWER CHART:

WORD	*TYPE*
He **forged** a piece of steel. He put the steel in the **forge** to heat it. He turned his shed into a **forge**.	☒ Homonym ☐ Homophone ☐ Homograph/Heteronyms
She put her tools **down**. When it's cold she wears a **down** jacket.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
They saw a **bear** in the woods. The ground was **bare.**	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
His **wound** was infected. He **wound** the bandage tighter.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
He finished his first **project** early. It was too early to **project** how long it would take.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
Wave your hand. The **wave** crashed on the shore.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
He watched the **dove** at the feeder. He **dove** for cover.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
She **led** the hike. They removed the **lead** pipe.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
He had to **wind** up the wire. He stood outside in the **wind**.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
He got his fishing **pole**. He climbed the hydro **pole**.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
They found a **bat** living in the forge. He learned to **bat** the ball.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
She bought a **pair** of work-boots. She ate a **pear** on her break.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
He went to the **sea** to collect shells. She came to **see** what all the noise was about.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms
Row the boat. Knit a **row**.	☐ Homonym ☐ Homophone ☐ Homograph/Heteronyms

HAMMER PRACTICE

Reading Text, Document Use, Numeracy, Oral Communication

Hammers are so common most people don't give them much thought. However, if you are hammering all day you will want to know as much as possible about hammers. You definately want get the most out of each swing.

This video clip shows an experiment on the moon that demonstrates the impact of gravity:

http://www.videograter.com/video/Galileo-Was-Right-Hammer-and-Feather-on-the-Moon

A hammer is used to increase the force of your swing. When you swing a hammer, energy is transferred to the object you are hitting. The amount of energy is a result of the length of your swing, the force produced by your muscles and by the affect of gravity.

You can increase your swing by selecting a hammer with a longer handle. This will increase the speed of your strike.

If you use a large, heavy hammer head you will get the added benefit of gravity.

Keep in mind that there are always tradeoffs. Long handles and heavy hammer heads:

- make it hard to work in small places
- make accuracy a challenge
- will cause your arm to become tired

The control you have over each hammer strike is actually more important than your strength, the weight of the hammer or the length of the handle. Ideally you want to hit the object you are striking exactly where you are aiming.

Newton's Third Law of Motion: Action-Reaction: Whenever one object exerts force on another object, the other object exerts an equal but opposite force.

This means that when the hammer hits the target, the head is stopped by a force coming from the target, which is equal but opposite to the force of the hammer head.

In blacksmithing, the hammer applies the action force and the metal applies the reaction force. The hammer pushes down on the metal and the metal pushes up on the hammer.

If the thing you are hitting is hard and heavy, or it is resting on something hard and heavy, like an anvil, the hammer head will stop quickly. This increases the overall force on the object you are striking.

http://en.wikipedia.org/wiki/Newton%27s_laws_of_motion

TASK STEPS

YOU WILL NEED:

- ✓ a board
- ✓ a hammer
- ✓ 4 nails
- ✓ a ruler or tape measure

Anything dropped and allowed to freefall will pick up speed at about 10 meters per second (32 feet per second). If you drop your hammer, watch your toes.

For more information about hammers: http://www.hammernet.com/hammers.htm

STEP ONE:

- Find a partner to work with
- Select a hammer
- Grasp the hammer by the handle
- Measure the distance from the end of the hammer (the butt) to your little finger

- Use a tape measure or ruler
- Adjust your grip so that the handle sticks out about 25 millimeters (1 inch) beyond your little finger

STEP TWO:

- Check the hammer to make sure it is safe to use
  - No chips or splinters
  - The head and handle must be a good fit
- Measure the face of the hammer (the flat striking area)
  - Use a tape measure or ruler
- Measure the head of one of the nails you will be hammering
- Calculate the size difference between the face of the hammer and the head of the nail
  - Hammer Face Size - Nail Head Size =
  - Ideally, the striking face of the hammer should be about 25 millimeters (1 inch) wider than the thing you are hitting

STEP THREE:

- Locate a place where you will have enough space to safely swing a hammer
  - You will want to be standing
- Pick up a board, hammer and four nails from your instructor
- Hammer the 4 nails into the board until the heads are flush with the wood

STEP FOUR

- Discuss this experience as a group
- What could you work on?

PLANNING

Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

Aliens have made contact with earth and they want to learn as much as they can about us.

Your group has been assigned the task of preparing a recipe to send them, along with the ingredients and the tools they will need to make the meal.

You must give them detailed instructions for making a cheese and mushroom omelet that will feed four. You can include written words, lists and/or drawings.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil
- ✓ flipchart paper/white board

STEP ONE:

- Work as a group
- Complete the chart at the end of this task including:
  - A list of ingredients, a list of tools and step-by-step instructions

STEP TWO:

- Compare your results with a checklist provided by your instructor

STEP THREE:

- Discuss the results
  - Was anything missing?
- What did you find challenging?
- Would sketches help/did sketches help?
- How would planning skills help you on the job?
- How will planning skills help you in your blacksmith work?

List of Ingredients	**List of Tools**
Step by Step Instructions: Preparing, mixing, cooking, serving	

BLACKSMITH - VIDEOS

Reading Text, Document Use, Writing, Computer Use, Oral Communication

Thinking Skills: Decision Making, Finding Information

In this task you will be asked to watch blacksmith video demonstrations online. You can work on your own or with one or two other members of your class. You may also want to watch these videos on your home computer.

TASK STEPS

YOU WILL NEED:

- ✓ a computer with access to the internet
- ✓ speakers/headset
- ✓ a pen/pencil
- ✓ paper

These videos may show blacksmiths using techniques that differ from the ones you learned in class. Please ask your instructor if you have any questions.

Some videos will actually show people making mistakes. Please discuss these with your instructor.

STEP ONE:

- Log onto the internet using a web browser
- Locate the Address Bar
- Enter the following URL into the Address Bar:

  http://www.youtube.com

- Enter the word “Blacksmith” in the search area of the YouTube site
- Scan the list of video options
- Find, select and watch at least three videos
  - The video will play on your screen

- Take notes or record questions that come up as you watch the videos
    - Talk with your instructor if you have any questions
    - Recommend videos and share information with the others in your class

Note: Step Two of this task can be used in addition to Step One or as an alternative. Also, it is challenging to enter long URL's. For this step you can ask your instructor if they have these sites bookmarked. You can also ask for an electronic copy of this task so you can click on the URL.

Sites come and go. If you find an address that is no longer valid please let your instructor know.

STEP TWO:

- Enter at least three of the following URL's into the Address Bar and watch the videos

Introduction to Traditional Techniques

http://www.metacafe.com/watch/yt-Qx73KWu-NVw/blacksmiths_blacksmithing_on_blacksmith_show_on_tv/

Technique Demonstrations

http://www.metacafe.com/watch/1701704/blacksmith_forging_a_leaf_key_chain/

http://www.youtube.com/watch?v=GLqSY6Y3xIE&feature=related

Gas Forge

http://www.youtube.com/watch?v=lNDhGO-r3Vk&feature=related

http://www.youtube.com/watch?v=284yI79O4bc&feature=related

Forge Welding – using a Gas Forge

http://www.youtube.com/watch?v=EEJsJg_h24c

http://www.youtube.com/watch?v=8wPZTc8stZk

Forging Nails

http://www.youtube.com/watch?v=D83SX6jTo1k&feature=PlayList&p=FF2A413D06A3FFA8&playnext=1&playnext_from=PL&index=6

http://www.youtube.com/watch?v=7YNbMAAxvnQ&feature=PlayList&p=FF2A413D06A3FFA8&index=9

http://www.metacafe.com/watch/473109/forging_for_a_museum_movie/

Making Tongs

http://www.youtube.com/watch?v=5sf27Olkgcw&feature=PlayList&p=F3AB156B03690035&playnext=1&playnext_from=PL&index=1

http://www.youtube.com/watch?v=qrw6XH-lb08&feature=PlayList&p=F3AB156B03690035&playnext=1&playnext_from=PL&index=25

Punching a Hole

http://www.youtube.com/watch?v=LDR6ilshb4E&feature=PlayList&p=F3AB156B03690035&playnext=1&playnext_from=PL&index=6

http://www.youtube.com/watch?v=DdNY3ID4v7A&feature=PlayList&p=FF2A413D06A3FFA8&index=7

http://www.youtube.com/watch?v=gt23ZlEn2wU&feature=related

Using Tools

http://www.youtube.com/watch?v=wzSHCKNTSwo

http://www.youtube.com/watch?v=9SAWr0c_wpo

Power Hammer

http://www.youtube.com/watch?v=msB-f5p3bzc

http://www.youtube.com/watch?v=qSyaoJjqZpo&feature=PlayList&p=F3AB156B03690035&index=7&playnext=2&playnext_from=PL

http://video.google.com/videosearch?q=blacksmith+power+hammers&sourceid=navclient-ff&rlz=1B2GGFB_enCA213CA214&um=1&ie=UTF-8&ei=97rkSYDnMNjfnQfg9MykCQ&sa=X&oi=video_result_group&resnum=13&ct=title#

RUST EXPERIMENT

Reading Text, Document Use, Numeracy, Oral Communication

From Wikipedia the online open source encyclopedia:

Rust is a general term for a series of iron oxides, usually red oxides, formed by the reaction of iron and oxygen in the presence of water or air moisture. Several forms of rust are distinguishable visually and by spectroscopy, and form under different circumstances.[1] Rust consists of hydrated iron(III) oxides Fe2O3·nH2O and iron(III) oxide-hydroxide (FeO(OH), Fe(OH)3).

