

Medical Math

Health Science Event

Eligible Divisions: Secondary & Postsecondary / Collegiate	Round 1: 50 Q test in 90 minutes	Digital Upload: NO
Solo Event: 1 competitor		



New for 2024 – 2025

Standard deviation has been removed from the test plan. Editorial updates have been made.

Event Summary

Medical Math allows members to gain the knowledge and skills required to identify, solve, and apply mathematical principles. This competitive event consists of a written test with tiebreaker questions. It 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

Proper business attire or official HOSA uniform. Bonus points will be awarded for [proper dress](#).

Competitor Must Provide:

- [Photo ID](#)
- Two #2 lead pencils (not mechanical) with erasers

General Rules

1. Competitors must be familiar with and adhere to the [General Rules and Regulations](#).

Official References

2. The references below are used in developing the test questions.
 - a. [Simmers, L., Simmers-Nartker, Simmers-Kobelak. DHO: Health Science. Cengage Learning, Latest edition.](#)
 - b. [Kenamer, Michael, Math for Health Care Professionals. Cengage, Latest edition.](#)
 - c. [Craig, Gloria P., Clinical Calculations Made Easy. Wolters Kluwer, Latest edition.](#)

Written Test

3. [Test Instructions](#): The written test will consist of 50 fill-in-the-blank items in a maximum of 90 minutes.
4. A series of ten (10) complex, multi-step tiebreaker questions will be administered with the original test.
5. **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.

6. Test Plan:

HOSA Medical Math ILC Guidelines (August 2024)

The expectation is that competitors read and are aware of all content within these guidelines and associated links. Successful competitors will study all links for detailed information.

The test plan for the Medical Math Test is:

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

- Abbreviations will be used in the written problems. In addition, the test will use standard medical abbreviations as designated in the Simmers DHOHealth Science reference.
- At least half of the computation and calculation problems involve conversions.
- At the International Leadership Conference, HOSA will provide basic handheld calculators (no graphing calculators) for addition, subtraction, division, multiplication, and square root calculations.
- 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 conversion chart or resource during the test.**
- 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”

- When a Scantron form is used** – the Scantron form for this event will require competitors to grid their responses with pencils. Numbers must be written with the last number of the answer in the far right box. (See sample to the right). When a paper/pencil test is used or administered on a computer, the competitor will write in or key in their response to each question.



- ROUNDING:** Converting between measurement systems will often render a different answer depending on which systems and conversions are used. The answer to a calculation problem will be the same after appropriate rounding. When determining a solution, round only the final answer after completing all the calculation steps.

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).

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

$$38 \text{ gtts}/1 \text{ min} \times 1 \text{ mL}/10 \text{ gtts} = 3.8 \text{ mL}/\text{min}$$
$$3.8 \text{ mL}/1 \text{ min} \times 60 \text{ min}/1 \text{ hr} = 228 \text{ mL}/\text{hr}$$
$$500 \text{ mL} \times 1 \text{ hr}/228 \text{ mL} = 2.1929824 \text{ hr}$$
$$0.1929824 \text{ hr} \times 60 \text{ min}/1 \text{ hr} = 11.578944 \text{ minutes}$$
$$1900 \text{ hr} + 2 \text{ hrs } 11.578944 \text{ min (Rounded} = 12 \text{ minutes)}$$
$$1900 \text{ hours} + 2 \text{ hrs } 12 \text{ min} = 2112 \text{ hours}$$
$$2112 \text{ hours}$$

2. A patient with an eating disorder weighs 95½ lbs. What is the patient's weight in kg? Round to the nearest tenth.

Simmers pp 372

Solution

$$95.5 \text{ lb} \times 1 \text{ kg}/2.2 \text{ lbs} = 43.40909 \text{ kg} \text{ Rounded} = 43.4 \text{ kg}$$

3. How many grams of sodium chloride are needed to prepare 500 mL of a 5% solution?

Kenamer pp235

Solution

$$5\% = 5 \text{ g}/100 \text{ mL} = 0.05 \text{ g}/1 \text{ mL}$$
$$0.05 \text{ g}/1 \text{ mL} \times 500 \text{ mL} = 25 \text{ g}$$

Final Scoring

15. 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.

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) = $\sqrt{([\text{height (cm)}] \times [\text{weight(kg)}]) / 3,600}$ BSA (m ²) = $\sqrt{([\text{height (in)}] \times [\text{weight(lb)}]) / 3,131}$