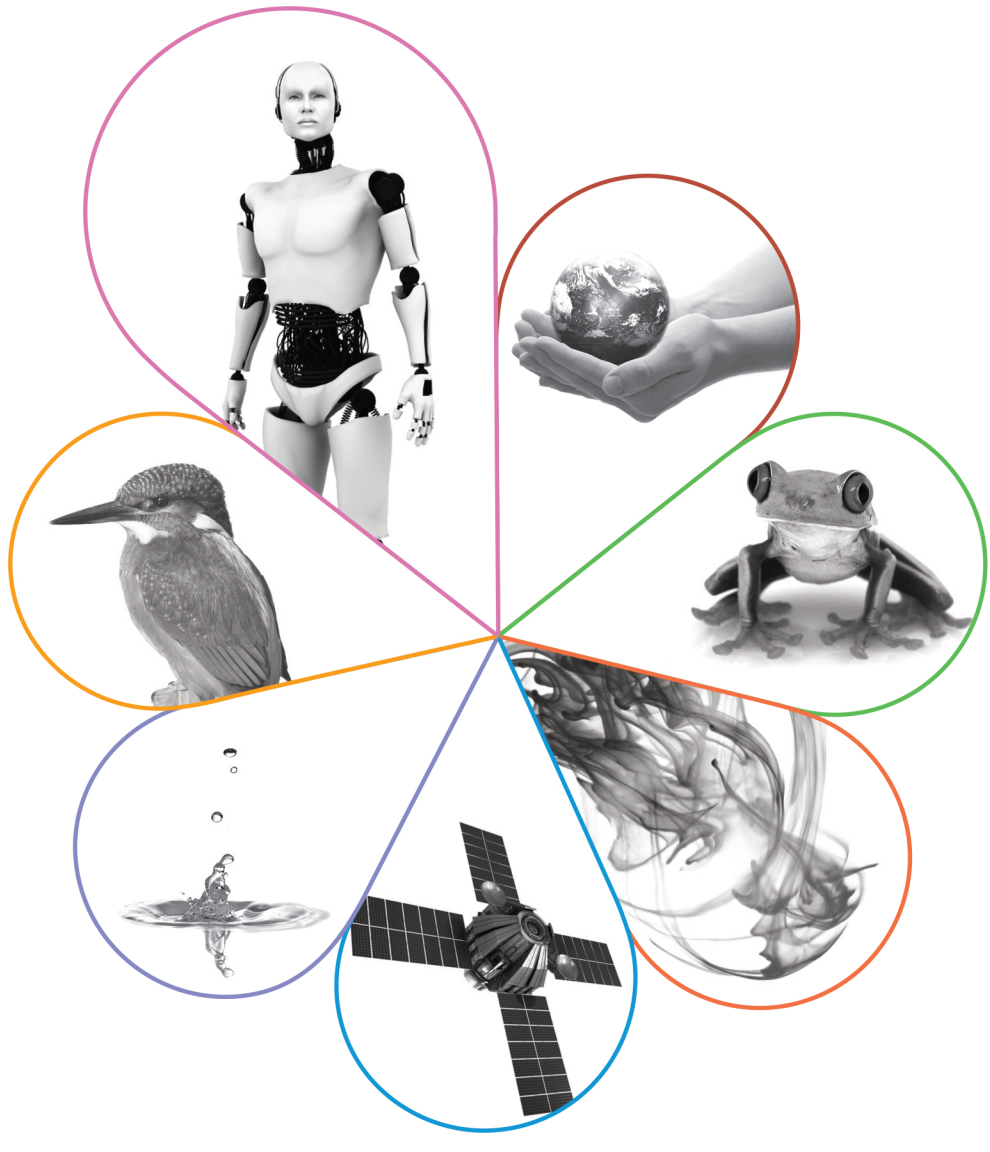
AQA
Realising potential

LEVEL 1/2 AWARD STEM
(3765)

SPECIFICATION
For teaching from September 2017 onwards
For Level 1/2 Award exams in 2019 onwards

Version 1.0 3 November 2017



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Are you using the latest version of this specification?

- You will always find the most up-to-date version of this specification on our website at aqa.org.uk/3765
- We will write to you if there are significant changes to the specification.

1 Introduction

1.1 About this qualification

Our Level 1/2 Awards in non-EBacc subjects are ideally suited to learners with a preference for practical, in addition to, theoretical learning. Many of them are tailored towards specific career areas and all have a focus on creativity.

These vocational qualifications fulfil entry requirements for academic and vocational study post-16, and will count as equivalent to one GCSE in the Key Stage 4 performance tables.

1.1.1 Who is this Level 1/2 Award in STEM for?

This qualification is for learners aged 14–16 years old who wish to study STEM in a multidisciplinary manner. They will learn in a way that integrates the different theories of Science, Technology, Engineering and Maths and be assessed in ways that are practical and relevant to STEM industries.

The STEM Level 1/2 Award will appeal to learners who have a particular interest in STEM-related careers and wish to enhance their choice of qualifications.

1.1.2 What will learners study?

Learners complete three mandatory units (one externally assessed and two internally assessed) across 120 guided learning hours.

- Unit 1: STEM in industry – Research task (learners will gain a broad experience of five key STEM industries, carry out research into a given area and present their findings).
- Unit 2: Creating a STEM product or service (learners will embark on a project utilising the Fixperts© process – they can use an existing contact within the community or use AQA's set of resources produced in collaboration with Fixperts©).
- Unit 3: Fundamentals of STEM (completion of this unit will provide learners with the underpinning knowledge and understanding of what STEM is and how it drives the development of products and services in industry).

1.1.3 Will the knowledge and skills developed be useful for further studies?

This Level 1/2 Award in STEM gives learners a whole host of technical transferable skills. They include:

- application of iterative processes
- prototype design and manufacture
- scientific enquiries
- analysis and evaluation
- end-user requirements
- mathematical principles
- the theory of deconstruction to reconstruct.

The knowledge and skills gained from the STEM Level 1/2 Award will help to develop transferable skills that will be useful in subjects such as Science, Technology, Engineering and Maths. These skills include communication, problem solving, research and teamwork skills.

1.1.4 Which subjects complement this course?

This Level 1/2 Award in STEM complements vocational qualifications including Material Technology, IT and Visual Communication.

It's also a great partner for GCSE Sciences, Design and Technology, Engineering, Business Studies, Maths and Computer Science.

Upon completion, learners can progress to other Level 2 qualifications or apprenticeships, to junior roles in STEM industries, or Technical Certificates, Technical Levels, BTEC Level 3 National Diplomas and A-levels.

1.2 Support and resources to help you teach

We've worked with experienced teachers to provide you with a range of resources that will help you confidently plan, teach and prepare for exams.

1.2.1 Teaching resources

Visit aqa.org.uk/3765 to see all our teaching resources. They include:

- schemes of work and lesson plans to help you plan your course with confidence
- exemplar materials to showcase sets of marked students' work supported by senior moderator commentaries and guidance
- learner textbooks that have been checked by AQA
- training courses to help you deliver AQA qualifications
- teacher standardisation (T-OLS) system to help work through exemplar and standardisation material quickly and easily
- subject expertise courses for all teachers, from newly-qualified teachers to experienced teachers looking for fresh inspiration.

1.2.2 Preparing for exams

Visit aqa.org.uk/3765 for everything you need to prepare for our exams, including:

- past papers, mark schemes and examiners' reports
- specimen papers and mark schemes for new courses
- exemplar learner answers with examiner commentaries.

1.2.3 Analyse your learners' results with Enhanced Results Analysis (ERA)

Find out which questions proved the most challenging, how the results compare to previous years' and where your learners need to improve. ERA, our free online results analysis tool, will help you see where to focus your teaching. Register at aqa.org.uk/era

For information about results, including maintaining standards over time, grade boundaries and our post-results services, visit aqa.org.uk/results

1.2.4 Keep your skills up-to-date with professional development

Wherever you are in your career, there's always something new to learn. As well as subject specific training, we offer a range of courses to help boost your skills.

- Improve your teaching skills in areas including differentiation, teaching literacy and meeting Ofsted requirements.
- Prepare for a new role with our leadership and management courses.

You can attend a course at venues around the country, in your school or online – whatever suits your needs and availability. Find out more at coursesandevents.aqa.org.uk

1.2.5 Help and support

Visit our website for information, guidance, support and resources at aqa.org.uk/3765

If you'd like us to share news and information about this qualification, sign up for emails and updates at aqa.org.uk/from-2017

Alternatively, you can call or email our subject team direct.

E: stemtechaward@aqa.org.uk

T: 01483 477756

1.3 National legislation

Schools and colleges should note that if there are any references made to legislation within this specification that does not apply (ie NI, EU), the relevant legislation in the county of study should be substituted.

2 Specification at a glance

This qualification is modular and is split into three units. One is an externally assessed exam and the other two are internally assessed.

2.1 Subject content

2.2 Assessments

Unit 1: STEM in industry – research task
What's assessed • Planning and research skills • Application of STEM knowledge and understanding • Investigation task selected from the example list provided.
How it's assessed • Internally assessed • 36 Guided Learning Hours (GLH) approx. • 60 marks • 30% of Level 1/2 Award
Evidence Learners' evidence to include a portfolio of: • electronic/paper portfolio of no more than 20 pages of A4 • a log book • a prototype or model • witness statements • observation report.

