



Key Skills – GCE AS/A Level Science

This Appendix offers detailed guidance on the Key Skills evidence that a candidate might produce during their programme. It focuses on the evidence required to meet the criteria for the internally assessed Key Skills portfolio. For example, in producing work for assessment as evidence of C3.2 (Read and synthesise information from two extended documents about a complex subject. One of these documents should include at least one image.) a candidate is required to:

- select and read material that contains the information you need;
- identify accurately, and compare, the lines of reasoning and main points from text and images; and
- synthesise the key information in a form that is relevant to your purpose.

The Key Skills and Evidence Requirements below are quoted from Part B of the QCA Key Skills specifications and, as such, are addressed to the candidate. The text below the Evidence Requirements is guidance for teachers about how the specifications might be used to provide teaching and learning opportunities and/or assessment opportunities for the Key Skill.

For further information, teachers should refer to QCA's Key Skills specifications (for use in programmes starting from September 2000).

For further information about the assessment and certification of Key Skills, teachers should contact OCR.

C3 Communication Level 3

C3.1a *Contribute to a group discussion about a complex subject.*

Evidence requirements

- i. Make clear and relevant contributions in a way that suits your purpose and situation.
- ii. Listen and respond sensitively to others, and develop points and ideas.
- iii. Create opportunities for others to contribute when appropriate.

Possible opportunities

The ability to take part in discussions with others is an important aspect of becoming better scientifically informed about situations that may arise throughout candidates' lives. Numerous opportunities for such discussion arise within this specification. These opportunities could be used for developing or producing evidence of achievement of this Key Skill.

Module 2841

Candidates can contribute to a group discussion about the following topics related to learning outcomes in Module 2841 of this specification:

- the value of different models for the structure of the atom in explaining different phenomena (5.1.2(i));
- the effect of deforestation of tropical rain forest ecosystems (5.1.4(d)).

Module 2842

Candidates can contribute to a group discussion about the following topics related to learning outcomes in Module 2842:

- the relative responsibilities of consumers and manufacturing companies for damage caused by acid deposition (5.2.2(g));
- the classification of different kinds of technological networks (5.2.3(n));

Module 2844

Candidates can contribute to a group discussion about the following topics related to learning outcomes in Module 2844:

- the use of gene transfer techniques in plants: e.g., as a member of a consensus conference (5.4.3(e));
- the measures that could be taken (e.g., by a regional authority) to reduce phosphorus levels in water sources (5.4.5(e)).

Module 2846, Component 1

Candidates can contribute to a group discussion about the following topics related to learning outcomes in Module 2846, Component 1:

- the links between scientific knowledge, observation and experiment: e.g., with respect to plate tectonic theory (5.6.2 (k), (l) & (m));
- the occurrence and significance of El Niño events (5.6.4(e)).

C3.1b Make a presentation about a complex subject, using at least one image to illustrate complex points.

Evidence requirements

- i. Speak clearly and adapt your style of presentation to suit your purpose, subject, audience and situation.
- ii. Structure what you say so that the sequence of information and ideas may be easily followed.
- iii. Use a range of techniques to engage the audience, including effective use of images.

Possible opportunities

This specification presents science in context. Numerous opportunities arise for candidates to make presentations both about science and about aspects of a related context. These opportunities could be used to develop or to produce evidence of achievement of this Key Skill.

Module 2841

Candidates can make a presentation about the following topics related to learning outcomes in Module 2841:

- the hazards associated with radioactive sources (5.1.2(e));
- one aspect of steady states and feedback (e.g., the effect on global temperatures of increased cloud cover resulting from increased human activity) (5.1.4(a));
- the structure of a tropical rain forest and some of the food chains found there (5.1.5(b)).

Module 2844

Candidates can make a presentation about the following topic related to learning outcomes in Module 2844:

- agriculture in Pakistan (5.4.2(a)).

Module 2846, Component 1

Candidates can make a presentation about the following topic related to learning outcomes in Module 2846, Component 1:

- the relationship between the bonding, structure, properties and uses of a particular material (5.6.3(j)).

C3.2 Read and synthesise information from two extended documents that deal with a complex subject. One of these documents should include at least one image.

Evidence requirements

- i. Select and read material that contains the information you need.
- ii. Identify accurately, and compare, the lines of reasoning and main points from texts and images.
- iii. Synthesise the key information in a form that is relevant to your purpose.

Possible opportunities

An important aspect of a course in science for non-specialists is that candidates should gain sufficient confidence in finding out scientific information for themselves to be able to carry on doing this throughout their lives. Opportunities arise from these specifications for candidates to develop or to produce evidence of achievement of this Key Skill.

