Scheme of Learning (SOL)

Subject: Science	**Year: 9**	**Group: All**
Term: 1	**Topics: Waves, Periodic table, cells**	**Duration: 6 weeks**

Curriculum Intent: An ambitious and rich curriculum with opportunities to develop thinking skills, promote curiosity and to nurture lifelong learners

Faculty vision: To develop inquiring minds and curiosity about science and the natural world, from the subatomic to the intergalactic, so that students are able to solve problems and make informed decisions on scientific and technological issues.

Overview of unit:
Links to National Curriculum/specifications/other topics in faculty/other topics
Similarities and differences between light waves and waves in matter
Light waves travelling through a vacuum; speed of light
Transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface
Differences between atoms, elements and compounds Development of the periodic table (Mendeleeve) Periodic table linked to atomic structure (groups and periods) RFM
Cell specialisation and differentiation. Revisit microscopy. Make links back to mitosis and introduce stem cells
The Big Question:
If everything is always changing, can we trust the Science of today?

Assessment Objectives		**Literacy Pillars:**	
Skills students will have by the end of this SOL	**<u>Processing data (results tables and graphs)</u>** **Selecting equipment** **Choosing ranges of variables** **<u>Interpreting graphs</u>** **Constructing results tables** **Identifying anomalies** **Calculating averages** **Drawing lines of best fit** **Calculating gradients** **<u>Calculating rates of reaction</u>** **Link between gradient and rate** **Significance of the end point**	**Reading**	**Following practical method given**
		Writing	**Recording results, describing patterns and relationships in the results, explaining results linked to particle theory**
Knowledge students will have by the end of this SOL	Transverse and longitudinal waves Properties of waves Refraction – required practical Atoms, elements and compounds	**Vocabulary**	**Use of key terms linked to waves, cells and periodic table as identified in the knowing more column for each section**

	Relative electrical charges of subatomic particles Size and mass of atoms Relative atomic mass Electronic structure The periodic table Development of the periodic table Metals and non-metals Conservation of mass and balanced chemical equations Cell structure Cell specialisation Cell differentiation Microscopy Microscopy – required practical Cell division	**Oracy**	**Discussing results with peers, explaining outcomes from practical tasks**
Topics for interleaving	Separating substances Make links to waves previously covered Make links back to atomic structure Make links back to cells from year 7 and 8.	**Presentation**	**Presenting data in a range of formats**

Week or lesson	**Link to the Big Question [promote enquiry, linking learning and stimulating ideas]**	**Knowing more [retention, breadth, context, LO, vocabulary]**	**Understanding more [depth of knowledge, application of knowledge, agility of thinking, fluency of expression]**	**Demonstrating more [Bloom's questioning, transferable skills, subject specific understanding]**
Prompts to include	How will you introduce the big question? What stimuli will you use? What links to previous topics? What links to topics in other subject areas?	What prior learning will you assess/identify with a recall/retrieval activity? What key knowledge/vocab do you want students to know by the end of the lesson?	What activities will students do to consolidate this knowledge? What activities will support them in applying this new knowledge to new and unfamiliar contexts?	How will you assess students' knowledge, skills and understanding during and at the end of the lesson? What questioning techniques?

1 Introduce BQ critical thinking	**The Big Question:** Introduce the BQ, allowing students to show what they already know. Encourage students to add their ideas to the white board and share with others. At this stage accept any ideas that students come up with. Encourage them to make links to previous concepts **Planning support** Give students the big question ask them to put this in the middle of a page (show example) , allow them to discuss with their peers what the BQ means and annotate around their BQ. Have white board pens so that students can come up and add their ideas to be able to share with each other.	Move to a critical thinking task linked to the BQ. Encourage students to identify key vocabulary **Activate:** Print slides 13-22 as small cards so that each student can look at one of these ideas (either individually or in a pair). If possible, have dictionaries/iPads available so that they can look up definitions for words they are unfamiliar with. Students can then create a 'tweet' to summarise the ideas they read about. Give students opportunity to look at each others and see if they can spot any similarities. All cards had ideas about theories that have since been disproved. **Planning support** Remember to print the information cards and the blank ones for students to write on. Where some support is needed students may need to be paired to support the reading of the text.	**Demonstrate:** Pose the statement "No scientific theories can be proven" - discuss student's thoughts on this statement and get them to arrange themselves on an imaginary line across classroom from 'strongly agree' to 'strongly disagree' and why. Discuss info on slide 10 - get students to consider the atomic models. Does this change their opinion? **Planning support** This takes organisation and students may need support to understand what you are asking them to do. Give students the opportunity to change their position on the opinion line if they wish and justify. If time allows, students could construct a debate between those who agree/disagree and try to convince others to alter their position.	**Consolidate:** On BQ page, write the statement 'No scientific theories can be proven' and explain whether they agreed/disagreed. **Planning support** To promote ambitious learning, after the sharing of ideas the students need to go back to their BQ and add ideas form the critical thinking task.
2 **Practical enquiry:** Types of waves Collins book 2/4.4	**Connect** Ask students to draw a diagram of a wave and label as much as they can about their diagram. These could be transverse or longitudinal, this will depend on what the student retrieves. Let them share their ideas. **Planning support** Where support is needed students could be given images of a transverse wave with key	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students the image of the ear to label, ask them to share there answers. Feedback to the class. **LO** to understand the features of transverse and longitudinal waves. **Vocabulary** Transverse	**Activate** Set up a wave machine, order slinkies and bowls for water so students can model waves. Give them time to do this and make notes about what they are seeing. **Demonstrate** Ask students to analyse their practical tasks, what have they found out, this is an opportunity for students to discuss with each other, they can then record their	**Consolidation** Give students the exam style questions, ask them to complete these independently. Then ask them to share their answers with each other, do they want to change their mind? Ask them to make changes with a green pen. **Planning support**

