

TEACHERS' STANDARDS FRAMEWORK

EXEMPLIFIED FOR TEACHERS OF CHEMISTRY

This document is designed to support chemistry teachers at every stage of their professional journey, from trainees entering the classroom to experienced practitioners seeking to refine and deepen their practice. Grounded in the [teachers' standards for England](#), it offers a subject-specific perspective on what effective chemistry teaching looks like and how it can be developed over time.

Each section aligns with one of the teachers' standards and includes practical examples, reflective prompts, and curated resources tailored to the unique challenges and opportunities of teaching chemistry. 🕒 Indicates a quick win; for example, a ready to use resource or easy implementation of a strategy.

By focusing on the pedagogical, practical, and professional dimensions of chemistry education, this document aims to foster a shared understanding of high-quality science teaching and empower teachers to continually enhance their impact in the classroom.


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TS1 – Set high expectations which inspire, motivate and challenge pupils

Establish a safe and stimulating environment for pupils, rooted in mutual respect

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that chemistry teaching carries unique risks associated with the use of chemicals. Know that health and safety legislation must be complied with, with specific reference to the use of chemicals in schools.	Know that chemistry teaching carries unique risks associated with the use of chemicals. Know that health and safety legislation must be complied with, with specific reference to the use of chemicals in schools.	Schools and education (HSE) Health and safety: responsibilities and duties for schools (DfE) Control of substances hazardous to health (COSHH)
	Know the role of the school's science technicians to provide support for science practical work and demonstrations, including risk-assessment.	Work with the school's science technicians to build up beneficial knowledge for supporting safe practical chemistry.	Support for technicians (RSC) 'The best parts are working with enthusiastic students and that no two days are ever the same' (RSC)
	Become familiar with the wide range of specialist resources available to support the enhancement of good health and safety practice in the chemistry laboratory.	Increase familiarity with the specialist resources available to support the enhancement of good health and safety practice in the chemistry laboratory, year-on-year.	RSC Education standard health and safety guidance CLEAPSS Health and safety resources (ASE)
	Become familiar with the school's internal expectations (or those of the local authority or multi-academy trust) for the health and safety of staff and pupils when organising outdoor learning trips (e.g. chemistry camp).	Increase familiarity with the external resources available to support the enhancement of good health and safety practice when organising outdoor learning trips (e.g. chemistry camp) and evaluate previous experiences from the science department to improve future events.	OEAP national guidance for outdoor learning  Co-curricular thinking (RSC)

Pedagogy	<p>Take reasonable care to protect your own health and safety and that of pupils and colleagues when handling chemicals. This includes identifying and mitigating risks during lessons. Assess and control the risks associated with hazardous chemicals and apparatus (risk-assessment), ensuring safe storage, handling and disposal.</p>	<p>Know that the risks associated with learning in a chemistry laboratory can be continuously reduced year-on-year, by examining accidents or near-miss incidents from the previous year and acting upon findings to improve risk assessments.</p>	<p>How to carry out a COSHH risk assessment (HSE)</p> <p>Making and recording risk assessments in school science (CLEAPSS)</p> <p>Risk assessing your chemistry practicals (RSC)</p>
	<p>Develop an understanding of strategies to increase the efficiency and likely success of laboratory-based and non-laboratory-based learning of chemistry.</p>	<p>Establish a strong understanding of strategies to support efficient and successful learning in the chemistry laboratory, including the sharing of good practice among colleagues.</p>	<p>Effective pedagogy (RSC)</p> <p>Seven simple rules for science teaching (RSC)</p>
	<p>Use chemistry as a unique springboard to inspire and motivate learning, for example by:</p> <ul style="list-style-type: none"> • linking learning to everyday life (e.g. refer to a wide range of relatable food substances that reflect the school community's life experiences) • ensuring that key chemistry terms are understood and frequently revisited • making use of and celebrating pupils' prior knowledge, acknowledging differing life experiences and cultural backgrounds. 	<p>Use chemistry as a unique springboard to inspire and motivate pupils, for example by:</p> <ul style="list-style-type: none"> • linking learning to current and cutting-edge chemistry, with topical or local interests • exposing pupils to a wide and diverse range of careers and study options, including academic and non-academic routes from all levels of chemistry attainment • making use of diverse role models in chemistry which reflect the school population as well as the UK and global community, taking into consideration fair representation of gender, ethnicity, disability and LGBT+ status. 	<p> Fixing the future: inspiring job profiles (RSC)</p> <p>Career options (RSC)</p> <p>Careers inspiration in chemistry (RSC)</p>



	<p>Understand how a range of good basic teaching pedagogies (expanded in TS2 through to TS7) impact upon creating a stimulating learning environment in which all pupils thrive. Examples of good (general) pedagogies include:</p> <ul style="list-style-type: none"> • the Great Teaching Toolkit evidence review • research-based strategies (Rosenshine) • EEF Teaching and Learning Toolkit 	<p>Stay abreast of current trends in research and resources in education (generally) and science education through resources and articles published by organisations such as:</p> <ul style="list-style-type: none"> • The Royal Society of Chemistry • Association of Science Education • STEM Learning • National Education Union 	<p>Great Teaching Toolkit evidence review</p> <p>Principles of instruction</p> <p>Teaching and Learning Toolkit (EEF)</p> <p>Royal Society of Chemistry: Education</p> <p>Association for Science Education</p> <p>STEM Learning</p> <p>Anti-racism charter (NEU)</p>
Skills	<p>Support safe practical chemistry work through good initial planning and establishing good routines, and by monitoring how pupils respond to instructions. Intervene on safety matters as needed. For example, always challenge pupils who are not wearing their eye protection correctly.</p>	<p>Use prior experiences to anticipate potential safety threats during practical chemistry work; plan to reduce or limit these. For example, the layout of the laboratory may be producing ‘traffic jams’ in pupil movement when collecting apparatus, which a redesign of apparatus distribution may overcome.</p>	<p>Successful science practicals (CLEAPSS)</p> <p>How to teach risk assessment skills Education (RSC)</p> <p> The challenges of managing behaviour in the chemistry lab (RSC)</p>
	<p>Build up positive relationships with science technicians, to make best use of their expertise. For example, work through an unfamiliar chemistry practical such as the thermite reaction together.</p>	<p>Establish and enhance positive relationships with science technicians, to jointly identify and close gaps in chemistry practical resourcing, practice and risk assessment.</p>	<p> Working together in perfect harmony (RSC)</p>
	<p>Develop a ‘can-do’ attitude where every pupil accesses learning through well-organised practical chemistry, with highly structured and clear instructions.</p>	<p>Remove obstacles to learning of practical chemistry by:</p>	<p> How to maximise learning from practicals (RSC)</p>

		<ul style="list-style-type: none">• making sure learning objectives are well-defined and highly focussed, with well-defined and measurable outcomes• plan the timing of learning episodes with good routines, to make a smooth transition between each part of the practical (e.g. allow for sufficient time to put practical apparatus away)• making sure pupils' skills and aptitude in practical chemistry are built up over time	Seven simple rules for science teaching – Rule 5 (RSC)
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TS1 – Set high expectations which inspire, motivate and challenge pupils
Set goals that stretch and challenge pupils of all backgrounds, abilities and dispositions

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that there may be barriers to engagement for pupils from a range of backgrounds for complex reasons and why science may be viewed differently by some, affecting the starting points of learning.	Find out how to bridge gaps in attitudes towards science, so they do not become barriers towards making good learning progress.	ASPIRES Research (UCL) Making good progress in key stage three science (STEM Learning)
	Know that learning is a complex process and that all pupils have a ‘spiky profile’ of strengths and weaknesses. This means that when pupils are placed in ‘ability sets’ for chemistry (commonly used in the UK), they are likely to have varying areas of strength and weakness that are not the same as the average assumed for any one set.	Know a range of flexible formative teaching and assessment strategies (or adaptive teaching) that allow pupils to work at different paces even when placed in ability sets. Plan the lesson so that pupils can switch their pace of learning as they move from one activity to the next, not trying to force one fixed pace of learning onto all pupils, for example, by allowing self-regulation.	Making good progress in key stage three science (STEM Learning) Seven simple rules for science teaching – Rule 2 and Rule 7 (RSC)
	Know that barriers to learning in science may fall under different categories, which may affect how goals are set to an appropriate level. The categories are: <ul style="list-style-type: none"> • preconceptions • understanding the abstract • literacy skills • maths skills • neurodiversity • SEND 	Find out how different types of barriers may be overcome, allowing for ambitious and realistic goals to be set. Explore the following categories: <ul style="list-style-type: none"> • preconceptions • understanding the abstract • literacy skills • maths skills • neurodiversity • SEND (refer to pupil’s EHCP) 	Seven simple rules for science teaching – Rule 1 (RSC) 🕒 Develop deeper understanding with models (RSC) Seven simple rules for science teaching – Rule 6 (RSC) 🕒 Better maths skills = better chemists (RSC)

			🕒 Unlocking your students' potential (RSC) 🕒 Tackling practicals for students with SEND (RSC)
Pedagogy	Use progress data, alongside raw attainment data, to make sure that learning goals are not set too low for all levels of prior attainment.	Use supplementary data (CATS scores, maths scores and English/literacy scores), to identify potential barriers to learning and to identify specific ways to support pupils in making good learning progress.	CAT4 (GL Assessment)
	Identify general pedagogical approaches that promote learning progression through self-regulation and identify approaches for making good progress in science.	Identify pedagogical approaches that promote learning progression to address barriers to learning in science which may fall under the following categories: <ul style="list-style-type: none"> • preconceptions • understanding the abstract • literacy skills • maths skills • neurodiversity • SEND 	Making good progress in key stage three science (STEM Learning) Metacognition and self-regulation (EEF) Seven simple rules for science teaching – Rule 1 and Rule 6 (RSC) 🕒 Develop deeper understanding with models (RSC) 🕒 Better maths skills = better chemists (RSC) 🕒 Unlocking your students' potential (RSC) 🕒 Tackling practicals for students with SEND (RSC)




	Make sure science learning goals are SMART (specific, measurable, achievable, relevant and time-bound).	Make sure science learning goals are scaffolded so that larger goals are broken down into steps or stages.	Setting SMART goals in chemistry  Scaffolding learning in chemistry (RSC)
Skills	Demonstrate equitable practice and promote social justice, for example using tools such as 'The Equity Compass'.	Demonstrate equitable practice and promote social justice, for example using tools such as 'The Equity Compass', paying particular attention to underserved pupil groups or those at greater risk of falling behind.	The Equity Compass (The YESTEM Project)
	Develop a 'can do' attitude in ensuring that suitably ambitious goals are generated for each pupil, that represent a good and achievable pace of learning.	Challenge yourself as well as colleagues, whenever artificially low expectations or beliefs about pupil learning capacities emerge.	Making good progress in key stage three science (STEM Learning)
	Share ideas about 'progress culture' and its rationale with parents, who may have traditional expectations about science learning.	Actively promote ideas about 'progress culture' and its rationale to parents, and recruit them to support the development of a progress culture at home.	Parental engagement (EEF)  Science capital – an introduction (King's College)



TS1 – Set high expectations which inspire, motivate and challenge pupils
Demonstrate consistently the positive attitudes, values and behaviour which are expected of pupils

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand how a positive pupil attitude towards the sciences can start from an early age and can heavily influence a young person's science trajectory into adulthood.	Understand how positive pupil attitudes towards science need to be introduced at an early age and then maintained at all stages with age-appropriate adjustments.	ASPIRES Research
	Understand that demonstrating passion and excitement about science and how it connects to the real world will influence pupils' science capital.	Understand that some pupil groups may have less science capital than others and identify a range of strategies that can support in building up science capital (for example trips, STEM visitors, exposure to careers, role of parents and other stakeholders etc.).	 Science capital – an introduction (King's College)
	Become aware of tools such as 'The Equity Compass'.	Identify how tools such as 'The Equity Compass' can be used alongside pre-existing whole-school inclusion policies and practices.	The Equity Compass (The YESTEM Project)
	Understand how cognitive load impacts likely learning behaviours and ability to focus on learning tasks.	Understand how cognitive load impacts likely learning behaviours and ability to focus on learning tasks, with specific reference to complexity of instructions for carrying out practical sciences.	 Reduce cognitive load to build knowledge (RSC)
Pedagogy	Plan science lessons to make sure that cognitive load is kept as low as possible.	Plan science lessons to make sure that cognitive load is kept as low as possible,	Making practical work more effective (RSC)



		with particular reference to instructions for practical work.	
	Make reasonable adjustments to expectations for learning and resources for pupils with SEND.	Make extensive adjustments to expectations for learning and resources for pupils with SEND, such that all pupils can fully participate in practical science.	Successful science practicals (CLEAPSS) Science for secondary-aged pupils with special educational needs and/or disability (SEND) (CLEAPSS)
Skills	Model positive values, attitudes and behaviours towards science in day-to-day teaching.	Explicitly model, describe in detail and actively promote, positive values, attitudes and behaviours towards science.	🕒 Sharing science stories to inspire and engage (RSC)
	Demonstrate equitable practice and promote social justice, for example using tools such as 'The Equity Compass'.	Demonstrate equitable practice and promote social justice, for example using tools such as 'The Equity Compass', paying particular attention to underserved pupil groups or those at greater risk of falling behind.	The Equity Compass (The YESTEM Project)
	Model safe practice in practical work and make it known to pupils.	Explicitly model safe practice in practical work and make it known to pupils, adjusting for different pupil groups, including those with SEND.	Successful science practicals (CLEAPSS) Science for secondary-aged pupils with special educational needs and/or disability (SEND) (CLEAPSS)
	Evaluate everyday pedagogical approaches for their suitability to use as tools to prevent and reduce misbehaviours.	Evaluate everyday pedagogical approaches for their suitability to use as tools to enhance positive behaviours for learning, paying particular attention to those pupils who may be flying under the radar.	Behaviour for learning in science: tips for teachers Behaviour for learning in science: audit tool guidance Behaviour for learning in science: audit tool filled in example

TS2 – Promote good progress and outcomes by pupils
Be accountable for pupils' attainment, progress and outcomes

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that chemistry teachers (like all teachers) are public servants and stewards of public resources and, as such, should adhere to 'The seven principles of public life' (also known as the Nolan Principles), which are: <ul style="list-style-type: none"> • selflessness • integrity • objectivity • accountability • openness • honesty • leadership 	Know that the Nolan Principles may be applied to make sure that every pupil, no matter their background, upbringing, learning capabilities, or learning attitudes, is entitled to gain access to the very best chemistry learning that the UK education system has to offer.	<p> The seven principles of public life (GOV.UK)</p> <p>Every child matters (GOV.UK)</p> <p> Why equity and inclusion are key issues for chemistry teachers (RSC)</p>
	Be aware of the 'Narrow the gap' approaches broadly, as well as in science, towards ensuring that no pupils are left behind.	Be aware that science presents special opportunities to boost learning. For example, according to ASPIRES Research, taking account of pupils' prior knowledge of science from their different home contexts can powerfully boost their science capital.	<p>Narrowing the gaps in science (STEM Learning)</p> <p>Narrowing the gap (STEM Learning)</p> <p>ASPIRES Research</p> <p> Science capital – an introduction (King's College)</p> <p>Targeting science capital (RSC)</p>