Module 2841

Candidates can read and synthesise information about the following topics related to learning outcomes in Module 2841:

- hazards associated with radioactive sources (5.1.2(e));
- the development of the theory of atomic structure (5.1.2(i));
- the importance of steady states and feedback in an environmental system (5.1.4(a));

Module 2842

Candidates can read and synthesise information about the following topics related to learning outcomes in Module 2842:

- acid deposition and lake damage in north-eastern USA (5.2.1(l));
- applications of ion exchange (e.g. in water softeners) (5.2.2(f));
- the possible effects on health of power frequency fields (5.2.3(j));
- factors important to the design of a chemical plant (5.2.4(f));
- the use of catalysts in industrial processes (5.2.4(g)).

Module 2844

Candidates can read and synthesise information about the following topics related to learning outcomes in Module 2844:

- different desalination techniques and/or sources and methods of treatment of their own water supply (5.4.4(o));
- different types of algal blooms and bloom-forming organisms (5.4.5(d)).

Module 2846, Component 1

Candidates can read and synthesise information about the following topics related to learning outcomes in Module 2846, Component 1:

- the ways in which time has been measured throughout history (5.6.1(g));
- the surveying techniques that led to the development of plate tectonic theory (e.g., from extracts from original papers) (5.6.2(h)).

C3.3 Write two different, types of documents about complex subjects. One piece of writing should be an extended document and include at least one image.

Evidence requirements

- i. Select and use a form and style of writing that is appropriate to your purpose and complex subject matter.
- ii. Organise relevant information clearly and coherently, using specialist vocabulary when appropriate.
- iii. Ensure your text is legible and your spelling, grammar and punctuation are accurate so your meaning is clear.

Possible opportunities

An important aim of this specification is that candidates should be able to write clearly and accurately about scientific topics. Unit 2846, Component 1 assesses this ability specifically. Opportunities for candidates to practise written communication should be an important feature of their study. These opportunities could be used to develop or to produce evidence of achievement of this Key Skill.

Module 2841

Candidates can write about the following topics which relate to learning outcomes in Module 2841:

- the uses of different types of em radiation in remote sensing (5.1.1(i) & (j));
- one aspect of the development of atomic theory (5.1.2(i));
- a summary of their understanding of an ecosystem, as part of a display (5.1.3(d));
- the importance of steady state and feedback in an environmental system (5.1.4(a));
- the effects of deforestation on a tropical rain forest ecosystem (5.1.4(d));
- the structure of a tropical rain forest (5.1.6(b)).

Module 2842

Candidates can write about the following topic which relates to learning outcomes in Module 2842:

- the sources and control of acid deposition (5.2.2(g));

Module 2844

Candidates can write about the following topic which relates to learning outcomes in Module 2844:

- eutrophication, as an illustrated text suitable for use by a particular audience: e.g., teachers of science or geography (5.4.5(e)).

Module 2846, Component 1

Candidates can write about the following topics which relate to learning outcomes in Module 2846, Component 1:

- natural phenomena that display simple harmonic motion, as an illustrated account (5.6.1(h));
- water in the natural world, as suitable text to accompany images (5.6.4(a)).

N3 Application of Number Level 3

You must:

Plan and carry through at least one substantial and complex activity that includes tasks for N3.1, N3.2 and N3.3

N3.1 *Plan, and interpret information from two different types of sources, including a large data set.*

Evidence requirements

- i. Plan how to obtain and use the information required to meet the purpose of your activity.
- ii. Obtain the relevant information.
- iii. Choose appropriate methods for obtaining the results you need and justify your choice.

Possible opportunities

Opportunities exist throughout all modules for candidates to gain experience of aspects of planning and carrying out numerical activities: e.g., working with a large dataset, making observations, using graphs, tables and charts, working with very large and very small numbers and using compound units.

Modules 2843, Component 2 and 2846, Component 2

It is likely that only Modules 2843, Component 2 and 2846, Component 2, which are concerned with experimental and investigative skills, will yield evidence of all aspects of all Evidence requirements for Application of Number.

N3.2 *Carry out multi-stage calculations to do with:*

- (a) amounts and sizes;
- (b) scales and proportion;
- (c) handling statistics;
- (d) rearranging and using formulae.

You should work with a large data set on at least **one** occasion.

Evidence requirements

- i. Carry out calculations to appropriate levels of accuracy, clearly showing your methods.
- ii. Check methods and results to help ensure errors are found and corrected.