Unit 2: Creating a STEM product or service

What's assessed

- Learners' ability to identify and construct a STEM product or service of their choosing.
- Learners' knowledge and skills of iterative processes, prototype design and manufacture, scientific enquiry, analysis and evaluation, end-user requirements, mathematical principles and the use of component parts.

How it's assessed

- Internally assessed
- 36 Guided Learning Hours (GLH) approx.
- 60 marks
- 30% of Level 1/2 Award

Evidence

Learners' evidence to include a portfolio of:

- a booklet documenting the Fixperts process and containing all required assessment paperwork
- a presentation or storyboard
- a working model/prototype.

Unit 3: Fundamentals of STEM

What's assessed

The core skills, knowledge and understanding related to STEM:

- problem solving in a real life context
- the circular economy
- knowledge of the principles of science, technology, engineering and maths.

How it's assessed

- Written exam: 1 hour 30 minutes
- 48 Guided Learning Hours (GLH) approx.
- 80 marks
- 40% of Level 1/2 Award

Questions

A mixture of multiple choice, short answer and extended questions.

3 Subject content

This subject content should be taught within a range of realistic vocational contexts based around the major themes in the specification. A number of the sections will benefit from being taught holistically. For example, the sections in the externally assessed Unit 3 could be taught alongside the relevant elements in the internally assessed Units 1 and 2.

There will be a need to understand the theoretical aspects of the subject matter when applying that knowledge to the practical aspects in the internally assessed units. In addition the skills developed in Units 2 and 3 will be valuable when completing the portfolio in Unit 1.

Whilst we don't prescribe the order in which units are delivered, a 'best practice' approach would be to deliver Unit 3 in conjunction with the relevant sections from Units 1 and 2.

3.1 Unit: 1 STEM in industry – Research task

In this unit learners will investigate the use of STEM in one of the following five key industries:

- construction
- communication
- security
- health
- transport.

Learners may choose what they would like to investigate from the research task examples provided in STEM research task titles (page 11). If schools/colleges have an existing relationship with a STEM-related industry within their own communities this would be an acceptable alternative.

Learners will be assessed on STEM skills, knowledge and understanding to develop a final outcome or solution. Marks are allocated as follows:

- Planning and research (15 marks).
- Application of STEM knowledge and understanding to the task (15 marks).
- Quality – fit for purpose (10 marks).
- Quality – quality of final outcome (5 marks).
- Evaluation (10 marks).
- Transferable skills (5 marks) (communication, research and problem solving).

Several different types of evidence may be used for the assessment of each task, including making a product/prototype, presentation, video, or short report.

3.1.1 STEM research task titles

During this unit, learners will complete a research plan, apply STEM knowledge and understanding which is relevant to solving a task and develop a solution which is fit for purpose. The learner will also have to show and consider the quality of the final outcome and complete a conclusion or evaluation of the entire process.

For example a scenario could be a natural disaster, such as an earthquake in a town. For this, learners could investigate the following:

- construction – ways to strengthen the remade buildings and bridges, considering new building materials and the ability of the new buildings to withstand a repeat of earthquake conditions
- transport – different opportunities to enable the local community to move around the town which has been cut off and re-establish links that have been damaged
- communication – ways to improve communication of earthquake warnings to vulnerable members of the community or an earlier warning system to the local community
- security – ways to secure homes or property that have been evacuated or damaged, or ways of securing an area to enable law enforcement to focus on other issues
- health – ways to prevent a potential outbreak of disease or infection due to the conditions that can be used on the ground.

Other examples of research tasks include investigating:

- how to construct a venue for the Olympic games
- how to secure the Olympic venue and ways to reduce ticket fraud
- alternative methods of generating electricity to overcome a potential energy crisis in the future
- ways to improve the efficacy of a mechanical engine
- ways to improve the precision of systems that give the location of a plane
- ways to enable a black box recorder to have a longer battery life than 30 days
- driverless technology in automobiles and how this could be utilised in other technologies
- the construction of a space station
- how new materials can be used to improve prosthetics for an athlete
- how genetic engineering/3D printing could be used to enable a person in the future to have a new grown organ
- the use of sustainable materials in the construction of new homes
- energy efficient homes which utilise smart meters and integrated smart gadgets
- the construction of a large-scale venue which can be repurposed for a new function
- how to reduce the length of time taken to build new homes
- how to utilise brownfield sites
- how to improve the reliability/speed/access of broadband in rural areas
- how to improve reliability of networks for communication between merchant sailors at sea
- ways to improve online security when a) at home or b) outside
- ways of improving the speed of airport security processes while maintaining accuracy
- how to devise a system to improve the security at a venue in your local area
- how to reduce the environmental impact of construction for a particular industry site in the local area
- how bags are tracked at an airport and ways to improve the loading/unloading for airside staff
- the construction of a ride at a theme park, including how security and safety systems are tested and used
- the use of personal data in hospitals to track medical history, including how hospital and GP surgery data is secured while maintaining ease of access for medical professionals
- how STEM is used to tackle public health issues, for example Zika and Ebola
- how emerging technology such as robots will help a specific section of society
- ways to improve hygiene at a hospital to reduce infection rates
- the construction methods and materials chosen in earthquake zones
- ways to reduce card fraud from card readers in shops
- the reconstruction of areas affected by a natural disaster eg a hurricane
- ways to integrate new transport methods into cities with current transport systems
- ways that a medical product could be produced more efficiently.

3.1.1.1 Planning and research (15 marks)

Learners will be required to produce a plan for their topic of research. The plan can be presented in any appropriate form, but should include the following:

- research methods and techniques to be used
- the issues and problems
- the relevant STEM information the learner will need and where they can source this information (learners should be encouraged to use both primary and secondary research)
- learners need to be selective and justify their research, presenting it clearly and concisely
- potential resources to be used
- use of the time allocated to meet deadlines, allowing for any required changes made.

3.1.1.2 Application of STEM knowledge and understanding (15 marks)

Learners will be required to analyse and apply appropriate STEM knowledge and understanding to the problem to gather information and apply to the set context, as follows:

- learners should incorporate the knowledge to explain how their possible solution could function/ operate based on the scientific principles that make it work
- the technology, materials and machine processes used to create the solution, ie reducing waste with less energy consumption
- engineering of the final outcome to test if it is fit for purpose, working to tolerance and testing of material components to ensure integrity of the components and structure with a force/load, or sheer with learner's results/data recorded and compared to expected outcome
- mathematics used to analyse results and identify issues or patterns within data/results/ observations.

3.1.1.3 Quality – fit for purpose (10 marks)

Learners will be required to create a prototype/final outcome/service/solution/model/drawing/ chemical formula/electrical/mechanical/circuit/coded and/or artefact that can be tested, or prove its effectiveness for its intended purpose for use in the environment. This should be based on STEM knowledge and understanding and results/data the learner has gathered.

3.1.1.4 Quality of final outcome/solution/service (5 marks)

- Learners will test the quality of the outcome/solution/service, showing their competence in the skills, knowledge and understanding needed to create a STEM product/service/solution.
- Learners can present their findings/solution in an appropriate format to a group/class.

3.1.1.5 Evaluation (10 marks)

Learners need to analyse and evaluate the findings/results/tested of the final outcome to make a judgement on its effectiveness and usefulness to solve the STEM task. This will include the learners' evaluation of their own personal effectiveness and of the process as a whole.

3.1.1.6 Transferable skills (communication, research and problem solving) (5 marks)

- Learners are able to communicate in a logical and concise manner, and are able to use the correct technical terms and language using a range of communication methods.
- Learners use research to inform their decision-making and select appropriate information to include, using their knowledge and understanding of STEM fundamentals.
- Learners are able to use a range of problem solving techniques to effectively generate a final outcome or solution.

This unit would logically be taught prior to Unit 2. There are opportunities for learners to develop the synoptic knowledge required for assessment in Units 2 and 3. Schools and colleges should refer to Synoptic assessment (page 47) for further information on synoptic delivery and assessment.

3.2 Unit 2: Creating a STEM product or service

This section focuses on the creation of a STEM product or service, following the Fixperts© framework.

Example tasks are delivered by AQA through the supplied 'Challenge Brief' films but schools and colleges are free to set their own so long as they meet the assessment criteria.

Fixperts is a programme which promotes resourcefulness and creative and social values through projects which engage people to solve problems.

- Learners work together to fix something for someone – a 'Fix Project'.
- Through the Fix Project they build a range of skills including observation and analysis, teamwork and communication and prototyping and making.
- They enjoy direct and positive feedback from a clearly defined and results oriented process.

Learners (Fixperts) are required to identify a Fixpartner to work with, engage in observation and conversation and identify a problem they will be working to solve. Over the course of the project, the learners will learn about creative problem solving, idea generation, product development, prototyping and testing.

At the end of the project learners will complete a storyboard detailing the process they went through. The storyboard will summarise the activities in a concise way that helps them relate together their aims, the stages they undertook and their outcomes, as well as to share their project with others. Learners should be able to identify key moments and explain/defend/justify the choices they've made along the way.

Learners will present their findings to the rest of the group allowing them to demonstrate their understanding of the fundamental ideas engaged with and, through conversation, generate insight into the process they've been through. This knowledge, understanding and insight will help them apply this process to solving problems in the future and is therefore synoptically linked to Unit 1.

3.2.1 Task outline

3.2.1.1 The Fix Project

Learners will be required to work with either a live Fixpartner or use the supplied 'Challenge Brief' films to identify a problem and work towards solving it.

