

# Heavy Equipment Operation

## Study Guide

Assessment:  
2325 Heavy Equipment Operator

Aligned with NCCER  
National Standards



## Overview

This study guide is designed to help students prepare for the Heavy Equipment Operator assessment. It not only includes information about the assessment, but also the skills standards upon which the assessment is based, resources that can be used to prepare for the assessment and test taking strategies. The assessment measures a student's ability to apply knowledge of the skills necessary for Heavy Equipment Operation.

Each of the four sections in this guide provides useful information for students preparing for the Heavy Equipment Operator assessment.

- CareerTech and Competency-Based Education: A Winning Combination
- Heavy Equipment Operator Assessment
  - ▶ Assessment Information
  - ▶ Standards and Test Content
  - ▶ Sample Questions
  - ▶ Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

The Heavy Equipment Operator assessment and standards are aligned with the National Center for Construction Education and Research (NCCER) national standards. NCCER is a nonprofit education foundation focused on creating a standardized training and credentialing program for the industry to build up a safe and industrious workforce. NCCER develops standardized construction and maintenance curricula and assessments.

**[www.nccer.org](http://www.nccer.org)**

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## CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the work force.

### Tools for Success

CareerTech education relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

**Curriculum materials and textbooks** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

**Certification Assessments** test the student over material outlined in the skills standards and taught using the curriculum materials and textbooks. When used with classroom performance evaluations, certification assessments provide a means of measuring occupational readiness.

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

### Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Certification assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

# Heavy Equipment Operator Assessment Information

## What is the Heavy Equipment Operator assessment?

The Heavy Equipment Operator assessment is an end-of-program assessment for students in Heavy Equipment Operation programs. The assessment provides an indication of student mastery of knowledge and concepts necessary for success in careers in this area.

## How was the assessment developed?

The assessment was developed by the CareerTech Testing Center. The assessment and standards align with the NCCER national standards. Items were developed and reviewed by a committee of subject matter experts.

The committee assigned frequency and criticality ratings to each skill, which determines the significance of each task for test development:

**Frequency:** represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

1 = less than once a week      2 = at least once a week      3 = once or more a day

**Criticality:** denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

1 = slight                              2 = moderate                              3 = extreme

## What does the assessment cover?

Specifically, the test includes multiple-choice test items over the following areas:

### Heavy Equipment Operator (55 questions)

Orientation to the Trade	7%
Heavy Equipment Safety	13%
Perform Practical Math	5%
Perform Grade Work	13%
Demonstrate Knowledge of Soil	7%
Load, Lash, and Unload Equipment	5%
Demonstrate Knowledge of Basic Principles of Engines (Gasoline and Diesel)	9%
Perform Preventive Maintenance	9%
Demonstrate Use of Dozers	19%
Demonstrate Use of Backhoes	13%

## What are the benefits of using this assessment?

Students receive a certificate for each assessment that he/she passes. This certificate may be included in his/her portfolio and used to communicate the student's mastery of the subject matter to potential employers.

## When should the assessment be taken?

The CareerTech Testing Center recommends that students take this assessment as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

## Is the assessment timed?


No. However, most students finish the assessment within one hour.

## What resources can students use on these assessments?

Students are allowed to use calculators and scratch paper on CTTC assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps on cell phones and other devices may not be used on these assessments.

## What accommodations can be made for students with Individualized Education Plans (IEPs)?

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- Extended time — This assessment is not timed; therefore, students may take as much time as needed to finish. The assessment must be completed in one testing session.
- Readers — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- Enlarged text — Students needing this accommodation can activate this feature by clicking the  icon in the upper right corner of the screen.

## What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor **cannot** be an instructor or anyone who was involved with the student during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Students may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that shows the student's score on the assessment and how the student performed in each standard area.

## Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who retest must wait at least three days between attempts.

