

Position Statement

Embedding sustainability and climate change in 11–19 chemistry education

Last reviewed: October 2025

Summary

A high-quality chemistry education that integrates climate change and sustainability helps young people to become scientifically informed global citizens, inspiring learners to pursue careers in the chemical sciences and equipping them with the knowledge and skills needed to contribute to a greener economy.

However, our research shows that sustainability and climate change issues are not sufficiently emphasised in the chemistry curriculum. Students often do not recognise existing content as relevant to these global challenges, and teachers report that some topics need updating to reflect current scientific and societal priorities.^{1,2}

To address this, we are calling for three key actions:

Curriculum Reform

Governments across the UK should embed contemporary sustainability and climate change content and contexts throughout national chemistry curriculums. This includes making clear connections between chemistry topics and other disciplines.

Assessment Reform

Exam boards should include sustainability and climate change contexts in chemistry assessments. This will encourage teaching that connects their chemistry knowledge to real-world applications.

Practical Learning Reform

Students should be supported to consider the environmental impact of practical work in school. This approach promotes sustainable scientific practice and aligns school-level learning with real-world sustainability decision making in academia and industry.

Introduction

Climate change and the unsustainable use of natural resources are pressing global challenges. Chemistry plays a critical role in addressing these issues, for example through the development of low-carbon technologies, the design of recyclable, biodegradable and reusable materials, pollution prevention, water treatment and innovations in carbon dioxide capture and utilisation.

¹ RSC (2021), Green shoots: A sustainable chemistry curriculum for a sustainable planet, [green-shoots-a-sustainable-chemistry-curriculum-for-a-sustainable-planet.pdf](#)

² As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

Learning about sustainability and climate change issues, and the solutions chemistry can offer, helps students understand how chemistry contributes to solving environmental problems. It provides young people with the agency to be responsible global citizens who strive to make the world a more sustainable place while also giving them knowledge and skills for jobs in the green economy.

Chemistry undergraduates have told us that sustainability and climate change education is important for their future careers.³ This aligns with workforce research showing that green skills are significantly more prominent in chemical science roles than in the broader UK job market.⁴

Sustainability and climate change content already features in secondary school science and chemistry curriculums across the UK, but students don't always recognise it as such. The undergraduates we spoke to describe their experiences of sustainability and climate change in school / college chemistry as 'minimal' and 'limited'.⁵

Teachers in England told us that the GCSE topics '*life cycle assessment and recycling*' and '*Earth's water resources and obtaining potable water*' needed to be revised.⁶ Young people aged 17-18, have called for more detailed coverage of sustainability and climate change in their chemistry lessons,⁷ and university students have expressed a need to focus on solutions through individual actions to address these issues as part of school / college education.⁸

Key messages

Our research highlights opportunities strengthen the focus on climate change and sustainability in the 11–19 chemistry curriculum through focusing on the following key areas:

Including up-to-date content and relevant contexts in the curriculum

Climate change and sustainability content in the chemistry curriculum should reflect appropriate scientific developments which are as up to date as possible and be exemplified with relevant contexts. This should be done with care as part of the curriculum reform / refresh cycle to avoid overloading the curriculum.

The use of local, national and global contexts (both historic and contemporary) to exemplify climate change and sustainability content, can help students connect chemistry to their lives and wider world.⁹

However, almost half of the young people who took part in one of our surveys said they did not learn about sustainability and climate change topics in the chemistry curriculum through contexts which were relevant to them.¹⁰

³ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

⁴ RSC (2024), Future Workforce and Educational Pathways, [rsc-future-workforce-ep-report.pdf](#)

⁵ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

⁶ RSC (2023), Science Teaching Survey, [Teachers recommend curriculum changes to make chemistry more relevant and accessible](#)

⁷ RSC (2021), Green shoots: A sustainable chemistry curriculum for a sustainable planet, [green-shoots-a-sustainable-chemistry-curriculum-for-a-sustainable-planet.pdf](#)

⁸ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

⁹ See the Royal Society of Chemistry's position on 'Global perspectives and diverse representation in chemistry education. <https://www.rsc.org/news/2025/february/opinion-we-need-new-stories,-contexts-and-examples-in-chemistry-education>

¹⁰ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

Using contexts to support students' learning in these areas is a key component of implementing teaching through a 'global citizenship'¹¹ lens. This approach involves designing and delivering education in a way that helps students understand their roles and responsibilities in an interconnected world. It encourages learners to think critically about global issues, appreciate cultural diversity, and act ethically and sustainably.

In relation to this, young people told us that content focused on 'personal and societal responsibilities' in schools felt relevant to them, but they did not feel that their education fully supported their understanding in this area.¹²

Recommendation 1: Governments across the UK should encourage the linking of relevant regional, national, and global contexts related to sustainability and climate change (including examples of workable solutions and mitigations), to appropriate chemistry curriculum topics.

