Medical Math

New for 2021-2022
Additional rounding information has been added.
The 9th edition of *DHO Health Science* by Simmers has been released.

Event Summary

Medical Math provides members with the opportunity to gain knowledge and skills required to identify, solve, and apply mathematical principles. This competitive event consists of a written test with tie-breaker questions. This event aims to inspire members to learn about the integration of mathematics in health care, including temperature, weights, and measures used in the health community.

Dress Code Competitors must be in official HOSA uniform or in proper business attire. Bonus points will be awarded for proper dress.

General Rules

1. Competitors in this event must be active members of HOSA-Future Health Professionals and in good standing.

2. Secondary and Postsecondary/Collegiate divisions are eligible to compete in this event.

3. Competitors must be familiar with and adhere to the **"**General Rules and Regulations of the HOSA Competitive Events Program (GRR)."

4. All competitors shall report to the site of the event at the time designated for each round of competition. At ILC, competitor's photo ID must be presented prior to ALL competition rounds.

Official References

- Simmers, L., Simmers-Nartker, Simmers-Kobelak. *DHO: Health Science*. Cengage Learning, Latest edition.
- Olsen, et al, *Medical Dosage Calculations*. Pearson Latest edition.
- Craig, Gloria P., *Clinical Calculations Made Easy*. Wolters Kluwer, Latest edition.
- Helms, Joel R., *Mathematics for Health Sciences: A Comprehensive Approach.* Cengage Learning. Latest edition.

Written Test

5. Test Instructions: The written test will consist of 50 fill-in-the-blank items in a maximum of 90 minutes.

6. **Time Remaining Announcements:** There will be a verbal announcement when there are 60 minutes, 30 minutes, 15 minutes, 5 minutes, and 1 minute remaining to complete the test.

7. A series of ten (10) complex, multi-step tie breaking questions will be administered with the original test. In case of a tie, successive tie-breaker questions will be used until a winner is determined. In the tiebreaker, correct spelling is required for an item to be considered correct.

8. **Test Plan:**

Mathematical essentials 5%
Measurement and conversion problems 20%
Drug dosages and intravenous solutions 35%
Dilutions, solutions and concentrations 25%
Interpreting medical information 15%

- Charts, graphs, tables
- Basic statistics: mean, median, mode, standard deviation
- Calculating body surface

NOTE:
1. Abbreviations will be used in the written problems. In addition, the test will use standard medical abbreviations as designated in the Simmers DHO Health Science reference.
2. At least half of the computation and calculation problems will involve conversions.

9. At the International Leadership Conference, HOSA will provide basic handheld calculators (no graphing calculators) for addition, subtraction, division, multiplication and square root. Check with State Advisor to determine if a calculator will be used at the State level.

10. All competitors will receive two (2) 8.5x11" sheets of blank paper for use during the test.

11. The medical math "Reference Materials Summary" included in these guidelines (page 4) will be used as the official reference for the test for uniformity. **Competitors may NOT use this summary page or any type of conversion chart or resource during the test.**

12. **When a Scantron form is used** – the Scantron form for this event will require competitors to grid-in their responses.

At the chartered association-level, when a paper/pencil test is used or the test is administered on a computer, the competitor will write in or key in his/her response to each question.

*Note: **Chartered associations** may use a different process for testing, to include but not limited to pre-conference testing, online testing, and testing at a computer. Check with your Area/Region/State**/Chartered Association** for the process you will be using.*

13. **ROUNDING:** Converting between measurement systems will often render a different answer depending upon which systems and conversions are being used. The answer to a calculation problem will ultimately be the same answer after appropriate rounding. When determining a solution, round only the final answer after all calculation steps have been completed.

When rounding decimal numbers to the nearest tenths, hundredths, or thousandths, look to the immediate right of the digit located in the position to be rounded. If the number to the direct right is 5 or larger, round to the position up one number and drop everything that follows. If the number to the direct right is 4 or smaller, leave the position being rounded as is and drop everything that follows. In specific situations, answers will be rounded per medical protocol. For example, pediatric dosage is always rounded DOWN to avoid potential overdose. Unless otherwise indicated, all answers should be rounded to the nearest whole number. (Examples: 31.249 (rounded down) = 31 and 23.75 (rounded up) = 24).