	terms and these in the appropriate place. Allow the students to share their ideas, these could be added to the class white board or tables using a white board pen if it is wipeable. This will support looking at properties of waves.	Longitudinal Oscillations Energy transfer Wavelength Amplitude frequency peak trough period **Planning support** Where support might be needed there are a range of diagrams with different degrees of support on the document in the folder.	ideas in their books. Give students key vocabulary and allow them to upgrade their ideas now including the key terms. **Planning support** Project up the key terms and ask students to use these when explaining what they have found out. Where support is needed students would benefit from sentence starters to help explain their ideas.	To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as the discovery of gravitational waves, comparing these with other types of waves the students have modelled. Use a video clip of gravitational waves for students to draw comparisons from. Where more support is needed students could be provided with starter sentences or key words to use.
3 **Practical enquiry:** Microscopes required practical KS4	**Connect** Give students the method for using a microscope muddled up, ask them to sort this into the correct order. Don't go over at this stage. **Planning support** This is an area students find very challenging and many may need support, this could be in the format of an image to help trigger ideas for their plan. A range of sentences that form a plan if put in the correct order.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task linked to the difference between eukaryote and prokaryote cells. Allow them to complete the task, share thier answers and feedback to the class. **LO** To understand how microscopes use light waves **Vocabulary** Magnification Eyepiece lens Objective lens Resolution Stains **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks	**Activate** Show students the video on how to use a microscope, ask them to return to their method and make any changes to the order. **Demonstrate** Allow students to complete the practical, if possible make thier own slide but if not give them prepared slides. Ask them again to return to their method and put in the final order, then glue into their books once they have checked the method. **Planning support** Allow students to make use of the video and thier sort task method to complete the practical.	**Consolidation** **Planning support** To promote ambitious learning, students could try and apply their knowledge to explain how the microscope they used and cells observed are different to Hooke's in 1670. Show students an image of Hooke's microscope and cork cells to enable students to draw comparisons. Where more support is needed students could be provided with starter sentences or key words to use.

		For more able students you could pose the question or give images with no information and ask them what the difference is. Where more support is needed students could be given key statements to match with each diagram. For less able students they could be given images of plant and animal cells to labels, use of QLA will identify what support is needed.		
5 **Practical enquiry:** Refraction practical	**Connect** Show students an image of light from the Sun reaching the Earth, ask students to explain how light from the Sun reaches the Earth. Allow them to share their ideas and feedback to the class, encourage them to make notes for later lessons. **Planning support** This makes links back to space and light from the Sun. This could be a discussion with students making notes to use in later lessons. If students do not need to have a definitive answer at this stage as this will be revisited in later lessons. Where support is needed students could have a diagram that shows light travelling from the Sun to the Earth.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task to label diagrams of reflection and explaining why light reflects in a mirror. Allow students to complete the task and share thier ideas. The feedback to the class. **LO** to understand how different materials affect the movement of a light wave. **Vocabulary** Refraction Incident ray Refracted ray Normal States of matter (mediums) **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks Students have covered reflection in year 7 and 8. Most will be able to complete diagrams without support, some may need support	**Activate** Give students a method to use for carrying out a refraction practical and allow them to use this and make mistakes. **Demonstrate** Ask students to analyse their practical tasks, what have they found out, this is an opportunity for students to discuss with each other, and ask them to record their ideas in their books. Give students key vocabulary and allow them to upgrade their ideas now including the key terms. **Planning support** Students will often not read a method carefully before they start to implement it. Initially just remind them to read the method, but do not go over this with them. Once they embark on the practical move around the room to give support whilst bearing in mind that making mistakes supports students learning. Students need to know that when light moves from a less dense to a more dense material it	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. Revisit the BQ to add new knowledge or change previous ideas. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as the path of seismic waves through the Earth and how this can provide evidence for the structure of the layers. Where more support is needed students could be provided with starter sentences or key words to use.

