
Master Spinners Handbook

Content in this document is current as of time of printing. Check the Master Spinner website for any recent changes

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Website

<http://www.oldscollege.ca/programs/ContinuingEducation/trades-career-studies/fibreweek/master-spinner-program.htm>

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Master Spinner Certificate Program

The Olds College Master Spinner Certificate Program consists of six progressive levels of classroom and independent study. These six levels involve skill development, research studies, and project assignments in the area of hand spinning of all major types of fibres, yarns, and the end use of the spun yarns.

Levels 1-4 each consist of a five-day (30 hours) workshop while Levels 5 and 6 are each seven days (42 hours) in length. Each level is followed by an independent home study portion for those students working towards certification. This home study portion will require about 100-150 hours of work.

A Prior Learning Assessment and Recognition (PLAR) option for experienced spinners is currently available for Levels 1-2.

At all levels, students are evaluated on the basis of written assignments, practical projects, oral presentations, and skill development.

Three College credits are earned upon successful completion of each level.

Those individuals who successfully complete the assignments in all six levels will receive a Master Spinner Certificate from Olds College. See Level 6 In-Depth Study policy for additional details.

Master Spinner Program Student Policies

Certificate Students

Students may enroll in the program with a view to earning the Master Spinner certification. As such they will need to complete the assignments associated with each level. These assignments will be marked and have a percentage grade assigned.

Audit Students

Students may enroll in a class to upgrade their skills only and not to obtain certification. As such, they may choose not to do the assignments needed to obtain a grade. These students will receive an audit (AU) designation rather than a percentage grade.

Changing From Audit To Certification

If after having received one or more audit grades, a student may make a request, in writing to the Olds College coordinator, to be considered for the certificate program.

Such requests must be made within three (3) years, and will be dealt with on an individual basis in consultation with a committee of Master Spinner instructors who will decide how the student should proceed.

A fee for each level affected will be connected to this request and all assignments must be submitted according to the timeline decided on by the committee.

Student Fees

Tuition and Marking fees will be established by Olds College and will be subject to periodic review.

Students will generally encounter costs in these areas:

- Course Registration Fees
- Materials Fees
- Personal Classroom Supplies
- Workbook Assignment Supplies
- Marking Fees
- Graduation Fee

Course Registration Fees

Classroom and PLAR fees will be set by Olds College at the time advertising is prepared. These fees will include the course manual.

Materials Fees

The instructor will supply many of the fibre materials (other than those on a student supply list) that are required for successful participation during a class. The fee for these materials will be collected at the time of registration.

Personal Classroom Supplies

The student is expected to come prepared with certain equipment and supplies necessary for successful participation in the classroom activities. This supplies list will be provided to all registrants and will also be available as an online download. If travel by air to Fibre Week is necessary, some supplies can be considered optional. These are indicated on each list. Such students may share the equipment or supplies brought by other students.

Workbook Assignment Supplies

Students are responsible for procuring fibres and other supplies needed to complete the workbook requirements. These can be purchased from vendors during Fibre Week or from other sources available to them. The classroom instructor may have a suggested list.

Marking Fees

Payment of a marking fee is required when an assignment is ready for evaluation. Students should check the Fibre Week website or contact the college coordinator for the current rates.

Graduation Fee

Olds College levies a graduation fee (\$25 at the time of this printing) for all students completing a college credit certification program.

Student Assignments

Students who are working towards certification will complete a major homework assignment following each level of instruction according to the guidelines presented.

Unless otherwise requested or designated, the assignment will be marked by the instructor who taught that student.

The Level 6 assignment will be reviewed by **two** instructors according to the published guidelines to determine a final grade.

Upon completion of a homework assignment, the student will pay the designated marking fee to Olds College and mail the project to the assigned instructor.

When the marking fee is received, Olds College will inform the instructor so that the evaluation can proceed.

Assignment Timelines

Students who wish to obtain a mark for each level and thus be eligible for the Master Spinner Certificate will observe the following timelines:

- The assignment will be submitted for marking within 12 months after the class has ended.
- If the work has not been submitted, an audit (AU) grade will be assigned unless an extension has been requested from the Olds College coordinator at least one month before the due date. If granted, the extension will not exceed four months beyond the original completion date. Only one extension date will be allowed per course level. An “Incomplete” grade (I) will be assigned for that student until completion.

Certification

Upon successful completion of all six levels along with their assignments, students will be eligible for the Master Spinner Designation. See the Level 6 In-Depth Study policy for additional details.

Prior Learning Assessment And Recognition (PLAR)

This option is currently only available for Levels 1 and 2.

An experienced spinner who wishes to enter the program without attending a class may contact the program coordinator and register for the PLAR option.

Completion timelines will be the same as for a classroom course and submissions must be marked before the student enters the next level.

When a student registers for the PLAR option, the coordinator will:

- assign an instructor to that student;
- give the instructor's contact information to the student;
- give the student's contact information to the instructor.

The student will receive:

- the current course materials;
- the current assignment requirements;
- up to 3 hours of instructor time (logged by the instructor).

The instructor will contact the student by email to arrange a suitable time for an orientation session (likely by phone) in order to review the assignment requirements.

The student will be able to address questions to the instructor at such times and in a manner agreed to during the orientation session.

When completed, the required marking fee will be submitted to Olds College and the assignment will be mailed to the instructor for evaluation.

Frequently Asked Questions

This document is designed to answer many of the questions students (both classroom and distance learning) ask about the “processes” of the Master Spinner program. Questions about the content of the various levels and the specific workbook requirements are best answered by contacting the assigned instructor.



How do I set up my workbook?

The workbook(s) need to contain all of the exercises listed in the workbook requirements and should be organized so that an instructor can find the needed materials. Many students submit their work in a three ring binder(s) using plastic page protectors to hold the skeins and samples. But for ease of shipping or personal preference, students are free to use file folders, storage boxes, or whatever system works for them – as long as it is organized and contents clearly labelled. If in doubt, contact the instructor to discuss possibilities.

All skeins (and samples, if loose) should be properly labeled, as described in the requirements. Skeins need to be taken out for examination, so they should not be permanently mounted in the workbook. Place the skeins into the plastic sleeve or folder being used. Proper labels will allow the skeins to be replaced in the correct location should they accidentally come out.

When using tape or glue to secure skeins or samples to a page, remember that when a binder or box is closed the pages may press against one another. Anything sticky will adhere to facing pages and an instructor may literally have to destroy a page or pages to remove a skein for examination.



I have a physical disability/limitation that makes it impossible for me to do one or more of the exercises needed for the workbook.

