DEPARTMENT OF HUMAN RESOURCES

Study Guide
Engineering Aide III
Written Examination

- This booklet contains SAMPLE QUESTIONS ONLY. Studying this booklet will not necessarily improve your exam score.

DECEMBER 2019

PURPOSE AND CONTENT OF THIS STUDY GUIDE

This guide was developed to help you prepare to take the written examination for Engineering Aide III. It contains general test-taking advice and also provides specific information related to the exam content. This information includes the subject areas covered by the exam, the kinds of questions to expect, strategies for approaching the questions, and sample questions. Though this information cannot guarantee a higher examination score, it can give you direction for your examination preparation that will assist you in doing your best.

PREPARING TO TAKE THE EXAMINATION

Before the Day of the Exam

- Review this guide to get familiar with the content of the exam. Knowing about the topics and kinds of questions that will be in the exam will ensure that you will not be surprised by the content of the exam or the manner in which it is presented. This can improve your ability to demonstrate your job potential.

- Make sure that you know where the exam will be administered and all of the relevant details, such as where to park, where to report for the exam, and what identification is required.

On the Day of the Exam

- Make sure that you are well rested and have eaten. These things will help your concentration during the exam.

- Plan your day to allow plenty of time to get yourself prepared and get to the exam site. Allow enough time to cope with weather, traffic, parking, etc. Hurrying creates anxiety, so do not put yourself in the position of having to hurry.

- Listen carefully to all instructions from the examination administrator. Make sure that you understand the instructions and carry them out correctly. Ask questions at the proper time before the exam begins if you are unsure of any aspect of what you should do during the exam.

GENERAL EXAM TAKING TIPS

- Use your time carefully. The time limit should provide you with more than enough time if you move through the exam steadily and do not spend too much time on any one question.

- Read the questions and answer choices carefully. Read all of the answer choices before you select an answer.

- If you come to a question that is especially difficult, skip that question and come back to it later if you have time.

- Answer every question. Scores are based on the number of correct answers. You will receive no credit if you leave an answer space blank. It is to your advantage to use your best judgment to make a choice among the answer choices provided.

THE ENGINEERING AIDE III WRITTEN EXAMINATION

The written examination for the Engineering Aide III is based upon a job study that identified the most important knowledge, skills, and abilities required to perform the job successfully. These areas include:

- your ability to accurately read and interpret written information.
- your knowledge of effective approaches for interacting with others.
- your knowledge of correct grammar, punctuation, and word usage for preparing written documents.
- your knowledge of terminology used to describe land and roadways and basic concepts related to land use and public works projects.
- your knowledge of concepts related to assisting with engineering tasks.

All of the exam questions are presented in a multiple-choice format. Each question is identified by a question number that is followed by a question statement. Unless indicated otherwise, there are between two and four answer choices following the question statement. You should read all of the answer choices and then choose the best answer. **Each question has only one correct answer.**

SECTION 1: READING WITH UNDERSTANDING

This examination section contains twenty (20) questions designed to assess your ability to accurately read and interpret written information. Questions will be based on brief reading passages similar to the type of reading that is encountered on the job, such as instructions, policies and procedures, and technical information related to public works and land use operations.

A good strategy to use for this type of question is to read through the entire reading passage, then read each of the questions, and finally refer back to the passage as you answer each question. When reading each question, determine what information the question is specifically looking for by giving careful consideration to each of the words used to convey meaning. Does the question ask about a cause or effect? Does it ask you to identify the correct method or sequence for performing tasks?

It is important that you select your answer solely based upon the information provided. The test questions are designed to assess your ability to correctly interpret what is provided, not to assess your knowledge of the subject area addressed by the reading passage.

Examples of these types of questions are shown below. Each question is followed by a brief explanation of the correct answer.

Instructions: Use the information below to answer the three (3) questions that follow.

