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2021-22

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NEW

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Save time and improve grades

Save planning time

Improve grades

GCSE lesson materials

Dear friends and colleagues

What a year it has been for us all.

We have all been tested to the limits of our ingenuity to find the best ways to support the students we all serve, and through this, the positives have shone through. In talking to teachers every day, it is evident that the use of technology through remote learning has evidently had a positive impact on learning again back in the classroom. This will hopefully improve the success of any additional provision where it is needed beyond the classroom this year. PG Online have been able to assist many schools through the past 12 months with our digital resources and I am confident that these will continue to aid those teachers and students for many more years to come.

Our new ClearRevise™ series launched in the summer of 2020. Work started in early last year with significant research involving students and teachers from a variety of schools, and research into the science of learning beyond our own teaching experiences. The guides provide a more accessible and approachable revision experience, with examination style questions, model answers and specification transparency at their heart. The series has been exceptionally well received and has a bright future for expansion in 2021. If you've not seen an award-winning copy for Biology, Chemistry or Physics, just ask us and we can send you one for evaluation.

PG Online continues to grow, helping more schools and more departments every year. Thank you for your reciprocal support and I hope that we can continue to support you even more in the future.

Best wishes for 2021.

Rob Heathcote
Director

Cover picture:
Fear of the dragon
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Secondary content provider 2018
Company of the Year Finalist 2018, 2017

Company of the Year Finalist
2019, 2018, 2017
Service and Support Finalist 2019
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Digital Publisher of the Year 2018, 2016

Category winner 2019
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UK SME Company of the Year 2018 Finalist

Education Publisher of the Year 2018

PG ONLINE

Contents

Save time and improve grades

GCSE grades increase 12% in schools using PG Online

A 'pick and mix' approach

We have given a lot of thought to the best strategy to help both experienced Science teachers and teachers unfamiliar with the subject to deliver the new GCSE specifications, without having to spend too much time planning or developing an entirely new set of resources. Teachers have discovered enormous value in our teaching material.

We decided that a 'pick and mix' approach allows teachers to select units on topics where they feel they could do with some help, and do not tie the school in to paying an annual licence, was the best solution. We started to recruit proven teachers, experienced published authors and educational researchers to create units. Each unit has been carefully edited and typeset to give the great end results you can see in the **free** sample material.

All the material in the units is fully editable – you can customise it to your own teaching style, the department timetable and your students' needs.

Our authors:
Dr Stephen Belding, Adelene Coghill, Ray Dexter, Jan Gledhill, Rob King, Stuart Lloyd, Nigel Saunders, Helen Sayers, Martin Scott, Mark Smith and David Waistnidge.

Did you know...

You can download free sample lessons and lesson plans for any of our published units from www.pgonline.co.uk

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Fergal Moane
Assistant Headteacher
Sandringham School

"I'd just like to express my thanks for the material and support. If I had needed to have made my own resources, the results wouldn't have been as good.

Paul Sloane
Head of Department
Lady Manners School

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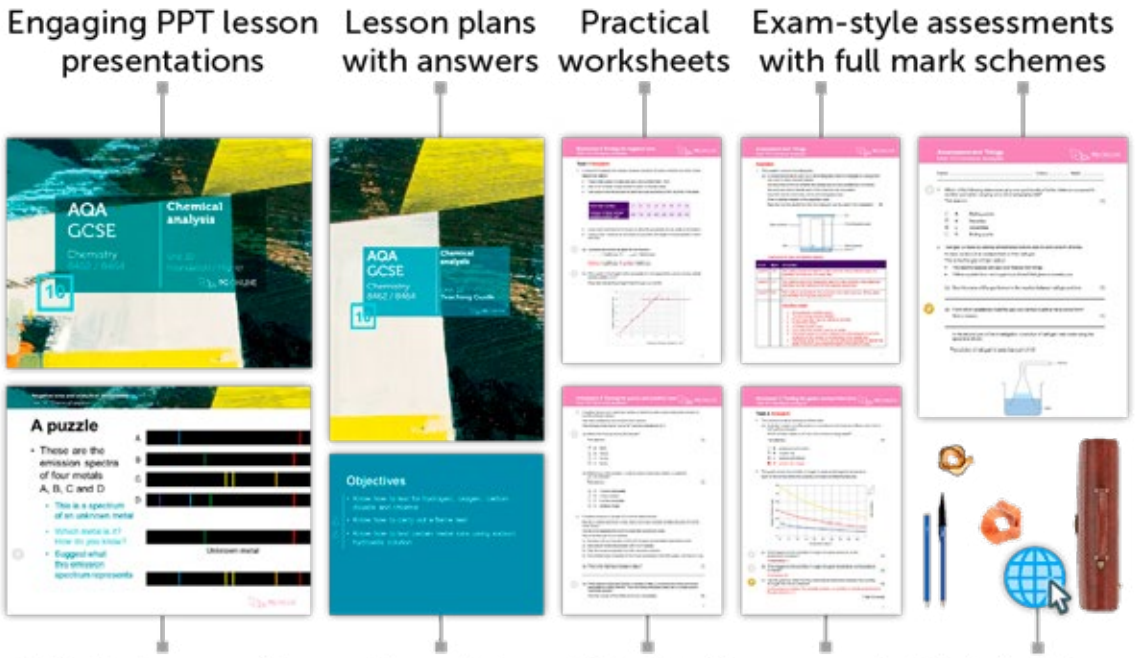