	<p>Be aware that a good education in chemistry encompasses an entitlement to learning that includes:</p> <ul style="list-style-type: none"> • learning through practical sciences • making links with the real world • fair representation of the diversity of the school community in the role models being used in the curriculum • links to interesting future study and career options that are linked to chemistry 	<p>Be aware that an excellent education in chemistry encompasses an entitlement to learning that includes:</p> <ul style="list-style-type: none"> • well managed practical sciences (learning about and learning by) • making links with the real world in relevant and exciting contexts, including current and cutting-edge chemistry, with topical or local interests • excellent representation of the diversity of the school community can be seen in the diversity of role models being used in the curriculum (for example STEM ambassadors), as well as of wider national and global communities, taking into consideration fair representation of gender, ethnicity, disability and LGBT+ status • links to a wide and diverse range of interesting and unusual future careers and study options, including academic and non-academic routes providing options for pupils at all levels of chemistry attainment (e.g. chemical engineering for the future) 	<p> Fixing the future: inspiring job profiles (RSC)</p> <p>Career options (RSC)</p> <p>Careers inspiration in chemistry (RSC)</p> <p> Education in Chemistry: news and analysis (RSC)</p> <p>Volunteers and STEM Ambassadors (IChemE)</p>
	<p>Be aware that good outcomes in chemistry education can be measured by more than test scores, for example, by improved pupils' attitudes towards chemistry and its</p>	<p>Be aware that to be held to account for the development of pupil attitudes, there must be a way to track and measure improvements in pupils' attitudes, which would need to be built into the curriculum.</p>	<p>The science capital teaching approach pack for teachers (UCL)</p>

	place, importance and relevance in the world.		
Pedagogy	Use hard data (test scores analyses, including question-level analysis of tests) and soft pupil data (teacher assessment and other) to set appropriate targets, as well as to identify and close gaps in pupil attainment and pupil progress through planned interventions.	Use all forms of data to identify and close gaps in pupil attainment, progress and outcomes, learning lessons so that future gaps are prevented from arising. Adopt a wide range of approaches to do this, e.g.: <ul style="list-style-type: none"> • use accurate and reliable pupil data (test scores and teacher assessment) to set pupil targets • use pupil voice and teacher voice to build up a picture of attitudes • use lesson observation to review the effectiveness of learning activities 	Narrowing the gaps in science (STEM Learning) Narrowing the gap (STEM Learning)
	Use resources such as 'The Science Capital Teaching Approach' and at the level of individual lessons, to raise pupils' science capital, to better engage pupils with science and promote social justice.	Use resources such as 'The Science Capital Teaching Approach' at curriculum level, to raise pupils' science capital, to better engage pupils with science and promote social justice. Use pupil voice resources, such as the survey found within 'The Science Capital Teaching Approach'.	The science capital teaching approach pack for teachers (UCL)
	Use resources such as 'The Equity Compass', at the level of individual lessons, to engage pupils with science and promote social justice.	Use resources such as 'The Equity Compass', at curriculum level, to engage pupils with science and promote social justice.	The Equity Compass (The YESTEM Project)
	Use resources such as the Gatsby practical science benchmarks, 'skills builder	Build in accountability for the development of pupil skills by tracking and measuring	Good practical science (Gatsby)

	partnership' and 'engineering habits of mind' to raise pupils' learning outcomes beyond just pure chemistry subject knowledge and incorporate this skills-building into day-to-day learning.	improvements in skills, which would need to be built into the chemistry curriculum.	Thinking like an engineer (Royal Academy of Engineering)
Skills	Demonstrate equitable practice and promote social justice, such that all pupils thrive, e.g. use tools such as 'The Equity Compass'.	Demonstrate equitable practice and promote social justice, for example using tools such as 'The Equity Compass', paying particular attention to underserved pupil groups or those at greater risk of falling behind.	The Equity Compass (The YESTEM Project)
	Develop a 'can do' attitude to make sure that suitably ambitious goals are generated for each pupil, which represent a good and achievable pace of learning.	Challenge yourself, as well as colleagues, when artificially low expectations or beliefs about pupil learning capacities emerge. Promote or create a culture of ethics or ethical leadership (e.g. use the 'Nolan Principles' or 'Every child matters' agenda as a driver) to make sure that every pupil, no matter their background, upbringing, learning capabilities, or learning attitudes, is provided with the very best chemistry learning.	Making good progress in key stage three science (STEM Learning)  The seven principles of public life (GOV.UK) Every child matters (GOV.UK)
	Promote a 'progress culture' within the classroom by recognising and celebrating learning distance travelled, progress made, efforts applied and skills built up. Avoid celebrating raw attainment or raw intelligence and proactively promote a	Promote a 'progress culture' among colleagues by challenging traditional ideas about praising raw attainment or raw intelligence, which may be inadvertently promoting a fixed mindset. Consider removing ability setting in chemistry altogether, which has (on average) no	 Carol Dweck - A study on praise and mindsets Setting and streaming (EEF)

	growth mindset in which all pupils can thrive.	beneficial impact on learning. EEF evidence suggests that setting and streaming has a small negative impact on low-attaining pupils and a small positive impact for higher attaining pupils. Carol Dweck's study shows that higher attainers may also lose out.	
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TS2 – Promote good progress and outcomes by pupils


Be aware of pupils' capabilities and their prior knowledge and plan teaching to build on these

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	<p>Know that each pupil is unique and has a spiky profile of capabilities (although all capabilities may be developed), as well as a spiky profile of prior chemistry knowledge. It is your responsibility to factor in differences in pupil profiles when planning learning, such that all pupils' needs are catered for and that no pupil is left behind.</p>	<p>Know that when pupils are placed in 'ability sets' for chemistry (commonly used in the UK), they are likely to have varying areas of strength and weakness that are not the same as the average that may be assumed for that set.</p> <p>Know that on average, pupils experiencing setting or streaming make similar progress to pupils taught in mixed attainment classes. The evidence suggests that setting and streaming has a small negative impact on low attaining pupils and a small positive impact for higher attaining pupils (EEF).</p>	Setting and streaming (EEF)
	<p>Build up an insight into pupils' prior science knowledge profiles over time, so that you can tailor teaching to individual pupils' needs, as you develop better knowledge about your pupils. For example, some pupils may find it more difficult than others to apply particle theory to explaining chemical phenomena (e.g. explaining dissolving) and this difficulty may be carried over to future learning units (e.g. chromatography).</p>	<p>Identify common patterns seen across different pupils' profiles over time, so that you can use this information to pre-empt issues across a group of pupils or a cohort, e.g. applying the particle theory to explaining chemical phenomena.</p>	Improving secondary science – Recommendation 1: preconceptions (EEF)
	<p>Build up an insight into different pupils' capabilities in their skills over time, i.e.:</p>	<p>Identify common patterns seen across different pupils' profiles over time and use</p>	Guide to maths for scientists (STEM Learning)

	<ul style="list-style-type: none"> practical science skills literacy skills for science maths skills for chemistry 	<p>this information to pre-empt issues across a group of pupils or a cohort, e.g. applying proportionality to carrying out a series dilution.</p>	<p>Good practical science (Gatsby)</p> <p>Literacy in science teaching (RSC)</p> <p>Seven simple rules for science teaching – Rule 5 and Rule 6 (RSC)</p>
	<p>Build up an insight over time into different pupils' general learning skills, such as speaking, listening and explaining, independent thinking and learning, collaborative learning and self-regulation.</p>	<p>Identify common patterns seen across different pupils' profiles over time and use this information to pre-empt issues across a group of pupils or a cohort, e.g. emphasise the difference between the command words 'describe' and 'explain'.</p>	<p>The science of learning (Deans for Impact)</p>
Pedagogy	<p>Know of a range of formative teaching, diagnostic assessment and feedback strategies (or adaptive/responsive teaching strategies) that allow pupils to work at different levels or different paces.</p>	<p>Know of a wide range of flexible formative teaching, diagnostic assessment and feedback strategies (or adaptive teaching strategies) that allow pupils to work at different levels or different paces, even when placed in ability sets.</p>	<p>Making good progress in key stage three science (STEM Learning)</p> <p>Seven simple rules for science teaching – Rule 2 and Rule 7 (RSC)</p>
	<p>Identify some pedagogical approaches for overcoming barriers or blocks identified in the prior science knowledge profiles of individual pupils, e.g. ask pupils to share and explain how particles behave during dissolving prior to explaining how particles behave during chromatography.</p>	<p>Identify a range of pedagogical approaches to overcome barriers or blocks identified in the prior science learning profiles of groups of pupils.</p> <p>For example, where pupils have been giving weak scientific explanations, incorporate the PEOE method (predict, explain, observe and explain) during a greater number of chemistry practicals, to encourage pupils to deeply explain their predictions and explain</p>	<p>Practical chromatography (RSC)</p> <p>The use of demonstrations in science teaching (Alom Shaha)</p>

		what they have observed during think-pair-share activities.	
	Identify some pedagogical approaches to overcome barriers or blocks identified in the general learning skills of individual pupils, e.g. provide them with an in-class mentor to support them to develop active listening skills.	Identify a range of pedagogical approaches to overcome barriers or blocks identified in the general learning skills of groups of pupils. For example, where pupils engage in off-task chatter during group work, incorporate greater structure in the instructions for group talk to make them more effective.	Effective group talk (STEM Learning) (see Golden rules)
Skills	Use some pedagogical approaches to uncover pupils' preconceptions.	Use a range of different pedagogies (including group discussion and diagnostic questions) effectively to uncover pupils' preconceptions.	Seven simple rules for science teaching – Rule 1 (RSC)
	Use formative assessment to check that misconceptions in chemistry conceptual understanding have been resolved and adjust your teaching if they have not.	Use a range of formative assessment strategies (such as low stakes quizzes, diagnostic questions and group discussion) to check that misconceptions have been resolved. If they have not, adjust your teaching. Understand that misconceptions are 'sticky' and test for them after a 'forgetting gap'.	Improving secondary science – Recommendation 1: preconceptions (EEF)
	Use formative assessment to check that pupils are progressively building up their underlying skills for science; resolve issues and adjust your teaching if they have not. Skills for science include: <ul style="list-style-type: none"> • practical science skills • literacy skills for science • maths skills for chemistry 	Use a range of formative assessment strategies (such as low stakes quizzes, diagnostic questions and group discussion) to check that shortfalls in pupils' skills are being resolved. Adjust your teaching if they have not.	Improving secondary science – Recommendations 5 and 6: practical science and literacy (EEF)

TS2 – Promote good progress and outcomes by pupils
Guide pupils to reflect on the progress they have made and their emerging needs

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that high-quality feedback (written or oral) provided by the teacher has a very high positive impact for very low cost based on extensive evidence (EEF), which translates into approx. six months of additional learning equivalence per pupil per year.	Know that the effects of feedback are high across all curriculum subjects, with slightly higher effects in mathematics and science (EEF). Be aware that low attaining pupils tend to benefit more from explicit feedback than high attainers.	Feedback (EEF) Teacher feedback to improve pupil learning (EEF)
	Find out what pupils understand and use the knowledge to inform teaching.	Regularly find out what pupils understand and routinely use this knowledge to inform teaching.	Improving secondary science – Recommendation 7: feedback (EEF) Seven simple rules for science teaching – Rule 7 (RSC)
	Know that pupils can also obtain high quality feedback through self-assessment, peer-assessment and collaborative group tasks.	Know that the better the payoff in terms of learning gained through feedback, the tougher the pedagogy is to develop, although the bigger payoff makes it worth it. Metacognitive strategies take more time for pupils to get used to and may require a shift in the established learning culture.	Black, P. and Harrison, C., 2004, <i>Science inside the black box: assessment for learning in the science classroom</i> , NfER Nelson, London.
	Know that some parents may hold traditional views about how teachers should give feedback to pupils (i.e. through grades rather than comments), which may be reflected in what pupils expect.	Know that schools and teachers can work together to improve parents' and pupils' expectations about the role of feedback, by providing good evidence and rationale to support this, as well as a commitment to make it work with the best outcomes for pupils in mind.	Parental engagement (EEF)  Science capital – an introduction (King's College)




Pedagogy	Know a range of pedagogies to find out what pupils understand and use tests and practice questions to help with this.	Know a wide range of strategies, including low stakes assessments, discussion and peer- and self-assessment to find out what pupils understand.	How to understand what your pupils know (RSC)
	Provide feedback on the task and the chemistry topic. For example, say, 'Your understanding of chemical yield is good, but be careful to use the correct units', or 'Next time you do a calculation for yield, try to set it out the way I showed you'.	Provide feedback on pupils' self-regulation and self-evaluation. For example, say, 'Are you happy that you understand the Haber process now?', 'What could you do to extend your flow diagram of the Haber process further?'.	Improving feedback now and for the future (RSC)
	Provide pupils with comments on how to improve in the future, rather than marks or grades. Doing this as written comments at the individual pupil level can be time consuming.	Provide pupils with comments on how to improve in the future. Understand a range of ways to do this, including orally to individuals or groups of pupils, or as a whole class for common errors. An example would be to say, 'I would like those pupils who chose Answer A for the question about the reactivity series to pair up with a pupil who chose Answer B, and in your pair, reach one joint answer with an explanation as to why that answer is right.'	How to give effective, descriptive feedback (RSC) Why reflection is better than grades (RSC)
	Create time in lessons or as homework to allow pupils to respond to feedback.	Create time in lessons or as homework to allow pupils to respond to feedback. Make sure there are specific feedback tasks for pupils to respond to and there is a clear understanding of the reason for and outcome of the feedback task.	Black, P. and Harrison, C., 2004, <i>Science inside the black box: assessment for learning in the science classroom</i> , NFER Nelson, London.
Skills	Use formative questioning to extract and measure understanding and provide useful feedback that moves pupils' learning on (e.g. by using well developed hinge point questions with follow up interventions where needed).	Use metacognitive learning tasks to empower the extraction and measuring of what has been understood and provide insights to the pupil that will move their learning on. Incorporate methods by which pupils can regulate their own learning (e.g.	Principles of assessment for learning (RSC) Seven simple rules for science teaching – Rule 7 (RSC)

	by using SOLO taxonomy) and learning through collaboration with others (group tasks with peer-assessment).	🕒 How to use hinge point questions effectively (RSC) 🕒 What is SOLO taxonomy? (RSC) 🕒 Capitalising on collaboration (RSC)
Provide clear, specific feedback and give pupils information about how to improve on the specific task.	Provide pupils with feedback on the task and information about how to improve on tasks of this type, so they can apply the feedback to other tasks (transferable learning). Also, give pupils feedback on their self-regulation and how to manage their learning.	Improving secondary science – Recommendation 7: feedback (EEF) 🕒 Why reflection is better than grades (RSC)
Make sure that a culture of utilising feedback exists, in which teachers provide pupils with feedback, and pupils also learn through self-assessment and peer-assessment.	Make sure that a culture of feedback exists in which pupils' learning thrives. Pupils become comfortable with accurately self-assessing or peer-assessing and are happy to receive feedback from their teacher in pupil groups or as an individual. Pupils can use tools such as SOLO taxonomy to rate their own learning. There is no judgement, which encourages feelings of safety in pupils and, in turn, encourages transparency of learning.	🕒 What is SOLO taxonomy? (RSC)
Share ideas about 'feedback with no grades', 'self-regulation', 'metacognitive learning' and their rationales with parents, who may have traditional expectations about science learning.	Proactively promote ideas about 'feedback with no grades', 'self-regulation', 'metacognitive learning' and their rationales to parents, and recruit them to support the development of a metacognitive learning culture at home.	Parental engagement (EEF) 🕒 Science capital – an introduction (King's College)





TS2 – Promote good progress and outcomes by pupils




Demonstrate knowledge and understanding of how pupils learn and how this impacts on teaching

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Be aware of common preconceptions and misconceptions in the understanding of chemistry that pupils may have and how these may be overcome. For example, there are four common misconceptions associated with learning about the particulate nature of matter.	Be aware of common preconceptions and misconceptions within the building blocks of a pupil's chemistry learning journey and how these may (if unchallenged) accumulate and affect the learning of more complex chemistry concepts in later years.	Beyond appearances: students' misconceptions about basic chemical ideas (RSC)
	Be aware that the sequence of key ideas is important for pupils' understanding of new chemistry topics and that the order in which chemistry concepts are taught will impact on learning. For example, before covering 'neutralisation', pupils should have learned about acids and bases, pH values, chemical reactions and compounds.	Be aware that you may need to revisit topics to build up the complexity of chemistry concepts. For example, 'neutralisation of an acid' may be taught at a higher level if ions have been understood, (i.e. neutralisation of an acid is the removal of H ⁺ ions: H ⁺ + OH ⁻ → H ₂ O); or at a simpler level if ions have not been taught yet (i.e. neutralisation as a simple chemical reaction in which atoms rearrange and the pH changes to 7). Scrutinise and test for the assumptions made about what pupils need to know before any new chemistry concept is unveiled.	CPD guides (RSC)
	Be aware that the best general teaching strategies according to research, may also be applied successfully to chemistry learning, for example: <ul style="list-style-type: none"> • metacognition and self-regulation • formative feedback • collaborative learning 	Be aware that science presents special opportunities to boost learning. For example, according to the EEF, 'collaborative learning' adds an average of five months of additional learning equivalence per pupil per year. However, in	Metacognition and self-regulation (EEF) Feedback (EEF) Collaborative learning approaches (EEF)