Rusting is the common term for corrosion of iron and its alloys, such as steel. Other metals undergo equivalent corrosion, but the resulting oxides are not commonly called rust. Given sufficient time, oxygen, and water, any iron mass eventually converts entirely to rust and disintegrates. The corrosion of aluminum is extremely slow because the resulting aluminum oxide forms a conformal coating, which protects the remaining aluminum. This process is known as passivation.

The Oxidation of Iron Metal

When in contact with water and oxygen, or other strong oxidants and/or acids, iron will rust. If salt is present as, for example, in salt water, it tends to rust more quickly, as a result of the electro-chemical reactions. Iron metal is relatively unaffected by pure water or by dry oxygen. As with other metals, a tightly adhering oxide coating, a passivation layer, protects the bulk iron from further oxidation. Thus, the conversion of the passivating iron oxide layer to rust results from the combined action of two agents, usually oxygen and water. Other degrading solutions are sulfur dioxide in water and carbon dioxide in water. Under these corrosive conditions, iron(III) species are formed. Unlike iron(II) oxides, iron(III) oxides are not passivating because these materials do not adhere to the bulk metal.

As these iron(III) compounds form and flake off from the surface, fresh iron is exposed, and the corrosion process continues until all of the iron(0) is either consumed or all of the oxygen, water, carbon dioxide, or sulfur dioxide in the system are removed or consumed.

http://en.wikipedia.org/wiki/Rust

TASK STEPS

YOU WILL NEED:

- ✓ a container
- ✓ a nail
- ✓ vinegar and access to water

STEP ONE:

- Work as a group
- Put a nail in a container of vinegar for one day
    - This will remove the protective coating

STEP TWO:

- Remove the nail from the vinegar
- Place the nail in a jar of water

STEP THREE:

- Check the nail in one week
    - The nail should be showing signs of rust

It is important that you take the time to add a protective coating to your finished piece. You can use beeswax, linseed oil, paint or varnish. Even if you keep your finished piece inside, it will eventually rust if it's not protected.

PRINTING A FILE

Reading Text, Document Use, Oral Communication, Computer Use

Thinking Skills: Finding Information

You may need to print a file as part of this course. You may also need to print information at home or on the job.

If you have used computer software, you have probably already noticed that there is usually more than one way to do the same thing. The people who design software realize that everyone learns differently so they try to provide options for the end users. This task will outline several ways to print a file.

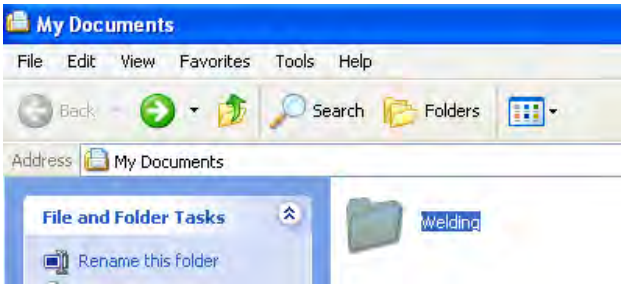
TASK STEPS

YOU WILL NEED:

- ✓ a computer
- ✓ printer
- ✓ MS Word

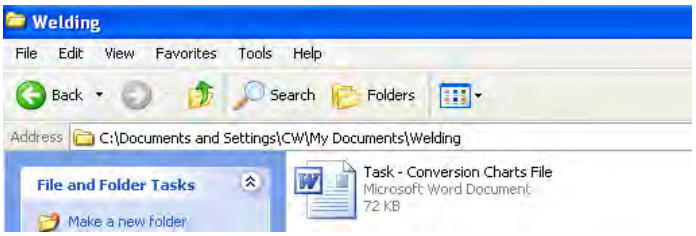
STEP ONE:

- Work as a group, along with your instructor
- Search the Desktop for an icon called “My Documents”
- Double click the “My Documents” icon
    - This will open a screen that looks like the one in the image below:



Step One Continued:

- Scan the screen to locate the Folder called “Blacksmith”
- Double click to open it
- Scan the Folder to find the File called “Conversion Charts”



- Double click the File. This File will open and become an active document

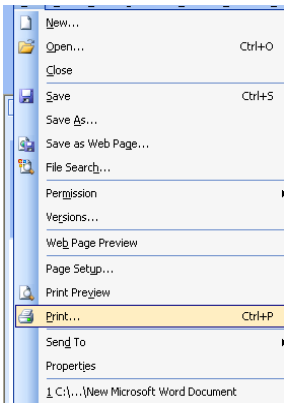
STEP TWO:

- Find the print icon on the menu at the top of your screen 
- Click on this icon to print the document

STEP THREE:

You can also print this document by opening the “File” menu available in the top left hand corner of your screen

- Click on the word “File” in the menu at the top of your screen
  - This will open a drop down menu of options
- Scroll down until the word Print is highlighted and click
  - You will notice Ctrl+P beside the word Print (CTRL is short for Control). Ctrl + P is another option for printing. Hold the Control key and strike the letter P



Step Three Continued:

With this print menu open you can make changes to the way your document prints. Spend some time as a group reviewing your print options.

- For example, you can:
  - print all (the whole document) or you can print the current page only
  - print a range of pages. For example, if your document is 10 pages long, you may only want to print pages 1 to 3
  - select a printer
  - print multiple copies of the document
- Click OK to print the document or click cancel to close this window

STEP FOUR:

With this document still open:

- Find the word "Help" on the menu bar at the top of your screen
  - The "Help" menu allows you to search for answers to your questions
  - Use the "Help" feature in any Microsoft program
- Click on the word "Help" to open a drop down menu
- Click "Microsoft Office Word Help"
  - This will open another menu, this time on the side of your screen
- Enter the word "Printing" in the area of the menu that begins with "Search for"
- Click the green arrow or hit enter
- Use your mouse to select and open one of the topics listed
  - Topics are identified with a blue question mark and blue lettering
- Read the information that displays
- Click the red X to close this information box
- Click the small black X to close the "Search Results" menu
  - You will be back at your main document

STEP FIVE:

- Close the entire document by clicking the red X in the top right hand corner of your screen
- Point your cursor to the “Conversion Charts” document without clicking
- Right click your mouse
    - Another menu will open
    - Using this method you can print the document without opening it
- Click Print to print a copy of the “Conversion Charts” document

DISCUSSION – WORKING IN A TEAM

Reading Text, Document Use, Oral Communication

Thinking Skills: Critical Thinking

It is likely that you will be working as a member of a team in the workplace. You may also be asked to work with others on the tasks in this course. Therefore, it is important to think about and learn from your past experiences. Take some time now to talk to the others in your group about your past experience as a member of a team.

TASK STEPS

- Tell the group about a time you participated as a member of a team
    - What was the team?
    - What role did you play?
    - What did you like about teamwork?
    - What was your least favorite thing about the team experience?
- Discuss whether you have been working independently, with a partner/helper or as a member of a team in this class
    - One of the Essential Skills is called “Working with Others” which describes employees working with others to carry out their tasks
- Tell the group about the things that are important to you when you are working with others. For example:
    - “It is important to me that we listen to each other.”

Printable Metric Conversion Chart and Table

Length

1 centimeter (cm)	=	10 millimeters (mm)
1 inch	=	2.54 centimeters (cm)
1 foot	=	0.3048 meters (m)
1 foot	=	12 inches
1 yard	=	3 feet
1 meter (m)	=	100 centimeters (cm)
1 meter (m)	≅	3.280839895 feet
1 furlong	=	660 feet
1 kilometer (km)	=	1000 meters (m)
1 kilometer (km)	≅	0.62137119 miles
1 mile	=	5280 ft
1 mile	=	1.609344 kilometers (km)
1 nautical mile	=	1.852 kilometers meters (km)

Weight

1 milligram (mg)	=	0.001 grams (g)
1 gram (g)	=	0.001 kilograms (kg)
1 gram (g)	≅	0.035273962 ounces
1 ounce	=	28.34952312 grams (g)
1 ounce	=	0.0625 pounds
1 pound (lb)	=	16 ounces
1 pound (lb)	=	0.45359237 kilograms (kg)
1 kilogram (kg)	=	1000 grams
1 kilogram (kg)	≅	35.273962 ounces
1 kilogram (kg)	≅	2.20462262 pounds (lb)
1 stone	=	14 pounds
1 short ton	=	2000 pounds
1 metric ton	=	1000 kilograms (kg)

