A LEVEL
Geology

Qualification Accredited

Oxford Cambridge and RSA

AS LEVEL
Specification

GEOLOGY

H014
For first assessment in 2018

Version 3 (March 2018)

ocr.org.uk/aslevelgeology

Registered office:
1 Hills Road
Cambridge
CB1 2EU

OCR is an exempt charity.

Disclaimer

Specifications are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published resources and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk

We will inform centres about changes to specifications. We will also publish changes on our website. The latest version of our specifications will always be those on our website (ocr.org.uk) and these may differ from printed versions.

Contents

1 Why choose an OCR AS Level in Geology?

1a. Why choose an OCR qualification?

Choose OCR and you've got the reassurance that you're working with one of the UK's leading exam boards. Our new AS Level in Geology course has been developed in consultation with teachers, employers and Higher Education to provide learners with a qualification that's relevant to them and meets their needs.

We're part of the Cambridge Assessment Group, Europe's largest assessment agency and a department of the University of Cambridge. Cambridge Assessment plays a leading role in developing and delivering assessments throughout the world, operating in over 150 countries.

We work with a range of education providers, including schools, colleges, workplaces and other institutions in both the public and private sectors. Over 13,000 centres choose our A Levels, GCSEs and vocational qualifications including Cambridge Nationals and Cambridge Technicals.

Our Specifications

We believe in developing specifications that help you bring the subject to life and inspire your learners to achieve more.

We've created teacher-friendly specifications based on extensive research and engagement with the teaching community. They're designed to be straightforward and accessible so that you can tailor the delivery of the course to suit your needs. We aim to encourage students to become responsible for their own learning, confident in discussing ideas, innovative and engaged.

We provide a range of support services designed to help you at every stage, from preparation through to the delivery of our specifications. This includes:

- A wide range of high-quality creative resources including:
  - Delivery Guides
  - Transition Guides
  - Topic Exploration Packs
  - Lesson Elements
  - …and much more.
- Access to Subject Advisors to support you through the transition and throughout the lifetime of the specification.
- CPD/Training for teachers to introduce the qualification and prepare you for first teaching.
- Active Results – our free results analysis service to help you review the performance of individual learners or whole schools.

All AS level qualifications offered by OCR are accredited by Ofqual, the Regulator for qualifications offered in England. The accreditation number for OCR's AS Level in Geology is QN 603/0783/3.

1b. Why choose an OCR AS Level in Geology?

The OCR AS Level Geology allows learners to first assimilate a toolkit of geological skills and concepts, before developing their understanding through study of geological principles. The specification allows flexibility in the teaching approach. Teaching of practical skills is integrated with the theoretical topics, and these skills are assessed through written papers.

All of our specifications have been developed with subject and teaching experts. We have worked in close consultation with teachers and representatives from Higher Education (HE) with the aim of including up-to-date relevant content within a framework that is interesting to teach and administer within all centres (large and small).

Our new AS Level in Geology qualification builds on our existing course and offers familiarity to existing centres but is also clear and logically laid out for centres new to OCR, with an assessment model that is straightforward to administer.

The re-development of our AS Level Geology qualification has been aligned with the popular OCR AS Level science suite B [Biology B (Advancing Biology), Chemistry B (Salters) and Physics B (Advancing Physics)]. It is based on an understanding of what works well in centres large and small. Areas of content have been updated where stakeholders have identified that improvements could be made. We have undertaken a significant amount of consultation through our science forums (which include representatives from learned societies, HE, teaching and industry) and through focus groups with teachers.

We have worked closely with teachers and HE representatives to provide high quality support materials to guide you through the new qualifications.

Aims and learning outcomes

OCR's AS Level in Geology will encourage learners to:

- develop essential knowledge and understanding of different areas of geology and how they relate to each other, to include civil engineering, engineering geology, hydrogeology, mining geology and petroleum geology
- develop through critical practice the skills, knowledge and understanding of scientific methods as applied in geology through practical work, including fieldwork
- develop competence and confidence in selecting, using and evaluating a range of quantitative and qualitative skills and approaches, (including observing, collecting and analysing geo-located field data, and investigative, mathematical and problem solving skills) and applying them as an integral part of their geological studies
- understand how society makes decisions about geological issues and how geology contributes to the success of the economy and society.

1c. What are the key features of this specification?

The OCR AS Level in Geology has been designed to inspire your learners, develop their interest in and enthusiasm for the subject and uses an engaging, flexible approach.

The specification:

- places a particular emphasis on the development of practical skills and geological literacy
- is laid out clearly in a series of teaching modules with Additional guidance added where required to clarify assessment requirements
- is structured to allow ideas to be introduced within relevant and contemporary settings that help learners anchor their conceptual knowledge of the range of topics required at AS Level
- is co-teachable with the A Level
- embeds practical requirements within the teaching modules. Whilst the Practical Endorsement is not part of AS Level in Geology, opportunities for carrying out activities that would count towards the A Level Practical Endorsement are indicated throughout the specification, in the Additional guidance column, by use of **PAG**. Refer to the A Level specification, Section 5g, for Practical Endorsement requirements.
- exemplifies the mathematical requirements of the course (see Section 5e)
- highlights opportunities for the introduction of key mathematical requirements (see Section 5e and the Additional guidance column for each module) into your teaching
- identifies, within the Additional guidance, how the skills, knowledge and understanding of How Science Works (HSW) can be incorporated within teaching.

Teacher support

The extensive support offered alongside this specification includes:

- **delivery guides –** providing information on assessed content, the associated conceptual development and contextual approaches to delivery
- **transition guides –** identifying the levels of demand and progression for different key stages for a particular topic and going on to provide links to high quality resources and ‘checkpoint tasks’ to assist teachers in identifying learners ‘ready for progression’
- **lesson elements –** written by experts, providing all the materials necessary to deliver creative classroom activities
- **Active Results** (see Section 1a)

Along with:

- Subject Advisors within the OCR science team to help with course queries
- teacher training
- *Science Spotlight* (our termly newsletter)
- OCR Science community, http://social.ocr.org.uk
- Practical Skills Handbook
- Maths Skills Handbook.

1d. What is new in OCR AS Level in Geology?

This section is intended for teachers currently delivering OCR AS Level in Geology. It highlights the differences between the AS Level in Geology (H087) and the AS Level in Geology (H014) for first teaching from September 2017:

What stays the same?	What's changing?
• Assessment is at the end of the course • Content is half the A Level Geology and remains co-teachable with the A Level • Assumes no previous experience of geology and develops concepts and ideas from GCSE (9–1) Science in the context of Earth science • Concept-led approach is familiar although updated and streamlined • Key topic areas have stayed the same (global tectonics, and igneous sedimentary and metamorphic rocks and processes) • Breadth of mathematical coverage.	• The assessment consists of a single exam of 2 hours 30 minutes • Course redesigned to give learners a toolkit of geological skills which are developed in familiar content • Reintroduced mineralogy and geochemistry, with advanced petrology concepts moved to A Level only • Fieldwork requirement (two days) and indirect assessment of practical skills in examination (15% weighting) • Assessment styles are consistent across all the OCR GCE Science Suite • 10% Level 2 maths weighting.

1e. How do I find out more information?

If you are already using OCR specifications you can contact us at: www.ocr.org.uk

If you are not already a registered OCR centre then you can find out more information on the benefits of becoming one at: www.ocr.org.uk

If you are not yet an approved centre and would like to become one go to: www.ocr.org.uk

Find out more?

Contact the Subject Advisors: ScienceGCE@ocr.org.uk, 01223 553998

Join our Science community: http://social.ocr.org.uk/

Check what CPD events are available: www.cpdhub.ocr.org.uk

Follow us on Twitter: @ocr_science

2 The specification overview

2a. OCR's AS Level in Geology (H014)

Learners take the component 01 to be awarded the OCR AS Level in Geology.

Content Overview	Assessment Overview	
Content is split into four teaching modules: • Module 1 – Development of practical skills in geology • Module 2 – Foundations in geology • Module 3 – Global tectonics • Module 4 – Interpreting the past Component 01 assesses content from all four modules.	Geology* (01) 120 Marks 2 hour 30 minutes written paper	**100%** of total AS level

* Indicates inclusion of synoptic assessment. See Section 3f.

2b. Content of AS Level in Geology (H014)

The AS Level in Geology specification content is divided into four teaching modules and each module is further divided into key topics.

Each module is introduced with a summary which contextualises the geology it contains and each topic is also introduced with a short summary text. These do not form part of the assessable content. It is expected that contexts are used in teaching to relate the subject to real-world geological experience. Learners will be expected to be able to apply their understanding of Geology to both familiar and unfamiliar contexts in the assessments.

The assessable content is divided into two columns: Learning outcomes and Additional guidance.