Building Permit Time Limits

Building permits are valid for a specified amount of time that is based upon the total cost of the construction project. Work must be completed, and final approval must be received, within the time frames outlined below:

Estimated value as determined by the Building Official	Time limit from issuance of building permit
$25,000 or less	6 months
$25,001 - $150,000	9 months
$150,001 - $500,000	12 months
$500,001 and above	18 months

A permit holder may apply for a 6-month extension to the building permit for good cause. The Building Official will decide whether the extension should be granted. To be considered, extension applications must be submitted to the Building Official at least 15 days before a permit is scheduled to expire.

If a permit time line is exceeded, the building permit becomes null and void. Extension requests received after permits have expired will not be approved. Daily penalties will accrue until construction is completed according to the following fine structure:

Time Limit	Penalty fine
First 30 days	$75 per day up to $2,250 maximum
31st day through 60th day	$150 per day up to $4,500 maximum
61st day through 120th day	$300 per day up to $18,000 maximum
121st day and all days after	$800 per day up to $200,000 maximum

1. A property owner was issued a building permit on February 1st for a project with a total cost of $50,000. As the construction deadline approached, the owner applied for and was granted a permit extension. According to the information provided, in what month must the project be completed?

   A. February.
   B. April.
   C. July.
   D. October.

Answer: The correct answer to sample question #1 is response choice "B". According to the Building Permit Time Limits, the initial permit time frame for a $50,000 project is nine (9) months and would end in September. When the six (6) month extension is added to the original permit length, the total amount of time to complete the project is fifteen (15) months which concludes in April.

2.   A construction project was completed seventy days after the permit for the project had expired. According to the information provided, the total penalty fine charge will be:

   A. $9,300.
   B. $9,450.
   C. $9,750.
   D. $9,900.

Answer: The correct answer to sample question #2 is response choice "C". The total penalty fine charge is calculated by adding the amounts shown for each of the time limits. The charge for days 1 through 30 is the maximum amount of $2,250 ($75 for 30 days). The charge for days 31 through 60 is the maximum amount $4,500 ($150 per day for 30 days) and the charge for days 61 through 70 is $3,000 ($300 per day for 10 days). Therefore, the total charge results from adding these amounts: $2,250 + $4,500 + $3,000 = $9,750.

3.   A property owner was issued a building permit on January 2nd for a project with a total construction cost of $25,000. The owner filed an application for a permit extension on June 28th . According to the information provided, when must the project be completed in order to avoid initiation of penalty fines?

   A. July 2nd of the current year.
   B. October 2nd of the current year.
   C. January 2nd of the next year.
   D. July 2nd of the next year.

Answer: The correct answer to sample question #3 is response choice "A". According to the Building Permit Time Line, the initial permit for a $25,000 project is six months. Six months from the January 2nd issue date is July 2nd of the current year. Though the owner applied for an extension, the application was not submitted within fifteen days before the permit was due to expire as specified in the last line of the paragraph immediately following the first table. Therefore, no extension would be applicable in this case and the project would need to be completed by the original permit date in order to avoid any penalty fines.

Instructions: Read the Recycling Facility Regulations below and then answer the two questions that follow using the answer key shown below:

Answer Key

A = The use or action is **acceptable** according to the regulations.
B = The use or action is **unacceptable** according to the regulations.
C = The use or action is **not covered** by the regulations.

Recycling Facility Regulations
Section III - General Regulations

A. Registration: No person shall install or maintain a recycling facility without first registering the facility with the City. Registration shall be in writing by the property owner or his/her authorized agent and shall be filed with the City Clerk. The name and telephone number of the facility operator and the date of City registration must be clearly displayed at facility.

B. Reverse vending machine requirements: Reverse vending machines and receptacles must be no closer than five (5) feet from a property line AND fifteen (15) feet from a public right-of-way. Such machines and receptacles may not occupy any driveway, parking space, or landscape area that is required for the property.

C. Recycling facility placement: Recycling facilities must occupy no more than 350 square feet of lot area AND must be no closer than 75 feet from residentially zoned property.

