Course
Health Science

Unit X
Occupationally Specific Knowledge and Skills

Essential Question
How will health care workers apply mathematical concepts in the coming decades?

TEKS
130.204(c)1A

Prior Student Learning
An understanding of Algebra I.

Estimated time
3 hours

Rationale
To pursue a career in the health care industry, students should be proficient in academic subject content.

Objectives
Upon completion of this lesson, the student will be able to:
- Illustrate the knowledge and skills necessary to perform the mathematical processes related to careers in health care
- Formulate mathematical calculations appropriate to career prep learning situations
- Apply concepts of measurement functions in multiple-step conversion problems
- Analyze the mathematical functions required in health care careers

Engage
Supply several malpractice scenarios demonstrating incorrect mathematical calculations leading to injury or death. Have the students analyze them, recognizing the need for correct calculations.

Key Points
I. Medical professionals use math every day while providing health care for people around the world.
  A. write prescriptions
  B. administer medication
  C. draw up statistical graphs of epidemics
  D. figure out the success rates of treatments

II. Basic mathematical calculations are used for:
  A. conversions
  B. charting
  C. graphing
  D. dosage calculations
  E. measurements

Activity
I. Interview health care professionals at various unpaid career prep sites to determine the mathematical calculations utilized. Present it to class.
  A. Are the mathematical calculations completed by humans or machines?
  B. What units of measurement are used in the health care area?
  C. What post-secondary courses are required to prepare for this career?

D. How is data recorded in this career?
E. Determine the need for accuracy of mathematical calculations and how accuracy affects the quality of client care.

II. Supply an epidemiological case study and have students work through the mathematical calculations. See the college board at http://www.collegeboard.com/yes/ft/iu/units.html for resources – "Measures in Epidemiology" is a great module to choose.

III. Students practice math conversion problems.

Assessment
Project Rubric
Successful completion of Epidemiological case study calculations

Materials
Hayden, Jerome & Davis, Howard T., Fundamentals of Mathematics for Health Careers, Delmar, ISBN 0-8273-6689-2

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

Olsen, etal., Medical Dosage Calculations, Addison-Wesley, ISBN 0132384701

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

Accommodations for Learning Differences
For reinforcement, the student will practice basic mathematical conversion problems.

For enrichment, the student will research the math requirements of health care careers represented at a clinical site to determine which careers require and utilize math skills most frequently, and create a visual diagram of findings.

National and State Education Standards
National Health Science Cluster Standards
HLC01.01 Academic Foundations
Health care workers will know the academic subject matter required (in addition to state high school graduation requirements) for proficiency within their area. They will use this knowledge as needed in their role.
HLC1O.01 Technical Skills
Health Care Workers will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.

TEKS
130.204(c)(1)A solve mathematical calculations appropriate to situations in a health-related environment.

Texas College Readiness Standards
English Language Arts
II. B. Understand new vocabulary and concepts and use them accurately in reading writing and speaking.
III. B. Develop effective speaking styles for both group and one on one situations.
IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.
IV. B. 2. Listen actively and effectively in one-on-one communication situations.

Mathematics
I. B. 1. Perform computations with real and complex numbers.
IV. A. 1. Select and use the appropriate type of unit for the attribute being measured.
IV. B. 1. Convert from 1 measuring system to another

Science
II. A. 1. Understand the real number system and its properties.
II. A. 7. Use calculators, spreadsheets, computers, etc., in data analysis.

HOSA MEDICAL MATH CONVERSION CHART
METRIC SYSTEM

Length

1 meter = 100 centimeters = 1000 millimeters
10 millimeters = 1 centimeter

Temperature

$^oC=(^oF-32)\ 5/9$
$^oF=(^oC)9/5 + 32$

Weight

1 gram = 1000 milligrams
1 milligram = 1000 micrograms
1 kilogram = 1000 grams

Weight Conversion

1 kilogram = 2.2 pounds
1 pound = 16 ounces

Volume for Solids

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

Volume for Fluids

1 liter = 1000 milliliters
10 centiliters = 1 deciliter
10 deciliters = 1 liter

APPROXIMATE EQUIVALENTS AMONG SYSTEMS
The following will be used for calculations instead of selecting from approximate equivalents.