		with labels and explanations. They could be given a list of labels to add to their diagrams.	changes direction and moves towards the normal.	
6 Hot task	**Connect** Ask students to return to their BQ, can they add new information or change information in light of work covered? **Planning support** Encourage students to look back into their notes and lab book and add the concepts they have learnt to their BQ, encourage the students to share their ideas with each other.	Students will complete a hot task that has a range of questions covering the content and skills taught, with some interleaving linked back to content delivered earlier. **Planning support** Students need to complete their hot task under exam conditions to allow the teacher to assess their understanding of the topic. Remember to order/print these before your lesson	This is an excellent opportunity to teach revision skills as students often don't understand how to revise and what methods they can use to revise. **Planning support** Students often struggle to know how to revise, plan some methods for them to do this such as having a number of keywords/ pictures ready to show on the board, one or two members of the class sitting in front of the board facing the class. They have to guess the keyword from the clues given by the class.	The hot task will allow the teacher to identify misconceptions and gaps in knowledge for future planning.
7 **Knowledge builder:** Effect of different states of matter on transmission of light linked to atoms elements and compounds	**Connect** Project up the connect image and pose the question How does the state of matter and arrangement of particles affect the movement of light waves? **Planning support** This is an opportunity to make the links between states of matter and waves travelling through different materials. Knowing students' progress and understanding through the previous lessons and practical tasks will support differentiation and possible addition of tasks. More able students should recognise that all images are	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a question about the three states of matter, ask them to complete the question. Feedback on thier answers but do NOT show the answer yet. **LO** understand the effect of different states of matter on transmission of light linked to atoms elements and compounds **Vocabulary** Transparent Translucent Opaque	**Activate** Show students three models of the states of matter and ask them to decide which one they think is the best representation and why? Show students the images of transparent translucent and opaque materials, ask if they can explain scientifically why light is able to pass through or not for each type of material. Revist the retrieval task ask students to make any amendments, feedback on students answers before going over the answers **Demonstrate** https://youtu.be/W5k_S8N0pFo	**Consolidate** Give students the exam question and ask them to complete the question independently. Allow them to share their ideas with each other, the self assess using a green pen. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as why keeping a fish tank clean is important for the growth of aquatic plants. Encourage students to make links to scientific ideas to justify their answer, such as transmission of light through different states of matter linked to

	made up of the same atoms and that in this scenario it is the state of matter that affects the travel of the light wave and not the atoms it is made up of.	**Planning support** Don't go over the answer yet as students will return to this later in the lesson. Remember differentiation doesn't mean a lower level task, you are identifying areas students don't understand, or giving them more support to reach the understanding the lesson aims for.	This is a very short optional video about the glass frog that students might find interesting. Show students the three diagrams to make links to the atomic structure of each material and how that affects its properties. Ask students to discuss their ideas and feedback to the class **Planning support** This first activate task links to the skill (Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects) and is an opportunity to discuss the pros and cons of different representation models. There is no right or wrong answer to the question and students need to be aware that they need to be able to give pros and cons and not a specific answer. Images are on the ppt but others could be used. The idea is students understand that the structure of a material linked to its atoms, affects the transmission or not of light. Tasks like this can throw up some real challenges for discussion and interesting answers. Students do not need to understand the actual structure of the materials shown	atoms/elements/compounds, as well as photosynthesis. Where more support is needed students could be provided with starter sentences or key words to use.
8 **Knowledge builder:** Wave calculations	**Connect** Give students the word equations for frequency and period of a wave, they need to write what they know about any of the terms in the equations. Allow students to	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task changing between units, allow them to work together on the task.	**Activate** Give students a range of equations to complete as a team, gradually increasing the complexity so they need to rearrange the equation, change between units. Allow them to share their answers with others.	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and

	share their ideas and feedback to the class. **Planning support** This is an opportunity to identify students' understanding of the equations and any misconceptions they might have, allowing you to differentiate in the rest of the lesson. Remember differentiation doesn't mean a lower level task, you are identifying areas students don't understand, or giving them more support to reach the understanding the lesson aims for.	Feedback to the class on their answers. **LO** to complete a range of wave equations **Vocabulary** Frequency Period Wavelength Hertz **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks Allow students to write their ideas down but don't at this stage go over the answers. Students should be able to relate wave speed to s/d/t equation and know some of the units.	**Demonstrate** Move to more complex questions that are from exam questions linked to more complex scenarios where students need to choose the correct values to use. **Planning support** Initially give students a list of equations to complete that become more challenging as they move form the first to last. For the demonstrate students need to show they can apply what they have learnt in an exam style scenario where they will need to identify the values needed from the range given.	teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - calculating wavelength of ultrasound waves used to scan a foetus. *You may need to print some copies of this as text is smaller and some students may struggle to read from board.* Where more support is needed have some support ready for students such as formula triangle and help with converting units. Encourage students to make links to ideas about waves that they have previously added to their BQ page, e.g. what type of wave is ultrasound? etc.

