



A warming ocean

Lesson plan: how the ocean absorbs heat, a sand and water experiment, and calculating coral heat stress with degree heating weeks



Ages	13 to 18 (grades 8 to 12)
Time	60 to 75 minutes
Group	Up to 35 students, in groups of three or four
Where	Classroom with a lamp or a sunny window
You need	The slides, per group two cups, sand, water, two thermometers and a lamp, plus one DHW worksheet per student

What students learn

- Why the ocean has absorbed most of the extra heat from climate change, tested with a simple experiment.
- What marine heatwaves are and how they cause coral bleaching.
- How NOAA measures heat stress with degree heating weeks, and what the alert levels mean.
- How to calculate DHW from temperature data.

Before the lesson

1. Per group: two identical cups, dry sand and water at room temperature, two thermometers and a desk lamp, or use the sun.
2. Print one **DHW worksheet** per student and one **experiment record sheet** per group.

The lesson

- 1** The ocean takes the heat **5 minutes, slides 1 and 2**. Introduce the headline fact.
- 2** Sand and water **20 minutes, slide 3**. Groups run the experiment while you continue. Sand warms and cools faster than water.
- 3** Heatwaves and DHW **15 minutes, slides 4 to 6**. Explain bleaching and the DHW idea with the two worked examples on slide 5.
- 4** Your turn **15 minutes, slides 7 and 8**. Students complete the worksheet, then check the answer.
- 5** Wrap up **5 minutes, slide 9**. Discuss one or two questions.

Answers and what to listen for

DHW answer key: weekly values above 29.5°C are -0.3, 0.1, 0.6, 1.1, 1.4, 1.7, 1.5, 1.9, 2.1, 1.8, 1.3, 0.9, 1.4, 0.7, 0.3, -0.1. Counting only values of 1.0 or more in weeks 2 to 13 gives $1.1 + 1.4 + 1.7 + 1.5 + 1.9 + 2.1 + 1.8 + 1.3 + 1.4 = 14.2$ DHW, which is alert level 3. Week 9 had the most heat stress (2.1°C above).

Experiment: sand heats faster and cools faster than water. Water has a much higher heat capacity, so it takes more energy to warm and holds on to heat longer.

Making it easier or harder

- **Younger groups:** do the DHW calculation together on the board.
- **Older groups:** explore live Coral Reef Watch maps for Philippine reefs and compare this year with 2024.
- **Link:** the Coral reefs lessons for younger students introduce bleaching.

Safety and good practice

- Lamps get hot: don't touch the bulb, and keep water away from the plug.

Curriculum links

- **Science:** energy transfer, specific heat capacity, climate change.
- **Maths:** reading graphs, cumulative totals.
- **Philippine senior high school:** General Science.
- **Ocean Literacy Principle 3:** the ocean is a major influence on weather and climate.

The teacher reading has the science behind every slide, with links to the sources.

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