Most exercises allow for more than one method to be used. For example, if a student cannot use hand cards he/she could use a drum carder or flick cards instead. For those exercises that ask for a specific technique, the student has the option of attempting the exercise and accepting a lower mark or of not submitting the exercise and receiving no mark for it. Students are encouraged to discuss their limitations with their instructor and see if other options are available.



How do I submit my workbook for marking?

There are two steps involved in submitting a workbook for marking. First, check the Master Spinner page on the Fibre Week website or call the Continuing Education Coordinator for the current marking fee payable to Olds College. Payment can be made with a credit card by phone or by mailing a cheque.

Secondly, contact your instructor for directions on how to send the workbook to her/him. Generally books are mailed to the instructor, who then marks the book and once the College has received the marking fee, returns it to the student along with the evaluation sheet(s) and the final mark for the level. Copies of the evaluation sheets and the final mark are submitted to Olds College and a certification of completion and a credit transcript is mailed to a student who successfully completes a level.

How is my work evaluated and how is my final mark determined?

A point value is assigned to each exercise in the workbook requirements and listed in the instructions. A student is assessed on how he/she has completed the assignment and a mark is given to it. Classroom students are also given a test and the results of it assigned a mark. The marks for the workbook and the classroom test are totaled and a percentage determined. NOTE: Distance learning students do not have to do a classroom test. Marks for a test are not included in determining their final mark. By adding up the marks for the individual exercises, students can determine the total marks available for the workbook.

I find the instructions for some of the exercises vague – why can they not be more specific?

Some exercises ask for specific tasks. Others are deliberately vague. Different students may have different approaches to completing a task and there is usually more than one way to accomplish what is being asked for. Students are encouraged to think about what needs to be done and how they best see it being accomplished. Creativity and independent thinking are encouraged. If one really cannot come up with a solution contact the instructor for help.

Why do I need to use references?

Any material you use in your workbooks that is not your own should be acknowledged. Credit must be given to the original source. Used appropriately, references will show that you have studied the task at hand and have selected certain materials to emphasize the points you are making. Failure to credit references and attempting to pass off the material as your own original work could lead to charges of plagiarism.

I am not comfortable with my instructor – is there anything I can do?

Whether it be a personality conflict, or a difference in teaching/learning styles, there are times when a student and instructor do not get along. If attempts to resolve the issues do not work, a student has the option of asking the Continuing Education Coordinator for another instructor. Another instructor may not be possible for the duration of a class but a different instructor could be assigned to mark the workbook. Similarly, distance learning students who are unhappy with the advice they are being given can request a different mentor.



Why should I bother filling in the evaluation forms?

Input from current students is always important. Evaluation forms are looked at and notes made of the comments. The more people who comment on an issue, the more likely a change will be made. If something is really bothering you, do not just say “this exercise is a total waste of time” or “this instructor is lousy”. Be specific – what is it that has you upset and what do you see as a solution to your concern. Well thought out comments will be far more effective at resolving an issue than an angry diatribe.

Praise for what you think are highlights of a course is also important. Knowing what works (certain course material, the instructor, the facility) enables the Coordinator and the instructors to further improve the program. And any suggestions for additions and/or deletions to the courses are also welcome.

9. I will not be able to finish my workbook before the deadline. Is it possible to ask for an extension?

You may request an extension by contacting the Continuing Education Coordinator (who may or may not discuss it with your instructor). The request for an extension should be made before the current deadline date. The Coordinator will decide to grant (or not grant) an extension and what the new deadline will be. Generally, only one extension per level will be granted. The Coordinator will inform both you and your instructor that the extension has been granted and what the new deadline is.

Failure to complete the work by the new deadline will result in you being given audit status for that level. In order to obtain the Master Spinner certificate, you will need to successfully redo and complete any levels that have audit status.

Formatting and Style Guidelines Summary

All work presented in your assignments must be properly researched and provided with correct citations. Proper references and citations give credit for other people's ideas and provide the reader with the sources of the information used in the paper.

The citation and referencing system used by Olds College is the American Psychological Association (APA) Formatting and Style Guide. Olds College has summarized the APA formatting guidelines, which can be found online at:

http://www.oldscollege.ca/library/pdf/APA_Style.pdf.

This appendix provides a brief summary of the expected citation and referencing styles you should use in your assignments.

Citations

- In-Text Citations: When direct quotes are used within the text, the citation source (which includes the author, date, and page number) must be provided. For example: "If the project calls for knitting yarn it is best to aim at an almost balanced yarn as a very unbalanced yarn can cause the knitting to skew to one side" (Field, 1995, p. 27).
- Citations of Summaries or Paraphrases: When summarizing or paraphrasing information, the source must be provided. For example: According to Field (1995), balanced yarn should be used for a knitted garment.

A complete reference must appear in the reference list at the end of the paper, for both in-text citations and summaries.

References

A reference list should be provided at the end of the paper that gives the details needed to retrieve the source of the information used in the paper. The reference list should be put in alphabetical order, using the authors' last names. The following examples show the general format used for different sources of information.

Books

Author surname, First Initial. Second Initial. (Year). *Book title: Subtitle*. Place of Publication: Publisher.

Fournier, N., & Fournier, J. (1995). *In sheep's clothing*. Loveland, CO: Interweave Press.

Journal or Magazine Article

Author Surname, First Initial. Second Initial. (Year). Article title: Subtitle. *Journal Title*, Volume (issue), page range.

Buchanan. R. (1999, Fall). Evaluating fibre diameter. *Spin Off*, pp. 23-24.

Web Sites

Author or Corporate Body. (Last update or copyright date; if not know, put n.d.).

Title of specific document. Place of Publication: Name of Corporate Body or Publisher.

(Do not repeat Corporate Body name if listed above.) Retrieved date the site was accessed from URL of specific document.

US Department of Agriculture. (1968). *United States standards for grades of wool*. Retrieved October 15, 2008, from: <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3062803> .

University of Kentucky, College of Agriculture. (n.d.). No article name. Retrieved November 3, 2008, from: <http://www.uky.edu/Ag/AnimalSciences/index.html>.

Level 6 In-Depth Study Policy

DEFINITIONS:

- ⌚ **Program Coordinator** or **Coordinator** – refers to the Olds College program coordinator
- ⌚ **Committee Chair** or **Chair** – refers to the Master Spinner instructor who is acting as the lead in the approval process.
- ⌚ **Approval Committee** or **Committee** – the current roster of Master Spinner instructors

PREAMBLE

The final assignment for successful completion of the Master Spinner certificate is an in-depth study selected and completed by the student on one aspect of hand spinning. A proposal for this study topic may be submitted for approval as early as Level 5.

