



Subject Benchmark Statement

Materials

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About this Statement

This document is a Quality Assurance Agency for Higher Education (QAA) Subject Benchmark Statement for Materials. It defines what can be expected of a Materials graduate in terms of what they are expected to know, do and understand at the end of their studies. Subject Benchmark Statements are an established part of the quality assurance arrangements in UK higher education. They are sector-owned reference points, developed and written with representatives from higher education institutions, industry and relevant accreditation bodies. Subject Benchmark Statements also describe the nature and characteristics of awards in a particular discipline or area. Subject Benchmark Statements are published in QAA's capacity as an expert quality body on behalf of the higher education sector. A summary of the Statement is also available on the QAA website.

Key changes from the previous Subject Benchmark Statement include:

- a revised structure for the Statement, which includes the introduction of cross-cutting themes of:
 - equity, diversity, and inclusion (EDI)
 - accessibility and the needs of disabled students
 - education for sustainable development (ESD)
 - employability, entrepreneurship and enterprise education (EEE)
 - generative artificial intelligence (Gen AI).
- a comprehensive review updating the context and purposes, including programme design and content in order to inform and underpin the revised benchmark standards.

How can I use this document?

Subject Benchmark Statements are not intended to prescribe any particular approaches to teaching, learning or assessment. Rather, they provide a framework, agreed by the subject community, that forms the basis on which those responsible for curriculum design, approval and update can reflect upon a degree programme, and its component course modules. This allows for flexibility and innovation in programme and course design while providing a broadly accepted external reference point for that discipline.

They are also useful as a reference point for external examiners when considering whether the design of a degree programme, and its threshold standards of achievement, are comparable with those of other higher education providers. Furthermore, they can support professional, statutory and regulatory bodies with their definitions and interpretations of academic standards.

This document is intended to be read by:

- Those involved in the design, delivery and review of degree programmes and course content in Materials, or programmes that contain elements of materials science and / or engineering within a wider engineering or science degree.
- Prospective students thinking about undertaking a degree in Materials.
- Employers who wish to find out about the knowledge and skills generally expected of Materials graduates.

Relationship to legislation

The responsibility for academic standards lies with the higher education provider which awards the degree. Higher education providers are responsible for meeting the requirements

of legislation and any other regulatory requirements placed upon them by their relevant funding and regulatory bodies. This Statement does not interpret legislation, nor does it incorporate statutory or regulatory requirements.

The status of this Statement differs depending on the educational jurisdictions of the UK. In England, Subject Benchmark Statements are not [Sector Recognised Standards](#) as set out under the Office for Students' [Regulatory Framework for UK Higher Education](#). However, Subject Benchmark Statements are part of the current quality arrangements in Scotland, Wales and Northern Ireland. Subject Benchmark Statements describe outcomes and attributes expected at the threshold standard of achievement in a UK-wide context. Many higher education providers use them as tools to aid the design and approval of degree programmes, and for subsequent monitoring and review, in addition to helping demonstrate the security of academic standards.

Additional sector reference points

Higher education providers are likely to consider other reference points in addition to this Statement when designing, delivering and reviewing programmes. These include requirements set out by professional, statutory and regulatory bodies, and by industry and / or employer expectations. The QAA has also published a [Quality Code](#) which is helpful when using this Statement.

Explanations of unfamiliar terms used in this Subject Benchmark Statement can be found in the QAA [Glossary](#). Sources of information about other requirements, and examples of guidance and good practice, are referenced where appropriate within the Statement and cited at the end.

1. Context and purposes of a Materials degree

What is the study of Materials?

1.1 The academic study of Materials links the sciences (principally chemistry, physics, and increasingly biology and computer/data science) with engineering applications. At the core of the subject is how the chemical or biochemical composition and physical structure of a material can be understood, and therefore designed or controlled by processing, to optimally fulfil an engineering application. Materials is inherently an interdisciplinary subject that combines relevant sciences with engineering to understand how any category, class or specific type of material (for example from an iron alloy to zirconium) behave under particular circumstances and in particular ways.