The Learning outcomes may all be assessed in the examinations. The Additional guidance column is included to provide further advice on delivery and the expected skills required from learners.

References to How Science Works (HSW, Section 5d) are included in the guidance to highlight opportunities to encourage a wider understanding of science.

The mathematical skills requirements (Section 5e), are referenced by the prefix M to link the mathematical skills required for AS Level Geology to examples of geology content where those mathematical skills could be linked to learning.

References to HSW statements and mathematical skills are indicative of where these skills could be developed, and are not intended to be either prescriptive or exhaustive. Where learning outcomes comprise several sub-statements, references relevant to any of the sub-statements have been grouped.

The specification has been designed to be co-teachable with the A Level in Geology qualification. Learners studying the A Level in Geology study modules 1 to 4 and then continue with the A Level only modules 5 to 7. The internally assessed Practical Endorsement skills also form part of the full A Level (see Section 1.2 in the A Level specification).

A summary of the content for the AS Level course is as follows:

Module 1 – Development of practical skills in geology

- Practical skills assessed in a written examination
- Practical skills developed through fieldwork and assessed in a written examination

Module 2 – Foundations in geology

- Minerals and rocks
- Fossils and time

Module 3 – Global tectonics

- Earth structure
- Plate tectonics
- Geological structures

Module 4 – Interpreting the past

- Sedimentary environments in time
- Geochronology

Assessment of practical skills

Module 1 of the specification content relates to the practical skills learners are expected to gain throughout the course, which are assessed throughout the written examination. In the written examination, a minimum of 15% of the total marks for the qualification will assess knowledge and understanding in relation to practical skills.

Practical activities are embedded within the learning outcomes of the course to encourage practical activities in the classroom which enhance learners' understanding of geological theory and practical skills.

Fieldwork skills

Fieldwork skills are fundamental to the study, practice and discipline of geology. They are integrated into all aspects of the subject. Learning these skills in the context of the content detailed in Section 2c will stimulate learners to 'think geologically'. It will also provide them with opportunities to apply the skills in a wide range of curriculum or learning contexts.

Conducting fieldwork as part of a varied learning programme allows learners to achieve skills such as the ability to visualise and extrapolate data in three dimensions, and to understand the application of practical methodologies.

Within the AS Level Geology course, learners are required to undertake a **minimum of two days** of fieldwork (see Section 4a). Specific fieldwork skills that learners must undertake and that have been identified for indirect assessment are detailed in Section 1.3.

2c. Content of modules 1 to 4

Module 1: Development of practical skills in geology

The development of practical skills is a fundamental and integral aspect of the study of any scientific subject and a common approach has been adopted across the OCR science suite (Biology, Chemistry, Geology and Physics). These skills not only enhance learners' understanding of the subject but also serve as a suitable preparation for the demands of studying geology at a higher level.

Geology gives learners many opportunities to develop the fundamental skills needed to collect and analyse empirical data. Skills in planning, implementing, analysing and evaluating (as outlined in 1.1) and fieldwork skills (as outlined in 1.3), will be assessed in the written examination.

1.1 Practical skills assessed in a written examination

The practical skills detailed in module 1 are embedded throughout modules 2 to 4 of this specification.

Learners will be required to develop a range of practical skills throughout their course. The practical skills assessed in the written examination will be assessed in contexts both familiar and unfamiliar to the learners.

1.1.1 Planning

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	experimental design, including to solve problems set in a practical context	Including selection of suitable apparatus, equipment and techniques for the proposed experiment. Learners should be able to apply scientific knowledge based on the content of the specification to the practical context. HSW3
(b)	identification of variables that must be controlled, where appropriate	
(c)	evaluation that an experimental method is appropriate to meet the expected outcomes.	HSW6

2

1.1.2 Implementing

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	how to use a wide range of practical apparatus and techniques correctly	HSW4
(b)	appropriate units for measurements	*M1.1*
(c)	presenting observations and data in an appropriate format.	*M1.1* HSW8

1.1.3 Analysis

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	processing, analysing and interpreting qualitative and quantitative experimental results	Including reaching valid conclusions, where appropriate. HSW5
(b)	use of appropriate mathematical skills for analysis of quantitative data	Refer to Section 5e for a list of mathematical skills that learners should have acquired competence in as part of their course. HSW3
(c)	appropriate use of significant figures	*M1.3*
(d)	plotting and interpreting suitable graphs from experimental results, including: **(i)** selection and labelling of axes with appropriate scales, quantities and units **(ii)** measurement of gradients and intercepts.	*M2.9, M2.10, M3.7, M3.8, M3.10*

1.1.4 Evaluation

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	how to evaluate results and draw conclusions	HSW6
(b)	the identification of anomalies in experimental measurements	
(c)	the limitations in experimental procedures	
(d)	precision and accuracy of measurements and data, including margins of error, percentage errors and uncertainties in apparatus	
(e)	the refining of experimental design by suggestion of improvements to the procedures and apparatus.	HSW3

1.2 is included in the OCR A Level Geology specification only

1.3 Practical skills developed through fieldwork and assessed in a written examination

Development of fieldwork skills is a vital part of a learner's development as part of this course. Relevant contexts for the development of fieldwork skills are included throughout all modules of the specification.

A minimum of two days of fieldwork conducted throughout the course will allow learners to undertake the following techniques (see Section 4a).

Learners should conduct their fieldwork responsibly, showing awareness for their own safety and of their impact on the environment.

As part of the AS Level Geology course, learners are required to:

- undertake fieldwork in different contexts: virtual fieldwork, local fieldwork outside the classroom and fieldwork on unfamiliar outcrop geology
- apply knowledge and concepts to identify and understand field observations.

1.3.1 Practical skills developed through fieldwork

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the measurement and description of the diagnostic properties of rocks in the field	To include: colour, composition, grain/crystal size and grain/crystal shape and sorting/ igneous texture/metamorphic fabric. *M1.1, M2.1, M2.2, M2.6, M2.8, M4.2* HSW4,10
(b)	the collection of valid data in the field relating to the igneous, metamorphic or sedimentary processes that formed the rocks	To include: random, stratified and systematic sampling techniques and sampling validity. *M2.5* HSW4,10
(c)	the measurement and description of rock deformation in the field	To include sampling validity. *M1.1, M2.4, M2.5, M4.2* HSW4,10
(d)	the use of geochronological principles in the field to place geological events in relative time sequences.	HSW4,10

Module 2: Foundations in geology

Like all sciences, Earth science is a broad discipline and geologists commonly work in multidisciplinary teams. Modules 2, 3 and 4 will be familiar to all geologists.

Taking a major oil development as an example of a multidisciplinary team: geologists explore for the oil (petroleum geology), use fossils to date the rocks (palaeontology), determine the ground conditions for construction (engineering geology), design the structures needed to recover the oil (civil engineering), find the bulk minerals needed for the project (mining geology) and use water to maximise hydrocarbon recovery (hydrogeology).

This section provides knowledge and understanding of minerals, rocks, fossils and the geological timescale. It builds on learners' knowledge of Earth science and places this within a scientific framework.

Learners will have knowledge of the geological phenomena from place-based study in geography, and relevant scientific principles from GCSE (9–1) Science.

This section aims to provide learners with a basic geological toolkit grounded in their hands-on experience of rocks and fossils (2.1 Minerals and rocks, 2.2 Fossils and time).

Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.

2.1 Minerals and rocks

'The best geologist is the one who has seen the most rocks.' – Prof H. H. Read

Minerals are the basic components of geology; all rocks contain one or more minerals. The understanding of minerals builds on learners' existing knowledge of chemistry and physics.

Knowledge of igneous, sedimentary and metamorphic rocks, based on the handling and description of rock samples, prepares learners for the study of modules 3 to 7 (5 to 7 are A Level only).

2.1.1 Minerals

The chemical composition and crystalline structure of rock-forming minerals determine their diagnostic characteristics and behaviour.

2

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	minerals as naturally occurring elements and inorganic compounds whose composition can be expressed as a chemical formula	To include: native sulfur and copper, calcite, quartz, pyrite and galena. Learners are **not** expected to recall the chemical formula of other minerals.
(b)	rock-forming silicate minerals as crystalline materials built up from silicon–oxygen tetrahedra to form frameworks, sheets or chains and which may have a range of compositions (qualitative only)	To include: • silicon tetrahedra (olivine, garnet) • chains (pyroxene) • sheets (micas and clays) • frameworks (quartz, feldspar).
(c)	**(i)** the diagnostic physical properties of rock-forming minerals in hand specimens	To include: colour, lustre, shape, streak, cleavage/fracture, density, hardness, reaction with acid.
	(ii) the classification of samples, photographs and thin section diagrams of minerals using their diagnostic physical properties	To include the application of the diagnostic properties of the major rock-forming minerals.
	(iii) practical investigations to determine the density and hardness of mineral samples	To include: • Mohs hardness test • density test.
	(iv) the techniques and procedures used to measure mass, length and volume	*M1.1, M1.3, M1.4, M1.5, M1.6, M2.1, M3.2* **PAG1** HSW4,5,8
(d)	rocks as mixtures of one or more minerals that are classified as igneous, sedimentary or metamorphic using their relationship to temperatures and pressures in the rock cycle.	