A list of completed and currently approved studies is available for viewing or download on the Master Spinner page of the Fibre Week website (www.oldscollege.ca/fibreweek). Completed studies are available for viewing in the Olds College Library.

SUBMITTING A PROPOSAL

In order to have a proposal considered for approval, the student should be currently enrolled in the program and be up-to-date with previous homework assignments.

While each study is expected to be unique, a student may take a section of an existing study and build upon it. The new study must add to the knowledge contained in the original.

The proposal may be submitted to any Master Spinner instructor who will forward it to the committee chair.

The student may change this topic at any time by submitting an altered or new proposal to any Master Spinner instructor and having it go through the approval process. The original deadline for completion of the study will apply.

Proposal guidelines and a submission form are available for viewing or download on the Master Spinner page of the Fibre Week website if they are not in your handbook.

PROPOSAL APPROVAL PROCESS

The committee chair will forward the proposal to all committee members for evaluation as soon as it is practical to do so. A reply from at least half of the members is required for a decision to be made. The chair will make every effort to complete this process within one month.

The chair will notify the student if the proposal is approved or approved with modifications. A copy of the approved proposal will be sent to the program coordinator to be kept in the student's file.

OWNING THE PROPOSAL

In order to retain ownership of the proposal, the student must remain active in the program and up-to-date with assignments. This includes taking the next available Level 6 class after the completion of their Level 5 homework. If the student cannot enroll in that class, their proposal topic will be made available to others, unless a request for deferral to the next class has been granted by the program coordinator. The coordinator may ask the committee for advice on this deferral. Only one such deferral will be granted.

COMPLETION DEADLINES

It is expected that the study will be completed within one year after having taken the Level 6 class, unless an extension has been requested. The extension will not exceed four months beyond the original completion date. Only one such extension will be granted. If this deadline cannot be met, the study topic will be freed up for others to use.

STUDY EVALUATION

Upon completion, the study will be submitted for evaluation to one of two instructors appointed by the program coordinator. The student should contact the coordinator to obtain the instructor's mailing address. After marking the study, this instructor will forward it to the second marker for review.

Each instructor will submit the assessment to the coordinator. If an agreement on the final mark cannot be reached, the coordinator may ask for a third instructor to review the study. The coordinator will then assign the final mark based on the consensus reached by the three instructors.

A student will not be required to orally defend their work. The assessment will be based solely on the written materials and the spun samples submitted.

MARKING AND GRADUATION TIMELINES

Each instructor will make every effort to complete the evaluation within two weeks. The total time taken for this process will be approximately one month plus the time spent in transit. Submission should be planned by the student to allow for completion by at least May 15th of the year in which graduation participation is desired.

Upon successful completion of the Master Spinner Certificate requirements, the student will be invited to participate in the next annual Olds College graduation ceremony held in the month of June. Alternatively, the student may choose to have the certificate presented at an informal gathering during Fibre Week or to have it mailed to them. In any case, the current Olds College graduation fee will be levied.

IN-DEPTH STUDY PROPOSAL SUBMISSION FORM

(Please refer to the In-Depth Study policy and guidelines before submitting this form)

Name: _____ Date: _____

Proposed Topic (Objective of the Study):

Fibre/s to be used: _____

Preparation method/s: _____

Spinning method/s: _____

Finishing method/s: _____

Samples or end product/s (describe how many and what they will be):

How will the objective be accomplished (briefly describe what you intend to do):

Received By: _____ Approved: _____

Date: _____ Approved with attached modifications: _____

In Depth Study Guidelines

Once your in-depth study proposal has been accepted and you have successfully completed the classroom session for level 6, you are ready to work on the study.

Organization and good record keeping are the major elements of a successful study. Your in-depth study proposal should have contained a general outline of what you propose to do and how you are going to do it. Now is the time to take that information and expand it. Having a well thought out plan will ensure that you are able to successfully complete your study. It will also be the basis for writing your final report.

The plan should contain any questions you are trying to answer and how you propose to get the answers. It will contain (but is not limited to) the following information:

Fibre to be used: Types – the animal(s) or plant(s) to be used; source of the fibre – purchased or raised/collected by you; how many samples will be needed,

Preparation method(s): Is the fibre ready to use or how will it be prepared; collection method; washing method; combing or carding method (and why each was chosen).

Spinning method(s): Each way it will be spun and why.

Finishing method(s): Each method used and why.

Samples/End products: What samples are needed to demonstrate what will be done and how many; or is a final end product what is needed? How will it/they be prepared?

By answering the above in a logical fashion, you should now have a plan to follow to conduct the study. You will know what supplies you need to obtain, what to do with them, and what final products you need to produce. All of this information will also be needed in the final study report.

Some of the points that need to be considered in setting up the plan might include:

- 🕒 What is the question you are studying?
- 🕒 What do you have to do to find the answer(s)?
- 🕒 what is the scope of the topic? What are the limits that need to be set (if the instructors have not already suggested limits, look seriously at how much you are proposing to do. Many studies have the potential to become overwhelming. Look at what you can reasonably accomplish, you might have to revise your study to a more limited topic than originally proposed. The instructors will be happy to help you redefine your study to a more manageable level).
- Is there enough spinning in the project? Spinning must be the main focus of the study. Research, dyeing (if done), production of the samples and the final report, while necessary to the study, must not overshadow the spinning component – they are there to enhance the work.

- What types of notes must be kept? What information will be needed for the final report? Good note keeping will ensure that you have all the information you need to write the report. If in doubt make notes – it is easier to not include excess information than to try to accurately remember what you used or did several weeks or months after the fact.
- How will the samples or end products be presented to demonstrate what was done.

Once the plan is complete review it – will what you plan to do accomplish your goal? Will the objectives of the study be met? Be critical of what you are proposing – if your plan does not provide the answers, you need to rethink what you have proposed and come up with a more suitable approach.

Once you know what needs to be done, you can begin the actual study. If you have not already done so, now is the time to do any research about the topic that is relevant to your study. Should you include information about the history and processing of the fibre or the traditional methods you are attempting to duplicate? Do you need something about the history of the equipment you will use? What information needs to be put into your report that will allow the reader to better understand what you have done?

Keep accurate notes on what references you use. Proper annotation will be needed for the reference section of the study (see: Formatting and Style Guidelines Summary for the acceptable methods). Compiling the list as you go along is much easier than trying to go back and find that particularly useful quote later on.

Number of Copies

Students should prepare a minimum of 2 copies of their report (after any suggested changes have been made). One copy will be placed in the Olds College library and the second copy is for the author. Should the student desire to do so, a third copy may be made and presented to the Handweavers Spinners and Dyers of Alberta library.

