

# NICET Construction Materials Testing Concrete Level I Practice Test (Sample)

## Study Guide



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**SAMPLE**

## **Questions**

- 1. How can the presence of air pockets impact concrete strength?**
  - A. They enhance the thermal insulation properties**
  - B. They can create weak points and reduce overall strength**
  - C. They improve workability during mixing**
  - D. They allow for better hydration of the mix**
- 2. In soundness testing, which material is commonly used to determine the loss of quality?**
  - A. Cement paste**
  - B. Gypsum**
  - C. Sodium sulfate**
  - D. Sand**
- 3. Which of the following parameters is NOT typically evaluated in sieve analysis of aggregates?**
  - A. Particle shape**
  - B. Particle size**
  - C. Grading compliance**
  - D. Fine material content**
- 4. What can excessive water content in a concrete mix lead to?**
  - A. Improved workability without any downsides**
  - B. Lower strength and higher porosity in concrete**
  - C. Increased durability and resistance**
  - D. Faster curing times and quick strength development**
- 5. What should the oven temperature be when drying aggregate to constant mass?**
  - A. 200°F (+/- 10°F)**
  - B. 230°F (+/- 10°F)**
  - C. 250°F (+/- 10°F)**
  - D. 180°F (+/- 10°F)**

- 6. What must be ensured about the experience of the manager directing the inspection company?**
- A. They should have a degree in engineering**
  - B. They must be certified by a national body**
  - C. They must be knowledgeable of the applicable standards and inspection processes**
  - D. They should have more than 10 years of experience**
- 7. How does temperature affect concrete curing?**
- A. Higher temperatures accelerate curing and strength gain**
  - B. Lower temperatures improve hydration speed**
  - C. Temperature has no effect on curing**
  - D. Only extreme temperatures impact curing**
- 8. What is the formula for total evaporable moisture loss?**
- A.  $100(\text{mass of dried sample} - \text{mass of original sample})/\text{mass of original sample}$**
  - B.  $100(\text{mass of original sample} - \text{mass of dried sample})/\text{mass of original sample}$**
  - C.  $100(\text{mass of original sample} - \text{mass of dried sample})/\text{mass of dried sample}$**
  - D.  $100(\text{mass of dried sample} - \text{mass of original sample})/\text{mass of dried sample}$**
- 9. Under whose direction shall the inspection company operate?**
- A. A manager who is knowledgeable of the applicable standards and inspection processes used**
  - B. A certified quality control inspector**
  - C. An external regulatory body**
  - D. The project owner or client**
- 10. How do you calculate the yield of concrete?**
- A. By measuring the water content only.**
  - B. By determining the height of concrete placed.**
  - C. By determining the volume of concrete produced from its constituent materials.**
  - D. By evaluating the time taken for mixing.**

## **Answers**

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1. B
2. C
3. A
4. B
5. B
6. C
7. A
8. C
9. A
10. C

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## **Explanations**

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**1. How can the presence of air pockets impact concrete strength?**

- A. They enhance the thermal insulation properties**
- B. They can create weak points and reduce overall strength**
- C. They improve workability during mixing**
- D. They allow for better hydration of the mix**

The presence of air pockets in concrete can indeed create weak points within the material, which ultimately reduces its overall strength. When air pockets exist, they disrupt the uniformity of the concrete matrix, leading to sections that are not as dense or solid as intended. This reduction in density results in lower compressive strength because the load-bearing capacity of concrete is compromised; the areas with air pockets are unable to bear loads effectively, which can lead to cracks and structural failures over time. Air pockets can form for several reasons, such as poor mixing techniques, improper vibration during placement, or excessive air entrainment. While air-entraining agents are sometimes added intentionally to improve freeze-thaw resistance and durability, excessive or uncontrolled air pockets are detrimental to the strength and durability of concrete. In contrast to the other options, the presence of air pockets does not enhance thermal insulation properties in a beneficial way, as air pockets that are too large can weaken the structure. While they might improve workability during mixing temporarily, the final hardened concrete is ultimately compromised. Additionally, they do not facilitate better hydration; in fact, air pockets can inhibit proper curing and hydration of the cement particles, leading to incomplete hardening.