1.2 This understanding (or materials know-how) is generally achieved through the study of how the chemical and physical characteristics of materials, from the atomic level to the macrostructural (engineering) level, combine to control all aspects of materials properties. Such know-how underpins applications that range from the ability to efficiently harvest energy from sunlight or direct bone regeneration around a hip replacement, to the suitability of materials, for example, in the construction of a low-impact, carbon neutral housing or in space launch systems.

1.3 Key to this field is the knowledge that the routes used to synthesise or process materials significantly affects their chemical and physical structure, and thus the characteristics and performance of materials. Knowledge of this processing-structure-property relationship is fundamental. It is also exploited to fine-tune a material's behaviour, to model its performance under specific environmental conditions, or its environmental impact, and in the data-driven discovery and design of new materials.

Characteristics of a Materials degree

1.4 Materials Science is predominantly concerned with understanding the relationships between the microstructure and composition of materials and their physical, chemical, mechanical and functional properties by using tools such as imaging, characterisation, simulation, and, increasingly, computational and data-driven methods (including materials informatics and machine learning). Materials Engineering seeks to design or optimise specific structures or compositions, through synthesis, processing, manufacture or modelling, to meet engineering or product needs. Materials Engineering and Materials Science are strongly interlinked and cannot be delivered in isolation, although a particular degree programme may choose to emphasise these two aspects differently.

1.5 Materials scientists and engineers may be employed in a wide range of industrial and commercial sectors, with careers in manufacturing, research, product or process development, production management, consultancy and technical sales as well as education. As materials is a broad underpinning subject, Materials graduates may be involved with:

- advanced transport systems (such as aerospace, automotive and high-speed rail)
- healthcare (such as implant materials, diagnostic methods and medical devices)
- energy generation and storage (such as efficient thermal, photovoltaic, nuclear, wind, battery, hydrogen and fuel cell methods)
- forensics (such as failure analysis, crime scene investigation)
- high-performance materials, sports equipment, environmental protection (such as recycling and pollution control)
- electronics (from consumer products to novel smart devices)

- traditional sectors (including materials production, construction, packaging, domestic goods).

1.6 Materials scientists and engineers help to develop the materials required for new products, improve and lower the cost of manufacturing routes, and enhance the performance of existing materials. They consider the environmental impact and sustainability of their products, for example by substituting scarce or critical raw materials, designing for reuse and recyclability within a circular economy, and avoiding substances hazardous to health. They discover how to optimise the selection of materials and create sophisticated models and databases from which properties and service behaviour can be predicted. Materials, and the study of materials, are central to socioeconomic well-being.

Materials degree programmes

1.7 This Statement refers to degree-level programmes of study, delivered by universities and other higher education providers, where the primary subject of study, and the majority of learning outcomes, are concerned with materials science and/or materials engineering. These programmes include but are not limited to:

- a bachelor's degree with honours (often denoted BEng (Hons) or BSc (Hons)) in a Materials programme such as Materials Science and Engineering or other specialisations such as Materials Chemistry and Biomaterials
- an integrated master's degree (often denoted MEng or MSci) in a Materials programme such as Materials Science and Engineering or other specialisations such as Materials Chemistry and Biomaterials
- a postgraduate taught master's degree (often denoted MSc) in a Materials programme such as Materials Science and Engineering or other specialisations such as Materials Chemistry and Biomaterials.

1.8 These degrees may also be delivered through part-time or flexible study, or through a degree apprenticeship that embeds a bachelor's or integrated master's degree within an apprenticeship combined with paid employment.

1.9 Given the multi- and inter-disciplinary nature of the discipline, Materials degrees may be named as, and have greater focus on, specialisms, for example metallurgy, polymers, ceramics, biomaterials, nanomaterials, functional materials and electronic materials.

Ethics

1.10 Materials engineers and scientists are obligated to carry out their work in accordance with the law and the ethical principles of their profession. Materials programmes therefore must include an understanding of ethical issues that is sufficient for students to make sound judgements and justify their choices. The Engineering Professors' Council promotes an [Ethics Toolkit](#) that contains advice, guidance and case studies on how to embed and assess ethics within the curriculum, and guidance is also available from other professional bodies such as the Institute of Materials, Minerals and Mining (IOM3) and the Royal Society of Chemistry (RSC).