4.   Registration of a recycling facility by someone other than the owner.

Answer: The correct answer to sample question #4 is response choice "A". The first paragraph of the reading passage states that "Registration shall be in writing by the property owner or his/her authorized agent..."

5.   A reverse vending machine placed ten feet away from a public street.

Answer: The correct answer to sample question #5 is response choice "B". The second paragraph of the reading passage states that reverse vending machines must be "no closer than... fifteen feet from a public right-of-way."

SECTION 2: COMMUNICATION SKILLS

This part of the examination contains twenty-five (25) questions that assess both your knowledge of effective interpersonal communication techniques and written communication skills. For the interpersonal communications questions, you will be presented with a situation and asked to select the most effective response, given the circumstances. For this type of question, it is important to remember to view the question from the perspective of how a government agency would want its employees to respond to its customers.

For the written communication skills questions, you will select words or phrases to complete sentences in the most accurate and effective manner possible. A recommended approach for doing your best on this type of question is to review basic grammar and punctuation rules prior to taking the test. Then, when taking the examination, sound each sentence out mentally to be certain that you are actually reading every word as it is presented. Sometimes, our eyes may see something that is incorrect, but our brain interprets it as what it expects to see, rather than what is actually there.

Examples of the types of questions in this examination section are shown below. Each question is followed by a brief explanation of the correct answer.

6. If you must persuade others to follow a rule that requires them to take an action that they find bothersome, you will be most successful if you provide them with which of the following pieces of information?

    A. Why the action needs to be taken.
    B. Who created or authorized the rule.
    C. That others have also been unhappy about the rule.
    D. Where they can go to file a complaint about the rule.

Answer: The correct answer to sample question #6 is response choice "A". The goal is to get people to comply with the rule. People are most likely to accept a situation when they understand the reason for it. The other response choices either do not help people's understanding or could potentially reinforce the idea that the rule should not be followed.

7.   A citizen who has asked you a question will be most likely to interpret a lack of eye contact on your part during the conversation as:

A. politeness.
B. indifference.
C. incompetence.
D. professionalism.

Answer: The correct answer to sample question #7 is response choice "B". Eye contact is an essential element of communication because it conveys attention and interest. Therefore, a lack of eye contact will most likely give the impression of disinterest or indifference.

Instructions: Assume that you have prepared the draft correspondence shown below. Review the correspondence and then respond to the questions that follow by indicating which words or phrases best fit in the numbered spaces.

I am writing to __1__ you that your request for an extension of Building Permit #5689 has been approved. Each of the __2__ three remaining inspections dates __3__ rescheduled based on the new completion date of June 30th.

8.   Which of the following is most appropriate to place in the space numbered "1"?

A. inform
B. assure
C. counsel
D. appraise

Answer: The correct answer to sample question #8 is response choice "A". The word "inform" is the best choice to place in the space because its meaning is most appropriate given the context of the word in the sentence. It is clear that the purpose of the communication is to provide information. Therefore, the word "inform" is the most precise word of those listed. The other response choices have meanings that do not fit as well with the sentence. For example, "assure" means to guarantee, "counsel" means to give guidance, and "appraise" means to measure. Reading the sentence with those meanings inserted into the space numbered "1" more clearly demonstrates why they are less desirable choices.

9. Which of the following is most appropriate to place in the space numbered "2"?

    A. project
    B. projects
    C. project's
    D. projects'

Answer: The correct answer to sample question #9 is response choice "C". The sentence is about the inspection dates that are a part of a single project. Therefore, using the singular possessive form of the word "project" is grammatically correct. Choice "A" is incorrect because it is not possessive. Choice "B" is not correct because it is plural and not possessive. Choice "D" is not correct because it is a plural possessive while the communication is about a single project.