## Standards and Test Content

### Orientation to the Trade (4 questions)

1. Explain the uses of heavy equipment **(3/3)**
2. Identify and describe the different types of heavy equipment **(3/3)**
3. Explain the basic terminology and types of equipment and their uses **(2/3)**
  - Backhoe
  - Excavator
  - Dozer
  - Skid Steer
4. Discuss the occupational outlook for equipment operators **(1/1)**
5. Identify career opportunities available to heavy equipment operators **(2/2)**
6. Explain the purpose and objectives of an apprentice training program **(1/1)**
7. Identify advantages and disadvantages for heavy equipment operators **(1/1)**
8. State characteristics of a good equipment operator **(3/3)**
9. Name major skills involved in equipment operation **(1/1)**
10. Explain the importance of safety in relation to heavy equipment **(3/3)**
11. Complete employment application **(1/2)**
12. Practice interview questions **(1/2)**



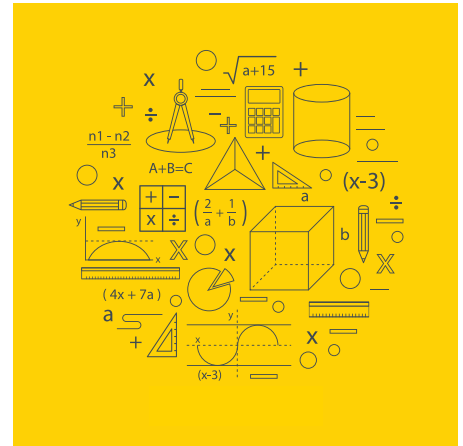
### Heavy Equipment Safety (7 questions)

1. Demonstrate knowledge of terms associated with safety and first aid **(2/3)**
2. Explain the need for safety measures when working in and around heavy equipment **(3/3)**
3. Understand the purposes of safety measures when working on construction sites: **(3/3)**
  - Signs
  - Tags
  - Barricades
  - Lockout/Tagout devices
4. Identify safeguards used in a highway construction work zone **(3/3)**
5. Demonstrate knowledge of general guidelines for safe operation and maintenance of heavy equipment **(3/3)**
6. Demonstrate knowledge of general dangers associated with working around an excavation area with heavy equipment **(3/3)**
7. Demonstrate knowledge of safety data sheets (SDS) in relation to hazardous chemicals used with heavy equipment: **(1/1)**
  - Handling & Storage
  - Personal Protective Equipment (PPE)
  - First Aid Measures
  - Health Effects
8. State general guidelines for working safely around heavy equipment **(3/3)**

9. Identify components of the fire triangle **(1/2)**
10. Identify and describe classes of fires **(1/1)**
11. Identify types of fire extinguishers and the classes of fire for which each is used **(2/2)**
12. Maintain a clean and orderly work area **(1/1)**
13. Lift heavy objects correctly **(3/3)**
14. Demonstrate knowledge of safety rules concerning flammable liquids **(2/2)**
15. Demonstrate knowledge of first aid **(2/2)**

### Perform Practical Math (3 questions)

1. Demonstrate knowledge of terms associated with practical math **(2/3)**
2. Demonstrate correct use of geometric figures **(2/2)**
3. Demonstrate correct use of units of measure **(2/3)**
4. Calculate area of geometric figures **(3/3)**
  - Engineer's rule
  - Addition
  - Subtraction
  - Multiplication
  - Division
  - Formulas
5. Calculate volume of solid figures **(2/3)**
  - Engineer's rule
  - Addition
  - Subtraction
  - Multiplication
  - Division
  - Formulas



### Perform Grade Work (7 questions)

1. Demonstrate knowledge of terms associated with grade work **(3/3)**
2. Demonstrate knowledge of purposes of stakes **(3/3)**
3. Identify information given on stakes **(2/3)**
4. Demonstrate correct uses of stakes **(2/3)**
5. Identify the importance of stakes **(3/3)**
6. Distinguish between full station and plus station **(2/3)**
7. Demonstrate use of equipment by the operator to check stakes **(2/3)**
8. Use a level and transit **(3/3)**
9. Use slope stakes **(2/3)**
10. Demonstrate knowledge of slope ratio **(3/3)**
11. Identify features of a good road design **(2/2)**
12. Distinguish between backslope and foreslope **(3/3)**
13. Read an engineer's rule **(2/3)**
14. Demonstrate the ability to check grades (transfer elevations) **(2/3)**
15. Demonstrate the ability to use a hand level to find height of a hill **(2/2)**