Organizing results and information

The final task of the In Depth Study is the preparation and submission of a written report. The report should be done using the currently acceptable guidelines and should contain the following elements:

TITLE PAGE: Should contain the title of the report, your name, the words “submitted to Olds College” and the date the report was submitted.

ABSTRACT/SUMMARY: A short (usually about 1 page) summary of the contents of the report. It should describe the object of the study, a main conclusion and a recommendation (if any) for further study. This section is usually written after the rest of the report is completed.

TABLE OF CONTENTS: This lists the contents of the report and the pages they begin on in order. A list of appendices and a list of illustrations (if needed) is included here.

INTRODUCTION: Discusses what the author's purpose was, the scope of the study, and any limiting factors. Any necessary background information needed to understand what the study is about is also included here.

MATERIALS AND METHODS: How you conducted the study: the materials and techniques used, how the data was collected and analyzed.

RESULTS: Your findings: the data collected, samples prepared, tables of data, whatever you have as a result of the work you did.

CONCLUSION: What do your results mean? How do you interpret what you found? You can also include any recommendations for how to apply your findings or suggestions for further study.

REFERENCES/BIBLIOGRAPHY: A list of all references used and cited in the study. Appendix: Formatting and Style Guidelines Summary details how references should be presented.

APPENDICES: If needed, contain data that should be included in the body of the work but would disrupt the smooth flow of information if included there. These might include detailed descriptions of methods, charts of results or photographs.

Other points to consider when preparing your report are:

- should be typed on good quality paper;
- should be free of grammatical errors;
- should be neat and well presented;
- should have margins of 1.5" on the right, 1" on the other 3 sides.

Master Spinner – Level 1 Competency Profile

Describe the characteristics of wool, its harvesting, and its preparation for spinning.	Describe the history of sheep, wool and spinning.	A1	Describe the characteristics and quality of wool.	A2	Describe the production and harvesting of wool.	Describe fineness classification of wool and types of wool.	A4
	Describe the procedures to wash, dry and store wool.	A5	Describe tools and methods to prepare wool for spinning.	A6			
Describe selected spinning wheel technology.	Describe spinning wheel technology.	B1	Assess the technical aspects of individual spinning wheels.	B2			
	Spin yarn for selected applications.		Explain the principles of spinning.		Create a skein.	Describe spinning errors and techniques for controlling the size and texture of handspun yarn.	C4
Dye fibre and yarn with natural dyes.	Explain selected spinning procedures.	C1	Spin woollen and worsted yarn.	C2	Blend silk and wool.		
	Describe the procedures to dye wool fibres.	C5	Prepare fibres and plant materials for dyeing.	C6	Perform dyeing procedures in a dye workshop.		
	Apply vocabulary, resources, and practical skills to complete required level 1 projects.	D1	Identify additional resources for reference material.	D2	Complete the Level 1 final project.		
	Describe vocabulary for spinning and wool.	E1		E2			
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Master Spinner – Level 2 Competency Profile

Select appropriate fibres for spinning.	A	Select sheep's fleece for spinning.	A.1	Select llama and alpaca fibre for spinning.	A.2	Select mohair fibre for spinning.	A.3	Select silk fibres for blending.	A.4
Apply the procedures for preparing fibres for spinning.	B	Identify characteristics of selected fibres that influence its preparation for spinning.	B.1	Apply the procedure for hand carding fibres.	B.2	Apply the procedure for blending fibres.	B.3	Apply the procedure for carding fibres using a drum carder.	B.4
		Apply the procedure for combing fibres with mini-combs.	B.5	Apply the procedure for blending coloured tops.	B.6				
Spin yarn for selected applications.	C	Spin yarn to suit fibre characteristics.	C.1	Spin yarn with different characteristics.	C.2	Spin yarn for knitting and crocheting.	C.3	Spin yarn for braiding.	C.4
		Spin yarn for needlepoint.	C.5						
Demonstrate the use of selected spinning equipment.	D	Demonstrate the use of hand spindles to spin yarn.	D.1	Research the history of selected spinning wheels.	D.2				
		Calculate the amount of fibre needed for a hand-knitted sweater.	E.1	Assess selected references in relation to their value in providing spinning knowledge.	E.2	Complete the Level 2 final project.	E.3		
Apply acquired spinning knowledge to complete required level 2 projects.	E								

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Master Spinner – Level 3 Competency Profile

Prepare cotton fibre for spinning.	A	Select cotton fibre for spinning.	A1	Select appropriate method of preparing cotton fibre for spinning.	A2	
	B	Select silk fibre for spinning.	B1	Select appropriate method of preparing silk fibre for spinning.	B2	
Spin yarn for selected applications.	C	Select wool fibre for spinning.	C1	Spin yarn with specific twist per inch.	C2	Reproduce commercial yarn.
		Create novelty yarn.	C5	Spin yarn for a specific end use.	C6	C4
Use selected spinning equipment.	D	Use support spindle for spinning yarn.	D1	Use selected types of spinning wheels to spin yarn.	D2	
		Demonstrate the procedures to dye fibre and yarn.	E1	Prepare mordants for dye bath.	E2	Demonstrate the procedure to dye skeins.
Apply acquired spinning knowledge to complete required level 3 projects.	E	Prepare 25 skeins for dyeing.	E1	Prepare a natural dye bath for dyeing.	E3	E4
		Demonstrate the procedure to modify skeins.	E5			
F	F	Complete the Level 3 final project.	F1	Assess selected references in relation to their value in providing spinning knowledge.	F2	

Master Spinner Level 4 Competency Profile

Select appropriate luxury fibre for spinning.	A	Select bison fibre for spinning.	A1	Select camel fibre for spinning.	A2	Select cashmere fibre for spinning.	A3	Select silk fibre for spinning.	A4
Select appropriate cellulose fibre for spinning.	B	Select cotton fibre for spinning.	B1	Select flax fibre for spinning.	B2	Demonstrate the procedure to spin flax fibre.	B3		
Spin yarn for selected applications.	C	Spin low-twist singles yarn.	C1	Spin a true worsted yarn.	C2	Spin designer yarns by manipulation.	C3	Perform burn test for fibre identification in spun yarns.	C4
Select colour techniques for protein fibres.	D	Blend wool for colour variations.	D1	Apply selected acid dyes to protein fibres.	D2				
Apply acquired spinning skills to complete required level 4 projects.	E	Deliver a presentation to the class.	E1	Complete the Level 4 final project.	E2				

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Master Spinner Level 5 Competency Profile

