INTERNATIONAL GCSE

Biology, Chemistry & Physics (2017)

CORE PRACTICAL GUIDE

Pearson Edexcel International GCSE in Science

For first teaching September 2017

First examination June 2019

Introduction

Purpose of this guide

This guide is designed to support you in delivering the core practicals for Edexcel. The following pages, for *each* core practical, will:

- Give you links to the specification content and highlight key areas to further your students' understanding.
- Contain key questions you can ask to focus your students, and get them thinking about why they are carrying out a particular practical in a certain way.

Changes to practical requirements

There will not be any coursework in the International GCSE (9–1) Science qualifications. Assessment of practical work is now included as part of the final exam, and a minimum of 15% of the total marks must be allocated to questions related to practical work. In our exams, we will have questions on the core practicals in our specifications, as well as questions on other practicals related to the core practicals or techniques that students should be familiar with from their studies.

As well as the practical requirement, there is a list of apparatus and techniques that has been set out by the Department for Education (*Appendix 1*) that we have adhered to for consistency with the UK qualifications. As long as you carry out all of the core practicals, you will automatically cover the apparatus and techniques list.

Approach to core practicals

In your day-to-day teaching, you should ensure you cover the core practicals outlined by us and that your students are recording the work that they are doing as part of carrying out the core practicals. In practice, this could just be completing worksheets, taking results and doing some analysis or writing notes in their exercise books as a follow up to carrying out the practical. If you prefer, you can use a separate lab book for practical work, but this is not necessary. Indeed, as students will be required to have knowledge of these practical techniques and procedures for the final exam, it may be better to have this practical work sit alongside the relevant theoretical knowledge.

It is important to note that the approach to covering core practicals should be the same approach as you currently take to practical work in your science lessons. If you occasionally cover particular techniques as a carousel, or split students into groups to take readings, there is no reason why you cannot still do this—as long as you have taken reasonable steps to ensure your students all acquire experience of carrying out that particular procedure or technique.

