



National Craft Assessment and Certification Program  
S P E C I F I C A T I O N S

**HEAVY EQUIPMENT OPERATOR: MOTOR GRADER**  
**AEN22MGRADE02**

February 2018

**Focus Statement**

A motor grader operator masters all concepts and procedures involved in the operation of motor graders. This includes basic daily preventive maintenance, safety checking, and control of the machine. He/she identifies the main attachments used with motor graders and uses the motor grader to perform the appropriate work-related tasks.

**Overview**

- Two-hour closed-book examination
- May use a basic function, non-printing calculator
- No extra papers, books, notes or study materials are allowed
- The minimum passing score is 75
- A corresponding hands-on Performance Verification is available

**NCCER Curriculum**

All NCCER knowledge assessments are referenced to NCCER's curriculum modules as listed on this specification sheet. You may order modules from Pearson (800.922.0579) or from NCCER's Online Catalog at [www.nccer.org](http://www.nccer.org).

**Assessment Development**

All questions are developed and approved by subject matter experts under the direction of NCCER.

**Credentials**

Upon successful completion of the knowledge assessment, NCCER will send applicable credentials to the assessment center.

**Score Report and Training Prescription**

Each candidate will have access to their assessment results including their overall score and recommended training.

**NCCER Registry**

Knowledge assessment results are recorded in NCCER's Registry and become a part of the portable record of an individual's NCCER credentials.

**Knowledge Assessment Contents:**

Content Domain	Number of Questions
<b>Safety</b> (22102-12)	7
<b>Basic Operations</b> (22104-12)	10
<b>Grades and Site Work</b> (22106-12) (22210-13)	20
<b>Earth Moving and Soils</b> (22201-12) (22308-13)	13
<b>Math</b> (22207-13)	10
<b>Motor Grader Operations</b> (22305-14)	25
<b>Total Number of Questions</b>	<b>85</b>



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Learning Objectives related to Assessment:

<b>Safety</b>	
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22102-12</b>	<b>Heavy Equipment Safety</b>
	Explain the importance of safety when working with heavy equipment.
	State the purposes of signs, tags, barricades, and lockout/tagout devices used on construction sites.
	Describe the long- and short-term health effects, first-aid measures, handling and storage, and/or required personal protective equipment (PPE) for a chemical using a material data safety sheet (MSDS).
	Identify safeguards used in a highway construction work zone.
	State general guidelines for safe operation, maintenance, and transportation of heavy equipment.
	Explain the dangers of working around an excavation area with heavy equipment.
<b>Basic Operations</b>	
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22104-12</b>	<b>Basic Operational Techniques</b>
	Describe basic prestart activities for heavy equipment machinery.
	Describe basic safety measures associated with operating heavy equipment.
	Explain how to properly start, operate, and shut down the following types of heavy equipment: utility tractors, dozers, loaders, backhoes, excavators, compaction equipment, motor graders, scrapers, on-road dump trucks, off-road dump trucks, forklifts, skid steers, and trenchers.
<b>Grades and Site Work</b>	
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22106-12</b>	<b>Grades</b>
	Explain the terms used in grade work.
	Identify types of stakes and explain markings on grade stakes and benchmark (BM) stakes.
	Identify equipment used by the operator to check stakes.
	Explain different types of slopes and slope ratio.
	Check horizontal and vertical distance of cut and fill slope stakes.
	Check finish subgrade on a cross slope.
<b>22210-13</b>	<b>Site Work</b>
	Describe the safety practices associated with site grading work. <ul style="list-style-type: none"> <li>a. Explain the purpose of a site safety program.</li> <li>b. Describe why safety inspections and investigations are important.</li> <li>c. Explain how hazardous materials are controlled on a job site.</li> <li>d. Describe safety practices associated with trenching and excavations.</li> <li>e. Describe how to prepare heavy equipment for transporting.</li> </ul>
	Describe the methods used to control water on job sites. <ul style="list-style-type: none"> <li>a. Explain the importance of maintaining proper drainage on a job site.</li> <li>b. Describe the methods used to control groundwater and surface water.</li> </ul>