Recommendation 2: Governments across the UK should ensure that contemporary sustainability and climate change content is included within their national chemistry curriculums.

Recommendation 3: Exam boards should include climate change and sustainability contexts within some exam questions. This should include both instances where the question is framed within a relevant context, and opportunities for students to demonstrate their knowledge of real-world examples in their answers.¹³

Systems Thinking

Systems thinking,¹⁴ which recognises the interdependence of components within dynamic systems, is essential for deepening students' understanding of sustainability. It can enable learners to make meaningful connections between concepts, whether across disciplines or within chemistry itself, supporting a more holistic and integrated approach to climate change and sustainability education. These connections should be made more explicit within chemistry curriculums. For instance, when exploring exothermic and endothermic reactions, students can be encouraged to think beyond the reaction itself and consider how the energy released or absorbed fits into a broader system. They might consider how using heat from exothermic reactions could power other processes in a closed-loop system. Similarly, linking the sustainability of chemical processes to the use of catalysts can lead to discussions about the properties of transition metals, which often function as effective and reusable catalysts. These conceptual links should be clearly reflected in curriculum documentation to support coherent and connected learning experiences for all students.¹⁵

Some of the existing sustainability topics within the chemistry curriculum lend themselves to a more interdisciplinary systems thinking approach. For example, when studying product life cycle assessment and recycling, students can learn about the sometimes conflicting environmental, ethical, economic, and political considerations and trade-offs.

¹¹ Oxfam and ASE (2016) define a global citizen as someone who: "is aware of the wider world and has a sense of their own role as a world citizen; respects and values diversity; has an understanding of how the world works; is passionately committed to social justice; participates in the community at a range of levels, from the local to the global; works with others to make the world a more equitable and sustainable place; takes responsibility for their actions." Science and Global Citizenship: Guidance for taking a global perspective to teaching science, <https://policy-practice.oxfam.org/resources/science-and-global-citizenship-guidance-for-taking-a-global-perspective-to-teac-620818/>

¹² As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

¹³ For example, a proportion (around 10%) of questions at GCSE/ National 5 level could include opportunities for young people to critically think about the mitigation of and solutions to climate change and sustainability problems. Teachers could be supported with a bank of example national and global contexts to their reduce workload, but they should also have the autonomy to identify local contexts relevant to their learners.

¹⁴ IUPAC definition: *Systems thinking* emphasizes the interdependence of components of dynamic systems. In the context of chemistry, systems thinking moves beyond isolated consideration of reactions and processes to consider where materials come from, how they are transformed and used, and what happens at the end of their life span. It draws attention to a need to balance the benefits and impacts of chemical substances and the role they play in societal and environmental systems.

¹⁵ Some of these links are highlighted in our chemistry curriculum framework. Royal Society of Chemistry (2020), The elements of a successful chemistry curriculum, <https://www.rsc.org/policy-and-campaigning/education/chemistry-curriculum-framework>

Recommendation 4: Governments across the UK should adopt a holistic and coordinated approach to embedding climate change and sustainability within their national curriculums. This includes making clearer connections within the chemistry curriculum and across related subject areas, enabling students to build a more integrated and meaningful understanding of sustainability.

Recommendation 5: Exam boards should ensure that content within chemistry and combined science specifications makes clear the connections between different ideas. These connections should build towards an overall story of how chemistry contributes to solving global challenges.

Practical Chemistry Education

Practical chemistry is an essential part of school level chemistry education. We believe that all learners should have regular access to relevant and purposeful practical activities.¹⁶

Young people highlighted practical skills such as identifying, classifying and grouping results; data analysis; setting up and using laboratory equipment; and drawing conclusions from an experiment, as important to develop in school/sixth form college chemistry courses to give learners the skills to help them combat climate change and sustainability issues in their future careers.¹⁷

There are currently no requirements for students to consider the environmental impact of practical activities they undertake as part of their chemistry A-level / Higher or GCSE / National 5 qualifications.¹⁸ This is reflected in our research where the majority of undergraduate participants in a focus group said that sustainability was rarely or never considered as part of their school / college practical chemistry learning.¹⁹

Higher education institutions are increasingly considering environmental impacts, using frameworks such as the Laboratory Efficiency Assessment Framework (LEAF)²⁰ and My Green Lab²¹ and incorporating aspects of green and sustainable chemistry, for example by following '12 principles of green chemistry'^{22, 23}. Introducing some of these concepts into 11-19 education would encourage young people to critically consider how practical activities can be designed to minimise environmental impact while also giving them a glimpse into what working in chemistry entails - knowledge that will be increasingly valuable as sustainability becomes a central focus in scientific careers and industry practices.