	<ul style="list-style-type: none"> activating hard thinking 	<p>science, the impact rises to 10 months of additional learning per pupil per year.</p>	<p>Great Teaching Toolkit evidence review (Activating hard thinking)</p> <p>Effective group talk (STEM Learning)</p>
	<p>Be aware that the science of learning, according to the broader research in education, may also be applied successfully to chemistry learning, for example:</p> <ul style="list-style-type: none"> how different types of praise impact learning (Carol Dweck) how incorporating a careers awareness angle powerfully motivates learning how pupils must transfer information from working memory (where it is consciously processed) to long-term memory (where it can be stored and later retrieved) 	<p>Be aware that science presents special opportunities to boost learning. For example, according to ASPIRES Research, taking account of pupil's prior knowledge of science from their different home contexts can powerfully boost their science capital.</p>	<p> Carol Dweck – A study on praise and mindsets</p> <p>Motivated to achieve (Education and Employers)</p> <p>ASPIRES Research</p> <p> Science capital – an introduction (King's College)</p> <p>The science of learning (Deans for Impact)</p>
<p>Pedagogy</p>	<p>Understand that one of the special characteristics of chemistry is that pupils need to be able to think in the abstract to access the sub-microscopic level of the unseen, using modelling or visualisation methods of what is happening at a particle level.</p>	<p>Understand that some pupils may find accessing the sub-microscopic level more difficult than others, factoring in variation such as:</p> <ul style="list-style-type: none"> social or cultural preconceptions about what is expected in chemistry learning ability to visualise in the abstract neurodiversity SEND 	<p>Chemical misconceptions (RSC)</p> <p> Develop deeper understanding with models (RSC)</p> <p>Improving secondary science – Recommendation 3: modelling (EEF)</p>

<p>Understand that one of the special characteristics of chemistry is that pupils need to be able to think in the abstract to access symbolic representation that is used to describe what can be observed in chemistry at the macroscopic level, using:</p> <ul style="list-style-type: none"> • word or symbol equations • mathematical formulas • graphs • diagrams <p>For example, converting units, interpreting graphs, rearranging equations, or using moles may be challenging for some pupils.</p>	<p>Understand that (as for the sub-microscopic level) some pupils may find accessing symbolic representation more difficult than others, factoring in variations such as:</p> <ul style="list-style-type: none"> • ability to visualise in the abstract • maths skills • neurodiversity • SEND 	<p>🕒 Develop deeper understanding with models (RSC)</p> <p>🕒 Better maths skills = better chemists (RSC)</p> <p>🕒 How to teach quantitative chemistry at post-16 (RSC)</p>
<p>Understand that pupils need to be able to link up and move fluidly between the three fundamental levels of chemistry (below), which requires repetition and practice:</p> <ul style="list-style-type: none"> • the macroscopic (i.e. what is concrete and observable) • the symbolic (abstract thinking) • the sub-microscopic (abstract thinking) 	<p>Understand that some pupils may access either one, or two, or three of these levels, but may have differing strengths in their ability to fluidly move between them without support or scaffolding.</p>	<p>🕒 Develop deeper understanding with models (RSC)</p>
<p>Understand that pupils will learn chemistry best if the development of underlying science skills such as:</p> <ul style="list-style-type: none"> • practical science skills • literacy skills for science • maths skills for chemistry 	<p>Assess and track the building up of skills and give them sufficient space in the curriculum. Predict and plan for potential learning challenges, for example:</p> <ul style="list-style-type: none"> • how to balance equations • how to measure volume accurately during a titration 	<p>Good practical science (Gatsby)</p> <p>Literacy in science teaching (RSC)</p> <p>Seven simple rules for science teaching – Rule 5 and Rule 6 (RSC)</p>

	<p>are given importance and planned to be developed over time alongside science subject knowledge.</p>	<ul style="list-style-type: none"> • how to explain the diffusion of gases in an extended question 	<p> Five effective ways to teach balancing equations (RSC)</p>
<p>Skills</p>	<p>Employ a range of teaching techniques to boost thinking in the abstract to access the sub-microscopic level of chemistry learning, such as:</p> <ul style="list-style-type: none"> • 2D modelling (e.g. dot and cross diagrams, flow charts, particle models, diagrammatic representation of giant covalent structures) • 3D modelling (Molymod, Plasticine, animations, physical representation of models, such as two-coloured beads in a jar to model dissolving) • group discussion (concept cartoons, think-pair-share) • role-play or dramatisation 	<p>Employ a wide range of teaching techniques to support and stretch thinking in the abstract to access the sub-microscopic level of chemistry, including peer-discussion work, used alongside practical work. Make sure teaching techniques serve to support and stretch all pupils, whatever their starting points, e.g. ask pupils to evaluate different models of representation in chemistry, since all models are imperfect and have pros and cons.</p> <p>Use models at appropriate times and make sure they are relevant to pupils and don't add unnecessary complexity. For example, the 'barrel analogy' for limiting factors.</p>	<p>Seven simple rules for science teaching – Rule 3 (RSC)</p> <p> Modelling for understanding (RSC)</p> <p>Molymod set (RSC)</p> <p> Science concept cartoons (RSC)</p> <p>Abrahams, I., Braund, M. <i>et al.</i>, 2012, <i>Performing science: teaching chemistry, physics and biology through drama</i>, Continuum, London.</p>
	<p>Employ a range of teaching techniques to boost thinking in the abstract to access symbolic representation in chemistry learning, such as:</p> <ul style="list-style-type: none"> • cross-referencing symbolic representation with sub-microscopic and macroscopic representation by using Johnstone's triangle across the whole of chemistry 	<p>Employ a wide range of teaching techniques to support and stretch thinking, including peer-discussion work used alongside practical work. Make sure teaching techniques serve to support and stretch all pupils, whatever their starting points.</p> <p>For example, use the 'back-to-back' technique, where one pupil orally describes a graph while sitting back-to-back with another pupil who must reproduce the graph without looking, then swapping roles.</p>	<p>Practical ideas for using Johnstone's triangle (RSC)</p> <p> Better maths skills = better chemists (RSC)</p>



	<ul style="list-style-type: none"> allowing for repetition of practice (e.g. rearranging the mole equation, writing half-equations, converting units, drawing dot and cross diagrams) for example by using mini-whiteboards 	<p>Both pupils then peer-assess one another's performance.</p>	
	<p>Use formative questioning to extract and measure understanding and provide useful feedback that moves pupils learning on (e.g. using hinge-point questions).</p>	<p>Use metacognitive learning tasks to empower the extraction and measuring of what has been understood and provide insights to the pupil that will move their learning on. Incorporate methods in which pupils can regulate their own learning (e.g. by using SOLO taxonomy) and learning through collaboration with others (group tasks with peer-assessment).</p>	<p>Principles of assessment for learning (RSC)</p> <p>Seven simple rules for science teaching – Rule 7 (RSC)</p> <p> How to use hinge point questions effectively (RSC)</p> <p> What is SOLO taxonomy? (RSC)</p> <p> Capitalising on collaboration (RSC)</p>
	<p>Know that learning intentions for practical work fall under one of the 'five purposes of practical science' (Gatsby), which impact on how the learning is planned, assessed and formative interventions carried out.</p> <p>For example, for the reaction of magnesium with oxygen, the intended learning outcome could be any of the following:</p> <ul style="list-style-type: none"> see that combustion is exothermic (a simple observation) 	<p>Use practical work in the laboratory purposefully, with clear and focussed learning intentions, measuring pupils' learning along the way, with opportunities for formative interventions built in. For example, use the PEOE method (predict, explain, observe and explain) during chemistry demonstrations or pupil-led practical work.</p> <p>Make sure formative questions and learning interventions during the lesson strongly align with the focussed learning intentions</p>	<p>Good practical science (Gatsby)</p> <p>Practical resources (RSC)</p> <p>The use of demonstrations in science teaching (Alom Shaha)</p> <p>Effective practical work in the science classroom – Ian Richardson (STEM Learning)</p>

	<ul style="list-style-type: none">• see that magnesium reacts more easily than less reactive metals (compare magnesium with other metals)• see that mass is conserved in a chemical reaction (magnesium oxide weighs more than magnesium, due to oxygen molecules)• calculate the formula for magnesium oxide (weighing reactants and products, drawing graphs and making calculations)	and in doing so make sure that all pupils make good learning progress in which the 'real learning' is not lost in the 'doing' of the practical.	
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TS2 – Promote good progress and outcomes by pupils

Encourage pupils to take a responsible and conscientious attitude to their own work and study

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	<p>Know that in Wynne Harlen’s ‘14 Big Ideas’, you can use ideas 11–14 to support being responsible and having a conscientious attitude through science.</p> <ul style="list-style-type: none"> Idea 11: science is about finding the causes of phenomena in the natural world. Idea 12: scientific explanations, theories and models are those that best fit the evidence available at a particular time. Idea 13: knowledge produced by science is used in engineering and technologies to create products to serve human ends. Idea 14: applications of science often have ethical, social, economic and political implications <p>Know that Ofsted’s SMSC (social, moral, spiritual and cultural) provision framework may also be useful.</p>	<p>Know that for ideas 11–14, there is progression in the engagement with content for different age groups, that are outlined in the document. An extract from the document (Idea 14, ages 11–14) is shown below:</p> <p><i>‘There are generally both positive and negative consequences of the applications of science. Some negative impacts can be anticipated but others emerge from experience. Clean water, adequate food and improved medicines have increased human life expectancy but at the same time the resulting population growth has increased demands on resources and on space on the Earth’s surface for increased food production, housing and disposal of waste. This has often been detrimental to those in developing countries and resulted in the destruction of habitats of other living things, causing some to become extinct.’</i></p> <p>Know that the SEAL (social and emotional aspects of learning) framework may also be useful.</p>	<p>Principles and big ideas of science education (Wynne Harlen)</p>
	<p>Know that learning through metacognition and self-regulation is a direct contributor</p>	<p>Know that metacognition and self-regulation approaches cannot easily be</p>	<p>Seven simple rules for science teaching – Rule 2 and Rule 7 (RSC)</p>




	<p>towards pupils taking responsibility and developing a conscientious attitude towards their own work and study.</p>	<p>used without first incorporating them into the curriculum and factoring in pupils' prior aptitudes towards learning through metacognition and self-regulation, which must be built up over time. Know that pupils from disadvantaged backgrounds may need to be explicitly taught metacognitive strategies. However, the investment yields significant benefits.</p> <p>Know that high quality metacognition and self-regulation teaching approaches have a very high positive impact for very low cost based on extensive evidence (EEF), which translates into eight months of additional learning equivalence per pupil per year.</p>	<p>Metacognition and self-regulation (EEF)</p> <p> How metacognition improves student engagement and outcomes (RSC)</p>
Pedagogy	<p>Share and nurture high expectations for learning.</p>	<p>Explicitly share clear instructions and high expectations for learning. Repeat and consolidated these as frequently as is necessary to habituate good learning behaviours in class.</p>	<p>How to get your post-16 students to manage their workload effectively (RSC)</p> <p>Improving secondary science – Recommendation 2: self-regulation (EEF)</p>
	<p>Use some metacognitive approaches and give regular opportunities for pupils to practise and develop their skills.</p>	<p>Use metacognitive strategies effectively and allow pupils extensive opportunities to practise metacognition, such as through SOLO taxonomy.</p>	<p>Seven simple rules for science teaching – Rule 2 and Rule 7 (RSC)</p> <p>Improving secondary science – Recommendation 2: self-regulation (EEF)</p> <p>Metacognition and self-regulation (EEF)</p> <p> What is SOLO taxonomy? (RSC)</p>


	Use worked examples and model your own thinking when pupils first encounter new types of problems or ways of thinking (e.g. formula triangles or thinking scaffolds, to make calculations about the rate of reaction).	Plan carefully how to introduce new problem-solving techniques and ways of thinking. Use worked examples and model your own thinking (e.g. formula triangles or thinking scaffolds, to make calculations about the rate of reaction). Remove these scaffolds over time so that pupils become independent and so that difficulty is deliberately introduced.	Rates of reaction (RSC)
Skills	Model positive values, attitudes and responsible behaviours towards science in day-to-day teaching.	Explicitly model, describe in detail and proactively promote positive values, attitudes and responsible behaviours towards science.	 Modelling self-correction (RSC)
	Give pupils feedback on aspects of their learning such as engagement in group talk, self-regulation and metacognition, in addition to feedback about their science understanding.	Make sure pupils can use tools such as SOLO taxonomy to evaluate their own learning of chemistry as well as other aspects of learning.	 What is SOLO taxonomy? (RSC)
	<p>Make sure that classroom discussions take place even though some pupils may refrain from taking part and limited metacognitive talk takes place.</p> <p>For example, pupils may hold a debate about whether plastic milk bottles or glass milk bottles are better for the environment, using life cycle assessment data, in which pupils are able to ask useful questions and create a plan to carry out research for the debate.</p>	<p>Make sure that productive, well-managed classroom discussion takes place frequently. Make sure metacognitive talk takes place, regularly encourage pupils to justify their answers and support pupils to strengthen their arguments.</p> <p>For example, pupils may hold a debate about whether plastic milk bottles or glass milk bottles are better for the environment, using life cycle assessment data, in which they competently plan and execute a</p>	Effective group talk (STEM Learning) Life cycle assessments (RSC)  Flowing SOLO (RSC)

		<p>research strategy prior to the debate, deliver the debate to a high standard of critical thinking and are then able to evaluate their own independent thinking skills, with ideas about how to make the next debate better.</p>	
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TS3 – Demonstrate good subject and curriculum knowledge

Have a secure knowledge of the relevant subject(s) and curriculum areas, foster and maintain pupils' interest in the subject, and address misunderstandings


	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Maintain up to date knowledge of science in the news/society and how it impacts on pupils' lives, e.g. the impact of increasing levels of greenhouse gases such as carbon dioxide and methane on climate change.	Know the 'big ideas' of science and how they build through the curriculum stage, e.g. the impact of increasing levels of greenhouse gases such as carbon dioxide and methane on climate change.	News & analysis (RSC)  Spiral your curriculum for electrochemistry success (RSC)
	Understand how science topics are used in everyday life and the careers available, e.g. an analytical chemist uses techniques such as chromatography or titration to determine the purity of water.	Actively promote how science topics are used in everyday life by selecting interesting teaching contexts and making pupils aware of relevant careers, e.g. an analytical chemist uses techniques such as chromatography or titration to determine the purity of water.	A Future in Chemistry (RSC) Titration screen experiment (RSC)
	Develop a detailed understanding of the science curriculum being taught, including purposeful practical work, demonstrations and investigations for learning.	Develop an understanding of how specific theories and practical lessons fit into the overall curriculum a pupil learns.	Nail every practical lesson (RSC)  Practise purposeful practicals (RSC)  Develop key scientific skills with practical videos (RSC) Exhibition chemistry (RSC)
	Build up an understanding of pupils' misconceptions in science and identify your own misconceptions, e.g. understand how science terminology, such as 'pure' or	Understand common misconceptions in science and know how and when to challenge pupils' ideas. For example, when teaching changes of state, challenge the	Beyond appearances: students misconceptions about basic chemical ideas (RSC)

	'molecule', is incorrectly used in everyday life.	common misconception that particles may expand or contract.	Chemical misconceptions (RSC)
Pedagogy	Begin to understand how pedagogical research applies to science as a curriculum area.	Maintain an up-to-date understanding of how pedagogical research applies to science as a curriculum area.	Improving secondary science (EEF) Education research (RSC)
	Develop strategies to identify your pupils' misconceptions in the sciences, then reinforce corrected misconceptions with appropriate response activities.	Regularly use diagnostic probes and questions to challenge pupils' understanding. Follow this up with appropriate response questions.	BEST resources (STEM Learning) Chemical misconceptions (RSC)
	Build up your repertoire of purposeful practicals. Set up and try out practical activities/observe experienced teachers before you use them in the classroom, e.g. the thermite reaction or testing for acids and alkalis on a microscale.	Use purposeful practical work to reinforce scientific concepts, teach working scientifically and develop pupils' practical skills.	Good practical science (Gatsby)
	Develop your own understanding of simple models and their pitfalls when used in school science to illustrate abstract concepts, e.g. the particle model of matter.	Use a range of models in your teaching and encourage pupils to evaluate the models.	Seven simple rules for science teaching – Rule 3 (RSC)
		Understand that misconceptions are difficult to shift and need to be revisited at different points, and use a range of pedagogies to address them, including cognitive conflict, group discussion and argumentation.	Improving secondary science – Recommendation 1: preconceptions (EEF)
Skills	Use a variety of skills to enable pupils to make links within and outside of science.	Enable pupils to make links within science, e.g. use concept/mind maps with types of	 Boost maths skills to improve chemistry learning (RSC)

		chemical reactions. Work across curriculums to develop and implement commonly used strategies and skills, e.g. the use of significant figures.	
	Use a range of strategies to identify pupils' misconceptions and how to deal with them.	Pre-empt misconceptions and put in place mitigating actions so pupils do not arrive at the misconceptions.	Seven simple rules for science teaching – Rule 1 (RSC)
	Understand how science/chemistry impacts on other subjects and vice-versa, e.g. enzymes or the structure of the atom.	Know which strategies to implement to make sure teaching in other subjects is consistent with science and chemistry, e.g. how to rearrange a formula when carrying out mole calculations.	Introducing moles and Avogadro's number (RSC)
	Develop an understanding of the correct terminology to use in pupil explanations and when to use it, e.g. oxidation is gain of oxygen or oxidation is loss of electrons.	Know and use the correct terminology at the appropriate times in pupil explanations.	Seven simple rules for science teaching – Rule 6 (RSC)