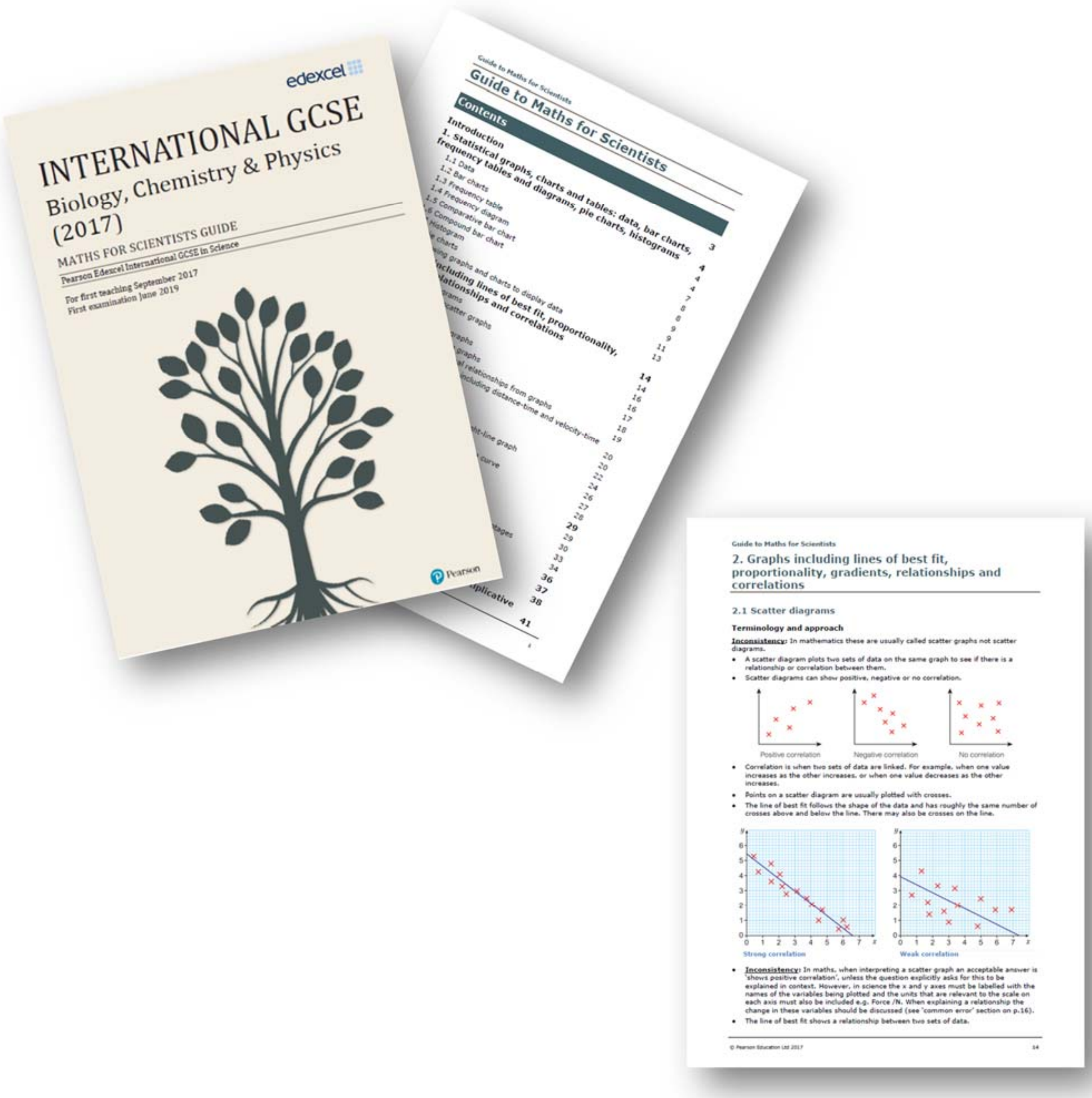
Assessment of practical work

In exam papers, practical work will be assessed across the assessment objectives. The sample questions included in this core practical guide outline how you can use that question to consolidate your students' understanding of that particular core practical. The exam papers will assess student's understanding of the practical work, and they will be at an advantage if they have carried out all the core practicals in the course.

Maths skills

Practical activities offer a wide range of opportunities to cover particular mathematical skills. As part of this guide, we have outlined where there are good opportunities to cover mathematical techniques as part of each core practical.

N.B. There is a Guide to Maths for Scientists which you can download from the Edexcel website. This guide outlines the content that students will have covered in their maths lessons throughout KS3 and KS4. You can use this guide to help you understand how different areas are approached in maths, and therefore support your teaching of mathematical content in science lessons.



International GCSE Chemistry Practicals

There are 8 core practicals in the chemistry section of International GCSE Combined Science. International GCSE Chemistry covers the same 8 practicals as well as an additional 4, to make up 12 core practicals in total.

This section outlines each core practical and gives a brief description of each one. Then the guide goes through each core practical in turn, outlining how to carry out the practical, questions that could be asked, and the key skills involved (including maths skills).

Core practical descriptions

Note: **1.7C**, **1.60C**, **2.43C** and **4.43C** are separate International GCSE Chemistry only

No.	Specification Reference	Description
1	**1.7C - Investigate solubility of a solid in water at a specific temperature**	
2	1.13 - Investigate paper chromatography using inks/food colourings	
3	1.36 - Determine the formula of a metal oxide by combustion or by reduction	
4	**1.60C - Investigate the electrolysis of aqueous solutions**	
5	2.14 - Determine the approximate percentage by volume of oxygen in air using a metal or non-metal	
6	2.21 - Investigate reactions between dilute hydrochloric and sulfuric acids and metals	
7	2.42 - Prepare a sample of pure, dry hydrated copper(II) sulfate crystals starting from copper(II) oxide	
8	**2.43C - Prepare a sample of pure, dry lead(II) sulfate**	

9	3.8 - Investigate temperature changes accompanying some of the following types of change: • salts dissolving in water • neutralisation reactions • displacement reactions • combustion reactions	
10	3.15 - Investigate the effect of changing the surface area of marble chips and of changing the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid	
11	3.16 - Investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution	
12	**4.43C - Prepare a sample of an ester such as ethyl ethanoate**	

Core practical 10: Rates of reaction

3.15 Core practical: Investigate the effect of changing the surface area of marble chips and of the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid

Links to the specification content

3.9	describe experiments to investigate the effects of changes in surface area of a solid, concentration of a solution, temperature and the use of a catalyst on the rate of a reaction
3.10	describe the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas, temperature and the use of a catalyst on the rate of a reaction
3.11	explain the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas and temperature on the rate of a reaction in terms of particle collision theory

Introducing the practical

There are two investigations to carry out and they are likely to take a lesson each.

In investigation 1, students investigate the effect of changing the concentration of hydrochloric acid on the rate of reaction between hydrochloric acid and marble chips.

