
# Allied Health Statistics - Anatomy and Physiology - Biochemistry Biology - Career Development - General Chemistry - Human Heredity Math for Health Professionals – Microbiology - Organic Chemistry Physics College

**New for 2023 – 2024**

Test plans have been updated. A new book is being used for the Career Development test. Calculators have been added to the following the National Geographic Learning Academic Testing Center events: Allied Health Statistics, Math for Health Professionals, Anatomy & Physiology, Biochemistry, General Chemistry, Organic Chemistry, & Physics. These guidelines are written for ILC. States may modify events or have different event processes and deadlines. Be sure to check with your Local/State Advisor (or state website) to determine how the event is implemented for the regional/area or state conference. Editorial updates have been made.

**Event Summary**

The goal of the National Geographic Learning Academic Testing Center (NGL ATC) Cengage sponsored events is to provide as many International Leadership Conference HOSA delegates as space permits with the opportunity to demonstrate their basic knowledge in preparation to become future health professionals.

The series of events in the NGL ATC are written tests based on items from the identified text specific to each event. Competitors will recognize, identify, define, interpret, and apply knowledge in a 50-item multiple choice test with a tie-breaker question. The written test will measure knowledge and understanding at the recall, application, and analysis levels. Higher-order thinking skills will be incorporated.

**Sponsorship.** These competitive events are sponsored by National Geographic Learning / Cengage

**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 pencils (not mechanical) with eraser

**Rules and Procedures**

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

2. **Eligible Divisions:** Secondary, Postsecondary/Collegiate, or Alumni division members may 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 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/area or state level conferences, submit the request form here by your state published deadline. Accommodations must first be done at state in order to be considered for ILC.

4. A tie-breaker question(s) will be administered with the original test. In case of a tie, the tie-breaker question(s) will be graded to break the tie.

5. All competitors shall report to the site of the event at the time designated for the test in ILC publications. Competitors will bring a photo ID as well as two #2 lead pencils (not mechanical) for test-taking.

6. Test Instructions: The competitors will be given instructions and will be notified to start the test. There will be a maximum of 60 minutes to complete the test.

7. 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.

8. At the International Leadership Conference, HOSA will provide basic handheld calculators (no graphing calculators) for addition, subtraction, division, multiplication and square root calculations for the following ATC tests: Allied Health Statistics, Math for Health Professionals, Anatomy & Physiology, Biochemistry, General Chemistry, Organic Chemistry, & Physics.

**Testing Areas and Resources**

9. Eleven (11) of the NGL Academic Testing Center events are sponsored by National Geographic Learning / Cengage.

10. The eleven (11) approved tests for ILC and their associated resources are as follows:

| Event | Resource Title (National Geographic Learning/Cengage) | ISBN |
|---|---|---|
| 1. Allied Health Statistics | Basic Allied Health Statistics and Analysis, 5th Edition | 9781337796965 |
| 2. Anatomy and Physiology | Body Structures and Functions, 14th edition. | 9780357457542 |
| 3. Biochemistry | Introduction to General, Organicand Biochemistry, 12th edition | 9781337571357 |
| 4. Biology | Biology: The Unity and Diversity of Life, 15th AP Edition | 9781337408592 |

| | | |
|---|---|---|
| 5. Career Development | Your Career: How to Make it Happen | 978035711460 |
| 6. General Chemistry | A Comprehensive Approach Chemistry AP Edition, 10th edition | 9781305957732 |
| 7. Human Heredity | Human Heredity: Principles and Issues, 11th edition | 9781305251052 |
| 8. Math for Health Professionals | Math for Health Professionals, 2nd edition | 9781305509788 |
| 9. Microbiology | Microbiology: Practical Applicationsand Infection Prevention, 1st Edition | 978113369642 |
| 10. Organic Chemistry | Introduction to General, Organicand Biochemistry, 12th edition | 9781337571357 |
| 11. Physics College | College Physics AP Edition, 11th | 9781305965393 |

11. Test Plans:

Allied Health Statistics:

- Identify the importance of health statistics 12%
- Describe health data across the continuum 8%
- Describe hospital census information 8%
- Identify hospital occupancy information 8%
- Understand statistics related to hospital length of stay 8%
- Understand hospital obstetric and neonatal statistics 8%
- Identify clinical and non-clinical statistics 8%
- Understand terms and rates related to mortality and autopsy 8%
- Understand community health statistics 5%
- Understand the basics of math and statistics 5%
- Describe organizing data for analysis 8%
- Identify how to display data for analysis 6%
- Understand the fundamentals of research 8%

Anatomy & Physiology:

- Compare and contrast anatomy and physiology 2%
- Describe the physiology of the human body 40%
- Identify the anatomy of the human body 40%
- Identify common diseases and disorder of the human body 14%
- Understand basic medical math problems 4%