Possible opportunities

Opportunities exist throughout all modules for candidates to gain experience of carrying out calculations: e.g., using powers and roots, using proportions and scaling, applying statistical techniques and rearranging and using formulae.

Modules 2843, Component 2 and 2846, Component 2

It is likely that only Modules 2843, Component 2 and 2846, Component 2, which are concerned with experimental and investigative skills, will yield evidence of all aspects of all evidence requirements for Application of Number.

N3.3 *Interpret results of your calculations, present your findings and justify your methods. You must use at least one graph, one chart and one diagram.*

Evidence requirements

- i. Select appropriate methods of presentation and justify your choice.
- ii. Present your findings effectively.
- iii. Explain how the results of your calculations relate to the purpose of your activity.

Possible opportunities

Opportunities exist throughout all modules for candidates to interpret results of calculations.

Modules 2843, Component 2 and 2846, Component 2

It is likely that only Modules 2843, Component 2 and 2846, Component 2, which are concerned with experimental and investigative skills, will yield evidence of all aspects of all evidence requirements for Application of Number.

IT3 IT Level 3

You must:

Plan and carry through at least one substantial activity that includes tasks for IT3.1, IT3.2 and IT3.3.

IT3.1 *Plan, and use different sources to search for, and select, information required for two different purposes.*

Evidence requirements

- i. Plan how to obtain and use the information required to meet the purpose of your activity.
- ii. Choose appropriate sources and techniques for finding information and carry out effective searches.
- iii. Make selections based on judgements of relevance and quality.

Possible opportunities

It is the intention that the scientific ideas outlined in these specifications be introduced through environmental contexts. A good deal of information about environmental topics is available on the Internet and on CD rom, and candidates should be encouraged to use IT when appropriate to search for and select relevant information for use in their study. The activities signposted below can provide candidates with opportunities to develop this Key Skill.

Module 2841

Candidates can search for and select information about the following topics related to learning outcomes in Module 2841:

- satellites in current use (5.1.1(j));
- hazards associated with ionising radiation: e.g., as presented by different interest groups (5.1.2(e));
- deforestation of tropical rain forests (5.1.4(d)).

Module 2842

Candidates can search for and select information about the following topics related to learning outcomes in Module 2842:

- land degradation, including desertification (5.2.1(l));
- acid deposition (5.2.2(g));
- emissions statistics and environmental burdens of a chemical manufacturing process (5.2.4(h)).

Module 2844

Candidates can search for and select information about the following topics related to learning outcomes in Module 2844:

- the Irish Potato Famine: contemporary news coverage, statistics of social consequences, etc, (5.4.1(d & e));
- crops grown in the UK and changes in land use over time (5.4.2(a)).

Module 2846, Component 1

Candidates can search for and select information about the following topic related to learning outcomes in Module 2846, Component 1:

- El Niño events (5.6.4(e)).

IT3.2 *Explore, develop, and exchange information and derive new information to meet two different purposes.*

Evidence requirements

- i. Enter and bring together information in a consistent form, using automated routines where appropriate.
- ii. Create and use appropriate structures and procedures to explore and develop information and derive new information.
- iii. Use effective methods of exchanging information to support your purpose.

Possible opportunities

The opportunities signposted could be used to develop skills at processing information.

Module 2841

Candidates can process information about the following topics related to learning outcomes in Module 2841:

- specialist remote sensing terms (e.g., involving the use of a database) which can be updated during candidates' study of this topic (5.1.1(j));
- the energy budget of an individual organism (e.g., a lion) (e.g., involving the use of a spreadsheet) (5.1.3(k));
- deforestation of tropical rain forests (5.1.4 (d)).

Module 2842

Candidates can process information about the following topic related to learning outcomes in Module 2842:

- acid deposition (e.g., including the use of a spreadsheet) (5.2.2(h)).

Module 2843, Component 2

It is likely that experimental activities and investigation will provide opportunities to develop skills in the processing of information.

Module 2844

Candidates can process information about the following topic related to learning outcomes in Module 2844:

- the water balance of a particular area or areas (e.g., where rainfall levels and water use by tourists are ill matched) (5.4.4(s)).

Module 2846, Component 2

It is likely that experimental activities and investigation will provide opportunities to develop skills in the processing of information.

IT3.3 *Present information from different sources for two different purposes and audiences. Your work must include at least one example of text, one example of images and one example of numbers.*

Evidence requirements

- i. Develop the structure and content of your presentation using the views of others, where appropriate, to guide refinements.
- ii. Present information effectively, using a format and style that suits your purpose and audience.
- iii. Ensure your work is accurate and makes sense.

