GCSE (9-1)

eduqas
Part of WJEC

# SUMMARY OF AMENDMENTS

| Version | Description | Page number |
|---|---|---|
| 2 | 'Making entries' section has been amended to clarify resit rules. | 23 |

# WJEC Eduqas GCSE (9-1) in GEOLOGY

## For teaching from 2017
## For award from 2019

# GCSE GEOLOGY

## SUMMARY OF ASSESSMENT

**Component 1: Geological Principles**
**On-screen examination: 1 hour 15 minutes**
**50% of qualification**

An on-screen assessment consisting of data and stimulus response questions.

This assessment requires multiple-choice, short, structured and extended writing answers relating to all the GCSE Geology subject content outlined in this specification. A data sheet is used in this assessment.

**Component 2: Investigative Geology**
**Written examination: 1 hour 30 minutes**
**50% of qualification**

A written assessment consisting of data and stimulus response questions.

This assessment requires short, structured and extended writing answers to investigate the geology of an area shown on a simplified geological map. This assessment is wholly based on the area covered by the geological map. A data sheet is used in this assessment.

This linear qualification will be available for assessment in May/June each year. It will be awarded for the first time in summer 2019.

**Ofqual Qualification Number (listed on The Register): 603/0598/8**

**Qualifications Wales Designation Number (listed on QiW): C00/1174/3**

# GCSE GEOLOGY

# 1 INTRODUCTION

## 1.1 Aims and objectives

The WJEC Eduqas GCSE in Geology provides the foundations for understanding the science of 'how the Earth works': its structure, evolution and dynamics, and its mineral and energy resources. In addition, learners following the course will appreciate that the understanding and application of Earth science is vital to the future quality of life and prosperity of the world's population; from supplying the ever-growing demand for mineral, energy and water resources to mitigation of natural hazards by improved engineering and prediction techniques.

In developing this specification, WJEC has provided opportunity for learners to:

- develop knowledge and understanding of rock types, geological structures, geochronology, the rock cycle and plate tectonics as the key ideas of geology
- develop understanding of the nature, processes and methods of geology, through the different types of scientific enquiry used to answer questions about how the Earth works
- develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills, both in the laboratory and in the field, and extend their competence in a range of fieldwork skills, including those required in understanding 3D geological data
- develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively.

The WJEC Eduqas GCSE in Geology places problem-solving at the heart of learning, encouraging learners to respond to geology in both familiar and novel situations in the laboratory and in the field. Learners are encouraged to think for themselves, reflecting the skills demanded by those engaged in the study of geology, and other disciplines, beyond GCSE.

The specification encourages the teaching of links between different areas of the geology curriculum, thereby building up a broad approach to the subject. It lends itself to a variety of teaching and learning styles and offers learners of all abilities an enjoyable and positive learning experience.

## 1.2 Prior learning and progression

There are no previous learning requirements for this specification. Any requirements set for entry to a course based on this specification are at the school/college's discretion.

This specification builds on subject content which is typically taught at key stage 3 national curriculum requirements for science and mathematics and provides a suitable foundation for the study of geology at either AS or A level. In addition, the specification provides a coherent, satisfying and worthwhile course of study for learners who do not progress to further study in this subject.

## 1.3 Equality and fair access

This specification may be followed by any learner, irrespective of gender, ethnic, religious or cultural background. It has been designed to avoid, where possible, features that could, without justification, make it more difficult for a learner to achieve because they have a particular protected characteristic.

The protected characteristics under the Equality Act 2010 are age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

The specification has been discussed with groups who represent the interests of a diverse range of learners, and the specification will be kept under review.

Reasonable adjustments are made for certain learners in order to enable them to access the assessments (e.g. candidates are allowed access to a Sign Language Interpreter, using British Sign Language). Information on reasonable adjustments is found in the following document from the Joint Council for Qualifications (JCQ): *Access Arrangements and Reasonable Adjustments: General and Vocational Qualifications.*

This document is available on the JCQ website (www.jcq.org.uk). As a consequence of provision for reasonable adjustments, very few learners will have a complete barrier to any part of the assessment.

# 2 SUBJECT CONTENT

This specification promotes the integrated study of geology. It enables learners to develop a broad range of skills and techniques in the areas of analysis and interpretation of data, problem-solving and drawing conclusions. In addition, learners are able to acquire data collection and interpretation skills in the field.

This specification covers all the requirements of GCSE Geology as outlined by the Department for Education. The knowledge, understanding, skills and techniques are set out in the two columns in the pages that follow. Learners should expect to be assessed on the details of both columns. The square brackets [ ] within pages 7-20 provide further details of the extent of relevant content.