Select appropriate man made fibre for spinning.	Select nylon for spinning.	A1	Select polyester for spinning.	A2	Select rayon and lyocell for spinning.	A3	Select bamboo and regenerated fibre for spinning.	A4
	Prepare man-made fibres for spinning.	A5						
Select cellulose fibre for spinning.	Select hemp for spinning.	B1	Prepare cellulose fibre for spinning.	B2	Perform a burn test on cellulose and man-made fibres.	B3		
	Select angora for spinning.	C1	Select wool for spinning.	C2	Card woollen preparations.	C3	Describe the history of other fibre types.	C4
Create yarn using selected techniques.	Card fibres and colours to produce yarns.	D1	Use carded or blended fibres to design yarns.	D2	Spin yarn with a specific twist per inch.	D3	Spin woollen yarn using the long draw method.	D4
	Spin yarn for a specific end use.	D5	Spin yarn by manipulation to produce designer yarns.	D6				
Dye fibres and yarns.	Prepare cellulose fibre/yarn and dyebath for chemical dyeing.	E1	Dye cellulose fibre/yarn in chemical dye bath.	E2	Dye 12 cellulose skeins to make a color wheel.	E3	Dye skeins using the percentage dyeing method.	E4
	Research lichen dyeing.	E5						
Apply acquired spinning skills to complete required level 5 projects.	Prepare a class presentation.	F1	Complete the Level 5 final project.	F2				

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Master Spinner Level 6 Competency Profile

A	A1	Describe the history of selected spinning apparatus.	A2	Describe the history of selected fibres.	
B	B1	Describe the history of indigo.	B2	Prepare an indigo dye bath.	
C	C1	Describe the history of fibre reactive dyeing.	C2	Prepare a fibre reactive dye bath.	B3
D	D1	Perform the reeling of silk cocoons.	D2	Spin reeled silk.	C3
E	E1	Perform specific spinning requirements.	E2	Complete final requirements.	

Olds College

April 2010

Twist Per Inch

The look and feel of a yarn is greatly influenced by, among other things, the amount of twist that is put into the singles yarn and plied yarn. Understanding how to analyze the amount of twist in a yarn and how to put the desired amount of twist into a yarn is an important skill for a spinner to master.

What is Twist Per Inch?

Twist per inch (tpi) is the number of times the fibres in a yarn sample are turned (twisted) in a linear inch of yarn. The amount of twist is one factor in determining how well a yarn will hold together and how soft or harsh a yarn will feel. Too little twist and the yarn will not hold together; too much twist and the yarn will be very kinked and feel very harsh and too much twist will break the yarn. The number of twists can be counted over any length of yarn, but the most common measurement used is the number of twists over an inch of length.

Measuring Twist Per Inch (tpi)

Each time the fibres are twisted a full turn, a small bump is produced in the yarn. By counting the number of bumps in an inch of yarn, the number of twists can be calculated. In a singles yarn, counting the bumps may be difficult, but with perseverance and a magnifying glass, they can be counted. Very thin singles are more difficult to analyze than a thicker sample. For a singles, the number of bumps counted in an inch will give the tpi of the yarn.

The bumps will be easier to see and count in plied yarns. To count the tpi in a plied yarn, count the bumps in an inch and divide that number by the number of plies of the yarn. For example: in a 2-ply yarn the number of bumps counted is divided by two; in a 3-ply yarn, the number of bumps counted is divided by three; in a 4-ply yarn the number of bumps counted is divided by four.

To understand why the division is necessary, take two short pieces of yarn of different colours. Hold them together at one end and twist the yarns one full turn. There will be two bumps in the yarn – one for each colour. Twist another full turn – there will now be four bumps in the yarn. Each time a full twist is put into the yarns, a bump is made for each strand, but each single has only one twist. Therefore, to determine the twist in the sample, divide the number of bumps by two. Repeat this exercise using three singles to see that each turn produces three bumps (one for each single), and divide by three to find the actual number of twists.

When plying singles of the same fibres there will not be different coloured bumps, but the principle remains the same: divide the number of bumps counted by the number of plies used to determine the number of twists.

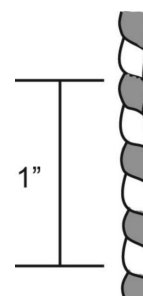


Figure 1

3 tpi 2-ply yarn
Courtesy of: Olds College.

Spinning to Specific tpi

There are times when a spinner must spin a yarn with a specific tpi, e.g., to duplicate a commercial yarn or to spin a yarn that is consistent throughout. The following formula can be used to determine a specific tpi:

$$\text{tpi} = R \times N / D \text{ or } N = \text{tpi} \times D / R$$

Where:

R = ratio of the wheel

N = number of treadles

D = length of drafting zone

Understanding how the formula works will allow the spinner to quickly make any adjustments needed to get the desired results.

The amount of twist in a yarn is determined by three factors: the ratio of the wheel, the length of the drafting zone, and the number of treadles made for the length of the drafting zone.

The **ratio of the wheel** (R) is the number of times the flyer or bobbin turns for each full turn of the drive wheel.

Manufacturers provide the ratio for a wheel, however, this number is usually a guideline and should be checked on a new wheel to determine the actual ratio. In addition, the wheel's ratio should be checked periodically over the life of the wheel to confirm it. To determine a wheel ratio, make a mark (with a marking pen or piece of tape) on the drive wheel. One full treadle of the wheel will rotate the mark 360°. Also make a mark on the flyer (or bobbin if it turns). Note that as the drive wheel turns, the flyer also turns. While slowly rotating the drive wheel through one full turn, count the number of turns the flyer makes. The number of turns is the ratio for that wheel. A manufacturer might give a whole number such as 6:1 (six turns of the flyer for each turn of the drive wheel), but when measuring the actual number of turns, the ratio might turn out to be, for example, 5.5:1 or 6.25:1. For a wheel that has multiple ratios, determine the ratio for each whorl (size) and record the results for future use. The ratio is the number in the equation that does not change: the spinner chooses a ratio and does not adjust it once the spinning begins.

A **full treadle** is one full rotation of the drive wheel.

A full treadle includes both the action of depressing the treadle and letting it come back up to the starting point. Varying the number of treadles for a given drafting length can change the amount of twist inserted into the yarn. If a wheel ratio of 6:1 is used, each treadle will put 6 twists into the yarn; two treadles inserts 12 twists into the yarn; three treadles inserts 18 twists into the yarn, and so forth. Count the number of treadles while spinning. Wind on the yarn when the desired number has been reached.

The **length of the drafting zone** is the drafted length into which twist is allowed to travel to produce yarn.