Metric	=	Household/English Liquid
1 liter		1 quart / 32 ounces / 2 pints
500 milliliters		1 pint / 16 ounces / 2 cups
240 milliliters		1 cup / 8 ounces
30 milliliters		1 ounce
15 milliliters		1 tablespoon / 3 teaspoons
5 milliliters		1 teaspoon
1 milliliter		15 drops
0.0667 milliliters		1 drop

Metric	=	Household/English Linear
1 meter		39.372 inches / 3.281 feet
0.914 meters		3 feet / 1 yard
0.3048 meters		12 inches / 1 foot
2.54 centimeters		1 inch

Source: Simmers, Louise, *Diversified Health Occupations (OR Introduction to Health Science Technology)* Delmar, Latest edition.

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 for Strength of Solutions = amount of drug / amount of solution
Percent of Strength by Volume = (volume of solute/volume of solution) x 100
Percent Strength by Weight (Mass) = (mass of solute/volume of solution) x 100
Amount of Solute /Amount of First Solution = Amount of Solute / Amount of Second
       Solution

Medical Mathematics Practice Problems

Read each question carefully and mark the correct answer. Do not mark on the test. Use blank scratch paper to do the calculations.

1. Your mother is to take 30 mg. of Sudafed four times per day. It is available in 15 mg. per ml. How many ml. will be needed each day?
   A. 2 ml.
   B. 4 ml.
   C. 8 ml.
   D. 16 ml.

2. You are to take 90 milligrams of a medication. Each tablet contains 30 milligrams or ½ grain. How many grains of the medication will you be taking?
   A. grain
   B. 1½ grains
   C. 3 grains
   D. 2½ grains

3. Mrs. Jones is to receive 2 fl. dr. of a medication. You have no fl. dr. measure. You may give
   A. 1 Tbsp.
   B. 2 tsp.
   C. 30 gtts.
   D. ½ ounce

4. A mother was told to give her 3 year old a ¼ cup of water every 4 hours. In 24 hours she will give the child
   A. 6 fluid ounces
   B. 8 fluid ounces
   C. 10 fluid ounces
   D. 12 fluid ounces

5. You assist a patient in wrapping an ace bandage around the leg. You use 30 cm. of ace bandage. How many inches did you use?
   A. 12 inches
   B. 75 inches
   C. 914.4 inches
   D. 1000 inches

6. The physician ordered 150 mg. of a medication. It is available in 0.1 scored tablets. How many tablets should be given?
   A. ½ tablet
   B. 1 tablet
   C. 1½ tablets
   D. 2 tablets

7. How many days will an 8-ounce bottle of medication last, if an adult takes the maximum dose of 2 tsp. every 8 hours?
   A. 7 days
   B. 10 days
   C. 15 days
   D. 30 days

8. A medication is available in 30 mg. tablets. A patient is given a prescription for gr. How many tablets should the patient take?
   A. 1 tablet
   B. 2 tablet
   C. 3 tablets
   D. 4 tablets

9. You are to give 10 minims of a medication. How many gtts is this?
   A. 5 gtts
   B. 8 gtts
   C. 10 gtts
   D. 15 gtts

10. The physician ordered 1000 ml. of D5W to be infused at 20 gtt/min. How long will it take for the I.V. to be completed?
   A. 12½ hours
   B. 15½ hours
   C. 25 hours
   D. 30¼ hours

11. A physician orders 1500 ml of saline to infuse @ 200 ml/hr. The infusion will take
   A. 4½ hours
   B. 7½ hours
   C. 8 hours
   D. 10 hours

12. The pharmacist needs to fill a prescription for 150 minims. How many ml is this?
   A. 3.33 ml
   B. 5 ml
   C. 7.5 ml
   D. 10 ml

13. The temperature in the classroom is 86° F. What is this in Celsius?
   A. 15.7° C
   B. 30.0° C
   C. 90.0° C
   D. 122.8° C

14. Marjorie has joined Weight Watchers. She would like to lose 12 kg in 30 days. On
    the average, how many pounds per day will Marjorie lose to meet her goal?
   A. 0.44 lbs.
   B. 0.88 lbs.
   C. 1.1 lbs.
   D. 2.5 lbs.