**2. In soundness testing, which material is commonly used to determine the loss of quality?**

- A. Cement paste**
- B. Gypsum**
- C. Sodium sulfate**
- D. Sand**

In soundness testing, sodium sulfate is commonly utilized because it is effective in simulating the potential expansion of concrete materials when subjected to moisture and temperature fluctuations. The primary goal of soundness testing is to assess the ability of aggregate particles to maintain their integrity under these conditions. Sodium sulfate specifically reacts with the components in the concrete or aggregate, leading to expansion that can cause cracking or other forms of deterioration. This reaction helps to quantify the material's resistance to such degrading factors, which is crucial for ensuring long-term durability in concrete structures. The other materials listed do not serve the same purpose in the context of soundness testing. Cement paste may provide insights into the properties of the binder but does not specifically relate to the evaluation of aggregate soundness. Gypsum is often used in conjunction with cement but is not the standard for testing soundness. Sand, though a significant component of concrete, is not used in its pure form for assessing soundness; instead, it's typically part of a larger aggregate mix. Thus, sodium sulfate stands out as the appropriate choice for soundness testing.

**3. Which of the following parameters is NOT typically evaluated in sieve analysis of aggregates?**

- A. Particle shape**
- B. Particle size**
- C. Grading compliance**
- D. Fine material content**

In the context of sieve analysis of aggregates, the primary focus is on determining the distribution of particle sizes within the material. This analysis helps assess how well the aggregate will perform in concrete mixtures, ensuring that the right proportions of coarse and fine materials are present. Particle size is a fundamental parameter since it directly influences the grading of the aggregate, which is crucial for achieving desired workability and strength in concrete. Grading compliance assesses whether the aggregate meets specific standards or specifications required for a particular application, making it an essential part of the sieve analysis process. Fine material content is also an important measurement since it determines how much smaller material is present in the aggregate blend. Too much fine material can negatively impact the concrete's workability and strength. On the other hand, while particle shape is important in evaluating the overall performance of aggregates in concrete, it is not a parameter typically determined during sieve analysis. Sieve analysis focuses solely on size distribution rather than the shape characteristics of the particles. Therefore, this parameter does not form part of the standard sieve analysis process.

**4. What can excessive water content in a concrete mix lead to?**

- A. Improved workability without any downsides**
- B. Lower strength and higher porosity in concrete**
- C. Increased durability and resistance**
- D. Faster curing times and quick strength development**

Excessive water content in a concrete mix is known to adversely affect the final properties of the concrete. When too much water is added, it dilutes the cement paste, reducing the overall strength of the concrete due to an inadequate cement-to-water ratio. This leads to lower compressive strength, making the concrete more susceptible to cracking and failure under load. In addition to strength reduction, excessive water increases the porosity of the concrete. Higher porosity means that there are more voids and air pockets in the concrete matrix, which can lead to greater vulnerability to environmental factors such as freeze-thaw cycles and exposure to chemical attacks. This compromised structure further diminishes the durability of the concrete over time. Proper balance of water in a concrete mix is crucial for achieving the desired mechanical properties and durability characteristics, and maintaining the integrity of the concrete throughout its lifespan.

**5. What should the oven temperature be when drying aggregate to constant mass?**

- A. 200°F (+/- 10°F)
- B. 230°F (+/- 10°F)**
- C. 250°F (+/- 10°F)
- D. 180°F (+/- 10°F)

The appropriate oven temperature for drying aggregate to a constant mass is 230°F (+/- 10°F). This temperature range ensures that the moisture content of the aggregate is effectively removed without overheating the material, which could potentially alter its properties. Drying at 230°F is a standard in various testing specifications, such as those from ASTM, as it strikes a balance between sufficient heat to evaporate moisture and avoiding damage to the aggregate's particles. Maintaining the specified range is essential to ensure reliable and consistent results in material testing. The other options, while close in temperature, do not align with the standard requirements for drying aggregate. For example, lower temperatures may insufficiently dry the aggregate, leaving excess moisture that can affect weight measurements and subsequent test results. Higher temperatures could lead to thermal degradation of the aggregate, impacting its performance in concrete mixtures.

**6. What must be ensured about the experience of the manager directing the inspection company?**

- A. They should have a degree in engineering
- B. They must be certified by a national body
- C. They must be knowledgeable of the applicable standards and inspection processes**
- D. They should have more than 10 years of experience

The requirement for the manager directing the inspection company to be knowledgeable of the applicable standards and inspection processes is crucial because understanding these standards ensures that the inspections are conducted accurately and in compliance with industry regulations. This knowledge enables the manager to effectively oversee the inspection team, ensure that all procedures are followed correctly, and interpret results appropriately. Knowledge of applicable standards includes an understanding of what is necessary to meet quality assurance and quality control measures, as well as safety regulations that may pertain to construction materials testing. It equips the manager to make informed decisions regarding inspection protocols, identify potential issues, and provide guidance to personnel conducting the inspections. Consequently, this competence plays a pivotal role in maintaining the integrity of the inspection company and ensuring reliable outcomes for clients. While having a degree in engineering, certification by a national body, and extensive experience can enhance a manager's qualifications, the most critical factor remains the understanding of the specific standards and processes required for effective inspections. Without this knowledge, even highly experienced or educated individuals may struggle to perform their roles effectively.