Biology:

- Describe the study of life and organization 6%
- Identify the building blocks of matter 4%
- Describe the structures and functions of plant and animal cells 18%
- Describe the mechanisms of genetics and heredity 14%
- Apply the principles of evolution 10%
- Describe evolution and biodiversity 10%
- Identify structures and functions of plant and animal systems 14%
- Identify plant and animal reproduction processes 14%
- Describe the principles of ecology 10%

Biochemistry:

- Understand the characteristics of water 10%
- Differentiate between amino acids and peptides 6%

- Describe the structures and functions of proteins (including enzymes) 14%
- Identify the structures and functions of carbohydrates 20%
- Understand nucleic acids (DNA and RNA) and the role in genetics 20%
- Describe the structure and functions of lipids 10%
- Understand biological membranes and their role in cell transport 6%
- Explain metabolism and how ATP is produced. 14%

Career Development:

- Recognize how to begin the process of career development 10%
- Identify the required skills needed for career development 12%
- Describe individual preferences for career development 8%
- Identify values needed for career development 8%
- Understand the exploration stage of career development 10%
- Describe the relationships required for career development 10%
- Identify the stages of the decision making 14%
- Determine the tools required for career development 6%
- Understand the launch stage of career development 16%
- Recognize the skills required for career management 6%

General Chemistry:

- Describe chemistry concepts, measurements, and calculations 10%
- Identify elements, atoms, ions, and periodicity 6%
- Describe chemical reactions, energy, and solutions 28%
- Compare solids, liquids, and gases 12%
- Identify chemical composition, quantities, kinetics, & equilibrium 12%
- Understand general concepts of bonding 6%
- Identify modern atomic theory 4%
- Compare and contrast acids and bases 6%
- Understand principles of chemical nomenclature 6%
- Identify the properties of matter 4%
- Understand electrochemistry and entropy 6%

Human Heredity:

- Identify common genetic diseases and disorders, including cancer 24%
- Understand genetics, genes, cells, and cell division 10%
- Understand chromosomes, inheritance, and the transmission of traits 10%
- Explain pedigree, karyotypes and the inheritance of complex traits 14%
- Explain how the immune system and viruses affect genes. 2%
- Describe DNA and RNA and how they relate to genetics 8%
- Explain phenotypes, gene expression and gene regulation. 8%
- Describe how mutations and epigenetics affects genes. 8%
- Describe genetic technologies, genomes, biotechnology, reproductive technology, genetic testing and gene therapy. 12%
- Describe the genetics of behavior 2%
- Describe population genetics 2%

Math for Health Professionals:

- Understand how to create the proper solution 20%
- Understand basic mathematical concepts and conversions 22%
- Understand how to determine proper drug dosages 30%
- Understand how to measure input and output 4%
- Identify how to convert roman numerals 2%
- Identify how to determine drops per minute and flow rate 10%
- Identify how to convert from the metric system to the English system and vice versa 10%

- Understand basic medical terminology 2%

Microbiology:

- Identify the different types of sanitation, sterilization, and disinfection 8%
- Identify diseases and disorders 26%
- Understand infection control, the chain of infection & pathogens transmission 14%
- Identify healthcare associated infections 6%
- Understand the history of microbiology 4%
- Describe the types of immunity, immunizations, & antimicrobials 10%
- Identify tests that can be used to determine infection 4%
- Understand asexual reproduction 2%
- Identify the characteristics of mold 2%
- Understand classifications of organisms 4%
- Identify characteristics of prokaryotic cells, including bacteria 8%
- Describe the different types of stains used in microbiology 4%
- Understand the pH scale and effect on microorganisms 2%
- Describe the characteristics of bacteria 6%

Organic Chemistry:

- Describe electronegativity – structure and bonding 16%
- Describe chemical bonds, shapes and naming of compounds 16%
- Describe stereochemistry 4%
- Describe between alkanes, cycloalkanes and functional groups 6%
- Describe substitution and elimination reactions 6%
- Differentiate between alkenes and alkynes 4%
- Differentiate between alcohols, ethers, epoxides and sulfides 8%
- Identify aromatic compounds and IUPAC names 12%
- Describe aldehydes and ketones 8%
- Identify carboxylic acids and derivatives 8%
- Understanding how to name amines 8%
- Describe spectroscopy 4%

Physics:

- Understand work, energy and particle dynamics (velocity, acceleration. Force, heat, friction, motion) 10%
- Understand concepts of waves (wavelengths, frequency) 10%
- Identify resistances, watts, amps and currents 10%
- Understand the principles of fluid mechanics including buoyancy 4%
- Identify electrical charges, electrical circuits and electrical fields 10%
- Understand the history of radiation 2%
- Compare and contrasts properties of light, waves and particle model 12%
- Describe optics, images and focal points 4%
- Describe the laws of thermal dynamics 8%
- Understand the concept of magnetism and inductance 10%
- Understand basic mathematical concepts related to physics 20%