9 **Knowledge builder:** Use of microscope to see cells linked to specialisation.	**Connect** Show students images of cells at different magnifications, ask them are these the same cells or different ones. Allow them to discuss with their peers and feedback thier ideas to the class. **Planning support** This is an opportunity to identify students' understanding of magnification, cell differences and any misconceptions they might have, allowing you to differentiate in the rest of the lesson. Some students may recall some organelles can be seen by microscope and some cannot such as mitochondria as they are too small.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task linked to the principles of organisation, allow students to complete the task and share their ideas, feedback to the class. **LO** to relate structure to function of a range of specialised cells **Vocabulary** Specialised cells Tissue Organ Organ system **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks Students should recognise that cells form tissue, tissue forms organs etc. This is an opportunity to make links back to work covered in KS2 and year 7.	**Activate** Give students images of specialised cells, ask them to name as many as they can and to link the structure to the function of the cell. Allow students to work in groups to complete the task. Once they have completed this they can then share their ideas with other groups and decide if they want to change any of their ideas. Feedback to the class. **Demonstrate** Give students a task related to specialised cells, encourage them to work independently on the task. Allow them to share their ideas. Once they have done this they can then do corrections in green pen. **Planning support** Some students may benefit from having a guided frame to complete. In the initial part allow students to work together and share ideas, it doesn't matter if they get things wrong students learn from their mistakes, they can use a green pen for corrections. Encourage quiet and independence for completing the exam style question so students can show they can apply what they have learnt.	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as why some people may believe that there are cells in a venus fly trap that work in a similar way to nerve cells. Where more support is needed students could be provided with starter sentences or key words to use.
10 **Knowledge builder:**	**Connect** Show students the image of cell differentiation and ask them what this is showing? Allow them to discuss and feedback	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Show students images of mitosis on ppt ask them	**Activate** https://youtu.be/pHI63v6wjVg Show students the stem cells video or give students the stem cell information on the slide, let them	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them

Differentiation linked to mitosis	to each other and then the class as a whole. **Planning support** At this point allow students to discuss the diagram and share their ideas with each other, they do not need to write anything down. Where more support is needed, having some key questions prepared will support them such as “what do you think the arrows are indicating?”	to explain in writing what they are showing. Allow them to share their ideas with each other and check their notes. Feedback to the class **LO** to know the importance of cell differentiation. **Vocabulary** Mitosis **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks Students should have some idea about mitosis and at the very least know that cells divide to create new ones. It is important that students understand this concept as it is difficult to move to differentiation without this understanding.	read this. They will then need the connect image and use the information they have been given to explain in writing what the diagram is showing. Allow students to share their ideas and notes they have made, they may want to go back and add to their information **Demonstrate** Give students an exam style question related to cell differentiation, encourage them to work independently on the question/s. They can then peer assess their answers. Once they have done this they can then do corrections in green pen. **Planning support** Print each student off a copy of the image to stick in their book, encourage them once they have read the information about stem cells and differentiation, more than once. They then need to summarise and add the key information to explain the diagram they have been given.	to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as designing a simple experiment to disprove ideas of spontaneous generation linked to maggots seen on dead meat. Where more support is needed students could be provided with starter sentences or key words to use. Question students on a range of scenarios linked to real life factors such as theory of spontaneous generation with examples of maggots in meat, or bacteria arising from disease.
11 **Knowledge builder:** Types of atoms, size of atoms, structure and mass	**Connect** What would a cell look like if we could see even more detail? Allow students to discuss the question and what they think in groups, then with the whole class. **Planning support** Students need to make links to the fact that everything is made of atoms and that the cell is a	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Ask students to draw and label an atom of carbon, remind them to add charges. Allow students to share their images, then feedback to the class. **LO** to know the structure of an atom	**Activate** Ask students to mind map every thinking they know about the structure of an atom in small groups. Once they have completed this, ask them to do information collecting by one of each group going around other groups to see if they can find anything they have forgotten. They should also be encouraged to add their ideas to the white board, if they think it is	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their