The subject content for GCSE Geology is assessed across two components. The context in which the content is assessed across the two components differs.

- In Component 1, the whole of the content of the specification is assessed in a theoretical way.
- In Component 2 there is a more practical approach, with the assessment structured to investigate the geology of an area shown on an accompanying simplified geological map. This assessment is wholly based on the area covered by the geological map.

**Component 1: Geological Principles**
On-screen examination: 1 hour 15 minutes
50% of the qualification
80 marks

**Component 2: Investigative Geology**
Written examination: 1 hour 30 minutes
50% of the qualification
80 marks

A data sheet is used in both components. Learners should become familiar with the use of this data sheet during their study of GCSE Geology.

WJEC offers full support to centres for the administration of Component 1, the on-screen examination. All the necessary technical and practical advice is available from WJEC to enable centres to oversee the management of this examination.

The content of the specification for WJEC Eduqas GCSE in Geology has a structure based on four key ideas. These provide a framework for the learner to appreciate the context and purpose of study of the content. The four key ideas are:

- rock exposures contain evidence of how rocks were formed and subsequently deformed
- major concepts and techniques underpin our current understanding of the Earth and its history

- comparisons of the Earth with other planetary bodies within the Solar System provide evidence for the origin and evolution of both

- human interaction with the Earth can increase or reduce risk of Earth hazards.

Fieldwork has long been an attractive aspect of the study of geology and has been incorporated at the heart of this specification. Learners are required to undertake a minimum of **two** days of work in the field in order to develop their field observation and practical skills. Furthermore, to develop learners' problem solving skills, it is expected that during at least one of these days they should have at least one opportunity to carry out a directed investigation to answer a geological problem.

Examples of appropriate directed investigations include:
- an investigation to determine the environments of deposition of a sequence of sedimentary rocks
- an investigation to determine the effects of tectonic stresses at a field location
- an investigation to determine the geological history of an area using field observations.

This list is by no means exhaustive and centres should feel able to devise alternative examples of directed investigations relevant to the field locations which are used.

Each centre must provide a **fieldwork statement** to WJEC that details the fieldwork carried out by learners from the centre in each assessment cycle. Centres will be able to make their fieldwork statement by completing the form that will be available to download from the GCSE Geology subject page of the Eduqas website. The fieldwork statement must be submitted to WJEC by 15 May of the year in which candidates receive their award. Failure to provide a fieldwork statement will be treated as malpractice and/or maladministration by WJEC.

Centres will be able to use the form to:
- confirm that each learner has been provided with opportunities to undertake geological fieldwork on **at least two occasions** and in respect of each of those opportunities:
    - the date on which it was provided
    - the number of learners who participated
    - the location at which it was provided
    - a brief description of the fieldwork undertaken
- confirm that each learner has been given a **minimum** of **one** opportunity to carry out a directed investigation to answer a geological problem and
- give a brief description of any directed investigation(s).

**Safety is paramount in the field and it is essential that all centres adhere to 'The Geological Code of Conduct' and the regulations of their centre concerning off-site activities.**

This specification encourages learners to take a practical approach to geology and the skills required for this (see Appendix B) should be developed through regular hands-on practical activities undertaken in the classroom and in the field.

Learners who follow this specification will develop a wide range of mathematical skills as outlined in Appendix A. Calculators may be used in both components. Candidates are responsible for making sure that their calculators meet the relevant regulations for use in written examinations: information is found in the JCQ publications *Instructions for conducting examinations* and *Information for candidates for written examinations*.

Learners who follow this specification will also develop practical skills and techniques as outlined in Appendix B. Problem-solving is at the heart of this specification and as learners study the subject content they will also develop the skills outlined below. Alongside knowledge of the subject content learners will be assessed on their ability to:

- use theories, models and ideas to develop geological explanations and present geological arguments
- use appropriate methodology to answer geological questions and solve geological problems
- evaluate methodology, evidence and partial data sets, and resolve conflicting evidence.

## Key Idea 1: Rock exposures contain evidence of how rocks were formed and subsequently deformed

This key idea enables candidates to analyse and interpret rock exposures from primary and secondary evidence. Key Idea 1 has been divided into five topics:

- Minerals
- Igneous rocks and processes
- Sedimentary rocks and their fossil content
- Metamorphic rocks and processes
- Deformational structures.