15. During each 15 minute test, a recording kymograph is set to use 7.5 mm of paper. The
    paper comes in rolls that are 15 cm. long. How many rolls will be needed for 500
    15-minute tests?
   A. 15 rolls
   B. 20 rolls
   C. 25 rolls
   D. 40 rolls

16. You fill a storage cabinet with 12 bottles of dextrose. Each bottle contains 15½
    ounces. How many ounces of this solution are in the storage cabinet?
   A. 186 ounces
   B. 180 ounces
   C. 96 ounces
   D. 90 ounces

17. It is your responsibility to maintain supplies. When supplied by the pharmacy, a container
    had 12½ ounces of liquid. When you do the inventory, you find there are 6¾ ounces
    of the liquid remaining. How much liquid had been removed?
   A. 6 ounces
   B. 5¾ ounces
   C. 5¼ ounces
   D. 5 ounces

18. You weigh an object that weighs 90 kg. How many pounds is this?
   A. 40.5 lbs.
   B. 40.9 lbs.
   C. 108.0 lbs
   D. 198.0 lbs.

19. The doctor ordered 0.25 g. of a medication for the patient. The medication comes in 125 mg per 5 cc's. You should give
    A. 2½ cc
    B. 5 cc
    C. 7½ cc
    D. 10 cc

20. The physician will need a needle 7.5 cm. long to take a bone marrow sample. This is equal to
    A. 3 inches
    B. 4.5 inches
    C. 5 inches
    D. 6 inches

21. Your weight is 55 kilograms. How many pounds do you weigh?
    A. 90 lbs.
    B. 119 lbs.
    C. 121 lbs.
    D. 135 lbs.

22. Marilee Jones is a dental assistant. She earns $7.88 an hour. She works 40 hours per week, for 52 weeks. She is single. Her state tax rate is 4.25%. The annual state tax withheld will be
    A. $172.09
    B. $362.19
    C. $696.59
    D. $1339.60

23. The stomach produces about 8 cups of gastric acid each day. How many liters is this?
    A. 1 l.
    B. 2 l.
    C. 3 l.
    D. 4 l.

24. The temperature today is -10° F. What is the temperature in Celsius?
    A. -33° C
    B. -23° C
    C. 23° C
    D. 43° C

25. You have a powdery substance that weighs 40 drams. How many ounces of the substance do you have?
    A. 4 ounces
    B. 5 ounces
    C. 8 ounces
    D. 200 ounces

26. A patient is to have 600 mg. of a medication. How many 0.3 gm. tablets should be given?
    A. 1 tablet
    B. 2 tablets
    C. 3 tablets
    D. 4 tablets

27. 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?
    A. 1 tsp.
    B. 2 tsp.
    C. 2½ tsp.
    D. 3 tsp.

28. How many mm. in 0.83 meters?
    A. 83 mm.
    B. 830 mm.
    C. 8300 mm.
    D. 83,000 mm.

29. Your mother is directed to take one tablespoon of cough medicine every two hours for 8 hours. How many ml. will she take?
    A. 16 ml.
    B. 20 ml.
    C. 60 ml.
    D. 320 ml.

30. You have a vial containing 8 ounces of medication. The average dose is 0.25 of an ounce. After 10 doses, how many ounces of medication are left in the vial?
    A. 2 ounces
    B. 2.5 ounces
    C. 5.25 ounces
    D. 5.50 ounces

31. Atropine sulfate is available in gr. 1/100 tablets. The patient is to have 2 mg. of the atropine. How many tablets should be given? *Round to nearest whole number.
    A. 1 tablet
    B. 2 tablets
    C. 3 tablets
    D. 4 tablets

32. A medical records clerk is asked to collect records regarding cancer patients. It is found that a ¼ of the records relate to breast cancer. There are a total of 20,920 records. How many are related to breast cancer?
   A. 83,680
   B. 10,460
   C. 5,230
   D. 2,660

33. A baby grew 5/8 inch in May, and 7/16 inch in June. How many total inches did the baby grow in May and June?
   A. ¾ inch
   B. 1 1/16 inch
   C. 1 1/8 inch
   D. 1¼ inch

34. You take a temperature with a celsius thermometer and find it is 38.2. Rounded to the nearest tenth, this is reported as a temperature of
   A. 53.2 F°
   B. 99.8 F°
   C. 100.8 F°
   D. 126.4 F°

35. Your friend is 65" tall. This is equal to
   A. 0.65 meters
   B. 1.625 meters
   C. 6.50 meters
   D. 16.25 meters

36. 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?
   A. 41 ml.
   B. 75 ml.
   C. 120 ml.
   D. 180 ml.

