Science

Hub schools network

Summer update

Accompanying materials

Published: Summer 2018

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Presentation slides

Discussion

What areas will you develop

Curriculum review

Information taken from the co teaching document found with the planning resources for each of the specifications
aqa.org.uk/subjects/science/gcse/biology-8461/planning-resources

Biology

Area of specification	Topics
Cell Biology	Cell Structure
	Cell division
	Transport in cells
Organisation	Principles of organisation
	Animal tissue, organs and organ system
	Plant tissue, organs and systems
Infection and response	Communicable diseases
	Monoclonal antibodies (Biol only)
	Plant disease (Biol only)
Bioenergetics	Photosynthesis
	Respiration
Homeostasis and response	Homeostasis
	The human nervous system
	Hormonal coordination in humans
	Plant Hormones (Biol only)
Inheritance, variation and evolution	Reproduction
	Variation and evolution
	The development of understanding of genetics and evolution
	Classification of living organisms
Ecology	Adaptions , interdependence and competition
	Organisation of an ecosystem
	Biodiversity and the effect of human interaction on ecosystems
	Trophic levels in an ecosystem
	Food production

Chemistry

Area of specification	Topics
Atomic structure and the periodic table	A simple model of the atom, symbols, relative atomic mass,electronic charge and isotopes
	The periodic table
	Properties of transition metals (Chem only)
Bonding structure, and the properties of matter	Chemical bonds, ionic, covalent and metallic
	How bonding and structure are related to the properties of substances
	Structure and boding of carbon
	Bulk and surface properties of matter including nanoparticles (Chem only)
Quantitative chemistry	Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations
	Use of amount of substance in relation to masses of pure substances
	Yield and atom economy of chemical reactions
Chemical changes	Reactivity of metals
	Reactions of acids
	Electrolysis
Energy changes	Exothermic and endothermic reactions
	Chemical cells and fuel cells (Chem only)
The rate and extent of chemical change	Rate of reaction
	Reversible reactions and dynamic equilibrium
Organic chemistry	Carbon compounds as fuels and feedstock
	Reactions of alkenes and alcohols (Chem only)
	Synthetic and naturally occurring polymers (Chem only)
Chemical analysis	Purity, formulation and chromatography
	Identification of common gases
	Identification of ions by chemical and spectroscopic means (Chem only)
Chemistry of the atmosphere	The composition and evolution of the Earth's atmosphere
	Carbon dioxide and methane as greenhouse gases
	Common atmospheric pollutants and their sources
Using resources	Using the Earth’s resources and obtaining potable water
	Life cycle assessment and recycling
	Using materials (chem only)
	The Haber process and the use of NPK fertilisers (chem only)

Physics

Area of specification	Topics
Energy	Energy changes in a system, and the ways energy is stored before and after such changes
	Conservation and dissipation of energy
	National and global energy resources
Electricity	Current, potential difference and resistance
	Series and parallel circuits
	Domestic uses and safety
	Energy transfers
	Static electricity (Physics only)
Particle model of matter	Changes of state and the particle model
	Internal energy and energy transfers
	Particle model and pressure
Atomic structure	Atoms and isotopes
	Atoms and nuclear radiation
	Hazards and uses of radioactive emissions and of background (Physics only)
	Nuclear fission and fusion (Physics only)
Forces	Forces and their interactions
	Work done and energy transfer
	Forces and elasticity
	Moments, levers and gears (Physics only)
	Pressure and pressure differences in fluids
	Forces and motion
	Momentum (HT only)
Waves	Waves in air, fluids and solids
	Electromagnetic waves
	Black body radiation
Magnetism and electromagnetism	Permanent and induced magnetism, magnetic forces and fields
	The motor effect
	Induced potential, transformers and the National Grid (Physics only)
Space physics (Physics only)	Solar system; stability of orbital motions; satellites (Physics only)
	Red-shift (Physics only)

Use of practical lessons across the department

Biology

Area of specification	Required Practical
Microscopy	Use a light microscope to observe, draw and label biological specimens.
Osmosis	Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.
Enzymes	Investigate the effect of pH on the rate of reaction of amylase enzyme.
Food tests	Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars, iodine test for starch and Biuret reagent for protein.
Photosynthesis	Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.
Reaction time	Plan and carry out an investigation into the effect of a factor on human reaction time.
Field investigations	Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.
Plant responses (Biol only)	Investigate the effect of light or gravity on the growth of newly germinated seedlings
Decay (Biol only)	Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.

