Wychwood School

Practical Science Policy
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Purpose of Policy
This policy is designed to improve, and ensure the effectiveness of practical science at Wychwood School in line with the overall aim of providing a world class scientific education. It explains why and how practical science is used as well as the expected outcomes. It has been constructed with input from the whole science department and is reviewed against practice by the whole science department annually.

This ensures that the department can meet benchmark 1 of the Good Practical Science Report: Every school should have a written policy that explains why teachers use practical science, the outcomes they expect from it and how they achieve these outcomes.

Purposes of Practical Science

Practical science should :

- Teach the principles of scientific enquiry
- Improve understanding of theory through practical experience
- Teach specific practical skills such as measurement and observation, that may be useful in future study or employment

- Motivate and engage students
- Develop higher level skills and attributes such as communication, teamwork, and perseverance

As recommended by the Good Practical Science, Gatsby Foundation, 2017 report Wychwood has adopted each of these key purposes of practical science.

Key Principles

- Practical science refers not only to traditional laboratory based experiments but also demonstrations, use of digital technology, and field work. Teachers must consider the most effective mode of delivery for practical work in each case.

- Practical science should be accommodated where required and appropriate in one of the 3 teaching laboratories. Where it is necessary to timetable some lessons in classrooms other than a laboratory, teachers should negotiate room swaps between

themselves on a week by week basis to facilitate this. The technician should be informed in a timely manner so she can make any necessary arrangements.
- Experiments should be done on a scale that is both safe and cost effective to ensure the best use of resources.
- The technician should be informed if equipment is faulty or broken or supplies which are consumable are running low. Where new materials are needed the department will decide collaboratively how to prioritise these needs to be cost effective in managing the department budget.

This allows the science department to meet bench mark 5 of the Good Practical Science Report : Schools should have enough laboratories to make it possible for every teacher to do frequent practical science safely. Each laboratory should have sufficient equipment for students to work in small groups.

- Sufficient guidance and time allocation should be given to the technician to prepare materials for practical science.

This meets benchmark 6 of the Good Practical Science Report : Science departments should have enough technical or technician support to enable teachers to carry out frequent and effective practical science.

- The need for expert science teachers and support staff is crucial in delivering exceptional science teaching and therefore the science department will seek to provide or source professional development opportunities for all staff with focus on both up to date development in content as new scientific discoveries, techniques and technologies develop, and up to date developments in science education.
- CPD outcomes for the department should be set annually as a collaborative exercise of the department and details of how these will be achieved should be documented in line with the Science department development plans.

This allows the Science department to meet benchmark 3 of the Good Practical Science report : Teachers should have subject specialist training(both initial and continuing) in the subject (biology, chemistry, physics etc) and age range they teach, so they can carry out with practical science with confidence and knowledge of the underlying principles.

- Each practical should have a clear teaching purpose. It should relate to the curriculum and involve an appropriate level of procedural and conceptual challenge.

This ensures that the Science Department can meet benchmark 2 of the Good Practical Science report: Teachers should know the purpose of any practical science activity, and it should be planned and executed so it is effective and integrated with other science learning.

- Practical science should, where safe, possible and effective, form a substantial part of the program of study. The teacher, as an expert in their field, is best placed to decide for each of their classes which practicals to include and what the focus of these practicals should be. They should aim to include a varied approach in which

the mode of delivery (demonstration, individual practical, group practical, virtual simulation etc) is determined by suitability for purpose.
- Where appropriate teachers should supplement practical science with opportunities for it outside of the classroom such as trips, visiting speakers and organisations, field work, extra curricular opportunities.

This ensures that the department can meet benchmark 4 of the Good Practical Science Report: Students should experience a practical activity in at least half of their science lessons. These activities can be short or long, but should be varied in type.

- Real laboratory experiments and equipment should be used when possible and safe to do so in preference to virtual experiences of experiments.

This ensures that the department can meet benchmark 7 of the Good Practical Science Report: Teachers should use digital technologies to support and enhance practical experience, but not replace it.

- Practical activities should be chosen which allow students to make long term progress in each of the first three key purposes of practical work (develop scientific enquiry, improve understanding of theory, develop key practical skills). This will involve some more open ended investigative work. The nature of this will be dependent upon the age, nature and attainment level of the students in the class.

This ensures that the department can meet bench mark 8 of the Good Practical Science Report: Students should have opportunities to do open-ended and extended investigative projects.

- Health and safety is a priority in practical science. All practical science lessons should come with **adequate and appropriate** risk assessment, appropriate teacher and student expertise and adhere to all health and safety guidelines as outlined in the Science department and whole school health and safety policies. Students' ability to assess risk should be developed as part of the teaching of scientific enquiry but it should not take the place of the risk assessment of the teacher. Teachers should seek help and support regarding health and safety in Science from their colleagues in the Science department, the safety officer, SLT and Cleapps when it is needed.