10. Which of the following is most appropriate to place in the space numbered "3"?

    A. were
    B. are being
    C. has been
    D. have been

Answer: The correct answer to sample question #10 is response choice "C". The phrase "has been" is the grammatically correct pairing of subject and verb in this sentence. The best way to approach questions of this type is to consider only the subject and verb portion of the sentence. To illustrate, the subject of the sentence is "Each" and the response choices are the verb. When read together, it is clear that "Each has been" is correct while "Each were", "Each are being" and "Each have been" are not.

SECTION 3: BASIC CONCEPTS

This part of the exam contains twenty-five (25) questions that assess your knowledge of basic terminology and concepts related to land use and public works projects. This includes terms used to describe land, roadway, and building features and how these things might be represented on maps or plans. This examination section also includes questions that assess your knowledge of basic spacial relationships such as directions (north, south, east, and west), distances, angles, and area.

An effective approach for preparing for these types of questions is to consider the range of tasks performed by Engineering Aides and the subject areas encompassed by those public works related tasks such as surveying, building and road construction, and code enforcement. Then, search for reference materials that provide an overview of those areas.

Examples of the types of questions in this exam section are shown below. Each question is followed by a brief explanation of the correct answer.

11. Which of the following would identify the reference point designated as the initial point for starting a description on a property map?

    A. ORR
    B. POB
    C. POR
    D. STA

Answer: The correct answer to sample question #11 is response choice "B". The starting reference point for a deed or legal description is called the "Point of Beginning" and would be referenced on a map by the abbreviation "POB". Survey maps and property descriptions are often used to identify and describe property so it is important to understand commonly used terms and symbols. Reviewing a glossary of surveying, public works, or real estate terminology will help familiarize you with these concepts.

12.   Which of the following is the most correct term for describing properties that are close to one another, but do not actually share a physical boundary?

    A. Aligned.
    B. Abutting.
    C. Adjacent.
    D. Adjoining.

Answer: The correct answer to sample question #12 is response choice "C". The term "adjacent" can be found in glossaries related to surveying, mapping, real estate, and land use. It is used to describe properties that are near to and visible from one another, but are not adjoining (touching).

13.   The primary purpose of zoning ordinances established by a local government is to identify which of the following?

    A. The community's service needs.
    B. The long-term development plan for the area.
    C. The standards for construction within the jurisdiction.
    D. The types of property uses allowed in specific areas.

Answer: The correct answer to sample question #13 is response choice "D". The purpose of zoning is to identify where the various types of property uses such as commercial, industrial, or residential are allowed. The nature of the work makes it important to understand how land is described, divided, and categorized in a public setting. Reviewing a glossary of land use, surveying, public works or construction terminology will help familiarize you with these concepts and terms.

Instructions: Use the diagram below to answer the question that follows.

Lot # 3791

1	2
3	4

14.   You are reviewing an application for a building permit for a storage building that will be located in the northwest corner of lot #3791. According to the diagram of the lot, the location of the building will be in the area identified by what number?

    A. 1.
    B. 2.
    C. 3.
    D. 4.

Answer: The correct answer to sample question #14 is response choice "A". Property is frequently described using directional orientation as a reference. In a typical diagram, the northern portion is towards the top of the page, while the southern portion is at the bottom. Similarly, the eastern portion is towards the right side of the page, while the western portion is the left side of the page. Therefore, in this situation presented in the question, the northwest corner is the upper left corner of the diagram and is identified by the number "1".

15.   A scale drawing indicates that a line that is one-half inch (½") long represents an actual length of eight feet (8'). Given this, how long would a line on the same drawing be if it is to represent an actual length of twenty feet (20').