## 1.1 Minerals

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Minerals are formed by:<br>• crystallisation from a melt [quartz, feldspar, mica, olivine and augite]<br>• metamorphic recrystallisation [calcite, garnet]<br>• crystallisation from solution in evaporating water [halite]<br>• crystallisation as cement from flowing pore waters [quartz, calcite]<br>• crystallisation from hydrothermal fluids [in veins and faults: gangue minerals - quartz, calcite; ore minerals - haematite, galena].<br><br>b. Modern laboratory techniques can be used to image mineral samples on a small scale and determine their chemistry e.g. the scanning electron microscope and electron microprobe. N.B. Access to these techniques is not required. | Use appropriate tests of:<br>• physical properties of minerals [observation of colour, hardness, streak, cleavage, lustre]<br>• [reaction with 0.5 mol $dm^{-3}$ hydrochloric acid]<br>to identify and distinguish between the minerals on the data sheet.<br><br>Interpret data from the data sheet. |

## 1.2 Igneous Rocks and Processes

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Igneous rocks have diagnostic properties; colour and texture [crystal size, equicrystalline, porphyritic and orientation].<br><br>b. Igneous rocks [peridotite, basalt, andesite, granite] can be classified by:<br>• texture<br>• mineralogy.<br><br>c. Crystal size in igneous rocks is related to the cooling rate of magma. | Identify the named igneous rocks in hand specimen/rock exposures, diagrams and photomicrographs from observation of their colour, crystal size [coarse >3 mm, fine <1mm], random crystal orientation of phenocrysts/groundmass and mineralogy. |
| d. Magma viscosity affects the type of volcanic activity and the shape of volcanoes - the differences between relatively passive [fissure] and violent eruptions [central vent]. | Recognise and interpret the differing shapes of volcanoes from diagrams/photographs.<br><br>Investigate factors affecting the length of lava flows using the 'Jelly lava flow' simulation experiment or equivalent. Factors investigated to include viscosity (related to temperature) and slope angle. |
| e. Igneous bodies can be distinguished by:<br>• structure [columnar jointing, pillow lava]<br>• form [lava flows, sills, dykes and plutons]<br>• field relationships. | Identify the characteristics of igneous bodies [crystal size, structures, field relationships] as seen in hand specimen/rock exposures, diagrams and photographs. Analyse simplified geological maps and cross-sections to interpret their contrasting modes of formation. |

## 1.3 Sedimentary Rocks and their Fossil Content

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Rock is disaggregated by weathering and erosion into particles of various sizes and dissolved materials that are transported and deposited to form new sediments. | Distinguish between the processes of weathering and erosion and evaluate their significance in the sedimentary characteristics and the geological history of sedimentary rock. |
| b. The grain size, shape and sorting of the resultant sediment is influenced by the energy of the transporting medium and the depositional environment [screes, rivers, shallow/deep seas, wind-formed dunes]. | Interpret:<br>• the distance of transport from the shape and sorting of sediment<br>• the energy level of the environment of deposition from sediment grain size. |
| c. Porosity and permeability of sedimentary rock depends upon the characteristics of the original sediment and the degree of compaction and cementation. | Distinguish permeable from impermeable rocks by observing the effects of dropping water on specimens and/or by immersing them in water. |
| d. Sedimentary rocks [breccia, conglomerate, sandstone, shale, evaporites, limestone] have diagnostic properties [colour, texture, reaction with acid] mineralogies and other diagnostic features. | Identify the named sedimentary rocks in hand specimen, rock exposures and diagrams/photographs from observation of their colour, texture [use of sediment comparators to determine grain size, shape and sphericity], [coarse >2 mm, fine $<{}^{1}/_{16}$ mm], reaction with 0.5 mol $dm^{-3}$ hydrochloric acid, mineralogy and other diagnostic features.<br><br>Construct and apply a classification system/key to identify the named sedimentary rocks. |
| e. Sedimentary rock type is dependent upon the environment of deposition:<br>• Shallow marine: [limestone, sandstone, conglomerate]<br>• Deep marine: [turbidites, black shale]<br>• Terrestrial:<br>1. deposited in rivers and deltas [shale, sandstone, conglomerate, coal]<br>2. deposited by wind and water in deserts [breccia, desert sandstone]<br>3. deposited by precipitation from saline water during evaporation [evaporites - halite and gypsum]<br>4. deposited by ice [glacial till/tillite]. | Use the characteristics of sedimentary rocks, including their distinctive sedimentary textures, structures, mineralogy and their fossil content, as seen in hand specimens, rock exposures, diagrams and photographs to interpret their environments of deposition.<br><br>Analyse sedimentary rock formations on simple geological maps, cross-sections and graphic logs to interpret geological structure and the history of sedimentation.<br><br>Construct a simple graphic log from bed thickness and grain size data. |
| f. Distinctive sedimentary structures [lamination/bedding, cross bedding, graded bedding, ripple marks, desiccation cracks] are characteristic of their environments of deposition. | |
| g. Fossils are indicators of past environments:<br>• reef-building corals [marine, shallow, warm]<br>• trilobite [marine], ammonite [marine]<br>• plants [terrestrial, indicating past climate]<br>• trace fossils [tracks indicating terrestrial, burrows indicating shallow water]. | Identify the following fossil groups on the basis of their morphology [trilobite, ammonite, coral, plants, trace fossils - burrows, footprints], as seen in hand specimens, diagrams/photographs. |

