National Fireplace Institute Certification Exam Preparation:

Practice Exams
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National Fireplace Institute
Woodburning Specialist
Certification Exam Preparation:

Woodburning Study Guide
The Hearth, Patio & Barbecue Education Foundation is pleased to furnish you with the Exam Study Guide to help you prepare for National Fireplace Institute Woodburning Specialist Certification Exam. It is important for you to understand three essential concepts:

1. The primary goal of Hearth, Patio & Barbecue Education Foundation programs is safety and responsibility through knowledge; the reference manual, study guides, training session, and certification exam work together to support that goal.
2. You get the most benefits from a training session and the greatest probability of success on the exam if you study the manual carefully and complete study exercise activities before you attend training. You should NOT depend solely on a training session to prepare you for the exam. You should NOT expect to pass the exam without reading the manual.
3. The enclosed Exam Study Guide is designed to help make you familiar with the kinds of questions on the Exam. It also demonstrates the kind of reasoning needed to choose correct answers and indicates why other answers are wrong.

We hope you will start the learning process now with the Reference Manual and Woodburning Study Exercises. You'll be starting a process that will help you learn, organize, and reinforce the knowledge that leads to professional certification and expertise.

The purpose of this study guide is to familiarize you with the nature of NFI exams so that testing reflects your knowledge and preparation as much as possible rather than your ability to take tests.

TEST OBJECTIVES

NFI Certification exams are intended to motivate examinees to confirm and increase their professional knowledge, to give them an opportunity to use that knowledge and careful attention to details in a challenging test, and to provide the rewards of professional recognition through certification. The exam itself consists of multiple choice questions which call for thorough knowledge of the information in the manual and the ability to apply that information in practical situations. While the exam studiously avoids "trick questions" whose purpose is demonstration of test taking skills, the essential professional skills of careful reading, attention to details, and clear reasoning that are called for in interpreting installation instructions and other technical information are purposely included in the exam.

TESTING INFORMATION

NFI Exams are based on the information, and application of the information contained in the current HPBEF Reference Manual. Each question is keyed to a specific educational objective and to a specific passage in the manual. Questions dealing with regulatory or code matters refer to the information in the manual about the relevant code or regulations. NFPA 211 is considered a fundamental reference source. Familiarity with NFPA 211 is essential to success on the certification exam.
Multiple choice questions in NFI exams call on you to select the best possible answer from four choices. Multiple choice testing is an exercise in careful discrimination between correct and apparently correct answers. A good question requires precise knowledge and attention to detail. Our effort is to avoid "trick questions" about insignificant information while challenging your mastery of manual subjects. The incorrect answers, known as detractors or foils in testing must be close or similar to the correct answer, but in some detail incorrect, in order for the question to be challenging and indicative of mastery rather than a result of superficial knowledge or guessing.

Types of Multiple Choice Questions

Selection of True Statement

Some multiple choice questions offer four statements and ask for selection of the true statement. The process is one of focusing in each statement on qualifiers like both, only, the best, all; paying close attention to defining categories of products and processes; and watching for correct logic in resulting conditions (true and related cause and effect). As clearly false statements are eliminated, the process may shift to checking the remaining choices by stating the reason the answers seem true or false. For example:

1. Which of the following statements about NFPA 211 requirements for chimney connector is true?
   a. A connector can pass through a floor or ceiling if adequate clearance is maintained.
   b. Connector slip joints do not have to be mechanically attached (fastened with screws).
   c. A connector routed through a listed wall pass-through device must be constructed of stainless steel or its equivalent.
   d. A connector to a masonry chimney shall extend 2 inches past the inner face of the chimney liner.

REASONING PROCESS

The elimination process may vary, but perhaps (b) and (d) can be eliminated first. NFPA 211 calls for “joints [to be] fastened -with sheet-metal screws, rivets, or other approved means.” Moreover, if not secured, a slip joint may do what it is supposed to when unsecured, that is, slip and become disconnected during use. For (d), NFPA 211 clearly calls for the connector to extend "to the inner face or liner but not beyond...." We can reach the logic of this requirement by considering the possibility of the connector extending too close to the opposite liner wall and restricting or blocking flow. The remaining answers, (a) and (c), may depend less on logic than on knowledge of NFPA 211. Answer (a) is eliminated by knowledge of the requirement that a connector "shall not pass through any floor or ceiling.... " Answer (c) not only remains as the last possibility, but knowledge of NFPA 211 that the qualities sought in this type installation are resistance to corrosion, softening, and cracking under 1800°F leads to the logic of the regulation. Answer (c) is correct.
Selection of False Statement
Occasionally it is necessary to word a question in the negative. The search then is for the statement that is false. The words NOT TRUE are printed in capital letters to flag such questions. For example:

2. Which of the following statements is NOT TRUE?
   a. A connector cannot pass through a floor or ceiling.
   b. Connector slip joints must be mechanically secured (fastened with screws).
   c. A connector routed through a listed wall pass-through device must be constructed of black steel or its equivalent.
   d. A connector to a masonry chimney shall not extend beyond the inner face of the chimney liner.

REASONING PROCESS
Care should be taken to make sure that the chosen answer is false. Check the chosen answer by asking yourself why it is not true and what would make it true. A connector should not pass through a floor or ceiling, so answer (a) is not the correct answer. Answer (b) is not the correct answer because slip joints must be mechanically secured. Answer (c) is the correct answer because the connector in this situation must be stainless steel or its equivalent. And (d) is not the correct answer because it is true that the connector should not extend beyond the inner face of the liner.

Qualifying Conditions
Attention must be paid to qualifying adjectives such as some, both, all, and all...except. Be sure to check the chosen answer with respect to these qualifiers. For example:

3. Which of the following is best characterized by consideration of ALL the following factors: size of the room, openings to other rooms, traffic patterns, proximity and convenience to fuel storage, desired chimney location?
   a. Selection of the appliance location
   b. Selection of the proper sized appliance
   c. Selection of the type of appliance
   d. Selection of the type of chimney

REASONING PROCESS
The key to this type of question is making sure the answer choice fits all the factors, not just some. For instance desired chimney location is a consideration for the type of chimney (d) and the size of a room and its openings may affect choices of the type of appliance (c), but only the selection of the appliance location (a) calls for consideration of all the listed factors.
4. ALL of the following contribute to good chimney draft EXCEPT:
   a. Tall rather than short chimney
   b. Cross sectional area much larger than the flue outlet
   c. Protection of chimney from cold weather
   d. Straight rather than offset or angled chimney

REASONING PROCESS
Questions with the all capital letters EXCEPT call for the selection of a false statement or for the one answer that does not fit the described condition or situation. One method of attacking this type of question is to make the main statement a question. Here that would be: Does this contribute to good chimney draft? The correct answer will be the selection whose answer is no. Here that selection is (b)

Resulting Conditions
Cause and effect multiple choice questions are marked by terms such as because, has the effect of, contributes to, in order to, and the like. The correct answer is the choice which is most directly related to the condition or effect in question. The incorrect answers, or detractors, may have an insignificant relationship, or they may not be correctly related at all. Sometimes answers will give a pair of conditions or effects; both must be correct in order for the question to be correct. Cause and effect answers can be checked by supplying the reason the cause and effect are related or why other choices are incorrect.

5. The small (crimped) end of chimney connector should point downward because:
   a. This method prevents smoke from escaping from the joint.
   b. This method increases draft by blocking excess air intake.
   c. This method makes sure that the connector fits outside the flue collar.
   d. This method contains solid and liquid materials inside the connector.

REASONING PROCESS
Answer (a) is an example of a myth or misconception that defies the physics of the situation. An air leak at this point would allow air to be pulled into the connector unless there was a blockage (in which case smoke would escape regardless of the direction of the connector). Answer (b) hints at these facts, but the sealing method, not the direction of the connector affects whether air enters the joint. Answer (c) alludes to the proper alignment of connector from its starting point to its connection with the chimney, but describes the opposite effect of having the small end down. The correct answer, (d), requires some familiarity with condensation and creosote accumulation and with the desire to contain these messy materials. Attacking and checking this type of question is aided by attempting to state whether the cause and effect are related, and why they are or are not. It may also be helpful to try to think about what would have to be different about an answer in order for it to be correct.
Familiarity with Code Regulations

Hearth Reference Manuals recognize the hierarchy of the building code system and the fact that it is the local "authority having jurisdiction" that determines what instructions and regulations must be followed. NFPA 211, however, is regarded as a nationally recognized, comprehensive document that provides guidelines for both listed and unlisted solid fuel equipment. The woodstove specialist may be called on to supplement or know exceptions to this body of information, but it is nonetheless a foundation that is essential knowledge for solid fuel professionals.

6. According to NFPA 211, a masonry wall constructed directly against a combustible wall can reduce appliance clearances by no more than:
   a. 25%
   b. 33%
   c. 50%
   d. 66%

REASONING PROCESS
Obviously, the question calls first for knowing details of the NFPA clearance reduction system. Then attacking the question is a matter of focusing on the specifics of the question: 1. a masonry (not sheet metal or other material), 2. constructed directly against the combustibles (not ventilated with an air space), 3. wall (not ceiling), and 4. by no more than (the maximum clearance reduction percentage, even though certain conditions and appliance clearances may not in every case allow this much). Following this process leads to (b) 33%.