TS3 – Demonstrate good subject and curriculum knowledge
Demonstrate a critical understanding of developments in the subject and curriculum areas, and promote the value of scholarship

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Improve your own pedagogical content knowledge (PCK) in the sciences, e.g. observe an established science teacher teaching a tricky topic.	Maintain up-to-date pedagogical content knowledge (PCK) in the sciences, e.g. read the 'How to teach chemistry' CPD <i>Education in Chemistry</i> articles.	RSC Education Association for Science Education STEM Learning
	Stay abreast of some new developments in chemistry, where they may be linked to the existing chemistry curriculum.	Stay abreast of a wide range of new developments in chemistry, where they may be linked to the existing chemistry curriculum.	Education in Chemistry New Scientist
	Improve your own pedagogical subject knowledge (PSK) in the sciences, e.g. complete past exam papers and use the exam board marks scheme to assess yourself.	Maintain up-to-date pedagogical subject knowledge (PSK) in the sciences, e.g. engage with annual examiners' reports and Ofsted subject reviews.	Consult relevant exam board examiners reports Teacher support sessions (RSC)
	Build up a detailed understanding of purposeful practical work, demonstrations and investigations for learning, including health and safety, e.g. refer to model risk assessments provided by CLEAPSS and SSERC.	Access and refer to the latest health and safety advice from CLEAPSS/SSERC when planning for and teaching practical activities, e.g. demonstrating the thermite reaction.	CLEAPSS
Pedagogy	Build up a bank of modern science teaching contexts and anecdotes that can later be used when teaching.	Teach science with enthusiasm and confidence using modern and interesting	A Future in Chemistry (RSC) News & analysis (RSC)

		real-life contexts that are of relevance to pupils.	@royalsocietyofchemistry (TikTok)
	Promote the value of chemistry work and study in the wider world, by linking to chemistry-linked careers and study options.	Promote the value of chemistry work and study in the wider world, by linking to a wide and diverse range of chemistry-linked careers and study options.	A Future in Chemistry (RSC) Here's how to showcase science careers students can aspire to (RSC) A Scientist Just Like Me (Primary Science Teaching Trust)
	Employ a range of strategies for assessing pupils' work that incorporates assessing new developments in chemistry and the importance of a scholarly approach and providing them with constructive feedback.	Regularly provide pupils with constructive feedback that incorporates assessing new developments in chemistry and the importance of a scholarly approach. Clearly state the steps to be taken to make sure pupils make further progress in science.	Classroom assessment skills: 6 ways to develop your assessment literacy (RSC)
	Relate current and cutting-edge science to the science curriculum.	Incorporate current and cutting-edge science into the science curriculum.	Global science (RSC Education)
Skills	Know where to access and how to use support materials to understand variations in pupils' understanding of science, for example Best Evidence Science Teaching (BEST) resources.	Regularly use support materials to understand variations in pupils' understanding of science, for example Best Evidence Science Teaching (BEST) resources.	BEST resources (STEM Learning)
	Promote a culture of enthusiasm for new developments in chemistry among pupils.	Promote a culture of enthusiasm for new developments in chemistry among pupils and staff.	 News and analysis (RSC Education)



TS3 – Demonstrate good subject and curriculum knowledge			
<i>Demonstrate an understanding of, and take responsibility for, promoting high standards of literacy, articulacy and the correct use of standard English</i>			
	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know the meaning of root words (e.g. <i>chlor</i> means green), prefixes (e.g. <i>mono</i> means one) and suffixes (e.g. <i>lysis</i> means decompose) in science vocabulary.	Help pupils to understand the meaning of difficult words by breaking down words into their components, e.g. exothermic; <i>exo</i> means out, <i>therm</i> means heat, therefore <i>exothermic</i> means ‘to give heat out’.	🕒 Help your students decode science vocabulary (RSC) Frayer models offer a window into students’ science capital (RSC)
	Use strategies to demonstrate how science is communicated among the real scientific community, e.g. making a scientific poster.	Use strategies to demonstrate how science is communicated among the real scientific community, e.g. making a scientific poster or writing a scientific report.	Seven simple rules for science teaching – Rule 3 (RSC) Oral communication skills (RSC)
	Be aware of the reading age of your pupils and use this to target pupils with literacy support.	Use the reading age data of your pupils to plan for activities with appropriate levels of literacy in your lessons.	Improving Literacy in Secondary Schools (EEF)
	Be aware that pupils can potentially gain a lot of learning through collaborative learning tasks.	Know that science provides a unique opportunity to gain learning benefit from collaborative group work. According to EEF research, group work has an especially high positive impact unique to the subject of science, which translates to 10 months of additional learning per pupil per year.	Collaborative learning approaches (EEF)
Pedagogy	Understand the need to promote high standards of communication and start to	Model very high standards of written and verbal communication in all science teaching-related professional activities,	Teaching EAL learners in science (The Bell Foundation)




	build reading and writing activities into science lessons.	paying special attention to EAL pupils, and recognising that teaching strategies that are good for EAL pupils are usually also good for all other pupils in science.	
	Start to use a variety of techniques for promoting disciplinary literacy in science, e.g. model different approaches to long answer questions.	Use a variety of techniques for promoting disciplinary literacy in science, e.g. model different approaches to long answer questions.	 Strategies for six-mark questions (RSC)
	Develop strategies that enable pupils to converse/debate science and empower them to research those areas, e.g. collaborative group work.	Write some open-ended tasks into the science curriculum which pupils must research and present and/or debate, e.g. should single-use plastics be banned?	 How best to engage students in group work (RSC) Build understanding through debate (RSC)  Debate in the chemistry class (RSC)
	Use collaborative learning as a vehicle to strengthen and deepen learning, as well as to drive articulation and oracy in chemistry (e.g. talk partners).	Use collaborative learning extensively as a vehicle to strengthen and deepen learning, as well as to drive articulation and oracy in chemistry (e.g. talk partners and debates).	Collaborative learning approaches (EEF)
	Develop literacy-based pedagogy/disciplinary literacy pedagogy to teach technical language and use reading, writing and talk to develop, consolidate and organise conceptual thinking, e.g. use the Frayer model and graphic organisers.	Know which strategies to implement to make sure your pupils gain a good understanding of the required scientific vocabulary and are able to communicate, e.g. use Johnstone's triangle to support scientific explanations of experimental observations.	 Teaching challenging vocabulary (RSC) Using Johnstone's triangle (RSC)
Skills	Understand and select from a variety of techniques to promote disciplinary literacy	Regularly use a variety of techniques for promoting disciplinary literacy in science, e.g. directed activities related to text in	Literacy and learning in science (STEM Learning)

	in science and teach how words are built up e.g. pent-ane.	science (DARTS). Pay special attention to EAL pupils and teach how words are built up, including roots, prefixes and suffixes, e.g. pent-ane	Teaching EAL learners in science (The Bell Foundation)
	Understand some techniques used to promote scientific reading, e.g. reading a short scientific text together.	Develop your pupils' comprehension skills by working in small groups to decode and understand a scientific text.	🕒 Reciprocal reading task: agriculture and ammonia (RSC) 🕒 Hand sanitiser in demand – reading comprehension (RSC)
	Start to use techniques to promote scientific writing, e.g. writing frames or structure strips.	Provide pupils with the opportunity to write for a variety of audiences and purposes, e.g. a lab report or a popular science blog, to develop their writing skills.	Structure strip resources (RSC) Editable literacy resources (RSC)
	Start to use techniques to promote scientific communication, e.g. group work where each member of the group has a different role to play.	Develop your pupils' communication and speaking skills. Use talk partners, so that pupils can discuss the questions before attempting a written answer.	Editable literacy resources (RSC)
	During collaborative learning, adjust resources and approaches to offer those who need it (e.g. low prior attainers) greater scaffolding to articulate their thinking successfully within a group.	During collaborative learning, adjust resources and approaches to offer those who need it (e.g. low prior attainers) greater scaffolding to articulate their thinking successfully within a group, and to reflect and improve on their learning through group work (metacognition).	🕒 How best to engage students in group work (RSC)



Note: the final two statements linked to TS3 on teaching early reading and early mathematics have been omitted from this document as they do not apply to chemistry or science teaching.

TS4 – Plan and teach well-structured lessons
Impart knowledge and develop understanding through effective use of lesson time

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand the complete science curriculum so that you are aware of all the content that needs to be covered in a given time.	Maintain long-term and medium-term plans so that they include carefully sequenced lessons and understand the role each individual lesson plays within the bigger chemistry learning plan.	National curriculum in England: science programmes of study - GOV.UK
	Understand the linked knowledge within and between each science subject; e.g. to understand electrolysis, pupils must understand the properties of ionic compounds, ions and electrical circuits.	Use a spiralling curriculum model, building on pre-learning from within and between each science subject; e.g. when teaching electrolysis, draw on pupils' knowledge of the properties of ionic compounds, ions and electrical circuits.	 Spiral your curriculum for electrochemistry success (RSC)
	Develop an understanding of the value of practical work in science, making links between scientific theory and practical activities; e.g. separation techniques are linked to the physical properties of a mixture. Filtration can only be used to separate a mixture if it contains both soluble and insoluble components.	Understand the links between scientific theory and practical activities. e.g. separation techniques are linked to the physical properties of a mixture. Filtration can only be used to separate a mixture if it contains both soluble and insoluble components.	Seven simple rules for science teaching – Rule 5 (RSC) Good practical science (Gatsby)
Pedagogy	Develop pedagogical strategies that aim to reduce barriers to learning, incorporating formative assessment strategies that identify gaps in learning.	Reduce barriers to learning by using different levels of scaffolding with different groups of pupils. Incorporate expertly crafted formative assessment and feedback or intervention strategies that find and address gaps in understanding; e.g. use hinge point questions with in-class interventions built in where needed.	 How to use hinge point questions effectively (RSC) Science for secondary-aged pupils with special educational needs and/or disability (SEND) (CLEAPSS)


<p>Make sure that the needs of pupils with SEND are met, including for practical work.</p>	<p>Make sure that the needs of pupils with SEND are understood and met, such that they are both challenged and supported to learn, including for practical work.</p>	<p>Guide to Special Educational Needs and Disabilities (ASE)</p> <p>Inclusive Science Group event (ASE)</p>
<p>Understand science theory and how it links to practical work in science, e.g. ask your pupils to apply their knowledge of the mole to calculate the mass of reactants needed to carry out a chemical reaction.</p>	<p>Regularly make links between scientific theory and practical activities; e.g. when demonstrating the thermite reaction, ask your pupils to calculate how much iron oxide would be needed to obtain a known amount of iron.</p>	<p> 4 ways to teach the law of conservation of mass (RSC)</p> <p> Teaching conservation of mass at 14–16 (RSC)</p> <p>Five steps to help students master mole calculations (RSC)</p>
<p>Understand that pupils need to be able to link up and move fluidly between the three fundamental levels of chemistry (below), which requires repetition and practice:</p> <ul style="list-style-type: none"> • the macroscopic (i.e. what is concrete and observable) • the symbolic (abstract thinking) • the sub-microscopic (abstract thinking) 	<p>Understand that some pupils may access either one, or two, or three of the fundamental levels of chemistry, but may have differing strengths in their ability to fluidly move between them without support or scaffolding.</p>	<p> Develop deeper understanding with models (RSC)</p>
<p>Develop engaging demonstrations that are effective and reinforce theory or offer an opportunity to introduce a topic; e.g. use the ‘whoosh’ bottle to introduce exothermic reactions.</p>	<p>Use engaging demonstrations that are effective and reinforce theory or offer an opportunity to introduce a topic; e.g. use the ‘whoosh’ bottle to introduce exothermic reactions.</p>	<p>Classic chemistry demonstrations RSC Education (RSC)</p> <p>The ‘whoosh’ bottle demonstration (RSC)</p>
<p>As well as formative assessment and practical work, incorporate (where relevant)</p>	<p>Make expert use of the ‘Seven simple rules for science teaching’ to bring forth and use</p>	<p>Seven simple rules for science teaching (RSC)</p>



	<p>the following considerations during planning to teach chemistry:</p> <ul style="list-style-type: none"> • build upon pupils' preconceptions • promote independence and self-regulation • use models to support understanding • support pupils to retain and retrieve knowledge (memory) • develop scientific vocabulary and support pupils to read and write about science 	<p>the best pedagogical tools. Adjust the prioritisation of different approaches as needed, to maximise on chemistry learning.</p>	
	<p>Plan a variety of activities to make sure pupils are on-task throughout the lesson. Refer to TS6 and TS7 for more in-depth ideas about how to do this.</p>	<p>Maintain a quick pace throughout the lesson, using a range of different pedagogies to make sure that pupils remain engaged. Refer to TS6 and TS7 for more in-depth ideas about how to do this.</p>	<p>Refer to TS6 and TS7</p>
<p>Skills</p>	<p>Use diagnostic questions, such as those from BEST, to uncover any pupil misconceptions at the start of a topic/lesson.</p>	<p>Identify and use the best questioning approaches to expertly diagnose and challenge pupil's understanding; e.g. when starting to teach structure and bonding, check pupils' prior understanding of atomic structure and make sure that gaps are addressed.</p>	<p>Best evidence science teaching (BEST)</p>
	<p>Use frameworks like Bloom's taxonomy or SOLO taxonomy to plan targeted questions, so that you can adapt your questioning to meet the needs of individual pupils.</p>	<p>Use questioning skilfully to keep all pupils on track, so that pupils are both supported and challenged.</p>	<p>🕒 What is SOLO taxonomy? (RSC) Seven simple rules for science teaching – Rule 2 (RSC)</p>

	<p>Create your lesson plans so that they include linked lesson objectives/outcomes, activities and assessment items; e.g. only include a practical activity if it meets an outcome of the lesson.</p>	<p>Adapt long-term and medium-term plans, as appropriate, so that all lesson objectives/outcomes are covered. If several chemistry lessons are missed due to training days or off-timetable days, know which learning activities can be omitted and what alternative activities will make sure that the key learning outcomes are met; e.g. use a microscale approach instead of a full-scale practical approach.</p>	<p>Seven simple rules for science teaching – Rule 5 (RSC)</p> <p> Maximising learning from practicals (RSC)</p> <p> Why I love microscale (RSC)</p>
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TS4 – Plan and teach well-structured lessons