1.11 Within public service the [Seven Principles of Public Life](#) (selflessness, integrity, objectivity, accountability, openness, honesty and leadership) apply. Professional Members of Institutions are also bound by their institutional codes of conduct that encapsulate and/ or

expand upon these principles. The Royal Academy of Engineering and the Engineering Council have together formulated a [Guidance on Ethical Principles](#) that covers the principles of honesty and integrity, respect for life, law, the environment and public good, accuracy and rigour, and leadership and communication. Materials students must learn to recognise their responsibility to act when they identify safety, quality or ethical concerns, including raising and escalating issues through appropriate channels where necessary to protect the public interest.

Safety and security

1.12 As materials science and engineering are fundamentally multi- and cross-disciplinary activities, Materials professionals need to appreciate total systems complexity to provide the safest, most appropriate, advice and guidance. Students must develop a holistic approach to protecting the safety and security of life, systems and assets. This requires knowledge of regulatory requirements, sector standards and codes of practice, risk management and monitoring, and the potential threats of human behaviours and interactions on systems. Omitting these requirements can result in premature failure of materials and systems, causing injury to people and assets and potentially leading to legal jeopardy.

1.13 Security includes preserving the value, longevity and ongoing operation and function of an enterprise's assets, whether tangible or intangible, and the handling of privacy issues, such as the protection of personally identifiable information. Students must learn to critically analyse their own design choices and work collaboratively with others to realise systems and solutions that are robust against security threats. Students must also be aware of the legal protections around personal data and how to invoke best practice in cyber security for personal, commercial and governmental sensitive information. Students must appreciate that some professional roles, particularly in sectors such as defence, aerospace, energy and critical infrastructure, require security clearance and place additional responsibilities on individuals.

Professional registration

1.14 While not all roles require membership of a professional body, registration through an appropriate institution as an Incorporated or Chartered Engineer or Scientist, or equivalent, is often highly desirable. To be accredited as contributing towards professional registration a programme of study must meet specific requirements and standards and be regularly reviewed. For Materials Science and Engineering programmes, this is normally undertaken by the Institute of Materials, Minerals and Mining under licence from the Engineering Council.

1.15 New degree programmes may not be accredited until the first cohort of students has completed the programme when accreditation can be backdated.

1.16 Some degree programmes are designed to follow similar study areas to accredited degrees while not meeting all of the Engineering Council/accrediting body required learning outcomes/key requirements. In such cases a non-accredited degree is awarded.

Equity, diversity and inclusion (EDI)

1.17 Materials science, engineering and technology are central to solving global challenges from clean energy and sustainable manufacturing to advanced healthcare and digital technologies. As these solutions affect communities across the world, it is essential that the discipline is inclusive, diverse, and socially responsible. Better materials-related solutions emerge when the people designing them reflect the diversity they serve. Global

challenges such as critical minerals, sustainable polymers, biomaterials, and low-carbon processing benefit directly from a wide range of cultural perspectives, skills, and lived experiences. Diverse teams generate more creative, relevant, and equitable materials solutions.

1.18 EDI is a key requirement for all materials-related disciplines and is embedded in the various professional standards such as the Engineering Council's [Accreditation of Higher Education Programmes](#) framework, which emphasises inclusive engineering practice and responsibility to support equity, diversity and inclusion. In materials disciplines this includes recognising and valuing diverse scientific contributions; embedding sustainability and global supply-chain awareness and considering cultural and environmental contexts in materials-related practices from materials design to selection and application. Materials programmes must emphasise that innovations influence not only the technologies they enable but also the wider stakeholders they affect, with significant implications for communities, resource equity and environmental justice. They must be designed to ensure that students learn how to:

- design materials and technologies that meet the needs of diverse and global users both now and in the future
- recognise ethical and social implications of material choices
- challenge assumptions built into materials standards and design practices
- demonstrate inclusive practice when working in teams.