Chemistry

Area of specification	Required Practical
Making salts	Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.
Temperature changes	Investigate the variables that affect temperature change in chemical reactions eg acid plus alkali.
Rates of reaction	Investigate how changes in concentration affect the rates of reactions by both measuring the volume of a gas produced and monitoring a change in colour or turbidity.
Chromatography	Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate R_f values.
Water purification	Analysis and purification of water samples from different sources. To include pH measurement, removal of dissolved solids and distillation.
Electrolysis	Investigate what happens when aqueous solutions are electrolysed using inert electrodes.
Neutralisation	Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration.
Identifying ions	Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from Flame tests and sulphates.

Physics

Area of specification	Required Practical
Specific heat capacity	An investigation to determine the specific heat capacity of one or more materials.
Resistance	Use circuit diagrams to set up and check appropriate circuits to investigate the factors that affect the resistance of an electrical circuit.
I-V characteristics	Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements including a filament lamp, a resistor and a diode at constant temperature.
Density	Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids.
Force and extension	Investigate the relationship between force and extension of a spring.
Acceleration	Investigate • the effect of varying the force on the acceleration of an object of constant mass • the effect of varying the mass of an object on the acceleration produced by a constant force.
Waves	Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves • in a ripple tank • in a solid.
Radiation and absorption	Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.
Thermal insulation	Investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.
Light	Investigate the reflection of light by different types of surface and the refraction of light by different substances.

Working scientifically criteria

Development of scientific thinking

Students should be able to:	Examples of what students could be asked to do in an exam
WS 1.1 Understand how scientific methods and theories develop over time.	Give examples to show how scientific methods and theories have changed over time. Explain, with an example, why new data from experiments or observations led to changes in models or theories. Decide whether or not given data supports a particular theory.
WS 1.2 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.	Recognise/draw/interpret diagrams. Translate from data to a representation with a model. Use models in explanations, or match features of a model to the data from experiments or observations that the model describes or explains. Make predictions or calculate quantities based on the model or show its limitations. Give examples of ways in which a model can be tested by observation or experiment.
WS 1.3 Appreciate the power and limitations of science and consider any ethical issues which may arise.	Explain why data is needed to answer scientific questions, and why it may be uncertain, incomplete or not available. Outline a simple ethical argument about the rights and wrongs of a new technology.
WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.	Describe and explain specified examples of the technological applications of science. Describe and evaluate, with the help of data, methods that can be used to tackle problems caused by human impacts on the environment.
WS 1.5 Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.	Give examples to show that there are hazards associated with science-based technologies which have to be considered alongside the benefits. Suggest reasons why the perception of risk is often very different from the measured risk (eg voluntary vs imposed risks, familiar vs unfamiliar risks, visible vs invisible hazards).

WS 1.6 Recognise the importance of peer review of results and of communicating results to a range of audiences.	Explain that the process of peer review helps to detect false claims and to establish a consensus about which claims should be regarded as valid. Explain that reports of scientific developments in the popular media are not subject to peer review and may be oversimplified, inaccurate or biased.

Experimental skills and strategies

Students should be able to:	Examples of what students could be asked to do in an exam
WS 2.1 Use scientific theories and explanations to develop hypotheses.	Suggest a hypothesis to explain given observations or data.
WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.	Describe a practical procedure for a specified purpose. Explain why a given practical procedure is well designed for its specified purpose. Explain the need to manipulate and control variables. Identify in a given context: • the independent variable as the one that is changed or selected by the investigator • the dependent variable that is measured for each change in the independent variable • control variables and be able to explain why they are kept the same. Apply understanding of apparatus and techniques to suggest a procedure for a specified purpose.
WS 2.3 Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.	Describe/suggest/select the technique, instrument, apparatus or material that should be used for a particular purpose, and explain why.
WS 2.4 Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.	Identify the main hazards in specified practical contexts. Suggest methods of reducing the risk of harm in practical contexts.
WS 2.5 Recognise when to apply a knowledge of sampling techniques to	Suggest and describe an appropriate sampling technique in a given context.

ensure any samples collected are representative.	
WS 2.6 Make and record observations and measurements using a range of apparatus and methods.	Read measurements off a scale in a practical context and record appropriately.
WS 2.7 Evaluate methods and suggest possible improvements and further investigations.	Assess whether sufficient, precise measurements have been taken in an experiment. Evaluate methods with a view to determining whether or not they are valid.