- Live Fixpartner: learners will identify a Fixpartner to work and engage with and identify a problem they will be working to solve.
- Challenge Brief film: the film introduces learners to a Fixpartner with a problem to solve. This film will form the basis for learners to write a design brief and design solutions.

3.2.1.2 The process

All the evidence produced should be included in the Assessment Booklet.

Task	STEM knowledge and understanding	Additional information and evidence
Identify a problem and write a brief statement (5 marks). • Learners meet the Fixpartner and understand the problem they face (this can be done through observations and interviews if using a Live Fixpartner or alternatively by watching the Challenge Brief film). • Learners use the materials they have available – interviews, questions, observations, photographs (Live Fixpartner) or Challenge Brief film – to isolate or analyse a problem they would like to work on solving. They may need to do additional research or speculate, should they not have necessary information to hand. • Learners write a short brief. This should be a description of what the problem is and what a good solution would have to do in order to be successful for the Fixpartner.	Learners can: • focus on the key issues to solve, working with a client • analyse and identify key information to be researched from STEM. This could be: S = forces, looking at levers, circuits and energy sources such as battery. T = mechanisms, coding using a programmable chip, possible materials and their working properties, such as waterproof, or how a similar product/part is made E = ergonomics and possible anthropometric data collection M = cost, estimation of size, shapes, area and volume.	Create a mind map. Write a brief statement to identify the problem. Diary/records of meetings/ conversations with the Live Fixpartner.

Generate ideas for solutions to the problem (5 marks).
• Learners work in their team to come up with a variety of ideas to solve the challenge they have identified.
• Learners should have experience of all five methods of generating ideas:
  • diverge
  • converge
  • five modifications of an existing product
  • one product, three users
  • cannibalisation.
	Learners can apply their knowledge and any research on STEM to the solution.	Communicate about each method and the conclusion drawn from final solution chosen.
		Provide evidence for each method and conclusion drawn from the final solution chosen.
		Evidence could include:
		• witness statement
		• observation report
		• Q&A session
		• written report.

Task	STEM knowledge and understanding	Additional information and evidence

Prototype their ideas using making and modelling skills (15 marks).
• Learners improvise a quick solution, communicate their initial ideas to other group members, or test the feasibility of an idea quickly rather than creating a perfect model.
• Learners will use quick prototyping to create 3D models of ideas they are exploring, including any modifications made as a result of basic tests and feedback from other group members.
• Learners should document their models at every stage and could use available technology such as phone cameras or sketching.
• Learners should consider the following as they work on their models:
  • how this model will help the Fixpartner overcome their problem
  • how this will work
  • what it will look like
  • how it will be made.
	Learners can:
	T = test materials and properties and fixing methods
	E = test ideas and possible solutions, such as range of movement and forces (angle).
		Draw a sketch and answer questions for each idea.
		Share ideas with the group.
		Group discussion and feedback.
		Further idea generation.
		Produce prototypes for testing with Fixpartner.
		Basic tests could include waterproofing, flexibility, durability.

Task	STEM knowledge and understanding	Additional information and evidence
Test their solutions with their Fixpartner or by themselves (5 marks). • Live Fixpartner: groups present their models and explain their intentions. They should get as much feedback as they can, and really understand what it is the Fixpartner likes about their design and what they feel is not working well or needs improvement. The Fixpartner is a great resource, so be sure learners make the most of their knowledge and experience and involve them in troubleshooting and suggesting ideas for improvement. OR • Challenge Brief film: one team member or teacher acts as Fixpartner, simulating the difficulty on their own body using the suggested restriction. With the restriction in place, the group watches as they try out their different models. Through experience and observation they understand what works and what doesn't and discuss ways of improving their solutions to overcome the issues they've raised.	Learners can: S = explain how the science behind their idea/solution will work – they may need to revisit a principle or check understanding E = test materials on conductivity, insulation (correct anthropometric sizing – and adjustment as necessary) M = record results into charts/percentages and averages.	Make a list of questions to ask the Fixpartner to answer during use of the prototypes. Document feedback received/observations.

Task	STEM knowledge and understanding	Additional information and evidence

Improve their solutions and make a final prototype (15 marks).
• Learners should consider materials and methods of production, which will require them to research, explore and select based on a wider consideration than the design itself. They should consider:
  • cost
  • materials performance
  • impact of resources used
  • scaling of the solution for market.
• Based on materials and production research, learners will then make their final decision and produce a final working prototype of their design.
	Learner can:
	T = identify the source of materials and material properties
	• considering new emerging materials in the solution
	• suggest a suitable method of scaling the product for mass production either as a part or the whole solution eg punching and blanking, foam moulding, JIT, continuous production circular economy model.
	E = draw a CAD diagram /model of the final solution or part.
	Use the correct scale/ ratio.
	Working to tolerance.
	M = work out costing of a single final product, correct use of measurements and units.
		Answer these questions to determine viability of the prototype:
		• Which prototype is being taken forward and why?
		• What improvements still need to be made to improve it even further?
		Mass production of prototype.
		Evidence could include:
		• witness statement
		• observation report
		• picture of final working prototype.

Task	STEM knowledge and understanding	Additional information and evidence
Tell the story of their Fix Project (10 marks). • Learners should now create a storyboard detailing the process they went through. This is to summarise the activities in a concise way that will help them relate together their aims, the stages they undertook and their outcomes, and share this story with others. • Learners should be able to identify key moments and explain/defend/justify the choices they've made along the way. • Learners demonstrate their understanding of the fundamental ideas engaged with and, through conversation, generate insight into the process they've been through. This understanding and insight will help them apply this process to solving problems in the future.	Learners can reflect on their learning, justifying or explaining decisions made, based on STEM knowledge and understanding. What future STEM solution, if available, would be useful to further improve the solution for the Fixpartner/user of solution?	Completed storyboard. Consider what advice you would give to someone undertaking a Fix project.
Transferable skills (5 marks). • Teamwork. • Communication.	Learners can: • articulate and present the solution to a Fixpartner/client as would occur in STEM industries • work in teams utilising the team's strengths and weaknesses, and time manage as in real world situations.	A record in the booklet of decisions made by, and roles of, different members of the group. Each learner will submit their own booklet and the work and content should be their own.

3.2.2 Supporting evidence

Learners should be reminded of the requirement for all work to be their own. Where sources of information have been used, these should be clearly referenced in a bibliography/references list at the end of the work. This list of references will form part of the evidence.

Whilst learners may work collaboratively on some tasks, eg undertaking a Fix Project, all planning work and writing up should be their own. Any extra help given to specific learners with SEN should be noted on the work and reflected in the teacher's marks.

Unit 2 builds on the synoptic STEM knowledge and understanding developed as a result of completing Units 1 and 3. It is logical that this would be delivered either with or after Unit 3, so that learners can apply their learning and knowledge in ways which show they are able to make connections between the two units. Schools and colleges should refer to Synoptic assessment (page 47) for further information on synoptic delivery and assessment.

3.3 Unit 3: Fundamentals of STEM

Learners will be assessed on their knowledge and understanding of key areas of STEM and also on how they have applied this knowledge with understanding to their own work.

STEM stands for Science, Technology, Engineering and Maths, but how do these disciplines work together? How does STEM feature in everyday products and services? How can having skills and knowledge of STEM enable us to solve real-world problems? This unit will allow learners to investigate these questions and find answers.

In this unit, learners will:

- undertake practical activities that introduce the concepts of STEM and the links between the disciplines
- deconstruct a product and service to investigate the component parts, before using one of the component parts to reconstruct a different product
- develop their problem solving skills by applying their knowledge to a product or service in different contexts
- learn about the circular economy model and how it could play a vital part in successful problem solving using STEM
- understand how adding the A to STEM makes STEAM and consider the role of STEM in future society.

Unit 3 draws on work that has been carried out across all the units of the qualification. The synoptic nature of this written paper allows learners to respond to a range of questions designed to assess their knowledge and understanding of STEM. This requires learners to demonstrate that they can identify and use effectively, in an integrated way, an appropriate selection of skills, techniques, concepts, theories and knowledge from across their whole course of study, which are relevant to a key task.

This unit could be taught alongside with Units 1 and 2, with opportunities for learners to demonstrate synoptic knowledge and skills that will benefit the assessment of this unit.

3.3.1 The nature of STEM

Content	Additional information
Understand the concept of STEM (learners should know that STEM refers to the academic disciplines of Science, Technology, Engineering and Maths). Understand what makes an industry a STEM industry (learners should know examples of STEM industries). Understand STEM products and services (learners should know examples of the products and services provided by STEM industries).	Examples of STEM industries include: • transport • communications • health • security • construction. Examples of STEM products and services: • Eurotunnel and bullet trains • broadband network, satellite GPRS • MRI scanners and medical research • encryption of card readers and online security • construction of the international space station.

Content	Additional information
Understand the STEM skills involved in the four practicals: • Science – the sunscreen practical • Technology – the battery practical • Engineering – the Geodesic domes practical • Maths – the drones practical. Learners should understand the holistic nature of STEM involved in the four practicals.	The practicals are set by AQA and fixed for the lifetime of the specification. The assessment of the practicals will be around application of the holistic nature of STEM, in addition to data analysis, interpretation and evaluation.

3.3.2 Deconstructing STEM

Content	Additional information
Understand the concept of deconstructing a product or service into its component parts. Learners should be able to identify the STEM within these component parts.	Assessment will be on the concept of deconstructing to component parts.
Deconstruction of a STEM product – solar-powered calculator.	Set by AQA and fixed for the lifetime of the specification.
Deconstruction of STEM services – a theme park.	Set by AQA and fixed for the lifetime of the specification.
Understand the interdisciplinary nature of some component parts.	Learners should be able to identify areas or elements that involve STEM and give examples.

