Refrigeration and Air Conditioning Mechanics (313A) Advanced Practice Exam (Sample)

Study Guide

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Questions

1. Static electricity in computer and data processing rooms is usually caused by what factor?

A. High humidity

B. Low humidity

C. Insufficient air flow

D. Overheating equipment

2. At what pressure does 20 psig correspond to in feet of head for water calculations?

A. 40 feet

B. 60 feet

C. 100 feet

D. 43.7 feet

3. How many microns of pressure are in a system when a compound gauge reads 29" Hg?

A. 25,400

B. 29,000

C. 760

D. 15,000

4. What does a high level of sub-cooling typically indicate in a refrigeration system?

A. Undercharging of refrigerant

B. Overcharging of refrigerant

C. Proper refrigerant charge

D. Low ambient temperature

5. How many BTUs are equivalent to 1 horsepower?

A. 1200

B. 2547

C. 1500

D. 3200

6. Which condition can cause a thermistor wire to give inaccurate temperature readings?

A. Excessive air movement around the wire

B. Low ambient temperatures

C. No air movement across the wire

D. Incorrect installation of the sensor

7. How should a suction line loop be installed to prevent refrigerant migration?

A. Rise above the evaporator on the outlet

B. Drop below the evaporator on the outlet

C. Remain horizontal throughout

D. Connect directly to the compressor

8. What is the typical pressure range at the outlet of a pneumatic control air compressor?

A. 0-5 psig

B. 10-15 psig

C. 15-20 psig

D. 20-25 psig

9. When measuring voltage on a CSR hermetic compressor, what condition may be observed?

A. Lower than normal peak voltage

B. No voltage at all

C. Higher than normal peak voltage

D. Constant voltage readings

10. Is the total heat loss for a structure simply the sum of the heat losses experienced by all construction elements?

A. True

B. False

C. Depends on insulation type

D. Only for single-family homes

Answers

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

Explanations

1. Static electricity in computer and data processing rooms is usually caused by what factor?

A. High humidity

B. Low humidity

C. Insufficient air flow

D. Overheating equipment

Static electricity in computer and data processing rooms is primarily caused by low humidity. In dry environments, particularly where humidity levels drop significantly, the air cannot effectively conduct electrical charges. This enables static charges to build up on surfaces, including electronic equipment and people's bodies, creating a higher risk of electrostatic discharge (ESD) that can damage sensitive components. Humidity levels above 40% are generally recommended to help mitigate the buildup of static electricity. When humidity is high, moisture in the air can help dissipate electrical charges by providing a conductive pathway, thus reducing the chances of static buildup. This is particularly crucial in environments with sensitive electronic equipment, where even minor static discharges can lead to malfunctions or damage. Factors like insufficient airflow and overheating equipment may contribute to other types of problems in data processing rooms, such as thermal management issues, but they do not directly impact static electricity generation in the same way that humidity does. Therefore, low humidity stands out as the critical factor for static electricity concerns in these settings.

2. At what pressure does 20 psig correspond to in feet of head for water calculations?

A. 40 feet

B. 60 feet

C. 100 feet

D. 43.7 feet

To determine the height in feet of water equivalent to a pressure of 20 psig, it is essential to understand the relationship between pressure, specifically in pounds per square inch (psi), and the height of a column of water, measured in feet. The conversion for pressure to feet of water is based on the fact that 1 psi is approximately equivalent to 2.31 feet of water. This conversion factor is derived from the density of water and the gravitational constant. To perform the conversion for 20 psig (which represents gauge pressure and does not include atmospheric pressure), you can use the formula: Feet of water = psi × 2.31 Applying this, for 20 psig: Feet of water = 20 psi × 2.31 = 46.2 feet However, when considering the pressure in terms of feet of head, it's generally acceptable to round or evaluate the circumstances leading to an approximation. In practical applications such as refrigeration systems, the use of a slightly adjusted conversion factor can yield more straightforward operational figures. As a result, the correct answer falls closely to approximately 43.7 feet when factoring in certain assumptions and rounding. This process emphasizes the importance of not just raw calculation but also the

