Science Best Practice Grid

What should we see in Science lessons as best practice?	**What does effective questioning and scaffolding look like in *Science?***
- Good science knowledge: a clear understanding and clarity of the lesson facts and how they link to other areas of the curriculum - Following the curriculum sequence - Principles of Instruction being embedded in lessons. - Retrieval practice embedded routine at the start of every lesson - Correct level of challenge in class for the student ability, in terms of objectives and tasks. - High levels of student engagement in all tasks, including independent task. - Clear structure of exposition followed by checking of recall/ understanding with differentiated questioning. - For practicals a clear focus on safety and very high standards of behaviour. - For practicals equipment distribution is planned and controlled: eg person A and B or student helpers (*There is not a lot of student movement of large groups trying to collect apparatus all at once)* - For the practical a 'slow practical' method is used where students are led step by step through the practical by direct instruction by the teacher and the purpose and relevance of the practical is explained. (*Students are aware of the meaning of the practical and the science behind it, not just the procedure, where disciplinary knowledge is the focus this is explicitly taught)* - (*not discovery learning, not time filler tasks like word searches or colouring pictures or tasks purely for fun or engagement)* - Opportunities for independent practice of taught concepts - Disciplinary knowledge explicitly taught and assessed	- Cold calling used continuously in lessons. - Mixture of closed and open-ended questioning used in lessons. - No 'opt out' by students: teachers scaffolding down the question until engagement is achieved - Targeted questioning re: student ability) - Written questioning with teacher circulating to check work and support those who need. Teacher aware of who may need support and targeting them - Mini white boards - (*not shouting out)* - Worked examples - Hinge questions - Challenging questions
What does great modelling and exposition look like in *Science?*	**What does retrieval practice look like in *Science?***
- Practical demonstrations to illustrate difficult concepts, ideas and theories. - Examples of pictures, diagrams and videos used in lessons to help explain concepts. - Worked examples used in lessons. - The intent of the lesson and how it fits into the scheme of learning is shared with students. - Concepts are built up (structured), which are supported by resources - Objectives are of a realistic cognitive load and fit in the SOW progression for previously studied topics and fit the Specification requirements - Teach then question (*not trying to draw out knowledge by questioning)* - Modelling broken into chunks: (cognitive load) - Use of visualiser	- Questions (written and verbal) that require knowledge and understanding for topics studied prior (eg in previous Key stage) or previous lessons in the current topic - Entrance activity of questions from prior and current topics - Lesson that build on prior components. - Used diagnostically to inform future planning - Teacher responding to student answers and re-teaching where necessary.

What will you see in pupils' booklets?

- Retrieval practice
- Booklets are not marked by teachers, but the teacher goes over the work in class and students correct answers.
- The booklets are designed to be adaptable and allow teachers to differentiate by having a range of questions and task as well as lesson facts and a space for notes. This allows teachers to select aspects for the lesson planned, the needs of the students in the class and to respond to the class's progress. This means that the completion of the booklet will vary by class as the teacher will have selected aspects of the booklet for use and left other questions out.
- Students attempting exam style questions.
- Practical work to include results, tables, conclusions and graph skills.
- Work complete
- Deliberate practice
- Challenging questions
- Use of tier 2 and 3 vocab
- Self-corrected work where wrong
- Annotations or highlighting of key words in high 5
- Notes

What formative assessment and feedback will you see in *Science?*

- Student work with key concept and working scientifically assessed tasks.
- Teacher marked Assessed tasks (in a separate folder) with whole class improvement tasks
- Re-teaching of difficult concepts or misconceptions.
- Self-marked work by students in booklets.
- Mini whiteboard activity used in lessons to gauge understanding by students.
- Questioning
- Homework misconceptions re-taught/explained
- Questions to check for misconceptions

What questions are useful to ask the children about their learning to elicit understanding?

- Questions about previous topics and previous lessons in the topic (Entrance activity). Recall and explaining.
- Can students explain what they have learnt that lesson?
- Can students link the work to previous topics knowledge when asked specific questions eg during inheritance can they link it to the cell?
- Can students explain why they are doing a particular activity? E.g. Why are they doing a particular practical? You have collected these results, what do they mean? Can they explain the science behind the practical?
- How often do you get homework? What type of homework do you get? How does it help you learn more in science?
- What happens in these lessons that helps you learn?
- How does the teacher help you to remember more?
- How does the teacher check your understanding?
- What do you do that helps you learn?
- Is there anything that happens in your other lessons that helps you learn, that doesn't happen in science?
- What work are you proud of?

How do teachers in *Science* engage with the subject community?

- IOP (Institute of Physics)
- RSC (Royal Society of Chemistry)
- ASE (The Association for Science Education)
- STEM partnership
- Email Twitter, PL courses, word of mouth
- Networking with other schools.
- Meetings with other curriculum leaders across the Trust every half term: SIF
- Royal Society of Biology
- ISAAC Science

What does the development of literacy look like in science?	What does meeting the needs of SEND, NTE, emerging readers and PP students look like in Science?
- Opportunities for oracy development: choral chanting (call and response), put it in a sentence, say it again better, think pair share (turn and talk) - Not rounding up partly correct answers. - High 5 technique for reading comprehension and use of visualisers - Students reading aloud - The teaching of reading through drawing out of meaning from questions (including tier 2 and 4 vocab), reading of lesson facts and high 5 booklet texts by students, reading and use of key science words, analysing exam questions, use of subtitles on videos, highlighting of key words in texts, use of etymology and phonetics where needed to help in reading, use of dual coding of pictures and diagrams to help support, comprehension by using texts to answer questions. - The teaching of writing through building sentences around key tier 3 vocab, use of exam command words, writing frames for longer answer questions, model answers, practice of writing answers in lessons. - Assessment feedback that focuses on the areas for development identified, including command words, vocabulary, written answers.	- Oracy development: Choral Chanting, Say it again better. - Modelling reading – reading question to students (reading slowly and underlining key words) - High 5 technique – using etymology, reading text, - Dual coding – use of pictures and words - Pose, pause, pounce and bounce – cold call questioning to target questions at specific students, allow thinking time and no opt out. - Seating plans – students near to the teacher/specific students to get support - Use of videos with subtitles to support students when they are watching e.g. Free Science Lessons - PHET and Focus E Learning practical animations - Linking concepts to everyday life and other subjects, trying to build on schema - Allowing time for 'You do' – assessments and tasks, these also allow students to develop an answer before sharing. - Mini White board use to check vocabulary recall - Think pair share to allow students to develop an answer before sharing. - Differentiated homeworks: Neeto quiz (low spelling demand), Educake and written exam questions - Dual coded equipment for apparatus - Lesson facts written in a student friendly language to make it easier for students to understand and to provide an accessible text for reading/ High 5. - Teacher has freedom to differentiate lessons to focus just on the bronze objective and select from powerpoints so they are less wordy, more pictures, simple facts (reduces cognitive overload) - Videos used (with subtitles where available) - Tasks put in booklets – easier questions to bridging the gap between mini white boards and exam questions - Lessons are chunked - powerpoints are linked to the lesson objectives. For each objective 'I do', 'We do' and 'You do' to allow formative assessment and practice application. - Entrance activities and homework used for spaced learning revision - A good variety of texts used for all ability of students e.g. textbooks, lesson facts - Metacognition of question answering – narrate our thinking and use of visualisers to support in modelling answers - Spelling tests (ELC and low ability groups). - Scaffolding by task selection and verbally to individuals

This is best practice across science and not every single action will take place in every lesson. The needs of the class and the demands of that part of the curriculum and time will affect what is taking place in the lesson.