CULINARY

ESSENTIAL MATH SKILLS FOR THE APPRENTICE

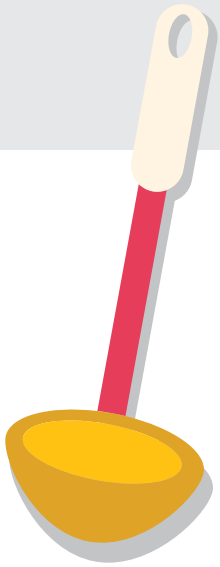
Dual Credit
School College Work Initiative

Student Handbook

Table of Contents

This is not the kind of assessment used to pass or fail. Instead, its purpose is to explore and discuss your current level of comfort in the kitchen, with reading, with numeracy, and on the computer.

Essential Skills	Questions	Responses
Kitchen scales or any measuring equipment.	• Have you ever used any type of measuring tools in a kitchen?	
Reading text	• What kinds of things do you read regularly? (e.g. newspapers, e-mails, letters, books, etc.) • Is there anything about reading that you find difficult? • What do you feel you need to do or learn in order to become a better reader?	
Numeracy	• Do you do tasks where you have to measure ingredients or materials (e.g., cooking) • Do you play games or musical instruments? • Are there any math skills you think you could improve in your everyday life	
Computer Use	• How often do you use a computer? Do you have one at home? • Do you need help when using it? What do you use it for (e.g., e-mail, finding information on the internet, etc.)? • Have you ever used interactive web sites such as learning programs or games?	



Reasons to standardize

- Produce high quality products
- Serve meals in a timely manner
- Be able to serve the numbers expected
- Create satisfied customers
- Avoid waste
- Earn a profit
- Work efficiently

Standardized procedures in the food service industry

- Recipes
- Yields
- Ingredients
- Measurements
- Temperature
- Purchasing
- Pricing
- Portion control
- Cost calculations

Professional Kitchens use two systems of measurement:

Metric

There are four basic units used in the metric system:

1. The **gram** is the basic unit of weight.
2. The **liter** is the basic unit of volume.
3. The **meter** is the basic unit of length.
4. The **degree Celsius** is the basic unit of temperature

Dry measures
- Gram (g) Kilogram (kg)

Liquid Measures
- Milliliter (ml), Liter (L)

Imperial (used mainly in the US)

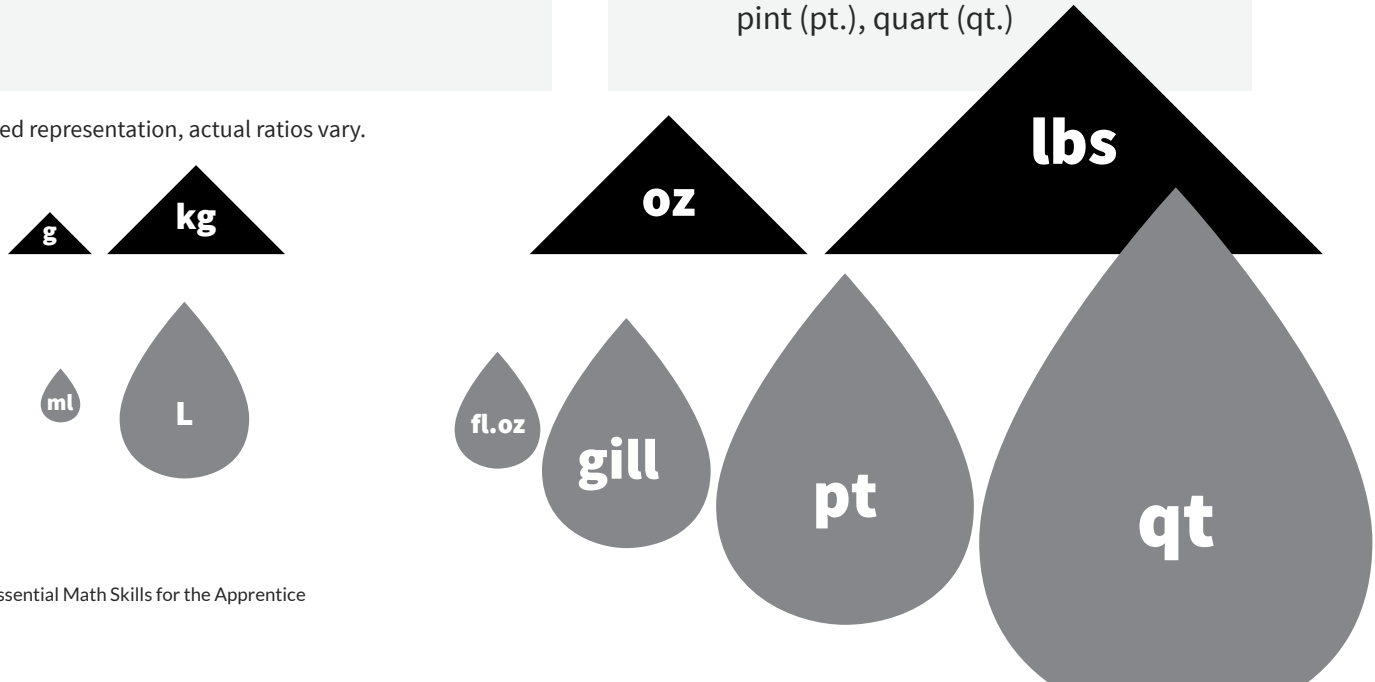
There are four basic units used in the imperial system:

1. **Ounce** is the basic unit of weight
2. **Fluid ounce** is the basic unit of volume
3. **Feet and inches** are the basic unit of length
4. **The degree Fahrenheit** is the basic unit of temperature

Dry Measures
- Ounces (oz.), and Pounds (lbs.)

Liquid Measures
- Fluid ounces (fl. oz), gill (gill), pint (pt.), quart (qt.)

*Simplified representation, actual ratios vary.



Weight (Mass)

1,000 milligrams = 1 gram
1,000 grams = 1 kilogram

Weight Conversion Between
U.S. Standard Measure and Metric

1 ounce = 28.35 grams
2.21 pounds = 1 kilogram

Volume (Liquid)

1,000 milliliters = 1 liter

Volume Conversion Between
U.S. Standard Measure and Metric

33.8 fluid ounces = 1 liter

Liter vs. Quart

Demonstrate to show the students that these are not the same.

1 Liter = 33.8 fl. oz

1 Quart = 32 fl. oz

Ounce vs. Gram

1 oz = 28 grams

Most recipes found on cooking websites in Canada and the United States use cups not grams.

*Close approximations

Cup	Fluid Oz	Tbsp	Tsp	Milliliter
1 C	8 oz	16 Tbsp	48 tsp	237 ml
3/4 C	6 oz	12 Tbsp	36 tsp	177 ml
2/3 C	5 ⅓ oz	10.6 Tbsp	32 tsp	158 ml
1/2 C	4 oz	8 Tbsp	24 tsp	118 ml
1/3 C	2 ⅔ oz	5.3 Tbsp	16 tsp	79 ml
1/4 C	2 oz	4 Tbsp	12 tsp	59 ml
1/8 C	1 oz	2 Tbsp	6 tsp	30 ml
1/16 C	½ oz	1 Tbsp	3 tsp	15 ml

Liquid		
1 tsp	=	6ml
1 Tbsp	=	15ml
⅛ cup	=	30ml
¼ cup	=	60ml
½ cup	=	120ml
1 cup	=	240ml

Butter		
⅛ cup	=	30g
¼ cup	=	55g
⅓ cup	=	75g
½ cup	=	115g
⅔ cup	=	150g
¾ cup	=	170g
1 cup	=	225g

Dried Ingredient		
1 tsp	=	5g
1 Tbsp	=	15g
1oz	=	28g
1 cup flour	=	150g
1 cup caster sugar	=	225g
1 cup icing sugar	=	115g
1 cup brown sugar	=	175g
1 cup sultanas	=	200g

Oven temperatures		
275°F	=	140°C
300°F	=	150°C
325°F	=	165°C
350°F	=	180°C
375°F	=	190°C
400°F	=	200°C
425°F	=	220°C
450°F	=	230°C

Scales

Why do we use scales in a professional kitchen?