7. An opening is to be cut on an exterior wall of a house to accommodate a masonry chimney. The inside surface of the chimney is to be flush (on the same plane with) the inside wall of the room. According to NFPA 211, what is the minimum opening size in the wall if the chimney is 24 inches wide?
   a. 24 inches
   b. 26 inches
   c. 28 inches
   d. 32 inches

REASONING PROCESS
The first consideration is determining the NFPA category of the chimney. An interior chimney is one which has "any portion of the chimney within the exterior wall of the building" so an exterior chimney must be situated completely outside the exterior wall. In this case, the chimney extends into the exterior wall and must be considered an interior chimney. The second matter is knowing that interior chimneys have a 2 inch clearance and exterior chimneys a 1 inch clearance. The opening size must be 24 inches (chimney width) + 2" + 2"(clearance on each side of the chimney): The answer is thus (c).
Application of Knowledge

Many multiple choice questions allow you to demonstrate your ability to use the information in the manual in practical situations. You may be called on to interpret sample manufacturer's instructions and diagrams, and code regulations; to use supplied formulas; and to perform mathematical calculations (you may bring and use a hand held calculator). These questions call for careful calculations as well as accurate interpretation of supplied information and knowledge of applicable regulations. Examples of these questions include:

8. If the appliance in Figure 1 is UNLISTED, what is the minimum clearance to combustibles without protection for A?
   a. 12 inches  
   b. 18 inches  
   c. 24 inches  
   d. 36 inches

REASONING PROCESS
Pay careful attention first to the qualifiers: unlisted appliance, minimum clearance, without protection. Then determine what is being asked for; here, for dimension A, the distance from the back of the appliance to the combustible wall. Then recall the appropriate NFPA information: 36 inches minimum clearance for an unlisted appliance to an unprotected combustible wall, answer (d).
9. What is the minimum distance from the cabinet in Figure 1 to the wall behind the back of the UNLISTED appliance if the appliance is 24 inches deep (front to back) and the combustible wall is protected with a properly ventilated sheet metal?
   a. 96 inches
   b. 72 inches
   c. 48 inches
   d. 36 inches

REASONING PROCESS
Though complicated, this is the kind of information that professionals must accurately supply their customers. One method is to break the process into steps:
   • Determine the NFPA category by focusing on the qualifiers: unlisted appliance, minimum clearance, protected (ventilated) wall.
   • Determine what dimension is asked for: distance from the cabinet to the combustible wall behind the appliance.
   • Determine what segments on the illustration make up this dimension: from the wall to the back of the appliance, from the back of the appliance to the front of the appliance, and from the front of the appliance to the cabinet.
   • Determine the parts of that dimension that are known: the depth of the appliance, 24 inches.
   • Determine the parts of that dimension that are not known: the distance from the wall to the back of the appliance; the distance from the front of the appliance to the cabinet.
   • Apply what you know of NFPA clearance and reduction methods to these unknowns: without protection the minimum distance from the appliance to the wall is 36 inches; with ventilated sheet metal, this can be reduced by 66% and be 12 inches (36 x 66 = 24 inches that can be subtracted from the normal clearance of 36 inches; 36 - 24 = 12 inches). The minimum distance from the front of the appliance to the unprotected cabinet is 36 inches.
   • Apply what you now know to the sought for dimension:
     o Protected combustible wall to back of appliance  12
     o Back of appliance to front of appliance  24
     o Front of appliance to cabinet  36
     o Wall to cabinet  72 inches
   • Find the correct answer, here (b).
10. For the appliance in Figure 2, use the dimensions and information in the Combustibles Table to determine the minimum clearance for (C) using single wall connector.

   a. 15 inches
   b. 12 inches
   c. 18 inches
   d. 10 inches

**REASONING PROCESS**
Determine what is being asked for, the distance from the side of the appliance to the combustible wall. Then focus on the particular conditions, here using single wall connector. Then carefully find the single wall dimensions and specifically (C), or 18 inches. Then match with (c) in the answers.
11. For the appliance in Figure 2, the customers want the floor protector to extend as little as possible into the room. They are willing to use whatever type of connector or wall protection that will provide that distance. Using appropriate protection and connector, what is the minimum distance from the wall behind the appliance to the front of the floor protector?
   a. 48 inches
   b. 50 inches
   c. 52 inches
   d. 57 inches

   **REASONING PROCESS**
   Analysis with this question can begin with a careful look at the desired dimension, the smallest distance possible from wall behind the appliance to the front of the floor protector. Note that the dimension called for is the extension from the wall, not the minimum dimensions of the floor protector (even though the floor protector is shown in the diagram with its minimum extension behind the appliance, not extending to the wall). You must next think what factors determine where the front of the protector lies. The distance from the front of the floor protector to the front of the appliance must be at least 18 inches; the depth of the appliance is known to be 24; that leaves the variable dimension the distance from the back of the appliance to the combustible wall, represented in the diagram as A. The focus on this variable dimension can begin with a look at the clearances table. Using double wall connector appears to give the closest clearance at 10 inches. Your knowledge of NFPA 211 should be exercised at this point. A ventilated wall offers the greatest clearance reduction percentage, but you also know that after using these reduction methods, the appliance can be no closer than 12 inches, unless the listing allows for closer placement without protection. Therefore, the closest rear clearance is the listed clearance, 10 inches. The next step is adding the segments that make up the desired dimension:
   - Front edge of protector to front of appliance 18
   - Front of appliance to rear of appliance 24
   - Rear of appliance to combustible wall using double wall connector 10
   - Front edge of protector to rear wall 52 inches

   **The minimum extension of the floor protector from the rear wall is therefore 52 inches, or answer (c).**
   (A variation of this question might ask under what conditions the floor protector could be this small.)

12. The installer for the appliance in Figure 2 wants to know the location for the factory built chimney. The appliance is to be installed at minimum clearances with vertical single wall connector pipe, and a ventilated masonry wall is constructed from floor to ceiling behind the appliance. How far is the centerline of the factory built chimney from the wall behind the appliance?
   a. 18 inches
   b. 21 inches
   c. 11 inches
   d. 7 inches
REASONING PROCESS
After determining that you are looking for the distance from the wall behind the appliance to the centerline of the connector pipe (which will be the same as the centerline of the factory built chimney above it), you must sort through the conditions for the installation. The diagram indicates that this dimension is represented by (B) (but notice carefully the measurement from the centerline of the connector; another question might depend on a measurement from the outside wall of the connector, which would be determined by knowing the diameter of the pipe and dividing it by 2 to get the radius, or distance from the centerline to the outside connector wall).

The question calls for minimum clearance placement of the appliance, so we determine first how close to the wall the appliance can be placed. Dimension (A) on the single wall connector chart is 15 inches without protection. We apply the NFPA reduction of 66% and get 5 inches, but we know the limitation of 12 inches minimum clearance of such reduction systems. We find that the appliance can be placed 12 inches from the wall, or 3 inches closer than without protection. If the appliance is placed 3 inches closer than normal with protection, the centerline of the connector will of course be 3 inches closer than its placement of 21 inches without protection so it will be 18 inches, answer (a).

13. For Figure 3, what is the minimum height of Chimney A above the point where it penetrates the roof if the roof pitch is 3/12 and chimney is 3 feet from the peak of the roof?
   a. 24 inches
   b. 33 inches
   c. 36 inches
   d. 45 inches

REASONING PROCESS
Knowledge of the 2-foot, 10-foot, 3-foot rule is the first consideration. Since the peak is within 10 feet of the chimney, it is the highest point and at least 2 feet of chimney must extend above it. We calculate the difference in height between the chimney roof penetration and the peak (how much chimney will be required to be level with the peak):

If the roof rises 3 inches in elevation in 1 foot of horizontal run, it must rise 9 inches in 3 feet of run (the horizontal distance from the chimney to the peak).

\[
\frac{3}{1} = \frac{x}{3}
\]

Multiply both sides by 3:

\[
9/1 = 3x/3
\]

\[
x = 9
\]

The next step is adding the 2 feet (24 inches) to this vertical rise of 9 inches; the result is 33 inches. The chimney height rule maintains, however, that the minimum height of the chimney above the roof penetration must be 3 feet (36 inches), regardless of roof pitch. So the answer is (c) 36 inches.
14. Which of the following is the shortest distance a factory built chimney can extend below a cathedral (sloped) ceiling in order that the single wall connector that joins it be at least 18 inches from the ceiling when the ceiling follows a 10/12 pitch?
   a. 12 inches
   b. 14 inches
   c. 15 inches
   d. 18 inches

REASONING PROCESS
Slope is simply the reverse of roof pitch. You may want to sketch on your scratch paper an illustration such as this:

The triangle abc represents the ceiling at a 10/12 slope; that is, the ceiling drops 10 inches in height for every 12 inches of horizontal run. The triangle xyz, represents the chimney extension into the room (xy) and the known desired minimum distance from the chimney to the ceiling (yz), 18 inches. You may phrase the question: If the ceiling drops 10 inches in 12 inches of horizontal run, how many inches will it drop in 18 inches of run?

\[
\frac{10}{12} = \frac{x}{18}
\]

Multiply both sides by 12:
\[
10 = 12x/18
\]
Multiply both sides by 18:
\[
180 = 12x
\]
Divide both sides by 12
\[
15 = x
\]

We know that the chimney must extend at least 15 inches into the room in order for it to be at least 18 inches from the ceiling. Answers a and b are eliminated because they are not at least 15 inches, (c) is correct, (d) is more than we need.
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Woodburning Practice Exam
Answer the questions below and click "Submit" to check your answers when you have completed all the questions.