1.19 In line with institutional policies of the educational provider and the requirements of relevant professional bodies, for example the Institute of Materials, Minerals and Mining and consistent with Science Council and Engineering Council guidance, Materials programmes must ensure an inclusive and supportive learning environment that enables all students to succeed. Programmes must seek to provide equitable access to laboratories, equipment, digital tools, and project opportunities; maintain robust wellbeing, inclusion, and diversity mechanisms, including appropriate policies and support structures; and adopt teaching and assessment approaches that anticipate and accommodate diverse learner needs. Beyond their statutory duties of non-discrimination and the provision of reasonable adjustments, programmes must give consideration to the impact of digital poverty and to the inclusive design of site visits, practical work, assessments and other learning activities, including for students with disabilities and neurodivergence.

Accessibility and the needs of disabled students

1.20 Equality of opportunity involves enabling access for people who have differing individual requirements as well as eliminating arbitrary and unnecessary barriers to successful learning. Materials programmes must therefore aim to make learning and assessment opportunities as accessible as is reasonably practicable for all students, through inclusive design wherever possible and through reasonable adjustments where individual needs require them, while maintaining academic and competence standards. Learning and assessment experiences must be diverse to both reflect the variety of the subject and to increase accessibility for all. This necessarily entails the use of flexible approaches to learning, teaching and assessment.

1.21 Accessibility must be treated as a standard part of Materials curricula, ensuring that programmes remove barriers to access and facilitate inclusion and therefore must be designed with accessibility in mind, meeting, and preferably exceeding, statutory requirements. Accessibility considerations must remove barriers to engagement and must extend beyond practical initiatives (such as access to laboratory and workshop environments, including digital resources) to all areas of study, including group work and

placements. Accessibility considerations must also address hidden disabilities and neurodivergence to ensure individuals or groups are not disadvantaged.

1.22 Some disabilities and/or neurodiversity can make it harder for students to show what they know, and can do in an assessment, than had the student not been living with that condition. Reasonable adjustments include changes to an assessment, or to the way an assessment is conducted, that reduce or remove such a disadvantage and must be tailored to the individual's needs whilst maintaining academic integrity. Providers can refer to the [Guidance on Assessment of Student Work, and Reasonable Adjustments on Recognised Programmes](#), for more detailed information and recommendations.

1.23 Materials science and/or engineering is inherently interdisciplinary in nature and includes elements of mathematics, physics, chemistry, design and, biology. It must be recognised that individual cohorts of students studying Materials, either as a specific subject at degree level or as part of a broader degree, will have a range of prior experience and knowledge of these related subjects. This must be accounted for in the educational resources made available to students during their programme, to ensure they are not unfairly disadvantaged, depending on their prior educational background.

Education for sustainable development (ESD)

1.24 Appropriate use of materials is key to sustainable development. Materials programmes need, therefore, to develop students who understand how considerations relating to sustainability are relevant in all stages of materials usage, from initial extraction of raw resources to end-of-life recovery. Key aspects include materials selection, materials sourcing, manufacturing processes, the in-service impact of material usage (such as leaching of chemicals, production of microplastics, energy and emissions inputs/outputs), processes related to life extension and end-of-life processes. This also includes consideration of resource utilisation associated with related digital processes such as modelling, data storage, and AI tools. The [Reimagined Degree Map](#) provides guidance on preparing students for 21st century challenges in this area.

1.25 Students in Materials programmes need to be equipped with the knowledge and skills to make, and justify, decisions informed by sustainable development principles. This includes a system-level thinking of materials as global resources, and an appreciation of the impacts that new uses of such resources can have on the components of this system. It also includes the skills to provide required data and maintain appropriate record-keeping, enabling effective life-cycle analysis, and supporting future work on asset management.

1.26 Materials graduates must be able to critically appraise materials aspects of projects and apply problem solving skills to optimise the sustainability of projects they are involved with. They must be able to work in a way that is informed by key external guidelines, policies and structures such as UK responses to the [United Nations \(UN\) sustainable development goals \(SDG\)](#) and the European Union (EU) critical materials list. They need to develop holistic approaches and thinking to enable effective application of sustainable development principles whilst working within wider systems of businesses and/or complex institutions. This includes considerations of aspects such as supply chain management, process control and optimisation, scale- up, quality control, analysis, testing, and certification.