Promote a love of learning and pupils' intellectual curiosity


	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Maintain your own curiosity about science by reading recent articles (for example, <i>Chemistry World</i> or <i>Education in Chemistry</i>) or by watching documentaries.	Maintain your own curiosity about science by reading widely (for example, recent articles in <i>Chemistry World</i> , <i>Education in Chemistry</i> or <i>New Scientist</i>) or by watching documentaries. Identify opportunities to use your new knowledge to enhance your teaching and to enthuse pupils about chemistry.	Chemistry World Education in Chemistry New Scientist
	Gain knowledge that supports and enhances the statutory curricular statements to build a wider and deeper understanding of science through the curriculum.	Gain knowledge that sits inside and outside of the statutory curricular statements to build a wider and deeper understanding of science. Draw upon this knowledge to make science teaching more relevant to today's world; e.g. the effect of microplastics and nanoparticles on marine life.	Education in Chemistry News & analysis (RSC) News – latest in science and technology (New Scientist)
	Learn about the scientific enquiry techniques that pupils may use to investigate their own questions, e.g. independent, dependent and control variables.	Actively promote how scientific enquiry skills are used in many careers, e.g. a forensic scientist must obtain accurate, reproducible results that will stand up in court	A future in chemistry (RSC)
Pedagogy	Develop strategies to introduce a topic that will engage and challenge pupils' ideas in science; e.g. when teaching the carbon cycle, use a recent newspaper article or YouTube clip on carbon capture and storage and then ask where it fits into the cycle.	Use strategies to introduce a topic that will engage and challenge common perceptions of science; e.g. when teaching the carbon cycle, use a recent newspaper article or YouTube clip about carbon capture and	 Sharing science stories to inspire and engage (RSC)






		storage and then ask where it fits into the cycle.	
	Design thought-provoking chemistry problems and challenges that will encourage pupils' intellectual curiosity, e.g. what is the link between analytical chemistry and medical imaging?	Design a wide range of thought-provoking chemistry problems and challenges to encourage pupils' intellectual curiosity and foster a love of learning and chemistry; e.g. what is the link between analytical chemistry and medical imaging? How can environmental pollution be reduced?	Help students solve problems by using models (RSC)
	Collect a series of stories from up-to-date scientific research and use them to encourage purposeful reading in your lessons, e.g. when teaching about fuel cells and the future of hydrogen-powered vehicles.	Use contexts from up-to-date scientific research to introduce/explore scientific content through a range of different media, e.g. when teaching about fuel cells and the future of hydrogen powered vehicles.	 New material could help power the hydrogen economy (RSC)
Skills	Be enthusiastic about science in your lessons and behave like an ambassador for chemistry and STEM, to promote the belief that science is for everyone. Build up your confidence when demonstrating key chemistry practical activities, e.g. the iodine clock.	Be enthusiastic about science in your lessons and behave like an ambassador for chemistry and STEM, to promote the belief that science is for everyone, especially when demonstrating key chemistry practical activities e.g. the iodine clock.	Tackling gender equality in science (RSC)  Foster more diverse involvement in all science lessons (RSC)
	Design a series of science hooks with a strong link to real-world chemistry to promote learning.	Use interesting and varied science hooks with a strong link to real-world chemistry to promote learning and curiosity.	Education in Chemistry News & analysis (RSC)
	Develop strategies to effectively manage group work and problem solving.	Use group work to enhance pupils' curiosity by working together to solve a problem, e.g. planning an investigation to find out which reaction could be used in a pair of hand warmers.	Effective group talk (STEM Learning)

	Encourage independent research and inquiry; provide opportunities for pupils to explore topics, for example the evolution of the periodic table.	Encourage independent research, inquiry and critical thinking; provide opportunities for pupils to explore topics like green chemistry and its importance to humans, fostering a deeper personal connection to the subject.	Periodic table of the elements (RSC)

TS4 – Plan and teach well-structured lessons

Set homework and plan other out-of-class activities to consolidate and extend the knowledge and understanding pupils have acquired

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Be aware of opportunities and resources that pupils can engage in, such as local nature conservation, citizen science and chemistry opportunities.	Seek out opportunities and resources that pupils can engage in, with relevant local context e.g. conservation, citizen science and chemistry opportunities.	Salters' Institute chemistry programmes
	Understand how professional science bodies can support enrichment activities, e.g. meet with your local RSC Education coordinator.	Engage with science resources and activities from national events or regional hubs, e.g. chemistry resources produced by the RSC for Chemistry Week or the STEM Ambassador programme.	Global experiment (RSC)
	Understand what makes good, stimulating homework that will build on and consolidate previous learning, or support new learning in the next lesson.	Regularly set stimulating homework tasks that build on and consolidate previous learning or support new learning, taking into account what the research says about best practice.	Homework (EEF)  Effective strategies for homework success (RSC)
Pedagogy	Attend and support an off-timetable science event with local STEM ambassadors in or out of school to help pupils learn about chemistry in the workplace; e.g. a visit to a local university chemistry outreach event.	Organise an off-timetable science event with local STEM ambassadors in or out of school to help pupils learn about chemistry in the workplace; e.g. a visit to a local university chemistry outreach event. Consider pupils' different cultural backgrounds or access needs that may affect how the activity is organised and how parents are reassured about pupils being kept safe.	OEAP national guidance for outdoor learning

	Engage in enrichment activities linked to the science curriculum, e.g. a chemistry quiz for use in form time across the school.	Create enrichment activities linked to the science curriculum, e.g. a chemistry quiz for use in form time across the school.	
	<p>Develop strategies for homework that reinforce understanding and practice of lesson content, e.g. make a poster of the water cycle.</p> <p>Make sure that the homework:</p> <ul style="list-style-type: none"> • is usually linked to classroom learning • receives feedback where beneficial to learning • has a clear purpose that is explicitly shared with the pupils 	<p>Use a range of homework strategies that help pupils to connect to the science around them and build on lesson content, e.g. make a poster of the water cycle.</p> <p>Make sure that the homework:</p> <ul style="list-style-type: none"> • is usually linked to classroom learning • receives feedback where beneficial to learning • has a clear purpose that is explicitly shared with the pupils 	 Effective strategies for homework success (RSC)
	Develop strategies for homework that prepare pupils for new learning, e.g. watch a video of how to make a soluble salt before carrying out the practical.	Regularly use flipped learning so that pupils come prepared for a practical lesson or already have an insight into the new learning; e.g. watch a video of how to make a soluble salt before carrying out the practical.	 Preparing a soluble salt (RSC)
Skills	Include a purposeful homework activity in your lesson plan, when it is a science homework day.	Regularly set homework in line with the science department homework policy, that is purposeful and of a high-quality. Evaluate whether the homework activity delivers on its intended purpose and adjust for next time if it does not.	 Effective strategies for homework success (RSC)  Add AI to your students' toolbox (RSC)
	Check pupils are using the school-wide policy (such as planners or online software)	Check pupils are using the school-wide policy (such as planners or online software) to note down homework tasks and	 Effective strategies for homework success (RSC)


	to note down homework tasks and deadlines.	deadlines. Support pupils at risk of gaining less benefit from homework tasks by mitigating the risks, e.g. access to IT and timescales.	
	Raise the profile of homework by rewarding pupils who complete it on time, e.g. use motivational stickers.	Develop and implement a rewards system to raise the profile of homework, e.g. use motivational stickers for those who complete homework on time, or contact home.	🕒 Does rewarding good behaviour deserve a gold star? (RSC)
	Work with parents/carers to gain their support in helping pupils to complete their homework and follow up when work is not completed, e.g. phone calls home.	Work with parents/carers to gain their support in helping pupils to complete their homework and follow up when work is not completed, e.g. letters home. Consider that there may be variation in parental engagement and level of involvement with homework and make sure that this does not place pupils at a disadvantage, e.g. build parental engagement and support of homework and/or provide other routes for pupils to study (such as study clubs).	Parental engagement (EEF) 🕒 Science Capital – an introduction (King’s College)

TS4 – Plan and teach well-structured lessons



Reflect systematically on the effectiveness of lessons and approaches to teaching

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Obtain new ideas and teaching approaches by participating in science-specific PD, e.g. attend an RSC sustained professional development course for early career teachers.	Update and explore new ideas and teaching approaches by participating in science-specific PD, e.g. attend an RSC sustained professional development course for experienced teachers.	Professional development for teachers (RSC)
	Grow your own chemistry learning profile by reviewing your progress against targets set from previous lessons.	Engage with and use the school's professional review system as a framework for continuous improvement through target setting and reflection.	Science leadership benchmarks (STEM Learning) Improving secondary science (EEF) Improving secondary science audit tool (EEF) The Equity Compass (The YESTEM Project)
	Understand how teaching assistants can effectively support pupil learning in the classroom.	Enable the effective deployment of teaching assistants in the classroom by knowing their key strengths and which pupils will benefit from additional support.	Deployment of teaching assistants (EEF)
	Use pupil voice data to reflect on how chemistry lessons are perceived by pupils and to identify what may be improved. Use resources such as the survey within 'The Science Capital Teaching Approach'.	Use a good range of pupil voice data to reflect on how chemistry lessons are perceived by pupils and to identify what may be improved. Make sure that all pupils' voices are gathered (e.g. by prior attainment, gender, ethnicity, disadvantage etc.). Use resources such as the survey	The Science Capital Teaching Approach pack for teachers

		within 'The Science Capital Teaching Approach'.	
Pedagogy	Observe an experienced science teacher teach a tricky/challenging topic and then reflect on how you will teach it, e.g. chemical equilibria.	Use the results of question-level analysis to identify areas of chemistry where pupils underperform and reflect on how it was taught.	🕒 Learning from lesson observations (RSC)
	Engage with the science teacher voice by asking how they would teach a scientific concept and then reflect on how you would teach it, e.g. particle theory.	Engage with the pupil voice to reflect on pupils' perceptions of science and how science is taught in lessons.	🕒 Why teaching matters: the bigger picture (RSC) Students' ideas about chemical equilibria (RSC)
	Use the results from your pupil assessment to help you reflect on the effectiveness of your teaching and learning strategies.	Carry out a work scrutiny and reflect on which teaching and learning strategies lead to the deepest learning, e.g. in chemical equilibria. Use question-level analysis of test papers to identify which lessons may be improved.	Start the year right with baseline assessments that give realistic results (RSC) Keep assessing assessments: 6 ways to improve your assessment skills (RSC)
	Practice practical activities before doing them in class and reflect on how to manage the practical in a classroom situation.	Work with colleagues to develop teaching and learning through a mentoring and/or coaching programme; e.g. mentor a chemistry ECT or be part of a chemistry coaching triad.	Develop key scientific skills with practical videos (RSC)
	Keep a reflective diary or professional learning log for reference, to support your personal reflection.	Regularly evaluate teaching and learning across the department. Record and share your reflections in an accessible document, such as the scheme of learning, or at a departmental meeting.	How using a reflective journal can help PD really make a difference in changing practice (EEF)




	Identify areas of learning in need of development through on-going monitoring and evaluation of pupils' work.	Identify areas of learning in need of development through on-going monitoring and evaluation across the department.	
Skills	Observe other teachers in both science and other subject areas to see whole-school skills in action.	Carefully select the right class to try out a new skill/pedagogy and invite feedback from pupils and colleagues.	 Learning from lesson observations (RSC)
	Learn how to become a reflective practitioner by seeking advice from established teachers through discussion, observation and team teaching, to develop a cycle of continuous improvement.	Engage in an open-door policy, welcoming colleagues into your classroom to enable productive teaching and learning discussions to take place.	





TS4 – Plan and teach well-structured lessons			
<i>Contribute to the design and provision of an engaging curriculum within the relevant subject area(s)</i>			
	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Gain an understanding of pupils' learning journey for science/chemistry throughout school, from primary to secondary and beyond, e.g. materials and their properties.	Understand the key components of an effective science curriculum and of pupils' learning journey for science/chemistry throughout school, from primary to secondary and beyond, e.g. materials and their properties.	National curriculum in England: science programmes of study (GOV) Steps into Science (RSC)
	Understand how science topics build on each other and link to interesting contexts.	Develop a deeper understanding of topics that link outside of curricular statements to enable pupils to have a contextualised and deeper understanding of science.	In context worksheets (RSC) Cross-curricular resources for primary science (RSC)
	Gain an understanding of science education trends within the UK.	Gain a broader understanding of science education trends within the UK and other comparable education systems.	Key points to take away from the 2025 chemistry exams (RSC)
	Support and learn about enrichment opportunities to complement the science curriculum, such as competitions, biology/chemistry week or art competitions.	Build in enrichment opportunities to complement the science curriculum such as competitions, biology/chemistry week or art competitions.	Chemistry teaching enrichment (RSC) I'm a scientist get me out of here (I'm a scientist) Science competitions your students can enter in 2025 (RSC)
Pedagogy	Build an understanding of when a practical task or demonstration can be used to effectively achieve learning objectives.	Know which practical task or demonstration can be used to effectively achieve learning outcomes, e.g. when testing for acids and	Develop key scientific skills with practical videos (RSC)

		alkalis, know whether to use a microscale drop method or test tubes.	
	Identify where lessons rely on assumptions about pupils' prior understanding that may not be true. For example, a proper understanding of dissolving before learning how chromatography works would help to avoid the misconception that dyes are separating due to particle size rather than differing solubilities.	Contribute to refining the order of learning so that the sequence of key ideas allows a logical building up of complexity. For example, before covering condensation polymerisation, pupils should have covered alkanes, alkenes and functional groups.	 Scaffold learning with decision trees (RSC)
Skills	Provide context and personal experience of activities to schemes of learning e.g. include your own photographs after visiting a salt mine.	Provide context and personal experience of activities to schemes of learning e.g. include your own photographs after visiting a salt mine.	Education in Chemistry print edition (RSC)
	Try out a new activity in the classroom and if successful share it with a colleague.	Contribute to the science scheme of learning by writing new activities, e.g. a chemistry worksheet.	Chemistry Teaching Empowerment Fund (RSC)
	Identify opportunities to incorporate chemistry careers and study options into the curriculum to make pupils aware of attractive, relevant and feasible post-16 options.	Systematically identify opportunities to incorporate a wide range of post-16 chemistry careers and chemistry study options into the curriculum. Examples should include diverse, interesting and unusual future careers and study options, with academic and non-academic routes, providing attractive, relevant and feasible options for pupils at all levels of chemistry attainment.	 Fixing the future (RSC) A future in chemistry (RSC) Careers inspiration in chemistry (RSC)

TS5 – Adapt teaching to respond to the strengths and needs of all pupils




Know when and how to use adaptive teaching appropriately, using approaches that enable pupils to be taught effectively

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand how cultural and social differences can influence attitudes to science in each school context.	Understand how cultural and social differences can influence pupils' engagement with, and attitudes towards, science and adapt your teaching to reflect these differences.	A framework for action in scientific publishing (RSC) Inclusion, diversity, accessibility and culture in the chemical sciences (RSC)
	Understand the specific physical and learning difficulties/differences pupils may have in science and know where to access information to support these specific needs.	Possess a deep understanding of the diverse physical, cognitive and learning needs of pupils in science and be familiar with strategies and resources to effectively support and include all pupils.	 Tackling practicals for students with SEND (RSC) Special Educational Needs in Mainstream Schools (EEF)
	Develop your knowledge of the curriculum in order to stretch and challenge pupils at each stage.	Have an in-depth knowledge of the science curriculum which enables you to design and deliver lessons that stretch and challenge pupils appropriately at every stage of their learning journey.	 Use structure strips to scaffold learning (RSC) Literacy in science teaching (RSC)
Pedagogy	Know what we mean by science capital and how you can improve pupils' science capital, e.g. by going on trips and visits.	Understand the concept of the Science Capital Teaching Approach and have experience in leveraging it to engage and inspire pupils by organising trips and visits and using examples of science in context regularly.	Science capital made clear (STEM Learning)  Foster more diverse involvement in all science lessons (RSC) The Science Capital Teaching Approach pack for teachers

	Develop strategies for teaching science/chemistry-specific vocabulary, reading skills and writing skills.	Use effective strategies for teaching subject-specific vocabulary, enhance pupils' reading and writing skills in science/chemistry contexts and effectively link to outcomes (for example GCSE assessment objectives).	How to teach science vocabulary using best practices (Sadler Science)  Developing pupils' scientific vocabulary (NEAT)  Ten ideas for science vocabulary (The Science Penguin)
	Know when to scaffold and challenge pupils of different abilities.	Effectively use SEND data and data from previous key stages.	 Use structure strips to scaffold learning (RSC)
Skills	Know how to identify the needs of your pupils and use adaptive teaching strategies to meet the needs of all pupils, e.g. adapt the physical components of practical work where required.	Know how to identify the needs of the pupils and use a variety of adaptive teaching strategies expertly to meet the needs of all pupils, e.g. adapt the physical components of practical work where required.	Assess, adjust, adapt – what does adaptive teaching mean to you? (EEF) Improve manipulative skills for all Ideas (RSC)
	For pupils with SEND, become familiar with their EHCP (Education Health and Care Plan) where it exists, as well as their IEP (Individualised Education Plan) or equivalent. Adjust learning goals accordingly to make them challenging but realistic.	Liaise with the SENCO or teaching assistants working with pupils with SEND to identify how specific learning needs may best be met in chemistry.	Deployment of teaching assistants (EEF)  Use adaptive teaching to improve access and progress for SEN students (RSC)

TS5 – Adapt teaching to respond to the strengths and needs of all pupils

Have a secure understanding of how a range of factors can inhibit pupils' ability to learn and how best to overcome these