    A. 1.00 inches.
    B. 1.25 inches.
    C. 1.50 inches.
    D. 1.75 inches.

Answer: The correct answer to sample question #15 is response choice "B". If one-half inch represents eight feet, then twenty feet would be represented by 1.25 inches. The most direct approach for determining this is to divide twenty by eight to determine the number of ½ inch increments required, then multiply ½ inch (.5 inches) by the result. Therefore, the calculations would be: 20/8=2.5, then 2.5 x .5 = 1.25. Alternatively, it is also possible to simply add the increments until the desired length is reached. In this case, one-half (.5) inch is eight feet, one inch is sixteen feet, and one and one-quarter (1.25) inches is twenty feet. Many public works tasks require interpreting plans or maps. As a result, it is important to understand how to interpret the scaling used to represent length or distance. The best way to prepare for this type of question is to look at maps or plans and practice interpreting the scales used.

16.   A rectangular shaped commercial lot measures 75 feet across (wide) and 125 feet deep (long). Given these dimensions, what is the area of the lot?

   A. 9,375 square feet.
   B. 9,400 square feet.
   C. 9,425 square feet.
   D. 9,450 square feet.

Answer: The correct answer to sample question #16 is response choice "A". The area of a rectangle is calculated by multiplying the length and the width. Therefore, in this question, the calculation is 75 feet x 125 feet = 9,375 square feet. It is important to know how to compute the area of basic shapes such as squares, rectangles, and triangles. This information can be found in online tutorials or text books that cover basic geometric shapes.

SECTION 4: ADVANCED CONCEPTS

This examination section contains twenty-five (25) questions designed to assess your knowledge and understanding of concepts related to assisting with engineering tasks. Exam content includes excavation and concrete concepts, math, basic geometry and trigonometry, and topographical maps. An effective approach to assist you in doing your best on this section is to prepare before the exam by reviewing the areas described above. Depending on your current knowledge and experience, additional preparation would include reviewing some references on these topics. Then, when taking the exam, carefully read each question and make sure you know exactly what is being asked. With a clear understanding of the question, you should be better able to draw upon your knowledge of these topics and thoughtfully consider the response choices.

Examples of these types of questions are shown below. The sample questions are followed by brief explanations of their correct answers.

17. The distinguishing characteristic of topographical maps is that they include:

   A. only the natural, physical features of the earth's surface.
   B. contour lines that show the shape of the earth's surface by indicating the elevation of its physical features.
   C. all government established jurisdiction boundaries, including Federal, state, municipal, military, and special districts.
   D. all roadways and also show mileage between their intersections to enable determination of travel time and distances.

Answer: The correct answer to sample question #17 is answer choice "B". According to the United States Geologic Service (USGS), the contour lines showing elevation above or below sea level, or some other reference, are the distinctive feature of topographical maps.

18. The primary problem with a concrete mix that contains too much water is that:

   A. the strength of the concrete will be reduced.
   B. removal of the forms will be much more difficult.
   C. the time required for the concrete to set will double or triple.
   D. the concrete will have reduced freeze-resistance when set in cold climates.

Answer: The correct answer to sample question #18 is answer choice "A". The water-to-cement ratio is a critical factor when mixing concrete. It must be kept constant. Too much water will make concrete weak and the cement may even be washed out of the mixture. Since even a small amount of excess water can weaken concrete, the sand that is to be used should be tested for moisture content.

19.   A ramp is to be constructed to produce a vertical rise of 12 feet and it will have a rate of grade of six percent (6%). The horizontal distance spanned by the ramp will be closest to which of the following values?

A.   72.0 feet.
B.   90.0 feet.
C.   200.0 feet.
D. 2,000.0 feet.

Answer: The correct answer to sample question #19 is answer choice "C". The rate of grade is 6 percent and is defined as the vertical rise over the horizontal distance, or run. In this case, the rise is 12. The relationship can be expressed as 12 : X = 6 : 100, where X is the run and is the unknown value. Therefore, the calculation to solve for X is (12 x 100) divided by 6. This becomes 1,200/6 = 200 and this is answer choice "C".