- Accuracy by weight
- Dry ingredient measurement preparation
- Portion control
- Consistency
- Types: digital, spring loaded, balance/baker's scale

Digital

Spring Loaded

Balance/Baker's Scale

Measuring Tools

Liquid Measuring tools

- Variety of clear plastic and glass, container sizes
- Measured in milliliters, fluid ounces and cups
- Read at eye level on level surface

Measuring Spoons

- Small quantities of dry and liquid ingredients
- Sets include:
  1 and ½ tablespoon, 1, ½ and ¼ teaspoons

Test # 1. Measuring Flour in Both Dry and Liquid Measuring Cups

Measure 1 cup of all-purpose flour in both dry and liquid measuring cups.
Weigh the flour to assess accuracy.

Note: a properly measured cup of all-purpose flour weighs 5 ounces. With the dry measuring cup, the measurements are off by as much as 13%. Measuring flour in a liquid measuring cup, where it's impossible to level off any excess, drives that variance all the way up to 26%.

Test # 2. Measuring Water in Both Dry and Liquid Measuring Cups

Measure 1 cup of water in both dry and liquid measuring cups.
Weigh the water to assess accuracy.

Note: 1 cup of water should weigh 8.345 ounces. The dry cup varies by 23%, while the liquid cup varies by only 10%. It is much easier to gauge the volume of water in the liquid measuring cup, as its transparency allows measurers to see when the meniscus—the bottom of the curved surface line of the liquid—has touched the 1-cup line. There is a greater variance when measuring water in a dry cup because it is so easy to overfill.

The Best Way to Measure Dry Ingredients
When measuring a dry ingredient, it is best to scoop it up with a dry measuring cup and then sweep off the excess with a flat utensil, a method we call “dip and sweep.”

The Best Way to Measure Liquid Ingredients
To fill a liquid measuring cup, we recommend placing it on the counter, bending down so that the cup’s markings are at eye level, and then pouring in liquid until the meniscus reaches the desired marking.

The Most Accurate Way to Measure Any Ingredient
And whenever you want to be nearly 100% accurate, use a scale!

Learning the Difference

Weigh
Name some dry measures commonly found in the kitchen.

Volume
Name some liquid measures commonly found in the kitchen.

What is the difference between them?
An excellent example is flour. If you “dip” the measuring cup into the flour bag you will get a different amount of flour than if you “spoon” the flour into your measuring cup. This is because flour tends to compact with transportation and storage and there is also the problem of humidity affecting its’ density (volume). However, neither of these things will affect the weight of flour. Because 130 grams of flour is always 130 grams of flour.

Experimenting with Measurement

Follow the steps below to compare measuring ingredients by weight and by volume.

Step 1 Assemble a baker's (balance) scale, a flat metal spatula, a set of measuring cups, a large mixing bowl and a bin of all-purpose flour.

Step 2 Familiarize yourself with the baker's scale by being able to recognize the parts.

- Two platforms on each side of the balance beam
- Food is always placed on the left side of the pan
- The counterweights are placed directly on the right platform
- A small moveable weight is located on the balance beam
- The counterweights are used to measure lbs while the small movable weight is used to weigh ounces

Step 3 Move the movable weight on the beam to zero (0). Place a pan on the left platform. Place the appropriate counterweight (2lb) on the right platform to balance the scale.

Step 4 Scoop the flour into the pan on the left until the scale balances. Have your facilitator check your measurement. Remove the flour and place in a mixing bowl making sure to remove all the flour.

Step 5 Now you will measure more flour by volume instead of weight. The equivalent of 2 lbs of unsifted flour is 7 ¼ cups. Use a measuring cup to measure out 7 ¼ cups of flour. Level off each cup with the spatula. Carefully empty each cup of measured flour into the empty pan on the left platform of the baker's scale.

