St. Louis Community College

Adult Learning Academy
Pre-Algebra Workbook

UNIT 8: METRIC SYSTEM

LEARNING OBJECTIVES

1. **Metric Prefixes:**
   - ☐ Know the basic units for measuring length, weight, volume, and temperature in the metric system
   - ☐ Know the meaning of metric prefixes and how they are related by powers of ten
   - ☐ List the metric prefixes in order from kilo to micro

2. **Metric Benchmarks:**
   - ☐ Identify metric benchmarks for length, weight/mass, volume, and temperature
   - ☐ Approximate the measures of everyday things using metric benchmarks
   - ☐ Approximate temperatures using metric benchmarks

3. **Converting in Metric:**
   - ☐ Convert units within the metric system
   - ☐ Understand the relationship between decimal point movement and powers of ten
   - ☐ Convert temperature from Fahrenheit to Celsius, and from Celsius to Fahrenheit

Topic	Website	Videos
Metric Prefixes	http://www.youtube.com/watch?v=2tcRNLHb0Yg	Wanda Sykes The Metric System
	http://www.youtube.com/watch?v=hCxDEB2t5Hc	Basics of Metric System Mathmanprice
	http://www.youtube.com/watch?v=83e3n83Re5s	Deirdre Flint The Metric System Song
	http://www.youtube.com/watch?v=KfrCaKyhwZk	Meters, Liters and Grams petehendley
	http://www.youtube.com/watch?v=PLhK9rat-NU	Think Metric by Amanda and Kimberly
Converting in Metric	http://www.youtube.com/watch?v=XS-8FCqYo5M	Metric Conversions Shortcut Method
	http://www.youtube.com/watch?v=pEDVddQvimI	Unit Conversion in the Metric System
Metric Temperature	www.khanacademy.org	Compare Celsius &Fahrenheit Temp Scales
		Converting Fahrenheit to Celsius
		Ex: Evaluate a Formula using Substitution
Unit 8 Review Flashcards	www.stlcc.edu	PowerPoint on Blackboard

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Metric Prefixes

KILO	HECTO	DEKA	BASE (UNIT)	DECI	CENTI	MILLI	X	X	MICRO
1000	100	10	1 gram liter meter	1/10	1/100	1/1000			1/1,000,000

****

Killer Whale	Hippo	Donkey		Dog	Cat	Mouse	Maggot? Mite?
King	Hector	Died		Drinking	Chocolate	Milk	
Kangaroos	Hop	Down	My	Driveway	Carrying	M&M's	

****

3.7 kilometers = _____ meters

20 milliliters = _____ liters

21.3 centigrams = _____ dekagrams

4.2 hectograms = _____ micrograms

50 deciliters = _____ kiloliters

Metric Length Benchmarks: Use a measuring tape.

1. Find a part of your body that is 1 centimeter long: _____
   (for many people, it's the width of their pinkie nail)

2. How high on your body is 1 meter? _____
   (for many people, it's their hip or bellybutton)

3. Measure from your shoulder blade across your back to your fingertips.
   How close is it to 1 meter? _____

4. How tall are you in centimeters? _____

Metric Mass/Weight Benchmarks: Use a scale.

5. What is the mass of your textbook in grams? _____

6. What is the mass of a pencil in grams? _____

7. What is the mass of a paperclip in grams? _____

8. At home, read the label on a bottle of pain reliever. How many mg of medicine is in each tablet? _____

Metric Temperature: Use a thermometer.

9. What is the temperature of the room in Celsius? _____ in Fahrenheit? _____

10. What is your body temperature in Celsius? _____ in Fahrenheit? _____

11. At what temperature does water freeze in Celsius? _____ in Fahrenheit? _____

12. At what temperature does water boil in Celsius? _____ in Fahrenheit? _____

1. **WHAT MAKES SENSE?** Circe the most reasonable measurement.

   a. A healthy newborn baby might weigh

   7 kilograms | 70 grams | 3 kilograms | 70 pounds

   b. You might wear shorts when the outdoor temperature is

   30° F | 35° C | 80° C | 212° F

   c. Your bedroom might have a length of

   5 feet | 5 cm | 5 kilometers | 5 meters

   d. If you are thirsty, you might drink this much water at one time:

   1 milliliter | 1 liter | 1 gallon | 1 dekaliter

   e. You might take a warm shower in water that is

   100° F | 100° C | 10° C | 10° F

   f. A basketball player might be this tall:

   2 dekameters | 2 centimeters | 2 meters | 2 decimeters

   g. Your finger is about this long:

   8 centimeters | 8 inches | 8 meters | 8 millimeters

   h. A jogger might run

   10 meters | 10 kilometers | 10 liters | 10 kilograms

   i. The length of a car might be

   4.6 kilograms | 4.6 meters | 4.6 millimeters | 4.6 kilometers

   j. The gas tank of a car might hold

   45 liters | 45 kiloliters | 45 milliliters | 45 grams

   k. A car might go this far on a tank of gas:

   482 centimeters | 482 liters | 482 kilometers | 482 meters

l. A carpentry nail might be this long:

4 meters 4 centimeters 4 grams 4 millimeters

m. A carpentry nail might weigh

3 kilograms 3 micrograms 3 liters 3 grams

n. The head of a carpentry nail might have this diameter:

2 kilometers 2 dekameters 2 millimeters 2 inches

o. The speed limit on a Canadian highway might be

96 miles/hour 9.6 kilometers/hour 96 kilometers/hour 96 feet/second

p. Your car steering wheel might have this diameter:

40 centimeters 40 inches 40 millimeters 40 decimeters

2. A **byte** is the fundamental unit of measurement for data. The Metric System allows us to use other prefixes to describe extremely large numbers. Look these up online:

a. How many bytes are in a **kilobyte**?

b. How many bytes are in a **megabyte**?

c. How many bytes are in a **gigabyte**?

d. How many bytes are in a **terabyte**?

e. How many bytes are in a **petabyte**?

3. Metric prefixes can also describe extremely small objects. Look these up online:

a. How many **nanograms** are in a gram?

b. How many **picograms** are in a gram?

4. The metric system prefixes can also be used for time:

a. How long is a **millisecond**?

b. How long is a **kilosecond**?

c. How long is a **nanosecond**?

5. From the Guinness Book of World Records (www.guinnessworldrecords.com)

The longest tongue measures 9.8 centimeters from the tip to the middle of his closed top lip and was achieved by Stephen Taylor (United Kingdom), at Westwood Medical Centre, Coventry, United Kingdom, on 11 February 2009.

a. Stephen's tongue was _____ meters long.

b. Stephen's tongue was _____decimeters long.

c. Stephen's tongue was _____millimeters long.

d. Stephen's tongue was _____ micrometers long.

e. Stephen's tongue was _____ kilometers long.

f. Name an object that is about as long as Stephen's tongue:

The shortest female who ever lived was Pauline Musters, born in 1876 in the Netherlands. At nine years old, she was 55 cm tall and weighed only 1.5 kg.

g. Pauline was _____ millimeters tall and weighed _____ grams.

h. Pauline was _____ meters tall and weighed _____ milligrams.

i. Pauline was _____ decimeters tall and weighed _____ decigrams.

j. Pauline was _____ dekameters tall and weighed _____ dekagrams.

k. Name an object that is about as tall as Pauline was at 9 years old:

l. Name an object that weighs about as much as Pauline did:

6. What is the most appropriate measure? Choose from among these:

micrometers, **millimeters**, **centimeters**, **meters**, **kilometers**, **milliliters, liters, grams, milligrams, kilograms**

Item to be measured	Most appropriate metric unit
Length of your pencil	
Distance between cities	
Mass (weight) of a large dog	
Amount of blood in a syringe	
Diameter of a freckle	
Length of a swimming pool	
Amount of medicine in a pill	
Amount of fat in a serving of food	
Amount of water in your bathtub	
The length of a DNA cell	

7. Temperature benchmarks:

Kelvin is a temperature scale designed so that zero degrees K is defined as absolute zero (at absolute zero, a hypothetical temperature, all molecular movement stops - all actual temperatures are above absolute zero) and the size of one unit is the same as the size of one degree Celsius. To find temperature on a Kelvin scale, just add 273 degrees to the Celsius temperature. In Algebra, the formula is: $K = C + 273$