1. Which of the following statements is true?
   a. A catalytic combustor glows to indicate proper operation.
   c. A catalytic combustor temperatures below 350 degrees F, the by-pass damper should be open.
   d. Catalytic combustors work most effectively at high burn rates.

2. Poor chimney draft can cause all of the following EXCEPT:
   a. Rapid burning of the fuel load
   b. Smoke spillage into the house
   c. Poor appliance performance
   d. Increased need for chimney maintenance

3. In comparison to Appliance to Flue Fireplace Conversion (partial relining), the Full Relining Fireplace Conversion (full relining to the top of the chimney) has the disadvantage of:
   a. More difficult cleaning
   b. Greater initial cost
   c. Lack of UL1777 listing
   d. Weaker draft

4. Which of the following clearance reduction practices is NOT acceptable according to NFPA 211?
   a. 1 inch air space between the shield and the combustible wall in a ventilated clearance reduction system
   b. Air tight seal around a connector passing through a masonry wall shield
   c. Masonry wall in contact with combustibles
   d. Noncombustible wall ties securing a ventilated masonry wall shield

5. Which of the following is NOT an NFPA 211 requirement for a masonry chimney?
   a. Smoke test after construction
   b. Cleanout opening
   c. Firestopping floors and ceilings through which the chimney passes
   d. Flue liner termination flush with the splay or wash

6. What is the minimum height above the roof penetration for the chimney in Figure 1?
   a. 42 inches
   b. 66 inches
   c. 90 inches
   d. 120 inches
7. The UNLISTED appliance in Figure 2. is connected to a factory built chimney through the ceiling with vertical single wall connector that is flush with the back of the appliance. The sheet metal shield behind the appliance is properly ventilated and extends 3 feet above the top of the appliance and 3 feet past both sides of the appliance. The top of the appliance is 30 inches above the floor and the ceiling height is 8 feet. What is the minimum clearance from the back of the appliance to the combustible wall?
   a. 6 inches
   b. 12 inches
   c. 18 inches
   d. 36 inches
8. The appliance in figure 3 is vented vertically to a factory built chimney. How far from the wall behind the appliance should the centerline of the factory built chimney be if the appliance is installed with single wall connector at minimum clearances and a floor to ceiling masonry wall is constructed in contact with the combustible wall behind the appliance?
   a. 15 inches
   b. 18 inches
   c. 19 inches
   d. 22 inches

9. Using Figure 3, what is the minimum distance from the side of the appliance to the closest wall a properly sized ventilated wall protection system is constructed on that wall and the appliance is vented with a listed double wall connector?
   a. 6 inches
   b. 5 inches
   c. 10 inches
   d. 12 inches
10. If the appliance in Figure 5 is installed with single wall connector and no protection on the walls, which of the following choices is the shortest distance from the corner to the front of the floor protector?

Formula for calculating the distance from the wall corner to the front of the appliance:
- \( X = R \times 1.4 + \frac{W}{2} + Y \)
- \( X \) is the distance from wall corner to front of appliance.
- \( R \) is the clearance from appliance rear corner to wall. 1.4 is a constant
- \( W \) is half the stove width
- \( Y \) is the stove depth
a. 50 inches
b. 65 inches
c. 68 inches
d. 48 inches
Woodburning Practice Exam
Answer Sheet

1. Selection of true statement. (a) is false because although the combustor may glow at temperatures over 1000 degrees F., it is not necessary for the combustor to glow to achieve good performance. (b) is false because over 1800 degrees F is dangerously overheating. (c) is correct because the smoke and heat need to be directed to the chimney to establish draft and to allow the combustor to reach operational temperatures, which begin somewhere above 350°F. (d) is false because "once the catalyst is activated, the appliance works best at low to moderate burn rates.

2. Resulting condition. While poor draft can cause (b), (c), and (d), it cannot be the cause of rapid fuel burning.

3. Resulting condition. While the Full Relining Conversion has the advantages of easier cleaning, the possibility of UL 1777 listing, and potentially stronger draft if compared to conventional masonry flue liners, it does have the disadvantage of greater initial cost.

4. Familiarity with code. The important footnotes to the table specify that there must be at least a 1 inch air space between the clearance reduction system and the combustible wall in answer (a) and there can be noncombustible wall ties to secure the shield answer (d). The table provides for clearance reduction with a masonry wall in contact with combustibles (c) however, specifically requires an air space between the connector and a masonry wall through which it passes, so answer (b) is not acceptable and therefore the correct answer.

5. Familiarity with code. There should be a smoke test (a), cleanout access (b) and fire stopping (c), but the flue liner should extend at least 2 inches above the wash/splay. (d) is correct.

6. Application of knowledge. In the 6' of horizontal run on the less steep 3/12 roof pitch, the roof rises 6 (feet of run) x 3 (inches of rise per foot) or 18 inches. From the point where the roof pitch increases to 12/12 to the peak of the roof is 12 - 6 = 6 feet more of horizontal run. But we are concerned with the point 10 feet from the chimney, so we are only concerned with the rise on the steeper roof pitch of 4' of horizontal run (10 total run - 6 run on/12 roof = 4' run on 12/12 pitch roof) in 4' of horizontal run the roof rises 4'. We convert this to 48 inches, add the 18 inches of rise on the 3/12 pitch roof to get 64 inches and then add the 24 inches needed to be 2 feet higher than this point 10 feet from the chimney. The answer is thus 66 + 24 = 90 inches (c).

7. Application of knowledge. It is the connector that determines the clearance because the sheet metal shield does not extend to the ceiling. The minimum clearance for unprotected single wall connector is 18 inches (c).
8. Application of knowledge and calculation. First determine the placement of the appliance. The listed clearance A, 16 inches can be reduced by as much as 33% by the masonry wall. 16 x .33 =5.28 inches, but the minimum clearance with 1" NFPA reduction systems is 12 inches. That distance would make (B) 15 inches from the wall (subtract (B) from (A) to determine that the back of the connector is 3 inches from the back of the appliance). But the question asks for the centerline of the factory built chimney (which is also the centerline of the connector). So we must add the radius (1/2" the diameter) of the connector to this number. Half of 6 =3, so the centerline of the chimney must be placed 12 + 3 + 3 = 18 inches from the wall behind the appliance (b).

9. Application of knowledge and calculation. The listed clearance (C) is 15 inches with a double wall connector. 66% reduction would be a clearance of 5 inches, but the ventilated wall system can only reduce the clearance to 12 inches (d).

10. Calculation. F - R (12) x 1.4 + W(20)/2 + D (22). 12 x 1.4 is 16.8. 20/2 is 10. So 16.8 + 10 + 22 = 48.8, the distance from the comer to the front of the appliance. We then add 18 inches, the minimum floor protector extension in front of the appliance to get a minimum distance of 66.8 Inches (c).
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Woodburning Study Exercises
Pre-Training Study Suggestions

1. The Certification Exam is based on the Reference Manual. Every question is related to one or more of the Knowledge Statements located in the Index of Knowledge statements and to a specific passage in the manual. Be sure, above all else, to read and think about the contents of the manual and to pay attention to the Knowledge Statements. Highlight important terms and information. Keep a list of areas that you find difficult or that you have questions about as you proceed.

2. Completing the Practical Applications at the end of each chapter of the Reference Manual will test and reinforce your understanding and memory of manual information and contents. Since suggested answers included in the manual may prevent you from the learning experience of seeking your own answers, selected questions from the Practical Applications sections and additional exercises are printed below so that you can write your own answers without looking at the suggested answers.

3. You should understand that the certification exam questions are multiple choice. These activities are designed to supplement and help focus your pre-training study. They do not necessarily cover all of the information for questions on the exam. If you are attending NFI Exam Review Course, you cannot get full benefits from the training seminar without reading the manual and checking your knowledge before you attend.

Answer/complete the following (use extra paper as needed):

**Basics of Burning**

1. List in order the stages of combustion, the temperature range of each, and the main characteristic of each stage.

2. What effect does leaving the appliance door completely open have while starting a fire have? Why?

3. What does the presence of smoke exiting the chimney indicate about the combustion process of the appliance?
4. What information in this section underscores the importance of a) maintaining high chimney temperatures and b) installing chimney connector small end downward?

Combustion Efficiency
5. List the results of incomplete combustion and why each is a concern.

6. Discuss the reasons manufacturers are concerned with temperature, turbulence, and time in improving combustion efficiency.

7. What conditions promote creosote build-up?

Heat Transfer and Overall Energy Efficiency
8. Relate the differences between combustion efficiency, heat transfer efficiency, and overall energy efficiency.

9. A stove owner wants to install a chimney connector heat reclaiming device like the one he has used with his pre-EPA appliance. Make a recommendation and give a rationale.
10. How can a blower affect heat transfer and overall efficiencies?

**Factors Affecting Efficiency**
11. List the primary factors that affect combustion efficiency.

12. List the primary factors that affect overall efficiency.

13. Compare and contrast catalytic and non-catalytic approaches to combustion efficiency.

14. Calculate the moisture content on the dry and wet basis for a piece of wood that weighs 10 pounds wet and 4 pounds when oven dried.