	large structure compared to an atom. If necessary use the image on the slide to show some of the molecular structures found in cells.	**Vocabulary** Proton Neutron Electron Charge Mass **Planning support** Remember to look back at QLA to identify the level of the retrieval for individuals having differentiated tasks. Some students will be able to draw and label an atom, if this is the case have alternative tasks linked to how the periodic table can tell the structure of the atom, groups and periods.	correct. Go over this to ensure no misconceptions. **Demonstrate** Give students the task related to atomic structure, encourage them to work independently on the this. They can then peer assess their work, feedback to the class. **Planning support** Have large A3 pieces of paper ready for each group to use. Keep groups to three max if possible as you potentially end up with some students contributing very little to the activity. It is essential that all of their ideas are looked at to check misconceptions, this can be done using the main white board in the classroom. Refer to spec points for key information students need to know by the end of the lesson.	knowledge to trends in atomic structure and ionisation energy (students do not need to understand this but can develop their skill of interpreting data in unfamiliar contexts). Students can be shown a table of data and a proposed hypothesis, they can explain whether or not this hypothesis supports the trends shown in the data and why. *You may need to print some copies of this as text is smaller and some students may struggle to read from board.* Where more support is needed students could be provided with starter sentences or key words to use.
12 **Knowledge builder:** Development and structure of the PT	**Connect** Using their periodic tables completed for retrieval allow students to move around the room sharing their ideas with others, can they add or do they want to change information. Encourage them to add to the main class white board. **Planning support** To ensure movement around the room is structured using students book codes of numbers and letters, giving them limited time each change of group will ensure pace and	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students an unlabeled copy of the PT and ask them to annotate everything they can recall about it independently with no talking. **LO** to understand the rationale behind the development of the periodic table layout and structure. **Vocabulary** Groups Periods Atomic/proton number	**Activate** This is a good opportunity for a literacy task, giving students a longer piece of information about Mendeleeves development of the periodic table. Ask them to read this is silence and then write down five key points they have identified from the article without discussing with others. Ask them to come up and write their ideas on the main white board, have a class discussion over which five are the most important. **Demonstrate**	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as how other scientists may have been involved in the development of Mendeleev's PT and why. Students

	challenge when sharing their ideas. Adding to the main whiteboard will allow teacher to identify misconceptions or missing information. Check spec for key details.	Atomic mass **Planning support** Students have covered the periodic table previously and the work of Mendeleev, be prepared for some more able students who may require some challenging extra tasks.	Give students a longer exam style question related to the development of the PT, encourage them to work independently on the question/s. They can then peer assess their answers. Once they have done this they can then do corrections in green pen. **Planning support** Students could be allowed to highlight areas they think are important but this would mean they would all need a copy printed. For more able students they could be given a more complex article than the one saved. Where support is needed a help desk could be set up with some key areas for support.	can be shown a picture of Mendeleev and other scientists commenting on how they are involved, ask students to explain which 2 scientists they feel are most important in developing Mendeleev's ideas and why. Where more support is needed students could be provided with starter sentences or key words to use.
13 Pause and reflect	**Connect** Use skills tasks here, identified from the assessment. This could be understanding the meaning of command words where a matching task could be used. Or using BUG to support the detail and key points needed for longer answer questions **Planning support** Again this needs to be bespoke to the students skills that they could not apply correctly. However often students tend to make similar mistakes, this may mean that only three or four different connect tasks are needed. The retrieval and connect will support students	**Interleaving/retrieval** Use QLA from the assessment, identify areas students may not have accessed/understood well and create a task to close their knowledge gap **Planning support** For retrieval use an area of content that students had some basic misconceptions or small gaps in knowledge and create a task/tasks to fill this. This needs to be bespoke to the individual, however often students tend to make similar mistakes, this may mean that only three or four different retrieval tasks are needed.	**Activate** Students to go back through their assessment and using green ink, "upgrade" their answers. Reteach any smaller areas all students did not understand. **Planning support** Students work with peers near to them to go through their assessment. Students can make corrections, based on the conversations they are having as a table. Identify areas all students did not get correct, teachers need to reteach specific areas to allow students to make corrections.	**Consolidate** Provide students with question similar to those in the assessment that most could not complete, making link to the area that has been retaught **Planning support** To promote ambitious learning, students need to work through an exam question based on the topic/similar structure to their assessment. Use the mark scheme to peer assess using green pen.