Area

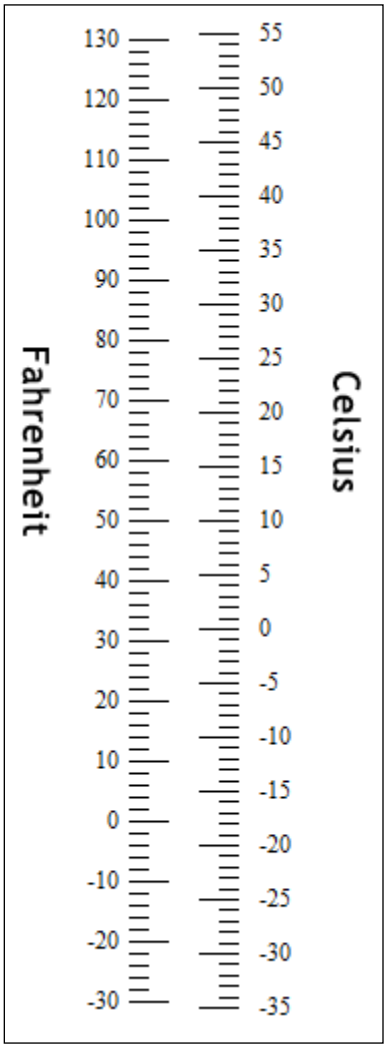
1 square foot	=	144 square inches
1 square foot	=	929.0304 square centimeters
1 square yard	=	9 square feet
1 square meter	≅	10.7639104 square feet
1 acre	=	43,560 square feet
1 hectare	=	10,000 square meters
1 hectare	≅	2.4710538 acres
1 square kilometer	=	100 hectares
1 square mile	≅	2.58998811 square kilometers
1 square mile	=	640 acres

Speed

1 mile per hour (mph)	≅	1.46666667 feet per second (fps)
1 mile per hour (mph)	=	1.609344 kilometers per hour
1 knot	≅	1.150779448 miles per hour
1 foot per second	≅	0.68181818 miles per hour (mph)
1 kilometer per hour	≅	0.62137119 miles per hour (mph)

Volume

1 US tablespoon	=	3 US teaspoons
1 US fluid ounce	≅	29.57353 milliliters (ml)
1 US cup	=	16 US tablespoons
1 US cup	=	8 US fluid ounces
1 US pint	=	2 US cups
1 US pint	=	16 US fluid ounces
1 liter (l)	≅	33.8140227 US fluid ounces
1 liter (l)	=	1000 milliliters (ml)
1 US quart	=	2 US pints
1 US gallon	=	4 US quarts
1 US gallon	=	3.78541178 liters


Fahrenheit
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
Celsius
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35

HEATING METAL

Reading Text, Document Use, Oral Communication

Thinking Skills: Finding Information

In this course you will need to heat metal. As you heat metal, you will need to estimate the temperature by watching for colour changes.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

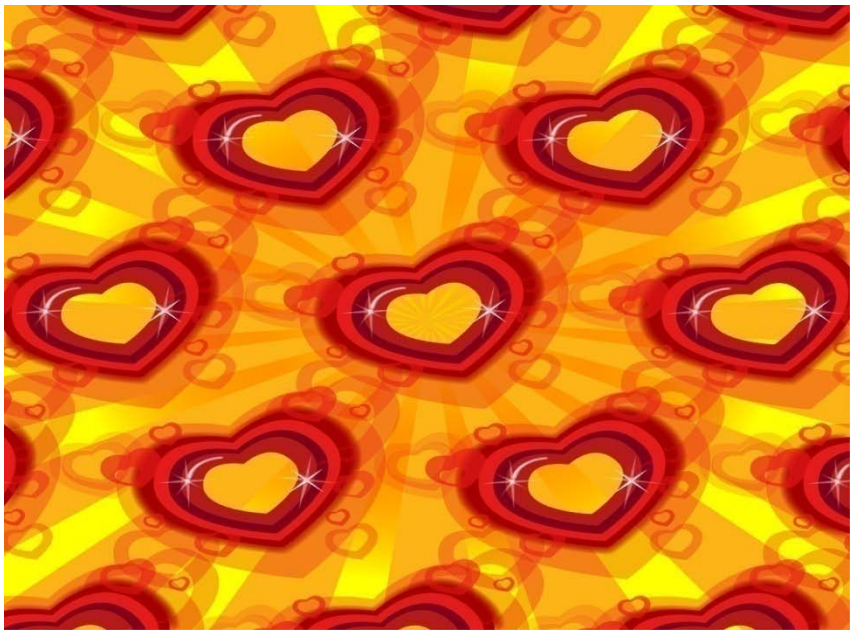
- Work independently
- Find the "**Temperature Chart"** in your Student Notes

STEP TWO:

- Look at the picture on the following page
- Number the colours from 1 (coolest) to 6 (hottest)
  - Use the "**Temperature Chart"** from your Student Notes as a guide
- Place a checkmark beside the colour you will look for when you are heating a piece of metal
- Record the temperature the metal will be when it reaches the right colour

STEP THREE:

- Discuss your answers with the group



- ☐ Light Red
- ☐ White
- ☐ Orange
- ☐ Yellow
- ☐ Dark Red
- ☐ Cherry Red

LABEL IMAGE

Reading Text, Document Use, Writing, Oral Communication

Thinking Skills: Critical Thinking

The image below shows two Blacksmiths working in a traditional forge. Take a few minutes to analyze the image.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

- Work on your own
- Identify all the tools and equipment you see in this image
  - Create a list
- Evaluate the image for safety
  - Create a list of all the safety items missing from the image

STEP TWO:

- Work as a group
- Discuss your answers with the group

POEM ANALYSIS

Reading Text, Document Use, Oral Communication

Thinking Skills: Critical Thinking

In his poem The Village Blacksmith, Henry Wadsworth Longfellow, captured the life of a Blacksmith. The poem highlights the role the blacksmith played in the community.

TASK STEPS

- Read the poem called The Village Blacksmith, by Henry Wadsworth Longfellow, 1807-1882
    - The poem can be found on the following two pages
- As a group discuss
    - What is this poem about?
    - Would you say that this Blacksmith was a role model in his community?
    - Compare the chestnut tree with the Blacksmith
    - What qualities/positive traits did this Blacksmith have?
    - What tools are mentioned?

If you would rather listen to the poem you can find it on YouTube: http://www.youtube.com/watch?v=siUqDtMtu2A

The Village Blacksmith, by Henry Wadsworth Longfellow, 1807-1882

UNDER a spreading chestnut tree
The village smithy stands;
The smith, a mighty man is he,
With large and sinewy hands;
And the muscles of his brawny arms
Are strong as iron bands.

His hair is crisp, and black, and long,
His face is like the tan;
His brow is wet with honest sweat,
He earns whate'er he can,
And looks the whole world in the face,
For he owes not any man.

Week in, week out, from morn till night,
You can hear his bellows blow;
You can hear him swing his heavy sledge
With measured beat and slow,
Like a sexton ringing the village bell,
When the evening sun is low.

And children coming home from school
Look in at the open door;
They love to see the flaming forge,
And hear the bellows roar,
And watch the burning sparks that fly
Like chaff from a threshing-floor.

He goes on Sunday to the church,
And sits among his boys;
He hears the parson pray and preach,
He hears his daughter's voice,
Singing in the village choir,
And it makes his heart rejoice.

It sounds to him like her mother's voice,
Singing in Paradise!
He needs must think of her once more,
How in the grave she lies;
And with his hard, rough hand he wipes
A tear out of his eyes.

Toiling,—rejoicing,—sorrowing,
Onward through life he goes;
Each morning sees some task begin,
Each evening sees it close;
Something attempted, something done,
Has earned a night's repose.

Thanks, thanks to thee, my worthy friend,
For the lesson thou hast taught!
Thus at the flaming forge of life
Our fortunes must be wrought;
Thus on its sounding anvil shaped
Each burning deed and thought!

PRICING A FORGE

Reading Text, Document Use, Numeracy, Oral Communication, Computer Use

Thinking Skills: Decision Making, Critical Thinking, Finding Information

You are working for a blacksmith and they assign you the task of buying a gas forge. Your employer has asked you to find and present two options and include your recommendation.

TASK STEPS

YOU WILL NEED:

- ✓ computer
- ✓ pen/pencil

STEP ONE:

- Work as a group
- Brainstorm a list of methods you could use to search for a gas forge

Brainstorming: a technique where all ideas are listed before you move on to the critical thinking and decision making stages. Each member of the group shares their ideas. No idea is discussed or disregarded. It is usually done in a group but can be done independently.

STEP TWO:

- Find the information you need to complete the "**Product Charts**" that follow this task
    - For this task, you may want to use the internet or any other sources you have available
- Identify at least two options
    - Record prices on the charts
    - Check that the prices are in Canadian dollars
    - Check that the product is available in Canada
    - Check the shipping fees, if the product is not available locally

STEP THREE:

- Identify the forge you would recommend to your employer
    - What is the price?
    - Why do you recommend this product?

Product Charts

Product Description	Company	Reviews	Price
Gas Forge #1:			

Product Description	Company	Reviews	Price
Gas Forge #2			

PROBLEM SOLVING

Reading Text, Document Use, Oral Communication, Writing

Thinking Skills: Problem Solving, Decision Making, Critical Thinking

Problem solving is required when you face a situation that needs a solution.