## **Demonstrate Knowledge of Soil (4 questions)**

1. Demonstrate knowledge of terms associated with soil **(2/2)**
2. Identify the physical properties of soil **(2/2)**
3. Identify basic types and characteristics of soils **(2/2)**
4. Identify factors that affect soil classification **(2/2)**
5. Identify methods of stabilizing soil **(2/2)**
6. Identify applications of energy to soil to attain compaction **(2/2)**
7. Distinguish between too wet soil and too dry soil **(2/2)**
8. Identify types of compacting equipment **(2/2)**
9. Use compaction equipment **(2/2)**
10. Demonstrate knowledge of how types of soil affect the equipment and the operator **(2/3)**
11. Demonstrate knowledge of wet digging techniques **(2/2)**



## **Load, Lash, and Unload Equipment (3 questions)**

1. Demonstrate knowledge of terms associated with loading, lashing, and unloading **(3/3)**
2. Demonstrate safety precautions for loading and moving equipment **(3/3)**
3. Identify types of equipment used to move heavy equipment **(2/3)**
4. Load equipment **(2/3)**
5. Protect pavement **(2/3)**
6. Secure (lash) equipment **(2/3)**
7. Demonstrate the ability to load dozer/backhoe from rear **(2/3)**
8. Demonstrate the ability to unload dozer/backhoe from rear **(2/3)**

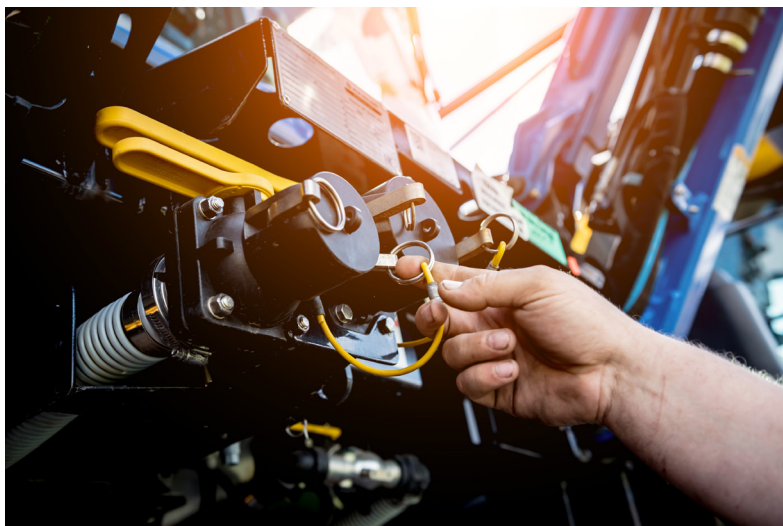
## **Demonstrate Knowledge of Basic Principles of Engines (Gasoline & Diesel) (5 questions)**

1. Demonstrate knowledge of terms associated with basic principles of engines **(1/1)**
2. Distinguish basic differences between a gasoline engine and a diesel engine **(2/2)**
3. Demonstrate preventive maintenance procedures **(3/3)**
4. Distinguish between components of fuel systems for gasoline and diesel engines **(1/2)**
5. Demonstrate knowledge of functions of battery **(2/2)**
6. Demonstrate safety rules pertaining to care and maintenance of batteries **(2/2)**

7. Demonstrate knowledge of the purpose of intake system and exhaust system in diesel engines **(1/1)**
8. Identify advantages of a turbocharged engine **(1/1)**
9. Demonstrate knowledge of purposes of engine lubrication system **(3/3)**
10. Identify oil contaminants **(1/1)**
11. Select engine oil **(1/1)**
12. Demonstrate the ability to test antifreeze solution **(1/1)**
13. Demonstrate the ability to service an air cleaner **(3/3)**
14. Demonstrate the ability to remove and replace a battery **(1/1)**
15. Demonstrate the ability to start an engine using a negative-ground booster battery **(2/2)**
16. Demonstrate the ability to change oil in an engine **(2/3)**
17. Demonstrate the ability to change an oil filter **(2/3)**

