Systems of Measurement

OBJECTIVES/RATIONALE

To pursue a career in the health care industry, the student should be proficient in academic subject content. The Health Science Technology student will have the knowledge and skills necessary to perform the mathematical processes used in careers in health care. The student is expected to convert units between systems of measurements, to use measurement functions for client assessment, and to interpret technical material related to health care.

TEKS 121.3 1A, 1B, 1C

TAKS ELA 1, 3
Mathematics 1, 2, 3, 4, 8, 9, 10

KEY POINTS

I. Knowledge and skills related to mathematical conversions are important in the health care industry. **Conversion Charts**
II. Systems of Measurement
    A. Metric System
    B. Apothecary System
    C. Household System
III. Terms used in measurement
    A. Metric System
    B. Scientific System
IV. Vital Signs, I&O, and Charting
    A. Proper technique for determining blood pressure, temperature, pulse, respirations, and I&O will be demonstrated by the teacher.
    B. Proper charting of client data will be demonstrated by the teacher.

ACTIVITIES

I. Analyze and interpret a sample hematology report for use of scientific notation and the metric system.
II. Complete the **Conversion Problems**.
III. Chart and graph a client's vital signs, I & O, height and weight.

MATERIALS NEEDED

Sample Hematology Report

Access to one or more of the following resources is recommended:

Colbert, Bruce J., Ankney, Jeff, Wilson,Joe, Havrilla, John, *An Integrated Approach to Health Sciences: Anatomy and Physiology, Math, Physics, and Chemistry*, Delmar, 1997, ISBN 0-8273-6082-7

Palau, Susan Marcus and Meltzer, Marilyn, *Learning Strategies for Allies Health Students*, W.B. Saunders Companies, 1996, ISBN 0-7216-5603-X

Simmers, Louise, *Diversified Health Occupations*, 4th edition, Delmar, 1998, ISBN 0-8273-7823-8

Badasch, Shirley A.. / Chesebro, Doreen S., *The Health Care Worker*, Brady, ISBN 0-89303-478-9

Hayden, Jerome D. & Davis, Howard, *Fundamental Mathematics for Health Careers*, Delmar, ISBN 0-8273-6689-2

Dunlap, Kathi, *Mathematics for Health Occupations*, Delmar, ISBN 0-8273-4173-3

Pickar, Gloria D., *Dosage Calculations*, Delmar, ISBN 0-8273-4982-3

Olsen, etal., *Medical Dosage Calculations*, Addison-Wesley

ASSESSMENT

Completion of **Conversion Problem Worksheet**

Charting of Client Data – 100% accuracy

ACCOMMODATIONS

For reinforcement, the student will identify the difference between scientific notation and the metric system data.

For enrichment, the student will research rationale for using the metric system in health care and why it was not adopted as the universal system in the United States.

REFLECTIONS

Medical Mathematics Conversion Chart
HOSA Medical Mathematics
Competitive Events

METRIC SYSTEM

LENGTH

10 millimeters = 1 centimeter
1 yard = 3 feet
1 foot = 12 inches

AREA

100 square millimeters = 1 square centimeter

WEIGHT

1 gram = 1000 milligrams
1 milligram = 1000 micrograms
1 gram (mass) = 1 milliliter (for solutions)
1 kilogram (mass) = 1 liter (for solutions)
1 pound = 16 ounces

TEMPERATURE

oC = (oF - 32)5/9
oF = (oC)9/5 + 32

VOLUME FOR SOLIDS

1000 cubic milliliters =1 cubic centimeter
1000 cubic centimeters = 1 cubic decimeter
1000 cubic decimeters = 1 cubic meter

VOLUME FOR FLUIDS

1 liter = 1000 milliliters

1 milliliter = 1 cubic centimeter

10 centiliters = 1 deciliter
10 deciliters = 1 liter

APPROXIMATE EQUIVALENTS AMONG SYSTEMS

Metric	Household
1 liter	1 quart / 32 ounces / 2 pints
480 – 500 millilite	1 pint / 16 ounces
240 milliliters	1 cup / 8 ounces
30 – 42 milliliters	1 ounce /2 tablespons / 6 teaspoons
15 – 16 milliliters	1 tablespoon
4 – 5 milliliters/cubic centimeter	1 teaspoon = 60 drops
1 millimeter	60 microdrops
1 kilogram	2.2 pounds
.045 kilogram	1 pound
2.5 centimeters	1 inch
4 liters	4 quarts = 1 gallon
	1 glass = 8 ounces
	1 teacup = 6 ounces
	1 unit = 1000 milliunits
0.06 milliliters	1 gtt
1 milliliter	15 – 16 gtts

Medical Mathematics Relationships

METRIC LENGTH MEASURE

10 millimeters = 1 centimeter (cm)
10 centimeters = 1 decimeter (dm)
10 decimeters = 1 meter (m)
10 meters = 1 dekameter (dam)
10 dekameters = 1 hectometer (hm)
10 hectometer = 1 kilometer (km)