The length of the drafting zone is measured differently, depending on the spinning method used. For a long draw, it is the distance from the orifice to the hands and for a short forward draft, it is the distance between the hands. The drafting zone should be measured periodically throughout the spinning to ensure the length remains consistent. Some spinners use a cord with knots at specific intervals to check the consistency of the length of the drafting zone. The cord is attached to the wheel and the spinner can measure the distance from the orifice by counting the number of knots. Other spinners use a lap cloth with measurements on it.

To calculate the tpi of a yarn, the above three values (wheel ratio, length of drafting zone, and number of treadles for each drafting zone) are needed. If you multiply the ratio (R) by the number of treadles made (N), the number of twists put into the fibres in the drafting zone can be determined. If the drafting zone (D) has been measured in inches, divide the number of twists (R x N) by D to get the tpi for that sample.

The formula is:

$$\text{tpi} = R \times N / D$$

By inserting your numbers into the formula, the tpi can quickly be calculated.

More often, a spinner will want to spin to a specific tpi. This can be done by trial and error, or alternately, a calculation can be completed to give the information needed. The above formula can be rearranged to look like this:

$$N = \text{tpi} \times D / R$$

The spinner determines the desired tpi and chooses the wheel ratio to be used. Drafting zones may vary with fibre types as well as the spinner's preference. Insert those three numbers into the formula to determine how many treadles are needed to give the desired tpi for a given drafting zone.

A table can be developed which shows the number of treadles needed to produce a specific tpi for a given ratio and length of drafting zone.

Table 1

Calculating number of treadles needed to produce a specific tpi.

Final tpi	Length of Drafting Zone	Wheel Ratio	Number of Treadles Needed
1.5	9	6:1	2.25
2	9	6:1	3
3	9	6:1	4.5

Final tpi	Length of Drafting Zone	Wheel Ratio	Number of Treadles Needed
4	9	6:1	6
5	9	6:1	7.5
6	9	6:1	9
7	9	6:1	10.5
8	9	6:1	12

It is generally accepted that the tpi of a plied yarn is $\frac{2}{3}$ that of the tpi of the singles being used. Conversely, singles tpi is $\frac{3}{2}$ (or 1.5) the tpi of the plied yarn, e.g., if the plied yarn is to be 6 tpi, then the singles should be spun to 9 tpi; if a singles has been spun at 6 tpi, it should be plied at 4 tpi.

Table 2

TPI of singles needed for specific tpi of 2-ply yarn

tpi of 2-ply yarn	tpi of singles yarn
1.5	2.25
2	3
3	4.5
4	6
5	7.5
6	9
7	10.5
8	12

Count

a. Fleece Count

Over the years, several different systems of assessing the fineness of fibres in a fleece have been developed. Many are still in use and can be confusing to the spinner looking to purchase a fleece. By understanding how different systems work and how they correlate to one another, the spinner will be able to make an informed choice about any fleece.

The **Blood (or American grade) System** is based upon merino wool being set as the standard against which other breeds of sheep would be rated. It is based upon the percentage of merino blood a particular breed would carry – in other words, was the breed developed from and considered to be half merino, quarter merino, etc. In the blood system, the more merino in the mix, the finer the fibre (see fig. 1). But the system is not very precise and is not used by processors today.

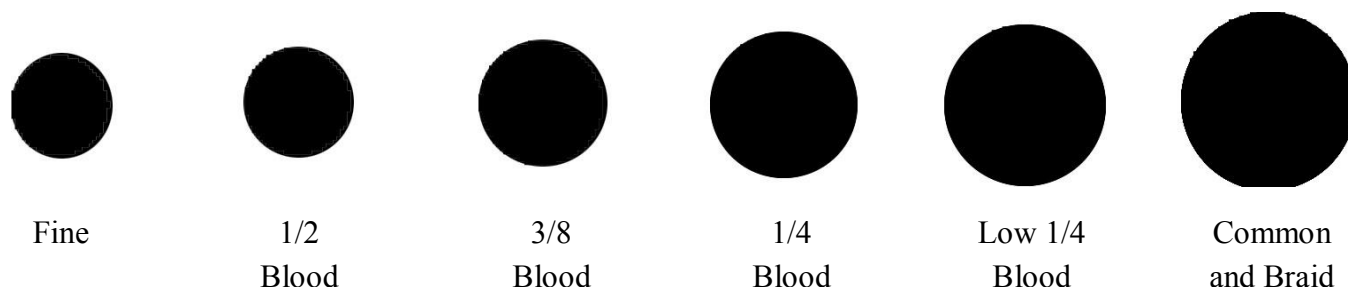


Figure 1

Relative diameters of the American Wool Grades (approximately 500x magnification).

The **Bradford (or English) Count System** was developed in Bradford, England and rather than being based on percentage of merino, it is based on the number of skeins (hanks) of worsted yarn of a given length (560 yards) that can be spun from one pound of fibre. For example, the number 64 means that sixty-four 560-yard skeins could be spun from one pound of wool. The higher the number, the finer the wool – i.e. finer wool can be spun into finer yarns and more skeins per pound can be spun.

The **Micron System** developed in response to the demand for precise measurements and became possible with the development of sophisticated machines capable of analyzing individual fibres. A micron is one millionth of a metre and can only be measured accurately under high magnification. It is currently becoming the system of choice for the industry.

However, the equipment needed to do the measurements is expensive and not readily available to the handspinner.

Table 1 shows a comparison of the values in each system for a number of breeds of sheep. A spinner who understands the values used in each system will have no trouble dealing with a producer and selecting an appropriate fleece.

Table 1

Comparison of blood, Bradford and micron measurements for selected breeds of sheep

	Staple Length 2 1/2 inches	Blood System Fine Wool	Count	Microns
Merino 80s	2 1/2 inches	Fine Wool	80s-64s	18 to 22
Rambouillet			70s-60s	19 to 25
New Zealand Merino 64s	3 inches	1/2 Blood	70s-60s	20 to 25
Targhee & Romedale			62s-58s	22 to 26
Corriedale & Columbia			62s-46s	22 to 34
Southdown			60s-50s	24 to 31
Blue Faced Leicester	3 1/2 inches	3/8 Blood	60s-56s	24 to 28
Suffolk, Dorset Horn, Montadale			58s-50s	25 to 31
Finns & Cheviot	4 inches	1/4 Blood	58s-48s	25 to 32
Oxford			50s-46s	29 to 34
Romney	4 1/2 inches	Low 1/4	48s-44s	31 to 36
Border Leicester	5 inches	Common	46s-40s	33 to 38
Lincoln & Cotswold	6 inches	Braid	40s-36s	37 to 40

b. Yarn Count

The Bradford count system (or count) is what is most commonly used by handspinners. Knowing the count for a particular breed of sheep allows the spinner to choose the correct fleece/fibre for the desired end project.