## 7. How does temperature affect concrete curing?

- A. Higher temperatures accelerate curing and strength gain**
- B. Lower temperatures improve hydration speed**
- C. Temperature has no effect on curing**
- D. Only extreme temperatures impact curing**

Higher temperatures accelerate curing and strength gain primarily due to their impact on the hydration process of the cement. As the temperature rises, the rate of chemical reactions involved in hydration increases, leading to faster strength development in the concrete. This acceleration is beneficial for construction schedules, allowing projects to progress more rapidly. Conversely, lower temperatures slow down the curing process and can even lead to incomplete hydration of the cement particles. While some might believe that lower temperatures could improve hydration speed, the reality is that they can hinder the chemical reactions necessary for strength gain. The notion that temperature has no effect on curing is inaccurate, as temperature is a critical factor that influences the rate of the curing process. Furthermore, while extreme temperatures can significantly impact curing, even moderate temperature variations have a noticeable effect, with higher temperatures generally being more favorable. Thus, acknowledging the role of temperature is essential for effective concrete curing practices.

## 8. What is the formula for total evaporable moisture loss?

- A.  $100(\text{mass of dried sample} - \text{mass of original sample})/\text{mass of original sample}$**
- B.  $100(\text{mass of original sample} - \text{mass of dried sample})/\text{mass of original sample}$**
- C.  $100(\text{mass of original sample} - \text{mass of dried sample})/\text{mass of dried sample}$**
- D.  $100(\text{mass of dried sample} - \text{mass of original sample})/\text{mass of dried sample}$**

The formula for total evaporable moisture loss is determined by comparing the mass of the original sample with the mass of the sample after drying. In this context, the correct formula helps to quantify the percentage of moisture lost due to evaporation during the drying process. The selected formula takes the mass of the original sample and subtracts the mass of the dried sample, which represents the moisture that has been lost. Dividing this value by the mass of the original sample gives a proportionate measure of how much moisture was present compared to the total weight of the sample prior to drying. Since the result is then multiplied by 100, it converts this proportion into a percentage, allowing for an easy understanding of the moisture loss in relation to the initial sample size. This method ensures accurate representation of the moisture loss as it factors in the initial weight, providing context for the amount of water that was present before evaporation occurred. By correctly utilizing this formula, one can gain valuable insights into the moisture content of materials, which is essential for various construction applications, including assessing material quality and influencing mix designs.

**9. Under whose direction shall the inspection company operate?**

- A. A manager who is knowledgeable of the applicable standards and inspection processes used**
- B. A certified quality control inspector**
- C. An external regulatory body**
- D. The project owner or client**

The inspection company should operate under the direction of a manager who possesses knowledge of the applicable standards and inspection processes used. This ensures that the inspections conducted are compliant with industry standards and legal requirements, as well as tailored to the specific needs of the project. A knowledgeable manager can effectively communicate the standards and processes to the team, guide them through the inspection procedures, and ensure that quality control measures are appropriately implemented. Having a well-informed manager also facilitates the identification of potential issues during inspections and enables timely and accurate reporting. This leadership is crucial for maintaining the integrity of the inspection process and ensuring that all activities align with quality assurance objectives. While a certified quality control inspector can certainly bring expertise to the table, their role typically focuses on specific functional areas or projects rather than providing overarching direction. An external regulatory body may set standards and regulations but does not directly manage the performance of the inspection company. Likewise, the project owner or client may have their interests or requirements, but they do not possess the specialized knowledge necessary to direction oversight of inspection operations. Thus, the direction must be rooted in expert knowledge to ensure successful adherence to relevant standards and procedures.

**10. How do you calculate the yield of concrete?**

- A. By measuring the water content only.**
- B. By determining the height of concrete placed.**
- C. By determining the volume of concrete produced from its constituent materials.**
- D. By evaluating the time taken for mixing.**

Calculating the yield of concrete involves determining the volume produced from its constituent materials, such as cement, water, aggregates, and any admixtures. The yield is usually computed by taking into account the specific proportions of these materials used in the concrete mix and confirming that they will produce a certain volume when mixed. This approach considers the materials' contribution to the total volume of concrete, accounting for factors like the density and specific gravity of the materials involved. It provides an accurate method for predicting the amount of concrete that will be produced, which is essential for planning and ensuring that enough material is available for the project. Other methods mentioned, such as measuring only water content or evaluating the height of placed concrete, do not provide a comprehensive assessment of the entire mix composition. Measuring mixing time alone does not relate directly to the yield of concrete produced. Therefore, determining the yield through the constituents' volume gives the most precise and actionable information for concrete yield calculations.