Medical Math

New for 2022 – 2023
Clarification for the use of zero has been added.
There will be NO verbal announcements during testing.

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 tiebreaker 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.

Competitor Must Provide:
- ☐ Photo ID
- ☐ Two #2 lead (not mechanical) with erasers

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

2. **Eligible Divisions:** 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)."
   - Per the GRRs #11 and Appendix H, HOSA members may request accommodation in any competitive event. To learn the definition of an accommodation, please read Appendix H. To request accommodation for the International Leadership Conference, submit the request form here by May 15 at midnight EST.
   - To request accommodation for any regional/state level conferences, please work with your local and state advisor directly. Accommodations must first be done at state in order to be considered for ILC.

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

5. All official references are used in the development of the written test.

6. Simmers, L., Simmers-Nartker, Simmers-Kobelak. *DHO: Health Science*. Cengage Learning, Latest edition.

7. Olsen, et al, *Medical Dosage Calculations*. Pearson Latest edition.

8. Craig, Gloria P., *Clinical Calculations Made Easy.* Wolters Kluwer, Latest edition.

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

Written Test

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

11. **Time Remaining Announcements:** There will be NO verbal announcements for time remaining during ILC testing. All ILC testing will be completed in the Testing Center and competitors are responsible for monitoring their own time.

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

13. **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

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.

14. At the International Leadership Conference, HOSA will provide basic handheld calculators (no graphing calculators) for addition, subtraction, division, multiplication and square root calculations.

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

16. 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.

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

18. **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 place; 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 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).

19. **USE OF ZERO:** Decimal expressions of less than 1 should be preceded by a zero – "leading zero". A whole number should never be followed by a decimal point and a zero – "trailing zero"

20. **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)
   1900 hours + 2hrs 12 min = 2112 hours
   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 pp 214-227

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

Final Scoring

21. The competitor should write his/her answer to the tiebreaker questions on the tiebreaker page of the test that remains attached to the original test.

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

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)	ºC (Degrees Celsius) = (ºF - 32) 5/9 ºF (Degrees Fahrenheit) = (ºC) 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.