



Lesson #3: Climate Zones (4 class periods)

Objectives

Students will be able to...

- Identify three main types and general locations of climate-hot, cold, and moderate.
- Recall number of climate zones by memory or ability to locate in reference documents.
- Describe how the physical location of a building can impact energy use.

Standards

LS 11-12.6
RSIT 11-12.2
RHSS 11-12.7
Problem Solving and Critical Thinking 5.1, 5.3, 5.4
Health and Safety 6.2, 6.3, 6.4, 6.5, 6.6
Mathematics 1.1
Communication 2.2
Responsibility and Flexibility 7.0
Leadership and Teamwork 9.0
Technical Knowledge and Skills 10.0, 10.1, 10.2, 10.3
Demonstration and Application 11.0
Residential and Commercial Pathway D1.2, D1.3, D1.4, D1.5, D2.1, D2.2, D3.1, D3.2, D3.3,
D 9.1, D 9.2, D9.3, D9.4, D9.5, D9.6

Materials

Climate vs. Weather Handouts
California's Climate Zone Map
[California's 16 Climate Zone Information](#) (Click link-website)
Building Energy Efficiency Basics Test

Lesson Sequence

- Pass out and review the ***Climate vs. Weather Handouts***. Discuss the difference between the two. Answer any questions students may have and have students highlight important information.

- Discuss the difference between hot, cold, and moderate/mild climate characteristics.
- Discuss the climate impact on building features:
 - Envelope- Opaque Surfaces
 - Attics, Walls, Floors
 - How does the insulation level of an attic or wall impact heat transfer? Why do the insulation requirements change depending on climate zone?
 - Envelope- Fenestration
 - Broad overview of the concept of solar heat gain
 - Coastal regions may want more solar heat gain to lower heating expenses
 - Hot Central Valley regions will want a lower solar heat gain to reduce cooling expenses
 - Not a major focus, but should be briefly mentioned
 - Window heat resistance will always be less than wall assembly, more glass in a wall means less efficient wall overall
 - Mechanical- HVAC
 - Very broad 1-2-minute discussion, focus is not on mechanical system but should be mentioned as part of the building as a whole
 - Mention that some areas do/don't use air conditioning, or rarely need heating due to location and weather
- Pass out and review the ***California's Climate Zone Map***.
- Have students access California's 16 Climate Zones online. [Link](#)
- Have students research the climate zone of their school as a class. Find the climate zone number. Describe as hot/cold/mild, locate on prescriptive table, discuss what type of energy code requirements apply related to the envelope.
- Have students identify three additional climate zones and identify the climate zone number. Describe as hot/cold/mild, locate on prescriptive table, discuss what type of energy code requirements apply related to the envelope.
- Review unit concepts as a class. Answer any questions students may have. Then pass out ***Building Energy Efficiency Basics Test***.

Assessment

Informal observation throughout lesson
Check for understanding through questioning
Building Energy Efficiency Basics Test

Accommodations/Modifications

One on One Support
Peer Support
Highlight Important Information Prior To Lesson
Additional Time on Test As Needed

Building Energy Efficiency Basics Test

1. How many Climate Zones are in California?
 - a. 2
 - b. 8
 - c. 12
 - d. 16

2. Which of the following would save energy in a mild climate, such as Climate Zone 5 near San Luis Obispo?
 - a. Higher building leakage
 - b. Exterior shade screens
 - c. More wall insulation
 - d. Low Solar Heat Gain Coefficient Windows

3. Which would you expect to use more energy?
 - a. A 20-watt light bulb left on for 8 hours
 - b. A 50-watt light bulb left on for 90 minutes
 - c. A 1500-watt hair dryer left on for 5 minutes
 - d. None of the above

4. Which of the following describes the second law of thermodynamics?
 - a. Heat rises
 - b. Heat flows from cold to hot
 - c. Heat flows from hot to cold
 - d. Energy can neither be created nor destroyed.

