Acid rain: trace the chemical pathway

Teacher / technician

YEAR 11 / LESSON 76 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Written and model-based lesson; no laboratory procedure is implied.

Coverage and delivery

Shared core: 4.14–4.16. Distinguish sulfur impurity combustion from nitrogen/oxygen reaction at high engine temperatures.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, working in 15 pairs

Item	Per pair / setup	Class total
Booklet / writing tools	1 per learner	30 sets
Model kit / periodic table	1 set per pair	15 sets

Immediate safety

Desk activity only; keep small model pieces away from mouths.

Preparation and delivery

Read alongside the student method

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1. Provide 30 booklets and 15 model kits or reusable atom counters; no chemicals are needed.

2. Use 10 minutes retrieval, 25 independent/pair tasks, 15 explanation and 10 corrections. Keep first attempts visible.

3. Use written pathways, not burning sulfur or making nitrogen dioxide.

4. Keep climate warming and acid deposition distinct. Avoid implying that all NO_x comes from nitrogen impurities in fuel.

5. Check all carbon valencies, formula subscripts and equation coefficients. Label any supplied numbers as practice data, not class observations.

Close of lesson

• Return shared equipment and retain corrected reasoning.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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- Sulfur-containing impurities in the fuel, which oxidise on combustion.
- At high temperature, N_2 and O_2 from air can react; sulfur is not needed for this route.
- $2NO + O_2 \rightarrow 2NO_2$.
- Acid reacts with carbonate in limestone, dissolving material and releasing CO_2.
- Removing sulfur before combustion reduces a source; adding suitable alkali to affected water treats acidity but does not stop emissions.
- No. Natural dissolved CO_2 and other natural sources contribute; industrial SO_2/NO_x can increase acidity and deposition.

References and provenance

Pearson Chemistry specification

US EPA acid-rain mechanism

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.