	making corrections on their assessment in the main activity.			
14 Pause and reflect	**Connect** Use skills tasks here, identified from the assessment. This could be understanding the meaning of command words where a matching task could be used. Or using BUG to support the detail and key points needed for longer answer questions **Planning support** Again this needs to be bespoke to the students skills that they could not apply correctly. However often students tend to make similar mistakes, this may mean that only three or four different connect tasks are needed. The retrieval and connect will support students making corrections on their assessment in the main activity.	**Interleaving/retrieval** Use QLA from the assessment, identify areas students may not have accessed/understood well and create a task to close their knowledge gap **Planning support** For retrieval use an area of content that students had some basic misconceptions or small gaps in knowledge and create a task/tasks to fill this. This needs to be bespoke to the individual, however often students tend to make similar mistakes, this may mean that only three or four different retrieval tasks are needed.	**Activate** Students to go back through their assessment and using green ink, "upgrade" their answers. Reteach any smaller areas all students did not understand. **Planning support** Students work with peers near to them to go through their assessment. Students can make corrections, based on the conversations they are having as a table. Identify areas all students did not get correct, teachers need to reteach specific areas to allow students to make corrections.	**Consolidate** Provide students with question similar to those in the assessment that most could not complete, making link to the area that has been retaught **Planning support** To promote ambitious learning, students need to work through an exam question based on the topic/similar structure to their assessment. Use the mark scheme to peer assess using green pen.
15 Pause and reflect	**Connect** Use skills tasks here, identified from the assessment. This could be understanding the meaning of command words where a matching task could be used. Or using BUG to support the detail and key points needed for longer answer questions **Planning support** Again this needs to be bespoke to the students skills that they could not apply correctly. However often students tend to	**Interleaving/retrieval** Use QLA from the assessment, identify areas students may not have accessed/understood well and create a task to close their knowledge gap **Planning support** For retrieval use an area of content that students had some basic misconceptions or small gaps in knowledge and create a task/tasks to fill this. This needs to be bespoke to the individual, however often students tend to make similar mistakes, this may mean that only	**Activate** Students to go back through their assessment and using green ink, "upgrade" their answers. Reteach any smaller areas all students did not understand. **Planning support** Students work with peers near to them to go through their assessment. Students can make corrections, based on the conversations they are having as a table. Identify areas all students did not get correct, teachers need to	**Consolidate** Provide students with question similar to those in the assessment that most could not complete, making link to the area that has been retaught **Planning support** To promote ambitious learning, students need to work through an exam question based on the topic/similar structure to their assessment. Use the mark scheme to peer assess using green pen.

	make similar mistakes, this may mean that only three or four different connect tasks are needed. The retrieval and connect will support students making corrections on their assessment in the main activity.	three or four different retrieval tasks are needed.	reteach specific areas to allow students to make corrections.	
16 Hot task	**Connect** Ask students to return to their BQ, can they add new information or change information in light of work covered? **Planning support** Encourage students to look back into their notes and lab book and add the concepts they have learnt to their BQ, encourage the students to share their ideas with each other.	Students will complete a hot task that has a range of questions covering the content and skills taught, with some interleaving linked back to content delivered earlier. **Planning support** Students need to complete their hot task under exam conditions to allow the teacher to assess their understanding of the topic.	This is an excellent opportunity to teach revision skills as students often don't understand how to revise and what methods they can use to revise. **Planning support** Students often struggle to know how to revise, plan some methods for them to do this such as having a number of keywords/ pictures ready to show on the board, one or two members of the class sitting in front of the board facing the class. They have to guess the keyword from the clues given by the class.	The hot task will allow the teacher to identify misconceptions and gaps in knowledge for future planning.
17 **Application:** Stem cells linked to mitosis cell specialisation and differentiatio n	**Connect** Ask students how stem cells, specialisation, differentiation and mitosis are linked. Allow them to write this on mini white boards and share their ideas with others. Feedback to the class. **Planning support** Students should now be able to link back to areas covered this term, previous terms and years. Making links is high level and support may be needed for students to do this giving and example will help. This is an	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task to describe the function of the main organelles in a plant and animal cell. Allow students to work together and feedback to the class. **LO** Stem cells linked to mitosis cell specialisation and differentiation **Vocabulary** Stem cells Differentiation Specialisation	**Activate** Give students the key spec information around stem cells and their use in treatments of various diseases. Ask students to read the information and identify areas they do not understand. Give them a range of books and iPads if available to research the areas they do not understand. Create a class discussion around these areas. **Demonstrate** Split the group into pros and cons for stem cells research and use. Give students the document on	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as research into stem cell transplants for treating Parkinson's and the use of adult stem cells vs. embryonic.

	opportunity to identify students' understanding of cells and any misconceptions they might have, allowing you to differentiate in the rest of the lesson.	Mitosis **Planning support** Cell structure and function of organelles is core information. Make use of QLA from previous assessments and tasks in class to pitch the retrieval. Have at least three differentiated tasks so that the more able can demonstrate the level of their retention, but support for others who have not retained information so well to access the retrieval.	the ethical issues behind the use of stem cells, allow them to read. Then set up a debate with one group for the use of one against. **Planning support** For the activate section in the class discussion this is a time to identify misconceptions and ensure students have the correct information and understanding. For the demonstrate, you may need to have a team lead to organise, but ensure all students have the opportunity to put their point across	Where more support is needed students could be provided with starter sentences or key words to use.
18 **Application:** Light and electron microscope differences linked to seeing cells and atoms.	**Connect** Give students a range of photos of objects using an electron microscope ask them to discuss what they are seeing and why. Feedback to the class on their ideas. **Planning support** Show the students the unlabelled diagrams first ask what they think they are seeing. The main objective is that they realise these images have higher magnification than would available with a light microscope. This is an opportunity to identify students' understanding of microscopes and any misconceptions they might have, allowing you to differentiate in the rest of the lesson.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to the lesson Devise a plan to create a slide sample to view under a microscope. Allow students to share their plans and feedback to the class **LO** To understand the differences between light and electron microscope linked to seeing cells and atoms. **Vocabulary** Electron microscope Magnification Resolution **Planning support** Students have created a slide before usually using onion skin, a question like this is often worth 3 or 4 marks.	**Activate** Give students the terms magnification and resolution and ask them to come up with a definition of each without looking in a book. Discuss their definitions Then using books ask them to find a definition, discuss their definitions. Feedback to the class. **Demonstrate** https://youtu.be/Lk1Mb1U11EY Give students information on light and electron microscopes or show the video. Ask students to create a table to compare a light microscope with an electron microscope. As students complete their comparison, ask them to share their ideas on the class white board. **Planning support**	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications - such as why and how images of the same object can look very different. Encourage students to make links back to Hooke's microscope from lesson 4 (the first image was drawn by Hooke, second is under light microscope and third is electron microscope). Where more support is needed students could be