2.1.2 Igneous rocks

Igneous rocks are the product of the cooling and solidification of magma or of lava.

Most igneous rocks can be classified based on their directly observable characteristics.

		Learning outcomes	Additional guidance
		Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	**(i)**	the classification of igneous rocks on the basis of their composition (silicic, intermediate, mafic and ultramafic) and crystal grain size (coarse-crystals >5 mm diameter; medium-crystals 1–5 mm diameter; fine-crystals <1 mm diameter)	To include: granite, microgranite, rhyolite; diorite, microdiorite, andesite; gabbro, dolerite, basalt and peridotite. *M1.2, M1.4, M1.5, M3.2*
	(ii)	the diagnostic properties of rocks to identify igneous rocks in samples, photographs and thin section diagrams	**PAG1** HSW8
(b)	**(i)**	igneous textures, crystal size and crystal shape as evidence for depth of formation and rate of cooling of igneous rocks	To include: volcanic and plutonic igneous rocks and obsidian.
	(ii)	the diagnostic properties of igneous textures and crystal shape in samples, photographs and thin section diagrams	To include: equicrystalline, glassy, vesicular, amygdaloidal, flow banding and porphyritic.
	(iii)	the representation using drawings and annotated diagrams of igneous textures and crystal shape in samples	*M1.4, M1.5, M3.2, M4.2* **PAG3**
	(iv)	the techniques and procedures used to measure temperature.	HSW1,8

2.1.3 Sedimentary rocks

Sedimentary rocks are the product of physical, biological or chemical deposition.

Sedimentary rocks can be classified based on their directly observable characteristics.

2

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	weathering and erosion, the mechanical, chemical and biological processes that produce the sediments that form sedimentary rocks	To include the formation of: • clastic material • clays • evaporites (gypsum, halite) • carbonate sediment. Learners should be able to recognise the mineral in a given chemical reaction but not recall the specific formula of individual minerals. HSW1
(b)	**(i)** the effect of the process of erosion on the characteristics and composition of modern sediments **(ii)** sieve analysis of sediments	To include: transport processes, Hjulström curve, length of transport and the concept of maturity. *M1.2, M2.1, M2.5, M2.6, M2.8* **PAG4** HSW1
(c)	the diagnostic properties of rocks to recognise and measure grain sizes in samples, photographs and thin section diagrams	To include the phi scale (qualitative only). Recall of Folk & Ward formulae is **not** required. *M1.4, M1.5, M2.2, M2.5, M2.6, M2.8, M3.2* **PAG1**
(d)	**(i)** the classification of siliciclastic rocks on the basis of their diagnostic properties (colour, composition, grain size and grain shape, sorting)	To include: orthoquartzite, arkose, greywacke.
	(ii) the classification of carbonate rocks on the basis of their diagnostic properties (grain size, cement, mineral composition and fossil content, and sorting)	To include the Dunham scheme (mudstone, wackestone, packstone, grainstone).
	(iii) the diagnostic properties of rocks to identify siliciclastic and carbonate rocks in samples, photographs and thin section diagrams	**PAG1**

	Learning outcomes	Additional guidance
(e)	the processes of diagenesis and lithification: **(i)** mechanical compaction **(ii)** chemical compaction by pressure dissolution and recrystallisation **(iii)** growth of cements **(iv)** how these changes in rock texture modify the porosity and permeability of rocks.	To include the effects of diagenesis on siliciclastic and carbonate grains, organic material and mud. To include: silica, calcite, hematite and clay minerals. Learners should be able to recognise the mineral in a given chemical reaction but not recall the specific formula of individual minerals. **PAG4** HSW1

2.1.4 Metamorphic rocks

Metamorphic rocks are the product of the readjustment of a sedimentary or igneous parent rock to different conditions of temperature and/or pressure.

The shale to gneiss series is used to illustrate the general principles of metamorphism.

Metamorphic rocks can be classified based on their directly observable characteristics.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	metamorphism as a solid state isochemical process that changes the characteristics of rock	To include: contact, dynamic and regional.
(b)	how the mineralogy and fabric of metamorphic rocks can be used to infer the composition of the parent rock	To include the formation of: • metaquartzite and marble • slate, phyllite, schist and gneiss from fine grained rocks. **PAG1** HSW1
(c)	how as the intensity of metamorphism changes different minerals form which can be used to reconstruct the conditions of metamorphism.	To include: metamorphic grade, index minerals. **PAG1** HSW1,2,8

2.2 Fossils and time

Fossils provide information about the interaction of organisms with the environment and an evolutionary record from which the geological timescale was developed. By combining biostratigraphy with numerical ages from radiometric dating of igneous rocks the geological timescale allows geologists to reconstruct regional and global palaeoenvironments.

2.2.1 Fossils

This section introduces learners to fossils and the application of fossil data. These concepts will be further developed and applied in modules 4 and 7 (module 7 is A Level only).

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	fossils as the preserved remains of living organisms or the traces of those organisms	To include the preservation of body fossils by replacement and the formation of trace fossils (burrows, tracks and trails). **PAG5**
(b)	the nature and the reliability of the fossil record and the morphological definition of species	To include taphonomic processes which produce life and death assemblages, preservation potential. *M2.5, M2.6, M2.10* HSW5,6,9,12
(c)	the use and interpretation of fossils as palaeoenvironmental indicators:	
	(i) trace fossils to provide information on the behaviour of the organism that formed them and the palaeoenvironment	To include: dwelling, protection and feeding structures and qualitative interpretation of locomotion.
	(ii) body fossils to provide information on the behaviour of the fossilised organism and the palaeoenvironment.	To include: skeleton thickness, robustness, ornament, sensory organs and geopetal structures within fossils. **PAG5** HSW1,5,9

2.2.2 Geological time

This section introduces the geological column and the principles used to construct it.

These concepts will be further developed and applied in module 7 (A Level only).

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	**(i)** the use of radioactive decay rates of the radionuclides in minerals to give a numerical age of those minerals and rocks **(ii)** the plotting and interpretation of half-life curves	To include: qualitative historical consideration of other numerical dating methods for the age of the Earth, appropriate minerals, and the dating of sedimentary and metamorphic rocks. *M1.1, M2.5, M2.9* HSW7,8,9,11
(b)	the geochronological division of the geological column for the Phanerozoic into eras and periods using a biostratigraphic relative time sequence.	To include basic identification of main invertebrate groups (trilobites, corals, brachiopods, bivalves, cephalopods) and an outline of the Palaeozoic, Mesozoic and Cenozoic faunas. Learners are **not** required to memorise dates. **PAG5**

Module 3: Global tectonics

When viewed on a geological timescale the Earth is the most dynamic of the terrestrial planets.

This section provides knowledge and understanding of the Earth, its structure and its place within the solar system. It builds on learners' knowledge of Earth science and places this within a scientific framework.

Learners will have knowledge of the geological phenomena from place-based study in geography, and relevant scientific principles from GCSE (9–1) Science.

This module aims to integrate learners' existing knowledge and extend their understanding of the interior of the Earth. It provides learners with the basis for understanding the tectonic environments in which rocks are formed and geological structures develop (3.1 Earth structure, 3.2 Plate tectonics and 3.3 Geological structures).

Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.

3.1 Earth structure

Our understanding of the layered structure of the Earth has developed rapidly since the 1960s and benefited from Cold War military research. More recently, insight from planetary science and oil exploration technology have allowed geologists to refine their understanding. This is still an area of active research and many questions remain to be answered.

In presenting the geochemical and geophysical understanding of the structure of the Earth in separate subsections we aim to avoid the common misconception that assumes the crust and the lithosphere are synonymous and that the Moho discontinuity is the base of the lithosphere.

3.1.1 The physical structure of the Earth

This section looks at the geophysical structure of the Earth. Learners will be familiar with ideas of the properties of matter, waves, gravity and magnetism from GCSE (9–1) Physics and Chemistry.

These concepts will be further developed and applied in module 5 (A Level only).