Analysis and evaluation

Apply the cycle of collecting, presenting and analysing data, including:

Students should be able to:	Examples of what students could be asked to do in an exam
WS 3.1 Presenting observations and other data using appropriate methods.	Construct and interpret frequency tables and diagrams, bar charts and histograms. Plot two variables from experimental or other data.
WS 3.2 Translating data from one form to another.	Translate data between graphical and numeric form.
WS 3.3 Carrying out and represent mathematical and statistical analysis.	For example: • use an appropriate number of significant figures • find the arithmetic mean and range of a set of data • construct and interpret frequency tables and diagrams, bar charts and histograms • make order of magnitude calculations • change the subject of an equation • substitute numerical values into algebraic equations using appropriate units for physical quantities • determine the slope and intercept of a linear graph • draw and use the slope of a tangent to a curve as a measure of rate of change • understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate.
WS 3.4 Representing distributions of results and make estimations of uncertainty.	Apply the idea that whenever a measurement is made, there is always some uncertainty about the result obtained. Use the range of a set of measurements about the mean

	as a measure of uncertainty.
WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.	Use data to make predictions. Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. Draw conclusions from given observations.
WS 3.6 Presenting reasoned explanations including relating data to hypotheses.	Comment on the extent to which data is consistent with a given hypothesis. Identify which of two or more hypotheses provides a better explanation of data in a given context.
WS 3.7 Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.	Apply the following ideas to evaluate data to suggest improvements to procedures and techniques. An accurate measurement is one that is close to the true value. Measurements are precise if they cluster closely. Measurements are repeatable when repetition, under the same conditions by the same investigator, gives similar results. Measurements are reproducible if similar results are obtained by different investigators with different equipment. Measurements are affected by random error due to results varying in unpredictable ways; these errors can be reduced by making more measurements and reporting a mean value. Systematic error is due to measurement results differing from the true value by a consistent amount each time. Any anomalous values should be examined to try to identify the cause and, if a product of a poor measurement, ignored.
WS 3.8 Communicating 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.	Present coherent and logically structured responses, using the ideas in 2 Experimental skills and strategies and 3 Analysis and evaluation, applied to the required practicals, and other practical investigations given appropriate information.

Assessments and tracking of progress

The following points apply to all AQA GCSE science specifications that will be awarded in summer 2018.

Levels of demand:

- Foundation papers have 60% of marks targeting low demand and 40% targeting standard demand.
- Higher papers have 40% of marks targeting standard demand and 60% high demand.
- Low demand questions are written to target grades 1–3.
- Standard demand questions target grades 4–5.
- High demand questions target grades 6–9.

Assessment objectives:

- AO1 = 40% of which no more than15% can be knowledge in isolation (direct recall from the specification).
- AO2 = 40%.
- AO3 = 20%.

Practical skills:

- 15% of marks will assess practical skills based on the required practicals.
- Could cover any aspect of an investigation
- Questions may cover any of the assessment objectives.
- If asked about methods/planning any suitable method or plan to achieve the outcome will gain marks.
- Working scientifically will be assessed across all papers. There is no minimum mark for working scientifically.

Maths skills:

- Biology 10% of marks.
- Chemistry 20% of marks.
- Physics 30% of marks.
- Combined Science, 20% of marks in the ratio of 1:2:3.
- Questions will be at all levels of demand.