	<ul style="list-style-type: none"> <li>c. Describe the safety practices and construction methods used when working around bodies of water.</li> </ul>
	<p>Explain how grades are established on a job site.</p> <ul style="list-style-type: none"> <li>a. Describe how to set grades from a benchmark.</li> <li>b. Describe how grades are set for highway construction.</li> <li>c. Describe how grades are set for building construction.</li> <li>d. Explain how grading operations are performed.</li> <li>e. Describe the use of stakeless and stringless grading systems.</li> </ul>
<b>Earth Moving and Soils</b>	
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22201-12</b>	<b>Introduction to Earthmoving</b>
	Identify and explain earthmoving terms and methods.
	Describe how to safely set up and coordinate earthmoving operations.
	Identify and explain earthmoving operations.
	Identify and explain soil stabilization methods.
	Identify the best equipment for performing a given earthmoving operation.
	List, in the correct order, the steps involved in an earthmoving operation.
<b>22308-13</b>	<b>Soils</b>
	<p>Describe the different types and characteristics of soils.</p> <ul style="list-style-type: none"> <li>a. Identify the types of soils.</li> <li>b. Describe the properties of soils.</li> <li>c. Explain how soil density is determined.</li> <li>d. Explain how moisture affects soil.</li> </ul>
	<p>Describe the factors that affect soil excavation.</p> <ul style="list-style-type: none"> <li>a. Explain what the swell factor is and how to calculate the swell factor of soils.</li> <li>b. Explain what the shrink factor is and how to calculate the shrink factor of soils.</li> <li>c. Describe how swell and shrink factors affect cycle times and equipment selection.</li> </ul>
	<p>Describe working in various soil conditions.</p> <ul style="list-style-type: none"> <li>a. Describe the weight bearing and flotation properties of different soils.</li> <li>b. Explain how soil characteristics affect machine performance.</li> <li>c. Describe how soil conditions can affect trenching safety.</li> </ul>
<b>Math</b>	
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22207-13</b>	<b>Excavation Math</b>
	<p>Explain how to use formulas.</p> <ul style="list-style-type: none"> <li>a. Explain the sequence of operations in solving a problem using a formula.</li> <li>b. Explain how squares and square roots are derived.</li> <li>c. Define angles and identify the types of angles.</li> </ul>
	<p>Explain how math is used to solve right triangle problems.</p> <ul style="list-style-type: none"> <li>a. Explain how to determine the length of a slope.</li> <li>b. Explain how a building is laid out using right triangle math.</li> </ul>
	<p>Define area and explain why determining the area of a space is required.</p> <ul style="list-style-type: none"> <li>a. Determine the area of squares and rectangles.</li> <li>b. Determine the area of a triangle.</li> <li>c. Determine the area of a trapezoid.</li> <li>d. Determine the area of a circle.</li> </ul>
	Define volume and explain the purpose of calculating volume.

	<ul style="list-style-type: none"> <li>a. Calculate the volume of a cube.</li> <li>b. Calculate the volume of a prism.</li> <li>c. Calculate the volume of a cylinder.</li> <li>d. Describe the estimating process used to determine the volume and weight of simple and complex excavations.</li> </ul>
	<b>Motor Grader Operations</b>
<b>Registry ID Number:</b>	<b>Module Title and Objectives:</b>
<b>22305-14</b>	<b>Motor Graders</b>
	<ul style="list-style-type: none"> <li>Identify and describe the components of a motor grader.</li> <li>a. Identify and describe common uses and types of motor graders.</li> <li>b. Identify and describe major parts of a motor grader.</li> <li>c. Identify and describe motor grader instrumentation.</li> <li>d. Identify and describe motor grader controls.</li> <li>e. Identify and describe common motor grader attachments.</li> </ul>
	<ul style="list-style-type: none"> <li>Identify and describe safety, inspection, and service guidelines associated with a motor grader.</li> <li>a. Describe guidelines associated with motor grader safety.</li> <li>b. Describe prestart inspection procedures.</li> <li>c. Describe preventive maintenance requirements.</li> </ul>
	<ul style="list-style-type: none"> <li>Describe basic startup and operating procedures for a motor grader.</li> <li>a. Describe startup, warm-up, and shutdown procedures.</li> <li>b. Describe basic maneuvers and operations.</li> <li>c. Describe common work activities.</li> </ul>