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the layered structures of the Earth as defined by the rheological properties of the layers	To include how each layer deforms in response to an applied force.
(b)	how the variation in P and S wave velocities provides indirect evidence to identify layers within the Earth and how their paths through the Earth produces the P and S wave shadow zones	To include how the state and depth of the inner and outer core of the Earth can be determined. HSW3,5
(c)	the lithosphere as a rigid, brittle layer made of the crust and part of the upper mantle, which is divided into plates	
(d)	how evidence from gravity anomalies and isostasy provides indirect evidence to determine the behaviour of the lithosphere and asthenosphere	To include: gravity anomalies (free air and Bouguer), isostatic equilibrium and isostatic rebound. HSW1,2,3,5,7
(e)	how indirect evidence from electromagnetic (EM) surveys may be used to identify the lithosphere and asthenosphere at mid-ocean ridges	To include the relationship between conductivity and partial melting. HSW1,2,3,7
(f)	the nature of the asthenosphere as a rheid, plastic layer with 1–5% partial melting	To include the role of the asthenosphere in plate tectonics.
(g)	how the density of the whole Earth and the rocks at the surface provide indirect evidence to infer the density of the core and mantle rocks	
(h)	the probable geodynamo origin of the Earth's magnetic field which provides indirect evidence for the subdivision of the core.	To include convection in a rotating conducting fluid. HSW1,2,7

3.1.2 The origin of the Earth's structure

This section introduces the geochemistry and origin of the structure of the Earth. Learners will be familiar with ideas of energy transfer and states of substance from GCSE (9–1) Physics and Chemistry.

It is also an opportunity for learners to study both renewable geological resources (such as geothermal energy) and finite mineral resources and the need to manage these resources for long term sustainability.

The Goldschmidt classification of elements provides a framework for understanding the geochemical behaviour of elements which will be developed in module 5 (A Level only).

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the bulk composition of the Earth and how it is inferred from the composition of meteorites (chondrites) and the Sun	To include the use of normalised diagrams displaying element concentrations (qualitative only).
(b)	a qualitative explanation of the nebular hypothesis for the formation of the solar system and the Earth	To include the evidence for protoplanetary discs, and impact craters on the Earth and other bodies in the solar system. **PAG12** HSW1
(c)	the transfer of geothermal energy from: **(i)** heat of formation by the Earth **(ii)** radioactive decay within the Earth	To include: • transfer of thermal energy from differentiation (potential energy) • formation of the solid core (specific latent heat) • early bombardment (kinetic energy) • the radioactive decay of K, U and Th.
(d)	the Goldschmidt classification of elements into four groups and a qualitative understanding of the preferred formation of states of substances (oxides and sulfides)	Lithophile, siderophile, chalcophile, atmophile. Learners are **not** required to study enthalpy changes or free energy.
(e)	the differentiation of the Earth into layers of distinct composition and density by the partitioning of each of the Goldschmit groups between the crust, mantle, core, and atmosphere and hydrosphere	To include: evidence for meteorites as a possible source of rare siderophiles in the crust, crustal abundance and concentration factor. *M1.1, M1.4, M1.6, M3.2*
(f)	the geochemical layered structure of the Earth as defined by the mineral composition of the layers and how the composition of these layers is inferred from direct evidence.	To include evidence from rocks and seismology: deep mines and boreholes, ophiolites, kimberlite pipes, mantle xenoliths, and the Lehmann, Gutenberg and Moho discontinuities. HSW5

3.2 Plate tectonics

Of the terrestrial planets, the Earth is the only one where geothermal energy is dissipated through plate tectonics. The plate tectonic paradigm allows geologists to explain the dissipation of heat by the Earth, tectonic environments, earthquakes and styles of igneous activity. On a longer timescale, the plate tectonics paradigm explains patterns of global sedimentation, long term sea level change and ore forming processes, as will be explored in modules 5 and 7 (A Level only).

3.2.1 The plate tectonics paradigm

Plate tectonics is a thermodynamically driven process which involves the mantle and the lithosphere.

The evidence for a dynamic Earth builds on a range of evidence from direct observation and remote sensing.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the transfer of energy from within the Earth which drives the Earth's internal geological processes	To include: evidence for the geothermal gradient, convection, conduction and advection, and estimates of geothermal flux. *M3.2, M3.10*
(b)	**(i)** the evidence from earthquake seismology data for the nature of lithospheric plates (aseismic interiors and boundaries defined by seismic activity)	To include earthquake foci along the inclined plane of a Benioff zone.
	(ii) the evidence for structure in the mantle from seismic tomography data	To include subducted slabs and areas of upwelling.
	(iii) the interpretation and analysis of seismograms	To include: • deriving the distance from epicentre; using time–distance curves to find the epicentre of an earthquake • use of seismograms to demonstrate shadow zones. *M3.7* **PAG2** HSW1,3,5,6,9,12
(c)	the nature of lithospheric plates: aseismic interiors and boundaries defined by seismic activity	

	Learning outcomes	Additional guidance
(d)	how the global distribution of geological features of the same age provides evidence to reconstruct historical plate movement	To include: orogenic belts (Caledonian orogeny–Iapetus), palaeoenvironments and geomagnetics (polar wandering curves), ocean floor magnetic anomalies, volcanic zones, palaeoecology and glacial geology. HSW1,5,6
(e)	the evidence for mantle plumes	To include: relative plate motion, geological features, heat flow and seismic tomography HSW1,5,6
(f)	how the resolution and precision of the direct measurement of relative movement of points on different plates using Global Positioning Systems (GPS) allow accurate measurement of the current relative movement of lithospheric plates	To include basic understanding of geodesy (ellipsoid model of the Earth, the geoid and terrestrial reference frames). Learners are **not** required to have an understanding of the operation of Global Positioning Systems. *M1.3* HSW1,3,5,6
(g)	subduction zones, lithospheric plates (cold thermal boundary) and mantle plumes which act as the active limbs of the convection cells which transfer energy from within the Earth	*M2.10*
(h)	how gravity and differences in density result in ridge push at mid-ocean ridges	To include: passive upwelling at divergent plate boundaries and seafloor spreading.
(i)	the relative importance of slab pull at subduction zones and ridge push at mid-ocean ridges as mechanisms driving the movement of tectonic plates	
(j)	**(i)** how the plate tectonic paradigm emerged from previous, gradually more sophisticated models (geosynclines, continental drift, active mantle convection carrying passive tectonic plates) **(ii)** interpretation of these and other examples of such developing models.	To include: • evidence for and against Contraction theory • evidence from ocean basin research • continental blocks, isostasy, radioactivity and tectonic plates Learners are **not** expected to recall named scientists and specific dates. HSW7

3.2.2 Plate boundaries and igneous process

This section develops ideas of pressure and pressure differences in fluids, and chemical bonds which will be familiar to learners from GCSE (9–1) Physics and Chemistry.

Using buoyancy and changing physical properties provides a scientific framework for learners to understand igneous processes which will be developed in module 5 (A Level only).

		Learning outcomes	Additional guidance
		Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)		the generation of mafic magma by partial melting which results from upwelling of the mantle at divergent plate boundaries and intraplate hot spot settings	To include: geotherm, solidus, liquidus and adiabatic conditions.
(b)		the generation of intermediate and silicic magmas at convergent plate boundaries where crustal material is carried downward resulting in partial melting	To include magma mixing.
(c)		the processes of intrusion which cause a body of magma to ascend through the crust and how these affect the country rock	To include formation of diapirs and transgressive sills.
(d)	**(i)**	the characteristics of major and minor intrusive bodies and the settings under which they form	To include: chilled and baked margins and metamorphic aureoles.
	(ii)	the use of geodetic and geophysical data to identify the subsurface intrusion of magma	To include: harmonic tremor, 3D visualisation of seismic data, tiltmeter and GPS observations. *M3.2, M3.7, M3.8* **PAG2** HSW3
(e)	**(i)**	how changes in the properties of magma can affect buoyancy forces such that the magma can make its way to the surface producing a volcanic eruption	To include: exsolution of volatiles, crystal content, recharge and groundwater changes. **PAG3** HSW1,4
	(ii)	practical investigations to model the properties of magma and how changes to conditions can affect buoyancy forces	
(f)		the diagnostic geological characteristics of dykes, sills and lava flows	

	Learning outcomes	Additional guidance
(g)	how the composition (percentage silica) and temperature of the erupting lava controls its viscosity and its ability to exsolve volatiles	To include a qualitative understanding of the effect of OH^- ions on silicate polymerisation. *M1.4, M3.2*
(h)	how the composition and physical characteristics of the erupted material control the volcanic landforms produced by both explosive and effusive activity	To include: • viscosity, rate of extrusion, gas content and frequency of eruption • fissure and central eruptions • subaerial and submarine • plateau, shield, composite and caldera
(i)	the nature of volcanic hazards and their relation to the composition and properties of the source magma.	To include the plotting and interpretation of isopachyte maps. *M3.7, M4.2* HSW8,9,12

3.3 Geological structures

This section introduces learners to structural geology and provides knowledge and understanding of folding, faulting and the behaviour of deforming rocks.

Learners are introduced to rock deformation at outcrop before considering regional and global tectonic environments.