This ensures that the department can meet benchmark 9 of the Good Practical Science Report: Students' experience of practical science should not be restricted by unnecessary risk aversion.

- The effectiveness of practicals should be determined on an on going basis through summative and formative assessments and amendments should be made to the teaching program accordingly.

This ensures that the department can meet bench mark 10 of the Good Practical Science report: Assessment of students' work in science should include assessment of their practical knowledge, skills and behaviours. This applies to both formative and summative assessment.

- All students are entitled to equality of provision and practical lessons should be modified as necessary to be accessible to all students and this should be reflected in the relevant risk assessments.
- Teachers should seek support from the relevant department (SEND, EAL), their science colleagues, Cleapps and SLT if they think that access to practical work is compromised.

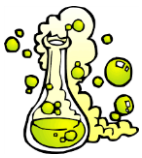
Science at different key stages

- Practical science will have different anticipated outcomes depending on the age of the students completing the practical work. Most students will be able to meet the following anticipated outcomes. These are based on those set down in the national curriculum at KS3 and the examination board specifications at KS4. At Wychwood KS3 science covers the remove and inters years. Students begin to work from the GCSE specification (KS4) during the LT year.

Skill Area	**Outcomes at KS3**	**Outcomes at GCSE**
Planning Practical work	• ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience • select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility • make predictions using scientific knowledge and understanding • evaluate risks	• use scientific theories and explanations to develop hypotheses • plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena • apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment • use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts • evaluate risks in practical science
Reporting Findings	• present observations and data using appropriate methods, including tables and graphs • understand and use SI units and IUPAC chemical nomenclature • apply mathematical concepts and calculate results	• use scientific vocabulary, terminology and definitions • recognise the importance of scientific quantities and understand how they are determined • use SI units and IUPAC chemical nomenclature unless inappropriate • □use prefixes and powers of ten for orders of magnitude • □inter convert units • use an appropriate number of significant figures in calculation

Skill Area	**Outcomes at KS3**	**Outcomes at GCSE**
Drawing conclusions and making predictions for further tests	• interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions • present reasoned explanations, including explaining data in relation to predictions and hypotheses • understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review • evaluate data, showing awareness of potential sources of random and systematic error • identify further questions arising from their results	• interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions • present reasoned explanations including relating data to hypotheses • communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms • understand how scientific methods and theories develop over time • recognise the importance of peer review of results and of communicating results to a range of audiences • being objective, evaluate data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error • evaluate methods and suggest possible improvements and further investigations

These expected outcomes at KS3, have been further split into levelled year descriptors such that easy assessment can take place and progress can be monitored. These are common descriptors across the sciences and are outlined in the marking rubrics which follow on the next page.

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Remove Practical Work in Science

Skill level	Description	✓
1	• Follows instructions correctly to carry out an experiment • Identifies hazard warning symbols and takes appropriate measures • Records the outcomes of experiments	
3	• Selects appropriate equipment to plan an experiment • Draw valid, simple conclusions • Makes accurate, qualitative observations • Makes simple quantitative measurements. • Presents data in a suitable table • Identifies simple patterns and trends in data • Identifies hazards in experiments and suggests simple suitable precautions • Plans experiments to test predictions • Uses a Bunsen Burner safely	
5	• Makes and explains predictions based on scientific knowledge and understanding. • Identifies variables in an investigation (independent, dependent and control) • Draws conclusions using scientific knowledge and understanding to explain data. • Decides on a suitable number and range of results to take.	
WWW		
EBI		

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Inters Practical Work in Science

Skill level	Description	✓
1	• Selects appropriate equipment to plan an experiment • Draw valid, simple conclusions • Makes accurate, qualitative observations • Makes simple quantitative measurements. • Presents data in a suitable table • Identifies simple patterns and trends in data • Identifies hazards in experiments and suggests simple suitable precautions • Plans experiments to test predictions Uses a Bunsen Burner safely • Makes predictions using scientific language	
3	• Writes reasoned explanations of conclusions based on experimental data • Makes and records accurate measurements and observations • Correctly reads simple scales • Identifies variables in an investigation (independent, dependent and control) • Makes predictions and draws conclusions using some scientific knowledge and understanding to explain data. • Decides on a suitable number and range of results to take • Identifies anomalous data points • Suggests improvements to investigative approaches • Explains safety precautions • Processes data mathematically	
5	• Explains anomalous data points • Comments on the reliability, objectivity and accuracy of the experimental procedure and explains suggested improvements • Evaluates data with reference to systematic and random errors • Suggests further work • Uses secondary sources to support claims • Processes data using complex calculations	
WWW		
EBI		