Few spinners will want to spin a pound of fibre to determine the yarn count. Formulas have been developed to allow a spinner to produce a small length of yarn and then calculate the count. Once the count has been determined, the spinner can then calculate how much fibre needs to be used to produce enough yarn for the desired project.

For a **WORSTED** wool yarn (or yarn from other protein fibres such as mohair or llama) the calculation is:

$$\text{Count} = (\text{yards of yarn} / \text{weight of yarn in oz}) \times 16 \text{ oz} \times \# \text{ of plies} / 560$$

Count = (The number of yards of yarn being measured divided by the weight of that yarn in ounces), multiplied by 16 ounces, multiplied by the number of plies in the yarn, divided by 560

If the weight is in grams, substitute 454 grams for the 16 ounces. The formula reads as:

$$\text{Count} = (\text{yards of yarn} / \text{weight of yarn in oz or g}) \times 16 \text{ oz (or 454 g)} \times \# \text{ of plies} / 560$$

The formula takes the measured value of weight per a given length of yarn and calculates how many yards would be in a pound, then multiplies that by how many plies to give the length of the singles used, and then finally divides by 560 (the number of yards in one count) to determine how many skeins of the yarn could be spun from one pound of fibre.

The above formula is for a worsted yarn only. For woollen yarns, or yarns spun from other fibres, other values were selected to define count.

There are several **WOOLLEN** count systems. The one used in North America is the Philadelphia (or American cut) count. This is based on measuring the number of 300-yard skeins spun woollen from 1 pound of fibre. The formula is:

$$\text{Count} = (\text{yards of yarn} / \text{weight of yarn in oz or g}) \times 16 \text{ oz (or 454 g)} \times \# \text{ of plies} / 300$$

For **COTTON**, the measure is the number of 840-yard skeins per pound of fibre and the formula is:

$$\text{Count} = (\text{yards of yarn} / \text{weight of yarn in oz or g}) \times 16 \text{ oz (or 454 g)} \times \# \text{ of plies} / 840$$

LINEN is based on 300 yards per pound = 1 lea (instead of the word count). The formula is:

$$\text{Lea} = (\text{yards of yarn} / \text{weight of yarn in oz or g}) \times 16 \text{ oz (or 454 g)} \times \# \text{ of plies} / 300$$

For spun **SILK**, the term is denier and 1 denier = 840 yards per pound. The formula is:

Denier = (yards of yarn / weight of yarn in oz or g) X 16 oz (or 454 g) X # of plies /840

SYNTHETICS (such as nylon or polyester) use the same measurement as spun silk (1 denier = 840 yards per pound).

Other yarn count systems are the **Tex system** and the **NM system**.

The tex system is based on the weight in grams per kilometer of yarn. For example, if one kilometer of yarn weighs 20 grams, the tex number is 20. It is a direct system of measurement since heavier yarns have a higher number.

The NM system indicates the number of meters in 1 gram of yarn. A 20 NM yarn will have 20 meters per gram.

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Review of Spinning Techniques

Table 1
Spinning Techniques.

Spinning Technique	Spinning Description	Fibre Preparation
True Woollen	<ul style="list-style-type: none"> • Traditional woollen longdraw. • Twist is added to the fibres before and during drafting to ensure random orientation in the yarn. 	<ul style="list-style-type: none"> • Hand carded rolag
Semi-woollen	<ul style="list-style-type: none"> • Twist is added to the fibres before or during drafting to ensure random orientation in the yarn. • Use point of contact with carded preparations. Spin parallel fibres from the fold. • Resulting yarn will have a semi-woollen character when fibres are short with lots of crimp, and they are not straight or parallel when twist is added. 	<ul style="list-style-type: none"> • Carded sliver • Flick-carded locks • Hand carded rolag • Hand carded batt with parallel fibres
Semi-worsted	<ul style="list-style-type: none"> • Fibres are of mixed lengths. They are nearly parallel when twisted. No twist is allowed into undrafted fibres. • Can use short or long worsted draws to achieve a semi-worsted result. • Resulting yarn will have a semi-worsted character when fibres are of mixed lengths, with little or no crimp, and they are nearly straight and parallel before twist is added. 	<ul style="list-style-type: none"> • Carded sliver • Gilled sliver • Hand carded batt with parallel fibres • Flick carded locks

Spinning Technique	Spinning Description	Fibre Preparation
True Worsted	<ul style="list-style-type: none"> • Short forward worsted draw, short and long backwards worsted draws. • No twist is allowed into undrafted fibres. The fibres are parallel when twisted. 	<ul style="list-style-type: none"> • Combed top from which all the short fibres have been removed.

Table 2

Fine, Medium and Coarse Breed: Comparison of Fleece Characteristics, Preparation and Spinning Techniques

	Example of Breeds	Count	Fibre Length	Crimp	Grease	Preparation Methods	Spinning Techniques	Special Yarn Characteristics
Fine	<ul style="list-style-type: none"> • Merino • Rambouillet • Cormo • Targhee 	<ul style="list-style-type: none"> • 64s and finer 	<ul style="list-style-type: none"> • 5-7.6 cm (2-3 in) 	<ul style="list-style-type: none"> • 10-30 per 2.5 cm (1 in) 	<ul style="list-style-type: none"> • high (many follicles to lubricate) 	<ul style="list-style-type: none"> • comb or card 	<ul style="list-style-type: none"> • woollen or worsted 	<ul style="list-style-type: none"> • warm, lofty, fulls well, soft hand
Medium	<ul style="list-style-type: none"> • Corriedale • Columbia • Hampshire • Suffolk • Jacob • Cheviot • Clun Forest • Dorset 	<ul style="list-style-type: none"> • 50s to 62s 	<ul style="list-style-type: none"> • 5-15 cm (2-6 in) 	<ul style="list-style-type: none"> • 6-11 per 2.5 cm (1 in) 	<ul style="list-style-type: none"> • varies (Merino crosses can have high grease) 	<ul style="list-style-type: none"> • comb or card 	<ul style="list-style-type: none"> • woollen or worsted 	<ul style="list-style-type: none"> • warm, lofty, fulls well, strong
Coarse	<ul style="list-style-type: none"> • Romney • Border Leicester • Lincoln • Scottish Backface • Karakul 	<ul style="list-style-type: none"> • 36s to 48s 	<ul style="list-style-type: none"> • more than 12.7 cm (5 in) 	<ul style="list-style-type: none"> • wavy or no crimp 	<ul style="list-style-type: none"> • low (few follicles) 	<ul style="list-style-type: none"> • comb or card 	<ul style="list-style-type: none"> • woollen or worsted (worsted preserves lustre) 	<ul style="list-style-type: none"> • often lustrous, strong, drapes well