3.3.1 Rock mechanics

This section introduces how rocks behave when subjected to stress. These concepts will be developed in module 6 (A Level only).

There are opportunities for learners to develop and apply these ideas in the laboratory and through fieldwork.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	**(i)** the geological structures produced by rock deformation as a result of tectonic stresses (tension, compression and shear forces) **(ii)** the identification, measurement and description of these geological structures on photographs, maps, cross-sections and in the field **(iii)** the construction of geological cross-sections from geological maps **(iv)** use of a compass-clinometer	To include: • bedding planes: strike, dip and apparent dip • faults: fault plane, throw, fault dip, dip-slip, strike-slip, hanging wall, footwall, upthrow and downthrow • folds: fold limbs, symmetrical, asymmetrical, hinge, crest, trough, axial plane, axial plane trace, plunge, antiform and synform • principal stresses. *M1.1, M1.4, M1.5, M3.2, M4.2* **PAG6** HSW4,5,8,10

		Learning outcomes	Additional guidance
(b)	(i)	how tectonic stress and strain vary due to temperature, confining pressure and time, resulting in the plastic or brittle deformation of rocks	To include the formation of joints, slickensides and fault breccia. **PAG9** HSW8
	(ii)	the use of stress and strain diagrams	*M3.7, M3.8*
(c)		how compressive forces can lead to the formation of a slaty cleavage.	To include the relationship of cleavage to folds.

3.3.2 Structural geology and plate boundaries

The plate tectonic paradigm provides a framework to understand both the distribution and styles of tectonic environments.

Knowledge of earthquakes and tectonic environment prepares learners for the study of module 6 (A Level only).

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	how earthquakes occur when elastic strain energy stored in rocks is released (elastic rebound theory)	
(b)	how plate movement at transform boundaries causes shear dominated tectonic environments, which can lead to rock deformation as a result of tectonic induced stresses	To include stress transfer.
(c)	how plate movement at convergent boundaries causes compressive and shear dominated tectonic environments, which can lead to rock deformation as a result of tectonic or gravity induced stresses	To include: fold mountains, overfolds, isoclinal folds, nappes, thrusts.
(d)	how plate movement at divergent boundaries causes tensional dominated tectonic environments, which can lead to rock deformation as a result of tectonic or gravity induced stresses.	To include: graben (rift), horst, relationship between spreading rate and topography, and oceanic core complexes. *M3.10*

Module 4: Interpreting the past

The realisation by geologists that the Earth was the product of processes that could be studied and understood revolutionised science (uniformity of process).

This section provides knowledge and understanding of modern sediments and sedimentary rocks. It demonstrates the power of applying scientific theories and a systems approach to understanding a complex world.

Learners will have knowledge of rocks and the rock cycle from KS3 geography and science, and those who have studied GCSE (9–1) Geography will have knowledge of surface process. This section aims to build on learners' hands-on experience of rocks and fossils and demonstrate to them that the present is the key to the past.

Learners should gain knowledge and understanding of the relationship between sedimentary rocks and environments (4.1 Sedimentary environments in time, 4.2 Geochronology).

Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.

4.1 Sedimentary environments in time

'The present is the key to the past.' – Charles Lyell, 1833

The discovery of the rock cycle and the principle of uniformitarianism by James Hutton demonstrated the importance of reviewing theory in the light of fieldwork.

The facies approach to sedimentary geology developed in the 1970s is analogous to a niche in ecology. By viewing multiple characteristics of three-dimensional bodies, facies link modern environments with ancient rocks and avoid the limitations of the layer-cake approach.

Knowledge of the application of uniformitarianism to the understanding of sedimentary facies prepares learners for the study of modules 5 and 7 (A Level only).

4.1.1 Uniformitarianism and the rock cycle

The rock cycle and uniformitarianism were revolutionary ideas 200 years ago. Deep time was the catalyst to new ideas in other sciences and made geology the lead science of its day.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the use of evidence in the field, photographs, diagrams and maps to recognise the rock cycle	To include the origin of an angular unconformity. **PAG6** HSW4,5,10
(b)	how uniformitarianism and the rock cycle model developed over time, including ideas of catastrophism, mass extinctions, and changing conditions and rates of processes through geological time including the contributions of James Hutton and William Smith	To include gradualism. HSW7,11
(c)	what facies associations are, why facies are the basic unit of sedimentary geology and how uniformitarianism is applied to the study of facies by analogy with modern sedimentary sequences and processes.	

4.1.2 Surface processes and products

This section develops and extends ideas of surface processes ('geomorphic processes') which will be familiar to learners from GCSE (9–1) Geography.

It focuses on facies and a systems approach to understanding sedimentary environments by applying the concept of uniformity of process.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	**(i)** how the characteristics of the facies in a sedimentary environment are related to the methods of sediment transport **(ii)** the diagnostic sedimentary structures produced by the sediment transport processes **(iii)** the recognition and application of the diagnostic properties of sedimentary structures to interpret way-up and sedimentary environments, in the field and on photographs	To include the characteristics of sediments transported by wind, glaciers, rivers and in shallow marine environments. To include: cross-bedding, ripple marks, graded bedding, desiccation cracks, salt pseudomorphs and imbricate structure. *M1.4, M1.5, M4.2* **PAG4, PAG6** HSW1,4,5,10
(b)	the construction and interpretation of graphic logs of modern sediment sequences and ancient sedimentary rock	To include fossil assemblages, sedimentary structures and directional data. *M4.2* **PAG6** HSW8,10
(c)	deposition in fluvial environments which produces a characteristic three-dimensional architecture due to lateral migration	To include: meandering rivers, braided rivers and alluvial fans (channel sandstones, flood plain clays and silts, breccias, and conglomerates). *M2.8*
(d)	deposition in hot desert environments which are controlled by gradual aeolian processes and episodic high energy events	To include wadis, dunes and playa lakes (aeolian sandstones, evaporites).
(e)	deposition in shallow siliciclastic seas which produces characteristic offshore transitions from beach deposits, current reworked sand sheets to muds, below the wave base	
(f)	deposition in shallow carbonate seas which produces characteristic limestones within, on and outside the reef (reef limestone, bioclastic limestone and oolitic limestones)	
(g)	deposition in deep water carbonate seas above the carbonate compensation depth.	To include chalk, micritic limestones and a qualitative understanding of chert/flint formation in siliciclastic starved seas and continental slopes.

4.2 Geochronology

'…we find no vestige of a beginning, – no prospect of an end.' – James Hutton, 1795

Hutton based his assertion on the field evidence for multiple rock cycles that he and his correspondents observed. Subsequent generations of geologists have developed increasingly sophisticated numerical dating techniques although reference to the most recent ICS chronostratigraphic chart will show that this is still a work in progress.

Knowledge of geochronology prepares learners for the study of modules 5 to 7 (A Level only).

4.2.1 Relative dating and biostratigraphy

This section introduces the geochronological principles of correlation (based on lithology and macrofossils) and relative dating.

There are opportunities for learners to develop and apply these ideas in the laboratory and through fieldwork.

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	the geochronological principles used to place geological events in relative time sequences in outcrops, photographs, maps and cross-sections to interpret geological histories	To include superposition, original horizontality, way-up criteria, cross-cutting relationships, included fragments and unconformities. *M1.4, M1.5, M4.2* **PAG6** HSW1, 10
(b)	the critical application of lithostratigraphic correlation (lateral variation, diachronous beds)	To include sequences of beds, thickness and composition.
(c)	the application and limitations of relative dating	HSW6
(d)	biostratigraphic correlation using first appearance of macro fossils, stratigraphic range, extinction and fossil assemblages.	To include zone fossils. *M2.2*

2d. Prior knowledge, learning and progression

This specification has been developed for learners who wish to continue with a study of geology at Level 3. The AS level specification has been written to provide progression from GCSE (9–1) Science qualifications, GCSE (9–1) Geology or GCSE Geology. Learners who have successfully taken other Level 2 qualifications in science with appropriate geology content may also have acquired sufficient knowledge and understanding to begin the AS Level Geology course.

There is no formal requirement for prior knowledge of geology for entry onto this qualification. Other learners without formal qualifications may have acquired sufficient knowledge of geology to enable progression onto the course.

Some learners may wish to follow a geology course for only one year as an AS, in order to broaden their curriculum, and to develop their interest and understanding of different areas of the subject. Others may follow a co-teachable route, completing the one-year AS course and/or then moving to the two-year A level. For learners wishing to follow an apprenticeship route or those seeking direct entry into science careers, this AS level provides a strong background and progression pathway.

Find out more at www.ocr.org.uk

3 Assessment of OCR AS Level in Geology

3a. Forms of assessment

OCR's AS Level in Geology consists of one externally assessed written component (01).