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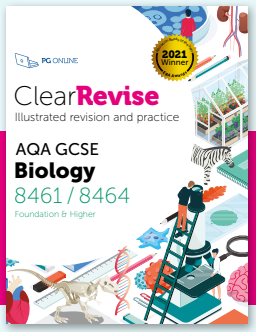

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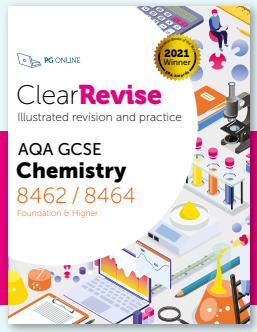

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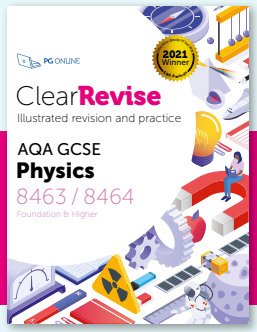

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Unit 10: Chemical analysis is FREE.

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Unit 10: Chemical analysis – FREE

The understanding of the term 'pure' is discussed in terms of a substance made of one chemical 'entity', and the measure of its purity using its melting point is a key focus of the first section of the topic. A look at 'formulations' as mixtures that have carefully selected and measured components then follows. Many will have already come across simple analytical techniques, for example, chromatography, but this unit dwells further on this particular technique in terms of an understanding of how the process works, and also aims to quantify the relative positions of substance spot and solvent front in terms of an Rf value. The modern and highly powerful analytical technique of flame emission spectroscopy is also studied with particular attention given to how this technique is used to analyse complex mixtures. With many experimental contexts and fascinating situations illustrated, this section then brings the unit to a colourful and engaging conclusion.

Topic 1 Pure substances and mixtures
Topic 2 Using chromatography
Topic 3 Testing for gases and positive ions
Topic 4 Negative ions and analytical techniques
Unit Assessment
This unit is free. Order online.

Unit 1: Atomic structure

This unit covers the fundamental nature of chemical substance, in terms of studying elements, compounds and mixtures. Although these are familiar terms to many students, this unit develops this idea further given the particulate nature of matter in these three chemical forms. Chemical equations are introduced as a way of representing chemical reactions, whether this be in simple word form, or more usefully, as a balanced chemical equation. The necessary mathematics skills are then introduced within the context of atomic size and the electrical charge of the main sub-atomic particles. Typically, the unit introduces new concepts using novel and innovative ideas, and also employs an appropriate delivery pace, so that students have the opportunity to maximise their learning. The model of the atom, together with its limitations, are then discussed with time devoted to how our understanding of atomic structure has evolved through time.

FREE LESSON
Topic 1 Elements and compounds
Topic 2 Separating mixtures
Topic 3 Chemical equations
Topic 4 Sizes of atoms
Topic 5 Inside atoms
Topic 6 Isotopes
Topic 7 Electrons and electronic structure
Topic 8 Models of the atom
Unit Assessment

Download a **FREE** topic with every unit at **www.pgonline.co.uk**

The PG Online materials have made a huge impact on me and my students. It's a well developed set of resources that any teacher can use.