Employability, entrepreneurship and enterprise education (EEE)

1.27 Employability, enterprise and entrepreneurship education (EEE) supports the development of behaviours, attributes and competencies that enable graduates to build successful careers and to contribute social, cultural and economic value to society. For

Materials graduates, who enter a wide range of technical and non-technical sectors, EEE enriches both discipline-specific learning and broader professional development. This Statement can therefore be read in conjunction with QAA's [Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers](#).

1.28 Employability education prepares students for the transition from study to work and for sustained progression throughout their careers from early-stage Initial Professional Development to Continuing Professional Development. For Materials graduates this includes developing technical fluency, professional communication, teamwork, ethical and sustainable practice, and the reflective and self-management skills that underpin lifelong learning and possible progression towards chartered status.

1.29 Enterprise education develops students' capacity to generate ideas and act on them, fostering creativity, initiative, resilience and adaptability. Entrepreneurship education builds on these competencies, developing skills needed to create value, whether through spin-out companies, start-ups, or intrapreneurial activity within established organisations. For materials scientists and engineers, this includes understanding how novel discoveries and innovations can be brought to application, market, and how intellectual property is managed and protected.

1.30 Materials programmes must provide opportunities to develop an entrepreneurial mindset through activities such as industry-linked project work, design challenges, placements, engagement with entrepreneurs and alumni, and exposure to commercialisation. The QAA EEE Guidance describes a pipeline from enterprise awareness through to entrepreneurial effectiveness, which is helpful when designing provision. Programmes must equip all students with the awareness, mindset and capability to pursue entrepreneurial or intrapreneurial paths as appropriate to their aspirations.

Generative artificial intelligence (GenAI)

1.31 Generative artificial intelligence refers to computational tools and models, including large language models and other machine learning systems, that can generate text, images, data, code and other outputs in response to user prompts. The rapid development and widespread availability of GenAI tools is transforming many aspects of higher education, professional practice and scientific research, and Materials programmes must engage seriously with both the opportunities and the challenges this presents.

1.32 Within the materials discipline, GenAI tools can be effectively used in research and professional practice for tasks including literature search and synthesis, hypothesis generation for materials discovery, computational modelling, automated data analysis, coding and scientific writing. Graduates are expected to use such tools routinely in their professional practice, therefore Materials programmes must equip students with the knowledge, skills and critical frameworks needed to use them effectively, ethically and appropriately. Students must understand both the capabilities and limitations of GenAI, including plausible but incorrect outputs, bias, and the energy and environmental costs of training and running large models. Students must also appreciate how AI-driven approaches can contribute to sustainability goals, for example by accelerating the discovery of lower-carbon materials or optimising resource intensive processes.

1.33 The use of GenAI by students in their learning and assessment raises important questions about academic integrity and the development of genuine understanding. Programme providers must ensure that assessment reliably measures students' own knowledge, understanding and skills, and that students develop genuine understanding rather than over-reliance on these tools.

1.34 The use of GenAI by staff in the marking and grading of student work is governed by data protection obligations under UK GDPR and by the provider's institutional policies. Where GenAI is used in any aspect of assessment, this must be communicated clearly to current students and made visible to prospective students at the point of application. Providers can refer to current guidance on [Generative Artificial Intelligence](#) and must keep their approach regularly reviewed and transparent to students and staff.

2. Distinctive features of a Materials degree

Curriculum design

2.1. Materials degrees may be general or specialist, theoretical or applied. Degree programmes offered by providers vary considerably with different emphasis. However, it is expected that Materials students are made aware of the full range of functional and structural materials. A materials curriculum, therefore, is likely to include some or all of the following: metals, alloys, composites, ceramics, polymers, glasses, biomaterials, sensor materials, device materials, electronic materials, sports materials and nano-materials.