This component contains some synoptic assessment and some extended response questions (see Sections 3f and 3e, respectively).

The use of scientific or graphical calculators are permitted in the written examinations. See Section 5e for further details.

Geology (Component 01)

This component is worth 120 marks, is split into two sections and assesses content from across all teaching modules. Learners answer all questions.

Section A contains multiple choice questions. This section is worth 20 marks.

Section B includes short answer and extended response questions covering structured questions, problem solving, calculations and practical skills. This section is worth 100 marks.

3b. Assessment objectives (AO)

There are three Assessment Objectives in OCR AS Level Geology. These are detailed in the table below.

Learners are expected to demonstrate their ability to:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of geological ideas, skills and techniques.
AO2	Apply knowledge and understanding of geological ideas, skills and techniques.
AO3	Analyse, interpret and evaluate geological ideas, information and evidence to make judgements, draw conclusions, and develop and refine practical design and procedures.

AO weightings in AS Level in Geology

The relationship between the assessment objectives and the component is shown in the following table:

Component	% of OCR AS Level in Geology (H014)		
	AO1	AO2	AO3
Geology [H014/01]	35	40	25
Total	35	40	25

3c. Assessment availability

There will be one examination series available each year in May/June to **all** learners.

All examined components must be taken in the same examination series at the end of the course.

This specification will be certificated from the June 2018 examination series onwards.

3d. Retaking the qualification

Learners can retake the qualification as many times as they wish. They retake all components of the qualification.

3e. Assessment of extended response

The assessment materials for this qualification provide learners with the opportunity to demonstrate their ability to construct and develop a sustained and coherent line of reasoning and marks for extended responses that are integrated into the marking criteria.

Extended response questions which are marked using a level of response mark scheme are included in Component 01. These extended response questions, marked using a level of response mark scheme, are indicated in the paper and mark scheme by an asterisk (*).

3f. Synoptic assessment

Synoptic assessment tests the learners' understanding of the connections between different elements of the subject.

Synoptic assessment involves the explicit drawing together of knowledge, understanding and skills learned in different parts of the AS level course. The emphasis of synoptic assessment is to encourage the development of the understanding of the subject as a discipline.

Synoptic assessment requires learners to make and use connections within and between different areas of geology, for example, by:

- applying knowledge and understanding of more than one area to a particular situation or context
- using knowledge and understanding of principles and concepts in planning experimental and investigative work and in the analysis and evaluation of data
- bringing together scientific knowledge and understanding from different areas of the subject and applying them.

3g. Calculating qualification results

A learner's overall qualification grade for AS Level in Geology will be calculated from their mark for Component 01.

This mark will then be compared to the qualification level grade boundaries for the relevant exam series to determine the learner's overall qualification grade.

4 Admin: what you need to know

The information in this section is designed to give an overview of the processes involved in administering this qualification so that you can speak to your exams officer. All of the following processes require you to submit something to OCR by a specific deadline.

More information about the processes and deadlines involved at each stage of the assessment cycle can be found in the Administration area of the OCR website.

OCR's *Admin overview* is available on the OCR website at http://www.ocr.org.uk/administration

4a. Pre-assessment

Estimated entries

Estimated entries are your best projection of the number of learners who will be entered for a qualification in a particular series.

Estimated entries should be submitted to OCR by the specified deadline. They are free and do not commit your centre in any way.

Final entries

Final entries provide OCR with detailed data for each learner, showing each assessment to be taken. It is essential that you use the correct entry code, considering the relevant entry rules.

Final entries must be submitted to OCR by the published deadlines or late entry fees will apply.

All learners taking AS Level in Geology must be entered for H014.

Entry code	Title	Component code	Component title	Assessment type
H014	Geology	01	Geology	External assessment

Private candidates

Private candidates may enter for OCR assessments.

A private candidate is someone who pursues a course of study independently but takes an examination or assessment at an approved examination centre. A private candidate may be a part-time student, someone taking a distance learning course, or someone being tutored privately. They must be based in the UK.

Private candidates need to contact OCR approved centres to establish whether they are prepared to host them as a private candidate. The centre may charge for this facility and OCR recommends that the arrangement is made early in the course.

Further guidance for private candidates may be found on the OCR website: http://www.ocr.org.uk

Head of Centre Annual Declaration

The Head of Centre is required to provide a declaration to the JCQ as part of the annual NCN update, conducted in the autumn term, to confirm that the centre is meeting **all** of the requirements detailed in the specification.

Any failure by a centre to provide the Head of Centre Annual Declaration will result in your centre status being suspended and could lead to the withdrawal of our approval for you to operate as a centre.

Fieldwork written statement

Centres must provide a written **fieldwork statement** detailing that reasonable opportunities have been provided to all learners being submitted for entry within that year's set of assessments to undertake at least **two** days of geological fieldwork.

To aid administration within centres we have combined the fieldwork statement requirement with the Head of Centre Annual Declaration. By signing the Head of Centre Declaration the centre is confirming that they have provided at least **two** days of geological fieldwork for learners and that they have allowed learners to:

- undertake fieldwork in the contexts of virtual fieldwork, local fieldwork outside the classroom and unfamiliar outcrop geology
- undertake the practical techniques detailed in module 1.3 of this specification.

Any failure by a centre to provide a fieldwork statement to OCR in a timely manner (as part of the Head of Centre Declaration) will be treated as malpractice and/or maladministration.

4b. Special consideration

Special consideration is a post-assessment adjustment to marks or grades to reflect temporary injury, illness or other indisposition at the time the assessment was taken.

Detailed information about eligibility for special consideration can be found in the *JCQ* publication *A guide to the special consideration process*.

4c. External assessment arrangements

Regulations governing examination arrangements are contained in the JCQ *Instructions for conducting examinations*.

4d. Results and certificates

Grade scale

AS level qualifications are graded on the scale: A, B, C, D, E, where A is the highest. Learners who fail to reach the minimum standard for E will be Unclassified (U).

Only subjects in which grades A to E are attained will be recorded on certificates.

Results

Results are released to centres and learners for information and to allow any queries to be resolved before certificates are issued.

Centres will have access to the following results' information for each learner:

- the grade for the qualification
- the total weighted mark for the qualification (equal to the raw mark for Component 01).

The following supporting information will be available:

- weighted mark grade boundaries for the qualification.

Until certificates are issued, results are deemed to be provisional and may be subject to amendment.

A learner's final results will be recorded on an OCR certificate. The qualification title will be shown on the certificate as 'OCR Level 3 Advanced Subsidiary GCE in Geology'.

4e. Post-results services

A number of post-results services are available:

- **Enquiries about results** – If you are not happy with the outcome of a learner's results, centres may submit an enquiry about results.
- **Missing and incomplete results** – This service should be used if an individual subject result for a learner is missing, or the learner has been omitted entirely from the results supplied.
- **Access to scripts** – Centres can request access to marked scripts.

4f. Malpractice

Any breach of the regulations for the conduct of examinations and coverage of fieldwork requirements (see Section 4a) may constitute malpractice (which includes maladministration) and must be reported to OCR as soon as it is detected. Detailed information on malpractice can be found in the JCQ publication *Suspected Malpractice in Examinations and Assessments: Policies and Procedures.*

5 Appendices

5a. Overlap with other qualifications

There is a small degree of overlap between the content of this specification and those for other AS levels and A Levels in Science and Geography.

Examples of overlap include:

Biology

- fossils as evidence for evolution
- fossils as evidence for classification.

Chemistry

- covalent network structures
- acid–carbonate reaction.

Physics

- wave theory
- energy transfers
- mechanical properties of matter
- density and pressure
- radioactive decay.

Geography

- no overlap with DfE subject criteria (core content)
- tectonic hazards (where added by an individual awarding organisation as non-core content in their specification).

5b. Accessibility

Reasonable adjustments and access arrangements allow learners with special educational needs, disabilities or temporary injuries to access the assessment and show what they know and can do, without changing the demands of the assessment. Applications for these should be made before the examination series. Detailed information about eligibility for access arrangements can be found in the JCQ *Access Arrangements and Reasonable Adjustments.*

The AS level qualification and subject criteria have been reviewed in order to identify any feature which could disadvantage learners who share a protected Characteristic as defined by the Equality Act 2010. All reasonable steps have been taken to minimise any such disadvantage.

5c. SI units in geology

The International System of Units (Système International d'Unités), which is abbreviated as SI, is a coherent system of base units. The six which are relevant for AS Level Geology are listed below. Also listed are eight of the derived units (which have special names) selected from the SI list of derived units in the same source.

It is expected that learners will show understanding of the scientific quantities and corresponding units, SI base and derived units listed below.

They will be able to use them in qualitative work and calculations. These units and their associated quantities are dimensionally independent.