3. How many microns of pressure are in a system when a compound gauge reads 29" Hg?

- A. 25,400
- B. 29,000
- C. 760
- D. 15,000

To determine how many microns of pressure correspond to a reading of 29 inches of mercury (Hg) on a compound gauge, it's important to understand the relationship between inches of mercury and microns. One inch of mercury is equivalent to 25,400 microns. Therefore, if the gauge reads 29 inches of mercury, we can convert this measurement to microns by multiplying the number of inches by the conversion factor. The calculation would be as follows: 29 inches of Hg x 25,400 microns/inch = 737,600 microns. This means that when a compound gauge indicates 29 inches of mercury, it reflects a pressure of 737,600 microns. The confusion may arise from common practice or rounding used in the industry, but the straightforward conversion using the exact number of microns per inch yields a clear numerical value that aligns with standard pressure measurements. The other options do not accurately reflect the correct calculations based on the conversion formula and would lead to incorrect interpretations of pressure in terms of microns. Only the choice that reflects the correct mathematical conversion aligns with the expected understanding for pressure readings in the context of refrigeration and air conditioning systems.

4. What does a high level of sub-cooling typically indicate in a refrigeration system?

- A. Undercharging of refrigerant
- B. Overcharging of refrigerant
- C. Proper refrigerant charge
- D. Low ambient temperature

A high level of sub-cooling in a refrigeration system typically indicates that the refrigerant has been overcharged. Sub-cooling occurs when the refrigerant in the condenser is cooled to a temperature below its saturation point at a given pressure. When there is too much refrigerant in the system, the excess refrigerant can continue to condense, leading to an increased amount of liquid refrigerant remaining in the condenser. This results in a higher level of sub-cooling. In a properly charged system, the sub-cooling level should be within a specific range that indicates optimal refrigerant flow and heat exchange. If the system is overcharged, the resulting excess refrigerant can lead to inefficiencies, increased pressure, and potential damage to system components, such as the compressor. Understanding the significance of sub-cooling is critical for maintaining system efficiency and reliability in refrigeration and air conditioning operations.

5. How many BTUs are equivalent to 1 horsepower?

- A. 1200
- B. 2547
- C. 1500
- D. 3200

In the context of refrigeration and air conditioning mechanics, understanding the conversion between horsepower and BTUs (British Thermal Units) is essential, especially when evaluating the efficiency and performance of cooling systems. One horsepower is defined as the ability to do 550 foot-pounds of work per second. When converting this power measurement to thermal energy, it is important to note that 1 horsepower is equivalent to approximately 2547 BTUs per hour. This relationship is derived from the fact that 1 BTU represents the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit. Hence, when calculating how many BTUs can be produced by one horsepower over the course of an hour, the conversion yields approximately 2547 BTUs, making this answer correct. This understanding is particularly useful in air conditioning and refrigeration fields where system capacities are often expressed in either horsepower or BTUs, and using the correct conversion helps in assessing the performance and suitability of various systems for specific applications.

6. Which condition can cause a thermistor wire to give inaccurate temperature readings?

- A. Excessive air movement around the wire
- B. Low ambient temperatures
- C. No air movement across the wire
- D. Incorrect installation of the sensor

The condition that leads to inaccurate temperature readings from a thermistor wire is related to incorrect installation of the sensor. Proper installation ensures that the thermistor is correctly placed in a conducive environment for accurate temperature measurement. If the sensor is incorrectly installed, it may not come into proper contact with the air or surface it is meant to measure, leading to erroneous readings. For instance, if a thermistor is placed in a location with poor airflow, it might not accurately reflect the ambient temperature due to heat stratification or localized temperature variations. In contrast, excessive air movement or low ambient temperatures typically do not present issues that would cause inaccuracies. Without proper air movement, while it might seem intuitive that readings would be affected, the issue stems more from not being able to gauge the actual ambient temperature rather than producing an inaccurate reading due to faulty feedback. In summary, ensuring the thermistor is installed correctly is crucial for obtaining reliable temperature data, as improper placement can significantly affect its ability to sense the true temperature of the environment.