### **Perform Preventive Maintenance (5 questions)**

1. Demonstrate knowledge of terms associated with preventive maintenance **(3/3)**
2. Identify factors that should be included in preventive maintenance **(3/3)**
3. Check items on a daily (or shift) checklist **(3/3)**
4. Perform preventive maintenance inspections **(3/3)**
5. Demonstrate safe service positions **(3/3)**
6. Demonstrate use of grease guns and grease fittings **(3/3)**
7. Identify main parts of the cooling system **(3/3)**
8. Demonstrate knowledge of and purpose of the cooling system **(2/3)**
9. Demonstrate the ability to lubricate equipment **(3/3)**



## **Demonstrate Use of Dozers (10 questions)**

1. Describe the common uses and types of dozers **(2/3)**
2. Demonstrate knowledge of terms associated with dozers **(2/3)**
3. Identify basic parts of a dozer **(3/3)**
4. Identify and describe dozer instruments **(3/3)**
5. Identify controls on a dozer **(3/3)**
6. Identify types of blades, attachments, and accessories used on or with dozers **(3/3)**
7. Demonstrate safety procedures to use when operating a dozer **(3/3)**
8. Demonstrate the ability to perform daily inspections on a dozer **(3/3)**
9. Demonstrate effective dozer operation **(3/3)**
10. Identify items to check when servicing a dozer **(3/3)**
11. Identify materials needed to service a dozer **(3/3)**
12. Demonstrate the ability to start, warm up, check gauges, and test controls for performance; make final visual check **(3/3)**
13. Demonstrate the ability to perform rough ditching and spreading **(2/2)**
14. Demonstrate the ability to perform job moving large boulder **(2/2)**
15. Demonstrate the ability to perform ripping operations **(2/2)**
16. Demonstrate the ability to cut and build a gentle slope bench **(3/3)**
17. Demonstrate the ability to perform excavation work in confined area **(2/3)**
18. Demonstrate the ability to perform finish work **(3/3)**
19. Demonstrate the ability to use dozer in unstable soils **(3/3)**
20. Describe dozer shutdown procedures **(3/3)**



## **Demonstrate Use of Backhoes (7 questions)**

1. Identify uses of backhoes **(3/3)**
2. Demonstrate knowledge of terms associated with backhoes **(3/3)**
3. Identify types and configurations of backhoes **(2/3)**
4. Identify basic components of a backhoe **(3/3)**
5. Identify controls on typical backhoe **(3/3)**
6. Demonstrate knowledge of backhoe attachments and accessories **(1/2)**
7. Demonstrate safety procedures to use when operating a backhoe **(3/3)**
8. Demonstrate the ability to perform daily inspections on a backhoe **(3/3)**

9. Perform backhoe operations **(3/3)**
10. Identify items to check when servicing a backhoe **(3/3)**
11. Identify materials needed to service a backhoe **(3/3)**
12. Demonstrate the ability to start, warm up, check gauges, and check controls for performance; shut down machine **(3/3)**
13. Demonstrate the ability to carry a straight line while excavating a ditch and loading a haul truck **(3/3)**
14. Demonstrate the ability to set up machine on level terrain and on sloped terrain **(2/3)**
15. Demonstrate the ability to operate a backhoe to dig a basement **(1/1)**