Metric/Imperial Conversion Charts

Length

Metric Units: millimetre (mm)
centimeter (cm) = 10 mm
metre (m) = 100 cm
kilometre (km) = 1000 m

Imperial Units: inch (in)
foot (ft) = 12 in
yard (yd) = 3 ft
mile (mi) = 1.609 km, 1609.3 m

Common Conversions

Metric		Imperial
1 mm	=	0.03937 in
1 cm (10 mm)	=	0.3937 in
1 m (100 cm)	=	1.0936 yd
1 km (1000 m)	=	.6214 mi
Imperial		Metric
1 in	=	2.54 cm
1 ft (12 in)	=	0.3048 m (30.48 cm)
1 yd (3 ft)	=	0.9144 m (91.44 cm)
1 mi (1760 yd)	=	1.6093 km

Converting Inches (in) to Millimetres (mm)

For cm equivalent, multiply mm by 10

Imperial (in)		Metric (mm)
1/16	=	1.58
1/8	=	3.17
3/16	=	4.76
1/4	=	6.35
3/8	=	9.52
1/2	=	12.70
3/4	=	19.05
1	=	25.4
12	=	304.8

Diameter

Imperial (in)		Metric (mm)
1/25	=	1.0
1/30	=	0.848
1/35	=	0.725
1/40	=	0.635

Area

Metric Units: square millimetres (mm²)
square centimetres (cm²) = 100 mm²
square metres (m²) = 10,000 cm²

Imperial Units: square inch (in²)
square foot (ft²)
square yard (yd²)

Conversions

Metric		Imperial
1 cm ² (100 mm ²)	=	0.1550 in ²
1 m ² (10,000 cm ²)	=	1.1960 yd ² (10.764 ft ² , 1,550 in ²)
Imperial		Metric
1 in ²	=	6.4515 cm ² (64.515 mm ²)
1 ft ² (144 in ²)	=	0.0929 m ² (92.9 cm ² , 929.0 mm ²)
1 yd ² (9 ft ² , 1296 in ²)	=	0.8361 m ² (8361 cm ² , 83610 mm ²)

Volume

Metric Units:	cubic centimetre (cm ³) (solid)	millilitre (ml) (liquid)
	cubic decimetre (dm ³) (solid)	litre (l) (liquid)
	cubic metre (m ³) (solid)	hectolitre (hl) (liquid)
Imperial Units:	cubic inches (in ³) (solid)	teaspoon (tsp)
& USA	cubic feet (ft ³) (solid)	tablespoon (tbsp)
	fluid ounce (fl oz) (liquid)	cup
	pint (pt) (liquid)	ounce (oz)
	quart (qt) (liquid)	
	gallon (gal) (liquid)	

Common Conversions

Metric		Imperial
1 cm ³	=	0.0610 in ³
1 dm ³ (1,000 cm ³)	=	0.0353 ft ³
1 m ³ (1,000 dm ³)	=	1.3080 yd ³
1 l (1,000 ml)	=	1.76 pt
1 hl (100 l)	=	21.997 gal
Imperial		Metric
1 in ³	=	16.3867 cm ³
1 ft ³ (1,728 in ³)	=	0.0283 m ³
1 fl oz	=	28.413 ml
1 pt (20 fl oz)	=	0.56831 l
1 qt (2 pt)	=	1.136 l
1 gal	=	4.5461 l
USA Measure		Metric
1 fl oz		
(1.0408 Imp. fl oz)	=	29.574 ml
1 pt (16 fl oz)		
(0.8327 Imp. fl oz)	=	0.4731 l
1 gal		
(0.8327 Imp. gal)	=	3.7854 l

Common Liquid Volume Equivalents

(Metric unless otherwise noted)

Metric		Metric
1/4 cup	=	60 ml
1/3 cup	=	75 ml
1/2 cup	=	125 ml
2/3 cup	=	150 ml
1 cup	=	250 ml
1 pt (Imp)	=	568.26 ml
1 qt (Imp)	=	1136.5 ml
1 US qt	=	0.946 litre

From Your Kitchen

Metric		Metric
1 tsp	=	5 ml
3 tsp	=	1 tbsp
1 tbsp	=	15 ml
16 tbsp	=	1 cup
1 cup	=	250 ml
2.5 cups	=	1 pt

Mass (weight)

Metric Units: milligram (mg) = 0.001 grams
gram (g) = 1,000,000 mg
kilogram (kg) = 1,000 g

Imperial Units: grain
ounce (oz) = 437.5 grains
pound (lb) = 16 oz
stone = 14 lb
hundredweight (cwt) = 112 lb

Common Conversions

Metric		Imperial
1 mg	=	0.0154 grain
1 g	=	0.0353 oz
1 kg	=	2.2046 lb
Imperial		Metric
1 oz	=	28.35 g
1 lb	=	0.4536 kg (453.6 g)
1 stone	=	6.3503 kg
1 cwt	=	50.802 kg

Converting Ounces to Grams and Grams to Ounces

Imperial (oz)		Metric (g)
1/4	=	7.09
1/2	=	14.17
3/4	=	21.26
1	=	28.35
Metric (g)		Imperial (oz)
1	=	1/28
2	=	1/14
5	=	1/5
10	=	1/3
20	=	2/3

Temperature

Metric Units: Celsius degrees ($^{\circ}\text{C}$)

Imperial Unit: Fahrenheit degrees ($^{\circ}\text{F}$)

Conversion Formulas

- Celsius degrees to Fahrenheit degrees, multiply Celsius temperature by 1.8 or $9/5$, then add 32
- Fahrenheit degrees to Celsius degrees, subtract 32 from the Fahrenheit temperature, then multiply by 0.5556 or $5/9$

Common Temperature Conversions

Metric		Imperial
100 $^{\circ}\text{C}$	=	212 $^{\circ}\text{F}$ Boiling Point
80 $^{\circ}\text{C}$	=	176 $^{\circ}\text{F}$
40 $^{\circ}\text{C}$	=	104 $^{\circ}\text{F}$
21 $^{\circ}\text{C}$	=	70 $^{\circ}\text{F}$ Average Room
10 $^{\circ}\text{C}$	=	33.8 $^{\circ}\text{F}$
0 $^{\circ}\text{C}$	=	32 $^{\circ}\text{F}$ Freezing

Websites: see: <http://www.metric-conversions.org/> and <http://www.almanac.com>