Mathematical Calculations

OBJECTIVES/RATIONALE

To pursue a career in the health care industry, students should be proficient in academic subject content. The student will have the knowledge and skills necessary to perform the mathematical processes as related to health science technology. The student is expected to add, subtract, multiply and divide rational numbers and apply data from tables, charts, and graphs to estimate and find solutions to health related problems.

TEKS 121.2 1A, 1B	TAKS ELA 1, 3, 4
U.S. History 24H	Mathematics 1, 2, 3, 8, 9, 10

KEY POINTS

I. Basic mathematical calculations are used in various conversion problems.
Conversion charts
A. Consequences of mathematical miscalculations
1. incorrect drug dosage may be administered
2. incorrect conversions to standard metric may affect amount of medication given

II. Tables, graphs and charts:
A. Growth Charts and Weight Charts in the practice of pediatrics.
B. Actuarial charts relating to DRG's and lifestyle behaviors.
C. Morbidity tables/charts , and graphs related to various diseases, i.e. smoking, cancer.

ACTIVITIES

I. Complete the **mathematics pre-test**.
II. Interpret **Birth Defects in the Lower Rio Grande Valley Report** and complete the **Birth Defects Report Analysis**.

MATERIALS NEEDED

Birth Defects in the Lower Rio Grande Valley – A Special Report of the Texas Birth Defects Monitoring Division, Texas Department of Health, December 1998.

Access to one or more of the following references 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 Allied 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, *The Health Care Worker*, Brady, ISBN 0-89303-478-9

Hayden, Jerome & Davis, Howard T., *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, *Dosage Calculations*, Delmar, ISBN 0-8273-4982-3

Olsen, et al., *Medical Dosage Calculations*, Addison-Wesley

ASSESSMENT

Completion of mathematics post-test.

Completion of the Birth Defects Analysis.

ACCOMMODATIONS

For reinforcement, the students will participate in drill practice using computer programs for basic mathematical skills. (Teacher Note: Partner with the math department in the school or with the Educational Service Center.)

For enrichment, the students will utilize multimedia technology to develop charts and graphs to compare Texas statistical data with data from other 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

Medical Mathematics Pre-Test/Post-Test

Read each question carefully and mark the correct answer on the scantron. Do not mark on the test. Use blank scratch paper to do the calculations. Non-programmable calculators may be used.

1. Your mother is to take 30 mg. of Sudafed four times a 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.1 ½ grains
   C.3 grains
   D.2 ½ 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 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 to wrap 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.1 ½ 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. ii. 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.12 ½ hours
   B.15 ½ hours
   C.25 hours
   D.30 ¼ hours

11. A physician orders 1500 ml of saline to infuse @ 200 ml/hr. The infusion will take
   A.4 ½ hours
   B.7 ½ 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 oF. What is this in celsius?
    A.15.7 oC
    B.30.0 oC
    C.90.0 oC
    D.122.8 oC

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..44 lbs.
    B..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 15 ½ 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 pharmacy, a container had 12 ½ ounces of liquid. When you do the inventory, you find there are 6 ¾ ounces of the liquid remaining. How much liquid had been removed?
    A.6 ounces
    B.5 ¾ ounces
    C.5 ¼ 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 .25 g. of a medication for the patient. The medication comes in 125 mg per 5 cc's. You should give
    A.2 ½ cc
    B.5 cc
    C.7 ½ 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 a 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 powder 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.2 ½ 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 cancer of the breast. There are a total of 20,920 records. How many are related to cancer of the breast?
    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.1 ¼ 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.1 ½ tablet
    C.2 tablets
    D.2 ½ 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.2 ½ 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