**Categories of Solid Fuel Appliances**
Space Comfort

16. List factors affecting the selecting appliance location.

17. In the following situations analyze and evaluate the given information in determining appliance size:
   a. The manufacturer's recommended heating area for an appliance is 2000 square feet.
   b. The EPA hang tags for two different appliances show high output of 34,000 BTUs.
   c. A customer describes his new house as 3000 square feet.

Codes and Standards

18. List the UL solid fuel appliance standards and the main characteristics of appliances tested under the standard.

19. List the primary HUD requirements for mobile home appliance installations.

20. What is the difference between "labeled" and "listed"?
Emissions Regulations
21. List the characteristics of appliances exempted from EPA regulations.

22. Describe the EPA test procedures.

Basics of Draft
24. List and explain the factors that affect draft.

25. Explain the relationship between draft and combustion air requirements in tightly constructed homes.

26. Describe the characteristics of an effective venting system.
27. Why are draft considerations more critical for EPA certified high efficiency appliances than for earlier, less efficient appliances?

**Chimneys**

28. Compare and contrast factory-built and masonry chimneys, including their safety standards requirements.

29. What factors contributed to the use and development of solid insulation in factory-built chimneys?

**Chimney Connectors**

30. Explain guidelines for length of single wall chimney connectors.

31. Explain safety precautions that must be taken with double wall chimney connectors.

32. What are the most important distinctions between the terms "chimney" and "chimney connector"?
Combustibles

33. Describe the criteria that walls/ceilings and floors must meet in order to be considered noncombustible.

34. Respond to the customer who insists his masonry chimney which touches combustibles is safe because "it's been there for years without a problem.

35. Distinguish between clearance and protection.

Planning the Installation

36. Explain the maximum allowable clearance reduction by NFPA 211 means.

37. Create a checklist of installation planning considerations for freestanding, insert, and built-in appliances.

38. Create a checklist of installation planning considerations for chimney connectors and chimneys.
39. A customer objects to installing a stainless liner in his new chimney because it already has a liner (13 x 13 clay flue liner). Relay the possible consequence of not following the full lining design for an insert with a 6 inch flue collar.

Chimney Installation
40. State and explain the rule for minimum chimney height above a roof. Explain its limitations.

41. List NFPA 211 masonry chimney construction requirements regarding flue liners, chimney walls, interior and exterior clearances, chimney crown, multiple flues, mortar, thimbles, and cleanout.

42. Determine the minimum chimney height above the roof for the following situations:
   a. the roof pitch is 8/12 and the chimney is 7 feet from the ridge.
   b. the roof pitch is 3/12 and the chimney is 3 feet from the ridge.

43. What is the minimum length of the roof opening cut out for the following chimneys and roofs?
   a. the roof is flat; the outside diameter of the chimney is 9 inches.
   b. the roof is 4/12; the outside diameter of the chimney is 9 inches.

44. How much factory-built chimney must extend below the low point of its penetration of a sloped cathedral ceiling? Minimum chimney connector clearance to combustibles is 18 inches. Calculate for a 6" connector with 9" o.d. chimney.
Solid Fuel Appliance Installation

44. What are the NFPA 211 minimum clearances from an unlisted appliance to a combustible wall; from single wall connector to a combustible wall?

45. What NFPA 211 clearance reduction methods reduce clearances up to
   a. 33%
   b. 50%
   c. 66%

46. What is the closest clearance allowable using NFPA 211 reduction methods for unlisted and listed stoves?

47. What type of floor protection is required in NFPA 211 for unlisted appliances with:
   a. legs less than 2 inches in height
   b. legs 2-6 inches in height
   c. legs greater than 6 inches?
**Chimney Connector Installation**

48. What are the minimum allowable clearances in inches for chimney connectors when the clearance reduction method allows up to
   a. 33% to wall

   b. 50% to wall; to ceiling

   c. 66% to wall; to ceiling

49. List the installation considerations for single wall connector; for double wall connector.

50. Give the minimum clearance from the appliance to an unprotected combustible wall in the following situations (all are top exit appliances and use single wall chimney connector which has a minimum clearance of 18" to unprotected combustibles):
   a. Appliance clearance is 36"; flue collar is flush with back of appliance.

   b. Appliance clearance is 14 "; flue collar is flush with back of appliance.

**Thimbles and Wall Penetrations**

51. List the approved methods of wall pass-through and discuss the advantages and disadvantages of each.

**Venting into Fireplaces**

52. Identify installation concerns and problems for each of the fireplace conversion methods:
   a. Chimney Breach

   b. Appliance to Flue Connection

   c. Full Relining
53. Identify potential problems involved in venting solid fuel appliances into factory-built fireplaces.

Communication with Users: Operating the Solid Fuel Appliance

54. Explain the significance of the following temperature readings (1" and downstream of combustor) for a catalytic appliance:
   a. up to 350° F
   b. 350-550° F.
   c. 1000°F.
   d. 1600°F.
   e. over 1800°F.

55. Compare fuel loads and operational techniques for EPA catalytic, EPA non-catalytic, and noncertified appliances.

56. List causes of smoke spillage and back buffing.

57. Outline preventive safety measures operators should know and practice.
58. What are guidelines for frequency of chimney cleaning?

60. What primary characteristic of catalytic combustors do owners need to be aware of.
The Hearth, Patio & Barbecue Education Foundation is pleased to furnish you with the Exam Study Guide to help you prepare for National Fireplace Institute Gas Specialist Certification Exam. It is important for you to understand three essential concepts:

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6. This Exam Study Guide is designed to help make you familiar with the kinds of questions on the Exam. It also demonstrates the kind of reasoning needed to choose correct answers and indicates why other answers are wrong.

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TEST OBJECTIVES

NFI Certification exams are intended to motivate examinees to confirm and increase their professional knowledge, to give them an opportunity to use that knowledge and careful attention to details in a challenging test, and to provide the rewards of professional recognition through certification. The exam itself consists of multiple choice questions which call for thorough knowledge of the information in the manual and the ability to apply that information in practical situations. While the exam studiously avoids "trick questions" whose purpose is demonstration of test taking skills, the essential professional skills of careful reading, attention to details, and clear reasoning that are called for in interpreting installation instructions and other technical information are purposely included in the exam.

TESTING INFORMATION

NFI Exams are based on the information, and application of the information contained in the current HPBEF Reference Manual. Each question is keyed to a specific educational objective and to a specific passage in the manual. Questions dealing with regulatory or code matters refer to the information in the manual about the relevant code or regulations. Familiarity with topics from the National Fuel Gas Code and ANSI categories of appliances and venting is important.
Multiple choice questions in NFI exams call on you to select the **best possible** answer from four choices. Multiple choice testing is an exercise in careful discrimination between correct and apparently correct answers. A good question requires precise knowledge and attention to detail. Our effort is to avoid "trick questions" about insignificant information while challenging your mastery of manual subjects. The incorrect answers, known as detractors or foils in testing must be close or similar to the correct answer, but in some detail incorrect, in order for the question to be challenging and indicative of mastery rather than a result of superficial knowledge or guessing.

### Types of Multiple Choice Questions

#### Selection of True Statement

Some multiple choice questions offer four statements and ask for selection of the true statement. The process is one of focusing in each statement on qualifiers like both, only, the best, all; paying close attention to defining categories of products and processes; and watching for correct logic in resulting conditions (true and related cause and effect). As clearly false statements are eliminated, the process may shift to checking the remaining choices by stating the reason the answers seem true or false. For example:

1. Which of the following is true about gas appliance ignition systems?
   a. Intermittent direct ignition systems require electricity.
   b. A piezo igniter lights a continuous pilot system when a thermostat senses a demand for heat.
   c. The electrode keeps the pilot flame burning when the main burner is off in intermittent pilot ignition systems.
   d. The hot surface igniter lights the pilot burner in hot surface ignition systems when the unit is turned on.

**REASONING PROCESS**

The call here is for careful categorization of these ignition systems and their characteristics. The elimination process may vary, but perhaps (b) and (c) are first to go. A match or piezo lights a continuous pilot system when the entire system (both pilot and main burner) are off, but then the pilot stays lit and provides the ignition as the main burner cycles on and off. For (c), the electrode lights the intermittent pilot, but both pilot and main burner go out when the unit is turned off or there is no heat demand. Answer (d) calls for the knowledge that hot surface igniters are direct ignition systems that have no pilot burners. Answer (a) must be checked by thinking whether all intermittent direct ignition systems, both hot surface and direct spark, require electricity, which they do.
Selection of False Statement
Occasionally it is necessary to word a question in the negative. The search then is for the statement that is false. The words NOT TRUE are printed in capital letters to flag such questions. For example:

2. Which of the following statements is NOT TRUE?
   a. LPG has a higher specific gravity than air.
   b. LPG has a higher specific gravity than natural gas.
   c. LPG has lower flammability limits than natural gas.
   d. LPG has a higher ignition temperature than natural gas.

REASONING PROCESS
Care should be taken to make sure that the chosen answer is false. Check the chosen answer by asking yourself why it is not true and what would make it true. The knowledge that LPG pools at the lowest level should indicate that its specific gravity (the weight of a cubic foot of gas compared to the weight of a cubic foot of air at the same temperature and pressure) is higher than both air and natural gas. It is important to know that the flammability limits (minimum and maximum percentage of fuel in the gas and air mixture that will support combustion) of LPG are lower than natural gas. This leaves (d), which is the correct answer (false), since LPG will ignite at a lower temperature than natural gas.

