



Architects

## HVAC Optimization Final Exam

1. **What does the “A” in HVAC stand for**
  - a. Automatic
  - b. And
  - c. Air
  - d. Augmented
  
2. **What are the two primary issues that HVAC systems address for building users?**
  - a. Carbon dioxide (CO<sub>2</sub>) extraction and acoustic control.
  - b. Air Quality and Comfort
  - c. Prestige and Pollution control
  - d. All of the above.
  
3. **\_\_\_\_\_ is a system used to warn the public when air pollution is dangerous.**
  - a. A cell phone
  - b. The Department of Energy’s Red Zone Alarm
  - c. A CO monitor
  - d. AQI
  
4. **What color is an Air Quality Index of 51-100**
  - a. Purple
  - b. Red
  - c. Yellow.
  - d. Orange

5. Which of the following temperatures is not in the zone for a comfortable ambient space:
- 65° C
  - 19° C
  - 72° F
  - 66° F
6. What 3 factors does indoor air comfort need to manage?
- Cost, noise and appearance
  - CO emissions, Nitrogen and heat loss
  - Sunlight, insulation and smells
  - Temperature, Humidity and Air flow
7. Prior to modern mechanical HVAC systems, who had the primary role in designing for building air comfort?
- The builder
  - The local ruler
  - The Architect or master builder
  - No one
8. \_\_\_\_\_ is a traditional cooling architectural element that has been used in areas with severe hot climates.
- Cistern
  - Windcatcher
  - Dynamic leaf fan
  - Refrigerant coil
9. Most early human settlements and civilizations developed around \_\_\_\_\_
- Tropical regions
  - In the northern hemisphere exclusively
  - The tropic of Capricorn
  - The southern regions of the tropic of Cancer

- 10. Between 1950 and 2018, the world's urban population increased from \_\_\_\_\_ to \_\_\_\_\_.**
- 20% to 90%
  - 751 million to 4.2 billion
  - 237 million to 1.56 billion
  - 19% to 44%
- 11. Which Texas landmark building is referred to as the 8<sup>th</sup> wonder of the world?**  
\_\_\_\_\_.
- The Houston Galleria
  - Daley Plaza
  - Cener Pompidou
  - The Astrodome
- 12. Which of the following is one of the variables that are mechanically manipulated in a HVAC system?**
- Direction
  - Materials
  - Humidity
  - All of the above
- 13. Which is the lowest cost option for residential air conditioning?**
- Heat Pump
  - Window and wall mounted ACs
  - Furnaces
  - Central Air
- 14. Which of the following is not a component of an HVAC system?**
- Solar capture controller
  - Combustion Chamber
  - Condenser
  - Refrigerant Lines

**15. What is the type of calculation performed by an HVAC engineer?**

- a. Net Zero compliance calculation
- b. LEED points credit calculation
- c. Power utilization analysis
- d. The Load calculation

**16. One benefit of high ceilings is**

- a. The keep a space warm.
- b. They help make the air cleaner.
- c. They prevent the use of air conditioning.
- d. They aid in cooling.

**17. Can heat from a computer be harnessed to power heating systems?**

- a. No. This is not conceivable.
- b. Yes, but is still in a theoretical stage.
- c. No, it was tried and has failed.
- d. Yes, it is being used in many buildings globally.

**18. According to the author of this course, architects and MEP consultants should strive to move from a sub contract relationship towards one of a \_\_\_\_\_**

- a. Partner
- b. An employer-employee
- c. A cautious consultant
- d. Stay the same.

**19. The interior environment factors for sustainable HVAC design are closely linked to which ASHRAE documents.**

- a. 34-1899 and 43-1961
- b. 78-1971 and 66-2323
- c. 62-1999 and 55-1992
- d. 12-8765 and 2-3168

- 20. For U-values, which of the following is not true?**
- a. Higher numbers are good.
  - b. Lower numbers are good.
  - c. It is the mathematical reciprocal of the “R” value.
  - d. It is a measure of heat transfer.
- 21. Which of the following is a characteristic of a “Smart” HVAC technology as noted in the course?**
- a. They always eliminate the need for petroleum-based electricity.
  - b. They are also known as Heat Pumps.
  - c. They have sensors that “talk” to one another.
  - d. They are ductless.
- 22. According to the *worldgbc.org* analysis cited in the course, how much of the of the global carbon emissions come from operational emissions – from energy needed to heat, cool and power buildings?**
- a. 11%
  - b. 28%
  - c. 39%.
  - d. 0%
- 23. In a “green building” designed to support NetZero initiatives, which would be the preferred facade for overhangs if the building was located in the southern hemisphere?**
- a. North
  - b. South
  - c. East
  - d. West