Step 6 Find the weight of the flour measured by volume in the pan by adding counterweights to the right platform. Move the small weight on the balance beam if necessary, until the scale balances exactly.

Record the weight of the flour _____

Weigh all the ingredients for a Scone/Tea biscuit recipe and cook them.

Scones/tea biscuits

Yield: \ 1.5 dozen Number of Portions: 9, 2 per serving Prep Time: 10 minutes
Size: \ 60gram Cooking Temperature: 400°F Cooking Time: 15 – 20 minutes

<table>
<tr><td colspan="2">MISE EN PLACE</td><td>PREPARATION METHODS</td></tr>
<tr><td>Quantity
250 gram
250 gram
5 gram
70 gram
25 gram
200 gram
225 ml
1 (only)

1 (only)

100 gram</td><td>Ingredients
All-purpose flour
Pastry flour
Salt
Sugar
Baking powder
Butter (unsalted)
Milk
Egg

Egg for egg-wash

Raisins (optional)</td><td>Make the Dough
• Sift the dry ingredients together into a mixing bowl
• Rub in butter until the mixture resembles a coarse, sandy texture
• Add raisins and mix evenly
• Beat egg with mix and add to the dry ingredients
• Mix just to combine, until soft dough is formed.
• Bring dough to the bench and knead lightly for a few seconds. Allow to rest.
• Shape the biscuits
• Dust the bench and roll out the dough to about 2 cm thickness
• Use a pastry cutter
• Bake the biscuits
• Line a baking tray with parchment paper and place the biscuits 5 cm apart. Brush with egg wash.
• Bake at 400°F for approximately 15-20 min.</td></tr>
<tr><td colspan="2">Notes
• Over kneading toughens the biscuits.
• Variations can include apples, cinnamon, orange or lemon zest, cranberries.
• Savoury scones add grated cheese, sun-dried tomatoes, and herbs (remember to remove most of the sugar)</td><td>Equipment Needed
• Scales (digital, baker’s or spring loaded)
• Measuring spoons and cups
• Bench mixer
• Paddle attachment
• Dough hook attachment
• Biscuit cutter 2”
• Sheet pan
• 2 stainless steel bowls</td></tr>
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Fractions

Fractions are very important in the culinary industry. Here is an example.

You have a cornbread that is 13 inches in length.
How many ¾ inch slices can be cut from this bread?

Solution

13 inches ÷ ¾ inches =
$\frac{13}{1} \times \frac{4}{3} = \frac{52}{3} = 17\frac{1}{3}$ slices

Converting Fractions to Decimals and Percentages

Fraction	Decimal	Percent
3/4 (Numerator / Denominator)	0.75	75%
95/100	0.95 (Move decimal 2 places to the right)	95%
6/100 = 3/50	0.06	6%
9/1000 (Read it in decimal, write it in fraction form to reduce it)	0.009	0.9%
75/10000 = 3/400	0.0075 (Move decimal 2 places to the left)	0.75%

Yield Percent (Y%) and Recipe Conversion Factor (RCF)

Yield	A specific quantity of a food produced by a recipe.
Converting the recipe	To change the yield of a recipe. (New yield, old yield)
Conversion factor	New yield ÷ old yield = conversion factor
New Quantity	Old quantity × conversion factor = new quantity
As Purchased (AP)	Price of an item before any trim or waste are considered. Example: unpeeled, whole potatoes.
Edible Portion (EP)	Price of an item after all trim and waste has been taken into account. Example: peeled, cubed potatoes.
Trim	The weight or volume of the waste. AP– EP = Unusable Trim
Yield Percent (Y%)	The percent of AP that is EP (edible portion)

Calculating Trim

Be sure to record your answers.

1. Guess how much waste there is from peeling and trimming a single carrot.
2. Weigh a carrot, peel and trim it, weigh it again to see what the difference is.
3. Weigh the peelings to see what the waste is.

Calculating Yield

If 44 kg of whole carrots yields 33 kg when cleaned and trimmed, what is the percentage yield?