Qualifying Conditions
Attention must be paid to qualifying adjectives such as some, both, all, and all...except. Be sure to check the chosen answer with respect to these qualifiers. For example:

3. Which of the following gas hearth appliances could be equipped with ALL of the following characteristics: oxygen depletion sensor (ODS), blower, thermostat, annual fuel utilization (AFUE) rating?
   a. Direct-vent decorative fireplace
   b. Unvented heating gas log set
   c. Direct vent heating fireplace insert
   d. Decorative gas log set

REASONING PROCESS
The key to this type of question is making sure the answer choice fits all the factors, not just some. For instance, all heating gas appliances can include a blower and thermostat (and no decorative appliances can have a thermostat), but vented appliances are not equipped with ODS. The only heating, unvented appliance here is (b).
4. Flue blockage can cause ALL of the following main burner conditions EXCEPT:
   a. Lifting (blowing) flames
   b. Floating flames
   c. Yellow tipping in blue flame burner
   d. Flame rollout

REASONING PROCESS
Questions with the all capital letters EXCEPT call for the selection of a false statement or for the one answer that does not fit the described condition or situation. One method of attacking this type of question is to make the main statement a question. Here that would be: Can flue blockage cause this condition? The correct answer will be the selection whose answer is no. The answer to (a) is no because lifting flames are caused by excess primary air, which would not be the situation with a blocked flue.

Resulting Conditions
Cause and effect multiple choice questions are marked by terms such as because, has the effect of, contributes to, in order to, and the like. The correct answer is the choice which is most directly related to the condition or effect in question. The incorrect answers, or detractors, may have an insignificant relationship, or they may not be correctly related at all. Sometimes answers will give a pair of conditions or effects; both must be correct in order for the question to be correct. Cause and effect answers can be checked by supplying the reason the cause and effect are related or why other choices are incorrect.

5. A greater volume of gas will flow
   a. If gas pressure and specific gravity are constant and the orifice size is reduced.
   b. If specific gravity and orifice size are constant and gas pressure is reduced.
   c. If orifice size and gas pressure are constant and specific gravity is lower.
   d. If orifice size and gas pressure are constant and specific gravity is higher.

REASONING PROCESS
Attacking and checking this type of question is aided by attempting to state whether the cause and effect are related, and why they are or are not. It may also be helpful to try to think about what would have to be different about an answer in order for it to be correct. A reduction in orifice size (a) or in gas pressure (b) result in a reduction of gas flow. The choice between (c) and (d) requires an understanding that higher specific gravity means a denser gas that does not flow as quickly as a lower specific gravity gas. For example, about 83% more natural gas (specific gravity .6) will flow through the same orifice at the same pressure as butane (specific gravity 1.95). (c) is correct.
Familiarity with Code Regulations

HEARTH Reference Manuals recognize the hierarchy of the building code system and the fact that it is the local "authority having jurisdiction" that determines what instructions and regulations must be followed. The *National Fuel Gas Code*, however, is regarded as a nationally recognized, comprehensive document. Additionally, ANSI standards that delineate categories of gas hearth appliances and venting contain important information. References to these documents in the HEARTH manual should be paid careful attention.

6. Which of the following is NOT a requirement for unvented room heaters according to ANSI Z21.11.2?
   a. An unvented heater that has a rating between 6,000 and 10,000 Btu/hr can be installed in a bedroom but not in a bathroom.
   b. An unvented room heater must be wall mounted.
   c. Unvented room heaters not certified for bedroom or bathroom installation must be so marked.
   d. Unvented room heaters under 6,000 Btu/hr. cannot be used in a bedroom.

REASONING PROCESS
The question calls first for knowing details of the regulation. Answer (a) also calls for logical reasoning: heaters certified for bathrooms must be under 6,000 Btu/hr., and those certified for bedrooms under 10,000 Btu/hr. Therefore, a heater with a rating between 6,000 and 10,000 could be certified for use in a bedroom, but not in a bathroom. Answers (b) and (c) are clearly covered in the standard. Answer (d) is the correct answer since the standard makes no minimum Btu/hr. restriction.

7. According to the *National Fuel Gas Code*, an approved shutoff valve must be installed:
   a. Adjacent to the appliance
   b. No more than 12 inches from the appliance
   c. No more than 3 feet from the appliance
   d. No more than 6 feet from the appliance

REASONING PROCESS
The manual points out that requirements for placement of shutoff valves vary in different codes, but that the National Fuel Gas Code calls for placement within 6 feet of the appliance, answer d. Answers (a), (b), and (c) are incorrect since the distance between the appliance and the shutoff valve could exceed these distances.
Application of Knowledge

Many multiple choice questions allow you to demonstrate your ability to use the information in the manual in practical situations. You may be called on to interpret sample manufacturer's instructions and diagrams, and code regulations; to use supplied formulas; and to perform mathematical calculations (you may bring and use a hand held calculator). These questions call for careful calculations as well as accurate interpretation of supplied information and knowledge of applicable regulations. Examples of these questions include:

8. Which one of the following living rooms, all of which are connected to other living spaces with doors, is the smallest in which a room heater with a 40,000 Btu/hr. rating can be installed? A confined space is defined as having a volume less than 50 cubic feet per 1,000 Btu/hr.
   a. 25' x 20' with 8' ceiling
   b. 15' x 15' with 10' ceiling
   c. 12' x 15' with 10' ceiling
   d. 12' x 15' with 8' ceiling

REASONING PROCESS
The easiest approach is to determine first what the minimum volume that would be an unconfined space for this appliance. Multiply 40 (number of thousand Btu in 40,000) x 50 (maximum cubic feet per 1,000 Btu) = 2000 cubic feet minimum required volume. Since the question calls for the smallest acceptable room, it is necessary to calculate the volume for all four rooms. Answers (c) (1800 cubic feet) and (d) (1240 cubic feet) are eliminated because they are less than the required minimum. The rooms represented by (a) (4000 cubic feet) and (b). (2250 cubic feet) both exceed the minimum volume; the smaller, (b), is the correct answer.
9. In Figure 1: In which illustration of a pilot safety shutoff system is the pilot being lit?
   a. Illustration X
   b. Illustration Y
   c. Illustration Z
   d. None of the above

REASONING PROCESS
The key to the question is locating the gas flow inlets and knowing that gas flows to the pilot but not to the main burner during pilot ignition. Illustration Y shows this condition when the reset button is depressed, while X shows a closed valve with no gas flow, and Z shows the released reset button and gas flow to both pilot and main burners after the pilot is lit.
National Fireplace Institute
Gas Specialist
Certification Exam Preparation:

Gas Practice Exam
Answer the questions below and click "Submit" to check your answers when you have completed all the questions.

1. Which of the following statements about draft hoods is true?
   a. A draft hood prevents dilution air from entering the venting system.
   b. A draft hood prevents back draft from entering the appliance.
   c. A draft hood raises stack temperatures to increase draft.
   d. A draft hood keeps flue gases inside the appliance in the event of flue blockage.

2. All of the following could cause an appliance to continually go into a relight mode as the burner flame repeatedly cycles on and off EXCEPT:
   a. Flame rectification circuit sensing current flow.
   b. Gas pressure too high.
   c. Improper grounding of control module or of intermittent pilot hood/burner.
   d. Improper flame rod/hot surface igniter positioning.

3. Which of the following is true of liquefied petroleum gas (LPG)?
   a. LPG has a higher ignition temperature than natural gas.
   b. LPG requires a higher percentage of gas in the fuel/air mixture to achieve combustion.
   c. LPG are made up of larger molecules which contain more hydrogen and carbon atom bonds.
   d. LPG requires less air per cubic foot of gas than natural gas to achieve complete combustion.

4. All of the following can employ an oxygen depletion sensor (ODS) EXCEPT:
   a. Intermittent pilot ignition system
   b. Continuous pilot ignition system
   c. Unvented room heater
   d. Direct ignition system

5. Corrective action to deal with increased indoor humidity and condensation on walls, windows, and baseboards include all of the following EXCEPT:
   a. Proper vent sizing.
   b. Replacing a low efficiency appliance with a high efficiency appliance.
   c. Insulating the venting.
   d. Troubleshooting appliance performance.

6. The component in a pressure regulator which responds to changes in gas pressure and moves the valve disc up and down to keep gas flow constant is the:
   a. Valve seat
   b. Sensing hole
   c. Diaphragm
   d. Adjustment spring

7. Vehicular traffic, foundation settling, corrosion, and freezing are code considerations for:
   a. Location of gas piping
   b. Location of gas venting
   c. Location of direct vent outlets
   d. Location of electrical wiring
8. The component required on ALL decorative gas hearth appliances is:
   a. Thermostat
   b. Oxygen Depletion Sensor (ODS)
   c. Vent Safety Shutoff System
   d. Automatic Ignition Gas Shutoff

9. The combination control gas valve combines the functions of all of the following components EXCEPT
   a. Automatic safety shutoff
   b. Thermostat
   c. Pressure regulator
   d. Valve operator

10. Identify the component in the illustrated bi-metal limit switch which expands when heated to cause the switch to open.
    a. A
    b. B
    c. C
    d. D
Gas Practice Exam

Answer Sheet

1. Selection of true statement. Answers (a) and (c) are false because one of the purposes of the draft hood is introduction of dilution air into the vent to reduce stack temperatures and to regulate stack effect on the appliance. Answer (b) is correct because the draft hood provides an exit for back draft gases. Answer (d) is incorrect because the draft hood provides release for flue gases if the flue is blocked.