TASK STEPS

YOU WILL NEED:

- ✓ a pen/pencil

STEP ONE:

- Work independently to complete one of the two "**Problem Solving - Scenarios**" outlined on the following page
    - You will be assigned a scenario
- Work on your own to identify three possible solutions
- Record your solutions in the space provided

STEP TWO:

- Find the other people who were assigned the same scenario
- Share your answers
- Identify three solutions as a group
- Decide on a spokesperson for your group

STEP THREE:

- Meet again with the entire group
- Have your spokesperson present the three solutions your group has identified
    - The spokesperson for the other group will present their three solutions
- Discuss both problems and solutions as a group

Scenario #1

Through this course you discovered that you enjoy working as a Blacksmith and you are actually pretty good at it. You decide to set up your own shop and start taking custom orders. You give a customer an estimate but before you begin the price of materials jump. You won't make any money if you don't raise your price. What do you do? List at least three options:

a.
b.
c.

Scenario #2

You enjoy working on your blacksmithing projects however you are having a problem with another student in the group. It started when this other student told you what piece they thought you should make. They are now telling you what you should do as you work on your piece. You know this other student is just trying to help but it is really starting to interfere with your work. What could you do to solve this problem? List at least three options:

a.
b.
c.

THINKING SKILLS

Reading Text, Document Use, Writing, Oral Communication

Thinking Skills: Problem Solving, Decision Making, Critical Thinking

In blacksmithing as well as in your work and home life you will need to use your critical thinking, decision making and problem solving skills.

- If you are facing a situation that requires you to find a solution, you are problem solving
- If you are in a situation where you need to choose between options, you are making a decision
- If you are assessing, evaluating, comparing or analyzing ideas or information, you are using your critical thinking skills

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

- Work independently
- Read the descriptions of the following three situations
    - Work through them in order and record your answers

1. Problem Solving

You would like to continue developing your blacksmithing skills. You think that you would eventually be able to sell your work. Right now however, you don't have the money for the tools or the materials you need to get started. What could you do?

2. Critical Thinking

You have worked to develop your blacksmithing skills and would now like to sell something you have made. How do you determine the selling price?

3. Decision Making

Now that you have identified a price for your work, you need to decide where you will sell it. What steps would you take to help you make this decision?

STEP TWO:

- Discuss your answers as a group
- How are these steps connected?
- Discuss the following statement
    - "It is common for people to make decisions before considering all of their options."

ROUNDING DECIMALS

Reading Text, Document Use, Numeracy

If you are asked to round to two decimal places:

- Find the number in the second decimal place (moving right from the decimal point)

  Example:
  0.1**2**3
  2 is in the second decimal place

- Look at the number in the third decimal place

  Example:
  0.12**3**
  3 is in the third decimal place

- If the number in the third decimal place is less than 5 you don't need to do any rounding, you just need to remove this third number

  Example:
  0.12**3** becomes 0.12

- If the number in the third decimal place is equal to or greater than 5 you need to "round up" the number in the second decimal place. This means removing the number in the third decimal place and adding 1 to the number in the second decimal place

  Example:
  0.12**5** becomes 0.13

- If there is a fourth decimal place that is equal to or greater than 5 you need to add 1 to the number in the third decimal place. If this makes the number in the third decimal place equal to or greater than five, you need to add 1 to the number in the second decimal place

  Example:
  0.124**7** becomes 0.12**5** which becomes 0.13

Three examples of rounding to two decimal places:

Step-by-step rounding of a number to two decimal places		
44.9358**4**	44.935**8**	Start with the last number. 4 is less than 5 so you don't need to round up the number on the left you just need to remove the number 4
44.935**8**	44.93**6**	8 is greater than 5 so 1 is added to the number on the left (5 becomes 6) and the 8 is removed
44.93**6**	44.9**4**	6 is greater than 5 so 1 is added to the number on the left (3 becomes 4) and the 6 is removed
You have now rounded the number to two decimal places: **44.94**		

Step-by-step rounding of a number to two decimal places		
56.9348**4**	56.934**8**	4 is less than 5 so you don't need to round up
56.934**8**	56.93**5**	8 is more than 5 so the number to the left rounds up
56.93**5**	56.9**4**	5 is equal to 5 so the number to the left rounds up
You have now rounded the number to two decimal places: **56.94**		

Step-by-step rounding of a number to two decimal places		
22.9348**4**	22.934**8**	4 is less than 5 so you don't need to round up
22.934**8**	22.93**5**	8 is more than 5 so the number to the left rounds up
22.93**5**	22.9**4**	5 is equal to 5 so the number to the left rounds up
You have now rounded the number to two decimal places: **44.94**		

Note: Rounding decimal places will affect the answers to the math tasks in this course.

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil

- Round the following numbers to two decimal places:

Number	Rounded to two decimal places
4.732	
22.567	
1.878	
0.1478	

IMPERIAL TO SI (METRIC)

Reading Text, Document Use, Numeracy, Computer Use

Imperial System

The Imperial System of measurement (e.g. feet, ounces) was developed in the United Kingdom and was used extensively until the 1960's.

Système International d'Unités (International System of Units)

Over 200 years ago the French developed an alternative measurement system called the SI or Système International d'Unités (International System of Units). This system is commonly known as the Metric System.

The SI system of measurement uses an internationally agreed upon set of units and has replaced the Imperial System in most countries. Today the United States is the only industrialized country that continues to use the Imperial System as their main system of measurement. The British converted in the 1960's followed by Canada in the 1970's.

The Imperial System continues to survive around the world, in large part due to the United States' extensive import/export business.

Fahrenheit and Celsius

The United States also uses Fahrenheit to measure temperature. Fahrenheit was developed in the early 1700's by physicist Daniel Fahrenheit. In most countries this system has also been replaced by the Celsius scale.

	Fahrenheit	Celsius
Boiling point of water	212°	100°
Freezing point of water	32°	0°
Absolute zero	–459.67°	–273.15°
The same when the temperature is:	-40°	-40°

Conversions

The SI uses units of 10; therefore many people find it easier to use than the Imperial System. The challenge for most people is converting between the Imperial System and SI.

Blacksmith artists will need to convert between inches/feet and millimetres/centimetres.

Products, tools, books and patterns that come from the United States will use the Imperial System of measurement.

If you have access to a computer it is easy to find conversion tools that will do the math for you. For example, if you enter the Imperial System measurement 5 inches, the program does the conversion to SI for you providing the number 12.7 centimetres.

° = degrees
°F = degrees Fahrenheit
°C = degrees Celsius

Example Conversion Site:

http://www.worldwidemetric.com/metcal.htm

Example Conversion Tables:

http://vulcan.wr.usgs.gov/Miscellaneous/ConversionTables/conversion_table.html

Many workplaces have conversion charts posted on the wall and some workers keep small conversion charts in their toolboxes.

If you don't have access to a computerized conversion tool or paper chart it will be helpful to know how to do some basic conversions on your own. The following task will help you develop the skills to do these conversions with and without technology.

This chart can be used as a guide for this task or you can keep it for future reference.

Symbol:			
mm = millimetre cm = centimetre m = metre km = kilometre			
SI to Imperial: some common conversions			
1 millimetre	.039 inches		
1 centimetre	10 millimetres	.39 inches	
1 metre	100 centimetres	39.37 inches	1.09 yards
1 kilometre	1000 metres	1093 yards	.62 miles
Imperial to SI: some common conversions			
1 inch	25.4 millimetres	2.54 centimetres	.0254 metres
1 foot	12 inches	.30 metres	30.48 cm
1 yard	3 feet	.91 metres	91 cm
1 mile	1760 yards	1.61 kilometres	

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil
- ✓ calculator (optional)
- ✓ computer

STEP ONE:

- Select a partner
- Review the "**Example Calculation**" below
- Complete the "**Conversion Problems:** (Imperial / SI)"

Example Calculation:

Problem:

You have a piece of metal 5 feet long.

How many metres is that?

Formula:

Feet x 0.30 = metres

- This formula can be found in the "**Formulas for Converting Between SI and Imperial"** chart (when you know feet and need to find metres)

Calculation:

5 feet x 0.30 = 1.5 metres

The piece of metal is 1.5 metres long

Note: Round your answers to one decimal place

Conversion Problems: (Imperial / SI)

1. You want to make a key holder and need .45 meters of steel. To buy metal you need to order it in feet. How many feet would you need to complete this project?

2. You need to cut off 4 inches from a bar of steel. How many centimeters will you need to cut?

3. You are making a small hole in a piece of metal. The steel is 3 inches wide and you need the hole to be 1 inch wide, how many millimeters wide does the hole need to be?