		some students may need support such as sentence starters	Students must have a clear understanding of the terms magnification and resolution and that an electron microscope, will give greater detail than a light microscope. Adding ideas to the board in the classroom will allow the teacher to identify any misconceptions.	provided with starter sentences or key words to use.
19 **Application:** Lack of particles in space linked to light moving through a vacuum	**Connect** Pose the questions How do transverse and longitudinal waves differ? Ask students to complete a table to show this, allow them to share their ideas and feedback to the class. **Planning support** Students should easily be able to answer this question, check they have the scientific answer as this can be asked in an exam This is an opportunity to identify students' understanding of waves and any misconceptions they might have, allowing you to differentiate in the rest of the lesson.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a task linked to space and light, allow them to work together to complete the task. Feedback to the class on their answers/ideas. **LO** understand why light and sound travel differently in space. **Vocabulary** Transverse Longitudinal **Planning support** Have differentiated questions that will challenge the more able and give support where needed. For more able students questions can be linked to data.	**Activate** Pose the question: how fast does light travel in space? Why can you not hear someone shouting in space? What is the term used to describe space? Why does light travel faster than sound? Allow students to work in pairs or threes to try and answer these questions linked to the connect tasks. **Demonstrate** Give students a longer exam style question related to how a loudspeaker works linked to the movement of sound, encouraging students to work independently on the question/s. They can then peer assess their answers. Once they have done this they can then do corrections in green pen. **Planning support** For the activate task discuss the answers as a class to identify any misconceptions. For demonstration task students need to link their understanding to a real life scenario how a loudspeaker uses sound. Where	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications such as how scientists can use different types of waves to measure distances. Show pictures of reflectors on moon from Apollo 11 mission and diagram of sound waves and echo from seabed - why is sound used to measure depth of seabed but light is used to measure distance to moon? Students can be challenged to think about how these methods work from the diagrams. Where more support is needed students could be provided with starter sentences or key words to use.

			support is needed key terms or starter sentences can be ready at the help desk.	
20 **Application:** Development and structure of the PT	**Connect** Give students the sort task for the development of knowledge of atomic structure, ask them to sort the task into the correct order, allow students to share their answers. Feedback to the class **Planning support** This is an opportunity to identify students' understanding of the development of atomic structure and any misconceptions they might have, allowing you to differentiate in the rest of the lesson.	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to this lesson content. Give students a question/task about atomic structure. Allow students to share thier ideas and feedback to the class. **LO** to understand the rationale behind the development of the periodic table layout and structure. **Vocabulary** Groups Periods Atomic/proton number Atomic mass **Planning support** Have differentiated questions that will challenge the more able and give support where needed. For more able students questions can be linked to data.	**Activate** Give students an element sorting task to complete. Allow them to work together and share thier ideas. Feedback to the class **Demonstrate** Give students a task that makes links to properties and structure of individual elements with others in the PT. Allow them to work together and share thier ideas. Feedback to the class **Planning support** Have differentiated questions that will challenge the more able and give support where needed. At this stage the lead teacher should have a sound understanding of the understanding of each students and differentiate tasks accordingly.	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their knowledge to other real-world applications looking at the changes in the development of the periodic table and Mendeleev's recognition that there were other elements to be discovered.
21 **Application:** Calculations of RFM	**Connect** Ask students what they think relative formula mass means. Give time to discuss and then feedback to the class. **Planning support** Check students understanding of the term identifying any misconceptions and ensuring they know that acronym RFM. This is an opportunity to	**Interleaving/retrieval** Use QLA to identify areas for retrieval that are linked to elements on the PT. Give students a list of elements to find and identify their mass and proton numbers plus number of each particle using this. Allow them to share their answers and feedback to the class. **LO** to know how to calculate RFM	**Activate** Give students a range of formulas of different compounds and ask them to work out the RFM of each. Ask students to complete the calculations independently. Then ask them to peer assess using the MS. Feedback to the class. **Demonstrate** Give students exam style questions related to calculating RFM,	**Consolidation** Give students an exam style question that can be linked to the practical and the theory from the current lesson, this will allow them to apply their knowledge and teacher to assess their understanding. **Planning support** To promote ambitious learning, students could try and apply their