2. Resulting condition. Answer (a) is correct because the appliance should continue operation as long as current is sensed from flame rectification. Answer (b) could cause the on/off cycling if the high pressure results in flames lifting off the pilot hood or burner, preventing proper electrical current flow. Improper grounding, (c), can prevent the control module from sensing electrical flow. Improper igniter positioning can prevent sufficient electrical current to allow operation.

3. Selection of true statement. This question calls for knowledge of gas characteristics terminology and understanding of the differences between natural gas and LPG. LPG ignites at a lower temperature (lower ignition temperature), does not require as high a percentage of gas in the fuel/air mix (lower flammability limits), and requires more air per cubic foot of gas for complete combustion (higher combustion ratio). Only (c) is true: the larger molecules containing more hydrogen/carbon bonds in LPG account for its greater heat value.

4. Qualifier: all... except. Both intermittent and continuous pilot ignition systems (a) and (b) employ ODS if the appliance is unvented. ODS is required on all unvented room heaters (c). But since ODS is a pilot ignition system, a direct ignition system that lights the main burner directly cannot employ this technology.

5. Resulting condition. Sizing the vent properly (a) and insulating it (c) are actions that promote good draft and therefore might alleviate condensation problems. Likewise, making sure the appliance is performing properly (d) is an appropriate corrective action. But increased efficiency may make a condensation problem worse, since the appliance will deliver less heat to the vent, which promotes condensation.

6. Resulting condition: The valve seat (a) does not move at all. The adjustment spring can move the valve disc up and down, but it is set manually and does not detect pressure. The sensing hole (b) plays a role in the movement of the disc, but the hole does not directly move the disc as does the correct answer (c) the diaphragm.

7. Knowledge of code: In certain conditions, one or more of these concerns might play a role in (b), (c) or (d) but these are code considerations only for a location of gas piping.

8. Knowledge of code, ANSI Z21.60 and Z21.50 are the relevant standards. They provide that decorative appliances must not have a thermostat (a), ODS, (b) is only required for unvented
appliances (which cannot be decorative categories), Vent Safety Shutoff System, (c) are optional components on appropriate gas appliances. All decorative appliances must have an automatic gas ignition system that provides for automatic shutoff of main burner gas in the absence of flame, the correct answer, (d).

9. Qualifier: all... except. Answers (a), (c) and (d) are all part of the valve. Answer (c). Thermostat is not and is therefore the correct answer.+

10. Application of knowledge. The flexible switch arm (A) moves to open the switch contacts, but not by expanding in direct response to heat. Likewise, the plunger (B) moves up and down, but does not function by expanding. The terminal (D) neither moves nor expands. The correct component is the bimetal disc (C).
National Fireplace Institute
Gas Specialist
Certification Exam Preparation:

Gas Study Exercises
Pre-Training Study Suggestions

1. The Certification Exam is based on the Reference Manual. Every question is related to one or more of the Knowledge Statements located in the Index of Knowledge statements and to a specific passage in the manual. Be sure, above all else, to read and think about the contents of the manual and to pay attention to the Knowledge Statements. Highlight important terms and information. Keep a list of areas that you find difficult or that you have questions about as you proceed.

2. Completing the Practical Applications at the end of each chapter of the Reference Manual will test and reinforce your understanding and memory of manual information and contents. Since suggested answers included in the manual may prevent you from the learning experience of seeking your own answers, selected questions from the Practical Applications sections and additional exercises are printed below so that you can write your own answers without looking at the suggested answers.

3. You should understand that the certification exam questions are multiple choice. These activities are designed to supplement and help focus your pre-training study. They do not necessarily cover all of the information for questions on the exam. If you are attending NFI Exam Review Course, you cannot get full benefits from the training seminar without reading the manual and checking your knowledge before you attend.

Answer/complete the following (use extra paper as needed):

Fuel Characteristics
1. Name and explain briefly the meaning of terms used to describe fuel characteristics.

2. Make a table as below and fill in characteristics of gas fuels.

<table>
<thead>
<tr>
<th>Fuel Characteristic</th>
<th>Natural Gas</th>
<th>LPG</th>
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<tbody>
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3. What do the differences between natural gas and LPG mean and why are they important?
Combustion

4. List the requirements for combustion and their source for combustion of fuel gases.

5. List the products of complete combustion and their significance.

6. List the products of incomplete combustion and their significance.

Standards and Codes/Categories of Gas Appliances

7. Define terms:
   a. Standard
   b. Code
   c. Listed
   d. Label
   e. Authority having jurisdiction.
8. Fill in the requirements/prohibitions of each ANSI Standard:

<table>
<thead>
<tr>
<th>ANSI Standard</th>
<th>Heating or Decorative Appliance</th>
<th>Venting Options</th>
<th>Appliance Requirements &amp; Options</th>
<th>Appliance Prohibitions</th>
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<tr>
<td>Z21.50</td>
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**Control Devices**

9. List the main purposes of the combination control gas valve.

10. List the main components of the combination control gas valve and briefly describe how each works.

11. List the types of ignition systems, and describe how each works to do its job and be a safety system.

12. Explain the factors affecting gas flow rate and how changing one affects the others.

13. List orifice problems, solutions, and precautions.

15. List and define the three kinds of air that make up combustion air.

16. Explain how variations in the main burner air/fuel mixture affect burning characteristics.

17. Explain burning speed and its significance.

18. List main and the causes of burner flame problems. For each cause list the conditions that they can cause.

19. Explain how thermostats and heat anticipators work.
20. List the places thermostats should and should not be located.

**Safety Controls**

21. Explain how thermocouples/piles generate electricity and why only a portion of them is heated.

22. List the causes of pilot safety shutoff system problems associated with thermocouples/piles and with pilot burners.

23. Explain flame rectification.

24. List the causes of flame rectification problems.

25. List the conditions that trigger a Vent Safety Shutoff System.
26. List the four purposes of gas venting systems.

27. List the factors affecting draft, and for each one list factors that improve draft and factors that impede draft.


29. Explain the principles of direct vent.

30. Explain the differences between Type B and Type BW vents.

31. List factors that must be considered regarding the venting of gas appliances into chimneys.
32. If vent tables indicate that a vent size smaller than the appliance draft hood can be used, what conditions must be met?

33. List the symptoms and causes of gas venting problems.

**Installation**

34. What are the purposes of drip legs and shutoff valves in gas piping?

35. What are the factors that play a role in gas pipe sizing?

36. What procedures are usually followed after piping connections are made and before appliances are installed?

37. Measure a room in your house or store and calculate whether it is a confined space or not.
38. List important installation considerations for gas logs in solid fuel burning fireplaces.

39. List the installation guideline(s) for direct vent, chimneys, Type B vents, and relining least likely to be known by installers.

40. List the course of actions to be followed if a gas leak is detected.

41. List the procedures to be followed in spillage testing.

Service After the Installation

42. List safety precautions to follow during service procedures.

44. List the system components usually assessed in an operational test.
National Fireplace Institute
Pellet Specialist
Certification Exam Preparation:

*Pellet Study Guide*
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3. The enclosed Exam Study Guide is designed to help make you familiar with the kinds of questions on the Exam. It also demonstrates the kind of reasoning needed to choose correct answers and indicates why other answers are wrong.

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**TEST OBJECTIVES**

NFI Certification exams are intended to motivate examinees to confirm and increase their professional knowledge, to give them an opportunity to use that knowledge and careful attention to details in a challenging test, and to provide the rewards of professional recognition through certification. The exam itself consists of multiple choice questions which call for thorough knowledge of the information in the manual and the ability to apply that information in practical situations. While the exam studiously avoids "trick questions" whose purpose is demonstration of test taking skills, the essential professional skills of careful reading, attention to details, and clear reasoning that are called for in interpreting installation instructions and other technical information are purposely included in the exam.

**TESTING INFORMATION**

NFI Exams are based on the information, and application of the information contained in the current HPBEF Reference Manual. Each question is keyed to a specific educational objective and to a specific passage in the manual. Questions dealing with regulatory or code matters refer to the information in the manual about the relevant code or regulations. NFPA 211 is considered a fundamental reference source.
Multiple choice questions in NFI exams call on you to select the best possible answer from four choices. Multiple choice testing is an exercise in careful discrimination between correct and apparently correct answers. A good question requires precise knowledge and attention to detail. Our effort is to avoid "trick questions" about insignificant information while challenging your mastery of manual subjects. The incorrect answers, known as detractors or foils in testing must be close or similar to the correct answer, but in some detail incorrect, in order for the question to be challenging and indicative of mastery rather than a result of superficial knowledge or guessing.

Types of Multiple Choice Questions

**Selection of True Statement**

Some multiple choice questions offer four statements and ask for selection of the true statement. The process is one of focusing in each statement on qualifiers like both, only, the best, all; paying close attention to defining categories of products and processes; and watching for correct logic in resulting conditions (true and related cause and effect). As clearly false statements are eliminated, the process may shift to checking the remaining choices by stating the reason the answers seem true or false. For example:

1. Which of the following is true about operational and safety devices in pellet appliances?
   a. The appliance can operate with the low limit snap switch open during startup.
   b. A high limit snap switch is normally open and closes if excessively high temperatures are reached.
   c. Pressure sensing switches must be open when negative pressure is sensed.
   d. The low limit snap switch is closed when blowers stop during normal shutdown.

