



NCF-Envirothon Test Writing Guidelines

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Test Writing Guidelines: An Introduction

Prior to the development of your tests, your subject area organizer(s) should have worked with you to develop a set of study resources for your subject, as well as major Key Topics and Learning Objectives specific to your area for the international competition. Please see the Resource Compilation Guide for more detailed instructions on this step in the test development process.

As you are developing your learning objectives and test questions for the NCF-Envirothon competition, please refer to the “[Mission, Goals, and Objectives](#)” and the “[NCF-Envirothon Learning Objectives](#)” on the Envirothon website. The “Mission, Goals, and Objectives” will give you an overview of the overall approach of designing an NCF-Envirothon test. The “NCF-Envirothon Learning Objectives” will provide some suggestions for major topics to cover in each area of study. The Learning Objectives are extensive in depth and broad in scope – It is not expected that every Objective will be covered on each subject area test. Using both of these sets of documents as a guide, highlight the points you feel are particularly relevant to your subject area and add others as appropriate. Use this to develop your key topics and learning objectives for your subject. Use the NCF Envirothon Learning Objectives as a model for how to structure and word your key topics and learning objectives. Your subject’s key topics and learning objectives, which may include more state/province-specific material than the NCF-Envirothon Learning Objectives, will guide the development of your test questions.

One of the outstanding aspects of the Envirothon competition is its emphasis on hands-on, problem-solving activities. Test questions should challenge the students to apply concepts that they have learned in the study materials and on Training Day. To accomplish this, we encourage critical thinking questions about real-world scenarios, as well as hands-on site assessment questions in all test areas.

The Envirothon tests should be written to address knowledge and skills at an advanced AP/IB high school to early college level. This is done to challenge the students, as well as to help prepare them for higher education and potential careers in the environmental field. Questions should address higher levels of thinking and application of concepts and skills.

Each test must total 100 points. All test questions will be answerable by applying knowledge derived from NCFE/Host-Provided materials pre-competition and onsite. Each test question should include a comprehensive grading rubric, complete with partial credit point breakdowns and citations for where the answer was found in the study material provided pre-competition or in the information provided to the students onsite. Due to how the station top score awards are structured, test questions must only come from **your subject’s** resources or training day material – They cannot be found in another subject’s resources.

A Note About Question Types

Multiple-choice questions are the easiest type of test question to grade, which is an advantage in a time-limited scenario such as the Envirothon competition. It is easy to write a multiple-choice

question that tests only rote memorization. However, it is possible (and highly recommended) to create multiple-choice questions that require problem-solving and the application of concepts. On the Envirothon tests, we want students to be able to demonstrate their knowledge through application, analysis, and evaluation. Written in this way, multiple-choice questions can be valuable for both the students and the test writers.

There are instances where the only practical way to test for the understanding of a concept is a recall-type question. Questions such as these are acceptable but should be used sparingly in the Envirothon tests. Memorization questions should only make up a small percentage of total questions.

Are you hesitant to use question types other than multiple-choice, for fear that the scoring will be too subjective? With a clearly defined scoring system and comprehensive rubric, short answer and fill-in-the-blank questions can be scored consistently and precisely. These types of open-ended questions are often the best choice for students to showcase their knowledge. This type of “active questioning” will frequently better test problem-solving skills and critical thinking than your typical multiple-choice question.

TRUE/FALSE QUESTIONS are not recommended for NCF-Envirothon test questions. True/false questions are simply too easy for students to guess. It is difficult to test in-depth concepts and problem-solving capacity with a true/false question.

BE AWARE that Active questioning, such as fill-in-the-blank and short answer, will most likely take more time to grade. If your station tests contain a large number of these types of questions, you may need to have a number of people assisting in grading. **Test writers should always be on site to take lead on grading for the station tests and to answer any questions assisting graders may have about content.** It is strongly recommended that each page of the test be graded by the same judge to insure consistency in scoring. If Judge ‘A’ grades Page 1, that judge should grade all Page 1’s. Additionally, graders should be routinely checking their work and the addition of points for each page.

Environmental Assessment

Environmental assessment activities provide excellent opportunities for hands-on involvement. The following suggestions are traditional kinds of questions found on Envirothon tests. The answers of these hands-on activities can also be referred to in later questions by asking teams to interpret and apply the results.

Beyond the more traditional Envirothon questions, you can also utilize the site conditions around the station to incorporate more first-hand experiences into your questions. For example: Don’t just ask teams to list three erosion prevention practices, but ask for ones they see at the station.

Soils and Land Use

Use a soil-judging sheet to rate the soil characteristics in a soil pit. The results of the soil description can then be utilized in problem-solving questions regarding the meaning of the soil

description related to the suitability of various land uses. Some types of hands-on questions are suggested below:

- Use of the “tools of the trade”- clinometers, augers, color charts, test kits, and meters
- Familiarity with soil judging/soil pits
- Determination of soil type by ribboning or use of particle screens
- Ability to quickly and effectively locate needed information in a soil survey
- Basic ability to determine land use class
- Identification of wetland indicators
- Identify landforms at the site
- Determine permeability of soil
- Identify drainage class, depth to bedrock, depth of rooting
- Measure thickness of topsoil, subsoil
- Identify horizons in a soil pit or soil monolith
- Analyze soil structure and texture
- Using a soil survey:
 - Identify hydrologic soil group
 - Analyze chemical properties of soil
 - Estimate erosion potential
 - Identify soil-mapping unit
 - Evaluate soil type for its suitability for crops and pasture, woodland productivity, wildlife habitat, recreation, building site development, and sanitary facilities, et cetera

Wildlife

A sample activity could include assessing the suitability of a habitat for a given wildlife species, using a provided fact sheet on that animal.