Extended response:

- No QWC marks but there will be questions that require students to write an extended response
- Minimum marks Foundation 10% of marks Higher 15% of marks

Updates

Useful resources for new AQA teachers

Resource	Description	Location
Co teaching combined science and Biology (Chemistry and Physics)	List common topics on combined specs and each separate science. Show extra content within these topic which are separate only and any whole topics which are separate only	Plan
Command word document	Lists our command words and an explanation of what the words and phrases mean. Command words tell students how they should answer a question.	Teach
Subject specific vocabulary	Definitions of what working scientifically terms mean	Teach
Maths powerpoints	Slides to incorporate into lessons to support the teaching of the maths skills	Teach/Maths skills in GCSE
Sample questions: maths in science	Selection of questions taken from the 1st set of SAM which illustrate how the range of maths skills might be assessed at different levels of demand	Teach/Maths skills in GCSE
Practical handbooks	Teacher and technician notes and student worksheets covering suggested methods for each of the required practicals	Teach/Practicals
Practical work and learning outcomes	This summary shows possible aims and learning outcomes which teachers could use for each of the RPAs	Hub school page Spring 2017
Teaching guide: effective use of practicals	Series of slides summarising all our information about practical requirements and a suggested teaching approach to make the most out of practical lessons	Teach/Practicals
How practical skills are assessed	Selection of questions taken from the 1st set of SAM which illustrate how practical skills may be assessed for each of the AOs	Teach/Practicals
Steps to success	Link to various teaching resources to help support literacy, working scientifically, revision and exam techniques	Teach

Teaching guide: sample AO2 questions and mark schemes	A simple explanation of what AO2 is and the type of questions that cover AO2. There are some suggestions on how teachers might approach integrating it into lessons	Teach
Our exams explained	Booklet covering the different types of questions used in our papers	Assess
Making questions clear	Booklet covering how we make our assessments accessible to students and how we develop questions during the question paper process	Assess
1st set of sample assessments and mark schemes	Exemplar papers and mark scheme to support teachers and students become familiar with the new question types	Assess
Extended response questions and sample responses	Explanation of how to extended response questions will be marked using a levelled response mark scheme. The generic level descriptors along with some student responses and the examiners commentaries regarding why a particular grade was awarded	Hub school page Spring 2018
Sample of high demand questions	Selection of questions taken from the 1st set of SAM which are aimed at grades 8 – 9	Hub school page Spring 2017

AQA research projects

As an educational charity, AQA invests any profit that is generated into research to support and develop assessment practice. During the course of the coming year, we will be setting up a range of research projects in science; most of these projects will run for a number of years with the findings shared through published reports. The exact questions to be explored are still being defined, but they will sit within the following broadly defined topics:

- Outcomes of A-level Physics options
- A-level practical skill assessment through CPAC and examination items
- Factors impacting upon distribution of A-level Unclassified grades compared to CPAC pass
- Impact of CPAC pass on skill base of HE students
- Effect of teaching time on performance of students on different GCSE pathways
- Exploration of progression from GCSE subject to A-level subject for matched students
- Legacy practicals and ISA compared to reform Required Practicals; combined pathway vs separates
- Subject teaching at GCSE – specialist vs non-specialist teachers?

There will be opportunities for teachers to support and participate in action research projects within these areas. More details will follow shortly, but if you would like to express interest in supporting this aspect of our work, please put this on your evaluation form or contact us by email.

MERiT data summary: second set of sample assessments

Separate sciences

Spec and Paper	Number of Students	Raw Mark	Total	Mean	Difference between P1 and Paper 2
Biology Foundation 1	1528	34	100	34	
Biology Foundation 2	1158	38	100	38	4
Biology Higher 1	17734	40	100	40	
Biology Higher 2	7976	42	100	42	2
Chemistry Foundation 1	1582	35	100	35	
Chemistry Foundation 2	1163	40	100	40	5
Chemistry Higher 1	17132	36	100	36	
Chemistry Higher 2	8220	47	100	47	11
Physics Foundation 1	1598	32	100	32	
Physics Foundation 2	1081	33	100	33	1
Physics Higher 1	16980	38	100	38	
Physics Higher 2	7721	32	100	32	**-6**