Possible opportunities

A number of opportunities to develop the skill of using IT to present information arise in the use of this specification. Examples have been selected that are capable of generating text, images and numbers, if required.

Module 2841

Candidates can present information about the following topic which relates to learning outcomes in Module 2841:

- the effects of deforestation on a tropical rain forest ecosystem (5.1.4(d)).

Module 2842

Candidates can present information about the following topic, which relates to learning outcomes in Module 2842:

- sources and control of acid deposition (5.2.2(g)).

Module 2843, Component 2

It is likely that experimental activities and investigation will provide opportunities to develop skills in the presentation of information.

Module 2844

Candidates can present information about the following topics which relate to learning outcomes in Module 2844:

- changes in land use over time in a particular area, for presentation as an article (5.4.2(a));
- eutrophication, for presentation as an illustrated newspaper feature (5.4.5(e)).

Module 2846, Component 1

Candidates can present information about the following topic which relates to learning outcomes in Module 2846, Component 1:

- natural phenomena that display simple harmonic motion (e.g., tide height, length of daylight hours) (5.6.1(h)).

Module 2846, Component 2

It is likely that experimental activities and investigation will provide opportunities to develop skills in the presentation of information.

IT3.1, 3.2 & 3.3

Possible opportunities to plan and carry through a substantial activity that includes tasks for IT3.1, IT3.2 and IT3.3.

The following opportunities exist for candidates to provide evidence of the above.

Module 2841

- deforestation of tropical rain forests, its extent and effects on the rain forest ecosystems (5.1.4(d)).

Module 2842

- acid deposition: causes and effects, sources and control (5.2.2(g & h)).

WO3 Working with Others Level 3

You must:

Provide at least one substantial example of meeting the standard for WO3.1, WO3.2 and WO3.3 (you must show you can work in both one-to-one and group situations).

WO3.1 Plan complex work with others, agreeing objectives, responsibilities and working arrangements.

Evidence requirements

- i. Agree realistic objectives for working together and what needs to be done to achieve them.
- ii. Exchange information, based on appropriate evidence, to help agree responsibilities.
- iii. Agree suitable working arrangements with those involved.

Possible opportunities

See WO3.3.

WO3.2 Seek to establish and maintain co-operative working relationships over an extended period of time, agreeing changes to achieve agreed objectives.

Evidence requirements

- i. Organise and carry out tasks so that you can be effective and efficient in meeting your responsibilities and produce the quality of work required.
- ii. Seek to establish and maintain co-operative working relationships, agreeing ways to overcome any difficulties.
- iii. Exchange accurate information on progress of work, agreeing changes where necessary to achieve objectives.

Possible opportunities

See WO3.3.

WO3.3 Review work with others and agree ways of improving collaborative work in the future.

Evidence requirements

- i. Agree the extent to which work with others has been successful and the objectives have been met.
- ii. Identify factors that have influenced the outcome.
- iii. Agree ways of improving work with others in the future.

Possible opportunities

A number of opportunities arise for candidates to follow through and provide evidence of a substantial activity that includes tasks for WO3.1, WO3.2 and WO3.3.

Module 2841

Candidates can work with others on the following topics relating to learning outcomes in Module 2841:

- the design and possible production of a video about colour (5.1.1(f));
- the production of a display about an ecosystem (5.1.3(d)).

Module 2844

Candidates can work with others on the following topic relating to learning outcomes in Module 2844:

- organising a mock consensus conference: e.g. on the use of gene transfer techniques in plants (5.4.3(e)).

Module 2846, Component 1

Candidates can work with others on the following topic relating to learning outcomes in Module 2846, Component 1:

- organising and carrying out the re-enactment of an original conference on continental drift (5.6.2(g)).

LP3 Improving Own Learning and Performance Level 3

You must:

Provide at least **one** substantial example of meeting the standard for LP3.1, LP3.2 and LP3.3.

LP3.1 *Agree targets and plan how these will be met over an extended period of time, using support from appropriate people.*

Evidence requirements

- i. Seek information on ways to achieve what you want to do, and identify factors that might affect your plans.
- ii. Use this information to agree realistic targets with appropriate people.
- iii. Plan how you will effectively manage your time and use of support to meet targets, including alternative action for overcoming possible difficulties.

Possible opportunities

Opportunities arise with each sub-section of Modules 2841, 2842, 2844 and 2846, Component 1 for candidates to agree targets and plan action.