Management practices could also be recommended to improve the habitat for a given range of species. Some additional hands-on questions are listed below:

- Assess suitability of habitat for given wildlife species
- Suggest management practices for this site that would improve habitat for a given range of species.
- Develop rural and urban wildlife management plans.
- Identify signs of wildlife (tracks, scat, songs, twigs/logs chewed by deer/beavers, et cetera)
- Cite examples of food chains/food webs based on specific site conditions
- Analyze/Interpret site factors that limit or enhance population growth, both in the field and with aerial photos
- Interpret significance of habitat alteration due to human impacts on site
- Evaluate factors that might upset ecological balance of specific site

- Use field guides to identify wildlife by their tracks, skulls, pelts, etc.
- Interpret how presence of wildlife serves as an indicator of environmental quality
- Identify common wildlife food
- Assess the amount of edge and size in acres in one successional stage

Aquatic Ecology

A kick net sample for a local stream could be taken. The students could be asked to identify macroinvertebrates either from a key or based on the resource material. Comparisons could be made between different samples regarding the diversity of the sample or which sample was more likely to indicate poor water quality. Definition of a watershed of a water body given a topographical map is also a good activity. Below are additional suggested topics for hands-on aquatics questions:

- Assess water quality using pH meter, secchi disk, turbidity tube, thermometer, chemical test kits, etc.
- Identify macroinvertebrates & vertebrates taken from a stream or pond using a key or field guide
- Compare water samples taken from different parts of wetland, stream, or pond
- Make inferences about species diversity based on water quality tests or measurements
- Complete a portion of a wetland determination / SQM-water quality form
- Assess physical components of a stream using a stream reach screening tool
- Identify existing nonpoint source management practices in place or make recommendations for other site-specific best management practices
- Use hand lenses, microscopes, and field guides to identify plankton or algae samples, submerged plants, emergent or floating plants, as well as terrestrial plants (such as riparian trees and shrubs).

Forestry

Hands-on activities in this area could include tree species identification; measurement of tree diameter, height, and log measurements; interpreting measurements using volume tables; identifying trees that could be thinned or trees to be saved as wildlife trees, etc. Below are suggested question topics:

- Identify common trees without a key and unusual species through the use of a key
- Use appropriate tools and measuring devices to determine tree diameter and height, log measurement, available board feet, crown spread, and cordwood volume
- Use appropriate charts and tables to calculate number of feet per acre needed for planting at any given spacing
- Use current timber price list to calculate state stumpage value of specific trees
- Use aerial photos to compare land use changes over time
- Identify different successional stages in field scenarios

- Recommend management strategies based on different management goals such as wildlife habitat, timber production, et cetera
- Apply forest ecology principles to make recommendations for specific species

Test Formatting Guidelines

1. Create tests in a Microsoft Word document. Submit tests as a Word document for reviews of the first and second drafts. Final drafts will be submitted as a PDF to preserve formatting.
2. Times New Roman font only for ALL questions. Variation in size, **bold**, underline, centered and *italics* may be used to change/enhance appearance to titles, stations, sections, etc. Minimum font size is 12 point.
3. All tests will have 1-inch margins, with the right margin used for grading.
4. All tests must have point blanks to the right of each question, with the point value for the question, followed by a blank for the graders to fill in the team's points (e.g.: 5 pt / ____)
5. Tests must total 100 points.
6. All questions must be numbered and assigned a point value. While partial credit may be given on multiple-point questions, only whole points are allowed (no fractional points).
7. Spacing should be consistent throughout the test.
8. Each page of the test should have the page number in the bottom left corner.
9. All parts of a question should be on the same page (e.g., question and answer choices).
10. When submitted for review, answers and references are required for each question.
11. All tests should have a cover page stating "NCF-Envirothon (Host Name and Year)", the station name, a blank for the Team Number, a section for the team's score, date of test, length of time to complete test, number of pages in test, names of station leaders, and a section for instructions and rules. (See following for Cover Page Template.)
12. Cover sheets will be color-coded for each station: Light green for Forestry, light blue for Aquatic Ecology, tan for Soils and Land Use, pink for Wildlife, and light yellow for Current Issue.
13. Up to 30% of the content for each test can be host state/province specific. The remaining 70% must be generally applicable.
14. One or more tiebreaker questions will be designated per station test to determine station high scores in the event of a tie.

Test Length

- Tests must be completed by students within a 55-minute testing window.

- Hands-on questions and critical thinking questions take more time to answer than a simple definition question.
 - This is particularly true for questions answered using the aid of identification keys, soil surveys, charts, maps, or another resource material.
- Travel time between interactive stations must also be factored into total test time.
- Group questions together by interactive station, to facilitate transitions for the students.

SAMPLE TEST COVER PAGE
NCF-Envirothon (Host and Year)
_____ Station

_____, July __, 20__

Team: _____ Score: _____ / 100

Time: 55 minutes

Station Leaders: _____ & _____ (CAT)

There are __ pages in this test, including the cover.

Instructions:

- ⊗ No food or drink may be brought into the test, except for one refillable water bottle per person.
- ⊗ No cell phones, tablets, or other electronic devices (except those given to you by the Station Leaders) are permitted during the test.
- ⊗ If you have a question or need to use the facilities, quietly get the attention of the Station Leader or CAT Leader.
- ⊗ Do not open the test booklet until directed to do so.
- ⊗ Please ensure that you have the correct test in front of you, with the correct number of pages.
- ⊗ Write your team number clearly in the spaces at the top of every page.
- ⊗ Teams should think over their answers thoroughly to make sure they match the criteria set out by the question. This includes the content of the question and the number of responses required. For example, a four mark question requires four answers. Any additional answers will not be marked, regardless of their validity.
- ⊗ Do not use the cover page of this test for answers. Anything written on the front or back of the cover page will not be counted toward your score.
- ⊗ Teams are permitted to separate the pages of the test, but must return the test to the CAT Leader with the pages in order.
- ⊗ Teams are responsible for the content of their test from when they receive it to when they submit a completed copy to the CAT Leader. Lost pages will not be replaced.
- ⊗ You are permitted to use only the writing utensils provided to you.
- ⊗ At the conclusion of the test, please place the pages in order and return the test to the CAT Leader.
- ⊗ If you complete the test early, please refrain from loud conversations and other distractions as other teams may still be completing their tests.
- ⊗ Teams are reminded that they are not permitted to leave the Station early.

