

Understanding Water Temperature

Introduction

Welcome to the Understanding Water Temperature learning module. This section provides information on the following topics:

- How water temperature is defined and measured in numbers
- Why water temperature is important
- Natural and human influences on water temperature

After completing this module you should be able to perform the following:

- Define the term water temperature
- Explain how water temperature is measured in numbers
- List some reasons why water temperature is important to aquatic life
- List some natural and human influences on water temperature

To begin the module, click the **Next** button at the bottom right of the screen.

Understanding Water Temperature

What is water temperature?

Water temperature is a measure of how hot or cold water is.

To be more specific, water temperature is a measure of the average kinetic energy of water molecules (H₂O)—that is, the average amount of energy produced by the movement of water molecules.

The faster water molecules move, the more energy is produced. The more energy produced, the higher the water temperature.

Understanding Water Temperature

How is water temperature measured in numbers?

There are different scales used to measure water temperature. People in the U.S. are most familiar with the Fahrenheit scale, where pure water is described as freezing at 32 degrees Fahrenheit (°F) and boiling at 212°F. However, scientists universally measure water temperature in degrees Celsius (°C), which allows for data to be compared easily.

The Celsius scale has these characteristics:

- Pure water freezes at 0°C.
- Pure water boils at 100°C.
- Room temperature is 20 to 25°C.

Understanding Water Temperature**Understanding the numbers**

Which of the following statements is false?

- A) Scientists measure water temperature in degrees Celsius (°C).
- B) Pure water freezes at 32°C.
- C) Pure water boils at 100°C.
- D) None of the above.

The correct response is B!

Scientists measure water temperature in degrees Celsius (°C). On the Celsius scale, pure water freezes at 0°C and boils at 100°C.

Understanding Water Temperature**The importance of water temperature**

Aquatic organisms can only function properly within certain temperature ranges. Water temperature that is either too high or too low may have these effects:

- Slow down metabolic processes
- Slow the rate of plant photosynthesis
- Alter the natural timing of reproduction and migration in many species
- Alter the geographic distribution of species

Water temperature that is too high may have other effects:

- Lead to dangerously low levels of dissolved oxygen
- Make some compounds—such as ammonia—more toxic to aquatic life

Understanding Water Temperature**Understanding the importance of water temperature**

Water temperature affects which of the following?

- A) Metabolic rates of aquatic organisms
- B) Rate of plant photosynthesis
- C) Timing of reproduction and migration in many species
- D) All the above

The correct response is D!

Water temperature that is either too high or too low may slow down metabolic processes in aquatic organisms, substantially decrease the rate of plant photosynthesis, and alter the natural timing of reproduction and migration in many species.

Understanding Water Temperature **Influences on water temperature**

Water temperature can be affected by both natural and human influences.

Natural influences:

- Water depth
- Seasons

Human influences:

- Impervious surfaces
- Warm water discharge

Understanding Water Temperature **Natural influences on water temperature (water depth)**

Water temperature typically decreases with depth. This is because water temperature is influenced by heat energy from the sun (sunlight does not penetrate water at great depths). Thus, deep water is typically colder than water closer to the surface.

Understanding Water Temperature **Natural influences on water temperature (seasons)**

As you might imagine, water temperature is influenced by season.

- During the summer, water temperatures are highest.
- During the winter, water temperatures are lowest.

Water temperature at SCORE restoration sites ranges from less than 10°C during the winter to 30°C or higher during the summer.

Understanding Water Temperature **Understanding natural influences on water temperature**

Which of the following statements is true?

- A) Water temperature typically decreases with depth.
- B) Water temperature typically increases with depth.

The correct response is A!

Water temperature typically decreases with depth. This is because water temperature is influenced by heat energy from the sun (sunlight does not penetrate water at great depths).

Understanding Water Temperature**Understanding natural influences on water temperature**

Which of the following statements is true?

- A) Water temperatures are highest during the winter and lowest during the summer.
- B) Water temperatures are highest during the summer and lowest during the winter.

The correct response is B!

Water temperatures are highest during the summer and lowest during the winter.

Understanding Water Temperature**Human influences on water temperature (impervious surfaces)**

Impervious surfaces often cause the temperature of surrounding waters to increase. Impervious surface refers to man-made materials—like roads, parking lots, and rooftops—that prevent rainwater from soaking into the ground.

- Impervious surfaces increase stormwater runoff (which flows across the land and into estuaries).
- Stormwater is warmer than estuarine water because it is heated by impervious surfaces which radiate heat from sunlight.
- Impervious surfaces made of asphalt are the main sources of heated stormwater.

Understanding Water Temperature**Human influences on water temperature (warm wastewater discharge)**

The release or discharge of warm wastewater into estuaries and other natural waters increases water temperature. This type of thermal pollution (artificial warming of natural water bodies) is typically caused by power plants and many industrial operations.

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Understanding human influences on water temperature

Thermal pollution is the artificial warming of natural water bodies. Which of the following is NOT a source of thermal pollution?

- A) Roads
- B) Parking lots
- C) Automobiles
- D) Power plants

The correct response is C!

Automobiles are not a source of thermal pollution. However, power plants and impervious surfaces—particularly roads and parking lots made of asphalt—are sources of thermal pollution.

Power plants and many industrial plants increase water temperature by discharging heated wastewater into natural waters. Impervious surfaces—which radiate heat from sunlight— increase water temperature by heating up stormwater (which flows across the land and into estuaries and other natural waters).

Understanding Water Temperature

Review

Congratulations! You have completed the Understanding Water Temperature learning module. In this section you learned about the following topics:

- How water temperature is defined and measured in numbers
- Why water temperature is important
- Natural and human influences on water temperature

You should now be able to perform the following:

- Define the term water temperature
- Explain how water temperature is measured in numbers
- List five reasons why water temperature is important to aquatic life
- List some natural and human influences on water temperature

To choose another module, click the drop-down menu at the top of the screen.