	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand the specific needs pupils will have in science, which could be physical challenges as well as learning challenges.	Recognise and address the diverse needs of pupils in science, including physical challenges and specific learning challenges, to create an inclusive and supportive learning environment.	CLEAPSS guidance for differentiated lesson planning Tackling practicals for students with SEND (RSC)
	Understand the need for curriculum and content adaptation and responsiveness; e.g. pupils with dyslexia or dyspraxia need different coloured paper.	Use knowledge of individual pupils to plan lessons to support progress for all, e.g. adapted seating and collaborative working groups.	 Breaking down barriers (RSC)
	Know strategies for inclusion, e.g. using models for complex ideas and appropriate scaffolding.	Know which chemistry concepts are challenging and plan in advance for strategies for inclusion, e.g. using models for complex ideas and appropriate scaffolding.	 Modelling for understanding (RSC)  Help students solve problems by using models (RSC)
Pedagogy	Understand how to support pupils with SEND so that practical work is accessible for all; e.g. know how visually impaired pupils can be supported to access practical equipment, such as reading the scale on a thermometer through use of appropriate technology or adaptations to the equipment.	Understand how to support pupils with SEND so that practical work is accessible for all; e.g. know how pupils with limited motor skills can be supported to conduct titrations using adaptive equipment, such as automatic burettes or pipette controllers.	Use adaptive teaching to improve access and progress for SEN students (RSC) Supporting SEND in science (STEM Learning) Teaching STEM subjects to blind and partially sighted learners (RNIB)

			Science teaching adaptations for SEND (ASE)
	Plan lessons that take into account varying levels of prior knowledge. Use practical experiments to actively engage pupils who are struggling with chemistry concepts, e.g. use microscale experiments to demonstrate observations and reduce the cognitive load of full-scale practical work.	Be aware of the varying levels of prior knowledge within a group of pupils and expertly use different strategies to adapt lessons to take these variations into account, e.g. use microscale experiments to demonstrate observations and reduce the cognitive load of full-scale practical work.	🕒 How to teach acids, bases and indicators for all (RSC) 🕒 From microscale to full-scale practicals (RSC)
	Use both formal and informal feedback to modify your approach after reflection on a lesson that has been delivered.	Use feedback to modify approaches within lesson time, based on formative assessment and questioning. This may include the use of verbal questioning and low stakes quizzes, which will identify learning gaps from which you adapt teaching accordingly.	3 ways to provide effective feedback (RSC)
Skills	Build a relationship with pupils, showing empathy and understanding for their individual needs.	Build a relationship with pupils, showing empathy and understanding for their individual needs, creating an environment where pupils feel confident engaging in lessons.	🕒 Get to know your students better to improve outcomes (RSC)
	Plan different explanations and analogies to explain scientific concepts, e.g. the analogy of making a cake to explain the conservation of mass idea.	Use a wide range of explanations and analogies to explain scientific concepts. These explanations can be adapted or created 'on the spot', based on the context	🕒 Help students solve problems by using models (RSC)

		of the pupils to increase their understanding.	
	Use resources effectively to allow accessibility, e.g. large print, coloured paper.	Use resources effectively to allow accessibility and consider the needs of pupils, e.g. memory processing difficulties, using mnemonics and step-by-step instructions to reduce cognitive load.	Consult individual needs of students
	Modify an existing science resource to make sure it is accessible to all pupils, e.g. add scaffolding or a challenge question.	Review science resources to make sure that they meet the learning outcomes of the topic/lesson.	Consult individual needs of students

TS5 – Adapt teaching to respond to the strengths and needs of all pupils



Demonstrate an awareness of the physical, social and intellectual development of pupils and know how to adapt teaching to support pupils' education at different stages of development



	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know how science capital can be built and developed, e.g. use examples from everyday life.	Develop strategies that will increase pupils' science capital, e.g. use examples of relevant contexts from news and technology.	Targeting science capital (RSC)  Frayer models offer a window into students' science capital (RSC)
	Be aware of pupils' different socioeconomic backgrounds and how this positively and negatively impacts their ability to access the chemistry curriculum.	Plan appropriate examples and contexts for examples, based on pupils' socioeconomic backgrounds.	 Why equity and inclusion are key issues for chemistry teachers (RSC)  Foster more diverse involvement in all science lessons (RSC)
	Plan effectively based on the key stage of the pupils.	Plan effectively based on the key stage of the pupils and their previous knowledge.	Using cognitive science for more effective lesson planning (RSC) Top tips for lesson planning (RSC)
Pedagogy	Develop an understanding of the key areas relating to pupils' physical development, e.g., how science skills vary in the National Curriculum through KS3 and into KS4.	Understand the key areas relating to young peoples' physical development and their implications in accessing the science curriculum content and practical activities.	National curriculum in England: science programmes of study (GOV)
	Develop your understanding of science capital and how it affects pupils in the classroom, e.g. supervise trips and visits.	Use your knowledge of science capital and how it affects the pupils in the classroom to provide a range of opportunities for pupils,	The Science Capital Teaching Approach pack for teachers  Why equity and inclusion are key issues for chemistry teachers (RSC)


		e.g. plan and risk-assess trips to see science in action.	
	Use everyday examples appropriate to pupils' stage of development.	Adapt and improvise the use of everyday examples appropriate to pupils' stage of development.	Contextualising core practicals (RSC)
Skills	Incorporate different strategies to increase pupils' science capital.	Plan opportunities into the curriculum to enable pupils to increase their science capital.	The Science Capital Teaching Approach pack for teachers
	Encourage inquiry-based learning, e.g. the planning of scientific investigations.	Encourage regular inquiry-based learning, to make sure learning is consolidated.	🕒 Improve students' scientific literacy through inquiry (RSC)
	Manage the classroom environment to support pupils' physical, social and intellectual development, e.g. have a range of strategies for use in classrooms.	Manage the classroom environment to support pupils' physical, social and intellectual development and accountability, e.g. repair conversations when things have not gone well regarding behaviour.	🕒 Targeted strategies to support good classroom behaviour (RSC) Learning behaviours (EEF)

TS5 – Adapt teaching to respond to the strengths and needs of all pupils

Have a clear understanding of the needs of all pupils, including those with special educational needs, those with disabilities, those of high ability and those with English as an additional language; use and evaluate distinctive teaching approaches to engage and support them

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Research the SEND needs of pupils in all classes and the evidence-informed strategies that can be used to meet these needs, e.g., dyslexia, ADHD, autism.	Effectively meet the SEND needs of pupils in all classes using evidence-informed strategies, e.g. provide digital resources with adjustable text sizes for pupils with visual impairments.	 Tackling practicals for students with SEND (RSC)
	Research the needs of high ability pupils in all classes and the evidence-informed strategies that can be used to meet these needs.	Effectively meet the needs of high ability pupils in all classes using evidence-informed strategies, e.g. be familiar with extension activities and advanced problem-solving opportunities. Challenge high ability pupils to calculate enthalpy changes or explore organic reaction mechanisms.	 Practical advice for inclusive science teaching (RSC)
	Research the EAL needs of pupils in all classes and the evidence-informed strategies that can be used to meet these needs.	Effectively meet EAL needs of pupils in all classes using evidence-informed strategies that can be used to meet these needs, e.g. incorporate bilingual glossaries for common chemistry terms and symbols or use visual representations and glossaries for terms	Five evidence-based strategies to support high-quality teaching for pupils with SEND (EEF)

		like 'covalent bond' and 'activation energy' to support EAL pupils.	
Pedagogy	Use different techniques for teaching pupils of different abilities, e.g. groupings to offer stretch and challenge for higher ability pupils and scaffolding for lower ability pupils.	Provide step-by-step support tailored to pupils' abilities, e.g. break down the process of balancing chemical equations into manageable steps.	 Where to start with teach-to-the-top differentiation (RSC)
	Work with the subject leader to discuss the pedagogical content knowledge needed to effectively teach new or non-specialist topics, as well as SEND and EAL pupils.	Work with the subject leader/teachers from other subjects to discuss the pedagogical content knowledge needed to effectively teach EAL and SEND pupils and produce exemplar materials for science colleagues to use. For example, develop ways for all pupils to access practical work.	Tackling practicals for students with SEND (RSC) Improve assessment accessibility for multilingual learners (RSC)
	Know and use some methods to represent information for SEND and EAL pupils, e.g. picture instructions.	Design activities that allow multiple entry points and methods of representation for SEND and EAL pupils, e.g. ask pupils to investigate factors affecting reaction rates, with scope for basic observations or advanced kinetic calculations.	Improving practical work with integrated instructions (RSC)
	Use formative assessment, targeted questioning and verbal and written feedback to identify and address class-wide learning gaps.	Use formative assessment, targeted questioning and verbal and written feedback to identify and address individual learning gaps.	 How to write questions for formative assessment (RSC)




Skills	Use basic explanations of chemistry concepts tailored to pupils' needs, e.g. describing the atom as a sphere.	Use a wide range of clear and accessible explanations of chemistry concepts tailored to pupils' needs, e.g. 'atoms sharing electrons are like friends sharing toys' to explain covalent bonding for EAL pupils.	 Four steps to explaining scientific concepts (RSC)
	Reflect on and adapt lessons based on pupil feedback and assessment outcomes.	Reflect on and adapt lessons based on your prior experience of teaching the topics.	
	Use educational websites, apps and resources to support SEND and EAL pupils and work with teaching assistants.	Use educational websites, apps and resources to support SEND and EAL pupils and direct teaching assistants.	SEN in the science department (STEM Learning)




TS6 – Make accurate and productive use of assessment			
<i>Know and understand how to assess the relevant subject and curriculum areas, including statutory assessment requirements</i>			
	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know the different types of assessment used in teaching science, e.g. practical work assessment and diagnostic questions.	Effectively use the different types of science teaching assessment, e.g. practical work assessment and diagnostic questions.	How to write effective multiple choice questions (RSC) Bridging the knowledge gap quizzes (RSC) RSC diagnostic questions
	Understand how content from other subject areas is required in science teaching and how this could impact on pupil assessment e.g. mathematical content.	Teach content from other subjects in cross-curricular linked topics, e.g. teach mathematical content such as rearranging equations to aid pupils' understanding of chemistry.	Mathematical skills in triple science (STEM Learning) Maths skills for chemistry (RSC) Teaching tips to tackle maths anxiety (RSC) Why you need to collaborate with English and maths teachers to boost student outcomes (RSC) Breed success by sharing skills with your maths colleagues (RSC)
	Understand the practicalities of assessing practical work in the classroom.	Understand the practicalities of assessing practical work in the classroom and develop pupils' progression in practical skills and working scientifically.	Practical skills tracking 16–18 years (RSC) Practical videos Resource collections (RSC)

			🕒 How making mistakes in practicals impacts student engagement (RSC)
Pedagogy	Use exit tickets and quizzes to assess pupils' understanding of chemical concepts, such as identifying trends in the periodic table or balancing chemical equations.	Use formative assessment, including questioning technique, exit tickets and quizzes, systematically to assess pupils' understanding of chemical concepts, such as identifying trends in the periodic table or balancing chemical equations.	Assessment for learning (RSC)
	Adapt lesson plans to address areas of difficulty, such as mole calculations or interpreting graphs from rate of reaction experiments.	Analyse and use data to adapt lesson plans to address areas of difficulty, such as mole calculations or interpreting graphs from rate of reaction experiments.	Success with GUESS for solving equation-based problems (RSC)
	Use practicals to develop practical skills, e.g. titration end points.	Evaluate skills during practicals, e.g. for GCSE and A-level required practicals.	🕒 RSC practical skills assessment videos
Skills	Use formative and summative assessments to inform lesson planning.	Use formative and summative assessments to inform lesson planning based on analysis and comparison of data on a faculty level.	🕒 How to use multiple choice questions for formative assessment (RSC)
	Provide timely, specific and actionable feedback.	Provide timely, specific and actionable feedback and set clear improvement targets linked to the curriculum.	Give effective, descriptive feedback (RSC) 🕒 Using feedback Principles of assessment for learning (RSC)
	Maintain records of pupil progress.	Maintain records of pupil progress and use them to inform planning for subsequent lessons.	

TS6 – Make accurate and productive use of assessment

Make use of formative and summative assessment to secure pupils' progress

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Incorporate assessment and feedback into lessons.	Incorporate assessment and feedback into the curriculum at timely intervals to make sure pupils make progress.	How to help students develop their practical skills (RSC)  3 ways to provide effective feedback (RSC)
	Use a range of diagnostic questions to elicit prior knowledge and misconceptions.	Develop and use a range of diagnostic questions to elicit prior knowledge and misconceptions.	Best evidence science teaching – age 11 to 16 (STEM Learning)
Pedagogy	Use summative assessments that cover a balance of different areas of study and assessment objectives.	Design and analyse a summative assessment that covers a balance of different areas of study and assessment objectives.	Keep assessing assessments: 6 ways to improve your assessment skills (RSC)
	Develop an understanding of and use the Assessment for Learning approach, using formative assessment by using hinge point questions and through effective planned questioning.	Develop an understanding of and use the Assessment for Learning approach, using formative assessment by designing hinge point questions and through effective responsive questioning.	 How to use hinge point questions effectively (RSC) Assessment for learning (RSC)
	Provide actionable feedback based on formative assessments, e.g. highlight errors in reaction stoichiometry and suggest practise strategies.	Provide actionable feedback based on formative assessments, e.g. highlight errors in reaction stoichiometry and suggest practise strategies. Make sure pupils can	 Five tips for approaching formative assessment (RSC)

		explain how the feedback will help them to reach the next stage.	
Skills	Select the appropriate type of formative assessment to use to assess different knowledge, e.g. concept cartoons.	Select the appropriate type of formative assessment to use to assess different knowledge for different pupil needs, misconceptions or skills, e.g. concept cartoons, hinge point questions, or mini whiteboards.	 How to write questions for formative assessment (RSC)
	Use formative assessment results to inform future lesson plans, e.g. provide scaffolding for pupils struggling with understanding ionic bonding.	Use formative assessment results to plan adapted tasks, e.g. provide scaffolding for pupils struggling with understanding ionic bonding.	 Five tips for approaching formative assessment (RSC)
	Use assessment data to identify areas of weakness (e.g. common errors in electron configuration) and adapt future lessons to address them.	Analyse assessment data to identify patterns (e.g. common errors in electron configuration) and adapt future lessons to address them.	Using feedback – principles of assessment for learning (RSC)
	Use pupil test data (including question-level analysis) and teacher assessment data to identify gaps or weaknesses in chemistry lessons and make suggestions for improvements.	Use all forms of data to identify gaps or weaknesses in chemistry lessons and make well-considered suggestions for improvements, that consider the full range of pupil needs, including SEND.	 Make the most of tests (RSC)

TS6 – Make accurate and productive use of assessment

Use relevant data to monitor progress, set targets and plan subsequent lessons



	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Have a basic understanding of formative and summative assessment techniques in science.	Have a good understanding of formative and summative assessment techniques in science.	🕒 Five tips for approaching formative assessment (RSC) 6 ways to develop your assessment skills (RSC) Keep assessing assessments: 6 ways to improve your assessment skills (RSC)
	Be competent in using software tools (e.g. Excel, SIMS and other school-based tools) to track pupils' progress.	Be competent in using software tools (e.g. Excel, SIMS and other school-based tools) to track and analyse pupils' progress.	
	Interpret data from tests, quizzes and other assessments to determine pupils' understanding of specific chemistry concepts, e.g. equilibria.	Interpret data and trends from tests, quizzes and other assessments to determine pupils' understanding of specific chemistry concepts, e.g. equilibria and plan for individual areas of weakness.	🕒 Make the most of tests (RSC)
Pedagogy	Plan adapted tasks for the class as a whole based on assessment data.	Plan adapted tasks for specific pupils and their needs based on assessment data.	🕒 Where to start with teach-to-the-top differentiation (RSC)
	Create assessments that target specific learning objectives, e.g. identifying elements on the periodic table or balancing chemical equations.	Create assessments that target specific learning objectives, e.g. identifying elements on the periodic table or balancing	🕒 How to write questions for formative assessment (RSC)

		chemical equations, then use this information to further inform planning.	
	Use practical activities (e.g. titration experiments) to assess pupils' understanding of theoretical concepts.	Use practical activities (e.g. titration experiments) to assess pupils' understanding of theoretical concepts and modify future planning effectively using this information.	Practical teaching resources (RSC)
Skills	Use software/systems to record formative assessments.	Use software/systems to record and analyse formative assessments.	Refer to individual school policy
	Monitor progress using test scores, homework completion rates and practical work performance.	Monitor progress using test scores, homework completion rates and practical work performance; communicate this effectively to parents and pupils.	Refer to individual school policy
	Use chemistry test scores data to inform most aspects of planning for teaching, including: <ul style="list-style-type: none"> • setting accurate targets for each pupil • monitoring and tracking individual pupils' progress • planning for interventions informed by the data 	Use moderated chemistry test scores data, moderated teacher assessment data and pupil voice to inform all aspects of planning for teaching, including: <ul style="list-style-type: none"> • setting appropriately ambitious targets for each pupil • monitoring and tracking individual pupils' progress, as well as by groups (e.g. by gender, ethnicity, EAL, disadvantage etc.), at time 	Narrowing the gaps in science: a practical guide for science staff and leaders (STEM Learning)