4. Calculate the number of centimeters there are in a piece of steel that measures 6 feet, 3 inches.

Formulas for Converting Between SI and Imperial:

When You Know	Multiply by:	To Find
Inches	25.4	Millimetres
Inches	2.54	Centimetres
Feet	30.48	Centimetres
Feet	0.30	Metres
Centimetres	0.39	Inches
Millimetres	0.039	Inches
Centimetres	0.03	Feet
Metres	3.3	Feet

STEP TWO:

- Work as a group
- Log onto the internet using a web browser
- Enter the following URL into the address bar

  http://www.worldwidemetric.com/metcal.htm

STEP THREE

- Using this online conversion tool, complete the same 4 "**Conversion Problems:** (Imperial / SI)"
- Record these answers beside your first set of answers
    - Did you notice any differences in your answers?
    - What would cause those differences?
    - Discuss your results as a group

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil
- ✓ calculator (optional)

STEP ONE:

- Work with your partner
- Complete the "**Find the Missing Measurement**" chart on the page following the example calculations
- Use the "**Imperial and SI (Metric) Reference Chart**" at the end of this task or the formulas in the "**Formulas for Converting Between SI and Imperial**" chart on the previous page
- Record your answers in the largest Imperial number
    - For example, if the answer is 16/16 record the answer as 1

Note: The first line of the chart has been done as an example – when you know 8/16 inch. The calculations are shown in the following two examples "**Find the Missing Measurement – Centimetres**" and "**Find the Missing Measurement - Millimetres**"

Example: Find the Missing Measurement - Centimetres:

Problem:

Convert this fraction **(8/16")** to a decimal

Formula*:*

Divide the numerator by the denominator

Numerator is the top number 8

Denominator is the bottom number 16

Calculate:

Divide 8 by 16 = 0.5 inch

Problem*:*

Find centimetres for **0.5** inch

Use the "**Formulas for Converting Between SI and Imperial**" chart

Formula:

inches x 2.54 = centimetres

Calculate:

0.5 inches x 2.54 = 1.27 centimetres

1.27 centimetres is the missing measurement

Example: Find the Missing Measurement - Millimetres:

Problem

Convert this fraction (8/16“) to a decimal

Formula:

Divide the numerator by the denominator

Calculate:

Divide 8 by 16 = 0.5 inch

Problem

Find millimetres for 0.5 inch

Use the “**Formulas for Converting Between SI and Imperial**” chart

Formula:

inches x 25.4 = millimetres

Calculate:

0.5 inches x 25.4 = 12.7 millimetres

12.7 millimetres is the missing measurement

Note: Round your answers to three decimal places.

Find the Missing Measurement:

Inches (Imperial)	Centimetres (SI/Metric)	Millimetres (SI/Metric)
8/16 inches	***1.27 cm***	***12.7 mm***
	0.635 cm	
	2.540 cm	
2/4 inches		
		19.050 mm
1/16 inches		
1 ½ inch		
		3500 mm

Imperial and SI (Metric) Reference Chart:

Imperial		SI/Metric	
Inches	***Decimal***	***Centimetres***	***Millimetres***
1/16"	0.062	0.157	1.575
2/16 = 1/8"	0.125	0.318	3.175
3/16"	0.187	0.475	4.750
4/16 = 1/4"	0.250	0.635	6.350
5/16"	0.312	0.792	7.925
6/16 = 3/8"	0.375	0.953	9.525
7/16"	0.437	1.110	11.100
8/16 = 1/2"	0.500	1.270	12.700
9/16"	0.562	1.427	14.275
10/16 = 5/8"	0.625	1.588	15.875
11/16"	0.687	1.745	17.450
12/16 = 3/4"	0.750	1.905	19.050
13/16"	0.812	2.062	20.625
14/16 = 7/8"	0.875	2.223	22.225
15/16"	0.937	2.380	23.800
16/16 = 1"	1.000	2.540	25.400

Reading a Ruler

Reading Text, Document Use, Oral Communication, Numeracy

A ruler is a straight edged tool used to measure distances. It is also used as an aid for drawing straight lines. A tape measure is a flexible form of a ruler. In this blacksmith course you will need to use a ruler and/or tape measure.

Imperial Rulers

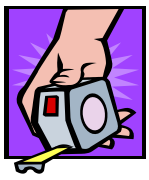
Imperial rulers are divided into inches. Each inch on the ruler is subdivided further by a series of long and short lines. The longer the line, the larger the unit of measurement.

For example:

- Each foot is divided into 12 inches
    - Each inch is marked with a whole number e.g. 1 to 12
- The longest line subdividing one inch is the ½ inch mark
- The ¼ inch mark is a shorter line. It divides the inch into 4 quarters
- The inch can also be divided into 1/8's
- In some cases the ruler will have lines dividing the inch into 1/16's

You will have noticed that Imperial measurements divide inches into fractions (¼ and ½). This can make it a difficult system to learn.

½ inch x 2 = 1 inch	¼ inch x 4 = 1 inch
1/8 inch x 8 = 1 inch	1/16 inch x 16 = 1 inch



The smallest line on this example ruler is 1/16 of an inch. If you look between the 1 and 2 inch markers you should be able to count 16 smaller lines.

When you see measurements written you will notice that the numbers are followed by an apostrophe. This is the symbol for feet. The quote symbol is used to represent inches.

<u>For example:</u>

- 6' is that same as 6 feet
- 7” is the same as seven inches
- 6’7” is six feet, seven inches

If you are writing down a measurement, record the whole number first. This number represents the number of inches. Leave a space then record the fraction of an inch. For example, 1 ½”.

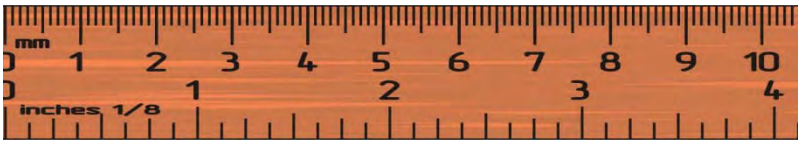
<u>SI Measurement or Système International d’Unités (International System of Units) – Commonly Referred to as Metric</u>

Most people find SI (Metric) rulers easier to use because they contain only centimetres and millimetres. A centimeter is divided into 10 millimetres. The larger numbered lines represent centimetres and the smaller lines represent millimetres. If you look between the 1 and 2 centimeter numbers you should be able to count 10 lines or 10 millimetres. A tape measure will include metres. One meter equals 100 centimetres.

Decimals are also in units of 10; therefore, 7 millimetres can be written as 0.7 centimetres.

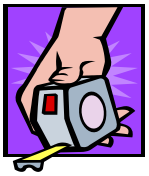
Tips for Blacksmiths

- Most rulers and tape measures will display both SI (Metric) and Imperial measurements; however it may be best to have two dedicated tape measures, one for SI (Metric) and one for Imperial
- If you need to make precise measurements avoid tape measures with hooks. Hooks on the end of a tape measure will bend which can make your measurement inaccurate
- Whenever possible, start your measurement at 1 rather than 0, especially if you are using a ruler. If the end of the ruler is worn down, your measurements won't be accurate
- If you are working with small detailed measurements, make sure you can see the lines on the ruler/tape measure
    - This may mean having your eyes tested
- Check the ruler or tape measure against another ruler or tape measure
    - They are not always printed accurately



TASK STEPS

YOU WILL NEED:



- ✓ a pen or pencil
- ✓ tape measure and/or a ruler (you will need to be able to read both Imperial and SI/Metric measurements)

STEP ONE:

- Work as a group
- Brainstorm a list of jobs where you would need to use a ruler or tape measure
    - When do you use a ruler or tape measure at home?
    - When will you use a ruler/tape measure in blacksmithing?
    - Do you prefer the Imperial or SI (Metric) system?

STEP TWO:

- Select a partner
- Find tape measures and rulers
- Pick three things to measure
- Record your measurements using both Imperial and SI (Metric) measurements

Item Measured	**Imperial** (feet or inches)	**SI/Metric** (centimetres / millimetres)

STEP THREE:

Using the SI/Metric ruler image below:

- Place an x above the 3 centimeter line
- Extend the 5 millimeter line to the bottom of the ruler
- Place an x under 4.5 centimetres

STEP FOUR:

Using the Imperial ruler image below:

- Place an x above the 3 inch line
- Extend the ½ inch line to the bottom of the ruler
- Place an x under 4 ½ inches

STEP FIVE:

- Use your ruler to identify which measurement is longer and circle that number

  10 mm or 10 cm

  75 mm or 5 cm

  100 mm or 12 cm

  1/4 inch or 3/8 inch

  1/3 inch or 1/6 inch

  8/16 inch or ¾ inch

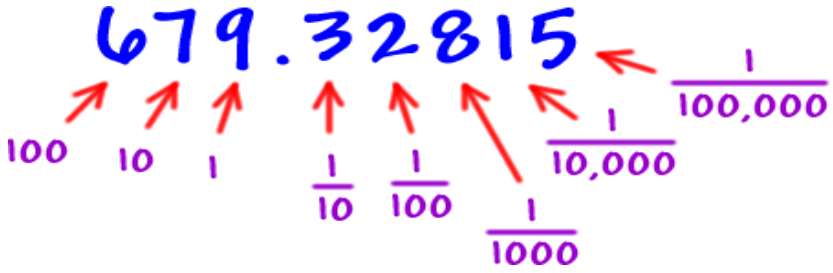
ORDERING DECIMALS

Reading Text, Document Use, Numeracy, Oral Communication

A decimal is a dot in a number that looks like a period.

A decimal point separates whole numbers from numbers that are only a part of a whole number (less than 1). Therefore, decimals allow you to write numbers that fall between two whole numbers. For example the number 3.6 is larger than 3, but smaller than 4.

Numbers to the left of the decimal increase in size as you move to the left. The numbers on the right of the decimal point decrease in size as you move to the right.



http://www.coolmath.com/decimals/01-decimals-place-value.html

In the image above you will notice that decimals show another way of writing a fraction. You will also notice decimals are based on the unit 10. The word "Decimal" is actually Latin for “A Tenth Part”.

Which Decimal Is Larger?

It can be difficult to determine which number is larger when you are comparing decimals. For example which is the largest number in the list below?

4.500, 4.050, 4.60, 4.01

It helps to have an equal number of digits after each decimal point. For example, it should be easier to tell which number below is the largest now that there are two numbers after each decimal point.