Solution

Step 1: Divide the edible portion by the as-purchased quantity.
33 / 44 = 0.75

Step 2: Convert the decimal to a percent by multiplying by 100 or moving the decimal two places to the right.
0.75 x 100 = 75

a. 76%
b. 75%
c. 1.3%
d. 13%

Calculating Portions

You have a recipe for Fried Rice that yields 2.7 kilograms of rice. You want to serve 30 guests each an equal portion. How many grams is each portion? (Note: 1kg = 1000g).

Solution

a. 27 g
b. 120 g
c. 45 g
d. 90 g

Converting a Recipe

A hummus recipe yields 1 litre of hummus and requires 240 ml of tahini. Calculate the RCF and determine the amount of tahini needed for a desired yield of 5 litres of hummus.

Formulas

Conversion factor	New yield ÷ old yield = conversion factor
New Quantity	Old quantity × conversion factor = new quantity

Solution

a. 120 g
b. 240 g
c. 1200 g
d. 1600 g

Short Answers

1. A standardized recipe tells what _____ to use.
2. There are _____ pints in one quart.
3. There are _____ ounces in two pounds.
4. Weight, Volume and numbers are examples of _____.
5. Use _____ _____to measure very small amounts of dry ingredients by volume.
6. Measuring dry ingredients by _____ is quick, easy and accurate.
7. The abbreviation for ounce is _____.
8. The _____ system is used in most other countries while the imperial system is used in the United States.
9. With the metric system food is measured by_____,
   and _____ and_____, instead of ounces, pounds and quarts.
10. Multiply each ingredient quantity by_____ _____ (2 words)
    when you have a recipe that produces 25 portions and you need to serve 75 portions.

Recipe Conversion – U.S. Measures

The following ingredients and quantities are for a Cream of Mushroom Soup recipe that yields 24 portions, 8 oz. each. Convert the recipe to the yields indicated.

Ingredients	**24 portions** 8 oz. each	**60 portions** 8 oz. each	**48 portions** 6 oz. each
Butter	12 oz		
Onion	8 oz		
Mushrooms	1.5 lb		
Flour	9 oz		
White stock	4.5 qt		
Milk	3 pt		
Heavy cream	1.5 pt		
Salt	2 g		
White pepper	1.5 g		

Recipe Conversion – Metric Measures

The following ingredients and quantities are for a Cream of Mushroom Soup recipe that yields 24 portions, 200 ml each. Convert the recipe to the yields indicated.

Ingredients	**24 portions** 250 ml each	**60 portions** 250 ml each	**48 portions** 200 ml each
Butter	375 g		
Onion	250 g		
Mushrooms	750 g		
Flour	275 g		
White stock	4.5 l		
Milk	1.5 l		
Heavy cream	750 ml		
Salt	5 g		
White pepper	3 g		

Average Produce Yields from Whole Product to Usable Product

Item	Yield
Asparagus	56
Lettuce 24 ct. cello	85
Peppers Yellow 15#	83
Avocado	72
Lettuce Boston 24 ct.	75
Peppers, Bell Green and Red	65
Beans, Green or Wax	88
Lettuce clean & Trim ⅘ ct.	89
Potato Idaho100 ct.	81
Beans, Lima	39
Lettuce Green leaf/24 ct.	67
Potato Red Bliss "A"	81
Beets	76
Lettuce Red Leaf 24 ct.	67
Potato Russet 100 ct.	81
Bok Choy	67
Lettuce Romaine 24 ct.	67
Potato Yukon Gold "A"	80
Broccoli 14 ct.	61
Lettuce, Chopped Romaine	99
Radish, Daikon	70
Broccoli Crowns	95
Lettuce, Endive Belgium	63
Radishes Cello 1⅘1#	63
Broccoli Florets	95
Lettuce, Escarole	74
Rutabagas	85
Broccolini	98
Lettuce, Pre-cut salad mix	98

