

Medical Math

New for 2018-2019

A standard deviation formula for sample data and body surface area formulas have been added.

At ILC, [photo ID](#) must be presented prior to competing.

Purpose To encourage HOSA members to improve their ability to identify, solve, and apply mathematical principles involving temperature, weights, and measures used in the health community.

Description This event shall be a written test dealing with selected problems involving conversions between the Fahrenheit and Celsius scales and the metric and household systems of measurement. Competitors will solve complex math problems utilized in health professions, in addition to identifying and interpreting related symbols and abbreviations in a 50 item test plus 10 tie-breaker problems. Written tests will measure knowledge and understanding at the recall, application and analysis levels. Higher-order thinking skills will be incorporated as appropriate.

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

- Rules and Procedures**
1. Competitors in this event must be active members of HOSA-Future Health Professionals and in good standing in the division in which they are registered to compete (Secondary or Postsecondary/Collegiate).
 2. Competitors must be familiar with and adhere to the [“General Rules and Regulations of the National HOSA Competitive Events Program \(GRR\).”](#)
 3. 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 tie-breaker, correct spelling is required for an item to be considered correct.

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

- NOTE:**
1. Abbreviations should be used in written problem
 2. At least half of the computation and calculation problems will involve conversions.

NOTE: States/regions 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 for the process.

5. At the International Leadership Conference, HOSA will provide basic handheld 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.
6. The conversion chart included in these guidelines will be used as the official reference for the test for uniformity. **Competitors may not use any type of conversion chart or resource during the test.**
7. The official references for selection of symbols, abbreviations, and problems are:
 - [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.](#)
8. All competitors shall report to the site of the event at the time designated for the event orientation. The test will immediately follow the orientation. At ILC, [photo ID](#) must be presented prior to competing. **No proxies will be allowed for the orientation.**
9. **When a Scantron form is used** – the Scantron form for this event will require competitors to grid-in their responses.

At the state-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.
10. [Test Instructions](#): All competitors will be given a test, a Scantron answer form and two (2) sheets of blank paper. Competitors will be given instructions on the use of the Scantron form. After instructions have been given, the competitors will be notified to start the test. There will be a maximum of **90 minutes** to complete the test. There will be a verbal announcement when there are 15 minutes remaining for the test period. Competitors may be excused from the testing site promptly after completion of the test.
11. 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.

ROUNDING: 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).

Competitor Must Provide:

- Event guidelines (orientation)
- Two #2 lead pencils with eraser
- [Photo ID](#)

FOR SPECIFICS ON EVENT MANAGEMENT SEE [MANAGING COMPETITIVE EVENTS](#)

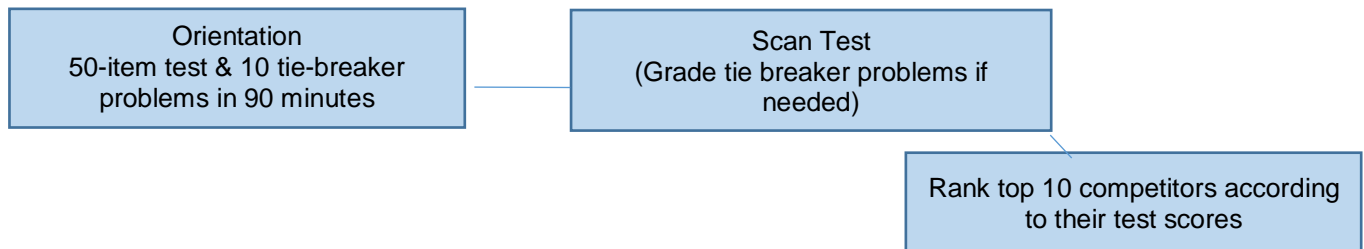
Required Personnel:

- One Event Manager
- One QA to provide quality assurance for the event by ensuring that the guidelines are followed and all event documents are complete.
- Proctors for Testing – Approximately one proctor for 20 competitors
- One-two event assistants per section