3.3.3 The problem solving process outline

Content	Additional information
Understand the problem solving process. Learners should understand the sequence of events that take place when problem solving: • identification of the problem • questions to ask • new designs • making • testing • evaluating • retesting.	Learners follow a logical order to solve the set problem. Learners are able to select appropriate STEM information. Learners are open to new methods to enable investigation of the problem which enables them to develop a range of problem solving tools. Learners make informed decisions based on finding/observations/data and results.

Content	Additional information
Understand the questions to ask when solving problems. Understand the what/where/how/when/why.	Learners are able to identify key questions to help focus on the task or issue.
Understand how to evaluate decisions made when solving problems. Understand 'what went well' (WWW). Understand 'even better if' (EBI).	Learners record decisions made and justify choices.
Understand how to deal with obstacles during a problem solving situation.	Learners are creative in their solutions and persevere to work through and around problems. Learners use initiative and learned skills in this unit to move forward.

3.3.4 The Fixpert process

Content	Additional information
Understand how Fixperts solve real life problems. The five stages of the Fixpert process are: • identification of the problem • finding solutions • producing prototypes • testing • improvement. Learners will: • understand how restrictions applied to their own bodies will cause problems and affect the performance of simple tasks • identify the difficulties and sketch and model solutions to make performing these tasks possible, testing their solutions and improving their designs so that they work better. Understand the participants in the Fixperts process: • Master Fixpert • Fixpert • Fixpartner • film maker/finance. Understand where STEM is involved in the Fixperts process.	Learners can: • apply restrictions to their hands, arms and legs, and attempt to perform simple tasks with these restrictions • work in pairs: one with a restriction, one observing (pairs should swap over so each performs both roles) • write down what needs to happen in order to make overcoming the difficulty possible. Assessment in the external exam will be on the Fixpert process. In Unit 2, learners will connect to a Fixpartner to help them develop a product or service specifically to meet their needs/solve their problem. Assessment in Unit 2 will require learners to complete the assessment booklet as evidence which will be internally assessed and moderated by AQA. Apply the knowledge and understanding of the Fixperts process from Unit 2.

3.3.5 The iterative process and prototypes

Content	Additional information
Explore possible solutions	Learners can: • use a range of methods/tools to test or try out different solutions. • choose a suitable solution to take forward and explain reasons for this.
Prototypes/test/improve	Learners can: • create prototypes that will function and can be tested • use an appropriate method to make the model/prototype • consider appropriate materials based on properties suitable for the function and environment • use suitable testing methods for the prototype such as strength, conductivity and elasticity • use any data or results from testing to inform and suggest further improvements to meet Fixpartner's needs.
Review	Learners can review their learning, identifying areas that went well, and areas where the learner could have improved.
Understand what prototypes are and the need for them within STEM industries.	Learners can: • state reasons why STEM companies create prototypes • give examples of different types of prototypes.
Identify the STEM considerations for scaling up.	Learners can: • consider the impact of scaling up the solution including cost, materials and availability of materials locally, moulds, and jigs • consider the impact of automation on the solution and on the environment and social impact including jobs and carbon footprint in a global economy • consider the development of 'hubs' to reduce manufacturing times, reduce costs, locally-sourced expertise.

3.3.6 The circular economy model and reconstruction

Content	Additional information
Understand the concept of reconstruction.	Learners can: • explain how reconstruction can be used to understand how products are organised and manufactured • identify the STEM of components and parts to understand • state how STEM function together to create a fully functioning product.
Understand the concept of the circular economy model. Learners should understand that the circular economy model (Principle 2) aims to optimise resource yields by circulating products, components and materials. Learners should know that the concept distinguishes between technical and biological cycles. Learners should know that in the biological cycle resources are regenerated and that in the technical cycle resources are recovered or restored.	Learners can: • give examples of the circular economy • state how this is used in STEM industries • describe the differences between the technical and biological cycles • give examples of the technical and biological cycles and how they are utilised by industries.
Understand the principles of and the differences between: • recycling • refurbishing and remanufacturing • reusing and redistributing. Learners should know that these aspects of the circular economy model have economic and environmental benefits. Learners should know why 'reusing and redistributing' has the most benefits and why 'recycling' has the least benefits of these aspects of the circular economy model.	Learners can: • identify these principles and explain these, giving examples • state and describe the environmental and economic benefits both to the final user but also the STEM industry • describe the advantages and disadvantages of the circular economy model.

3.3.7 STEAM and STEM in emerging technologies

Content	Additional information
Understand the use of the Arts in STEM industries, products and services. Learners should be able to recognise where the Arts could be included in a range of STEM industries, products and services.	Learners are aware of the Arts as an emerging element in STEM and how it integrates within a STEM product or service Learner can state where on the STEM product or service the A (arts) would be applicable.
Understand the use of STEM in emerging technologies. Any future emerging technologies during the lifetime of this specification will be listed at aqa.org.uk/3765.	By definition emerging technologies will change over time. Learners should know examples of emerging technologies that are current at the time of their assessments. Current emerging technologies include: • AI robotics for autistic children to help them learn facial recognition • smart meters in the home • electronics within textiles • graphene material and its use in medicine, electronics, chemical and industrial processes • personal peripherals enabling user to interact with the digital world • self-healing concrete • self-driving hover taxi. Assessment will involve case studies of emerging technologies that highlight the use of STEM. Information on the case study will be given in the STEM of the question.

3.3.8 Scientific principles

Content	Additional information
Learners should understand and know the following scientific principles of: • forces, levers and moments • energy states and the transfer of energy • conductors/insulators • states of matter • electromagnetic spectrum • electronic symbols and the movement of electrons in a circuit • Ohms Law • magnetic field and motors • speed/distance/velocity • Pressure Boyle's law/kinetic theory • alternative power sources.	Learners should be able to apply these principles to a problem, being aware that these will overlap with Technology, Engineering and Mathematics.

3.3.9 Technological principles

Content	Additional information
Learners should understand and know the following technological principles of: • sources of raw materials • preparation of material to a working form • availability of material ie sheet, rods, ingots, etc. • knowledge of material working properties including smart materials • knowledge of mechanisms and different types • manufacturing processes and technology • scales of productions (mass production, JIT and issues with chosen method including automation vs costing and jobs) • reduction of waste in production for efficacy • sustainability and carbon footprint • motors and actuators • nano technology • systems and control • robotics • basic coding.	Learners should be able to apply these principles to a problem, being aware that these will overlap with Science, Engineering and Mathematics.

3.3.10 Engineering principles

Content	Additional information
Learners should understand and know the following engineering principles of: • engineer drawing (orthographic) and understand the convention • able to draw an engineering drawing using a CAD program • scales and ratios • maintainability of the part(s)/machine or production line • integrity of the structure – consideration of materials – links to science (sheer/ductility/ moments) • external integration in the environment and the user • ergonomics and anthropometric data/ percentiles • ethics • testability of components and parts • tolerance • quality control.	Learners should be able to apply these principles to a problem being aware that these will overlap with Science, Technology, and Mathematics.

3.3.11 Mathematical principles

Content	Additional information
Learners should understand and know the following mathematical principles: • multiplication/division/addition/subtraction • fractions • decimals • area and the terms associated eg perimeter, circumference and radius • shape • tessellation • angle of an internal and external shape • volume including irregular shapes • scale and ratios • units • averages • estimation • percentage • Pythagoras • Pie • charts, and be able to read and create to show data • trigonometry • rearrange formulas • golden ratio/Fibonacci.	Learners should be able to apply these principles to a problem, being aware that these will overlap with Science, Technology, and Engineering. Follow a logical process and use the appropriate mathematical principle.

4 Scheme of assessment

Find past papers and mark schemes, and specimen papers for new courses, on our website at aqa.org.uk/pastpapers

This specification is designed to be taken over two years but can also be taken in one.

In order to achieve the qualification, learners must complete all assessments by the end of the course.

Awarding for this specification is available for the first time in May/June 2019 and then every May/June for the life of the specification.

All materials are available in English only.

4.1 Aims and learning outcomes

Courses based on this specification will develop knowledge of the subject and encourage learners to:

- develop broad knowledge and understanding of STEM-related industries and practices
- develop practical skills to produce high quality products
- develop the ability to solve problems effectively and in a timely manner
- develop valuable, transferable skills such as research, written and verbal communication skills
- develop decision-making skills through both independent, team and collaborative work
- be able to read, interpret and work from scientific data, plans and instructions
- develop the skills to link knowledge and understanding from different STEM disciplines and apply to unfamiliar contexts to solve real problems
- develop creative and logical thinking skills including resilience and perseverance
- develop an understanding of quality and how this can be achieved
- use materials efficiently in relation to environmental impact
- demonstrate safe working practices
- use key technical terminology related to STEM materials and processes
- develop their knowledge and understanding to evaluate and refine their own skills and those of others
- develop an awareness of industrial practices and employment opportunities.

4.2 Assessment objectives

- AO1: Demonstrate knowledge and understanding of the content.
- AO2: Demonstrate skills by applying knowledge and understanding to practical activities.
- AO3: Analyse and evaluate own performance, data and information and draw conclusions.

