New Specification A-Level Practical Endorsement Guide: Updated August 2017

This guide has been written to help teachers make the most of the new practical endorsement for students. Each exam board will provide a set of core practicals that they recommend their teachers do, however, most of the exam boards are being flexible and are allowing teachers to choose the experiments their students complete. This guide gives a series of alternative experiments that match with the practical apparatus and techniques, so that you have the freedom to choose which experiments you do. Moreover, if you have students who have found some of the techniques difficult, but you don't want them to repeat the same experiment, then this guide offers alternatives to help your students to master these techniques and to allow them to meet the Common Practical Assessment Criteria (CPAC).

In this updated version we have added some resources to help students with the Common Practical Assessment Criteria (CPAC). Students are expected to meet all CPAC "consistently and routinely" by the end of their A-Level studies. The resources highlighted here can help students to develop their skills by offering guides to key practical techniques and apparatus use, as well as resources to help them plan experiments and process their results. These resources can be used on their own, or alongside the core and alternative practicals.

New Specification A-Level: Practical Apparatus and Techniques

	Apparatus and Techniques
1	use appropriate apparatus to record a range of measurements (to include mass, time, volume of liquids and gases, temperature)
2	use water bath or electric heater or sand bath for heating
3	measure pH using pH charts, or pH meter, or pH probe on a data logger
4	use laboratory apparatus for a variety of experimental techniques including: i. titration, using burette and pipette ii. distillation and heating under reflux, including setting up glassware using retort stand and clamps iii. qualitative tests for ions and organic functional groups iv. filtration, including use of fluted filter paper, or filtration under reduced pressure
5	use volumetric flask, including accurate technique for making up a standard solution
6	use acid-base indicators in titrations of weak/strong acids with weak/strong alkalis
7	purify: i. a solid product by recrystallization ii. a liquid product, including use of separating funnel
8	use melting point apparatus
9	use thin-layer or paper chromatography
10	set up electrochemical cells and measuring voltages
11	safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances
12	measure rates of reaction by at least two different methods, for example: i. an initial rate method such as a clock reaction ii. a continuous monitoring method

Practical techniques and suitable practicals from Learn Chemistry (where possible they have been matched to the specification core experiments).

Practical Technique	Experiments from Learn Chemistry	Exam Board Experiment
1	The Volume of Hydrogen Gas	OCR 1; Edexcel 1; Eduqas C2.3; WJEC 2.2
	The Formula of Hydrated $CuSO_4$	Eduqas PI1.2: WJEC 3.2
	Finding the Formula of an Oxide of Copper	Eduqas PI1.2; WJEC 3.2
	Weighing Gases	
	Heats of Reaction	AQA 2; Edexcel 8: OCR 3: Eduqas C2.2
	Exothermic and Endothermic	AQA 2; Edexcel 8; OCR 3
	Measuring Enthalpy Changes	AQA 2; Edexcel 8; OCR 3
	Thermometric Titration	
	Problem-based practical activities 1	
	Problem-based practical activities 3	
	Problem-based practical activities 4	
	Problem-based practical activities 7	
	Problem-based practical activities 9	
2	Limonene from Oranges and Lemons (use a water bath or electric heater to meet the practical technique requirement)	
	Aspirin (or Aspirin)	AQA 5, 10; OCR 5, 6, 7; Edexcel 16; Eduqas OA4; WJEC 4.8
	Paracetamol	
	Problem-based practical activities 4	
3	Universal Indicators	AQA 1, 9; Edexcel 9; OCR 2, 11; Eduqas C2.1; WJEC 3.9
	Properties of Ethanoic Acid	
	pH of Oxides	
	Determining the pK_a of 2-hydroxy benzoic acid, Aspirin, and Glycine	
4i	Neutralisation of Indigestion Tablets	
	Titration of NaOH with HCl	AQA 5, 10: Edexcel 3; OCR 2, 11; Eduqas C2.1; WJEC 1.7
	Tannin in Wine	
	Gifted and Talented Chemistry – 'Acids and Alkalis'	
	Thermometric Titration	
	Problem-based practical activities 6	
	A Conductimetric Titration	
	Low-sodium Salt Substitutes	
	Use of Salt in Cooking	
4ii	Limonene from Oranges and Lemons	
	Fractional Distillation of Crude Oil	
	Paracetamol	
	Aspirin (or Aspirin)	AQA 5, 10; Edexcel 16; OCR 5, 6; Eduqas C3.4; WJEC 4.8
	Detecting Aspartame	
	Hydration of Alkenes	
	Problem-based practical activities 4	