Item	Yield
Carrots Baby Peeled	61
Mushroom Oyster 5#	97
Squash Acorn	66
Carrots Jumbo	82
Mushroom Portabello 5#	90
Squash Butternut	66
Cauliflower 12 count	55
Mushroom Shitake 3#	97
Squash Green(Zucchini)	95
Celery 24 ct.	75
Okra	78
Squash Hubbard	66
Chard	77
Olive, Kalamata pitted	95
Squash Yellow (summer)	95
Cucumbers Select Pared	73
Onion Jumbo Yellow 50#	89
Sweet Potato	80
Cucumbers Select Unpared	95
Onion Jumbo-Red 25#	89
Tomatoes 5x6	91
Eggplant	81
Onion Med-Red 25#	89
Tomatoes 6x6	91
Endive, chicory, escarole	74
Onion Whole Peeled 25#	99
Tomatoes Cherry 12/ct.	95
Fennel	60
Onions, Green	92

Average Produce Yields from Whole Product to Usable Product

Item	Yield
Salad Dressings (avg. / gal)	95
Brussels sprouts	74
Mushroom Button	97
Scallion 48 ct.	70
Cabbage Green	79
Mushroom ex. Large.	97
Spinach Baby	92
Cabbage Red	79
Mushroom Fancy 3#	97
Spinach Cello Untrimmed 1 2/10 oz.	74
Carrots - peeled	97
Mushroom Med.	97
Spinach Trimmed 4/ 2.5#	92
Peppers Suntan 25#	83

Item	Yield
Tomatoes Sundried 5#	99
Garlic Peeled 4/5# Jars	95
Parsnips	85
Turnips 25#	81
Ginger Root	80
Peas, green	38
Yams #1	80
Herb, Cilantro	75
Peas-Snap	85
Kale	74
Peas-Snow	85
Leeks 12 ct.	75
Peppers Orange Holland	93
Lemon Grass	80

Average Fruit Yields from Whole Fruits to Usable Product

Item	Yield
Apples 100 Ct 2=1Lb Peeled & Cored	76%
Avocado	72%
Banana	67%
Blueberries	96%
Cantaloupe 15-18 count w/o rind	50%
Cherries, pitted	89%
Cranberries	97%
Grapefruit section	47%
Grapefruit Supremes per grapefruit	12
Grapes - red - seedless	92%
Grapes - white - seedless	92%
Honeydew 6 ct., without rind	57%
Kiwi 36/39 ct.	76%

Item	Yield
Lime, Fresh, Juice	30%
Orange Fresh for Juice	30%
Oranges 88ct, Sectioned	56%
Orange Supremes per orange	10
Peaches	76%
Pears	78%
Pineapple 12 ct.	52%
Pineapple Jet Pack 6 ct.	52%
Plums	94%
Rhubarb, partly trimmed	86%
Strawberries (Calif.)	89%
Watermelon 22# avg.	47%

Dry Spice Conversions

Spice	Oz per Cup	Tbsp per Oz	Tsp per Oz
Ajwain	2.4	6.67	20
Allspice, Ground	3.37	4.75	14.33
Anise, Ground		4	12
Anise Seeds	3.56	4.5	13.5
Annato Powder (Achiote)	5.19	3.1	9.25
Annato Seed (Achiote)			
Basil, Ground	2.67	6	18
Bay Leaves	1.33		36/oz
Bay Leaves, Ground	3.79	4.2	12.66
Capsicums			
Caraway, Ground		5	15
Caraway Seed	4.1	3.9	11.7
Caraway, Black (Russian Caraway)			
Cardamom, Ground	3.31	4.8	14.5
Cayenne	3.56	4.5	13.5
Celery Salt	8.42	1.9	5.7
Celery Seed	3.81	4.2	12.6
Celery Seed, Ground	4	4	12
Chervil Leaves	1.12	14.33	43
Chili Flakes, Red	2.82	5.67	17
Chili Pods, Casabel		9/oz	
Chili Pods, Arbol		50/oz	
Chili Pods, Guajullo		5/oz	
Chili Pods, Japones		80/oz	
Chili Pods, Morita		9/oz	
Chili Pods, Pasilla		2/oz	
Chili Pods, Paquin		500/oz	
Chili Powder	3.76	4.25	12.75