Questions #20 through #22 are based on the drawing shown in Figure A below. The triangle ABC that is depicted is a right triangle with the angle ACB being a 90 degree angle. The lines GH and BC are parallel. The drawing is <u>not</u> to scale.
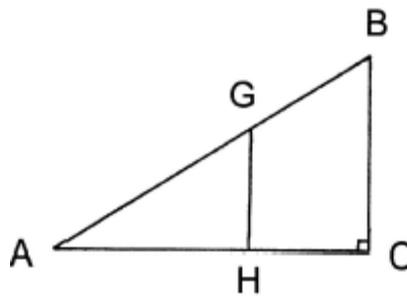

FIGURE A

20. In Figure A, assume the following dimensions: Line AG = 42 feet, Line AH = 36 feet, and Line GH = 22 feet. Which of the following values is closest to the value of the cosine (adjacent/hypotenuse) of angle AGH?

A. 0.52
B. 0.61
C. 0.86
D. 1.91

Answer: The correct answer to sample question #20 is answer choice "A". The trigonometric function called the "cosine" is defined as the ratio of the adjacent side (next to the angle of interest) divided by the hypotenuse (the side opposite the right angle). In this question, Line GH is the side that is adjacent to angle AGH and GH equals 22 feet. Line AG is the hypotenuse of the triangle AGH and AG equals 42 feet. Therefore, the cosine of angle AGH is: 22/42 = 0.5238 = 0.52. This is answer choice "A".

21. In Figure A, angle ACB is exactly 90°. If the size of angle ABC is assumed to be 56°32'48", the size of angle BAC is:

A. 34°28'12"
B. 34°27'12"
C. 33°28'11"
D. 33°27'12"

Answer: The correct answer to sample question #21 is answer choice "D". The sum of the interior angles of a triangle is always 180 degrees. Therefore, the size of angle BAC is equal to 180 degrees minus the sum of the other two angles, ACB and ABC. Expressing 180° as 179°59'60" makes the subtraction easier and less error prone. The computation becomes: 179°59'60" - (90°+ 56°32'48") = 33°27'12". This is answer choice "D".

22. In Figure A, assume that the length of Line GH = 30 feet and the length of Line AH is 40 feet. Given this information, the length of Line AG is closest to:

A. 35 feet.
B. 45 feet.
C. 50 feet.
D. 55 feet.

Answer: The correct answer to sample question #22 is answer choice "C". In this question, the length of the two legs of a right triangle are provided and the length of the hypotenuse is the value to be calculated. This involves the application of the formula known as the Pythagorean Theorem, which states that the square of the hypotenuse of a right triangle is equal to the sum of the squares of its legs. This relationship among the three sides can be represented as $a^2 = b^2 + c^2$, where "a" is the hypotenuse and "b" and "c" are the other two sides. This means that $a^2 = (30)^2 + (40)^2 = 2,500$. Therefore, "a", the hypotenuse, is equal to the square root of 2,500, which is 50 and is answer choice "C."

23. A biosolids drying field contains 200,000 cubic yards of dried biosolids that are ready to be removed by truck. Assume that the average weight of a cubic yard of these biosolids is 250 pounds. Since the contracted price for trucking the biosolids is by weight, the total weight of the dried biosolids in the field must be determined. Which of the following values is closest to the number of tons that are ready to be removed.

    A.   1,250 tons.
    B.   1,600 tons.
    C. 12,500 tons.
    D. 25,000 tons.

Answer: The correct answer to sample question #23 is answer choice "D". The total number of pounds of dried biosolids is determined by multiplying the number of cubic yards by the weight per cubic yard. This is 200,000 x 250 = 50,000,000 pounds. Since the question asks for the weight in tons, the pounds must be divided by 2,000, which is the number of pounds in a ton. This is 50,000,000 ÷ 2,000 = 25,000 tons and this is answer choice "D".

ADDITIONAL ASSISTANCE

If you feel that you would benefit from more practice, your local library or relevant internet web sites may have reference materials that can be helpful. This is true for all of the subject areas covered by the Engineering Aide III written examination.