5

SI base units		
Physical quantity	**Unit**	**Unit**
Length	metre	m
Mass	kilogram	kg
Time	second	s
Current	ampere	A
Temperature	kelvin	K
Amount of a substance	mole	mol

SI derived units		
Physical quantity	**Unit**	**Unit**
Frequency	hertz	Hz
Force	newton	N
Energy	joule	J
Power	watt	W
Pressure	pascal	Pa
Electric charge	coulomb	C
Electric potential difference	volt	V
Electric resistance	ohm	Ω

Non-standard units		
Physical quantity	**Unit**	**Unit**
Time	day	d
Time	year – annum	a
Mass	tonne	t

5d. How Science Works (HSW)

The idea that science progresses through a cycle of hypothesis, experimentation, observation, development and review is encompassed in this section. It covers aspects of scientific thinking and aims to develop the scientific skills and conventions fundamental to the study of science. The section includes understanding of theories and applications of science, the practical aspects of scientific experimentation, and objective analysis and evaluation. This will enable learners to develop an understanding of the processes and methods of science and, through consideration of the different types of scientific enquiry, learners will become equipped to answer scientific questions about the world around them.

OCR's AS Level in Geology encourages the development of skills, knowledge and understanding in science through opportunities for regular hands-on practical and fieldwork.

Learners will be required to have carried out practical activities especially in field situations. The skills, knowledge and understanding developed through fieldwork will also be assessed indirectly in written examinations.

How Science Works (HSW) was conceived as being a wider view of science in context, rather than just straightforward scientific enquiry. It was intended to develop learners as critical and creative thinkers, able to solve problems in a variety of contexts. Developing ideas and theories to explain geological processes is at the heart of geology. Learners should be aware of the importance that peer review and repeatability have in giving confidence to this evidence.

Learners are expected to understand the variety of sources of data available for critical analysis to provide evidence and the uncertainty involved in its measurement. They should also be able to link that evidence to contexts influenced by culture, politics and ethics.

Understanding *How Science Works* requires an understanding of how scientific evidence can influence ideas and decisions for individuals and society, which is linked to the necessary skills of communication for audience and for purpose with appropriate scientific terminology.

The examples and guidance within the specification are not exhaustive but give a flavour of opportunities for integrating HSW within the course.

HSW1	Use theories, models and ideas to develop geological explanations.
HSW2	Use knowledge and understanding to pose scientific questions, define geological problems, present scientific arguments and geological ideas.
HSW3	Use appropriate methodology, including information and communication technology (ICT), to answer geological questions and solve geological problems.
HSW4	Carry out fieldwork, experimental and investigative activities in a range of contexts, to include the collection, compilation and analysis of Earth science data from the field and subsurface, and appropriate risk management.
HSW5	Analyse and interpret data to provide evidence, recognising correlations and causal relationships, manipulate and extrapolate these sometimes incomplete data sets in both two and three-dimensions.
HSW6	Evaluate methodology, evidence and partial data sets, and resolve conflicting evidence.
HSW7	Know that scientific knowledge and understanding develops over time.
HSW8	Communicate information and ideas in appropriate ways (including geological maps and cross-sections) using appropriate terminology, SI units and their prefixes and the ability to express in standard form.
HSW9	Consider applications and implications of science in geology and evaluate their associated benefits and risks.
HSW10	Consider ethical issues in the treatment of humans, other organisms and the environment.
HSW11	Evaluate the role of geology within the scientific community in validating new knowledge and ensuring integrity.
HSW12	Evaluate the ways in which society uses science to inform decision making.

5e Mathematical skills requirements

It is a requirement within AS Level Geology that at least 10% of the marks available assess the use of mathematical skills (in the context of geology) at a level of demand which is not lower than that expected at higher tier GCSE (9–1) Mathematics.

The table below provides some examples of the mathematical requirements which will be assessed in AS Level Geology and how the application of skills may be assessed within a written exam.

All mathematical content will be assessed within the lifetime of the specification. Please note that while M2.3, M3.3, M3.4 and M4.1 are A level only content learners can be required to apply their prior mathematical skills from GCSE (9–1) Mathematics and GCSE (9–1) Science in AS assessments; for example, to rearrange and solve the concentration factor formula.

This list of examples is not exhaustive and is not limited to GCSE (9–1) examples. These skills could be developed in other areas of specification content from those indicated.

Learners are permitted to use a scientific or graphical calculator for all written examinations. Calculators are subject to the rules in the document Instructions for Conducting Examinations published annually by JCQ (www.jcq.org.uk).

Formulae used in AS Level Geology

To address geology questions using mathematical skills learners will need to be able to use and, in some cases, recall formulae and equations. Some of these will be mathematical equations applied in geological contexts, while others are formulae for geological concepts, which may need to be manipulated using standard mathematical algebraic techniques.

	Geological	**Mathematical**
Recall	• Magnification • Rates • Concentration factor • Phi (ϕ) scale (at AS, qualitative understanding only) • Surface Area to Volume ratio	All of GCSE (9–1) Maths recall including (but not limited to): • circumference and area of circle • surface area and volume of right prisms (including cylinders) • mean • percentage (to include %change and %error)
Provided		• Standard deviation

GCSE (9–1) Mathematical formulae to recall

At AS and A Level Geology we assume knowledge of higher tier GCSE (9–1) Mathematics content. This includes (but is not limited to) the following list of formulae which learners will need to recall.

Note that learners should be familiar with the convention of using *r* for radius, *h* for height, *b* for base and *l* for length.

- Circumference of circle

  $$circumference\ of\ circle = 2\pi r$$

- Area of circle

  $area\ of\ circle = \pi r^2$

- Surface area of cuboid

  $Surface\ area\ of\ cuboid = 2(bh + bl + hl)$

- Surface area of right prism (including cylinder)

  $surface\ area\ of\ right\ prism = \Sigma(area\ of\ each\ face)$

- Volume of cuboid

  $volume\ of\ cuboid = hbl$

- Volume of right prism (including cylinder)

  $volume\ of\ right\ prism = area\ of\ cross\text{-}section \times height$

- Mean

  $$\bar{x} = \frac{\Sigma x}{n}$$

- Percentage (which can be used to calculate percentage change, percentage yield and percentage error)

  $$percentage\ change = \frac{new\ quantity - original\ quantity}{original\ quantity} \times 100$$

  $$\%\ error\ (uncertainty) = \frac{2 \times absolute\ uncertainty}{quantity\ measured} \times 100\%$$

Geological formulae to recall

The following are the geological formulae which learners will need to recall:

- Magnification

  $$Magnification = \frac{size\ of\ image}{size\ of\ real\ object}$$

- Rates (e.g. geotherm, relative plate motion, radioactivity, sedimentation rate)

  $$Rate = \frac{change\ in\ quantity}{time\ taken}$$

- Surface Area to Volume ratio

  $$Ratio = \frac{Surface\ Area}{Volume}$$

- Concentration factor

  $$concentration\ factor = \frac{grade\ of\ metal\ ore}{average\ crustal\ abundance}$$

- Phi (ϕ) scale (at AS, qualitative understanding only)

$$\text{phi} = -\log_2\left(\frac{\text{diameter of grain in mm}}{1}\right)$$

Mathematical formulae that will need to be used but not recalled

The following are the mathematical formulae which learners will be given in the exam, or in a list from which they select and apply as appropriate:

- Standard Deviation

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

Mathematical skills for geology – M1 – M4 Coverage Table

Ref	Mathematical skills to be assessed	Exemplification of mathematical skill in the context of AS Level Geology (assessment is not limited to the examples below)	Areas of the specification which exemplify the mathematical skill (assessment is not limited to the examples below)
M1 – Number			
M1.1	Recognise and make use of appropriate units in calculations	Candidates should demonstrate their ability to: • convert between units e.g. ppb to gram per tonne • use correct units as part of calculations for gold ore concentration factor • work out the unit for a rate e.g. sedimentation rate	1.1.2(b), 1.1.3(c), 2.1.1(c), 2.2.2(a), 3.1.2(e), 3.3.1(a)
M1.2	Recognise and use expressions in decimal and standard form	Candidates should demonstrate their ability to: • use an appropriate number of decimal places in calculations e.g. for a mean • carry out calculations using numbers in standard and ordinary form e.g. use of magnification • convert between numbers in standard and ordinary form • understand that significant figures need retaining when making conversions between standard and ordinary form e.g. 0.063 mm is equivalent to 6.3×10^{-2} mm	2.1.2(a), 2.1.3(b)