Will Chau. Computer Science teacher, The ISF Academy, Hong Kong

Unit 2: The periodic table

This unit delves deeper into the understanding of chemical elements introduced at Key Stage 3, looking at how elements are grouped into families based on their similar chemical behaviour. A focus on the highly reactive elements in groups 1 and 7 of the periodic table is presented with well thought-through examples that bring this fascinating aspect of chemistry to life. The elements in group 0 are compared and contrasted with those in the other main groups, answering some of the fundamental questions regarding their remarkable chemical inactivity. The unit then moves on to have a brief look at the transition metals, both in terms of their unique properties and their differences when compared to main group elements, particularly those in group 1. The final topic brings together many of the key skills in this essential unit, particularly the ability to interpret information from the periodic table in terms of electronic structure and structure and bonding.

FREE LESSON

Topic 1 The periodic table and its development
Topic 2 The modern periodic table
Topic 3 Group 1 – The alkali metals
Topic 4 Group 7 – The halogens
Topic 5 Group 0 – The noble gases
Topic 6 Properties of transition metals
Topic 7 Unifying principles
Unit Assessment

Unit 3: Structure and bonding

This unit develops further ideas introduced at Key Stage 3 on the particulate nature of matter. An essential unit for students to master, the journey begins with the development of ideas relating to states of matter, then moves rapidly onto a study of the various key structural types. The ability for students to compartmentalise different substances into one of the main structural types is a key skill, and also highly useful, as it offers the ability to predict physical properties of materials. This is a beautifully illustrated unit consisting of highly interesting and engaging examples, including mention of useful and innovative modern-day materials. The unit concludes by delving into the fascinating world of metals and finishes with an exciting and highly contemporary focus on nanoparticles.

FREE LESSON

Topic 1 The three states of matter
Topic 2 Ionic bonding
Topic 3 Giant ionic structures
Topic 4 Covalent bonding
Topic 5 Simple covalent structures
Topic 6 Giant covalent structures
Topic 7 Metals and giant metallic bonding
Topic 8 Bulk and surface properties of matter
Unit Assessment

Unit 4: Chemical calculations

This unit focuses on some of the numerical aspects of chemistry in terms of the ability to calculate amounts of products and reactants based on chemical reactions. It is a key skill that students must possess, in that it provides an extra layer of understanding and appreciation of chemical reactions. Each topic is presented so that new numerical ideas have an opportunity to settle into place before they are further developed and applied. There is ample time devoted to worked examples – giving students the chance to think and practice – with questions on each slide to deepen students' understanding and learning. The unit brings to life a topic that many students find challenging, using meaningful and imaginative examples, that illustrate beautifully how chemistry can be interpreted quantitatively.

FREE LESSON

Topic 1 Mass changes in reactions
Topic 2 The mole and equations
Topic 3 Masses from chemical equations
Topic 4 Solution calculations and titrations
Topic 5 Volumes of gases
Topic 6 Yield and atom economy
Unit Assessment

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Unit 5: Chemical change

Chemical change is a fundamental aspect to the understanding of chemistry, and this unit focuses on many of the key reaction types that underpin a sound understanding of this fascinating science. Reaction types are studied as individual and beautifully illustrated 'themes' throughout the unit, with each type being introduced within an interesting context. Topics begin by looking at displacement reactions and using the reactivity series. The idea of redox reactions involving a transfer of electrons provides a step up from simple oxygen transfer that would have been met previously. Reactions of acids with metals, metal oxides and metal hydroxides may also be familiar to students, but the interpretation of these reactions in terms of proton or hydrogen ion transfer will be new and inspiring. The unit concludes with a study of how salts can be made in the laboratory, with particular focus on experimental technique and method.

FREE LESSON

Topic 1 The reactivity series
Topic 2 Extracting metals
Topic 3 Acids and alkalis
Topic 4 Reactions of acids
Topic 5 Making salts
Topic 6 Strong and weak acids
Unit Assessment

Unit 6: Heat changes and electrolysis

This unit employs evidence based on experimental study to enhance the development of knowledge and understanding. Many students will have come across exothermic and endothermic reactions previously in terms of simple temperature measurement, but this unit concentrates on the transfer of heat energy between the system and the surroundings. A look at how energy changes are represented as energy profiles then explains how energy changes may be explained in terms of chemical bonding. A study is then made of electrolysis in terms of the ability to decompose chemical compounds to form elements. The underlying processes involved in electrode surface transformations is discussed in terms of higher-level ionic half equations throughout this section. The unit then covers the process of electrolysis in terms of its relevance to the extraction of aluminium from its ore.