- 24. A building type that contributed to the exponential growth of cities like Chicago and New York between 1880-1900 was:**
- Concrete frame structures.
  - The Industrial style.
  - Rococo.
  - Skyscrapers.
- 25. The first air-conditioned office building was:**
- The Sidd Music Hall in Brooklyn, NY.
  - The Milam Building in San Antonio, TX.
  - The Galleria in Houston, TX.
  - The Reliance Building in Chicago, IL.
- 26. Air Conditioning has been central to the growth of which of the following cities?**
- Dubai, UAE.
  - St. Louis, MO.
  - Beijing, China.
  - Detroit, MI.
- 27. According to a 2023 report on KIRO7 new2s station, which city was considered the most air-conditioned in the United States?**
- Seattle.
  - Houston.
  - Phoenix.
  - Atlanta.
- 28. Who typically generates the Reflected Ceiling Plan (RCP) background?**
- The architect.
  - The MEP engineer.
  - The Owner.
  - The Structural engineer.

**29. According to the 2013 Australian study cited in the course how much of the total building energy consumption is generally attributed to the HVAC system?**

- a. 22%
- b. 39%
- c. 44%
- d. 25%.

**30. What type of refrigerants were developed to replace the ozone depleting CFCs?**

- a. Bromine Refrigerants.
- b. Feron refrigerants – FFCs
- c. Hydrocarbon refrigerants - HFCs
- d. Chlorine Refrigerants – CRCs.

**31. What is the difference between VRF and VRV systems?**

- a. VRF regulates refrigerant while VRV regulates air flow.
- b. VRF is used in dry climates while VRV is used in humid climates.
- c. VRF is used primarily for small residential or light commercial projects while VRV is used in large, complex buildings.
- d. They are synonymous terms.

**32. An ideal application for a Heat Pump system would be:**

- a. for commercial buildings in mild to moderate climates, where heating and cooling requirements are relatively balanced throughout the year.
- b. for commercial buildings in locations where land is available for the installation of underground loops.
- c. office complexes or multi-story residential buildings, where sophisticated temperature control and energy efficiency are essential.
- d. for small commercial spaces like offices, retail shops or restaurants in climates with wide shifts in temperature.

**33. Which of the following materials is used for HVAC refrigerant lines?**

- a. PVC.
- b. Zinc.
- c. Copper.
- d. Brass.

**34. Which of the following architectural elements influence HVAC design?**

- a. Building size and perimeter.
- b. Floor to floor heights.
- c. Building insulation.
- d. All of the above.

**35. The greatest amount of air infiltration or loss of heat/cooling occurs from which elements in the building?**

- a. Doors.
- b. Cracks / joints (leaks).
- c. Ceilings.
- d. Windows.

**36. What is the difference between Active and Passive design?**

- a. Active design relies on Solar energy. Passive design relies only on mechanical systems to passively work in the background.
- b. Active design makes use of active building services systems to create comfortable conditions. Passive design maximizes the use of 'natural' sources of heating, cooling and ventilation to create comfortable conditions inside buildings.
- c. Active design requires direct Architectural manipulation of the building façade while Passive design engages the use of an MEP engineer to overcome building design flaws.
- d. Active design requires architectural input while passive design does not require architectural input.

**37. Low floor to floor heights are good for:**

- a. Heating.
- b. Cooling.
- c. Humidity control.
- d. Tropical climates.

**38. Which of the following innovations is not new but has only caught on recently?**

- a. Ice powered Air-Conditioning.
- b. Harnessing heat from a computer.
- c. Geothermal Heat Pumps.
- d. None of the above.

**39. How did architects feel “liberated” by HVAC systems?**

- a. MEP engineers assumed all liability for building envelope design.
- b. They made more money as they had less to design.
- c. They could add features to buildings because HVAC systems lowered costs.
- d. They felt free to design any form in any orientation without being constrained by environmental factors.

**40. Who is credited with inventing the Air-conditioner?**

- a. Jonathan Trane.
- b. Willis Carrier.
- c. Andrei Olczak.
- d. Rutherford B Hayes.