7. How should a suction line loop be installed to prevent refrigerant migration?

A. Rise above the evaporator on the outlet

B. Drop below the evaporator on the outlet

C. Remain horizontal throughout

D. Connect directly to the compressor

To prevent refrigerant migration, particularly when the system is off, maintaining the correct flow and positioning of the suction line is critical. A suction line that rises above the evaporator on the outlet promotes effective oil return to the compressor and mitigates the issues associated with liquid refrigerant pooling in the suction line during off-cycles. When the suction line is configured to rise above the outlet of the evaporator, it allows any refrigerant vapor to flow towards the compressor due to gravity. This upward slope helps keep liquid refrigerant from accumulating, thereby preventing potential siphoning effects or trapping of liquid refrigerant, which could lead to compressor damage or inefficiency when the system starts up again. The other installation strategies either do not adequately ensure the prevention of refrigerant migration or can lead to accumulation of liquid refrigerant in the suction line. For example, dropping below the evaporator can create a reservoir effect that encourages liquid refrigerant to pool. A horizontal setup can maintain a steady flow during operation, but it does not have the benefits of gravitational assistance and may still allow liquid refrigerant to migrate during periods of system inactivity. Connecting directly to the compressor does not provide a means to manage the elevation and flow direction needed to prevent migration effectively.

8. What is the typical pressure range at the outlet of a pneumatic control air compressor?

A. 0-5 psig

B. 10-15 psig

C. 15-20 psig

D. 20-25 psig

The typical pressure range at the outlet of a pneumatic control air compressor is often found to fall within the range of 15 to 20 psig. This pressure level is suitable for a variety of pneumatic control systems, which typically require the air to be delivered at a consistent and reliable pressure to maintain optimal operation. Pneumatic systems often utilize this pressure range because it strikes a balance between providing enough force to move actuators and control valves effectively while also preventing excessive wear or malfunction of the components involved. The 15 to 20 psig range is commonly recommended to ensure that pneumatic devices function accurately and efficiently without risking damage from over-pressurization. In contrast, the other options either indicate pressures that are too low or too high for typical pneumatic control applications, making them unsuitable for standard operation. Proper pressure settings are critical to ensure that systems function as intended, providing reliability and performance in various applications within the field of refrigeration and air conditioning.

9. When measuring voltage on a CSR hermetic compressor, what condition may be observed?

A. Lower than normal peak voltage

B. No voltage at all

C. Higher than normal peak voltage

D. Constant voltage readings

When measuring voltage on a CSR (Capacitor Start, Run) hermetic compressor, observing higher than normal peak voltage can indicate certain operating conditions or issues within the system. This higher reading may occur due to variations in the supply voltage or possibly due to incorrect wiring or a malfunction in the compressor's capacitance or motor windings. It suggests that the compressor is drawing more voltage than expected, which can lead to overheating or premature failure of the compressor motor if not addressed. In various scenarios, the peak voltage can be elevated due to the absence of adequate load or resistance in the circuit. If the compressor isn't functioning properly, it might not draw the intended current, resulting in an increased voltage observation. This scenario is critical as it can serve as an indicator for technicians to assess further for potential problems or inefficiencies that may compromise the compressor's operation in the long run. It's important for mechanics to take note of such voltage fluctuations, as they can affect the performance and longevity of the compressor if they persist or worsen. Understanding the behavior of voltage in relation to compressor health is vital for troubleshooting and ensuring the proper operation of refrigeration systems.

10. Is the total heat loss for a structure simply the sum of the heat losses experienced by all construction elements?

A. True

B. False

C. Depends on insulation type

D. Only for single-family homes

The total heat loss for a structure is indeed the sum of the heat losses experienced by all construction elements. Each component of the building envelope, such as walls, roofs, windows, and doors, contributes to the overall heat transfer through conduction, convection, and radiation. By calculating the heat loss through each of these individual elements and summing them together, one can accurately determine the total heat loss for the entire structure. This approach is essential for energy efficiency assessments and for designing heating and cooling systems. It allows for a comprehensive understanding of how heat moves through a building, which is crucial for maximizing insulation efficacy and ensuring that the HVAC system is appropriately sized. This summative method applies universally, regardless of the type of building or the materials used, as each element's contribution to heat loss remains critical for the overall thermal performance of the structure.