	identify students' understanding of RFM and any misconceptions they might have, allowing you to differentiate in the rest of the lesson.	**Vocabulary** Relative formula mass Atomic/proton number Mass number Proton Neutron Electron **Planning support** This could be made into a competition to see who finishes first. The amount of information students can recall will depend on QLA, have a range of differentiated tasks so that all students can access it. More able students will be able to complete the task without support and identify all of the information about a range of atoms, some may need this simplified and some support linking number to particles.	encourage students to work independently on the question/s. They can then peer assess their answers. Once they have done this they can then do corrections in green pen. Feedback to the class. **Planning support** Have differentiated tasks so that all students can access them. For the more able, increase the challenge by including calculations with brackets. Ensure there are differentiated tasks for the students to complete and that exam questions are of the appropriate tier.	knowledge to other real-world applications such as the discovery of the Higgs boson by CERN in 2012 - this is claimed to be one of the most important scientific discoveries of the decade. Encourage students to look at all of the ideas they have added to their BQ page, how have their own ideas/skills developed since the first lesson? What has been their own most important 'discovery' so far?
22-Review hot task and PATH	**Connect** Show students the statement; Making mistakes makes great learners. Ask students if they agree or disagree with this statement and why? **Planning support** From this explain to students that they are going to be reviewing their hot task and completing a PATH sheet.	**Interleaving/ retrieval** Use students' hot task to create 3 groups of questions for students to complete based on individual weaknesses. **Planning support** Not all students will complete all questions, just those they didn't quite understand in the hot task. Have a help desk or knowledge organiser to support students.	**Activate** Reteach any areas that students as a class struggled with. Make sure you use a different method of teaching the content. You could also use the students as experts to support others. **Demonstrate** Once students are more confident with the content allow them to complete tasks that will show that they are making progress towards their targets on their PATH sheet.	**Consolidate** Ask students to produce a check list to help them stop making the mistakes that they previously made.
23 Closing the gap	**Connect** Use skills tasks here, identified from the assessment. This could be understanding the meaning of command words	**Interleaving/retrieval** Use QLA from the assessment, identify areas students may not have accessed/understood well and	**Activate** Students to go back through their assessment and using green ink, "upgrade" their answers. Reteach	**Consolidate** Provide students with question similar to those in the assessment that most could not complete,

	where a matching task could be used. Or using BUG to support the detail and key points needed for longer answer questions **Planning support** Again this needs to be bespoke to the students skills that they could not apply correctly. However often students tend to make similar mistakes, this may mean that only three or four different connect tasks are needed. The retrieval and connect will support students making corrections on their assessment in the main activity.	create a task to close their knowledge gap **Planning support** For retrieval use an area of content that students had some basic misconceptions or small gaps in knowledge and create a task/tasks to fill this. This needs to be bespoke to the individual, however often students tend to make similar mistakes, this may mean that only three or four different retrieval tasks are needed.	any smaller areas all students did not understand. **Planning support** Students work with peers near to them to go through their assessment. Students can make corrections, based on the conversations they are having as a table. Identify areas all students did not get correct, teachers need to reteach specific areas to allow students to make corrections.	making link to the area that has been retaught **Planning support** To promote ambitious learning, students need to work through an exam question based on the topic/similar structure to their assessment. Use the mark scheme to peer assess using green pen.
24 Closing the gap	**Connect** Use skills tasks here, identified from the assessment. This could be understanding the meaning of command words where a matching task could be used. Or using BUG to support the detail and key points needed for longer answer questions **Planning support** Again this needs to be bespoke to the students skills that they could not apply correctly. However often students tend to make similar mistakes, this may mean that only three or four different connect tasks are needed. The retrieval and connect will support students making corrections on their assessment in the main activity.	**Interleaving/retrieval** Use QLA from the assessment, identify areas students may not have accessed/understood well and create a task to close their knowledge gap **Planning support** For retrieval use an area of content that students had some basic misconceptions or small gaps in knowledge and create a task/tasks to fill this. This needs to be bespoke to the individual, however often students tend to make similar mistakes, this may mean that only three or four different retrieval tasks are needed.	**Activate** Students to go back through their assessment and using green ink, “upgrade” their answers. Reteach any smaller areas all students did not understand. **Planning support** Students work with peers near to them to go through their assessment. Students can make corrections, based on the conversations they are having as a table. Identify areas all students did not get correct, teachers need to reteach specific areas to allow students to make corrections.	**Consolidate** Provide students with question similar to those in the assessment that most could not complete, making link to the area that has been retaught **Planning support** To promote ambitious learning, students need to work through an exam question based on the topic/similar structure to their assessment. Use the mark scheme to peer assess using green pen.

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