4iii	Testing Salt for Anions and Cations Flame Tests Testing for Negative Ions Reactions of Positive Ions The Oxidation of Alcohols Testing for Aldehydes and Ketones Testing for Unsaturation Halogen Compounds Creative Problem Solving – 'Five White Solids' Hydration of Alkenes Silver and Lead Halides Problem-based practical activities 1	AQA 4, 11; Edexcel 7; OCR 4; Eduqas C1.6 AQA 4 AQA 4 AQA 6; Edexcel 15; OCR 7; Eduqas OA4; WJEC 4.8 AQA 4 AQA 11 AQA 6; Edexcel 15, OCR 7 AQA 4
4iv	Paracetamol Aspirin (or Aspirin) Preparing an insoluble salt Nitration of methyl benzoate	Edexcel 16; OCR 6
5	Reaction between manganate(VII) and ethanedioate ions Determination of Soil CEC Low-sodium Salt Substitutes Use of Salt in Cooking	AQ 1; Edexcel 2; OCR 2; Eduqas C2.1, PI1.2; WJEC 1.7
6	Neutralisation of Indigestion Tablets Titration of NaOH with HCl Problem-based practical activities 6 Gifted and Talented Chemistry – 'Acids and Alkalis'	AQA 1, 9; OCR 2; Eduqas C2.1, PI5.2; WJEC 1.7
7i	Paracetamol Aspirin (or Aspirin) Purifying an Impure Solid Nitration of methyl benzoate Problem-based practical activities 5 Preparing an insoluble salt	AQA 10; Edexcel 16; OCR 6; Eduqas OA4; WJEC 4.8
7ii	Hydration of Alkenes	AQA 10; OCR 5; Eduqas OA4; WJEC 4.8
8	Observing the lowering of Melting Point Paracetamol Nitration of methyl benzoate Problem-based practical activities 8	AQA 10; OCR 6; Eduqas OA2.2, OA4; WJEC 4.8
9	Chromatography of Leaves Aspirin (or Aspirin) Chemistry Masterclass Detecting Aspartame Paracetamol Problem-based practical activities 5	AQA 12; Edexcel 6; OCR 6; Edexcel 16; Eduqas OA4; WJEC 4.8
10	Electricity from Chemicals Kitchen Potential	AQA 8; OCR 8; Edexcel 10; Eduqas PI1.1; WJEC 3.1
11	**All Experiments**	**All Experiments**

12i	Rate of Reaction – Concentration and Temperature Rate of reaction - Temperature Rate of Reaction - Concentration Iodine Clock Rates and Rhubarb Problem-based practical activities 7	AQA 3, 7; OCR 10; Eduqas C2.3 AQA 7; Edexcel 13; OCR 10; Eduqas C2.3; WJEC 2.2
12ii	Rate of Hydrolysis of Aspirin Rate of Reaction – Magnesium and Hydrochloric acid Reaction between manganate(VII) and ethanedioate ions	AQA 7; OCR 9; Eduqas C2.3; WJEC 2.2

Common Practical Assessment Criteria (CPAC)

The resources highlighted in this table can be used by both teachers and students. They can be used to teach practical technique and to help inform apparatus choices when planning experiments.

Competency	Resources
1 – Follows written procedures *[Correctly follow instructions to carry out the experiments techniques or procedures]* 2 – Applies investigative approaches and methods when using instruments and equipment *[i - Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting.* *ii - Carries out techniques or procedures methodically, in sequence and in combination identifying practical issues and making adjustments when necessary.* *iii - Identifies and controls significant quantitative variables where applicable and plans approaches to take account of variables that cannot readily be controlled.* *iv - Selects appropriate equipment and measurement strategies in order to ensure suitability accurate results]*	All experiments highlighted in the above table Interactive Lab Primer – Lab Apparatus Interactive Lab Primer - Heating Interactive Lab Primer – Titration Interactive Lab Primer – Distillation Interactive Lab Primer – Reflux Interactive Lab Primer – Filtration (gravity) Interactive Lab Primer – Filtration (vacuum) Interactive Lab Primer – Standard Solution Interactive Lab Primer – Titration Interactive Lab Primer – Recrystallisation Interactive Lab Primer – Separating Funnel Interactive Lab Primer – Melting Point Interactive Lab Primer - TLC Interactive Lab Primer – Working Safely Accuracy and Precision Measurement, Accuracy and Precision Titration Screen Experiment Aspirin Screen Experiment Organic liquid quizzes (LCP members only) Titration quizzes (LCP members only) Qualitative analysis quizzes (LCP members only)
3 – Safely uses a range of practical equipment and materials *[i – Identifies hazards and assesses risks associated with these hazards when carrying out experimental techniques and procedures in the lab or field.* *ii – Uses appropriate safety equipment and approaches to minimise risks with minimal prompting.* *iii – Identifies safety issues and makes adjustments when necessary.]*	Health and Safety Guidance Risk Assessment Titration Screen Experiment Aspirin Screen Experiment
4 – Makes and records observations *[i – makes accurate observations relevant to the experimental or investigative procedure.* *ii – Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions.]*	Titration Screen Experiment Measurement, Accuracy and Precision Accuracy and Precision
5 – Researches, references and reports *[I – Uses appropriate software and/or tools to process data, carry out research and report findings.* *Ii – Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.]*	How to reference