Facilities, Equipment and Materials:

- One room to accommodate the total number of competitors
- Tables/chair or schoolroom desks/chairs for total number of competitors
- Table/chairs for event personnel to provide for registration and distribution of materials
- List of competitors for check-in
- One pre-numbered test per competitor
- Scantron/answer forms - one copy per competitor
- Blank paper (2 sheets per competitor)
- Calculators (1 per competitor)
- Clock or timer
- Evaluation Forms – competitor and personnel
- #2 lead pencils with eraser to complete evaluations (event personnel)

Event Flow Chart



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?
2. A patient with an eating disorder weighs 95½ lbs. What is the patient’s weight in kg?
3. How many grams of sodium chloride are needed to prepare 500 mL of a 5% solution?

HOSA MEDICAL MATH CONVERSION CHART

METRIC EQUIVALENTS

<p>Length</p> <p>1 meter = 100 centimeters = 1000 millimeters 1 centimeters = 10 millimeters</p>	<p>Temperature</p> <p>$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \frac{5}{9}$ $^{\circ}\text{F} = (^{\circ}\text{C}) \frac{9}{5} + 32$</p>
<p>Weight</p> <p>1 kilogram = 1000 grams 1 gram = 1000 milligrams 1 milligram = 1000 micrograms</p>	<p>Weight Conversion</p> <p>1 kilogram = 2.2 pounds 1 pound = 16 ounces</p>
<p>Volume for Solids</p> <p>1000 cubic decimeters = 1 cubic meter 1000 cubic centimeters = 1 cubic decimeter 1000 cubic millimeters = 1 cubic centimeter</p>	<p>Volume for Fluids</p> <p>1 liter = 1000 milliliters 10 centiliters = 1 deciliter 10 deciliters = 1 liter 1 cubic centimeters = 1 milliliter</p>

APPROXIMATE EQUIVALENTS AMONG SYSTEMS

Metric	Household/English Liquid
240 milliliters	1 cup / 8 ounces / 16 tbsp
30 milliliters	1 ounce / 2 tbsp / 6 tsp
15 milliliters	1 tablespoon / 3 teaspoons
5 milliliters	1 teaspoon
1 milliliter	15 drops
0.0667 milliliters	1 drop
1 meter	39.4 inches
2.54 centimeters	1 inch

- Sources: Simmers, L., Simmers-Nartker, Simmers-Kobelak. *DHO: Health Science*. Cengage Learning, Latest edition. and Olsen, et al. *Medical Dosage Calculations*. Pearson. Latest Edition.

MEDICAL MATH

ABBREVIATIONS, STANDARDS, & FORMULAS

The following are the abbreviations and I & O standards that will be used for the Medical Math event. (Official references are identified in the Medical Math Guidelines.)

Any measurement terms not listed in the chart below will be spelled out. (Example: deciliter)
In addition, the test will use standard medical abbreviations as designated in the Simmers *DHO Health Science* reference.

Term	Abbreviation
meter	m
millimeter	mm
centimeter	cm
kilogram	kg
gram	g
milligram	mg
microgram	mcg
liter	L
milliliter	mL
cubic centimeter	cc or cm ³
degrees Celsius (Centigrade)	° C

Term	Abbreviation
foot/feet	ft
Inch	in
pound	lb
ounce	oz
quart	qt
pint	pt
cup	C
tablespoon	tbsp or T
teaspoon	tsp or t
drop or drops	gtt or gtts
degrees Fahrenheit	° F

I & O Standards:

Juice glass = 6 oz.
Coffee cup = 8 oz.
Water glass = 7 oz.
Jello cup = 5 oz.
Ice cream = 4 oz.
Creamer = 1 oz.

Formulas:

Standard Deviation Formula for Sample Data:

$$\sqrt{\frac{\sum (x - \bar{x})^2}{(n - 1)}}$$

Body Surface Area Formulas:

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

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