Station Rules and Equipment

- ⊗ There are _____ Application Stations at this Eco-Station.
 - ⊗ Each team will have _____ (# _____) minutes at the Application Station.
 - ⊗ Each team's time slot at the Application Station is pre-determined.
 - ⊗ When teams are told to vacate the Application Station, they must do so immediately.
- ⊗ There are a variety of BMI samples provided to complete this test.
 - ⊗ The samples will be available for viewing for all teams during the entire test.
 - ⊗ Please do not crowd the samples or remove any of the samples from the sample area.
 - ⊗ Please vacate the sample area as soon as you are finished with the samples.
- ⊗ You will need the following equipment to complete the test. If the equipment is associated with a specific Application Station, do not remove the equipment from the Application Station.
 - ⊗ DBH tape
 - ⊗ Clinometer

How to Construct a Good Test Question

It cannot be overemphasized that you should avoid questions that just require rote regurgitation of the facts. When you write a fact-based question, ask yourself:

“Is knowing this fact important for understanding the subject?”

An example of a question that is NOT very productive would be:

Question (1 pt): How many lakes in the state have been affected by acid rain?

- A. 100
- B. 500
- C. 1,000
- D. 1,500

A better question is one that takes the knowledge presented to the student and asks them to apply it to answer the question. A sample of this would be:

Question (3 pts): For each pair of situations, circle the lake that is more likely to be affected by acid rain. Circle one in each pair:

A high-altitude lake OR a lake at lower elevations?

A lake with granite bedrock OR a lake with a limestone bedrock?

A lake with deep soils OR a lake with shallow soils?

Questions that teach a new concept and then ask the students to apply that concept are also valuable. With these types of questions, students learn something new while also being tested for their problem-solving ability. An example of this is:

Question (3 pts): Fish continue to grow as they age, and their scales grow as the fish grow. This allows fisheries biologists to age fish by the pattern of the rings similar to the way foresters age a tree. Closely spaced rings are laid down in winter when growth is slow. In spring and summer, the rings are further apart. The scale shown at this station is from a White Perch, a spring spawning species that was collected in July. How many winters had this fish lived? (The scale in question could either be displayed with a photocopy of the scale or shown under a magnifying glass.)

The following is an example of an excellent question in this area:

Question (5 pts): Students were given a short paragraph on tag and release methods for estimating populations. The students were then presented with a pan of tagged and untagged fish. They were told the number of tagged sunfish that had been collected the

week before and released. The specimens in the pan were the results of the recent sample. Based on the sample, they were asked to estimate the population of sunfish in the pond.

Questions that utilize equipment also are good hands-on questions:

Question (4 pts): Use the meter at the station to measure the pH of the water sample. What is the pH? Is this acidic or basic?

Each testing station will present numerous opportunities for teams to be active. Reading maps, interpreting charts and graphs, using mathematical formulas, using keys, and locating information in resource manuals are all question topics that demand critical thinking from the team. Engaging teams physically and challenging them mentally, using some of the suggestions given here, will significantly impact the quality of station tests and the training that goes into preparation for your Envirothon.

Development of a Test Question Rubric

Because time is critical in all aspects during a competition, grading short answer questions consistently across all tests is extremely important. Developing a rubric for short answer questions is one way to make it easier on station captains while establishing grading consistency. **It is important to include the point value on each test question. Partial credit may be awarded if it is a multi-point question, but no fractional points are allowed. Rubrics should also include a citation for where the answer was found in the study material provided pre-competition or in the information provided to the students onsite.**

A rubric is a point scale (example: 5-point scale), and the corresponding answers that make up this scale. Below is an example of a test question and its rubric.

Question (4 pts): Explain why the Red Cedar River may recharge the area's aquifers at the highest water level or drain area aquifers at the lowest water levels.

Answer: A seasonal water budget simply shows water flows from higher elevations to lower. During high river levels, the top of the aquifer is lower and water goes into the area aquifer. During lowest river levels, the top of the aquifer is above the river and the aquifer flows into the river, making the river both a recharge and discharge area.

Rubric: *Four points: 1 point for each aspect; a) at high river levels, water goes into aquifer and b) at low river levels, aquifer flows into river. 2 points for c) designating the river as both a recharge and discharge area.*

When developing an objective scoring system to a fill-in-the-blank format or a short essay, define a range of acceptable answers or list all the elements that would be included in a well-rounded answer and distribute the points among them. Some examples of rubrics for short answer questions are as follows:

Question (3 pts): Is this site suitable habitat for the Red Wolf? Why or why not?

Answer: This site is not suitable habitat for the Red Wolf because its major food sources (white-tailed deer, raccoon, hares) cannot survive here.

Rubric: *Three points: 2 points for determining if the site is suitable Red Wolf habitat and b) 1 point for the explanation why*

Question (2 pts): List two practices at this station that reduce non-point source pollution.

Answer: Buffer next to the pond, grass lined ditches, silt fence, diversion ditch, mulch

Rubric: *1 point for each practice listed*

Question (8 pts): Wildlife management planning for a given area is based on the goals of the landowner and the many different needs of wildlife for survival. Imagine a landowner would like to increase songbirds in the area around the station. List FIVE management practices that the landowner could implement to achieve this goal. **You will be scored on how well your answer matches the goal of increasing songbirds and to what extent you cover all the basic survival needs of the songbirds.**

Rubric: *1 point each for including the following aspects of wildlife needs: food, shelter, water. One point (up to a maximum of 5) will be awarded for each unique practice that would help achieve the goal of increasing the songbird population (8 points maximum)*

CAUTION: In these kinds of questions it is especially important that you give the students a clear understanding of the grading criteria (as in the bold type above). It is important when asking open-ended questions that students understand what is expected of them or the question may be more confusing and frustrating than instructive.

An example of a rubric for a test question using a map is as follows:

Question (4 pts): Given the topo map of _____, define the watershed of _____.

An objective way to grade such a question is to set up specific criteria for awarding points. If the example above is worth 4 points, values can be awarded as follows:

Answer: Topographic map has watershed boundary drawn on it.