## 1.4 Metamorphic Rocks and Processes

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Metamorphic rocks are the result of increased temperature and/or pressure on pre-existing rocks causing recrystallisation to form new minerals and textures. | Identify the named metamorphic rocks in hand specimen from observation of their crystal size [coarse, fine], crystal orientation [aligned, random] and reaction with 0.5 mol $dm^{-3}$ hydrochloric acid. |
| b. Metamorphic rocks [slate, schist, marble, metaquartzite] have diagnostic textures [crystal size and orientation]:<br>• non-foliated texture<br>• foliated texture [slaty cleavage and schistosity].<br><br>c. Metamorphic rocks [schist, marble and metaquartzite] have diagnostic mineralogy. | Identify the characteristic features of a metamorphic aureole on diagrams and simplified geological maps and cross-sections.<br><br>Use the characteristics of metamorphic rocks [texture, mineralogy, acid reaction] as seen in hand specimens/rock exposures, diagrams and photographs, simplified geological maps and cross-sections to interpret their contrasting modes of formation [contact and regional metamorphism]. |

## 1.5 Deformational Structures

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. The rock record provides evidence of tectonic activity. | Describe safety precautions to be taken when visiting field exposures.<br><br>Measure strike and dip.<br><br>Analyse strike and dip measurements to describe and interpret rock structures in 3D. |
| b. Folding is caused by tectonic stress [compressional]. | Interpret characteristic features of folding in field exposures, diagrams, photographs, simplified geological maps and cross-sections:<br>• horizontal beds<br>• dipping beds<br>• folded beds [antiform, synform, axial plane trace, limb]. |
| c. Faulting is caused by tectonic stress [compressional, tensional, shear]. | Interpret features of rock deformation by faulting in field exposures, diagrams, photographs, simplified geological maps and cross sections:<br>• normal fault<br>• reverse/thrust fault<br>• strike-slip fault<br>• fault displacement. |
| d. Unconformities are gaps in the rock record. Angular unconformities are formed by a sequence of events including deformation, uplift, erosion and later deposition. | Identify unconformities in the field, in diagrams, photographs, geological maps and cross-sections. Use unconformities in interpreting the geological history of exposures. |

# Key Idea 2: Major concepts and techniques underpin our current understanding of the Earth and its history

This key idea enables candidates to demonstrate an understanding of the "big ideas" in geology. Key Idea 2 has been divided into five topics:

- The rock cycle
- Plate tectonics
- Geochronological principles
- Global climate and sea level change
- The origin and development of life on Earth.

## 2.1 The Rock Cycle

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Sedimentary, metamorphic and igneous processes and rocks are linked by the rock cycle [energy transfer] over geological time. | Interpret rock cycle diagrams. |
| b. Rock cycle processes take place at different rates, from seconds to millions of years [catastrophism v gradualism - e.g. meteorite impact v river erosion]. | Distinguish between processes reflected in the rock record that occurred at different rates. |

## 2.2 Plate Tectonics

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. The Earth has a concentric structure based on its:<br>• chemical properties [crust, mantle and core]<br>• mechanical behaviour [lithosphere, asthenosphere]. | |
| b. The mechanical behaviour of the outer Earth involves the lithosphere [cold, rigid outer shell composed of crust and uppermost mantle]. It is underlain by the asthenosphere [weaker layer composed of upper mantle]. | |
| c. The lithosphere is divided into a number of rigid 'tectonic plates' which move relative to one another by mechanisms not yet completely understood. | |
| d. With new evidence, plate tectonic theory developed from continental drift.<br>• Continental drift was proposed by Wegener (1915)<br>• Evidence for sea floor spreading was discovered by<br>Hess (1960)<br>Vine and Matthews (1963)<br>J. Tuzo Wilson (1965). | Analyse the evidence for plate tectonics [jigsaw pattern fit, fossil distributions, heat flow, magnetic stripes, age of the ocean floor, Global Positioning System (GPS) data]. |
| e. There is a range of evidence supporting the theory of plate tectonics and the direction and rate of plate movements. | Use maps to interpret the global distributions of present day earthquakes, volcanic activity and mountain belts in the context of processes at or near to plate boundaries. |