	Degrees Fahrenheit	**Degrees Celsius**	**Degrees Kelvin**
Water freezes			
Water boils			
Normal Human Body			

8. Circle the GREATER quantity from each pair:

a. one mile one kilometer

b. one quart one liter

c. one yard one meter

d. one inch one centimeter

e. one pound one kilogram

f. one ounce one gram

9. Switching from one measurement system to another:

Here are some common equivalents between the Metric and American systems:

1 inch ≈ 2.54 centimeters	1 kilogram ≈ 2.2 pounds
1 kilometer ≈ .62 miles	1 quart ≈ .96 liter

Use proportions (remember Unit 4?) to change from one system to the other:

a. 150 pounds ≈ _____ kilograms

b. 63 inches ≈ _____ centimeters

c. 10 miles ≈ _____ kilometers

d. 4 quarts ≈ _____ liters

e. 25 kilograms ≈ _____ pounds

f. 30 centimeters ≈ _____ inches

g. 10 kilometers ≈ _____miles

h. 5 liters ≈ _____ quarts

8.1 Metric Prefixes

1. 3700 meters
2. .02 liters
3. 0.0213 dekagrams
4. 4,200,000,000 micrograms
5. .005 kiloliters

8.2 Living Metric!

Answers for questions 1 – 9 will vary

10. Celsius = **37** Fahrenheit = **98.6**
11. Celsius = **0** Fahrenheit = **32**
12. Celsius = **100** Fahrenheit = **212**

8.3 Career Applications: STEM

1a. 3 kilograms
1b. 35° C
1c. 5 meters
1d. 1 liter
1e. 100° F
1f. 2 meters
1g. 8 centimeters
1h. 10 kilometers
1i. 4.6 meters
1j. 45 liters
1k. 482 kilometers
1l. 4 centimeters
1m. 3 grams
1n. 2 millimeters
1o. 96 kilometers/hour
1p. 40 centimeters

2a. 1000 bytes
2b. 1,000,000 bytes (one million or 10^6)
2c. 1,000,000,000 bytes (one billion or 10^9)
2d. 1,000,000,000,000 bytes (one trillion or 10^{12})
2e. 1,000,000,000,000,000 bytes (one quadrillion or 10^{15})

8.3 Career Applications: STEM

3a. *A nanogram is 10^{-9} or .000000001 (one billionth) of a gram, so…*
1 gram = 1,000,000,000 nanograms
3b. *A picogram is 10^{-12} or .000000000001 (one trillionth) of a gram, so …*
1 gram = 1,000,000,000,000 picograms

4a. .001 seconds (or 1/1000th of a second)
4b. 1000 seconds
4c. .000000001 seconds (or one billionth of a second)

5a. .098 meters
5b. .98 decimeters
5c. 98 millimeters
5d. 98,000 micrometers
5e. .000098 kilometers
5f. *answers will vary*
5g. 550 millimeters; 1500 grams
5h. .55 meters; 1,500,000 milligrams
5i. 5.5 decimeters; 15,000 decigrams
5j. .055 dekameters; 150 dekagrams
5k. *answers will vary*
5l. *answers will vary*

6.

Item to be measured	Most appropriate metric unit
Length of your pencil	centimeter
Distance between cities	kilometers
Mass (weight) of a large dog	kilograms
Amount of blood in a syringe	milliliter
Diameter of a freckle	millimeters
Length of a swimming pool	meters
Amount of medicine in a pill	micrograms
Amount of fat in a serving of food	grams
Amount of water in your bathtub	liters
The length of a DNA cell	micrometers

8.3 Career Applications: STEM (cont.)

7.

	Degrees Fahrenheit	Degrees Celsius	Degrees Kelvin
Water freezes	**32**	**0**	**273**
Water boils	**212**	**100**	**373**
Human Body	**98.6**	**37**	**310**

8a. **one mile**
8b. **one liter**
8c. **one meter**
8d. **one inch**
8e. **one kilogram**
8f. **one ounce**

9a. **368.2 kilograms**
9b. **160 centimeters**
9c. **16.1 kilometers**
9d. **4.2 liters**
9e. **55 pounds**
9f. **11.8 inches**
9g. **6.2 miles**
9h. **4.8 quarts**

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