Dry Spice Conversions

Spice	Oz per Cup	Tbsp per Oz	Tsp per Oz
Chinese 5 Spice	3.76	4.25	12.75
Chives	34	46.67	140
Cinnamon	4.09	3.92	11.75
Cloves, Ground	3.69	4.33	13
Cloves, Whole	3	5.33	16
Coffee, Espresso Grind	2.82	5.67	17
Coriander, Ground	3.35	4.78	14.33
Coriander Seeds	2.29	7	21
Cream of Tartar	6.4	2.5	7.5
Cumin, Ground	3.38	4.73	14.2
Cumin Seeds	3.84	4.17	12.5
Curry Powder	3.62	4.42	13.25
Dextrose, Powdered		3	9
Dill Seed	3.69	4.33	13
Dill Weed	1.7	9.42	28.25
Epazote	1.6	10	30
Fennel, Ground	3.72	4.3	12.9
Fennel Seed	3.69	4.33	13
Fenugreek Seed	6.19	2.58	7.75
Fermento		4	12
Flour, AP	4.25		
Garlic, Granulated	5.65	2.83	8.5
Garlic Powder	4.49	3.57	10.7
Garlic Salt	8	2	6
Ginger	3.25	4.92	14.75
Herbs du Provence	1.45	11	33
Hibiscus Flowers	40/oz		
Kosher Salt	6.02	2.66	8
Lavender, Dry	1.07	15	45

Dry Spice Conversions

Spice	Oz per Cup	Tbsp per Oz	Tsp per Oz
Mace	3.24	4.93	14.8
Marjoram	1.41	11.33	34
Mint Leaves	0.53	30	90
MSG	6.4	2.5	7.5
Mustard Ground	3.43	4.67	14
Mustard Seeds	6.4	2.5	7.5
Nutmeg	3.87	4.13	12.4
Onion Powder	3.75	4.27	12.8
Orange Peel	4	4	12
Oregano Leaves	1.71	9.33	28
Paprika	3.84	4.17	12.5
Parsley Flakes	0.69	23.33	70
Pepper, Black Coarse	3.84	4.17	12.5
Pepper, Black Cracked	4	4	12
Pepper, Black Table Grind	4	4	12
Pepper Flakes, Red Crushed	2.82	5.67	17
Pepper, Szechwan	2	8	24
Pepper, White Ground	4.12	3.88	11.5
Peppercorns, Black	4.57	3.5	10.5
Peppercorns, Pink		7.5	
Peppercorns, White	4	4	12
Pickling Spice	5.33	3	9
Poppy Seed	4.8	3.33	10
Pumpkin Spice	3	5.33	16
Rosemary, Ground	2.82	5.67	17
Rosemary Leaves	1.78	9	27
Saffron	1.2	13.33	40
Sage, Ground	1.45	11	33
Salt, Kosher (Diamond Crystal)	4.8	3.33	10

Dry Spice Conversions

Spice	Oz per Cup	Tbsp per Oz	Tsp per Oz
Salt, Kosher (Morton)	8.73	1.83	5.5
Salt, Seasoning (Johnny's)	8.21	1.95	5.85
Salt, Table	10.13	1.58	4.74
Savory Leaves	2.67	6	18
Sesame Seeds, White	4.37	3.66	11
Sugar, Granulated	6.86	2.33	7
Sugar, Brown		1.5	4.5
Sugar, Granulated		1.5	4.5
Tarragon Leaves	1.3	12.33	37
Thyme, Ground		3.75	11.25
Thyme Leaves	2.29	7	21
Turmeric	4	4	12
Wasabi Powder	2.7	5.75	17.25

Source:
Facilitator's Guide for Delivering a Workshop in Culinary Math, Chef Fintan Flynn.

References:

- Professional Cooking 8th ed. for Canadian Chefs, Wayne Gisslen
- Culinary Math 4th ed., Linda Blocker & Julia Hill
- ChefResources.com