| | |
|---|---|
| f. The relative movements between plates produce a range of magmatic types, structures and topography identified at different types of plate boundary.<br>• Divergent plate boundaries [basalt extrusion, sea floor spreading, the origin of basaltic magma by partial melting of the upper mantle, ocean ridges, high heat flow, rift valleys, abyssal plain]<br>e.g. Mid-Atlantic Ridge.<br>• Conservative plate boundaries [earthquake activity, transform faults] e.g. San Andreas fault zone.<br>• Convergent plate boundaries:<br>1. oceanic-oceanic [island arc/trench systems] e.g.Java-Sumatra/Caribbean.<br>2. oceanic-continental [active continental margins; subduction zones, Benioff zone, partial melting producing andesitic and granitic magmas] e.g. the Andes.<br>3. continental-continental [mountain building, folding, thrust faulting, partial melting of the crust producing granites, associated regional metamorphism] e.g. the Himalaya.<br><br>g. Plate theory is being continually re-evaluated in the light of new evidence e.g. seismic tomography and ocean drilling - RRS James Cook, Joides Resolution 360 (2016). | Interpret the relative movement of plates from their plate boundary context shown in maps and diagrams.<br><br>Interpret the type of plate boundaries from data [magmatic, seismic and topographic] provided in text, diagrams/photographs and maps. |

## 2.3 Geochronological Principles

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Geological events are dated and interpreted using stratigraphic principles:<br>• uniformitarianism - the present is the key to the past<br>• the concepts of original horizontality, lateral continuity and superposition of strata<br>• the relative dating of rocks on the basis of included fragments, cross cutting relationships. | Investigate the link between ancient and modern processes by applying the principle of uniformitarianism.<br><br>Apply the principles of relative dating to interpret the evidence in rock exposures in the field, in diagrams/photographs and simplified maps and cross-sections for the sequence of geological events that formed/deformed them. |
| b. Rocks can be dated and correlated using the evolutionary change of zone fossils over time. | |
| c. The following zone fossil groups have morphological changes with time that are used in dating/correlation:<br>• cephalopods [goniatites, ceratites, ammonites - suture line]<br>• graptolites [stipes, thecae]. | Use the named fossils, as seen in specimens and diagrams/photographs to interpret the geological history of a rock sequence. |
| d. The decay of radioactive materials provides a method of absolute dating for some rocks and minerals. | Carry out a simple analysis of the age of a radioactive mineral based on the half-life concept [parent - daughter ratio, unstable parent, stable daughter]. |
| e. The development of the concept of *Deep Time* [Ussher (The Bible), Hutton, Kelvin, Joly and Holmes] has extended the age of the Earth back to around 4.6 billion years. | |

## 2.4 Global Climate and Sea Level Change

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. There is evidence for global climate change through geological time [icehouse to greenhouse conditions]. Deposition of glacial deposits in regions close to the equator [Carboniferous tillites], deposition of limestone in areas outside the Tropics [Cretaceous limestones/chalk]. | |
| b. There is evidence for change in the climate of the British area caused by a change in its latitude. | Interpret the evidence from hand specimens of rocks and fossils, maps, diagrams/ photographs for the changes in latitude of the British area from the Lower Palaeozoic to the Cenozoic. Interpret data from the data sheet. |
| c. There is evidence for changes in sea level [drowned forests]. | |
| d. The major sources of carbon dioxide in the atmosphere are volcanic emissions and the burning of fossil fuels. | Evaluate the relative roles of volcanic emissions and fossil fuels in current rates of climate change. |
| e. There is evidence for changes in atmospheric carbon dioxide levels over geological time [ice cores and sedimentary rock]. | |
| f. There is both positive [reduction of icecap albedo accelerating warming] and negative [carbon dioxide dissolved in sea water, absorption by organisms to form limestone] feedback on the carbon dioxide content of the atmosphere [subduction, volcanic emissions, chemical weathering and marine storage]. | |
| g. Global warming/cooling affects continental ice sheet dimensions and global sea level. | Investigate the evidence from the internet, maps and aerial images for past and current fluctuations in continental ice and the effect on global sea levels. |
| h. Carbon sequestration/capture is a geological strategy for reducing atmospheric carbon dioxide. | |

## 2.5 The Origin and Development of Life on Earth

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Life probably originated from the oceans or hydrothermal pools 3500 Ma [black smokers]. | |
| b. The development of diversity in the evolution of life [through single cells, multicellular organisms, animals with hard parts, fish, amphibians, reptiles, mammals, birds and humans] is identified from the fossil record. | Use simple evolutionary trees diagrams [cladograms] to demonstrate evolutionary trends. Interpret data from the data sheet. |
| c. The development of life on Earth was punctuated by major extinction events [Cretaceous/Palaeogene (K/Pg) mass extinction]. | |
| d. Major fossil finds show:<br>• rare and exceptional preservation [Burgess shale fauna]<br>• the links in macro fossil evolution through the morphology of modern reptiles and birds [*Archaeopteryx*]<br>• that complex fossil skeletons have to be interpreted from incomplete and disarticulated remains [dinosaurs]<br>• features of early hominids ["Lucy"]. | Evaluate the significance of the incomplete nature of the fossil record. |

## Key Idea 3: Comparisons of the Earth with other planetary bodies within the Solar System provide evidence for the origin and evolution of both

This key idea enables candidates to appreciate the links between natural processes on Earth and those on other planetary bodies within the Solar System.