2.2. A key to the application of materials is to understand the links between structure and properties, and between processing and structure. Hence a Materials degree programme must include development of the skills to enable students to select appropriate materials, and design their synthesis/fabrication routes, in order to balance properties and in-service performance.

2.3. Given its intrinsically multidisciplinary nature, materials students can find future roles in a wide variety of different engineering and scientific sectors. A Materials degree curriculum cannot cover detailed subject knowledge for all potential sectors of materials graduate employment but must deliver the underlying foundations linking properties, processing and structure which can then be augmented by the detailed subject knowledge required to fit career paths within any specific sector.

Materials-related knowledge: building “know how”

2.4. Materials degree programmes need to deliver a broad understanding of structure, properties, characterisation, modelling, simulation, processing, application, performance in service, sustainability and their inter-relationships. These requirements include, but are not limited to, most or all of the following topics.

- **Structure:** structure at all length scales (atomic to macro) including amorphous structures, crystallinity, macro, micro, molecular and atomic structures. As well as the relationship between defects and disorder, phase equilibria and transformations, thermodynamics and kinetic aspects.
- **Properties:** mechanical and physical behaviour, strengthening, toughening, creep, yielding, fracture and fatigue and microstructural influences on functional behaviour.
- **Characterisation:** microscopy, diffraction, mechanical testing, spectroscopic methods, physical properties (such as electrical, optical and magnetic), functional analysis and forensics.
- **Computational materials science:** use of density functional theory, molecular dynamics, finite element analysis and machine learning-based approaches to materials modelling, image analysis and data analysis.
- **Sustainable and green materials:** principles of the circular economy, lifecycle analysis, use of bio-based or recycled/reused materials, and the environmental impact of materials production/processing.
- **Materials in service:** materials selection and design, durability, service performance (such as corrosion, friction and wear, biocompatibility, ageing), repair and sustainability.

- *Sector specific materials*: biomaterials, functional materials, sports materials, smart materials, device materials, aerospace materials and electronic materials.

2.5. Materials students must have had opportunities, through practical work, or first-hand experience, to engage with a range of materials and techniques (by artefact analysis, characterisation, processing, computational simulation and testing) sufficient to develop the ability to plan, implement and interpret experimental investigations.

Underpinning scientific and engineering skills

2.6. Materials students need to acquire sufficient underpinning knowledge of science, engineering and mathematics in order to understand sector-specific components, to understand aspects of materials production, performance in service and to be able to communicate effectively. A Materials degree is often divided into core and optional course components depending on the programme requirements. Topics that are expected to be covered as part of the core curriculum include the following.

- *Mathematics*: sufficient fluency and familiarity to express and apply scientific principles mathematically, formulate and solve problems, design experiments and analyse data with competency in probability and statistics.
- *Chemistry*: sufficient understanding to support the necessary materials-related knowledge including, for example, thermodynamics and kinetics, characterisation and analysis, chemical processing and production of materials and materials degradation.
- *Physics*: enabling understanding of physical principles important in the structure of materials, mechanical and physical properties including, for example, optical, electronic and magnetic.

2.7. Depending on the specific emphasis of the degree programme optional course elements such as design, manufacture, synthesis, tissue engineering, physiology, asset management and informatics may also be included.

Progression

2.8. The [Framework for Higher Education Qualifications of UK Degree-Awarding Bodies \(FHEQ\)](#) for England, Wales and Northern Ireland, and the [Scottish Credit and Qualifications Framework](#) provide the national references for academic standards. Over the duration of a standard undergraduate degree with honours (FHEQ level 6 or SCQF level 10) or, if available, an integrated master's degree (FHEQ level 7 or SCQF level 11), students can progress from one level of study to the next in line with the regulations and processes for each institution. However, it is expected that each level increases the attainment of knowledge, expertise and experience and builds towards the final achievement of meeting the threshold (and if specified higher-level) subject-specific and generic skills listed in this Statement. This usually includes successful completion and the award of credit for the full range of learning and assessment, including any practical components.

2.9. Undergraduates studying Materials programmes as part of a combined or joint degree with other subjects (including programmes that specify major and minor options) achieve core course elements of the specific and generic skills outlined in this Statement and can add optional courses according to the areas covered in the other subject(s) of their degree. Additionally, they may explore the overlap between different disciplines, creating further opportunities for interdisciplinary study.