**REASONING PROCESS**

The call here is for careful attention to terminology and description of operation. The elimination process may vary, but perhaps answers b. and d. are eliminated first. Both describe situations that are not possible: an open switch does not allow current flow while a closed one does. The high limit switch must interrupt operation at excessively high temperatures. By the time blowers cease operation in shutdown, temperatures should be low enough that the low limit snap switch is open to prevent current flow. Answer c. is somewhat more difficult since the normal position of pressure switches varies from appliance to appliance. While the description here may be true in positive pressure designs and is possible in negative pressure systems if the negative pressure is not strong enough, it is not true of negative pressure systems with normally closed switches and adequate negative pressure. Answer a. is a better answer because the low limit snap switch is bypassed during startup and remains open until operating temperatures are reached. It is only after the startup time period that the low limit switch must be closed for the appliance to operate.
Selection of False Statement
Occasionally it is necessary to word a question in the negative. The search then is for the statement that is false. The words NOT TRUE are printed in capital letters to flag such questions. For example:

2. Which of the following statements is NOT TRUE?
   a. ASTM E 1509 provides for negative pressure tests to ensure that burnback and unsafe carbon monoxide levels do not occur.
   b. ASTM E 1509 provides for temperature tests while motors and blowers are disabled individually and in combinations.
   c. UL 641 testing includes a 1700°F test of pellet venting.
   d. UL 641 testing includes pressure testing of pellet venting joints and seals.

Reasoning Process
Care should be taken to make sure that the chosen answer is false. Check the chosen answer by asking yourself why it is not true and what would make it true. Familiarity with ASTM E 1509 eliminates answers a. and b. since the standard does call for burnback/CO testing and for temperature tests conducted in the adverse conditions of motor and blower failure. UL 641 does include a 1700°F test of venting, but it does not include pressure testing (although ULC 441 does).

Qualifying Conditions
Attention must be paid to qualifying adjectives such as some, both, all, and all...except. Be sure to check the chosen answer with respect to these qualifiers. For example:

3. Which one of the selections below is determined by all of the following: normal vent pressure, altitude, number of elbows and tees, roof pitch?
   a. Vent size for positive pressure exhaust system
   b. Vent length for natural draft exhaust system
   c. Equivalent vent length (EVL) for positive pressure exhaust system
   d. Vent type for positive and negative exhaust systems

Reasoning Process:
The key to this type of question is making sure the answer choice fits all the factors, not just some. For instance, vent size and EVL for positive pressure exhaust are determined by vent pressure, altitude, restrictions like elbows and tees, but roof pitch does not play a role. Even if the vent penetrates the roof, NFPA calls for a minimum height of one foot above the penetration. Vent type is not related to these factors. Determining vent length for an exhaust system without a mechanical exhauster (natural draft) calls for consideration of all of these factors, including roof pitch since the vent must extend vertically above the roof and the minimum height called for is two feet above anything within ten feet of the roof penetration.
4. A fire going out because of insufficient fuel feed can be caused by all of the following EXCEPT:
   a. Combustion air setting too high
   b. Fuel setting too low
   c. Low ash content fuel
   d. High limit switch tripped

**Reasoning Process**
Questions with the all capital letters EXCEPT call for the selection of a false statement or for the one answer that does not fit the described condition or situation. One method of attacking this type of question is to make the main statement a question. Here that would be: Can this condition cause the fire to go out due to insufficient fuel feed? The correct answer is the one whose answer is no. Here it is a., low ash content fuel. Answer a. can cause the outage by burning the fuel too rapidly and thereby not leaving the embers needed to sustain the fire. Answer b. can cause the outage by not providing sufficient fuel. Answer c. can also be a cause by cutting off the auger motor and stopping the fuel feed.

**Resulting Conditions**
Cause and effect multiple choice questions are marked by terms such as because, has the effect of, contributes to, in order to, if...then, and the like. The correct answer is the choice which is most directly related to the condition or effect in question. The incorrect answers, or detractors, may have an indirect relationship or they may not be correctly related at all. Sometimes answers will give a pair of conditions or effects; both must be correct in order for the question to be correct.

Cause and effect answers can be checked by supplying the reason the cause and effect are related or why other choices are incorrect.

5. Vertical sections of venting are under positive pressure for an appliance whose combustion air fan is downstream of the combustion chamber:
   a. If the appliance shuts down unexpectedly.
   b. If the pressure in the combustion chamber is negative.
   c. If the appliance is operating under normal conditions.
   d. If the convection air fan is operating.

**Reasoning Process**
Attacking and checking this type of question is aided by attempting to state whether the cause and effect are related, and why they are or are not. It may also be helpful to try to think about what would have to be different about an answer in order for it to be correct. Here it must first be determined that the venting system is under positive pressure during normal operation because of the location of the combustion air fan after the combustion chamber, answer c. Thus a shutdown in a. could produce negative pressure in the venting. Negative combustion chamber pressure, b., might result not only from normal operation, but also from an unexpected shutdown, in which case the vent pressure should also be negative. Answer d. is eliminated because the convection air fan could continue to operate despite combustion air fan failure. This abnormal condition could result in negative pressure in the vertical venting.

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Familiarity with Code Regulations

HEARTH manuals recognize the hierarchy of the building code system and the fact that it is the local "authority having jurisdiction" that determines what instructions and regulations must be followed. NFPA 211, however, is regarded as a nationally recognized, comprehensive document that provides guidelines for both listed and unlisted solid fuel equipment. The pellet specialist may be called on to supplement or know exceptions to this body of information, but it is nonetheless a foundation that is essential knowledge for hearth products professionals. Additionally, information in the manual concerning PFI fuel standards, ASTM E 1509, UL 641, ULC C441, and HUD mobile home requirements should be paid careful attention.

6. Which of the following is NOT an NFPA requirement for mechanical sidewall venting termination?
   a. Minimum distance to adjacent buildings.
   b. Minimum distance to doors and windows.
   c. Minimum distance from forced air inlet.
   d. Minimum distance below eave.

Reasoning Process:
The question calls first for knowing details of the regulation. Answers a., b., and c. are all clearly included in the regulation. The distance between the termination and the eave is not covered.

7. According to NFPA 211
   a. Vents with mechanical exhausters must terminate above the roof.
   b. Vents with mechanical exhausters which penetrate the roof must extend at least two feet above anything within ten feet of the penetration.
   c. Vents without mechanical exhausters must terminate at least five feet above the appliance outlet.
   d. All vents without mechanical exhausters must terminate at least two feet above anything within ten feet and extend at least three feet above the roof penetration.

Reasoning Process:
The relevant information is contained in NFPA 211 6-4 on page 136 and in the discussion in Chapter 11. NFPA provides the conditions under which venting can terminate under the roof, so a. is eliminated. Mechanically powered vents which penetrate the roof, b., only have to extend one foot above the roof. Answer c. is stated in 6-4.3. Answer d. is incorrect because there is no three foot minimum rule for pellet or gas vents as there is for solid fuel chimneys.
**Application of Knowledge**
Many multiple choice questions allow you to demonstrate your ability to use the information in the manual in practical situations. You may be called on to interpret sample manufacturer's instructions and diagrams, and code regulations; to use supplied formulas; and to perform mathematical calculations (you may bring and use a hand held calculator). These questions call for careful calculations as well as accurate interpretation of supplied information and knowledge of applicable regulations and components. Examples of these questions include:

8. According to NFPA 211 what is the minimum height above the roof for a natural draft appliance vent 11 feet from the peak on a 6/12 pitch roof?
   a. 24 inches  
   b. 60 inches  
   c. 66 inches  
   d. **84 inches**

**REASONING PROCESS:**
The first requirement is knowing that NFPA calls for termination 2 feet above anything within 10 feet of the penetration. In 10 feet of horizontal run the roof rises 60 inches. We add 24 inches in order to be 2 feet above this height, so the correct answer is d.
9. Use the equivalent vent length (EVL) table and chart below.