Rubric: (4 points)

1 point for having the watershed boundary around the body of water

1 point for boundary line through the mountain peaks around the body of water

1 point for boundary lines drawn generally at right angles to the contour lines

1 point for the watershed boundary that matched map in the answer key

Rubrics help the test graders to look for key answers and then to assign points for each of those answers. Frequently, there can be more than one answer to a particular question, and this is the most important reason to have the station captains (who are experts in their fields) grade unusual answers to prevent incorrect scoring.

Bloom's Taxonomy

Bloom's Taxonomy is a pedagogical system of categorizing thought processes into six levels. The major categories are (in ascending level of complexity):

1. Remember
2. Understand
3. Apply
4. Analyze
5. Evaluate
6. Create

Remember

This level of questioning requires students to recognize and recall information they have already learned. Students are not asked to use this information in any way. Tested information may include factual data, definitions, or observations.

Words used to write knowledge-level questions include:

- When
- Where
- Who
- What
- Define

These recall-type questions do not test in-depth understanding and should be used sparingly when constructing NCF-Envirothon test questions.

Understand

This type of question asks students to consider factual information they have learned and interpret it. Students are required to make comparisons and interpret graphs, tables, charts, and

even cartoons. Students can also classify information, provide examples of concepts, and summarize key points.

Words used to write comprehension questions include:

- Compare
- Contrast
- Describe
- Show
- Explain
- Classify

Apply

Application level questions require students to give solutions to problems.

Phrases used to write application questions include:

- Solve
- Which
- Use
- Choose
- How much

Analyze

These types of higher-level thinking questions test the depth of a student's understanding of information. A student must show understanding of each part of an entire concept. Students can differentiate and organize information.

Phrases used in analysis questions include:

- Analyze
- Support
- Provide evidence
- Identify reasons
- Why
- Provide conclusions

Evaluate

This level of Bloom's Taxonomy tests the synthesis of information, and these types of questions do not have one correct answer. Evaluation questions ask students to make judgments on ideas, solutions, methods, or even products. Answers that provide reasons for the evaluation demonstrate knowledge and understanding of the topic, requiring the use of all the previous levels of thought processes.

Phrases used in evaluation questions include:

- Assess
- Decide
- Judge
- Argue
- Appraise
- Give an evaluation of ...

Create

The highest level of Bloom's Taxonomy is Creation. A good example of this in the NCF-Envirothon competition would be the Oral Presentation Scenario. To prepare their Oral Presentation, students must use all previous levels of cognitive processing to create an inventive and feasible solution to the problem. Creation questions are more difficult to incorporate into station tests because of the time required for the students to provide a complete and comprehensive answer and for the judges to grade many varied and inventive correct answers.

Test Item Readability

When writing test questions, reduce the number of possible reading difficulties that could keep students from demonstrating what they know about science. You may consider using diagrams and illustrations to make the test questions clearer. The following checklist gives one system to rate questions to determine suitability for an NCF-Envirothon station test.

Rate each question using the following system:

- 5 – Excellent
- 4 – Good
- 3 – Adequate
- 2 – Poor
- 1 – Unacceptable

- _____ 1. Students would likely have the experiences and prior knowledge necessary to understand the content of the question.
- _____ 2. The vocabulary is appropriate for early college level.
- _____ 3. Sentence complexity is appropriate for early college level.
- _____ 4. Definitions and examples are clear and understandable.
- _____ 5. The required reasoning skills are appropriate for the students' cognitive level.
- _____ 6. Relationships are made clear through precise, logical connectives.
- _____ 7. Content within the question item is clearly organized.
- _____ 8. Graphs, illustrations, and other graphic aids facilitate comprehension.
- _____ 9. The question is clearly framed.
- _____ 10. The content of the question is of interest to the intended audience (*i.e.* addresses Envirothon learning objectives and is relevant to subject station).
- _____ 11. Sentence structure is unambiguous and has correct grammar.
- _____ 12. The question clearly states what is being asked of the students, and what type of answer(s) will receive full credit.
- _____ 13. A point value is assigned to each question.
- _____ 14. Answer spaces included with the question are straightforward to use.

Suggested Category Breakdowns for Station Tests

Questions written for the NCF-Envirothon Competition Station should span a wide variety of aspects of the relevant natural resource area. We want to test students on both the breadth and the depth of their knowledge in the subject area. Below is a chart with recommended percentages for different types of topics covered in each area.

Topic Category	Percentage of Questions on Each Station Test
Terminology	10%
Identification	20%
Equipment / Career	10%
Management Planning	50%
Overall Importance of the Resource	10%

There are also guidelines for each test as a whole, that can span many topic areas within each station. These percentages may overlap.

Across all topics for each station:

- Test Question Content
 - 30% of the test should be composed of Host state/province, site-specific questions
 - 70% of the test should be comprised of generally applicable information
 - 70% of the test questions should be from the reference material provided to the students
 - 30% of the test questions can be from topics covered during training day
- Test Question Format
 - 50% of the test should address problem-solving and technical skills
 - 50% of the test should be hands-on and experiential

For example, you could have a hands-on question that addresses problem-solving skills that is also specific to your state/province, and it would count towards each of these percentages.

Guidelines for Multiple Choice Questions

A variety of questions should be used on NCF-Envirothon tests, including fill-in-the blank/short answer, matching, and multiple-choice. Multiple-choice questions involve a statement or question (the "stem"), followed by several alternative responses. One of these responses is the answer; the others are distracters. There should be a maximum of 5 total responses.

Multiple-choice questions allow the test writer to:

- ◆ evaluate learning in any content area;
- ◆ evaluate learning at all cognitive levels;
- ◆ grade more easily;
- ◆ assess more content information in a shorter period of time;
- ◆ reduce ambiguity and decrease the chance of scoring bias; and/or
- ◆ prepare learners for standardized tests.

Unfortunately, good multiple-choice questions are difficult and time-consuming to construct, especially when assessing higher levels of thinking. Multiple-choice questions also do not evaluate how well students are able to communicate their understanding; however, considering the number of tests that must be graded in a short period of time, multiple choice questions can be scored much more quickly.

Guidelines for Multiple-Choice Question Development

The stem should not be written in the form of an unfinished sentence. It should be meaningful by itself and ask a question (who, what, where, when, why, how, which) or present a problem.