## Sample Questions

- \_\_\_\_\_ 1. What type of maintenance is performed systematically to avoid downtime and high repair costs?
- a. systematic
  - b. periodic
  - c. preventive
  - d. reactive
- \_\_\_\_\_ 2. What does red in the safety color code indicate?
- a. biological hazard
  - b. danger
  - c. caution
  - d. warning
- \_\_\_\_\_ 3. What is the area of a concrete pad that is 30 ft long x 30 ft wide?
- a. 100 ft<sup>2</sup>
  - b. 900 ft<sup>2</sup>
  - c. 2700 ft<sup>2</sup>
  - d. 27000 ft<sup>2</sup>
- \_\_\_\_\_ 4. Which type of station is located a shorter distance from the preceding station, such as on curves or rough ground?
- a. plus
  - b. half
  - c. full
  - d. staggered
- \_\_\_\_\_ 5. A Safety Data Sheet (SDS) provides specific details on:
- a. chemical products.
  - b. machine data.
  - c. safe handling of soil materials.
  - d. safe operation of equipment.
- \_\_\_\_\_ 6. Soil that becomes loose or powdery under pressure is:
- a. optimum.
  - b. too dry.
  - c. stable.
  - d. lacking compaction.

- \_\_\_\_\_ 7. What device converts fuel?
- a. accelerator pump
  - b. pump atomizer
  - c. injection pump
  - d. injector nozzle
- \_\_\_\_\_ 8. What device prevents leakage at the machine joint?
- a. ball joint
  - b. joint seal
  - c. fender washer
  - d. packing gland
- \_\_\_\_\_ 9. What is the most appropriate piece of equipment for clearing land and removing trees?
- a. chainsaw
  - b. dozer
  - c. excavator
  - d. log skidder
- \_\_\_\_\_ 10. What backhoe component cuts a flat bottom in a trench?
- a. boom
  - b. bucket
  - c. curl cylinder
  - d. stick

## Sample Questions — Key

1. What type of maintenance is performed systematically to avoid downtime and high repair costs?
  - a. systematic Incorrect
  - b. periodic Incorrect
  - c. preventive Correct
  - d. reactive Incorrect
  
2. What does red in the safety color code indicate?
  - a. biological hazard Incorrect
  - b. danger Correct
  - c. caution Incorrect
  - d. warning Incorrect
  
3. What is the area of a concrete pad that is 30 ft long x 30 ft wide?
  - a. 100 ft<sup>2</sup> Incorrect
  - b. 900 ft<sup>2</sup> Correct
  - c. 2700 ft<sup>2</sup> Incorrect
  - d. 27000 ft<sup>2</sup> Incorrect
  
4. Which type of station is located a shorter distance from the preceding station, such as on curves or rough ground?
  - a. plus Correct
  - b. half Incorrect
  - c. full Incorrect
  - d. staggered Incorrect
  
5. A Safety Data Sheet (SDS) provides specific details on:
  - a. chemical products. Correct
  - b. machine data. Incorrect
  - c. safe handling of soil materials. Incorrect
  - d. safe operation of equipment. Incorrect
  
6. Soil that becomes loose or powdery under pressure is:
  - a. optimum. Incorrect
  - b. too dry. Correct
  - c. stable. Incorrect
  - d. lacking compaction. Incorrect

7. What device converts fuel?

- a. accelerator pump Incorrect
- b. pump atomizer Incorrect
- c. injection pump Incorrect
- d. injector nozzle Correct

8. What device prevents leakage at the machine joint?

- a. ball joint Incorrect
- b. joint seal Incorrect
- c. fender washer Incorrect
- d. packing gland Correct

9. What is the most appropriate piece of equipment for clearing land and removing trees?

- a. chainsaw Incorrect
- b. dozer Correct
- c. excavator Incorrect
- d. log skidder Incorrect

10. What backhoe component cuts a flat bottom in a trench?

- a. boom Incorrect
- b. bucket Correct
- c. curl cylinder Incorrect
- d. stick Incorrect

## Abbreviations, Symbols and Acronyms

The following is a list of abbreviations, symbols, and acronyms used in the Heavy Equipment Operation study guide and on the Heavy Equipment Operator assessment.

&	And
%	Percent
CTTC	CareerTech Testing Center
Ft <sub>2</sub>	Square feet
IEP	Individualized Education Plan
NCCER	National Center for Construction Education and Research
PPE	Personal Protective Equipment
V	Volt

## Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

### General Testing Advice

1. Get a good night's rest the night before the test — eight hours of sleep is recommended.
2. Avoid junk food and “eat right” several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

### Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar, to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.

## NOTES

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