<table>
<thead>
<tr>
<th>EVL Table</th>
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<tbody>
<tr>
<td>90° elbow or tee</td>
<td>5 EVL</td>
</tr>
<tr>
<td>45° elbows</td>
<td>3 EVL</td>
</tr>
<tr>
<td>1’ horizontal pipe</td>
<td>1 EVL</td>
</tr>
<tr>
<td>1’ vertical pipe</td>
<td>.5 EVL</td>
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</tbody>
</table>

Clearance problems necessitate the use of 3 inch pellet venting for an installation of a positive pressure exhaust appliance. What is the maximum length of vertical pipe that can be used at 2500 feet above sea level if the following components must be used?
1- 90° tee
2- 45° elbows
2 feet of horizontal pipe
a. 7 feet
b. 14 feet
c. 20 feet
d. Cannot be determined from this information

**Reasoning Process**
The process can begin with determining the maximum EVL for 3 inch pipe at 2500 feet of elevation. The diagonal line that divides 4 inch diameter only from 3 or 4 inch pipe intersects the 20 feet EVL line at the 2500 feet elevation point. Next we determine the total EVL of the known components:
- 1- 90° tee = 5 EVL
- 2- 45° elbows = 6
- 2’ horizontal = 2
- Subtotal = 13 EVL

We subtract the subtotal of these components, 13, from the known maximum EVL, 20, to determine that the maximum EVL of the vertical pipe is 7. We must be careful to remember that this is 7 EVL, not 7 feet. Finally, we convert 7 EVL to feet:
- .5x = 7
  (x is the unknown # of feet in 7 EVL of vertical pipe)
  x = 7/.5
  (divide both sides by .5)
  x = 14 feet

Answer b. is correct.
10. Use the following conversion formulas to answer the question.

\[ k = K \times 12 \]
\[ r = \frac{1}{k} \]
\[ R = r \times \text{inches of thickness} \]
\[ R = \frac{1}{k} \times \text{inches of thickness} \]
\[ k = \text{inches of thickness} / R \]

\[ k \text{ of the alternate material} \times \text{thickness of} \]
\[ k \text{ of the specified material} \]
\[ = \text{thickness of} \]
\[ \text{specified material} \]
\[ \text{alternative material} \]

What is the minimum thickness of a floor protector if the appliance installation instructions call for a 3/4 inch thick material with an R value of 1.25 and the material to be used has a k factor of 2.5?

a. 3 inches  
b. 4 inches  
c. 5 inches  
d. 6 inches

**Reasoning Process**

The first task in determining material thickness requirements is converting specifications to appropriate terms. As the manual points out, conversion to k factor is easiest if only one floor protection material is being used, while R factor is easier if more than one material is to be used in the floor protector. Here, one material is used so we convert to k using the formula \( k = \text{inches of thickness} / R \):

\[ k = \frac{3}{4} \text{ (inches of thickness)} / 1.25 \text{ (R value)} \]
\[ k = 0.75 / 1.25 \]
\[ k = 0.6 \]

Now we use the formula:

\[ k \text{ of the alternate material} \times \text{thickness of} \]
\[ k \text{ of the specified material} \]
\[ = \text{thickness of} \]
\[ \text{specified material} \]
\[ \text{alternative material} \]

\[ 2.5 \times \frac{\text{inches of thickness}}{0.6} \times \frac{3}{4} \text{ (thickness of specified material)} \]
\[ = X \text{ (thickness of alternative) } \]

\[ 4.17 \times 0.75 = X \]
\[ X = 3.1 \]

Since the material must be at least 3.1 inches thick, the correct answer is the smallest number above 3.1, answer b.
National Fireplace Institute
Pellet Specialist
Certification Exam Preparation:

Pellet Practice Exam
Answer the questions below and click "Submit" to check your answers when you have completed all the questions.

1. All of the following are factors which affect clinkering EXCEPT:
   a. Ash content
   b. Silica content
   c. Sodium content
   d. Fuel density

2. Setting the convection air fan too low can result in:
   a. The high limit switch opening.
   b. The low limit switch opening.
   c. Lazy yellow flame
   d. Blowtorch flame

3. Many pellet appliances are EPA non-affected facilities (exempt) because:
   a. Pellet appliances are exempt from EPA regulations
   b. Their air-to-fuel ratio is greater than 35 to 1.
   c. Their overall efficiency is very high.
   d. Their firebox volume is very low.

4. The component which is cut off by ALL safety override devices such as high limit, low limit, and pressure sensing switches is:
   a. Combustion air fan
   b. Convection air fan
   c. Fuel feed motor
   d. Fuse

5. The distance from a pellet vent tee to the roof line above it is 6 feet. What is the minimum length of pellet vent for vertical backup in the event of power loss if the vent penetrates the roof?
   a. 7 feet
   b. 8 feet
   c. 11 feet
   d. 13 feet

6. Which of the following helps prevent incomplete combustion?
   a. Ash build-up
   b. Fuel build-up
   c. High-limit snap switch
   d. Low-limit snap switch
7. The minimum rear clearance for a rear vent pellet stove is 2 inches. The pellet vent is to be installed with a pipe adapter and tee behind the stove and turn vertically inside the house to exit through the ceiling and roof. The minimum clearance to the pellet vent is 3 inches. The distance from the back of the stove to the back of the tee is 10 ½ inches. Of the following options, which is the closest allowable distance from the back of this stove to a combustible wall?

   a. 3”
   b. 13”
   c. 14”
   d. 16”

8. You are performing a corner installation for an appliance that is 21" wide, 24" deep, and 27" high. The minimum clearance from the back corner of the appliance to the wall is 2". Floor protection must extend 6” in front of the appliance. Using the provided formula, which of the following is the shortest distance that the floor protector can extend in the figure, measured from the corner of the room?

   \[ Y = E \times 1.414 + \frac{W}{2} + D \]

   \( Y \) = distance from wall corner to front of appliance  
   \( E \) = minimum clearance from rear appliance corner to wall  
   \( W \) = width of appliance  
   \( D \) = depth of appliance

   a. 37”
   b. 41”
   c. 43”
   d. 44”
9. A properly operating pressure sensing switch would be closed if:
   a. Positive pressure is sensed in a negative pressure combustion air system.
   b. The exhaust system is severely blocked.
   c. The combustion air fan provides adequate pressure and exhaust flow.
   d. The opening to the pressure switch tubing is blocked.

10. Which of the following is **not** an NFPA 211 requirement for non-sealed, mechanical draft vent terminations?
    a. Positive pressure systems must be gastight or prevent leakage of combustion products into a building.
    b. Minimum distance of the vent from an adjacent building or public sidewalk.
    c. Minimum distance of the vent from inlets into the house.
    d. Termination above the roof.
## Pellet Practice Exam
### Answer Sheet

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<table>
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<tbody>
<tr>
<td>1.</td>
<td><strong>d</strong></td>
<td>Qualifier: <em>all...EXCEPT.</em> Resulting condition: effect, clinkering; incorrect cause, fuel density. a. and b. clearly affect clinkering since their fusion results in clinkers. Sodium affects clinkering by reducing the melting point of silica. Fuel density affects Btu content and other factors, but not clinkering.</td>
</tr>
<tr>
<td>2.</td>
<td><strong>a</strong></td>
<td>Resulting condition: effect, high limit switch opening; cause, low convection air fan setting. If the convection fan does not remove heat adequately, the high limit switch may trip. Low fan speed should not directly affect the low limit switch or the appearance of the flame (except to extinguish it after the fuel feed motor stops).</td>
</tr>
<tr>
<td>3.</td>
<td><strong>b</strong></td>
<td>Knowledge of code and regulations. Manufacturers can choose to design and test their appliances as EPA compliant or exempt. Answers c. and d. are correct statements but they are not related to EPA status.</td>
</tr>
<tr>
<td>4.</td>
<td><strong>c</strong></td>
<td>Resulting condition. Qualifier: <em>only.</em> While the fuel feed motor is stopped by all of these switches, the combustion air and convection fans may continue to run to dissipate heat and remove combustion by-products. Fuses are not directly affected by these switches.</td>
</tr>
<tr>
<td>5.</td>
<td><strong>a</strong></td>
<td>Knowledge of code and application. Defining category. All of the choices involve penetrating the roof. The fact that the vertical venting is for backup indicates the presence of a mechanical exhaustr. NFPA 211 allows such a vent to extend a minimum of 1 foot above the penetration, so answer a. 7 feet is the minimum length.</td>
</tr>
<tr>
<td>6.</td>
<td><strong>d</strong></td>
<td>Application of knowledge. Both ash build up (a) and fuel build up (b) can cause the blockage of combustion air that may starve the fire and cause incomplete combustion. The high-limit snap switch (c) is used to prevent overheating. The low limit snap switch (d) is designed to indicate sufficient temperature in the firebox so complete combustion will be achieved. Consequently by shutting the system down when temperatures are too low incomplete combustion is prevented.</td>
</tr>
<tr>
<td>7.</td>
<td><strong>c</strong></td>
<td>Application of knowledge. The question asks for the distance from the back of the stove. The clearance to the pipe is 3” (a) but the pipe extends further back from the back of the stove so this is incorrect. The distance from the back of the stove to the edge of the pipe is 10½ inches, add the 3” minimum clearance and the stove must be 13½” from the wall. 13” (b) is not acceptable since it is less than the minimum clearance. 16” (d) is not correct because the question asks for the closest allowable distance. The correct answer is 14” (c).</td>
</tr>
</tbody>
</table>
8. **d**  
\[ Y = E \times 1.414 + \frac{W}{2} + D \]  
\[ Y = 2 \times 1.414 + \frac{21}{2} + 24 \]  
\[ Y = 2.828 + 10.5 + 24 \]  
\[ Y = 37.328 \]  
Therefore the front of the appliance must be 37.328” from the corner. The floor protector must extend 6” out from the appliance: 37.328 + 6 = 43.328”. Since answers (a), (b) & (c) are all less than the 43.328” minimum, the only correct answer is 44” (d).

9. **c**  
Resulting condition. Pressure sensing switches may measure positive pressure or negative pressure. They may be normally open or normally closed. Answers (a), (b) and (d) would require knowledge of the specific type of pressure system. Consequently, answer (c) is the only answer that gives enough information for the statement to be true.

10. **d**  
Selection of false statement. The question refers to non-sealed systems. Answer (a) discusses sealed systems and is therefore not correct. Both answer (b) and (c) refer to established clearances which are specified in NFPA 211. Answer (d) is the correct answer.