1. Avoid using negative questions or statements in the stem or response, as they tend to be ambiguous and confusing.
2. Do not give grammatical clues to the correct answer. Using the article "a" or "an" at the end of a stem indicates whether the answer starts with a vowel or consonant.
3. Write stems that have only one correct answer but *make the distracters plausible*.
 - a. Write the correct response first, then generate 3-4 reasonable alternatives.
 - b. Write alternative responses of roughly equal length and parallel construction.
 - c. Arrange the alternative responses in alphabetical order to avoid establishing a pattern.
4. Use the responses "all of the above" or "none of the above" sparingly or not at all.
5. Place the entire item (stem and alternative responses) on the same page. Use upper case letters before each of the responses.
6. Make a deliberate effort to stress comprehension, application, analysis, synthesis, and evaluation when you write questions. Guard against writing too many knowledge-level questions. (See **Bloom's Taxonomy** on Page 9)

Multiple Choice Guidelines and Sample Questions

Guideline	Weak Question	Strong Question
1. The stem should not be written in the form of an unfinished sentence. It should be meaningful by itself and ask a question or present a problem.	The natural soil drainage class of this soil is: A. Excessively well drained B. Well drained C. Well drained, wet substratum D. Somewhat poorly drained E. Poorly drained	Soil drainage classification is a method of indicating how well water moves off the surface or through the soil. Which of the following best describes this soil's natural soil drainage class? Same answer choices
2. Avoid using negative questions or statements in the stem or response: they tend to be ambiguous and confusing.	Which swan is not considered to be a true wild swan but an exotic bird? A. Mute Swan B. Trumpeter Swan C. Tundra Swan D. Whistling Swan	Which swan is considered to be an exotic bird, rather than a true wild swan? A. Mute Swan B. Trumpeter Swan C. Tundra Swan D. Whistling Swan
3. Do not give grammatical clues to the correct answer.	The tree marked with a red flag is <u>an</u> : A. Norway Spruce B. Austrian Pine C. White Pine D. Pin Oak	Identify the tree marked with the red flag from the list below. Same answer choices
4. Write stems that have only one correct answer but make the distracters plausible.	Now found in every county in the state, this common predator has extended its range to the east coast in recent years: A. Polar bear B. Alligator C. Coyote D. Lion	What common predator, now found in every county in the state, has extended its range to the east coast in recent years? A. Badger B. Black bear C. Coyote D. Marmot
5. Use the responses "all of the above" or "none of the above" sparingly or not at all.	The material that is the biggest money- maker in recycling is: A. Aluminum cans B. Paper C. Glass D. All of the above	What material is the most profitable in community recycling programs? A. Aluminum cans B. Glass C. Paper D. Plastic
6. Place entire question on the same page. Use upper case letters to distinguish responses.	Question in which several answers are listed on following page. Lower case letters are used to distinguish responses.	Entire question is contained on single page. Upper case letters are used to distinguish responses.
7. Make a deliberate effort to stress higher level thinking skills.	The soil at this site has developed from which of the following? A. Bedrock B. Glacial outwash C. Lacustrine sediments D. Glacial till	If a septic tank absorption field were installed at this site, which soil feature would be most restrictive and likely to cause groundwater pollution problems? A. Depth to bedrock B. Seasonal wetness or drainage C. Slow subsoil permeability D. Underlying sand and gravel

Guidelines for Matching Questions

A variety of questions should be used on NCF-Envirothon tests, including short answer, multiple-choice, identification, and matching. Matching items are objective and will test the relationship between a term and its definition. In general, matching items consist of a column of stimuli presented on the left side of the exam page and a column of responses placed on the right side of the page. Students are required to match the response associated with a given stimulus.

Some relationships that might be tested with a matching exercise are:

1. Historical events and dates
2. Tools and their uses
3. Problems and their solutions
4. Elements and their symbols
5. Causes and their effects
6. Drawings and their interpretations

Matching questions allow the test writer to:

- Evaluate learning in any content area;
- Test for associations and recognition of facts;
- Test for complex learning (especially concepts);
- Grade more easily; and
- Reduce ambiguity and decrease the chance of scoring bias.

On the negative side, it is difficult to write reliable matching items, and this type of question can be subject to guessing.

Guidelines for Matching Question Development

1. Include directions, which clearly state the kind of relationship you are testing, and the basis for matching the stimuli with the responses. Explain whether or not a response can be used more than once and indicate where to write the answer.
2. Use only homogeneous material in matching items.
3. Arrange the list of responses in some systematic order if possible (e.g., chronological, alphabetical).
4. Avoid grammatical or other clues to the correct response.

(See following page for example questions for each guideline.)

More tips:

- Keep matching items brief, limiting the list of stimuli to 10 or fewer.
- Include more responses than questions to help prevent answering through the process of elimination. The list of answers should be approximately 2 or 3 items longer than the list of prompts.
- When possible, reduce the amount of reading time by including only short phrases or single words in the response list.

Guidelines for Fill-In-The-Blank Questions

Fill-in-the-Blank questions require the student to answer a question or to finish an incomplete statement by filling in a blank with the correct word or phrase.

Fill- in-the-Blank questions allow the test writer to:

- Provide a wide sampling of content;
- Efficiently measure lower levels of cognitive ability; and
- Minimize guessing as compared to multiple choice.

On the negative side, fill in the blank/short questions can be ambiguous and can be difficult to construct so that the desired response is clearly indicated. These questions can be difficult to score if the question allows two (or more) possible correct answers; however, blind guessing is eliminated.

Guidelines for Fill-in-the-Blank Question Development:

1. Omit only significant words from the statement.
2. Do not omit so many words from the statement that the intended meaning is lost.
3. Avoid grammatical or other clues to the correct response, such as: a, an, he, or she.
4. Be sure to list in the answer rubric, ALL possible correct answers in the grading rubric.
5. To minimize answer clues for Fill-in-the-Blank, make the blanks of equal length.
6. When possible, delete words at the end of the statement after the student has been given a clearly defined problem.
7. Avoid lifting text from study materials or other resources to avoid memorized answers.
8. Limit the desired response to a single word or phrase.

