

# Medical Math

## ***New for 2019-2020***

Competitors are no longer required to show event guidelines at ILC. Time remaining announcements have been added to the test. Editorial updates and clarifications have been made to guidelines. Scholarship information has been added to the guidelines. The Reference Materials (page 5 of guidelines) has been updated.

- 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**
- 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).
  - Competitors must be familiar with and adhere to the [“General Rules and Regulations of the National HOSA Competitive Events Program \(GRR\).”](#)
  - 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:**
- Abbreviations will be used in written problem. 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.

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 (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.
6. All competitors will receive two (2) 8.5x11" sheets of blank paper for use during the test.
7. The medical math "Reference Materials Summary" included in these guidelines (page 5) 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.**
8. 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.](#)
9. 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.**
10. **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.
11. [Test Instructions](#): The competitors will be given instructions and will be notified to start the test. There will be a maximum of 90 minutes to complete the test. Competitors should leave the testing site promptly after submitting all testing materials and evaluations.
12. **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.
13. 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).

14. HOSA offers numerous scholarships every year to its members interested in pursuing a variety of health careers. As you consider participating in this competitive event, please keep in mind there may be a HOSA Scholarship offered that fits your interests! For more information on the HOSA Scholarship program, please visit <http://www.hosa.org/scholarships>.

**Competitor Must Provide:**

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

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

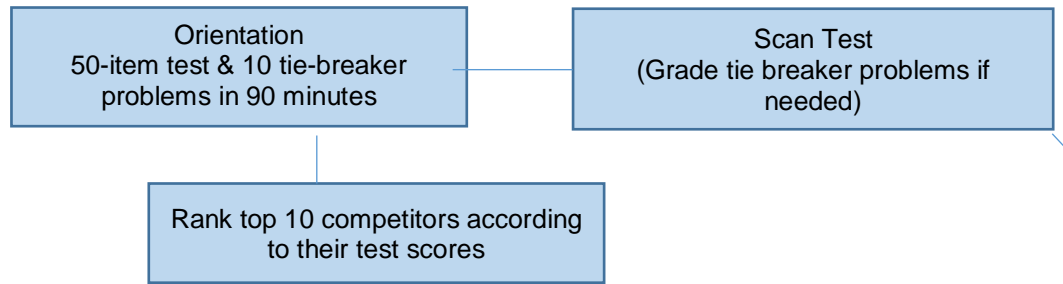
**Required Personnel:**

- One Event Manager
- One Judge Manager (JM) 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 (see [HOSA Room Sets](#))
- 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?

# 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 <sup>3</sup> )	1 liter (L) = 1000 milliliters (mL)
1000 cubic centimeters (cm <sup>3</sup> ) = 1 cubic decimeter (dm <sup>3</sup> )	10 centiliters (cL) = 1 deciliter (dL)
1000 cubic millimeters (mm <sup>3</sup> ) = 1 cubic centimeter (cm <sup>3</sup> or cc)	10 deciliters (dL) = 1 liter (L)
	1 cubic centimeters (cm <sup>3</sup> 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 <sup>2</sup> ) = $\sqrt{([\text{height (cm)} \times \text{weight(kg)}]/3,600)}$ BSA (m <sup>2</sup> ) = $\sqrt{([\text{height (in)} \times \text{weight(lb)}]/3,131)}$

### References

Craig, Gloria. *Clinical Calculations Made Easy*. Lippincott, Williams & Wilkins, Latest Edition. 6e.

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

Olsen, et al, *Medical Dosage Calculations*. Prentice Hall. Latest edition. 11e.