Modules 2841, 2842, 2844 and 2846, Component 1

Each Module can be supported by two packs of *Science in the Environment* materials. These materials are designed specifically to help students improve their own learning and to facilitate teachers in assisting this process. Each pack of materials contains a map of available learning activities and a list of learning outcomes. Candidates are encouraged to negotiate with their teachers a plan of study; this can be tailored to suit an individual candidate's needs or preferences if wished.

LP3.2 *Take responsibility for your learning by using your plan, and seeking feedback and support from relevant sources, to help meet targets.*

Improve your performance by:

- • studying a complex subject;
- • learning through a complex practical activity;
- • further study or practical activity that involves independent learning.

Evidence requirements

- i. Manage your time effectively to complete tasks, revising your plan as necessary.
- ii. Seek and actively use feedback and support from relevant sources to help you meet your targets.
- iii. Select and use different ways of learning to improve your performance, adapting approaches to meet new demands.

Possible opportunities

Opportunities arise with each sub-section of Modules 2841, 2842, 2844 and 2846, Component 1 for candidates to use plans, feedback and support to meet targets, and to use different ways of learning.

Modules 2841, 2842, 2844 and 2846, Component 1

Each Module can be supported by two packs of *Science in the Environment* materials. These materials are designed specifically to help students improve their own learning and to facilitate teachers in assisting this process. Each pack of materials contains activities which include questions and tasks, as well as opportunities for feedback from teachers and peers. Thus candidates are assisted in meeting learning targets. The activities involve different styles of learning and are designed to be used flexibly to suit the particular needs of candidates.

LP3.3 *Review progress on two occasions and establish evidence of achievements, including how you have used learning from other tasks to meet new demands.*

Evidence requirements

- i. Provide information on the quality of your learning and performance, including factors that have affected the outcome.
- ii. Identify targets you have met, seeking information from relevant sources to establish evidence of your achievements.
- iii. Exchange views with appropriate people to agree ways to further improve your performance.

Possible opportunities

Opportunities arise with each sub-section of Modules 2841, 2842, 2844 and 2846, Component 1 for candidates to review progress and establish evidence of their achievements.

Modules 2841, 2842, 2844 and 2846, Component 1

Each Module can be supported by two packs of *Science in the Environment* materials. These materials are designed specifically to help students improve their own learning and to facilitate teachers in assisting this process. Each pack of materials contains summaries of targets that should have been reached and answers to questions and tasks. Candidates are encouraged to discuss the quality of their learning and performance with their teachers and to agree what further action is required.

PS3 Problem Solving Level 3

You must:

Provide at least one substantial example of meeting the standard for PS3.1, PS3.2 and PS3.3.

PS3.1 *Explore a complex problem, come up with three options for solving it and justify the option selected for taking further.*

Evidence requirements

- i. Explore the problem, accurately analysing its features, and agree with others on how to show success in solving it.
- ii. Select and use a variety of methods to come up with different ways of tackling the problem.
- iii. Compare the main features of each possible option, including risk factors, and justify the option you select to take forward.

Possible opportunities

See PS3.3.

PS3.2 *Plan and implement at least one option for solving the problem, review progress and revise your approach as necessary.*

Evidence requirements

- i. Plan how to carry out your chosen option and obtain agreement to go ahead from an appropriate person.
- ii. Implement your plan, effectively using support and feedback from others.
- iii. Review progress towards solving the problem and revise your approach as necessary.

Possible opportunities

See PS3.3.

PS3.3 *Apply agreed methods to check if the problem has been solved, describe the results and review your approach to problem solving.*

Evidence requirements

- i. Agree, with an appropriate person, methods to check if the problem has been solved.
- ii. Apply these methods accurately, draw conclusions and fully describe the results.
- iii. Review your approach to problem solving, including whether alternative methods and options might have proved more effective.

Possible opportunities

Opportunities arise for candidates to follow through and produce evidence of a complex activity which includes tasks for PS3.1, PS3.2 and PS3.3.

Module 2841

Candidates can engage in problem solving with regard to the following situations relating to learning outcomes in Module 2841:

- how best to present appropriate information about the em spectrum for a non-scientist user (e.g., a geographer) (5.1.1(d) & (e));
- how to produce a video about colour (5.1.1(f)).

Module 2844

Candidates can engage in problem solving with regard to the following situation relating to learning outcomes in Module 2844:

- how to design, in outline, a new domestic laundry system which places a reduced burden on the environment (5.4.5(f)).