5

Ref	Mathematical skills to be assessed	Exemplification of mathematical skill in the context of AS Level Geology (assessment is not limited to the examples below)	Areas of the specification which exemplify the mathematical skill (assessment is not limited to the examples below)
M1.3	Use an appropriate number of significant figures	Candidates should demonstrate their ability to: • report calculations to an appropriate number of significant figures given raw data quoted to varying numbers of significant figures • understand that calculated results can only be reported to the limits of the least accurate measurement	1.1.3(c), 2.1.1(c), 3.2.1(f)
M1.4	Use ratios, fractions and percentages	Candidates should demonstrate their ability to: • calculate percentage yields • calculate surface area to volume ratio • use scales for measuring	2.1.1(c), 2.1.2(b), 3.1.2(e), 3.2.2(g)
M1.5	Make order of magnitude calculations	Candidates should demonstrate their ability to: • use and manipulate the magnification formula $\text{magnification} = \dfrac{\text{size of image}}{\text{size of real object}}$	2.1.1(a), 2.1.2(b), 2.1.3(c), 3.3.1(a)
M1.6	Estimate results	Candidates should demonstrate their ability to: • estimate results to sense check that the calculated values are appropriate	2.1.1(c), 3.1.2(e)
M2 – Statistics and probability			
M2.1	Find arithmetic means	Candidates should demonstrate their ability to: • find the mean of a range of data e.g. the mean clast size	2.1.1(c), 2.1.3(b)
M2.2	Construct and interpret frequency tables and diagrams, bar charts and histograms	Candidates should demonstrate their ability to: • represent a range of data in a table with clear headings, units and consistent decimal places • interpret data from a variety of tables e.g. data relating to intrusive dykes • plot a range of data in an appropriate format e.g. grain size distribution as a cumulative frequency graph • interpret data for a variety of graphs e.g. explain seismograph traces	2.1.2(a), 2.1.3(c), 4.2.1(d)

Ref	Mathematical skills to be assessed	Exemplification of mathematical skill in the context of AS Level Geology (assessment is not limited to the examples below)	Areas of the specification which exemplify the mathematical skill (assessment is not limited to the examples below)
M2.5	Understand the principles of sampling as applied to scientific data	Candidates should demonstrate their ability to: • estimate optimum sample size from a plot of number of clasts sampled vs running mean of mean b-axis length	1.3.1(b), 1.3.1(c), 2.1.3(b), 2.2.1(b), 2.2.2(a)
M2.6	Understand the terms mean, median and mode	Candidates should demonstrate their ability to: • calculate or compare the mean, median and mode of a set of linear data e.g. Folk and Ward graphic statistics from sieve analysis of sand samples from different sedimentary environments	2.1.3(b), 2.2.1(b)
M2.8	Understand measures of dispersion, including standard deviation and interquartile range	Candidates should demonstrate their ability to: • calculate the standard deviation • understand why interquartile range might be a more useful measure of dispersion for a given set of data than standard deviation e.g. where there is an extreme observation which is part of the inherent variation	2.1.3(b), 2.1.3(c), 4.1.2(c),
M2.9	Plot two variables from experimental or other linear data	Candidates should demonstrate their ability to: • select an appropriate format for presenting data: bar charts, histograms, graphs, triangular diagrams and scattergrams	2.2.1(b), 2.2.2(a)
M2.10	Use a scatter diagram to identify a correlation between two variables	Candidates should demonstrate their ability to: • interpret a scattergram e.g. rate of plate motion vs total length of subducting plate margin	2.2.1(b), 3.2.1(g)
M3 – Algebra and graphs			
M3.1	Understand and use the symbols: $=, <, \ll, \gg, >, \propto$ and $\sim$	No exemplification required	
M3.2	Change the subject of an equation	Candidates should demonstrate their ability to: • use and manipulate equations e.g. magnification	2.1.1(c), 3.1.2(e), 3.2.1(a)

Ref	Mathematical skills to be assessed	Exemplification of mathematical skill in the context of AS Level Geology (assessment is not limited to the examples below)	Areas of the specification which exemplify the mathematical skill (assessment is not limited to the examples below)
M3.7	Translate information between graphical, numerical and algebraic forms	Candidates should demonstrate their ability to: • understand that data may be presented in a number of formats and be able to use these data e.g. time distance curves for earthquakes	3.2.1(b), 3.2.2(d), 3.3.1(b)
M3.8	Understand that $y = mx + c$ represents a linear relationship	Candidates should demonstrate their ability to: • predict/sketch the shape of a graph with a linear relationship e.g. burial curves in a sedimentary basin or the effect of intrusion size on the width of the baked margin	1.1.3(d), 3.2.2(d), 3.3.1(b)
M3.10	Calculate rate of change from a graph showing a linear relationship	Candidates should demonstrate their ability to: • calculate a rate from a graph e.g. geothermal gradient through the lithosphere	1.1.3(d), 3.2.1(a), 3.3.2(d)
M4 – Geometry and measures			
M4.2	Visualize and represent 2D and 3D forms, including 2D representations of 3D objects	Candidates should demonstrate their ability to: • draw geological cross-sections interpreted from geological maps • interpret block diagrams to show geological structures in 3D • interpret field exposures and record 3D geological structures using field sketches	2.1.2(b), 3.3.1(a), 4.1.2(a), 4.1.2(b), 4.2.1(a)

5f. Health and Safety

In UK law, health and safety is primarily the responsibility of the employer. In a school or college the employer could be a local education authority, the governing body or board of trustees. Employees (teachers/lecturers, technicians etc.), have a legal duty to cooperate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 2002 (as amended) and the Management of Health and Safety at Work Regulations 1999, require that before any activity involving a hazardous procedure or harmful microorganisms is carried out, or hazardous chemicals are used or made, the employer must carry out a risk assessment. A useful summary of the requirements for risk assessment in school or college science can be found at: https://www.ase.org.uk

For members, the CLEAPSS® guide, *PS90*, *Making and recording risk assessments in school science*[1] offers appropriate advice.

Most education employers have adopted nationally available publications as the basis for their Model Risk Assessments.

Where an employer has adopted model risk assessments an individual school or college then has to review them, to see if there is a need to modify or adapt them in some way to suit the particular conditions of the establishment.

Such adaptations might include a reduced scale of working, deciding that the fume cupboard provision was inadequate or the skills of the learners were insufficient to attempt particular activities safely. The significant findings of such risk assessment should then be recorded in a *'point of use text'*, for example on schemes of work, published teachers guides, work sheets, etc. There is no specific legal requirement that detailed risk assessment forms should be completed for each practical activity, although a minority of employers may require this.

Where project work or investigations, sometimes linked to work-related activities, are included in specifications this may well lead to the use of novel procedures, chemicals or microorganisms, which are not covered by the employer's model risk assessments. The employer should have given guidance on how to proceed in such cases. Often, for members, it will involve contacting CLEAPSS®.

[1] These, and other CLEAPSS® publications, are on the CLEAPSS® Science Publications website **www.cleapss.org.uk**. Note that CLEAPSS® publications are only available to members. For more information about CLEAPSS® go to **www.cleapss.org.uk**.

Summary of updates

Date	Version	Section	Title of Section	Change
December 2017	2	Multiple		Changes to generic wording and OCR website links throughout the specification. No changes have been made to any assessment requirements.
March 2018	3	Section 5e	Mathematical skills requirements	Change to indicate mathematical formulae learners should be familiar with, those necessary to recall and those that will be presented in an assessment.

YOUR CHECKLIST

Our aim is to provide you with all the information and support you need to deliver our specifications.

- ☐ Bookmark ocr.org.uk/aslevelgeology for all the latest resources, information and news on A Level Geology
- ☐ Be among the first to hear about support materials and resources as they become available – register for Geology updates at ocr.org.uk/updates
- ☐ Find out about our professional development at cpdhub.ocr.org.uk
- ☐ View our range of skills guides for use across subjects and qualifications at ocr.org.uk/skillsguides
- ☐ Discover our new online past paper service at ocr.org.uk/exambuilder
- ☐ Learn more about Active Results at ocr.org.uk/activeresults
- ☐ Join our Geology social network community for teachers at social.ocr.org.uk

Download high-quality, exciting and innovative AS Level Geology resources from ocr.org.uk/aslevelgeology

Resources and support for our AS Level Geology qualification, developed through collaboration between our Geology Subject Advisors, teachers and other subject experts, are available from our website. You can also contact our Geology Subject Advisors who can give you specialist advice, guidance and support.

Contact the team at:
01223 553998
science@ocr.org.uk
@OCR_Science

To stay up to date with all the relevant news about our qualifications, register for email updates at ocr.org.uk/updates

Geology Community

The social network is a free platform where teachers can engage with each other – and with us – to find and offer guidance, discover and share ideas, best practice and a range of Geology support materials. To sign up, go to social.ocr.org.uk

follow us on

facebook.com/ocrexams
linkedin.com/company/ocr
@OCR_Science
youtube.com/ocrexams

ISO 9001
UKAS MANAGEMENT SYSTEMS 001

Cambridge Assessment

ocr.org.uk/aslevelgeology