5. What method of heat transfer is the transfer of heat between substances that are in direct contact with each other?
 - a. Conduction
 - b. Convection
 - c. Radiation

6. What method of heat transfer is the transfer of heat by means of electromagnetic waves?
 - a. Conduction
 - b. Convection
 - c. Radiation

7. What method of heat transfer is responsible for causing heat to rise and cooler air to sink?
 - a. Conduction
 - b. Convection
 - c. Radiation

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8. Which of the following is not a form of air infiltration?
- Wind Effect
 - Stack Effect
 - Mechanical Effect
 - Thermal Effect
9. _____ energy is stored energy; _____ energy is transitional (or moving) energy.

Insert the correct term: Kinetic, Potential

10. If electricity costs \$0.13 per kWh, how much money would it cost to operate a 20w light bulb for 8 hours per day for an entire year?
- \$0.75
 - \$7.59
 - \$75.90
 - \$759
11. Reducing _____ through a building's envelope can increase indoor comfort and energy savings.
- Insulation R-value
 - Air space
 - Heat transfer
 - None of the above
12. The _____ the R-value, the better the resistance to heat transfer. The _____ the U-factor, the slower the rate of heat transfer.

Insert the correct term: lower, higher

13. In a very hot climate zone, such as Climate Zone 15 (Palm Springs), which of the following would NOT be energy efficient:
- High insulation levels in walls and attics
 - Low U-factor and Low Solar Heat Gain Coefficient windows
 - External shading devices such as overhangs or permanent awnings
 - High U-factor and High Solar Heat Gain Coefficient windows
14. A BTU is equivalent to the amount of heat from one match?
- True
 - False
15. Which of the following best describes Air Infiltration?
- The unintentional or accidental introduction of outside air into a building.
 - The deliberate introduction of outside air into the building.
 - The movement of air through heating and cooling ducts.
 - The movement of air caused by hot and cool air.
16. How many Climate zones are in California? _____

17. Which of the following would save energy in a mild climate, such as climate Zone 5 near San Luis Obispo?
- Higher building leakage
 - Exterior shade screens
 - More wall insulation
 - Lower solar heat gain coefficient windows
18. Which would you expect to use more energy?
- A 20-watt light bulb left on for 90 minutes
 - A 50-watt light bulb left on for 90 minutes
 - A 1500-watt hair dryer left on for 5 minutes
19. The second law of thermodynamics states that heat moves from _____ to _____.
20. The transfer of heat between substances that are in direct contact with each other is called _____.
21. _____ is the transfer of heat by means of electromagnetic waves.
22. What method of heat transfer is responsible for causing heat to rise and cooler air to sink? _____
23. Which of the following is not a form of air infiltration?
- Wind effect
 - Stack effect
 - Mechanical effect
 - Thermal effect
24. _____ energy is stored energy; _____ energy is transitional (or moving) energy.
25. If electricity costs \$0.13 per kWh, how much money would it cost to operate a 20w light bulb for 8 hours per day for an entire year?
26. Reducing _____ through a building's envelope can increase indoor comfort and energy savings.
27. The _____ the R-value, the better the resistance to heat transfer. The _____ the U-factor, the slower the rate of heat transfer. Therefore, a _____ R-value and _____ U-factor will be more energy efficient in a building assembly.

28. In a very hot climate zone, such as Climate Zone 15 (Palm Springs), which of the following would NOT be energy efficient:
- High insulation levels in walls and attics
 - Low U-factor and Low solar heat gain coefficient windows
 - External shading devices such as overhangs or permanent awnings
 - High U-factor and high solar heat gain coefficient windows
29. True or False: A BTU is equivalent to the amount of heat from one match?
30. Which of the following best describes air infiltration?
- The unintentional or accidental introduction of outside air into a building
 - The deliberate introduction of outside air into the building
 - The movement of air through heating and cooling ducts
 - The movement of air caused by hot and cool air

Building Energy Efficiency Basics Test – Answer Key

1. D
2. C
3. A
4. C
5. A
6. C
7. B
8. D
9. Potential; Kinetic
10. B
11. C
12. Higher; lower
13. D
14. A
15. A
16. 16
17. C
18. A
19. Hot to cold
20. Conduction
21. Radiation
22. Convection
23. D
24. Potential; kinetic
25. \$7.59
26. Heat transfer
27. Higher; lower; higher; lower
28. D
29. True
30. A