FREE LESSON

Topic 1 Exothermic and endothermic reactions
Topic 2 Energy profile diagrams
Topic 3 Energies of bonds
Topic 4 Bond energy calculations
Topic 5 Chemical cells and fuel cells
Topic 6 Electrolysis
Topic 7 Extraction of aluminium
Topic 8 Electrolysis of aqueous solutions
Unit Assessment

Unit 7: Rates of reaction and equilibria

This unit considers two highly important topics in the area of physical chemistry – rates of reaction and chemical equilibria. This unit builds on an understanding that some chemical reactions are fast and some are considerably slower. Experimental work is presented as an essential method for monitoring the rate of a chemical reaction, with time devoted to the planning of such experiments, and the analysis and interpretation of the results. This unit illustrates the rate of reaction including the role of activation energy when explaining the effect temperature on rate, and the world of catalysts. The second phase of the unit concentrates on reversible reactions, and how these may attain a state of chemical equilibrium. The final part of the unit concentrates on how to change the position of equilibrium by altering external conditions – a fascinating and challenging way to conclude this particular topic.

FREE LESSON

Topic 1 Calculating the rate of reaction
Topic 2 Factors that affect the rate of reaction
Topic 3 Collision theory
Topic 4 Catalysts
Topic 5 Reversible reactions and equilibrium
Topic 6 Changing conditions - Concentration
Topic 7 Changing conditions - Temperature and pressure
Unit Assessment

"PG Online resources are very well planned and easy to use."

Gillian Broadhead. ACTL Creative and Technical Studies
Ridgewood High School

"The stretch and challenge provided for was outstanding."

Tim Baguley. Head of Mathematics
Queen Elizabeth's School

Unit 8: Crude oil and fuels

Crude oil continues to play a crucial role in our lives, and this unit illustrates some of the key properties and uses of its highly important and essential-to-life components. The unit emphasises and consolidates the understanding of the molecular form at the outset of this unit, as many students confuse terms like 'atom', 'ion' and 'molecule'. Once the various properties of molecules are understood, the unit then applies this understanding within the context of the hydrocarbons present in crude oil.

The unit studies the composition of crude oil through to its separation into fractions, and thereafter into an individual study of the alkanes, as the starting point for gaining an understanding of the properties of molecules in an homologous series. The unit then moves onto the alkenes as a different homologous series from the alkanes, together with a consideration of the cracking process.

FREE LESSON Topic 1 Crude oil and its composition
Topic 2 Representing molecules
Topic 3 Hydrocarbons and alkenes
Topic 4 Fractional distillation of crude oil
Topic 5 Cracking hydrocarbons
Unit Assessment

Unit 9: Further organic chemistry

A more in-depth study of some important reactions of the alkenes begins this unit, for those studying GCSE chemistry. The unit then focuses on some of the important chemistry of alcohols, carboxylic acids and polymers, and continues to exemplify how the molecules from crude oil continue to play essential roles in our lives using highly engaging and thoughtful examples. The collaboration between this unit and Units 1 and 3 is significant as this unit brings together, reinforces and further enhances an understanding of several areas of study, particularly those involving structure and bonding. The ability for students to use and apply understanding introduced in one area of chemistry to another, is a key skill that lies at the heart of chemistry and is encouraged in this unit.

FREE LESSON Topic 1 Alkenes
Topic 2 Alcohols and carboxylic acids
Topic 3 Addition polymers
Topic 4 Condensation polymers
Topic 5 Natural polymers and DNA
Unit Assessment

Unit 11: The Earth's resources

This particular unit has genuine impact as it discusses and presents some of the main issues regarding the Earth's scarce resources. A study of the atmosphere in terms of its modern-day composition and also its evolution begins in Topic 1, with many fascinating and highly illustrative examples that will provide students with ample food for thought. Using the Earth's resources is the next study in terms of how we can sustain resources for future generations. Essential resources for life, like potable water is discussed with attention given to the chemical principles involved in its purification. Reducing energy consumption and resource waste by recycling, are key aspects of this interesting area of study, as is the role of life cycle assessments in the determination of a product's impact and life span. The everyday use 'energy-rich' materials, for example, metals, glasses and polymers brings the unit to a highly interesting and thought-provoking conclusion.

FREE LESSON Topic 1 The atmosphere
Topic 2 Greenhouse gases
Topic 3 Atmospheric pollutants
Topic 4 Using the Earth's resources
Topic 5 Life cycle assessment and recycling
Topic 6 Metals and alloys
Topic 7 Glass, ceramics and polymers
Topic 8 The Haber Process
Unit Assessment

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Richard Bunn. Curriculum Leader, Our Lady & St Chad Catholic Sports College Wolverhampton

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