4.2.1 Assessment objective weightings for Level 1/2 Award in STEM

Assessment objectives (AOs)	Unit weighting (approx %)			Overall weighting (approx %)
	Unit 1	Unit 2	Unit 3	
AO1	5	2.5	22	29.5
AO2	17.5	22.5	0	40
AO3	7.5	5	18	30.5
Overall weighting of units	30	30	40	100

4.3 Marking criteria for internal assessment

Assessments in Units 1 and 2 are marked by teachers using the assessment criteria tables provided.

The assessment criteria must be applied to the assessment of learners' work. Each table indicates the levels of attainment that would be expected for the award of marks in the ranges shown. Further guidance on how to apply the assessment criteria to a learner's work can be found in Internal assessment administration (page 53).

You're required to provide a mark for each of the assessment criteria and complete a Candidate Record Form (CRF) for each learner.

The CRF is also an opportunity to provide supporting information that will help the moderator confirm the correct mark.

4.3.1 Internal assessment unit 1

4.3.1.1 Planning and research (AO1: 10 marks, AO2: 5 marks)

Mark	Description
13–15	• The plan is clear, complete, logically structured, and workable. • The plan shows a comprehensive understanding of the task requirements. • An appropriate range of sources, research methods and/or presentation techniques have been used and are clearly identified. • The plan/research has a timeline or flowchart showing a logical order to keep on track. • The plan has been completed independently.

Mark	Description
10–12	• The plan is complete and largely logically structured and workable. • The plan shows a good understanding of the task requirements. • Sources, research methods and/or presentation techniques have been used and identified. • The plan has been completed with little guidance.
7–9	• The plan has some structure and is mostly workable. • The plan shows some understanding of the task requirements. • Some sources, research methods and/or presentation techniques have been used and identified. • The plan has been completed with guidance.
4–6	• The plan is basic but some aspects are workable. • The plan shows some basic understanding of the task requirements. • Some sources, research methods and/or presentation techniques have been used but have not been identified. • The plan has been completed with guidance.
1–3	• The plan is unstructured and mostly unworkable. • The plan shows little or no understanding of the task requirements. • Very few, if any, sources, research methods and/or presentation techniques have been used. • The plan is incomplete.
0	Insufficient evidence is provided for a mark to be awarded.

4.3.1.2 Application of STEM knowledge and understanding (A02) (15 marks)

Mark	Description
13–15	• Learner works independently to select and prepare materials ready for use. • Learner uses complex processes and techniques at a high level to produce a high quality outcome that is complete and suitable for the intended purpose. • Quality control techniques are used throughout preparation and making to ensure that the outcome complies with all aspects of the specification and meets fine tolerances. • Learner works independently to follow safe working practices at all times. • There is clear evidence that the learner has selected and deployed the relevant skills to effectively complete the task and can give a detailed account of why those skills were relevant.
10–12	• Learner works mostly independently to select and prepare materials ready for use. • Learner uses appropriate processes and techniques, some of them complex, to produce a high quality outcome that is complete and suitable for the intended purpose. • Quality control techniques are used during making to ensure that the outcome complies with all aspects of the specification and generally meets tolerances. • Learner works mostly independently to follow safe working practices. • There is evidence that the learner has selected and deployed the relevant skills to complete the task and can give an account of why those skills were relevant.

Mark	Description
7–9	• Learner prepares given materials ready for use with minimal guidance. • Learner uses appropriate processes and techniques to produce an outcome that is complete and largely suitable for the intended purpose. • Quality control techniques are used during most stages of making to ensure outcome complies with most aspects of the specification. • Learner requires some prompts to follow safe working practices. • Learner selects relevant skills and deploys them in appropriate ways.
4–6	• Learner prepares given materials ready for use with some guidance. • Learner uses a limited range of processes and techniques to produce an outcome that is largely complete but may require further development to be suitable for the intended purpose. • Limited use of quality control techniques, resulting in poor compliance with the specification. • Learner requires frequent prompts and guidance to follow safe working practices. • Learner identifies the relevant skills and puts some of them into practice, with variable success.
1–3	• Learner requires assistance to prepare given materials. • Learner uses basic processes and techniques to produce an outcome which requires further development to be suitable for the intended purpose. • Quality control techniques have not been used, resulting in poor compliance with the specification. • Learner requires close supervision and guidance to work safely. • Learner identifies a small number of the relevant skills and attempts to put those skills into practice.
0	Insufficient evidence provided for a mark to be awarded.

4.3.1.3 Quality – fit for purpose (AO2) (10 marks)

Mark	Description
9–10	Learner has provided clear evidence that the product/service is fit for purpose, by making links between the product/service purpose and key identified elements/aspects of the product/service.
7–8	Learner has demonstrated, using arguments, that the product/service is fit for purpose.
5–6	Learner has made a range of points relevant to the product/service fitness for purpose and sets out those points in detail.
3–4	Learner has made a number of points, which are relevant to the product/service fitness for purpose, but clear links between those points and the product/service purpose are not made.
1–2	Learner has made limited comments about the product/service fitness for purpose. The comments may not be relevant.
0	Insufficient evidence provided for a mark to be awarded.

4.3.1.4 Quality – quality of final product (AO3) (5 marks)

Mark	Description
5	• The quality of the product/service is excellent. • Learner has demonstrated full competence in all or almost all of the skills required to create and test the product/service.
4	• The quality of the product/service is good and it is useable. • Learner has demonstrated competence in most of the skills required to create and test the product/service.
3	• The quality of the product/service is sufficient to make it useable, although some deficiencies remain. • Learner has demonstrated competence in some of the skills required to create and test the product/service.

Mark	Description
2	• The quality of the product/service is just sufficient to make it useable, although there are some deficiencies. • Learner has demonstrated competence in a few of the vocational skills required to create and test the product/service.
1	• The quality of the product/service produced is basic. The artefact is only just useable. • Learner has demonstrated competence in a limited number of the vocational skills required to create and test the product/service.
0	Insufficient evidence provided for a mark to be awarded.

4.3.1.5 Evaluation (AO3) (10 marks)

Mark	Description
9–10	• Learner can offer a reasoned judgement about their work and the work of others (if appropriate) based on clear and coherent observations. • Learner identifies and selects relevant evidence, interpreting it in order to make judgement on what could have been improved on, referencing personal effectiveness and achievement.
7–8	Learner can offer a comprehensive understanding of how all processes involved contributed to the overall success of the task.
5–6	Learner will offer some reflection on the processes and skills utilised and how this affected the task.
3–4	A judgement is made and reasons are given in support of that judgement, but those reasons are limited in scope.
1–2	A judgement is asserted and some relevant points might be made, but there is no clear link between the points and the judgement.
0	Insufficient evidence provided for a mark to be awarded.

4.3.1.6 Transferable skills – communication, research and problem solving (AO2) (5 marks)

Mark	Description
5	• Written evidence conveys information in a logical, fluent and concise manner, showing excellent use of technical terms and thorough understanding. • Learner is able to verbally articulate what they have done and answer questions in a confident and knowledgeable manner. • Research is from a range of well-chosen primary and secondary sources. • Research has been clearly and concisely recorded and presented. • Learner is able to consider solutions from alternative sources/contexts to apply to the problem. • Learners uses a range of problem solving techniques efficiently and effectively.
4	• Written evidence is presented logically, with technical terms used well and a good understanding shown. • Learner can explain verbally what they have done and answer questions well with little prompting. • Clear and appropriate research from both primary and secondary sources is evident. • Research has been recorded and presented to a good standard. • Learner is able to problem-solve following a process to generate possible solutions and use past learning experiences to apply to the problem and process. • Learner uses a range of problem-solving techniques effectively.

Mark	Description
3	• Written evidence is presented logically, with some good use of technical terms together with some understanding shown. • Learner can explain what they have done and answer questions with some prompting. • Some research is evident. • Research is from primary and secondary sources but may not be concise or clearly recorded or presented. • Learner is able to problem solve following a process to generate possible solutions. • Learners uses a range of problem-solving techniques.
2	• Written evidence is presented with some structure and with some use of technical terms and understanding. • Learner can verbally respond to most questions asked. • Limited research is evident. • Research may be mainly from secondary sources and may lack focus. • Learner is able to generate solutions. • Learner uses a limited range of problem solving techniques.
1	• The learner has provided some unstructured written evidence which is simple and lacks technical terms and understanding. • Learner struggles to respond to questioning. • Little research is evident. • Learner generates a limited solution(s). • Learner uses techniques to problem-solve.
0	Insufficient evidence provided for a mark to be awarded.