### 3.1 Planetary Geology

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. There are similarities and differences between the Earth and its planetary neighbours [rocks, landscapes, atmosphere, temperature, pressure and gravity].<br><br>b. Meteorites provide evidence for the composition of the Earth.<br><br>c. The relationship between landforms and geological processes on Earth provides an analogue for interpreting landforms on planetary bodies within the Solar System.<br><br>d. Planetary landforms provide evidence for unseen Earth processes e.g. Moon impact craters.<br><br>e. Impacts from meteorites/comets may have had a significant effect on the evolution of the Earth and its biosphere. | Use the principle of uniformitarianism to interpret the geological processes operating on planetary bodies within the Solar System.<br><br>Use evidence from space imagery and other planetary exploration data [maps, diagrams/ photographs] to interpret the landforms and processes operating on planetary bodies within the Solar System<br>e.g. Moon and Mars. |

## Key Idea 4: Human interaction with the Earth can increase or reduce risk

This key idea enables candidates to appreciate the cause and effect of human interactions with the natural environment. Key Idea 4 has been divided into two topics:

- Earth hazards and their mitigation
- Earth resources and engineering.

## 4.1 Earth Hazards and their Mitigation

| Knowledge and understanding | Geological techniques and skills |
|---|---|
| a. Geological events can be hazardous:<br>• earthquakes [shaking triggering landslides]<br>• volcanic eruptions [lava, ash, pyroclastic and mud flows]<br>• landslides [and related subsidence]<br>• tsunamis. | Investigate and interpret geological data relating to the distribution, measurement and possible causes of earthquakes, volcanic eruptions, landslides and associated tsunamis. |
| b. The level of risk of a hazard is associated with life and property and relates to:<br>• population density<br>• technology [buildings]<br>• development [economic situation, education, communication]. | Use examples to contrast the risk of naturally occurring hazards in areas of contrasting development - LEDC and MEDC. |
| c. The level of accuracy of hazard prediction is limited. | |
| d. The methods of reducing risk include:<br>• building design and regulation<br>• prediction<br>1. hazard interval patterns [seismic gaps]<br>2. ground deformation [tiltmeters]<br>3. groundwater changes<br>4. gas emissions<br>• warning schemes and evacuation. | |

| 4.2 Earth Resources and Engineering | |
|---|---|
| **Knowledge and understanding** | **Geological techniques and skills** |
| a. There is a distinction between Earth's:<br>• resources - naturally occurring useful substances<br>• reserves of a resource - the calculated amount that is economic to extract. | |
| b. Mineral resources are important in construction, industrial manufacturing and energy generation. | Investigate the uses of the following minerals<br>• [Limestone for aggregate in construction<br>• Haematite in the steel industry<br>• Uranium in energy generation]. |
| c. Geologists prospecting for new reserves use a variety of techniques:<br>• geological mapping<br>• borehole correlation [using microfossils]<br>• geophysical [seismic, magnetic and ground penetrating radar]<br>• geochemical [soil and river sediment analysis]. | Interpret prospecting data [geological mapping, geophysical, geochemical] to identify possible valuable mineral resources. |
| d. There are characteristic structures and rock properties associated with the migration and accumulation of oil and gas in potential on-shore and off-shore gas/oilfield resources:<br>• source rock<br>• contrasting porosity and permeability of reservoir and cap rocks<br>• the main types of trap for oil and gas [anticline, fault, unconformity, salt dome]. | Interpret data from maps, cross-sections and seismic surveys to identify possible gas/oilfields. |
| e. There are technological difficulties and environmental issues involved in exploring for and extracting oil and natural gas [including fracking]. | |
| f. Factors affecting the extraction of underground water from aquifers include:<br>• height of the water table<br>• porosity/permeability of the aquifer<br>• the presence of natural springs<br>• the distribution of wells. | Analyse different rock types for their suitability as an aquifer. |
| g. The impact of domestic and hazardous waste disposal on vulnerable aquifers depends upon:<br>• geological factors [permeability]<br>• engineering factors [geomembranes]<br>• monitoring of potentially polluted water<br>• restoration of contaminated ground. | Use data from descriptions, diagrams/photographs, maps and cross-sections to:<br>• investigate the suitability of a potential landfill site for the disposal of domestic waste.<br>• investigate the suitability of a potential site for the long term storage of hazardous waste. |
| h. Geological factors affect the siting of engineering projects e.g. reservoirs, dams, tunnels and cuttings [permeability, stability of bedrock, dip of strata, the presence of faults and joints]. | Use data from descriptions, diagrams/photographs, maps and cross-sections to investigate the geological factors affecting the siting of major engineering projects. |