14. **Sample Test Questions**
**Competitors will grid-in (or write in) their answers to the test problems.*

1. An IV bag of 500 mL solution is started at 1900. The flow rate is 38 gtts per minute, and the drop factor is 10 gtts per mL. At what time (24-hour clock) will this infusion finish?
(Craig pp 174-178)

Solution *38 gtts/1 min x 1 mL/10 gtts = 3.8 mL/min*
3.8 mL/1 min x 60 min/1 hr = 228 mL/hr
500 mL x 1 hr/228 mL = 2.1929824 hr
0.1929824 hr x 60 min/1 hr = 11.578944 minutes
1900 hr + 2 hrs 11.578944 min (Rounded = 12 minutes)
2100 hours + 12 min = 2112 hours

2. A patient with an eating disorder weighs 95½ lbs. What is the patient's weight in kg? Round to the nearest tenth.
(Helms pp 110-114)

Solution *95.5 lb x 1 kg/2.2 lbs = 43.40909 kg Rounded = 43.4 kg*

3. How many grams of sodium chloride are needed to prepare 500 mL of a 5% solution?
(Olson pp214-227)

Solution *5% = 5 g/100 mL = 0.05 g/1 mL*
0.05 g/1 mL x 500 mL = 25 g

Final Scoring

15. Final rank is determined by the test score. In case of a tie, the tie-breaking questions will be used to determine the rank.

Competitor Must Provide:
- ☐ Two #2 lead pencils with eraser
- ☐ Photo ID

Medical Math – SS/PSC
Reference Materials Summary

METRIC EQUIVALENTS

Length	**Temperature**
1 meter (m) = 100 centimeters (cm) = 1000 millimeters (mm) **1 centimeters (cm) = 10 millimeters (mm)**	**°C (Degrees Celsius) = (°F - 32) 5/9** **°F (Degrees Fahrenheit) = (°C) 9/5 + 32**
Weight	**Weight Conversion**
1 kilogram (kg) = 1000 grams (g)	**1 kilogram (kg) = 2.2 pounds (lb)**
1 gram (g) = 1000 milligrams (mg)	**1 pound (lb) = 16 ounces (oz)**
1 milligram (mg) = 1000 micrograms (mcg)	
Volume for Solids	**Volume for Fluids**
1000 cubic decimeters (dm) = 1 cubic meter (m^3)	**1 liter (L) = 1000 milliliters (mL)**
1000 cubic centimeters (cm^3) = 1 cubic decimeter (dm^3)	**10 centiliters (cL) = 1 deciliter (dL)**
1000 cubic millimeters (mm^3)= 1 cubic centimeter (cm^3 or cc)	**10 deciliters (dL) = 1 liter (L)**
	1 cubic centimeters (cm^3 or cc) = 1 milliliter (mL)
	Units (U) = a measure for drugs such as insulin

APPROXIMATE EQUIVALENTS AMONG SYSTEMS

Metric	**Household/English**
240 milliliters (mL)	**1 cup = 8 ounces (oz) = 16 tablespoons (tbsp)**
30 milliliters (mL)	**1 ounce (oz) = 2 tablespoons (tbsp) = 6 teaspoons (tsp)**
15 milliliters (mL)	**1 tablespoon (tbsp) = 3 teaspoons (tsp)**
5 milliliters (mL)	**1 teaspoon (tsp)**
1 milliliter (mL)	**15 drops (gtts)**
0.0667 milliliters (mL)	**1 drop (gtt)**
1 meter (m)	**39.4 inches (in)**
2.54 centimeters (cm)	**1 inch (in)**
	1 foot (ft) = 12 inches (in)

Formulas

Standard Deviation Formula for Sample Data	**Body Surface Area**
$\sqrt{\frac{\sum (x-\bar{x})^2}{(n-1)}}$	**BSA (m^2) = √([height (cm) x weight(kg)]/3,600)** **BSA (m^2) = √([height (in) x weight(lb)]/3,131)**

References

Craig, Gloria. *Clinical Calculations Made Easy*. Lippincott, Williams & Wilkins, Latest Edition.

Helms, Joel R., *Mathematics for Health Sciences: A Systematic Approach*. Cengage Learning. Latest edition.

Olsen, et al, *Medical Dosage Calculations*. Prentice Hall. Latest edition.