4.3.2 Internal assessment unit 2

4.3.2.1 Identify a problem and write a brief statement (A01) (5 marks)

Mark	Description
5	• The mind map clearly shows that relevant information has been considered. • The brief statement shows a clear understanding of the needs of the Fixpartner and the problem to be solved. • Additional research is relevant and has been clearly identified.
4	• The mind map shows that relevant information has been considered. • The brief statement shows a good understanding of the needs of the Fixpartner and the problem to be solved. • Additional research required has been identified.
3	• The mind map shows some relevant information has been considered. • The brief statement shows an understanding of the needs of the Fixpartner and the problem to be solved. • Some additional research required has been identified.
2	• The mind map shows that some information has been considered but most is not relevant. • The brief statement shows little understanding of the needs of the Fixpartner and the problem to be solved. • Little additional research required has been identified.
1	• The mind map shows little information of any relevance. • The brief statement shows very little or no understanding of the needs of the Fixpartner and the problem to be solved. • No additional research required has been identified.
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.2 Generate ideas for solutions to the problem (AO2) (5 marks)

Mark	Description
5	• Extensive evidence is provided that confirms group discussions have taken place. • All five methods of generating ideas have been used and clear documentation provided. • The most effective method has been identified and explained.
4	• Detailed evidence is provided representing the group discussion that has taken place. • All five methods of generating ideas have been used and detailed documentation provided. • An opinion has been provided about the most effective method.
3	• The evidence provided sufficiently represents the group discussion that has taken place. • Several, but not all, of the methods of generating ideas have been used and some notes made. • Structured comments have been made about the most effective method.
2	• Limited evidence provided but produced independently to show that some group discussion has taken place. • At least one of the methods of generating ideas has been used and some notes made. • A comment may have been made about the most effective method.
1	• The learner needed help to produce evidence to show that some group discussion has taken place. • At least one of the methods of generating ideas has been used but little evidence presented.
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.3 Prototype their ideas using making and modelling skills (A02) (15 marks)

Mark	Description
13–15	• Documented evidence of the prototypes shows a clear understanding of the problem to be solved and is appropriately annotated. • The documented evidence for making the prototype is followed accurately to ensure that the prototype is effective and realistic. • Plans for pitching the idea to other learners, feedback and suggestions for improvement are clearly expressed and logically structured.
10–12	• Documented evidence of the prototypes shows a good understanding of the problem to be solved and is appropriately annotated. • The documented evidence for making the prototype is followed fairly accurately to ensure that the prototype is effective and realistic. • Plans for pitching the idea to other learners, feedback and suggestions for improvement are expressed well and have a mostly logical structure.
7–9	• Documented evidence of the prototypes shows an understanding of the problem to be solved and has some appropriate annotation. • The documented evidence for making the prototype is followed but the prototype performs inconsistently. • Plans for pitching the idea to other learners, feedback and suggestions for improvement are expressed well and have some logical structure.
4–6	• Documented evidence of the prototypes shows a little understanding of the problem to be solved and has little or no annotation. • The documented evidence for making the prototype is mostly followed but the prototype produced is inaccurate and inefficient. • Plans for pitching the idea to other learners, feedback and suggestions for improvement are simple but have some structure.

Mark	Description
1–3	• The evidence of the prototypes shows very little or no understanding of the problem to be solved and is not documented. • The prototype produced is of poor quality and cannot be used. • Plans for pitching the idea to other learners, feedback and suggestions for improvement are basic and have little or no structure.
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.4 Test their solutions on their Fixpartner or themselves (A02) (5 marks)

Mark	Description
5	• Questions demonstrate an excellent understanding of the needs of the Fixpartner and the problem to be solved. • The prototype is fully tested using suitable tests and this information/data is recorded and used to form a conclusion.
4	• Questions demonstrate a good understanding of the needs of the Fixpartner and the problem to be solved. • The prototype is tested in a few ways with information/data recorded and used to form a conclusion.
3	• Questions demonstrate an understanding of the needs of the Fixpartner and the problem to be solved. • The prototype is tested with information/data recorded and used to form a conclusion.
2	• Questions demonstrate a little understanding of the needs of the Fixpartner and the problem to be solved. • The prototype is tested superficially and some information/data is recorded and used to form a conclusion.
1	• Questions demonstrate little or no understanding of the needs of the Fixpartner and the problem to be solved. • The prototype is not tested or no available information/data recorded but a conclusion is formed by learners.

Mark	Description
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.5 Improve their solutions and make a final prototype (A02) (15 marks)

Mark	Description
13–15	• Records of the feedback from the Fixpartner and ideas for scaling up, including improvements suggested, are clearly expressed and logically structured. • The prototype or model is functional as intended and of a high quality. It has been made with suitable materials or if materials are not available justifies the reason for material choice.
10–12	• Records of the feedback from the Fixpartner and ideas for scaling up, including improvements suggested, are expressed well and have a mostly logical structure. • The prototype or model shows good functionality and is of a good standard. It has been made with suitable materials or if materials are not available explains material choice.
7–9	• Records of the feedback from the Fixpartner and ideas for scaling up, including improvements suggested, are expressed well and have some logical structure. • The prototype or model has good features and is of a reasonable standard. It has been made with suitable materials and the material choice is commented upon.
4–6	• Records of the feedback from the Fixpartner and ideas for scaling up are simple but have some logical structure. • The prototype or model would be suitable for the Fixpartner and works. The materials used are stated.
1–3	• Records of the feedback from the Fixpartner and ideas for scaling up are basic and have little or no structure. • The prototype or model is incomplete or is unsuitable for the Fixpartner, materials have been used with little thought.

Mark	Description
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.6 Tell the story of their Fix Project (A03) (10 marks)

Mark	Description
9–10	• Story board demonstrates a clear and logical sequence of events that provides an extensive and detailed representation of the whole Fixperts process. • Learner is able to demonstrate a comprehensive understanding of the ideas they have engaged with and the process they have completed.
7–8	• Story board demonstrates the correct sequence of events that represents all stages of the Fixperts process. • Learner is able to demonstrate a thorough understanding of the ideas they have engaged with and the process they have completed.
5–6	• Story board demonstrates a sequence of events that represents most stages in the Fixperts process. • Learner is able to demonstrate a secure level of understanding of the ideas they have engaged with and the process they have completed.
3–4	• Story board is not in the correct order of events and only partially presents the Fixperts process. • Learner is able to demonstrate a basic level of understanding of the ideas they have engaged with and the process they have completed.
1–2	• Story board does not show the correct order of events and does not represent the Fixperts process. • Learner is able to demonstrate limited understanding of the ideas they have engaged with and the process they have completed.

Mark	Description
0	Insufficient evidence provided for a mark to be awarded.

4.3.2.7 Transferable skills – teamwork and communication (A02) (5 marks)

Mark	Description
5	• Excellent teamwork shown, including leading the team and an ability to listen to others. • Excellent verbal and written communication skills are demonstrated throughout.
4	• The learner is collaborative, willing to help and contributes by providing suggestions. • Good verbal and written communication skills are demonstrated throughout.
3	• The learner contributes to the task and the team, but has a tendency to work independently. • Verbal and written communication skills are both generally satisfactory.
2	• The learner is unable to accept suggestions from other members of the team and works in isolation. • Verbal and written communication skills are limited.
1	• Very little teamwork is shown. • Verbal and written communication skills are limited.
0	Insufficient evidence provided for a mark to be awarded.

4.4 Internal assessment controls

The two internally assessed units of this Level 1/2 Award in STEM are equally weighted at 30% and collectively account for 60% of the assessment for the qualification.

These units can be studied and evidenced at any stage during the course. This offers schools and colleges flexibility in the structure of delivery of the specification and gives learners the opportunity to submit evidence whenever appropriate.

Further details on the requirements and suggested types of evidence relevant to the internally assessed units can be found within the subject content.

The assessed tasks must be based on the requirements of this specification. These activities have been designed to provide learners with the opportunity to address the assessment objectives and achieve, to the very best of their abilities, the assessment criteria.

Within the internally assessed units, learners are required to demonstrate their ability to recall and apply knowledge within a specific context related to the subject content of this specification. They are also expected to use their knowledge and practical skills to plan and carry out activities, analyse and evaluate information, and use these to make reasoned judgements and/or decisions.

4.4.1 Levels of control

Setting the activity

Activities for which learners are required to submit evidence must be appropriate and relevant to the subject content of this specification.

Carrying out the activity

- Authenticity: all practical assessments should be completed under supervised conditions in an environment appropriate to the activity. Any research based activities requiring assessment can be completed away from the classroom, provided the work is collated under supervision. To protect the authenticity of any submitted evidence, CRFs must be fully completed. The school/college must ensure that plagiarism does not take place, that any sources used by learners are clearly recorded and that each learner's portfolio of evidence is their own work.
- Feedback: teachers may review learner work and can provide advice at a general level. Any feedback can evaluate progress to date and propose suggested broad approaches for improvement, but the detailed correction of work prior to submission is not allowed. Teachers must not provide detailed and specific advice on how the evidence may be improved to increase the mark awarded. Learners can be guided as to the approach they might adopt but the outcome must remain their own.
- Time: schools/colleges are to ensure that internal assessments are carried out within the guided learning hours allocated to each unit.and within the total qualification time.
- Teamwork: we accept that learners will provide evidence as a result of teamwork as well as independently. If working within a team, learners must produce individual and personal evidence for assessment.
- Resources: schools/colleges must ensure that learners have access to the appropriate resources required in order to carry out and complete any activity to be assessed.

Assessing the activity

Schools and colleges must mark internal assessments using the level of response mark schemes provided. Moderation of the internally assessed learner evidence is by inspection of a sample of learners' work sent to a moderator appointed by AQA. Further details are provided in Internal assessment administration (page 53).

4.4.2 Authenticating learner evidence

Learners' work for assessment must be undertaken under conditions that allow the school to validate the work. If work is carried out unsupervised, the school must be sure that the learners' work can be authenticated with confidence – eg being sufficiently aware of an individual learner's quality and level of work to appreciate if the evidence submitted is of a reliable standard.

For assessment undertaken outside the classroom, supporting statements such as Witness or Observation Testimonies can be provided to support a learner's evidence. These must be

completed by a subject matter expert during or shortly after the activity and by a person in authority.

To protect the authenticity of any submitted evidence, the learner is required to complete and sign a Candidate Record Form (CRF) when submitting portfolios of work. This will confirm and certify that:

- all evidence submitted within the portfolio is the work of the learner
- resources used in the evidence are clearly referenced.