	<ul style="list-style-type: none">• evaluating interventions for quality and success.	<p>intervals that allow for early intervention</p> <ul style="list-style-type: none">• planning for interventions takes place early, with continuous improvements and continuous movement towards in-class interventions (quality-first teaching, e.g. using Molymods with chemistry demonstrations to triangulate between the macroscopic and sub-microscopic level; make use of Johnstone's triangle)• planning for skills development interventions, e.g. improving the specificity of learning objectives for practical sciences or improving pupil aptitudes for collaborative learning.	
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TS6 – Make accurate and productive use of assessment


Give pupils regular feedback, both orally and through accurate marking; encourage pupils to respond to the feedback




	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand that feedback can come from a variety of sources, e.g. verbal feedback, during or immediately following practical work.	Have a variety of techniques, e.g. verbal feedback, assessment for learning and probing questioning, to increase progress during or immediately following practical work.	How to help students develop their practical skills (RSC)
	Use assessments to support pupils in their understanding and to set targets to address misconceptions.	Use assessments to support pupils in their understanding and to set targets to minimise reoccurrence of gaps in knowledge (what I got wrong once).	All Misconceptions articles (RSC)
Pedagogy	Provide immediate, general feedback during practical activities, such as helping pupils with basic issues in techniques during a titration experiment.	Provide immediate, specific feedback during practical activities, such as helping pupils refine techniques during a titration experiment.	How to help students develop their practical skills (RSC)
	Plan activities for pupils to reflect on areas of weakness e.g. 'what went well' (WWW) and 'even better if' (EBI).	Plan activities for pupils to reflect on areas of weakness through regular retrieval practice, e.g. 'what went well' (WWW) and 'even better if' (EBI).	 What is SOLO taxonomy? (RSC)
	Mark pupils' work using clear success criteria, pointing out strengths and areas for improvement, e.g., for a pupil's explanation of reaction kinetics, provide detailed	Mark pupils' work using clear success criteria, pointing out strengths and areas for improvement considering their specific learning needs, e.g., help EAL pupils to	 A new approach to marking (RSC)


	comments highlighting correct reasoning and suggesting improvements on graph interpretation.	make progress through verbal rather than written feedback.	
Skills	Plan the use of probing questions to deepen understanding, e.g. 'Why does the colour change occur at the endpoint of a titration?'.	Use probing questions responsively to deepen understanding during lessons based on pupil misconceptions, e.g. 'Why do elements in the same group of the periodic table exhibit similar chemical properties?' (when teaching atomic structure).	Questioning – principles of assessment for learning (RSC)
	Encourage reflective practice, e.g. ask pupils to write a response to the question: 'What did you learn from your mistake, and how can you avoid it in future problems?'.	Encourage reflection during activities in lessons through probing questioning.	10 effective questioning techniques (RSC)
	Plan lessons that incorporate prior feedback, e.g. a starter activity reviewing chemical formula mistakes noted in a previous assessment.	Plan lessons systematically to check prior learning, e.g. a series of activities to help individual pupils.	
	Use formative teaching, assessment and feedback methods that require less teacher workload. For example, give oral feedback to a small group of pupils with the same stumbling block in their understanding that both positive and negative ions move during electrolysis, rather than providing the same feedback to each individual pupil who is stuck.	Plan the lesson so that pupils can switch their pace of learning as they move from one activity to the next. Do not try to force one fixed pace of learning on all pupils, e.g. allow self-regulation.	Making good progress in key stage three science (STEM Learning) Seven simple rules for science teaching – Rules 2 and 7 (RSC)

TS7 – Manage behaviour effectively to ensure a good and safe learning environment

Have clear rules and routines for behaviour in classrooms; take responsibility for promoting good and courteous behaviour both in classrooms and around the school, in accordance with the school's behaviour policy




	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Become familiar with the school and departmental behaviour policy for both in and out of lesson time.	Embed the school and departmental behaviour policy for both in and out of lesson time into school life.	 Establish good learning behaviours in the science lab (RSC)
	Know the legal responsibilities of a teacher with regard to the health and safety of pupils in a science classroom.	Understand the legal responsibilities of a teacher with regard to the health and safety of pupils in a science classroom. Make sure rules are in place to keep pupils safe.	Health and safety at work (gov.uk) Control of substances hazardous to health (gov.uk)
	Understand what guidelines exist for practical working in schools including: risk assessments related to chemicals, chemical reactions and personal protective equipment.	Work with the school's science technicians to build up beneficial knowledge for supporting safe practical chemistry and effective risk assessment.	Chemistry practical procedures (CLEAPSS) Hazardous chemicals database (SSERC)
	Understand how to report incidents and who to go to for first aid measures if required.	Understand how to report incidents and take the appropriate first aid measures if and when required, e.g. know how to use an eye wash.	Refer to individual school policy
Pedagogy	Carry out an effective risk assessment for each practical lesson.	Consistently implement control measures from your risk assessment, e.g. insist pupils wear eye protection during practical activities or use the lowest possible acid/alkaline concentration.	Managing risk assessment in science (CLEAPSS) Risk assessing your chemistry practicals (RSC)








	Share clear instructions and high expectations for learning.	Explicitly share clear instructions and high expectations for learning. Repeat and consolidate them as frequently as necessary to habituate good learning behaviours in class.	Behaviour for learning in science: tips for science teachers How to win at classroom behaviour Ideas (RSC)
	Establish clear routines for all stages of the lesson, including how pupils enter the room. Periodically remind pupils about routines.	Establish and maintain highly organised, consistent and clear routines for all stages of the lesson, including how pupils enter the room. Periodically remind pupils about routines, and reinforce them with praise and sanctions.	Behaviour management in the chemistry classroom (RSC) Improving behaviour in schools (EEF) Successfully stop disruptive behaviour in its tracks (RSC)  Meeting a new class (RSC)
	Apply rewards and sanctions to improve behaviour in line with school policy.	Apply rewards and sanctions to improve behaviour in line with school policy. Actively promote and implement departmental behaviour policy, e.g. supervise a science department detention session.	Behaviour interventions (EEF) Targeted strategies to support good classroom behaviour (RSC)  Does rewarding good behaviour deserve a gold star? (RSC)  Why detentions work (RSC)
Skills	Develop skills to specifically teach learning behaviours, e.g. how to plan your chemistry revision.	Proactively promote the specific teaching of learning behaviours, e.g. how to plan your chemistry revision.	Improving behaviour in schools: evidence review (EEF)

	Create a bank of behaviour management strategies in line with school/departmental policy.	Appropriately employ a range of behaviour management strategies to make sure good and courteous behaviour is seen at all times.	 Overcome tricky classroom scenarios with handy phrases (RSC)
	Discuss individual pupil behaviour with colleagues to inform lesson planning.	Adapt your lesson plans to counteract poor behaviour, e.g. replace a class practical with a teacher demonstration in the likely event of poor behaviour.	Set your students up for success Feature (RSC)

TS7 – Manage behaviour effectively to ensure a good and safe learning environment

Have high expectations of behaviour and establish a framework for discipline with a range of strategies, using praise, sanctions and rewards consistently and fairly

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Become familiar with the school and departmental behaviour policy for both in and out of lesson time.	Embed the school and departmental behaviour policy for both in and out of lesson time into school life.	 Targeted strategies to support good classroom behaviour (RSC)
	Develop behaviour management strategies during practical work through observing experienced teachers teach a range of classes.	Embed behaviour management strategies during practical work so that all pupils know what is expected, e.g. no one can access practical equipment until everyone is wearing safety glasses.	 The challenges of managing behaviour in the chemistry lab (RSC)
	Know that a predictable and secure environment benefits all pupils, especially those with special educational needs.	Know how to create a predictable and secure environment so that all pupils, especially those with special educational needs feel comfortable and are ready to learn.	Improving behaviour in schools (EEF)
	Know that by ensuring all pupils have the opportunity to experience meaningful success, pupils' resilience and beliefs about their ability to succeed will improve.	Know how to create a predictable and secure environment so that all pupils, especially those with special educational needs have the opportunity to succeed.	Use adaptive teaching to improve access and progress for SEN students (RSC)
Pedagogy	Put a copy of the agreed behaviour or rewards and sanctions up in the classroom and constantly refer to and apply it.	Implement the agreed behaviour or rewards and sanctions consistently with all classes.	 Successfully stop disruptive behaviour in its tracks (RSC) How to win at classroom behaviour (RSC)

	Establish clear routines for all stages of the lesson, including how pupils enter the room and transition between lesson activities. Periodically remind pupils about routines.	Establish and maintain highly organised, consistent and clear routines for all stages of the lesson, including how pupils enter the room. Periodically remind pupils about routines, which are reinforced with praise and sanctions.	 Establish good learning behaviours in the science lab (RSC)
	Introduce classroom drills in preparation for practical work, e.g. move stools under, clear benches and floor, ensure uniform and hair is appropriate, put eye protection on.	Use classroom drills in preparation for practical work, e.g. move stools under, clear benches and floor, ensure uniform and hair is appropriate, put eye protection on.	 Targeted strategies to support good classroom behaviour (RSC)  Meeting a new class (RSC)
	Demonstrate positive professional relationships with pupils, e.g. meet and greet pupils as they come into the lab. Contribute to pupils' 'on report document' at the end of each lesson.	Demonstrate positive professional relationships with pupils at all times, e.g. meet and greet pupils as they come into the lab. Complete pupils' 'on report document' at the end of each lesson, using praise as appropriate.	 Get to know your students better to improve outcomes (RSC)
Skills	Develop and implement strategies to reinforce positive behaviour and prevent negative behaviours causing unsafe conditions in the laboratory.	Use strategies to reinforce positive behaviour and prevent negative behaviours causing unsafe conditions in the laboratory.	 Does rewarding good behaviour deserve a gold star? (RSC)
	Develop strategies to quickly get pupils' attention while carrying out practical work or a group activity, e.g. use the phrase, 'Three, two, one, stop what you are doing and eyes on me'.	Use a range of strategies to quickly get pupils' attention while carrying out practical work or a group activity, e.g. use an electronic timer to signal the end of the activity.	 Overcome tricky classroom scenarios with handy phrases (RSC)
	Reflect on the way you manage behaviour and the classroom. Be prepared to change what isn't working.	Be a reflective practitioner, able to identify the reason for poor behaviour, with routines in place to ensure that next time the lesson	 Four ways to boost behaviour management (RSC)

		is taught the issue is not repeated, e.g. put a note in the teaching and learning file or scheme of learning.	Improving behaviour in schools (EEF)
	Develop strategies to stop low level disruption/misbehaviour, e.g. position yourself beside the pupil who is chatting.	Respond quickly and subtly to low level disruption, so that pupils know that they can't get away with, e.g. chewing gum in your classroom.	🕒 Successfully stop disruptive behaviour in its tracks (RSC) No words necessary: the classroom hand signals you need to know (RSC)




TS7 – Manage behaviour effectively to ensure a good and safe learning environment
Manage classes effectively, using approaches which are appropriate to pupils' needs in order to involve and motivate them

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Develop a range of strategies to ensure that pupils' work is at the correct level to challenge, motivate and engage them. For example, when pupils are answering six-mark questions, know when to provide scaffolding such as sentence stems or structure strips and when to encourage free writing.	Use a range of strategies to set work at the correct level and with suitable contexts to challenge, motivate and engage your pupils. For example, when setting up a class practical, know which groups of pupils will respond best to written, integrated or photo instructions.	🕒 Get to know your students better to improve outcomes (RSC) 🕒 7 ways to motivate your students (RSC)
	Know that by adapting your lesson and teaching resources to account for pupils with different physical and learning needs, the level of pupil engagement will increase.	Understand that by adapting your lesson and teaching resources to account for pupils with different physical and learning needs, the level of pupil engagement will increase.	Use adaptive teaching to improve access and progress for SEN students (RSC)
Pedagogy	Provide opportunities for pupils to consider their long-term goals and help them to see how these are related to their success in school, e.g. include chemistry careers in lessons.	Develop schemes of learning to provide opportunities for pupils to consider their long-term goals and help them to see how these are related to their success in school, e.g. include chemistry careers in lessons.	What jobs can I do with a chemistry qualification? (RSC) Linking the curriculum to careers in chemistry (RSC)
	Support pupils to master challenging content, which builds towards long term goals, e.g. use scaffolded worksheets to develop confidence in answering questions.	Support pupils to master challenging content, which builds towards long term goals, e.g. teach problem solving skills.	Teaching tips to tackle maths anxiety (RSC) Literacy in science teaching (RSC)
	Identify some pedagogical approaches to overcome barriers or blocks identified	Identify a range of pedagogical approaches to overcome barriers or blocks identified in	Effective group talk (STEM Learning)

	<p>in the general learning skills of individual pupils, e.g. provide them with an in-class mentor to support them in developing active listening skills.</p>	<p>the general learning skills of groups of pupils, e.g. where pupils engage in off-task chatter during group-work, incorporate greater structure in the instructions for group talk to make them more effective.</p>	<p>Golden rules for effective group talk (STEM Learning)</p> <p>Research-informed tips for using dialogic teaching (RSC)</p> <p>Foster deeper comprehension and engagement with oracy (RSC)</p>
Skills	<p>Set up practical work groupings to get all pupils involved.</p>	<p>Use a range of practical work groupings to get all pupils involved and be ready to change groups around if they are not working correctly.</p>	<p>6 steps to successful science lab groups (RSC)</p> <p>How best to engage students in group work (RSC)</p>
	<p>Plan and teach lessons that consider the special needs of individual pupils, so that they are less likely to misbehave, e.g. make sure worksheets are written at the appropriate reading age.</p>	<p>Plan and teach lessons that consider the special needs of individual pupils, so that they are less likely to misbehave, e.g. make sure worksheets are written at the appropriate reading age.</p>	<p>Literacy in science teaching (RSC)</p>

TS7 – Manage behaviour effectively to ensure a good and safe learning environment


Maintain good relationships with pupils, exercise appropriate authority and act decisively when necessary



	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that establishing and reinforcing routines, including through positive reinforcement, helps create an effective learning environment and maintain good teacher/pupil relationships. Take the opportunity to observe established teachers doing this.	Understand that establishing and reinforcing routines, including through positive reinforcement, helps create an effective learning environment and maintain good teacher/pupil relationships.	 Managing behaviour beyond the classroom (RSC)
	Know that building and maintaining effective relationships is easier when pupils believe that their feelings will be considered and understood. Pupils are motivated by intrinsic factors related to identity and values as well as extrinsic factors related to rewards.	Build and maintain effective relationships with pupils through acknowledging intrinsic factors related to identity and values as well as extrinsic factors related to rewards.	 Get to know your students better to improve outcomes (RSC)  Targeted strategies to support good classroom behaviour (RSC) Why it's important to encourage student decision-making in practicals (RSC)
	Understand that pupils' investment in learning is also driven by their prior experiences and perceptions of success and failure.	Handle pupils' successes and failures with sensitivity to encourage them to continue with their learning. For example, when you send a pupil out of the classroom for poor behaviour, ask them what led to the incident and how can they avoid it happening again, rather than just telling them off.	6 ways to motivate students while teaching remotely (RSC)

Pedagogy	Liaise with colleagues to better understand individual pupils' circumstances and how you can support them to meet high academic and behavioural expectations.	Liaise with parents, carers and colleagues to better understand individual pupils' circumstances and how they can be supported to meet high academic and behavioural expectations.	How to successfully support disengaged learners (RSC)
	Respond to pupil behaviour consistently, apply rewards and sanctions as necessary and follow up as appropriate. When relationships break down, seek support from colleagues.	Respond to pupil behaviour consistently, apply rewards and sanctions as necessary and follow up as appropriate.	🕒 4 ways to boost behaviour management (RSC)
	Demonstrate positive, professional relationships with pupils.	Demonstrate positive, professional relationship with pupils, e.g. successfully manage 'repair conversations' when relationships have become strained or even broken down.	🕒 What is 'teacher connectedness'? (RSC)
	Follow up pupils' behaviour within your classroom e.g. pick up on uniform expectations within your classroom.	Follow up pupils' behaviour around the school as well as in your own classroom, e.g. pick up on uniform expectations in the corridors.	🕒 Managing behaviour beyond the classroom (RSC)
Skills	Make a decision when to change or postpone practical work in response to pupil behaviour.	Adapt your pedagogical approach to match the mood of your class. Judge when individual learning will be more effective than your planned collaborative learning.	
	Manage your own emotions when teaching.	Manage your own emotions when teaching and support colleagues to manage their emotions when they are e.g. going through a difficult personal situation.	