Combined science Trilogy

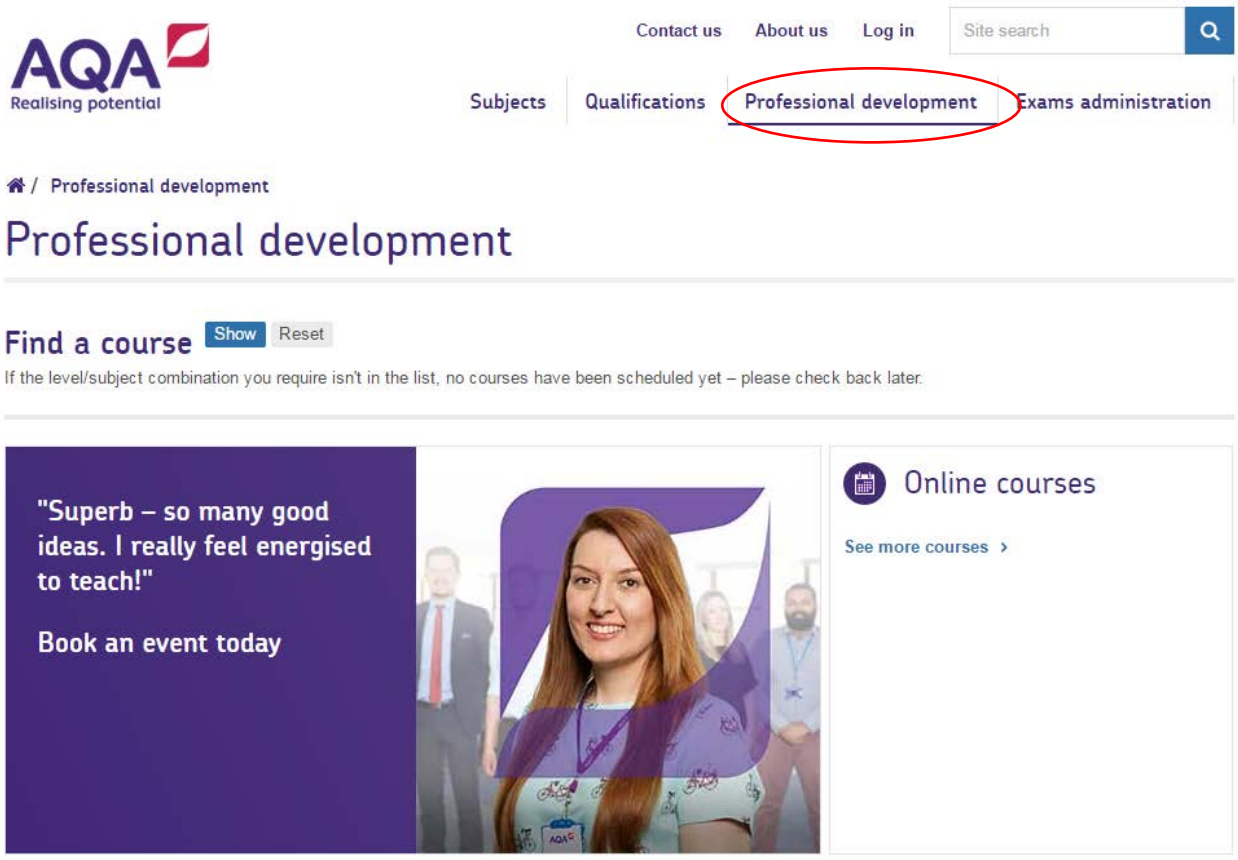
Spec and Paper	Students	Mark	Total	Mean %	Difference between P1 and Paper 2
Biology Foundation 1	24667	20	70	29	
Biology Foundation 2	13978	29	70	41	12
Chemistry Foundation 1	23909	17	70	24	
Chemistry Foundation 2	14185	21	70	30	6
Physics Foundation 1	23254	23	70	33	
Physics Foundation 2	13421	20	70	29	**-4**
Biology Higher 1	25076	19	70	27	
Biology Higher 2	11777	26	70	37	10
Chemistry Higher 1	24489	15	70	21	
Chemistry Higher 2	12170	22	70	31	10
Physics Higher 1	23861	19	70	27	
Physics Higher 2	11753	16	70	23	-4