The school/college will also countersign this declaration and include any reference to work carried out under any specified conditions and record details of any additional assistance. The CRF must be provided with each learner's work for external quality assurance purposes.

Teachers must inform learners that to present material copied directly from books or other sources such as the internet, without acknowledgement, will be regarded as malpractice. This also includes original ideas, as well as the actual words or products generated by someone else.

Further information regarding supervising and authenticating learner evidence can be found in Internal assessment administration (page 53).

4.4.3 Assessment criteria

The assessment grids for this qualification are broken down into levels each of which has a descriptor and a mark or range of marks applied to it. The descriptor for a band with a range of marks shows the average performance for the level required.

As best practice, before you apply the mark scheme to a learner's evidence, review the work and annotate/make notes to show the qualities that are being looked for. You can then apply the marking criteria. Start at the lowest level of the marking criteria and use it as a ladder to see whether the work meets the descriptor for that band. The descriptor for the band indicates the different qualities that might be seen in the learner's work for that level. If it meets the description for the lowest band then go to the next one and decide if it meets this, and so on, until you have a match between the band descriptor and the learner's work.

When assigning a mark you should look at the overall quality of the work. If the evidence covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the work to help decide the mark within the band.

To select the most appropriate mark in the band descriptor, teachers should use the following guidance to locate the best fit:

- where the learner's work fully meets all statements, the highest mark should be awarded
- where the learner's work mostly meets all statements, the most appropriate mark in the middle of the range should be awarded
- where the learner's work just meets the majority of statements, the lowest mark should be awarded.

There will be instances where a learner fully meets, for example, three statements but only just meets the fourth. In this scenario a best fit approach should be taken.

4.5 Transferable skills

These valued skills are an integral element within the design of our Level 1/2 Awards.

As a result of discussions and collaborations with schools, colleges and stakeholders such as post-16 education providers and professional/trade bodies, we have included the following transferable skills within the subject content:

- teamwork
- communication
- research
- problem solving.

Rather than force the inclusion of these skills in each unit, certain tasks have been identified as being the most appropriate and suitable for a transferable skill to be assessed within the subject context. However, this many not apply to every unit – only when appropriate.

4.6 Synoptic assessment

Synoptic assessment is a form of assessment which requires a learner to demonstrate that they can identify and use effectively, in an integrated way, an appropriate selection of skills, techniques, concepts, theories and knowledge from across the whole qualification or unit, which are relevant to a key task.

Our Level 1/2 Award in STEM includes assessments that allow learners to demonstrate their ability to draw together different areas of knowledge, skills and/or understanding from across the full course of study for this qualification.

The significant amount of synoptic content supports synoptic learning and assessment by:

- showing how teaching and learning connects between the units across the specification
- giving guidance relating to the internally assessed units as to where learners could apply their knowledge and understanding from other areas of the specification
- providing opportunities for the learning and assessment of units combined together to promote holistic delivery
- developing and assessing a learner's use and development of a defined transferable skill in different contexts.

Whilst we do not prescribe in which order the units should be delivered or assessed, we do identify a suggested, logical order for delivery. Where schools or colleges are not following the recommended order of unit delivery, it's important they identify those links that are relevant for their own pattern of delivery.

It is important for schools and colleges to be aware of the links between units so that teaching, learning and assessment can be planned accordingly. This means that when learners are being assessed, they can apply their learning in ways which show they are able to make connections across the qualification. Within the synoptic links table we provide references to where the unit content maps from or to other units within the qualification. This will help the learner understand where there are explicit opportunities for synoptic learning as well as synoptic assessment.

It is therefore a requirement that all learners undertake meaningful synoptic learning and assessment during their study. Plans for how this will be undertaken will be scrutinised as part of our centre approval process and its implementation monitored during moderation and quality assurance activities with centres.

4.6.1 Unit 1

Topics	Links to other units	Specification reference
Planning and Research	Unit 3 Unit 2	3.3.1 The nature of STEM (page 20) 3.3.2 Deconstructing STEM (page 21) 3.3.3 The problem solving process outline (page 21) 3.3.4 The Fixpert process (page 22) 3.3.7 STEAM and STEM in emerging technologies (page 25) 3.2.1.2 The Fixpert process (page 22)
Application of STEM knowledge and understanding	Unit 3	3.3.8 Scientific principles (page 26) 3.3.9 Technological principles (page 26) 3.3.10 Engineering principles (page 27) 3.3.11 Mathematical principles (page 28)
Evaluation	Unit 3	3.3.3 The problem solving process outline (page 21) 3.3.5 The iterative process and prototypes (page 23)
Transferable skills	Unit 3	3.3.3 The problem solving process outline (page 21) 3.3.5 The iterative process and prototypes (page 23)

4.6.2 Unit 2

Topics	Links to other units	Specification reference
Fixpert process	Unit 1 Unit 3	3.1.1.2 Planning and research (page 13) 3.1.1.4 Quality – fit for Purpose (page 34) 3.1.1.5 Quality – quality of final product (page 34) 3.1.1.6 Evaluation (page 35) 3.3.3 The problem solving process outline (page 21) 3.3.4 The Fixpert process (page 22) 3.3.5 The iterative process and prototypes (page 23) 3.3.8 Scientific principles (page 26) 3.3.9 Technological principles (page 26) 3.3.10 Engineering principles (page 27) 3.3.11 Mathematical principles (page 28)

4.6.3 Unit 3

Topics	Links to other units	Specification reference
The nature of STEM	Unit 1	3.1.1.2 Planning and research (page 13)
Deconstructing STEM	Unit 1	3.1.1.2 Planning and research (page 13)
The problem solving process	Unit 2	3.2.1.2 The Fixpert process (page 22)
The fixpert process	Unit 2	3.2.1.2 The Fixpert process (page 22)
The iterative process and prototypes	Unit 2	3.2.1.2 The Fixpert process (page 22)
STEM and STEAM in emerging industries	Unit 1	3.1.1.2 Planning and research (page 13)

Topics	Links to other units	Specification reference
Scientific principles	Unit 1 Unit 2	3.1.1.2 Planning and research (page 13) 3.2.1.1 The Fix project (page 14) 3.2.1.2 The Fixpert process (page 22)
Technology principles	Unit 1 Unit 2	3.1.1.2 Planning and research (page 13) 3.2.1.1 The Fix project (page 14) 3.2.1.2 The Fixpert process (page 22)
Engineering principles	Unit 1 Unit 2	3.1.1.2 Planning and research (page 13) 3.2.1.1 The Fix project (page 14) 3.2.1.2 The Fixpert process (page 22)
Mathematical principles	Unit 1 Unit 2	3.1 Research task (page 11) 3.2.1.1 The Fix project (page 14) 3.2.1.2 The Fixpert process (page 22)

4.7 Guided learning hours

Guided learning hours (GLH) is defined (within the Education and Skills Act 2008) as the time a person spends:

- being taught or given instruction by a lecturer, tutor, supervisor or other appropriate provider of education or training
- otherwise participating in education and training under the immediate guidance or supervision of such a person.

It doesn't include time spent on unsupervised preparation or study, whether at home or otherwise.

The guided learning hours are specified within Specification at a glance (page 9)

4.8 Total qualification time

Total Qualification Time (TQT) is the total number of hours assigned to a qualification – combining the GLH, assessment time and Directed Study Hours (DST).

DST is defined as the activity of a learner in preparation, study or any other form of participation in the qualification subject, which takes place as directed – but not supervised – by a teacher, tutor or other appropriate provider.

The anticipated TQT for this qualification is 180 hours.

5 Internal assessment administration

The internal assessment for this specification are Units 1 and 2. These units are marked by the teacher and moderated by AQA.

Visit aqa.org.uk/3765 for detailed information on all aspects of internal assessment administration.

The head of the school or college is responsible for making sure that internal assessment is conducted in line with our instructions.

5.1 Supervising and authenticating

- all **learners** must sign the *Candidate Record Form* (CRF) to confirm that the work submitted is their own
- all **teachers** who have marked a learner's work must sign the declaration of authentication on the CRF. This is to confirm that the work is solely that of the learner concerned and was conducted under the conditions laid down by this specification
- teachers must ensure that a CRF is provided with each learner's work.

Learners must have sufficient direct supervision to ensure that the work submitted can be confidently authenticated as their own. If, as a teacher, you cannot be sure that the work is the learner's own you cannot accept it for marking. If a learner receives additional assistance and this is acceptable within the guidelines for this specification, you should award a mark that represents the learner's unaided achievement. Please make a note of the support the learner received on the CRF and sign the authentication statement. If the statement is not signed, we cannot accept the learner's work for assessment.

5.2 Avoiding malpractice

Please inform your learners of AQA's regulations concerning malpractice. They must not:

- submit work that is not their own
- lend work to other learners
- allow other learners access to, or use of, their own independently-sourced source material
- include work copied directly from books, the internet or other sources without acknowledgement
- submit work that is word-processed by a third person without acknowledgement
- include inappropriate, offensive or obscene material.

These actions constitute malpractice and a penalty will be given (for example, disqualification).

If you identify malpractice **before** the learner signs the declaration of authentication, you don't need to report it to us. Please deal with it in accordance with your school or college's internal procedures. We expect schools and colleges to treat such cases very seriously.

If you identify malpractice **after** the learner has signed the declaration of authentication, the head of your school or college must submit full details of the case to us at the earliest opportunity. Please complete the form JCQ/M1, available from the JCQ website at jcq.org.uk

You must record details of any work which is not the learner's own on the front of the submitted work or other appropriate place.