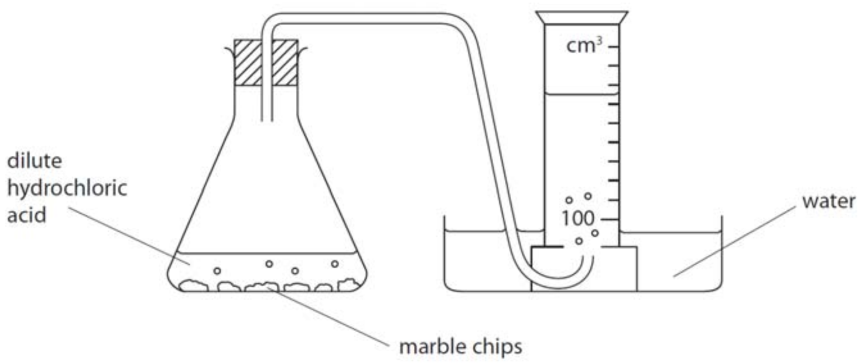
In investigation 2, students investigate the effect of changing the size of marble chips on the rate of reaction between hydrochloric acid and marble chips.

The volume of gas can be measured by collecting it in an upturned measuring cylinder over water or in a gas syringe. It would be helpful to demonstrate the method that the students do not use so they are familiar with both methods.

Students should plot appropriate graphs using their results, for example, volume of gas produced against time. They can then draw a tangent to the curve and calculate the gradient to determine the rate of reaction at a particular time.

Investigation 1

A typical set up for collection over water is shown in the diagram:



It is impossible to maintain an exactly constant surface area from one experiment to the next, but it can be partly controlled by taking the same mass of chips, the same number of the chips and similar size of chips in each case.

The exact concentrations of acid to use are best determined in advance by trial and error using the supply of marble chips at your disposal.

A good starting point would be 2mol/dm^3 and work downwards from there.

Investigation 2

In the investigation it is necessary to vary the surface area of the marble chips.

This can be done if you have access to marble chips of different size. Alternatively, you can start with large marble chips and hit them with a hammer (first wrap the chips in a towel) to produce smaller chips.

Once again, it is best to trial the experiments beforehand to determine the most effective concentration of hydrochloric acid to use. A concentration of 2mol/dm^3 often works well, providing times that are neither too long nor too short.

If the reaction in the first investigation has been followed by measuring the total volume of gas collected at set time intervals, it may be worthwhile to follow this reaction by measuring the time taken to collect a fixed volume of gas each time. The overall rate of reaction could then be calculated for each reaction by dividing the volume of gas collected by the time taken, giving typical units of say cm^3/s for the rate.

Additional investigations

1. Investigate the change in concentration of sodium thiosulfate on the rate of reaction between sodium thiosulfate and hydrochloric acid.
2. Investigate the effect of temperature of the rate of reaction between sodium thiosulfate and hydrochloric acid.

These two investigations are described here and here on the RSC website.

Rates of reaction

Questions you could ask to enhance learning and focus your students on important aspects of the practical:

- What is the balanced equation for the reaction?
- What are the state symbols for the reactants and products?
- What is the best practical method to determine the rate of this reaction and why?
- What are two different methods of collecting and measuring the volume of gas produced?
- What is the biggest procedural error in this experiment?
- How could you reduce this procedural error?
- How do you decrease the size of the marble chips?
- What specific safety precaution should you take when decreasing the size of the marble chips?
- How does this affect the surface area of the marble chips?
- What effect does this have on the rate of reaction?
- How can you explain this effect from graphs of volume of gas plotted against time for two different sizes of marble chips?
- How can you calculate the rate of reaction from these graphs?
- What needs to be kept the same when you repeat the first experiment but use different size marble chips?
- How could you decrease the concentration of the hydrochloric acid?
- What effect will decreasing the concentration of hydrochloric acid have on the rate of reaction?
- How do you explain this effect in terms of particles and collisions?

Skills that are covered in the practical:

- Use appropriate apparatus to make and record measurements of mass, volume of solutions, time, temperature and volume of gas
- Use appropriate apparatus and techniques for monitoring chemical reactions, for example, a gas syringe or collecting gas over water in an upturned measuring cylinder
- Make and record observations and measurements of rate of reaction when a gas is produced
- Safe use and handling of hydrochloric acid and marble chips

Maths skills:

1A Use expressions in decimal form (eg when calculating gradients)

1B Use ratios (in balanced equations)

2A Use an appropriate number of significant figures (when calculating rate)

4A Translate information between graphical and numeric form

4C Plot two continuous variables from experimental data

4D Draw and use the slope of a tangent to a curve as a measure of rate of reaction