12. Chapter Advisors – contact your Cengage Sales Consultant for a review copy of the reference title of your choice, for events 1-11 above. Most resources also offer online interactive study tools, virtual labs, and auto-graded practice. Find your Sales Consultant at NGL.Cengage.com/repfinder

**Registration Priority and Process**

13. **ILC registration** includes the opportunity to take one NGL Academic Testing Center test. Delegates who wish to take additional NGL Academic Testing Center tests may do so by

paying $20 per additional test. There is no maximum to the number of NGL ATC tests that can be taken at ILC, as long as the competitor can logistically sit to test in all events for which they are registered.

14. Delegates will pre-register for the NGL Academic Testing Center at ILC in the HOSA Conference Management System. No walk-up NGL ATC registration is allowed at ILC, only registered delegates by the published ILC deadline will be allowed to test.

15. Competitors should refer to the General Rules and Regulations for information on how many competitive events they can register for at ILC.

16. At State Chartered Association Conferences, these eleven (11) tests MAY be available as an additional event opportunity. Please check with your state HOSA leadership for details.

**Recognition and Awards**

17. A Certificate of Participation is given to every delegate who takes a test in the NGL Academic Testing Center.

18. The Top Ten HOSA members in EACH EVENT (not by division) will be recognized on stage at the Grand Awards Ceremony, with 1st, 2nd and 3rd place receiving special recognition.

19. HOSA Advisors will receive a Certificate of Excellence for any HOSA members from their chapter ranking in the Top Ten.

## Sample Test Questions

*The remaining pages of these guidelines include sample test questions from each of the eleven event tests.*

### Allied Health Statistics

1. Which of the following facilities delivers the highest level of nursing care?
   a. Intermediate Care
   b. **Residential Care**
   c. Skilled Nursing Care
   d. Rehabilitation Care

2. Which type of validity refers to how well the study adheres to accepted and established standards?
   a. Face validity
   b. Content validity
   c. **Construct validity**
   d. Criterion validity

3. Where do low numbers appear in a frequency polygon?
   a. Bottom and to the right
   b. Bottom and to the left
   c. Top and to the right
   d. **Top and to the left**

### Anatomy and Physiology

1. Health care workers use a spirometer to measure the_____.
   a. level of carbon dioxide in the blood

b. **lungs' capacity for air**
c. amount of pressure in the lungs
d. level of pleural fluid

2. What causes plasma like fluid to flow from the blood in the glomerulus into Bowman's capsule?
   a. Increase in blood pressure in the capillaries
   b. **Hormonal secretions**
   c. Stimulation from the nerves
   d. Level of salt in the blood

3. Which of the following is the definition of a fomite?
   a. Bacterial infection transmitted through contaminated water
   b. Small worm that may be present in meat and which infects the intestinal tract.
   c. Person who experiences no symptoms but can transmit an infection.
   d. **Nonliving object that is contaminated with an infectious agent**

## Biochemistry

1. Which of the following compounds would have the highest boiling point?
   a. $CH_3CH_2CH_2CH_3$
   b. $CH_3NH_2$
   c. $CH_3OH$
   d. **CH2F2**

2. Which subatomic particle is found in all isotopes of hydrogen?
   a. **Proton**
   b. Neutron
   c. Electron
   d. Positron

3. $CH_3C \equiv CCH_2CH_2Cl$ is named:
   a. 1-chloro-3-pentyne
   b. 5-chloro-2-pentene
   c. 1-acetylenyl-3-chloropropane
   d. **5-chloro-2-pentyne**

## Biology

1. In the electromagnetic spectrum,_____.
   a. infrared energy has the shortest wavelength
   b. infrared radiation has more energy than red radiation
   c. **visible light provides the energy for photosynthesis**
   d. near-infrared radiation provides the energy for photosynthesis

2. In order for DNA molecules to undergo recombination,_____.
   a. they must be from the same species
   b. their strands must separate as in replication
   c. **they must be cut and spliced at specific nucleotide sequences**
   d. one of the two DNA strands must be degrade

3. In garden peas, one pair of alleles controls the height of the plant, and a second pair of alleles controls flower color. The allele for tall (*D*) is dominant to the allele for dwarf (*d*), and the allele for purple (*P*) is dominant to the allele for white (*p*). A tall plant with purple flowers crossed with a tall plant with white flowers produces 3/8 tall purple, 1/8 tall white, 3/8 dwarf purple, and 1/8 dwarf white. What is the genotype of the parents?
   a. **Dd Pp x Dd pp**
   b. Dd Pp x Dd Pp
   c. DD Pp x dd Pp

d. Dd pp x dd Pp

## Career Development

1. If a physician fails to use a degree of skill and learning commonly expected and the person receiving care is injured, the physician can be sued for____.
   a. Negligence
   b. Defamation
   c. **Malpractice**
   d. Assault and battery