Developing a Scoring Rubric for Fill-in-the-Blank

Because time is critical in all aspects during a competition, developing a rubric for fill-in-the-blank questions is one way to establish grading consistency. When developing a rubric to a fill-in-the-blank format, define a range of acceptable answers or list all the elements that would be included in a well-rounded answer and distribute the points among them. A rubric is a point scale

(example: 5-point scale), and the corresponding answers that make up this scale. Below is an example of a test question and its rubric:

Question: List two practices at this station that reduce non-point source pollution.

Answer: Buffer next to the pond, grass-lined ditch, silt fence, diversion ditch, mulch

Rubric: 1 point for each practice listed

Fill-in-the-Blank Guidelines and Sample Questions

Guideline	Weak Question	Strong Question
1. Omit only significant words from the statement.	Mycorrhizal fungi improve the uptake of (water) and nutrients.	Mutually symbiotic (mycorrhizal) fungi improve the uptake of water and nutrients.
2. Do not omit so many words from the statement that the intended meaning is lost.	_____ are toxic.	Heavy metals such as __ (lead) __ and __ (mercury) __ are toxic in high quantities.
3. Avoid grammatical or other clues to the correct response.	An (aquifer) is an underground area of porous rock or sand that is capable of holding water.	What is an underground area of porous rock or sand capable of holding water called? _____ (aquifer) _____
4. Be sure to list in the answer rubric, all possible CORRECT answers.	Trees which shed their leaves annually are __ (seed-bearing) __.	Trees which shed their leaves annually are __ (deciduous, seed-bearing, common) __.
5. Makes the blanks of equal length.	__ (Eutrophication) is when a pond or stream is nutrient- <u>(rich)</u> , resulting in a heavy growth of algae and plants.	__ (Eutrophication) is when a pond or stream is nutrient-_____ <u>(rich)</u> , resulting in a heavy growth of algae and plants.
6. When possible delete words at the end of the statement after the student has been given a clearly defined problem.	A (<u>keystone species</u>) is a species that has a significant influence on many other species of animals.	What type of species has a significant influence on many other species of animals? (<u>keystone species</u>)
7. Avoid lifting text from study materials or other resources.	“Although a showy wetland plant that many find beautiful, (<u>Purple Loosestrife</u>) forms impenetrable mats where few other plant species can live.”	Each plant of this showy wetland species can produce up to 2 million seeds each year, forming dense mats of vegetation. (<u>Purple Loosestrife</u>)
8. Limit the desired response to a single word or phrase.	What do legumes (nitrogen-fixing plants) do to gaseous nitrogen from the environment? (<u>Legumes convert gaseous nitrogen to a form that is usable by plants</u>)	Nodulated legumes convert (<u>gaseous nitrogen, N₂, N₂ gas</u>) to a form that is usable by plants.

Guidelines for Short Answer Questions

Fill-in-the-Blank questions require the student to answer a question or to finish an incomplete statement by filling in a blank with the correct word or phrase.

Fill- in-the-Blank questions allow the test writer to:

- Provide a wide sampling of content;
- Evaluate how well students can communicate ideas and concepts;
- Minimize guessing as compared to multiple choice; and/or
- Test higher levels of cognitive processing.

On the negative side, fill in the blank/short questions can be ambiguous and can be difficult to construct so that the desired response is clearly indicated. These questions can be difficult to score if the question allows two (or more) possible correct answers; however, blind guessing is eliminated.

Guidelines for Short Answer Question Development:

1. Make sure the question is clearly and concisely worded, and students understand what type of answer will receive full credit.
2. Leave enough blank space for students to fully answer the question. (Also, take into account larger handwriting styles.)
3. Avoid grammatical or other clues to the correct response, such as: a, an, he, or she.
4. Be sure to list in the answer rubric, ALL possible CORRECT answers in the grading rubric.
5. Ensure that students know how many components are required in an answer (e.g. List three erosion control practices that would benefit this site; Define Indicator Species and give ONE example native to this area, et cetera).
6. Limit the scope of the question so that it may be answered in one paragraph or less of text.
7. Avoid broad, unspecific questions that would require an extensive grading rubric for all potentially correct answers.
8. Short answer questions are a fantastic way to evaluate problem-solving, critical thinking, analysis, and application skills.

Developing a Scoring Rubric for Short Answer

Because time is critical in all aspects during a competition, developing a rubric for short answer questions is one way to establish grading consistency. When developing a rubric for short answer format, define a range of acceptable answers, or list all the elements that would be included in a well-rounded answer and distribute the points among them. A rubric is a point scale (example: 5-point scale), and the corresponding answers that make up this scale. Below is an example of a test question and its rubric:

Question: List two practices at this station that reduce non-point source pollution.

Answer: Buffer next to the pond, grass-lined ditch, silt fence, diversion ditch, mulch

Rubric: 1 point for each practice listed

(See following page for example questions for each guideline.)

Short Answer Guidelines and Sample Questions

Guideline	Weak Question	Strong Question
1. Make sure the question is clearly and concisely worded, and that students understand what type of answer will receive full credit.	What are some common contaminants found in groundwater?	Name TWO groundwater contaminants that would likely be found in an urban area.
2. Leave enough blank space for students to fully answer the question. (Also, take into account larger handwriting styles.)	Define an indicator species and provide one example native to this area. _____	Define an indicator species and provide one example native to this area. _____ _____ _____
3. Avoid grammatical or other clues to the correct response, such as: a, an, he, or she.	What famous author was is credited with helping to launch modern environmental movement and what was the name of her seminal book?	How did Rachel Carson’s book <i>Silent Spring</i> inspire the modern environmental movement?
4. Be sure to list in the answer rubric, ALL possible CORRECT answers in the grading rubric.	Name TWO types of human disturbance in this area and describe their effects on wildlife. (Rubric: Soil compaction – impact species of vegetation able to grow; Habitat fragmentation – forest cleared for grass picnic area)	Same Question; but rubric includes more than two answers, encompassing all possibilities.
5. Ensure that students know how many components are required in an answer.	List erosion control practices that would benefit this site.	List THREE erosion control practices that would benefit this site.
6. Limit the scope of the question so that it may be answered in one paragraph or less of text.	What anthropogenic activities have accelerated global climate change?	Name TWO ways that anthropogenic activities have accelerated global climate change and how EACH has an impact on (Host State/Province).
7. Avoid broad, unspecific questions that would require an extensive grading rubric for all possible correct answers.	How does clear-cutting impact wildlife populations?	How has clear-cutting impacted regional populations of mountain lions?
8. Short answer questions are a fantastic way to evaluate problem-solving, critical thinking, analysis, and application skills.	The Viceroy butterfly has evolved a very similar coloration and pattern to the Monarch butterfly. What is this type of coloration called?	Name TWO evolutionary factors have contributed to the development of the coloration pattern in the Viceroy butterfly.