# 3 ASSESSMENT

## 3.1 Assessment objectives and weightings

Below are the assessment objectives for this specification. Learners must:

**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 and draw conclusions.

The table below shows the weighting of each assessment objective for each component and for the qualification as a whole.

| | AO1 | AO2 | AO3 | Total |
|---|---|---|---|---|
| **Component 1** | 24% | 17% | 9% | 50% |
| **Component 2** | 16% | 23% | 11% | 50% |
| **Overall weighting** | 40% | 40% | 20% | 100% |

For each series:

- the weighting for the assessment of mathematical skills (see Appendix A) will be at least 10%
- the weighting for the assessment of practical skills and techniques (see Appendix B) will be at least 15%.

Learners will be expected to provide extended responses which are of sufficient length to allow them to demonstrate their ability to construct and develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

# 4 TECHNICAL INFORMATION

## 4.1 Making entries

This is a linear qualification in which all assessments must be taken at the end of the course. Assessment opportunities will be available in May/June each year, until the end of the life of this specification. Summer 2019 will be the first assessment opportunity.

A qualification may be taken more than once. Candidates must resit all examination components in the same series.

The entry code appears below.

WJEC Eduqas GCSE Geology: C480P2

The current edition of our *Entry Procedures and Coding Information* gives up-to-date entry procedures.

## 4.2 Grading, awarding and reporting

GCSE qualifications are reported on a nine point scale from 1 to 9, where 9 is the highest grade. Results not attaining the minimum standard for the award will be reported as U (unclassified).

# APPENDIX A

**Use of mathematical skills in GCSE Geology**

The list below outlines the range and extent of mathematical skills required by WJEC Eduqas GCSE Geology. The exemplifications are to aid understanding and to suggest range. Learners will be expected to apply mathematical skills in familiar and novel contexts.

| Mathematical skill | Exemplification |
|---|---|
| **Arithmetic and numerical computation** | |
| Recognise and use expressions in decimal form | |
| Recognise and use expressions in standard form | |
| Use ratios, fractions and percentages | Calculate the ratio of ore minerals to gangue minerals in an ore body<br><br>Use the scale x ½ on a diagram<br><br>Calculate the percentage of calcium carbonate in a sand deposit |
| Calculate squares and square roots | Calculate the area of a square portion of a photograph of the surface of the moon<br><br>Calculate the length of an edge of a square map of known area |
| **Handling data** | |
| Use an appropriate number of significant figures | Express answers to the same number of significant figures as the values involved in the calculation e.g. 5.71 x 1.26 = 7.19<br><br>Express answers to the lowest number of significant figures if the values involved have different number of significant figures e.g. 5.7 x 1.26 = 7.2 |
| Find arithmetic means | Calculate the mean clast size in a gravel deposit<br><br>Calculate the mean crystal size in a granite specimen<br><br>Calculate the mean spreading rate at an oceanic ridge |

| | |
|---|---|
| Construct and interpret frequency tables, bar charts and rose diagrams | Construct a frequency table of sand grain shape in a sand sample<br><br>Construct and interpret a bar chart of grain composition in a sediment<br><br>Construct and interpret a rose diagram of direction of dip of cross bedding |
| Understand the principles of sampling as applied to geological data | Use a transect for data collection for pebbles on a beach |
| Use a scatter diagram to identify correlation between two variables | Correlation between mean groundmass crystal size and distance from the edge of a pluton |
| Make order of magnitude calculations | |
| **Algebra** | |
| Understand and use the symbols: =, <, <<, >>, >, ∝, ~ | |
| Change the subject of an equation | Re-arrange mass, volume and density values |
| Substitute numerical values into algebraic equations using appropriate units for physical quantities | Use $d = \frac{m}{v}$ |
| Solve simple algebraic equations | |
| **Graphs** | |
| Translate information between graphical and numeric form | Record values off line graphs, bar graphs |
| Plot two variables from experimental or other data | Plot $CO_2$ concentration against time for Quaternary ice core data<br><br>Plot heat flow against distance from an ocean ridge |
| Draw an appropriate trend line onto plotted data | Plot a line of best fit for crystal size and distance from the edge of an intrusion |
| Interpret data presented in graphical form | Interpret sorting from bar graphs of sieved sand data<br><br>Interpret a rose diagram showing the orientation of cross bedding dip direction for an area of Mars |
| Determine the slope of a graph | Calculate the gradient of a graph showing the age of the ocean lithosphere and distance from the ocean ridge |
| Calculate the rate of change from a graph showing a linear relationship | Calculate the rate of sea floor spreading<br><br>Calculate the rate of movement of a continent<br><br>Calculate the cooling rate of a lava flow |