The sustainability of practical chemistry can be enhanced by carefully selecting the type and quantity of chemicals used, minimizing single-use plastics, optimising energy and water consumption of laboratory instruments, prioritising the reuse and recycling of materials, and systematically designing experiments to reduce environmental impact,²⁴ whilst still adhering to relevant health and safety guidance. Schools may be able to reduce

¹⁶ RSC (2024) Practical chemistry education: A vision for practical chemistry in 5 – 19 education <https://www.rsc.org/policy-and-campaigning/policy-library/practical-chemistry-education>

¹⁷ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

¹⁸ In some cases, exam boards recommend that students consider environmental impact, but it is not a formal assessment criterion (as of September 2025)

¹⁹ As yet unpublished RSC research which gathered the views of undergraduate chemists and sustainability and climate change education experts.

²⁰ UCL's Laboratory Efficiency Assessment Framework (LEAF), <https://www.ucl.ac.uk/sustainable/take-action/staff-action/leaf-laboratory-efficiency-assessment-framework>

²¹ My Green Lab Certification for Lab Sustainability, <https://www.mygreenlab.org/green-lab-certification.html>

²² American Chemical Society, 12 Principles of Green Chemistry, developed by Paul Anastas and John Warner in [Green Chemistry: Theory and Practice](https://www.acs.org/green-chemistry-sustainability/principles/12-principles-of-green-chemistry.html) (1998), <https://www.acs.org/green-chemistry-sustainability/principles/12-principles-of-green-chemistry.html>

²³ Aspects of green chemistry are often included in chemistry A Level and Higher syllabuses, without necessarily being linked to students' own laboratory work.

OCR A - links between atom economy, energy use, sustainability

²⁴ Additionally, experiments can be designed to ensure that process or measurement is carried out only as many times as is needed (this links to competence in statistics and data).

the environmental footprint of some practical activities by using microscale set-ups for some experiments.²⁵ In addition, these activities can support discussions around sustainability and help students think critically about the potential impacts of practical chemistry.

Exam boards are generally supportive of microscale equipment being used for some of their specified required practicals,²⁶ but anecdotally, many teachers assume that their students will be disadvantaged in exams if they don't have experience of the full-scale version of an experiment.

Recommendation 6: *Governments across the UK should embed consideration of the environmental impacts of practical chemistry activities within national secondary science and chemistry curriculums. This will ensure students develop the skills and awareness needed to conduct experiments responsibly and sustainably, in line with the developing expectations in academia and industry.*

Recommendation 7: *Exam boards should embed environmental evaluations within their assessment frameworks for older students,²⁷ ensuring sustainability considerations are integrated into their scientific learning and practice.²⁸*

Recommendation 8: *Microscale practical activities can reduce cost and waste and make some practical chemistry activities more sustainable and less environmentally damaging. Exam boards should reassure teachers that their students will not be disadvantaged if they have experience of a microscale rather than a full-scale practical experiments.*

Teacher Support

Many teachers told us that the amount of time they undertook subject-subject professional development in chemistry was insufficient.²⁹ Teachers may need time and support to embed sustainability and climate change education effectively into their practice.³⁰

For any queries relating to this position statement, please contact: EducationPolicy@rsc.org

²⁵ Microscale practical activities use small amounts of reagents and simple equipment. The RSC provides resources to help teachers use microscale chemistry activities. See: <https://edu.rsc.org/resources/collections/microscale-chemistry>

²⁶ For example, see OCR's 'Purposeful Practicals' which include microscale alternatives which meet the DfE requirements for apparatus and techniques: <https://www.ocr.org.uk/Images/716261-purposeful-practicals-menu-guide.pdf>

²⁷ I.e. as a part of Common Practical Assessment Criteria (CPAC) practical endorsement or assignment at A-Level Higher/Advanced Higher level or required practical activities at GCSE/ assignment at National 5 level.

²⁸ An example of what this could look like can be seen here: [Chemistry in Curriculum for Wales: chemistry skills template \(progression step 4\)](#), i.e. the question: *What impact does this reaction have on our world around us?* Consider significance, usefulness, sustainability, pollutants and energy requirements for reaction

²⁹ RSC (2025), Science Teaching Survey 2025, [The Science Teaching Survey 2025](#)

³⁰ See our policy statement on *Secondary school science teachers' deployment according to their subject expertise in the sciences* which include our recommendations about subject-specific professional development. <https://www.rsc.org/policy-and-campaigning/policy-library?Search=Secondary%20school%20teachers%E2%80%99%20deployment%20according%20to%20their%20subject%20expertise%20in%20the%20sciences%20%20&sortBy=score>