Sample Test Questions

Here are some sample test questions from past Envirothon Competitions. These sample questions come from station tests. At the international level, a minority of questions is site-specific, with the majority of test questions focused on general knowledge content, the study materials posted on the web, and in study packets prepared by the Host. Test writing in this manner prevents an unfair advantage against teams who have prepared for the international competition for the previous several months (as opposed to teams who have only mastered learning station information on-site). More [sample test questions](#) can be found on the NCF-Envirothon website.

Note to Test Writers: Provide background information on measurements in both Imperial and Metric measure.

Forestry Station Test Questions

1. (2pts) Identify the following trees by their common name without the use of a key.

Answer depends on the site and the trees chosen by the station captain.

Two-points for each tree correctly identified. Station captain's discretion as to the number of trees to be identified and what degree of accuracy is required (i.e., maple versus the more specific identification of sugar maple.)

2. (4 pts) How does a biodiverse forest ecosystem contribute to the diversity of the animal community within that ecosystem? Give two reasons:

Diversity of animals increases as the complexity of an ecosystem increases. A wider variety of plant and tree species provides a broader base of food and habitat for more species of animals.

Four-point question: a) two points for the complexity of the forest encouraging biodiversity and b) two points for a broader base of food in a forest with a high diversity of tree species.

3. (___pts) Use a clinometer to determine the height of the designated tree(s).

Answer depends on the tree or trees chosen by the station captain.

The point scheme is dependent on what the site captain sets up. The development of a sliding point scale based on the accuracy of the measurement would provide partial credit instead of having this question be an all-or-none situation.

Assumption: a clinometer is available for the students to use, and the station captain is able to designate a tree for the students to measure.

4. (4 pts) Would you expect to find a great amount of organic matter and available nutrients in the soil of a coniferous forest or a northern mixed hardwood stand? Give two reasons.

Hardwood forests generally have more organic matter and nutrients in them. Conifers generally are found in sandy, dry, and nutrient poor soil. Additionally, the organic layer in a coniferous stand is deep and poorly decomposed because the needles make a thick mat that does not mix very well with the mineral soil and does not contribute as much organic matter to the soil.

(Students could also answer this question focusing on hardwood forests: Most hardwoods are deciduous trees which drop their leaves each autumn, contributing to the O horizon. The leaves of deciduous trees are composed of compounds that are more easily broken down than the recalcitrant chemicals in conifer needles, and thus more easily incorporated into the soil.)

Four-point question: a) two-points for conifers growing on nutrient poor sandy soil and b) two points for conifers not adding as much organic matter. (Students could also answer this question focusing on hardwood forests: a) two points for stating that most hardwoods are deciduous trees which drop their leaves each autumn, contributing to the O horizon. Two points for stating the leaves of deciduous trees are composed of compounds that are more easily broken down than the recalcitrant chemicals in conifer needles, and thus more easily incorporated into the soil.)

5. (3 pts) Describe the role of mycorrhizae fungi in maintaining the health of the tree.

Mycorrhizal fungi form a mutualistic symbiotic relationship with the roots of the tree. The tree provides the fungus with sugars, and the fungus helps the tree to more readily take up water and nutrients from the soil.

Three-point question: a) one point for it being a symbiotic relationship and b) two points for the relationship allowing more nutrients to be taken up by the tree.

Soils and Land Use Station Test Questions

1. (6 pts) Using the soil pit at this site, evaluate the following aspects (A-F) of the soil profile.

- A. What is the depth of the O horizon?
- B. What are the major components of the O horizon?
- C. What is the depth of the A horizon?
- D. What is the texture of the A horizon?
- E. What is the depth of the B horizon?
- F. What is the texture of the B horizon?

Answers A-F are dependent on the site.

Six-point question: one point for each correct answer.

Assumption: The station captain is able to dig a soil pit at the site. Labeling the horizons ahead of time will help to save time for the students taking the test and for test graders.

2. (4 pts) Based on the color of the A and B horizons in the soil pit, does this soil have a greater amount of organic matter in comparison to the sample provided by the station captain? Explain your answer.

Answer is based on the site. Assuming that the two soils being compared have a similar texture in most instances (but not all) if the soil pit horizons A and B are darker than the sample provided then it has more organic matter than the sample. If it is lighter in color, then it has less organic matter than the sample.

Four-point question: a) two points for the correct analysis and b) two points for the justification.

Assumption: the station captain is able to dig a soil pit at the site. Labeling the horizons ahead of time will help to save time for the students. The station captain is also able to provide a sample of A and B horizons from another area.

3. (4 pts) Based on the characteristics of the soil and the location of the site, would it be appropriate to put a septic field in at this site? Describe your soil evaluation and explain your answer.

Answer depends on the site. In general, if the soil is very sandy or near a body of water, then it might not be appropriate to build a septic field because of the likelihood of waste getting into the body of water.

Four-point question: a) two points for correct evaluation of the soil and b) two points for the explanation of suitability.

4. (4 pts) Explain how soil colloids can bind heavy metals. Why is this important?

Heavy metals (e.g. lead and mercury) are toxic in high quantities. Negatively charged soil colloids adsorb these metals and clean the water as it passes through the soil profile. This is important to keep our groundwater clean.

Four-point question: a) two points for binding heavy metals to colloids and b) two points for keeping ground water clean.