METRIC AREA MEASURE

100 square millimeters (mm 2) = 1 square centimeter (cm2)
100 square centimeters (cm2) = 1 square decimeter (dm 2)
100 square decimeters (dm 2) = 1 square meter (m 2)
100 square meters (m 2) = 1 square dekameter (dam2)
100 square dekameter (dam2) = 1 square hectometer (hm 2)
100 square hectometers (hm 2) = 1 square kilometer (km 2)

METRIC VOLUME MEASURES FOR SOLIDS

100 cubic millimeters (mm3) = 1 cubic centimeter (cm3)
100 cubic centimeters (cm3) = 1 cubic decimeter (dm3)
100 cubic decimeter (dm3) = 1 cubic meter (m3)
100 cubic meters (m3) = 1 cubic dekameter (dam3)
100 cubic dekameters (dam3) = 1 cubic hectometer (hm3)
100 cubic hectometers (hm3) = 1 cubic kilometer (km3)

METRIC VOLUME MEASURES FOR FLUIDS

10 milliliters (mL) = 1 centiliter (cL)
10 centiliters (cL) = 1 deciliter (dL)
10 deciliters (dL) = 1 liter (L)
10 liters (L) = 1 dekaliter (daL)
10 dekaliters (daL) = 1 hectoliter (hL)
10 hectoliters (hL) = 1 kiloliter (kL)

METRIC VOLUME MEASURE EQUILAVENTS

1 cubic decimeter (dm3) = 1 liter (L)
1000 cubic centimeters (cm3) = 1 liter (L)
1 cubic centimeter (cm3) = 1 milliliter (mL)

METRIC MASS MEASURE

10 milligrams (mg) = 1 centigram (cG)
10 centigrams (cG) = 1 decigram (dG)
10 decigrams (dG) = 1 gram (g)
10 grams (g) = 1 dekagram (dag)
10 dekagrams (dag) = 1 hectogram (hg)
10 hectograms (hg) = 1 kilogram (kg)

1000 kilograms (kg) = 1 megagram (Mg)

HOUSEHOLD EQUIVALENTS
APPROXIMATE LIQUID MEASURE EQUIVALENTS

60 drops = 1 teaspoonful (t)
4 teaspoonfuls = 1 tablespoonful (T)
2 tablespoonfuls = 1 fluidounce
6 fluidounces = 1 teacupful
8 fluidounces = 1 glassful

APOTHECARIES EQUIVALENTS
EQUIVALENT MEASUREMENTS OF VOLUME

60 minims (m) = 1 fluiddram (f3)
8 fluiddrams (f3) = 1 fluidounce
16 fluidounces = 1 pint (pt)
2 pints (pt) = 1 quart (qt)
4 quarts = 1 gallon (gal)

EQUIVALENT MEASUREMENTS OF WEIGHT

60 grains (gr) = 1 dram (3)
8 drams (3) = 1 ounce
12 ounces = 1 pound (lb)

DOSE AND DOSAGES

YOUNG'S RULE:
Child's Dose = (Child's Age (in years)/Child's Age in Years + 12) x Adult Dose

FRIED'S RULE:
Infant's Dose = (Age (in months) /150 pounds) x Adult Dose

CLARK'S RULE:
Child's Dose = (Weight of Child (in pounds) / 150 pounds) x Adult Dose

Child's Dose = (Weight of Child (in kilograms) / 68 kilograms) x Adult Dose

SOLUTIONS

Ratio Strength of Solutions = amount of drug / amount of solution
Percent of Strength by Volume = (volume of solute/volume of solution)x100
Percent Strength by Weight (Mass) = (mass of solute/volume of solution)x100
Amount of Solute /Amount of First Solution = Amount of Solute / Amount of Second Solution

Conversion Problems

1. A medication is available in 30 mg. tablets. A patient is given a prescription for gr. ii. How many tablets should the patient take?

2. The temperature in the classroom is 86 oF. What is this in celsius?

3. You fill a storage cabinet with 12 bottles of dextrose. Each bottle contains 15 ½ ounces. How many ounces of this solution are in the storage cabinet?

4. The physician will need a needle 7.5 cm long to take a bone marrow sample. This is equal to how many inches?

5. The stomach produces about 8 cups of gastric acid each day. How many liters is this?

6. The temperature today is –10 °F. What is the temperature in Celsius?

7. The doctor gives you a prescription for a cough medication. He tells you to take 6 mg. The label on the prescription says there are 2 mg per 4 ml. How many teaspoons do you need to take?

8. A patient drank 6 ounces of juice, 3 cups of water, and a half pint of milk. What was the total intake in ml?

9. You measure a friend who is 5 ft. 3 inches tall. What is her height in centimeters?

10. A laboratory technician measures 45 ml of urine sample in a 4 ounce beaker. How many more ml of urine are necessary to fill the beaker?