4.50, 4.05, 4.60, 4.01

Note: Adding and removing zeros at the end of a number that follows a decimal does not change the value of the number. For example 4.5 and 4.50 are equal.

Look at the numbers below. Which number is larger?

5.50, 5.05, 5.205

Adding zeros makes it easier to see that:

5.500 is larger than **5.205**

5.205 is larger than **5.050**

Table for Ordering Decimals:

Using a table also makes it easier to order numbers from largest to smallest. The following table orders the following list of numbers:

0.419, 0.88, 0.450, 6.4, 2.570

Whole#	Decimal	Tenths	Hundredths	Thousandths
6	.	4	0	0
2	.	5	7	0
0	.	8	8	0
0	.	4	5	0
0	.	4	1	9

Explanation:

The whole number **6** is larger than the whole number **2** so **6.4** is larger than **2.570**

2 is the only other whole number so it comes second

Starting in the tenths column, **8** is larger than **4** so **0.88** is next

There are two number **4's** in the tenths column so the number in the hundredths column must be used. **5** is larger than **1**, therefore **0.450** is larger than **0.419**

Greater Than/Less Than Chart

The following chart identifies whether the number on the left is “Larger Than”, “Smaller Than” or “Equal to” the number on the right

Example: Greater Than /Less Than /Equal to:

	Greater than > Less than < Equal to =	
0.406	Less than <	0.709
13.468	Less than <	13.58
0.987	Equal to =	0.9870
0.678	Greater than >	0.43
0.087	Greater than >	0.07
0.24	Equal to =	0.2400

TASK STEPS

YOU WILL NEED:

- ✓ a pen or pencil

STEP ONE:

- Find a partner
- Work together to complete the table below
- Enter the following list of sizes from the largest to smallest
    - It will help if you cross out the numbers as you place them in the chart

0.71

1.7

0.500

0.76

1.5

0.369

Whole #	Decimal Point	Tenths	Hundredths	Thousandths
	.			
	.			
	.			
	.			
	.			
	.			

STEP TWO:

- Work with your partner
- Complete the following chart
    - Identify whether the number on the left is "Larger Than", "Smaller Than" or "Equal to" the number on the right

	Greater than > Less than < Equal to =	
3.5		3.50
6.5		6.67
0.88		0.445
0.867		0.944
0.766		0.7660
1.339		1.39

STEP THREE:

- Work as a group
- Discuss your answers for all the steps in this task
- Discuss examples of when you would use decimals in blacksmithing?

HOME WORKSHOP

Reading Text, Document Use, Writing, Numeracy, Oral Communication, Computer Use

Thinking Skills: Decision Making, Critical Thinking, Finding Information

If you want to continue blacksmithing as a hobby it is a good idea to research the costs associated with starting up and purchasing the necessary tools and equipment.

You will need to do some research outside of class time. You will be asked to present your findings to the group in a future class.

TASK STEPS

YOU WILL NEED:

- ✓ sign-up chart
- ✓ a pen/pencil
- ✓ a computer

STEP ONE:

- Review the "**Product Research**" sign-up sheet that your instructor will provide
- Choose the item you would like to research
- Write your name in the space beside the item

STEP TWO:

- Gather information about the item you chose using resources such as:
    - your instructor
    - the internet
    - supply stores
- Collect information about the item including the:
    - price and size
    - locations (where the product can be purchased)
    - value – customer reviews
    - features – why is it better/different than other products
- Record your findings on the "Product Comparison Chart" found on the following page
- Compare a minimum of two makes/models/brands/companies
    - If you want to compare more than two, print another copy of the "**Product Comparison Chart**"
- Select the product you think is the best option and be prepared to present your recommendation to the class
    - Record your recommendation on the "**Results of the Group Presentation**" chart, found at the end of this task

PRODUCT COMPARISON CHART

The Item:

Research	Results – Product A - Name:	Results – Product B – Name:
Price		
Size		
Location (where it can be purchased)		
Value – customer reviews etc.		
Features – what makes it better/different than the other products		
Other Information		

TASK STEPS

YOU WILL NEED:

- ✓ your notes
- ✓ a pen/pencil

STEP ONE:

- Refer to the research notes you recorded on the "**Product Comparison Chart**"
- Tell the group about your research including:
  - the item you researched
  - the makes/models/brands/companies you researched
  - the techniques you used for doing your research e.g. internet
- Present the one product you would recommend for a home workshop, including the:
  - company name
  - price
  - size
  - location (where can it be purchased)
  - value – customer reviews
  - features – what makes it better/different than the other products

STEP TWO:

- Record notes on the "**Group Presentation Results**" chart as others in your class are presenting
  - This chart is available at the end of this task

STEP THREE:

- Work as a group to calculate the cost of setting up a home workshop
  - If information is missing ask your instructor for help

GROUP PRESENTATIONS RESULTS

Product	Is this necessary?	Make/Model/ Brand/Company	Product Details	Price
Anvil				
Hammers				
Anvil Tools				
Tongs				
Ear Protection				
Safety Goggles				
Gloves				
Traditional Forge				
Gas Forge				
Total Costs				

STEP FOUR:

- Discuss making your own tools
- Discuss purchasing steel for projects
    - Where could you buy steel locally?
    - What other sources of steel are there?

BLACKSMITH - QUIZ FOUR

Notes: The Forge, Forging, Forging Techniques and Tools and Equipment

1. Which type of fuel was not used in a Blacksmith's forge?
    a. Charcoal
    b. Coal and Coke
    c. Wood
    d. Natural Gas and Propane

2. When the word forge is used as a noun it means:
    a. a furnace used to heat metal
    b. the blacksmith shop
    c. shaping metal by using force
    d. A and B

3. Before they begin work, Blacksmiths usually need the colour of metal to be:
    a. Orange or Yellow
    b. Cherry Red
    c. Black
    d. White

4. In most cases you don't want metal to exceed:
    a. 1,083 degrees Celsius (1,981 degrees Fahrenheit)
    b. 426 degrees Celsius (800 degrees Fahrenheit)
    c. 147 degrees Celsius (297 degrees Fahrenheit)
    d. 1,316 degrees Celsius (2,400 degrees Fahrenheit)

5. Many burns happen with black heat. This is when metal is as hot as 426 degrees Celsius (800 degrees Fahrenheit) but still looks black.
    a. True
    b. False

6. The two most common mistakes made by new Blacksmiths are:
    a. They remove the metal from the forge before it is ready
    b. The pick advanced projects
    c. They continue hammering when the metal should be returned to the fire
    d. They forget to watch the metal in the forge

7. You can change the size and shape of metal, however, the volume will stay the same unless you cut a piece off. Therefore, if you shorten metal with hammer blows it will become:
    a. Thicker
    b. Thinner
    c. Flatter
    d. Weaker

8. Upsetting is a technique used to:
    a. bend and twist the metal
    b. decrease the length and increase the diameter of metal
    c. increase the length and decrease the diameter of metal

9. A rivet is:
    a. A type of scrolling
    b. A metal pin
    c. A tool used for punching a hole in metal

10. What causes gouge marks in metal?
    a. Heating it to a high temperature
    b. Striking the metal with the edge of the hammer head
    c. Using the wrong anvil tool
    d. Hitting the metal after it has cooled

11. Find the section in your notes called Tools and Equipment. Find the page with the heading Tongs. In the sidebar the Essential Skill “Job Task Planning and Organizing” is listed. List one example of “Job Task Planning and Organizing” from this page.

BLACKSMITH - QUIZ FIVE

Notes: Finishing, Forging and Overall Questions

1. Bronze is an alloy combining which two metals?
    a. Silver and Copper
    b. Copper and Tin
    c. Copper and Zinc

2. Steel is an alloy of:
    a. Iron and Carbon
    b. Silver and Copper
    c. Iron and Tin

3. Historically, a Blacksmith would start their ten year apprenticeship at what age?
    a. 7
    b. 17
    c. 27

4. Historically, Blacksmiths played a critical role in the community. In addition to making and fixing tools, it was not uncommon for a blacksmith to also be the:
    a. Pub Operator
    b. Doctor
    c. Dentist
    d. Sheriff

5. If unprotected iron is exposed to oxygen and moisture, how long before it rusts to nothing?
    a. 100 years
    b. 500 years
    c. 1,000 years
    d. 10 years

6. Years ago, the Smith family of England was well known for their work with black metal. Soon people started to call metal work Blacksmith.
    a. True
    b. False

7. Which words can be used to describe metal?
    a. Opaque, ductile, malleable and conductive
    b. Transparent, water soluble and fragile
    c. Heat resistant, electronegative and brittle
    d. A and C

8. Diffuse means
    a. Remove the fuse
    b. To spread something throughout something else
    c. Remove the grains of the metal
    d. Cool the metal quickly

9. Which of the following is not used for protecting metal?
    a. Beeswax
    b. Flux
    c. Linseed Oil
    d. Paint

10. It is important to plan your project before you begin. What step is the most important?
    a. Measuring and sketching
    b. Writing out step-by-step instructions
    c. Identifying all the materials you will need
    d. Identifying all the tools you will need
    e. All of the above

11. Find the section in your notes called Forging. Find the page with the heading "Tips – Heating Metal". In the sidebar the Essential Skill "Critical Thinking" is listed. List one example of "Critical Thinking" from this page.