2. Patients confined to bed should have their position changed at least every ____.
   a. 30 minutes
   b. Hour
   c. **2 hours**
   d. 3 hours

3. 5/8 + 3/12 =___.
   a. 11/12
   b. 13/16
   c. 8/24
   **d. 7/8**

## General Chemistry

1. Select the correct molecular structure for $CO_2$:
   a. **linear**
   b. trigonal planar
   c. tetrahedral
   d. Bent

2. Consider the molecular orbital description of the $NO^-$ anion. Which of the following statements is false?
   a. $NO^-$ is paramagnetic.
   b. **$NO^-$ is isoelectronic with CO.**
   c. The bond energy in $NO^+$ is greater than the bond energy in $NO^-$.
   d. The bond order in $NO^-$ is 2.

3. For which of the following compound(s) are *cis* and *trans* isomers possible?
   a. **2,3-dimethyl-2-butene**
   b. 3-methyl-2-pentene
   c. 4,4-dimethylcyclohexanol
   d. *ortho*chlorotoluene

## Human Heredity

1. The letters G, Q, R, and C, used to describe the appearance of chromosomes, refer to the ___.
   a. position of the bands
   b. **staining procedure used to reveal the bands**
   c. number of arms per chromosome
   d. number of centromeres per chromosome

2. Which of the following sequences indicates the promoter region of a gene?
   a. **CAAT**
   b. UAAG
   c. CTTT
   d. ACAT

3. The ability to taste PTC and other bitter chemicals is controlled by_____.
   a. hormone levels that change throughout life
   b. **proteins on the surface of receptor cells**
   c. the amount of PTC exposure as a child
   d. the amount of capsaicin present in taste buds

## Math for Health Professionals

1. Goniometers measure
   a. **range of motion**
   b. weight
   c. surface area
   d. Time

2. The hospital uses a 15-drop-per-mL drip set. How will you adjust the IV to infuse 250 mL over 3 hours?
   a. constant infusion
   b. every minute
   c. every 30 seconds
   d. **every 3 seconds**

3. Calculate the BMI for Weight: 165 pounds; Height: 73 inches.
   a. 30
   b. 25
   c. 18
   d. **22**

## Microbiology

1. By what mechanism does a virus cause disease?
   a. by infecting the nervous system in humans
   b. **by shutting down or destroying a cell**
   c. by living on or in another organism
   d. by infecting red blood cells

2. Toxic proteins that can be secreted outside of the cell are called?
   a. bactericides
   b. endotoxins
   c. **exotoxins**
   d. aspergillus

3. Which main class of disease-causing parasites contain tapeworms?
   a. **Helminths**
   b. protozoa
   c. ectoparasites
   d. Ergosterol

## Organic Chemistry

1. Name the following: $CH_3 – CH_2 – CH_3$
   a. ethane
   b. **propane**
   c. butane
   d. Pentane
2. $CH_3C \equiv CCH_2CH_2Cl$ is named:
   a. 1-chloro-3-pentyne
   b. 5-chloro-2-pentene
   c. 1-acetylenyl-3-chloropropane
   d. **5-chloro-2-pentyne**

3. What is the correct (IUPAC) name of the following molecule: 2-methyl-4-t-butylpentane
   a. 2-t-butyl-4-methylpentane
   b. **2,2,3,5-tetramethylhexane**
   c. 2,4,5,5-tetramethylhexane
   d. 1-sec-butyl-1,2,2-trimethylpentane

Physics College

1. How many moles of air must escape from a 15.0-m × 9.0-m × 6.0-m room when the temperature is raised from 10.0°C to 20.0°C? Assume the pressure remains unchanged at one atmosphere while the room is heated. ($R$ = 8.31 J/mol·K)
   a. 4.9E+3 moles
   b. **1.2E+3 moles**
   c. 2.2E+2 moles
   d. 7.9E+2 moles

2. A loop of area 0.384 $m^2$ is in a uniform 0.0565-T magnetic field. If the flux through the loop is $6.10 \times 10^{-3}$ T·$m^2$, what angle does the normal to the plane of the loop make with the direction of the magnetic field?
   a. 73.7°
   b. 89.3°
   **c. 16.3°**
   d. 76.0º

3. The escape speed from the surface of the Earth is 11.2 km/s. Estimate the escape speed for a spacecraft from the surface of the Moon. The Moon has a mass 1/81 that of Earth and a radius 0.25 that of Earth.
   a. **2.5 km/s**
   b. 4.0 km/s
   c. 5.6 km/s
   d. 8.7 km/s