Customer portal guide

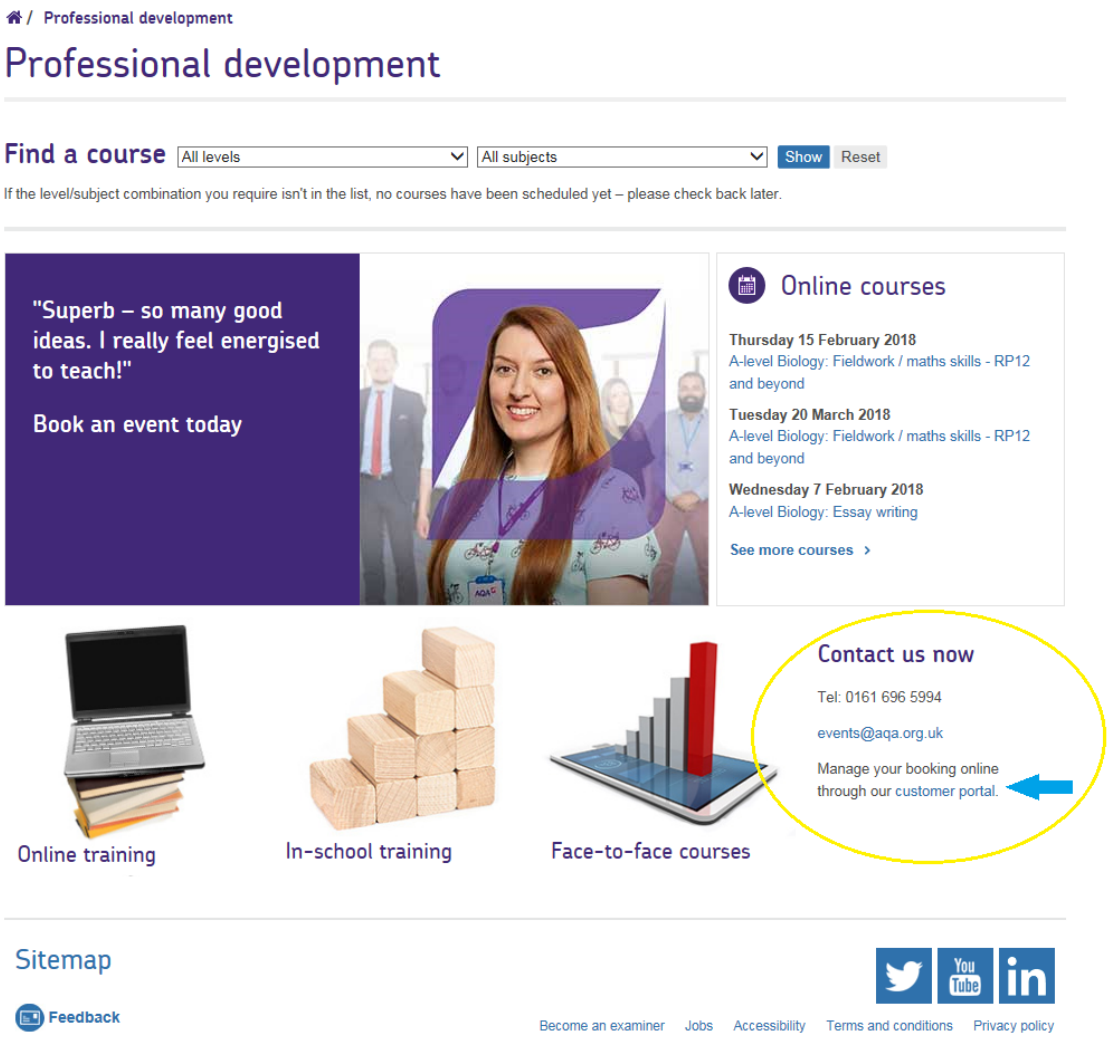
How to access your course material

You're now able to access and download electronic copies of the material shown at the events you attend from your Customer Portal on the AQA website.