TECHNICAL SKILLS IN BLACKSMITHING

Reading Text, Document Use, Numeracy, Writing, Oral Communication

Thinking Skills: Critical Thinking

Employers and supervisors will often ask their employees to rate their own skills and skill improvement as part of their yearly evaluations. The ratings are done to show improvement and help identify areas that still need to be developed. This task gives you an opportunity to rate your own skill development in this course.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

- Read the list of technical skills on the left side of the "**Technical Skills**" chart on the following page
  - Add any missing skills in the blank space provided
- Rate each skill based on an estimate of your skill level at the start of this course
- Rate your current skill level now that you have almost completed this blacksmith course
- Compare the two scores for each of the skills listed
  - Did your skills improve?

STEP TWO:

- Work as a group
- Brainstorm jobs that may require these same skills
- Record the job titles the group identifies
  - Use the final column on the chart to keep your own notes

Rating your Technical Skills			
1 = Low and 5 = High			
Skill	**Starting Skill**	**Current Skill**	**Jobs Using the Same Skill**
Hammering	1 2 3 4 5	1 2 3 4 5	
Measuring – ruler/tape measure	1 2 3 4 5	1 2 3 4 5	
Creating and reading guidelines / sketches/ diagrams	1 2 3 4 5	1 2 3 4 5	
Using power tools	1 2 3 4 5	1 2 3 4 5	
Heating and forging metal	1 2 3 4 5	1 2 3 4 5	
Assessing blacksmith projects	1 2 3 4 5	1 2 3 4 5	
Use of safety equipment and working safely	1 2 3 4 5	1 2 3 4 5	
Motor coordination / manual dexterity	1 2 3 4 5	1 2 3 4 5	
	1 2 3 4 5	1 2 3 4 5	
	1 2 3 4 5	1 2 3 4 5	
	1 2 3 4 5	1 2 3 4 5	

ESSENTIAL SKILLS IDENTIFICATION

Document Use, Oral Communication, Writing

Thinking Skills: Decision Making, Critical Thinking, Significant Use of Memory

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

- Work with your group to complete the "**Essential Skills Identification"** sections
    - You will be assigned to either Group 1 or Group 2

STEP TWO:

- List 1- 4 examples of the Essential Skills you have demonstrated in this course for each of the Essential Skills categories in your assigned section
    - Record your groups responses on your copy
    - Complete this exercise without looking back in your notes
- Find a volunteer to present the group findings

STEP THREE:

- Work with the entire group
- Have the presenter report your groups responses
    - When the other group is presenting, record their results on your sheet

STEP FOUR:

If you have completed the "**Essential Skills Checklist**" at the end of each class:

- Work independently and read over your checklist to review the skills you have developed

ESSENTIAL SKILLS IDENTIFICATION - GROUP 1

Reading Text
Reading materials in the form of sentences or paragraphs

Document Use
Tasks that involve a variety of information displays in which words, numbers, symbols and other visual characteristics (e.g. lines, colours or shapes) are given meaning by their spatial arrangements (including charts)

Numeracy
Using numbers and thinking in quantitative terms to complete tasks

Writing
Writing text and writing in documents, such as filling in forms, and non-paper-based writing such as typing on a computer

Oral Communication
Using speech to give and exchange thoughts and information

Working with Others
Employees working with others to carry out their tasks

ESSENTIAL SKILLS IDENTIFICATION - GROUP 2

Thinking Skills

Problem Solving

addressing problems that require solutions

Decision Making

deciding between options

Critical Thinking

assessing, evaluating ideas or information to reach a rational judgment of value

Job Task Planning and Organizing

planning and organizing tasks

Significant Use of Memory

memorization of procedures, codes, numbers, remembering information, learning from an experience

Finding Information

using text, people, databases or systems to find information

Continuous Learning

Workers participating in an ongoing process of acquiring skills and knowledge

Computer Use

Using different kinds of computer applications and other related technical tools

TOP THREE ESSENTIAL SKILLS

Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil

STEP ONE:

- Work independently
- Review the nine Essential Skills in the list below
- Circle the top three Essential Skills you think someone would need to be successful as a blacksmith

Nine Essential Skills:

Reading	Writing	Continuous Learning
Document Use	Oral Communication	Computer Skills
Numeracy	Working with Others	

Thinking Skills:

Problem Solving, Decision Making, Critical Thinking, Job Task Planning and Organizing, Significant Use of Memory, Finding Information

STEP TWO:

- Present your choices for the top three Essential Skills in blacksmithing
- Discuss with the group

CAREER RESEARCH ASSIGNMENT

Reading Text, Document Use, Writing, Oral Communication, Computer Use

Thinking Skills: Decision Making, Critical Thinking, Finding Information

In this task you will:

- research a website to learn more about blacksmithing as a career
- research a website to learn more about apprenticeships and trades
- research a website to learn more about a career you are interested in

This assignment is to be done independently; however, your instructor is always available to help. You can work on this task at home or in class.

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil or computer
- ✓ printer and paper

STEP ONE:

- Talk with your instructor to arrange a time to present to the class
- Work independently
- Visit the sites listed at the end of this task or search for other apprenticeship, trade or career related sites
- Bookmark the sites you want to use to complete this task or write down the URL's
- Have a pen and paper available to record your notes
    - You can also use a computer and printer to type and print the notes for your presentation
    - There is space provided in this task for notes

- Record at least one thing you found interesting when you researched:
    - Blacksmith
    - Apprenticeships and trades
    - A career you are interested in

STEP TWO: In Class Presentation

- Present the websites you searched
- Present information you found interesting about each of the topics you researched
- Present your plan for further research

Notes:

- Blacksmithing

- Apprenticeships and trades

- Your career research

WEBSITES

Essential Skills Website

http://srv108.services.gc.ca/english/general/home_e.shtml

Service Canada Career Exploration

http://www.jobsetc.gc.ca/categories.jsp?category_id=12&lang=e

Service Canada Apprenticeship Page of Links – select one of the links

http://142.236.54.114/eng/on/lmi/eaid/occinfo/apprent.shtml

National Occupational Classifications (NOC)

http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/OccupationIndex.aspx

Ministry of Training, Colleges and Universities (MTCU) - Pathway to Apprenticeship

http://www.edu.gov.on.ca/eng/training/apprenticeship/appren.html

NOC Forging Machine Operator

http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/QuickSearch.aspx?val65=9512

Apprenticeship Search Ontario

http://www.apprenticesearch.com/default.asp

Ontario Blacksmith Association

http://www.ontarioblacksmiths.ca/

Blacksmith Association

http://www.abana.org/

Trends in Apprenticeship in Canada

http://www.statcan.gc.ca/pub/81-004-x/2006002/9250-eng.htm

Ministry of Training, Colleges and Universities (MTCU) - What is an Apprenticeship?
http://www.hrsdc.gc.ca/eng/workplaceskills/trades_apprenticeship/index.shtml

Canadian Apprenticeship Forum
http://www.caf-fca.org/en/

BUILDING YOUR RÉSUMÉ

Reading Text, Document Use, Oral Communication, Writing

Thinking Skills: Decision Making, Critical Thinking

TASK STEPS

YOU WILL NEED:

- ✓ pen/pencil/highlighter

Note: We are not assuming that you will want to be a Forging Machine Operator or blacksmith.

Essential Skills Website: http://srv108.services.gc.ca/english/general/home_e.shtml

STEP ONE:

- Scan the Occupational Profile for Forging Machine Operator at the end of this task
- Circle or highlight any word or skill you could now add to your résumé
    - This may include a portion of a skill listed

STEP TWO: *Complete only if you used the "Essential Skills Checklist"*

- Review the individual "**Essential Skills Checklist**" you completed at the end of each class
- Highlight or circle any skill you could now add to your résumé

STEP THREE:

- Use the information you selected in Step One and Two to write a line that you could include on your résumé
    - If you have time, continue writing points you could include on your résumé

STEP FOUR:

- Work as a group
- Present what you have written to the others in your class
- Discuss any other skills you may consider adding to your résumé

The following information has been gathered from the Essential Skills Profile for Welders found at the Human Resources and Skills Development Canada website: http://srv108.services.gc.ca/english/profiles/215.shtml. This site has the full, detailed Welder profile as well as many other occupational profiles.

FORGING MACHINE OPERATORS

NOC 9512

INTRODUCTION

Forging machine operators operate forging machines to form and shape metal into various shapes and sizes and impart desired strength, hardness or other characteristics. They are employed primarily in the fabricated metal products, machinery, and transportation equipment industries.