37. You have a headache. You are told to take aspirin, 600 mg. How many 5 gr. tablets should you take?
   A. 1 tablet
   B. 2 tablets
   C. 3 tablets
   D. 4 tablets

38. The physician ordered 2000 mg. of a medication with milk after meals. The
    medication is available in 0.5 g. envelopes. How many envelopes are needed after
    each meal?
    A. 1 envelope
    B. 2 envelopes
    C. 3 envelopes
    D. 4 envelopes

39. A psychologist charges $45 for a 20-minute therapy session. If the overhead
    (receptionist, office space, insurance, etc.) takes 60% of this income, how much does
    the psychologist clear per hour?
    A. $27
    B. $45
    C. $54
    D. $81

40. You are to use a needle, 3 inches long, to give an injection. How many mm. is this?
    A. 7.5 mm.
    B. 25.0 mm.
    C. 75.0 mm.
    D. 100.0 mm.

41. The physician has ordered a patient to have 2.5 g. of a medication. The scored tablets
    contain 15 gr. How many tablets must be taken?
    A. ½ tablet
    B. 1½ tablet
    C. 2 tablets
    D. 2½ tablets

42. The physician ordered 60 mg. of a medication IM. It is available in 30 mg. per 5 ml.
    To give the correct dosage, the nurse will need to give
    A. 2½ ml.
    B. 3 ml.
    C. 6 ml.
    D. 10 ml.

43. You are required to make a solution with 7 ml. of a liquid substance. You are to use a
    dropper to measure the substance. You will use
    A. 56 gtts.
    B. 105 gtts.
    C. 210 gtts.
    D. 420 gtts.

44. A patient drank 6 ounces of juice, 3 cups of water, and a half pint of milk. The total
    intake was
    A. 1050ml.
    B. 1150 ml.
    C. 1460 ml.
    D. 2420 ml.

45. You take a patient's temperature and find it is 102° F. You are to record the
    temperature as
    A. 24.66° C
    B. 34.22° C
    C. 38.89° C
    D. 70 °C

46. You measure a friend who is 5 ft. 3 inches tall. What is her height in centimeters?
    A. 53 cm.
    B. 157.5 cm.
    C. 530 cm.
    D. 1524.5 cm.

47. The medical assistant needs 7 ml. of a medication. This is equal to
    A. 21 minims.
    B. 56 minims.
    C. 105 minims.
    D. 210 minims.

48. You are working in the laboratory. You have a substance that weighs 6 ounces. How
    many grams does it weigh?
    A. 48 grams
    B. 90 grams
    C. 180 grams
    D. 360 grams

49. If 250 cm. of cloth are required for a uniform, how many uniforms could be made
    from a 15 meter piece of cloth?
    A. 1 uniform
    B. 6 uniforms
    C. 7 uniforms
    D. 10 uniforms

50. You are to use 5. g to make a laboratory solution. The material comes in 25 gr. per 1
    tsp. You need to use
    A. ½ tsp.
    B. 1 tsp.
    C. 3 tsp.
    D. 5 tsp.

KEY - Medical Mathematics Pre-Test/Post-Test

1. C
2. B
3. B
4. D
5. A
6. C
7. B
8. D
9. C
10. A
11. B
12. D
13. B
14. B
15. C
16. A
17. B
18. D
19. D
20. A
21. C
22. C
23. B
24. B
25. B
26. B
27. D
28. B
29. C
30. D
31. C
32. C
33. B
34. C
35. B
36. B
37. B
38. D
39. C
40. C
41. D
42. D
43. B

44. B
45. C
46. B
47. C
48. C
49. B
50. C

Project Rubric

Student: _____

Course: _____

Date: _____

Scoring criteria	4. Excellent	3. Good	2. Needs Some Improvement	1. Needs Much Improvement	N/A
Clearly/effectively communicates the main idea or theme.					
Information clearly provided.					
Strong examples used to describe the theme or objective.					
Illustrations logical reasoning.					
Each image and font size is legible to the entire audience.					

NOTE: N/A represents a response to the performance which is "not appropriate."

Scale:
22-25 - A Excellent
18-21 - B Good
14-17 - C Needs Some Improvement
10-13 - D Needs Much Improvement
5-9 - F Not Appropriate

TOTAL =