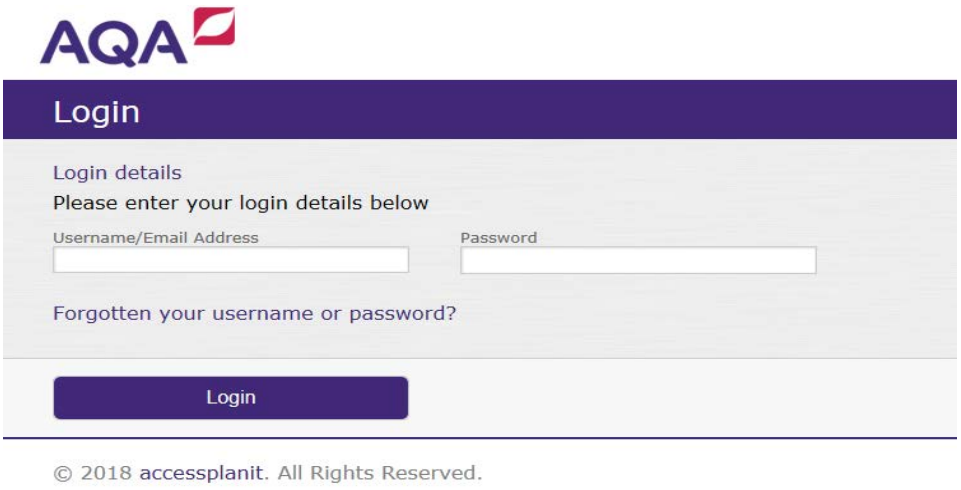
On aqa.org.uk, you'll need to select 'Professional development' from the top bar which will take you to the Professional development page.



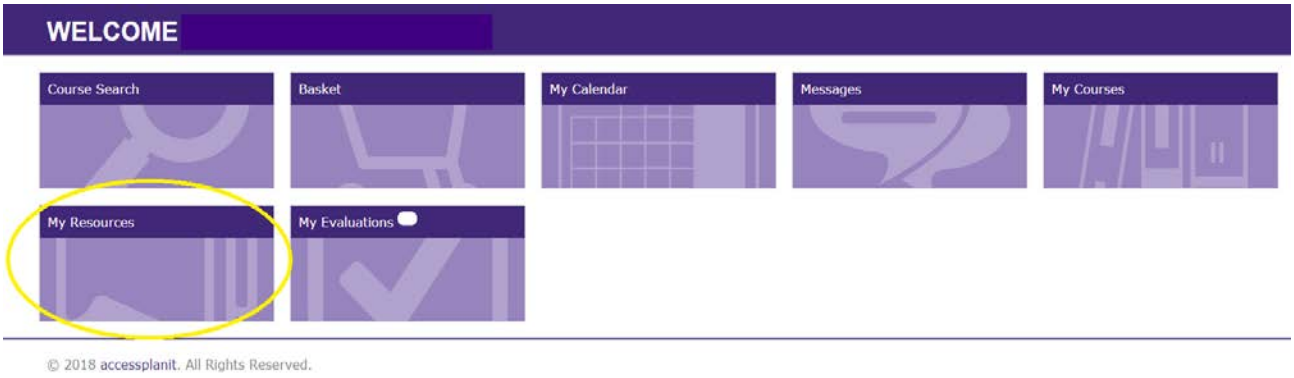
Under **Contact us** click on **Customer Portal**



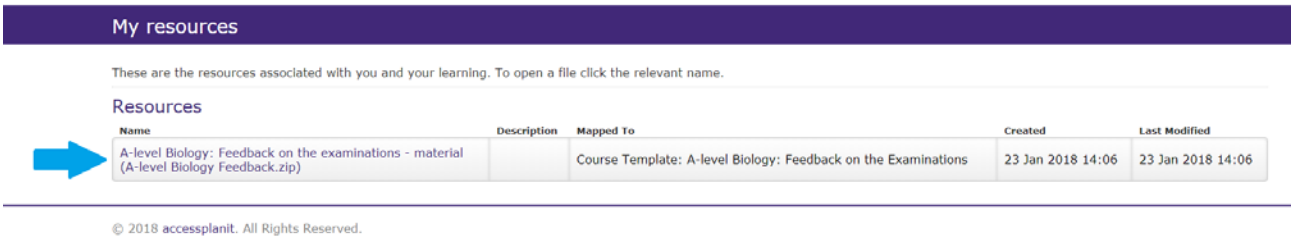
In the **Login** page, enter your email address and password used for booking your course



Once you're on your **Portal**, click on **My Resources**



You'll then be able to see a list of resources. Click on the one that has the title of the event you attended and you'll be able to download and open the zip File



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