Climate change: evidence and responses

Student activity • calculation and evidence workshop

YEAR 10 / LESSON 63 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

The question

Which claims are supported by evidence, and which actions address the cause?

Interpret dated assessment evidence, separate weather from climate and compare mitigation with adaptation. Explain ocean acidification without confusing it with the infrared greenhouse mechanism.

Equipment

- Booklet, calculator and source extracts/links
- No chemical handling, gas generation or heating

No chemicals or heating. Discuss evidence and response options respectfully; the activity requires no personal disclosure.

Course coverage: Shared core: 2.13. Human contributions, evidence and responses. Numerical evidence is explicitly dated to the IPCC AR6 assessment; it is not a current-year reading.

Plan, model or apparatus sketch

Map a climate driver, evidence, mitigation and adaptation action.

Method and reasoning

Read the whole sequence before starting

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1. Read the dated evidence cards: IPCC AR6 reports global surface warming of about 1.1 °C in 2011–2020 relative to 1850–1900, and atmospheric CO_2 about 410 ppm in 2019. Write the date/baseline beside each number.

2. Convert 410 ppm to a percentage by volume. Explain why a small atmospheric fraction can still affect infrared radiation.

3. Evaluate “one cold day disproves warming” and “two rising curves alone prove causation”. Separate a local weather event, a long-term global trend and causal attribution.

4. Sort four proposed actions: reduce fossil-fuel combustion, repair methane leaks, improve flood defences and establish heat-health plans. Label mitigation, adaptation or both with reasons.

5. Use $CO_2 + H_2O \rightleftharpoons H_2CO_3$ and acid dissociation to explain why dissolved CO_2 can lower seawater pH. Less alkaline does not necessarily mean below pH 7; this chemical effect is distinct from radiative warming.

6. Write a short evidence-based recommendation for a school/community, including one emissions action, one adaptation action and a limitation or trade-off. Do not claim one action eliminates all risk.

Cleanup

- Keep recommendations and return shared materials.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Dated assessment cards (IPCC AR6 Synthesis, 2023): approximately 1.1 °C global surface warming for 2011–2020 above 1850–1900; approximately 410 ppm atmospheric CO_2 in 2019. The assessment attributes observed global warming to human activity. These values have different units/time references and should not be plotted as one interchangeable quantity. ppm means parts per million.

Evidence / action	Interpretation	Limit / justification
1.1 °C; stated period/baseline		
410 ppm CO_2; 2019		
Mitigation example		
Adaptation example		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Convert 410 ppm CO_2 to percent, showing the conversion.

2. What do the period 2011–2020 and baseline 1850–1900 tell you about the 1.1 °C value?

3. Why is a cold day insufficient to reject a long-term global warming trend?

4. Explain why correlation alone is insufficient, and name additional evidence relevant to human-caused warming.

5. Classify the four response actions and explain why adaptation does not automatically reduce emissions.

6. Explain ocean acidification and why a pH decrease does not necessarily mean seawater is below pH 7.