5. (5 pts) Describe two ways that farmers can reduce water erosion in their fields. Why is this particularly important near streams and lakes?

Farmers can reduce water erosion by terracing, contour stripping, establishing no-till areas, creating buffer strips, and orientating crop rows perpendicular to the slope of the hill. This is particularly important where the run-off from erosion will end up in lakes and streams. Soil eroded by water can carry pollutants and excess nutrients in it, which would harm the health of the receiving body of water.

Five-point question: a) two points for each solution and b) one point for the importance of erosion control near water.

Aquatic Ecology Station Test Questions

1. (12 pts) Using the keys provided, identify the Order or Family (as indicated on the specimen) of the following organisms

	Order	Family
A.	_____	_____
B.	_____	_____
C.	_____	_____
D.	_____	_____
E.	_____	_____
F.	_____	_____

Answers depend on the organisms the station captain has chosen.

Twelve-point question: one point for each correct answer

2. (5 pts) Define adhesion and capillary action and describe how you would demonstrate these two principles with a glass of water and straw. Explain how these principles are significant in respect to soil particles.

Adhesion is where water molecules stick to other surfaces (molecule other than H₂O), such as the side of a glass. Capillary action is a combination of cohesive and adhesive forces that allows water to move up a small column of water. The significance is that soil particles, particularly clay can hold on to particles of water through adhesion, which combined with capillary action makes them available to plants.

Five-point question: a) one point for definition of adhesion b) one point for definition of capillary action c) two points for demonstration of both principles, and d) one point for relation to soil particle.

3. (4 pts) Explain the difference between a driven well and a drilled well. How do their maximum depths differ?

A driven well is a well that is a series of pipes with a point at the end that is driven into the ground; this well can go about 50 feet. A drilled well requires special drilling equipment and can go as deep as 1000 feet.

Four-point question: a) two points for definition of a driven well and its depth and b) two points for definition of a drilled well and its depth.

4. (4 pts) Give one example of a non-point source and point source pollution. Which is more difficult to control and why?

An example of non-point source would be fertilizer run-off from the lawns in an urban area where the sewage runs directly into a body of water. An example of point source would be a sewer pipe dumping sewage into the river. The non-point source is harder to control because its origins are much more difficult to identify, and it is usually the result of more than one person or organization.

Four-point question: a) one-point for an example of non-point source, b) one-point for an example of point source, c) one point for non-point being more difficult to control, and d) one point for reason why.

5. (4 pts) What is summer-kill? How does it relate to Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD)?

Summer-kill is fish mortality due to lack of dissolved oxygen and high temperatures. High temperatures decrease the amount of dissolved oxygen that water can hold. Coupled with

generally lower water levels in lakes and streams during summer due to evaporation, high temperatures affect a larger portion of the water column, decreasing the total amount of DO available for aquatic life. The BOD of the organisms can exceed the amount of DO available, resulting in fish mortality and summer-kill.

Four-point question a) two points for the definition of summer kill and b) two points for its relation to DO and BOD.

Wildlife Station Test Questions

1. (8 pts) Identify the animal skulls/hides without the use of a key.

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____

Answers depend on the items the station captain has chosen. Test should make clear if scientific names are required.

Eight-point question: one point for each correct answer

2. (5 pts) Define forest fragmentation. Explain what effect it can have on the diversity of the wildlife species living on the altered section of land.

Forest fragmentation is the breaking up of large tracts of forested land into smaller ones. This results in a decline in the number of wildlife species that depend on large undisturbed tracts of land, and it causes an increase in the number of generalist species and species that are tolerant of edge.

Five-point question: a) one point for the definition of fragmentation b) two points for a decline in species that require large tracts of land and c) two points for an increase in generalist species an edge tolerant species.

3. (3 pts) Is this site suitable for the Prairie Chicken? Explain your answer by describing ideal Prairie Chicken habitat and describing your evaluation.

Prairie Chickens prefer grassland areas characterized by sedges and grasses with little trees or shrubs. Answer depends on site.

Three-point question: a) two points for knowing the habitat needs of the prairie chicken and b) one point for being able to determine if this site is suitable habitat.

4. (4 pts) Describe two forms of habitat destruction and give one example of an animal species affected by habitat destruction.

Fragmentation of forestland, pollution of waterways, filling in wetlands changing forest types after a harvest (changing a hardwood forest to pine plantation). Passenger pigeon went extinct because of loss of habitat. The spotted owl is a threatened species due to lack of continuous old growth forest. The loss of prairie land due to urban development and conversion to farmland has negatively affected the greater prairie chicken population in Wisconsin; the filling in of marshland along the Gulf coast has reduced juvenile habitat for species of shrimp, crabs and fish.

Four-point question: a) one point for each form of habitat destruction and b) two points for a correct example.

5. (2 pts) Why is it important to not hunt or fish out of season?

Hunting seasons and limits on what you can take are designed to maintain the health of the animal population being hunted. It is based on the life cycle of the animal and is timed so that it does not negatively impact the animal population.

Two-point question: a) point for health of animal population and b) one point for life cycle of animal.

OVERALL CHECKLIST FOR TEST WRITERS

- _____ All questions are numbered.
- _____ Each question, and its answer choices or blanks, are contained on one page.
- _____ There are NO True/False questions on any portion of any test.
- _____ There is a good mixture of multiple-choice, matching, fill-in-the-blank, and short answer questions on each test.
- _____ Rubrics are clearly written for each test question, with a precise point breakdown for partial credit.
- _____ There are point values assigned and visible next to each test question.
- _____ Questions have been formulated using the higher levels of Bloom’s Taxonomy, such as Comprehension, Application, and Analysis.
- _____ Questions incorporate problem-solving and critical thinking.
- _____ For Fill-In-The-Blank and Short Answer questions, the rubric contains as many correct answers as possible.
- _____ Each test question gives information, in specific terms, on the number of requested answers.
- _____ Based on the phrasing of the question, it is clear to the students what type of answer will receive full credit.
- _____ Reference materials have been provided for each objective.
- _____ Each station test is within recommended Category Breakdown percentages.

Bloom’s Taxonomy: Remember * Understand * Apply * Analyze * Evaluate * Create