READING TEXT

- read routine memos and notices about safety posted around work areas to stay up-to-date on related company policies and recommended practices
- read routine memos and notices about safety posted around work areas to stay up-to-date on related company policies and recommended practices
- may read a newsletter to stay informed about industry trends
- may read reports from head office to obtain information on production problems and corresponding set up changes which need to be implemented
- read various manuals to find information about operating forging machines or about quality assurance

DOCUMENT USE

- may complete checklist forms to provide standardized orientation for new workers
- read labels on gas pipes and water lines to operate furnaces
- read Workplace Hazardous Materials Information System (WHMIS) labels to obtain safety information
- read work orders to obtain such product information as quantity, dimensions and type and gauge of steel to use

- interpret sketches, drawn by co-workers, to learn how to set up machines for a specific order
- read tables to obtain data such as the temperature requirements for forging pipes, die code numbers and corresponding shelf numbers indicating where they are stored
- interpret isometric drawings to bend metal according to the customer's specifications and blueprints to set up the machine for the required tolerances
- complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported
- read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported
- read tables, schedules or other table-like text (e.g., read work shift schedules)
- recognize common angles such as 15, 30, 45 and 90 degrees
- draw, sketch or form common shapes such as circles, triangles, spheres, rectangles, squares, etc
- interpret scale drawings (e.g. blueprints or maps)
- take measurements from scale drawings
- read assembly drawings (e.g. those found in service and parts manuals)
- make sketches
- obtain information from sketches, pictures or icons (e.g., computer toolbars)

WRITING

- write brief comments on a work order, such as an explanation of why a customer's order cannot be met in full
- maintain log books to record production data including product numbers, quantities produced, dates, shifts and the number of each drawing used
- may complete progress report forms after every 100 pieces produced to comply with quality control procedures set by the International Standards Organization (ISO)

- complete rejection tags or nonconformance reports of up to a paragraph in length to describe why defective materials do not meet quality control standards
- may prepare accident investigation forms requiring more than one paragraph to record the results of accident investigations

ORAL COMMUNICATION

- speak to suppliers to make sure that the required sizes of pipes are available
- communicate with other forging machine operators to co-ordinate shared access to machines, to give instructions to junior operators and to exchange job-related information
- may communicate with partners to jointly accomplish tasks or with helpers to provide information and oversee their work
- may interact with co-workers in the capacity of group leader to provide explanations and assist workers who are having problems
- interact with their supervisors to obtain work assignments, provide progress reports and discuss production problems
- interact with millwrights to discuss the symptoms of equipment problems
- interact with workers in other departments, such as engineering and quality control, to exchange information and to obtain feedback
- Needs to manage noise from equipment, such as furnaces and forging machines, coupled with the use of hearing protection, makes verbal communication difficult.

NUMERACY

- measure dimensions, such as the diameter and length of pipes, and measure furnace temperatures to perform routine job tasks. (Measurement and Calculation Math)
- take a variety of measurements to ensure that pipe dimensions are as specified. (Measurement and Calculation Math)

- calculate the number of steel rods needed to make 600 18-inch steel bolts. (Measurement and Calculation Math)
- take precise measurements, using callipers and micrometers, to obtain some of the data needed for identifying whether the item is within tolerance limits. (Measurement and Calculation Math)
- may calculate how much pipe will be required to complete bends, which are given as degrees of rotation around a circle with a fixed radius. (Measurement and Calculation Math)
- estimate how many pieces are in a box or on a lift, in case they need to make set up adjustments such as splitting up a lot. (Numerical Estimation)
- estimate heating times for metal to ensure that it reaches the correct temperature, considering such variables as the size of steel and complexity of the dies. (Numerical Estimation)

For example:

- reading whole numbers shown on blueprints or subtracting the number of parts made from the number ordered to calculate the outstanding number of parts to be made, or counting 250 blanks into boxes and multiplying (250) (number of boxes) to get a daily count of products produced
- reading metal rod sizes, such as 7/16 inch, or dividing a pipe's diameter in two to calculate its radius
- taking measurements using callipers or other metric instruments or calculating whether a measurement is within prescribed tolerance limits
- identifying the decimal equivalent of a fraction, using equivalency tables, to use tools interchangeably
- applying formulae to calculate the perimeter of a circle or to calculate the length of steel needed for a bolt, given its shank and head dimensions and the length of a steel rod
- converting between the metric and imperial measurement systems, such as between inches and centimeters

- calculating the perimeter of circles, or calculating a part circumference of a circle and its corresponding sector angle

Measuring Instruments:

- Time – clock or watch
- Dimensions - using a measuring tape, ruler, micrometer or calipers
- Temperature - using a forging gauge, temperature helical coil or optical pyrometer.
- Pressure – using a gauge
- Electrical potential – volt meter
- Wattage – wattage meter
- Angles – protractor or square
- Measurement – SI (metric) or Imperial Measurement System

THINKING SKILLS

Problem Solving

- may notice that metal "brightens up" when going by on the line, a sign of a particular problem. They address the problem, measuring edges and making welds
- may notice temperature fluctuations in the furnace which threaten the quality of the final product. They make temperature adjustments to the furnace at various intervals, drawing on their experience to time the adjustments so that an even temperature is consistently maintained
- may deal with defective materials, such as faulty pipe seams which break when bent. They identify whether they should modify the bending process to perform a more gradual bend or whether the pipe needs to be upgraded to a heavier type
- may observe that a machine was running too hot, scarring the eye nuts under production. They use their judgement in recommending whether the scarred pieces are in conformance with quality control standards and, if not, write a non-conformance report. They then identify the

cause of the problem, using a process of elimination, and make the necessary corrections, such as removing a piece of metal stuck in the machine

- may be informed that stress tests show cracks in the weld. They collaborate with their foreperson to assess the probable cause of the problem, which may relate to whether the pipe was formed correctly. Together they decide on what corrective measures to take, such as changing the angle of a fin, and have a second stress test taken to determine the success of the actions taken

Decision Making

- decide when the colour of metal indicates proper forging temperature
- decide whether to obtain a new die or improvise with a similar die when it is worn out or missing, justifying their actions to their supervisor
- decide what constitutes safe working practices at all times to protect the well being of themselves and others
- decide whether the metal products that they have produced meet quality assurance standards

Critical Thinking

Not available for this profile

Job Task Planning and Organizing

- own job planning and organizing
- perform repetitive tasks but the content of the tasks may vary depending on the work at hand. Work priorities and related deadlines are tied to customer demand and forepersons provide most forging machine operators with work order assignments detailing this information. Forging machine operators whose companies have adopted team principles may allocate work as a team at the beginning of each shift. Most forging machine operators have wide scope to determine the order of tasks, sequencing multiple tasks for efficiency by, for example, ensuring that machines, equipment and supplies are available when needed. Some co-ordinate with the

work plans of other machine operators to arrange shared access to machines and to arrange for assistance in performing heavy job tasks.

Significant Use of Memory

- remember procedures to operate heaters and forging machines and to troubleshoot minor problems
- memorize tool codes to identify when the use of various hand tools is specified

Finding Information

- refer to blueprint books to verify the product specifications for a particular job
- speak with their supervisor to find information needed to troubleshoot process problems
- refer to manuals to find information on how to set up forging machines for various jobs. This may be deemed mandatory as a quality assurance measure
- speak with journeypersons working in the plant, such as electricians and millwrights, to seek electrical or mechanical information needed to troubleshoot quality control problems which may be equipment related

WORKING WITH OTHERS

Most forging machine operators work independently to form and shape metal under the direction of a supervisor. Some forging machine operators, working for companies which have adopted team principles, work independently as a team under the direction of a group leader. They co-ordinate with: supervisors or group leaders to troubleshoot production problems; co-workers to exchange/arrange shared access to machines; quality control staff to ensure that products meet quality assurance standards; and, workers in other classifications, such as millwrights to provide information about machine problems. They may work with another forging machine operator or a helper to complete large or complex tasks.

COMPUTER USE

- use computer or computer-controlled machinery or equipment with no knowledge of software required. For example, they may use computer-controlled forging machines or they may use customized programs for just-in-time (JIT) inventory systems

CONTINUOUS LEARNING

Forging machine operators have a need for ongoing learning to acquire information about new products, machining procedures, quality assurance and to maintain safety skills and knowledge. Some forging machine operators may have an additional need for ongoing learning to operate computer-controlled forging machines. New learning is acquired through informal means as part of regular work activities and by participating in training sessions primarily offered in the workplace.

OTHER INFORMATION

In addition to collecting information for this Essential Skills Profile, our interviews with job incumbents also asked about the following topics.

Physical Aspects

Forging machine operators stand, walk, bend and stretch to operate furnaces and forging machines.

Attitudes

The forging machine operators interviewed felt that forging machine operators should be patient, hard working and willing to work in extreme heat. They should be safety conscious.

Future Trends Affecting Essential Skills

More companies may decide to seek International Standards Organization (ISO) certification to gain a competitive edge. As a result, forging machine operators may be required to read text and write more frequently to find and record information for ISO documentation. They may also require more complex numeracy skills to maintain Statistical Process Control (SPC) standards. These changes may place more emphasis on continuous learning requirements.

GROUP WRAP-UP

Document Use, Oral Communication

Thinking Skills: Decision Making, Critical Thinking

TASK STEPS

YOU WILL NEED:

- ✓ your finished project(s)

STEP ONE:

- Present your finished project(s) to the group and tell the group about your experiences
  - Were you confident in your skills?
  - What do you like most about blacksmith work?
  - Are you happy with the results?
  - What would you do differently next time?
  - What problems did you solve?
- Present the most important Essential Skill you learned/developed?
- Present the challenge you are most proud of overcoming?
- Discuss your overall experience in this blacksmith course

STEP TWO:

- Present your plans to the group:
  - Ongoing courses in blacksmithing
  - Ongoing courses in other areas
  - Job search
  - Setting up an area at home to work