| | |
|---|---|
| Draw and use the slope of a tangent to a curve as a measure of rate of change | Calculate the rate of change of $CO_2$ concentration in ice cores |
| **Geometry and trigonometry** | |
| Use angular measures in degrees | Record dip angle and dip direction of bedding planes |
| Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects | Draw labelled diagrams of fossils<br><br>Construct a geological map<br><br>Construct a geological cross-section |
| Calculate areas of triangles and rectangles, surface areas and volumes of cubes. | Calculate the area of a triangular and rectangular coalfields on a map<br><br>Calculate surface area of a cubic sample of rock<br><br>Calculate the volume of a cubic mineral deposit |

# APPENDIX B

**Practical skills and techniques in GCSE Geology**

The list below outlines the range of practical skills and techniques required by WJEC Eduqas GCSE Geology. These should be developed through regular hands-on practical activities undertaken in the classroom and in the field.

The following practical skills and techniques will be assessed in the components.

| Practical Skills and techniques | Exemplification |
|---|---|
| Recording observations | Record observations of features of folds in the field<br><br>Record observations of sedimentary structures from images from Mars<br><br>Record observations of features of hand specimens of igneous rocks |
| Use of photomicrographs to identify minerals and rock textures | Use photomicrographs to identify minerals and rock textures of igneous, sedimentary and metamorphic rocks |
| Constructing graphic logs | Construct a graphic log of a sequence of sedimentary rocks at a field exposure |
| Applying classification systems | Apply a classification system /key to identify sedimentary rocks |
| Producing annotated scientific drawings | Produce annotated field sketches<br><br>Produce annotated drawings of fossils<br><br>Produce annotated drawings of an igneous rock |
| Constructing geological maps | Complete a partially constructed geological map using a written description of the geology of the map area |
| Constructing geological histories | Construct a geological history of a small area in the field<br><br>Construct a geological history of the area shown on a geological map |

Knowledge and understanding of the following practical skills and techniques will be assessed in the components**.**

| Knowledge and understanding of practical skills and techniques | Exemplification |
|---|---|
| Location of geological features in the field using traditional navigation and basic field survey skills, and with the use of GPS | Locate geological features onto a base map<br><br>Locate geological features in the field using six figure grid references<br><br>Use GPS to locate geological features in the field |
| Identification of geological structures in the field | Identify folds, faults or sedimentary structures in the field |
| Measurement of two and three-dimensional geological data across a range of scales such as dip and strike of planar surfaces or apparent dip of fold limbs at a field exposure using a compass clinometer | Measure dip and strike elements: dip angle, dip and strike directions of a bedding plane or fault at a field exposure using a compass clinometer |
| Sampling | Use sampling along a transect for data collection for graphic log construction |
| Production of full rock description of macro and micro features from conserved hand specimens and unfamiliar field exposures | Produce a full rock description of a sedimentary rock in the field<br><br>Produce a full rock description of a metamorphic rock from a hand specimen |
| Use of appropriate apparatus to record a range of quantitative measurements (mass, time, volume, temperature and length) | Investigate factors affecting the length of lava flows using the 'Jelly lava flow' simulation experiment or equivalent<br><br>Investigate the porosity of rocks using immersion in water |
| Use of physical and chemical testing to identify minerals:<br>• density test<br>• Mohs' hardness test | Use density to distinguish between quartz and galena by hefting of hand specimens<br><br>Use a finger nail, copper coin, and steel pin to distinguish the relative hardness, on Mohs' hardness scale, of the range of minerals named in Key Idea 1.1 |
| Use of accuracy of measurements, such as timing over multiple observations, or use of a set square or plumb line | Investigate factors affecting the length of lava flows using the 'Jelly lava flow' simulation experiment or equivalent |
| Compilation and analysis of geological data sets through to visualization using a geographic information system (GIS) | Assess the suitability of a location for a civil engineering project using a range of data e.g. from the British Geological Survey website, Environment Agency website |
| Use of information and communications technology (ICT) such as computer modelling, or data logger to collect data, or use of software to process data | Use software to plot and analyse the results of the 'Jelly lava flow' simulation experiment or equivalent |