You should consult your exams officer about these procedures.

5.3 Teacher marking and standardisation

We'll provide support for using the marking criteria and managing the assessment tasks through teacher standardisation.

For further information about teacher standardisation visit aqa.org.uk/3765

For further support and advice please speak to your adviser. Email your subject team at stemtechaward@aqa.org.uk for details of your adviser.

5.4 Internal standardisation

You must ensure that you have consistent marking standards by all teachers for all learners. One person must manage this process. They must sign the *Centre Declaration Sheet* to confirm that internal standardisation has taken place.

Internal standardisation may involve:

- all teachers marking some sample pieces of work to identify differences in marking standards
- discussing any dif ferences in marking at a training meeting for all teachers involved
- referring to reference and archive material, such as previous work or examples from our teacher standardisation.

5.5 Commenting

You must show clearly how marks have been awarded against the assessment criteria in this specification.

Your comments will help the moderator to see, as precisely as possible, where you think the learners have met the assessment criteria.

You must record your comments on the CRF.

5.6 Submitting evidence and marks

An AQA moderator will check a sample of your learner's work. Your moderator will tell you which learner's work to send them. If you're entering fewer than ten learners it will be the work of all your learners. Otherwise it will be a percentage of your learners' work.

You must show clearly how marks have been awarded against the assessment criteria in this specification. Your comments will help the moderator to see, as precisely as possible, where you think the learners have met the assessment criteria. You must:

- record your comments on the CRF
- check that the correct marks are written on the CRF and that the total is correct.

You must send all your learner evidence and marks to AQA for moderation by the specified date given at aqa.org.uk/keydates

5.7 Moderation

The moderator re-marks a sample of the evidence and compares this with the marks you have provided to check whether any changes are needed to bring the marking in line with our agreed standards. Any changes to marks will normally keep your rank order but, where major inconsistencies are found, we reserve the right to change the rank order.

5.8 After moderation

You will receive a report when the results are issued, which will give feedback on interpretation of the assessment criteria and how learners performed in general.

We will give you the final marks when the results are issued.

For awarding, archiving or standardisation purposes, we may need to keep some of your learners work. We will let you know if we need to do this.

You must keep all the evidence for learners until they have completed the course and results have been issued. Evidence of moderation activity must be kept for two years.

5.9 Factors affecting individual learners

For advice and guidance about arrangements for any of your learners, please email us as early as possible at eos@aqa.org.uk

Occasional absence: you should be able to accept the occasional absence of learners by making sure they have the chance to make up what they have missed. You may organise an alternative supervised session for learners who were absent at the time you originally arranged.

Lost work: if work is lost you must tell us how and when it was lost and who was responsible, using our special consideration online service at aqa.org.uk/eaqa

Extra help: where learners need extra help which goes beyond normal learning support, please use the CRF to tell us so that this help can be taken into account during moderation.

Learners who move schools: learners who move from one school or college to another during the course sometimes need additional help to meet the requirements. How you deal with this depends on when the move takes place.

- If it happens early in the course, the new school or college should be responsible for the work.
- If it happens late in the course, it may be possible to arrange for the moderator to assess the work as a learner who was educated elsewhere.

5.10 Keeping learners' work

Learners' work must be kept under secure conditions from the time that it is marked, with completed CRFs. After the moderation period and the deadline for Enquiries about Results (or once any enquiry is resolved) you may return the work to learners.

5.11 School and college consortia

If you're in a consortium of schools or colleges with joint teaching arrangements (where learners from different schools and colleges have been taught together but entered through the school or college at which they are on roll), you must let us know by:

- filling in the *Application for Centre Consortium Arrangements for centre-assessed work*, which is available from the JCQ website jcq.org.uk
- appointing a consortium coordinator who can speak to us on behalf of all schools and colleges in the consortium. If there are different coordinators for different specifications, a copy of the form must be sent in for each specification.

We'll allocate the same moderator to all schools and colleges in the consortium and treat the learners as a single group.

All the work must be available at the lead school or college and marking must be standardised across all schools or colleges in the consortium.

6 General administration

You can find information about all aspects of administration, as well as all the forms you need, at aqa.org.uk/examsadmin

6.1 Entries and codes

You only need to make one entry for each qualification – this will cover all the question papers, internally assessed units and certification.

Qualification title	AQA entry code
AQA Level 1/2 Award in STEM	3766
Unit 1: STEM in industry – Research Task	STM1
Unit 2: Creating a STEM product or service	STM2
Unit 3: Fundamentals of STEM	STM3

The Ofqual qualification accreditation number (QAN) is 603/1225/7.

6.2 Overlaps

There are no overlaps with any other AQA qualifications at this level.

6.3 Awarding grades and reporting results

At Level 1, unit and qualification grades will be Credit and Advanced Credit.

At Level 2, unit and qualification grades will be Pass, Merit, Distinction and Distinction*.

Learners who fail to reach the minimum standard for Level 1 will be recorded as U (unclassified) and will not receive a qualification certificate.

6.4 Re-sits and shelf life

Learners can re-sit the externally assessed unit (written exam) once and re-submit internally assessed units, but only once prior to certification. If an internally assessed unit is re-submitted, then a new task must be undertaken.

6.5 Previous learning and prerequisites

There are no previous learning requirements. Any requirements for entry to a course based on this specification are at the discretion of schools and colleges.

6.6 Access to assessment: diversity and inclusion

Level 1/2 Awards are designed to prepare learners for a wide range of occupations and further study. Therefore our qualifications must assess a wide range of competences.

The subject content has been assessed to see if any of the skills or knowledge required present any possible difficulty to any learners, whatever their ethnic background, religion, sex, age, disability or sexuality. If any difficulties were encountered, the criteria were reviewed again to make sure that tests of specific competences were only included if they were important to the subject.

As members of the Joint Council for Qualifications (JCQ) we participate in the production of the JCQ document *Access Arrangements and Reasonable Adjustments: General and Vocational qualifications*. We follow these guidelines when assessing the needs of individual learners who may require an access arrangement or reasonable adjustment. This document is published on the JCQ website at jcq.org.uk

6.7 Learners with disabilities and special needs

We can make arrangements for disabled learners and learners with special needs to help them access the assessments, as long as the competences being tested are not changed. Access arrangements must be agreed **before** the assessment. For example, a Braille paper would be a reasonable adjustment for a Braille reader.

We are required by the Equality Act 2010 to make reasonable adjustments to remove or lessen any disadvantage that affects a disabled learner.

If you have learners who need access arrangements or reasonable adjustments, you can apply using the Access arrangements online service at aqa.org.uk/eaqa

6.8 Special consideration

We can give special consideration to learners who have been disadvantaged at the time of the assessment through no fault of their own – for example a temporary illness, injury or serious problem such as the death of a relative. We can only do this **after** the assessment.

Your exams officer should apply online for special consideration at aqa.org.uk/eaqa

For more information and advice about access arrangements, reasonable adjustments and special consideration please see aqa.org.uk/access or email accessarrangementsqueries@aqa.org.uk

6.9 Working with AQA for the first time

You need to register as a AQA centre to offer our specifications to your learners. Find out how at aqa.org.uk/becomeacentre

6.10 Private candidates

This specification is not available to private candidates.

7 Grades

7.1 Overview

In order to be awarded the qualification learners must:

- complete all three units **and**
- achieve a Level 1 Credit grade in the externally assessed unit.

Individual units and the overall qualification will be graded at Level 1 Credit, Advanced Credit, Level 2 Pass, Merit, Distinction or Distinction Star.

7.2 Determining grades

The raw mark a learner is awarded in each unit will be converted to a Uniform Mark Scale (UMS). The UMS points achieved for all three units are combined to determine the overall qualification grade.

7.2.1 Unit grade boundaries

The grade boundaries for each unit are:

Unit grade	Internally assessed unit 1: Total 90 UMS	Internally assessed unit 2: Total 90 UMS	Externally assessed unit 3: Total 120 UMS
L2 Distinction*	72	72	96
L2 Distinction	63	63	84
L2 Merit	54	54	72
L2 Pass	45	45	60
L1 Advanced credit	36	36	48
L1 Credit	27	27	36

AQA aims to maintain grade boundaries for the internally set units over time unless there is a good reason not to.

7.2.2 Qualification grade boundaries

The grade boundaries for the overall qualification are:

Qualification grade	UMS	Grade boundary as % of total UMS
L2 Distinction*	240	80
L2 Distinction	210	70
L2 Merit	180	60

Qualification grade	UMS	Grade boundary as % of total UMS
L2 Pass	150	50
L1 Advanced credit	120	40
L1 Credit	90	30

7.3 Calculating grades for the external unit

Grades for the externally assessed unit will be determined by senior examiners guided by statistics.

7.4 Calculating grades for the internal units

The internally assessed units use level of response mark schemes with a description of what needs to be achieved within each mark band.

This approach allows compensation for learners whose performance is not consistent across all criteria. For example, where a learner has performed well against most criteria but underachieved in another, they can still achieve a unit grade so long as the cumulative mark meets the minimum of that required for a Level 1 Credit.

This approach ensures that high quality work is rewarded but a basic level of competency is attained across the majority of each unit and the whole qualification.

Get help and support

Visit our website for information, guidance, support and resources at aqa.org.uk/3765

You can talk directly to the STEM subject team:

E: stemtechaward@aqa.org.uk

T: 01483 477756