TS8 – Fulfil wider professional responsibilities



Make a positive contribution to the wider life and ethos of the school

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Understand the expected standards of personal and professional conduct. Take into account fundamental British values, including democracy, the rule of law, individual liberty and mutual respect, and tolerance of those with different faiths and beliefs.	Understand the expected standards of personal and professional conduct. Take into account fundamental British values, including democracy, the rule of law, individual liberty and mutual respect, and tolerance of those with different faiths and beliefs.	Science leadership benchmarks (STEM Learning)  Foster more diverse involvement in all science lessons (RSC)
	Understand the statutory frameworks which set out your professional duties and responsibilities and always act within this framework.	Understand the statutory frameworks which set out your professional duties and responsibilities and always act within this framework.	
	Assist at a school-wide STEM club supporting activities that complement the existing curriculum or apply understanding pupils already have, e.g. make bath bombs.	Plan STEM club activities that complement the existing curriculum or apply understanding pupils already have, e.g. make bath bombs.	Outreach resources hub (RSC) How to run a successful Chemistry Olympiad club (RSC)
	Develop an understanding of the role STEM Ambassadors play in both promoting STEM subjects and careers across the school and providing hands on support for STEM activities.	Understand the role STEM Ambassadors play in both promoting STEM subjects and careers across the school and providing hands on support for STEM activities.	Resources for STEM ambassadors (RSC)
Pedagogy	Treat pupils with dignity and build relationships rooted in mutual respect. Always show tolerance of, and respect for, the rights of others. Observe the proper	Treat pupils with dignity and build relationships rooted in mutual respect. Always show tolerance of, and respect for, the rights of others. Observe the proper	Foster more diverse involvement in all science lessons (RSC) Making a big difference in diversity (RSC) Advocating for race equity (RSC)



	boundaries appropriate to a teacher's professional position at all times.	boundaries appropriate to a teacher's professional position at all times.	
	Show a professional regard for the ethos, policies and practices of the school and maintain high standards in your own attendance and punctuality. For example, carry out cover lessons and school duties as required.	Show a professional regard for the ethos, policies and practices of the and maintain high standards in your own attendance and punctuality. For example, carry out cover lessons and school duties as required. Demonstrate leadership qualities and encourage/support early career teachers in their own professional development.	 Get to know your students better to improve outcomes (RSC)
	Support a STEM Ambassadors activity taking place in your school.	Plan ahead and invite STEM Ambassadors into school to promote and raise the profile of STEM careers during the school careers week.	STEM Ambassadors (STEM Learning)
Skills	Learn when it is appropriate to challenge or bend the school rules and when they should be applied rigorously, e.g. when a pupil is going through a difficult time at home, be lenient about accepting late homework or missed deadlines.	Use your professional judgement to discern when it is appropriate to challenge or bend school rules based on the context to support pupils' wellbeing, e.g. when a pupil is having a difficult time at home, be lenient about accepting late homework or missed deadlines.	 Managing behaviour beyond the classroom (RSC) Behaviour management in the chemistry classroom (RSC)
	Develop your time management skills so that deadlines are met and you are in the right place at the right time.	Use your time efficiently to make sure that you are punctual and can meet deadlines.	Reduce your workload with ChatGPT (RSC) Make time for time off (RSC)
	Build up an understanding of routes to science/STEM careers. Know how to support pupils' understanding of the routes and options available to them.	Understand routes to science/STEM careers and support pupils' understanding of the routes and options available to them.	Study options (RSC) Chemistry job profiles (RSC)



TS8 – Fulfil wider professional responsibilities


Develop effective professional relationships with colleagues, knowing how and when to draw on advice and specialist support

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know which subjects teach content which overlaps significantly with that in chemistry, e.g. the skills developed in maths lessons.	Work with teachers in other departments to understand how key skills are taught to aid your teaching pedagogy in chemistry lessons.	Why you need to collaborate with English and maths teachers to boost student outcomes (RSC)  Boost maths skills to improve chemistry learning (RSC) Foster deeper comprehension and engagement with oracy (RSC)
	Develop an understanding of the needs of EAL pupils and know where to seek advice on how to overcome barriers to learning in science.	Understand the needs of EAL pupils and know where to seek advice on how to overcome barriers to learning in science.	Teaching EAL learners in science (The Bell Foundation) Improve assessment accessibility for multilingual learners (RSC) Secure students' understanding of scientific vocabulary (RSC)
	Develop an understanding of the needs of your SEND pupils and know where to seek advice on how to overcome barriers to learning in science.	Understand the needs of your SEND pupils and know where to seek advice on how to overcome barriers to learning in science.	Why don't we include everyone when we talk about 'science for all'? (RSC)  Supporting diverse learners (RSC) Who is chemistry for? (RSC)


	Develop an understanding of what constitutes a safeguarding issue and how to respond. Know who the school safeguarding leads are.	Recognise the signs of potential safeguarding issues and know how and when to access specialist support.	Keeping children safe in education (gov.uk)
Pedagogy	Gain an understanding of linked knowledge between science and other subjects, such as maths, by knowing who to contact in the relevant department for support, e.g. when teaching how to do a serial dilution, know how and when proportionality is taught in maths.	Work with other departments to produce a spiralling curriculum model, building on learning from previous science lessons and other subjects, such as maths, e.g. when teaching how to do a serial dilution, draw on pupils' knowledge of concentration and proportionality (from maths).	Guide to maths for scientists (STEM Learning)
	Discuss any suspected safeguarding issues with the appropriate pastoral or safeguarding lead.	Discuss any suspected safeguarding issues with the safeguarding lead and act upon advice received.	Refer to individual school policy
Skills	Recognise when maths skills are causing a barrier to learning, e.g. the correct equation has been used to calculate the number of moles, but pupils are unable to give the answer to 3 significant figures. Learn when it is appropriate to teach the required maths skills.	Recognise when maths skills are causing a barrier to learning in chemistry, e.g. the experimental data has been collected, but pupils are unable to correctly draw a graph and calculate the gradient. Know how and when to teach the required maths skills.	🕒 Boost maths skills to improve chemistry learning (RSC) 🕒 Teaching tips to tackle maths anxiety (RSC) Improve learners' confidence with numbers (RSC)
	Learn how to communicate effectively with EAL pupils so that they understand your instructions, e.g. when setting up a practical, demonstrate the equipment or use photographic instructions. Carefully consider pupil groupings to allow peer support during practical work.	Communicate effectively with EAL pupils. Skilfully group your pupils to enable peer support for EAL pupils during practical work or other learning activities.	Teaching EAL learners in science (The Bell Foundation) 🕒 Improving practical work with integrated instructions (RSC)


	Learn to spot the signs of safeguarding issues.	Identify certain behavioural patterns related to safeguarding issues.	 Get to know your students better to improve outcomes (RSC)  The anxiety epidemic (RSC) Education
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TS8 – Fulfil wider professional responsibilities			
<i>Deploy support staff effectively</i>			
	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Build up an understanding of the different responsibilities of teachers, technicians and teaching assistants.	Understand the different responsibilities of teachers, technicians and teaching assistants.	Teaching assistant interventions (EEF)
	Investigate the evidence base for the deployment of support staff in science lessons.	Know how to deploy support staff effectively to improve the quality of teaching and learning in science.	 Playtime with the technicians (RSC)
	Gain an understanding of the different pressures and workloads associated with different roles and how to avoid duplication of tasks.	Understand the workload considerations of staff and put in place clear procedures to avoid the duplication of tasks and unnecessary admin.	The role of school support staff (GOV)  Meet the technician who wants a diamond knife (RSC)
Pedagogy	Follow the departmental guidance so that you don't need to re-invent the wheel!	Reduce workload by referring to departmental guidance/improvement plans to find out who is responsible for what, e.g. ordering chemicals or producing end of unit tests.	Refer to individual school policy
	Work with support staff to make sure that their in-class support aligns with the learning outcomes of the lessons, e.g. support staff do not simply complete the work for the pupil they are supporting.	Effectively deploy support staff and provide any subject-specific training required to make sure they carry out their role effectively.	Deployment of Teaching Assistants (EEF) Scaffolding framework for teaching assistant – pupil interactions (EEF)
Skills	Clearly communicate outcomes for lessons and any specific interventions required to the appropriate support staff.	Clearly communicate outcomes for lessons and specific interventions that are required to the appropriate support staff. Develop	

		subject-specific resources for the support staff to use with pupils.	
	Work sensitively with established teachers to make sure that support staff are not passing on misconceptions to your pupils.	Skilfully assess your support staff's knowledge, e.g. ask some subject-specific science questions to make sure that they do not pass on any misconceptions to the pupils they support.	Effective teacher – teaching assistant partnerships (EEF)
	Build up a good working relationship with support staff deployed in your classes. Learn when to intervene and when to let the support staff carry on, e.g. during practical work, if support staff are not wearing eye protection then it's time to intervene.	Establish good working relationships with support staff deployed in your classes. Know when to intervene and when to let the support staff carry on, e.g. during practical work, if support staff are not wearing eye protection then it's time to intervene.	Effective teacher – teaching assistant partnerships (EEF) Making Best Use of Teaching Assistants (EEF)
	Interpret and discern the strengths and weaknesses of the support staff involved in your lesson, so you can effectively deploy them.	Interpret and discern the strengths and weaknesses of the support staff involved to provide a best-fit scenario for in-class support.	 Deployment of Teaching Assistants - Summary of recommendations (EEF)

TS8 – Fulfil wider professional responsibilities
Take responsibility for improving teaching through appropriate professional development, responding to advice and feedback from colleagues

	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Attend whole-school PD to gain a deeper understanding of whole-school teaching and learning strategies and policies.	Attend whole-school PD to gain a deeper understanding of whole-school teaching and learning strategies and policies. Work with science colleagues to understand what this looks like within science, e.g. how to develop extended writing in chemistry.	
	Attend subject-specific PD to teach new or non-specialist topics effectively.	Maintain up to date pedagogical content knowledge (PCK) in the sciences, e.g. read the teacher PD articles in <i>Education in Chemistry</i> . Share new learning with colleagues.	Professional development for teachers (RSC) Professional development articles (EiC)
	Improve your own pedagogical subject knowledge (PSK) in the sciences, e.g. complete past exam papers and use the exam board marks scheme to assess yourself.	Maintain up to date pedagogical subject knowledge (PSK) in the sciences, e.g. engage with annual examiners' reports and Ofsted subject reviews to understand the common challenges in science.	Sustained professional development courses (RSC)
Pedagogy	Work with more experienced colleagues to discuss the PCK needed to effectively implement whole-school teaching and learning strategies.	Work with science colleagues to produce, try out and reflect upon exemplar materials required to implement new whole-school teaching and learning strategies in science, e.g. use structure strips to develop extended writing in chemistry.	 Structure strip resources (RSC)

	Work with more experienced colleagues to discuss the PCK needed to teach new or non-specialist topics effectively.	Work with one class to try out new science pedagogies, reflect upon the outcomes and share your findings with colleagues, e.g. a new way to teach the mole.	Chemistry for science teachers (RSC)
	Attend internal moderation of pupils' work and compare the moderated outcome to your initial attempts at marking pupils' work.	Carry out internal moderation of pupils' work to make sure there is a common understanding of when to award marks.	
	Work with more experienced colleagues to discuss your risk assessment and try out a class practical or teacher demonstration before doing it in a lesson.	Discuss health and safety issues in chemistry regularly with departmental colleagues to make sure good practice is always adhered to.	CLEAPSS  Do you know your safety spectacles from your goggles? (RSC)
Skills	Learn how to create a safe environment where pupils feel valued and want to learn in their science lessons, e.g. agree lab rules with the class; observe lessons with established teachers.	Create a safe environment where pupils feel valued and want to learn in their science lessons, e.g. insist pupils wear safety glasses during practical work.	Behaviour management in the chemistry classroom (RSC)
	Use the school performance management structure in place to identify and develop your teaching and learning.	Use the school performance management structure in place to identify and develop your teaching and learning.	Refer to individual school policy

TS8 – Fulfil wider professional responsibilities			
<i>Communicate effectively with parents with regard to pupils' achievements and wellbeing</i>			
	Trainee teachers (ITT/ECT)	Established teachers	Resources to support
Knowledge	Know that parental science knowledge will range from professional scientists to those who feel intimidated or have had negative experiences of learning science during their own schooling and consider this in communications.	Understand that parental science knowledge will range from professional scientists to those who feel intimidated or have had negative experiences of learning science during their own schooling and consider this in communications.	Parental engagement (EEF)
	Gain an understanding of the school's pastoral system and lines of communication both within the school and with parents.	Understand the school's pastoral system and lines of communication, both within the school and with parents.	Refer to individual school policy
	Develop an understanding of the school's central assessment data system and be aware of the key dates to report and input assessment data.	Understand the school's central assessment data system and know the key dates to report and input assessment data.	Refer to individual school policy
	Know that parents' days/evenings and written reports are important opportunities to share and discuss pupils' achievements and wellbeing with parents and carers.	Take part in parents' days/evenings and provide written reports to share and discuss pupils' achievements and wellbeing with parents and carers.	
Pedagogy	Use the school/departmental pastoral systems to communicate issues connected with achievement, wellbeing or behavioural concerns to parents/carers.	Use the school/departmental pastoral systems to communicate issues connected with achievement, wellbeing or behavioural concerns with parents/carers, as well as developing your own strategies e.g. send a postcard home for continued excellent effort during science lessons.	Refer to individual school policy

	Carry out pupil assessment and input the data into the science/central system by the school deadlines so that progress can be reported to parents/carers.	Contribute to the production of common assessment activities. Then, carry out pupil assessment and input the data into the science/central system by the school deadlines so that progress can be reported to parents/carers.	Refer to individual school policy
	Encourage your pupils to make in-person or online appointments prior to a parent event. If you have an ongoing concern about a pupil's achievement or level of engagement in class, talk to your head of department for advice about contacting parents/carers.	Encourage your pupils to make in-person or online appointments prior to a parent event. Invite parents/carers to meet with you if you have an ongoing concern about a pupil's achievement or level of engagement in class.	Refer to individual school policy
	Discuss with established teachers whether it is appropriate for you to directly contact a parent/carer by phone or email, e.g. the pupil has failed to return a signed form giving permission to take part in an extracurricular science event.	Directly contact a parent/carer by phone or email when appropriate, e.g. the pupil has failed to return a signed form giving permission to take part in an extracurricular science event.	Refer to individual school policy
Skills	Learn when it is appropriate to contact a parent/carer by discussions with established teachers, e.g. discuss how serious the issue is.	Judge when it is appropriate to contact a parent/carer, e.g. assess how serious the issue is.	Refer to individual school policy
	Learn the best way to communicate with parents/carers for the situation at hand by discussions with established teachers, e.g. should it be a friendly phone call (light touch) or a more formal letter requesting a meeting at school (a heavier approach).	Judge how parents/carers should be communicated with, e.g. should it be a friendly phone call (light touch) or a more formal letter requesting a meeting at school (a heavier approach).	Working with parents to support children's learning (EEF)

	<p>Decide who is the best person to carry out a communication by discussing the situation with an established teacher, e.g. if a communication is about underachievement in science lessons, then the head of science should contact a pupils' parents.</p>	<p>Judge whom a communication should come from. Decide if the class teacher, head of department or senior leader should send the communication.</p>	<p>Refer to individual school policy</p>
	<p>Learn how to phrase/write communications in a sensitive way that is to the point but considers the circumstances of the communication.</p>	<p>Phrase/write communications in a sensitive way that is to the point but considers the circumstances of the situation. Develop a working relationship with parents.</p>	<p>Refer to individual school policy</p>