2.10. Any student enrolled in a standard undergraduate Materials degree course may exit earlier and be eligible for a Certificate of Higher Education (FHEQ level 4; SCQF level 7), a Diploma of Higher Education (FHEQ level 5; SCQF level 8), or other awards depending upon the levels of study completed to a satisfactory standard. Please refer to the [Characteristics Statement -Short Cycle Qualifications](#) for more detailed information on 'break points' in degree programmes.

Flexibility

2.11. At providers in England, Wales and Northern Ireland, the duration of full-time study leading to a standard undergraduate degree is typically three years, or four years for a degree involving a year abroad (such as a programme involving languages) or a placement year, or for an integrated master's degree. In Scotland, a bachelor's/ordinary degree is set at three years at Level 9 on the SCQF. A bachelor's degree with honours, which is the most typical route for learners, is designed to include four years of study, and is set at Level 10 of the SCQF. In addition, a number of Scottish universities have a long tradition of labelling certain undergraduate academic degrees as a Master of Arts (MA). This title reflects historic Scottish custom and practice with an MA/ordinary degree at Level 9 and MA with Honours at Level 10 on the SCQF. Students following part-time routes accumulate academic credit in proportion to the intensity of their study, and their total study time and credit value are equivalent to those achieved on full-time routes.

2.12. Higher education providers structure the degree programmes they offer to support students' learning and attainment. Depending on the educational mission of the provider, this includes opportunities to engage in learning on site, online, workplace-based learning including apprenticeships and/or through hybrid learning. Teaching may be arranged in terms, by semester, year-long, block, or other formats offered in full- and/or part-time modes of study. Credit is accumulated through the completion of micro-credentials, short-accredited learning, recognition of prior learning or accreditation of prior experiential learning.

Partnership

2.13. Degree-awarding bodies may deliver programmes in partnership with other providers through validation and franchising arrangements. Others may work with partners who deliver specific course elements through placement learning or as part of a degree apprenticeship. Subject Benchmark Statements, such as this one, play an important role in helping partners design provision that contributes to threshold standards being met in a specific subject area.

Monitoring and review

2.14. Degree-awarding bodies, and their collaborative partnerships, routinely collect and analyse information and undertake periodic programme review according to their own needs. Considering the student voice forms an important part of this process. They draw on a range of external reference points, including this Statement, to ensure that their provision aligns with sector norms. Monitoring and evaluation involve periodic assessment of a degree programme, conducted internally or by external independent evaluators. Evaluation uses information from both current and historic monitoring to develop an understanding of student achievement or inform future degree programme planning.

2.15. External review is an essential component of the quality assurance system in the UK. Providers use external reviewers as part of periodic review to gain an independent perspective on any proposed changes and ensure threshold standards are achieved and content is appropriate for the subject.

2.16. The external examining system currently in use across the UK higher education sector also helps to ensure consistency in the way academic standards are secured by degree-awarding bodies. Typically, external examiners are asked to comment on the types, principles and purposes of assessments being offered to students. They consider the types of modules on offer to students, the outcomes of a cohort and how these compare to similar provision offered within other UK higher education providers. External examiners are asked to produce a report each year and make recommendations for changes to modules and assessments, where appropriate. Subject Benchmark Statements, such as this one, can play an important role in supporting external examiners in advising on whether threshold standards are being met in a specific subject area.

2.17. Degree programmes with professional and vocational outcomes also require evaluation and accreditation from professional and regulatory bodies. This is usually done through a combination of site visits and desk-based reviews.

3. Content, structure and delivery

3.1. This section explores how the content of the curriculum for Materials shapes the likely teaching and learning strategy and the modes of assessment that allow students to demonstrate they have met the benchmark standards and to discriminate between different levels of attainment.

Teaching, learning and assessment

3.2. Existing Materials degree programmes have been developed over many years and deploy a diverse range of teaching, learning and assessment methods to convey the taught concepts and enhance the student learning experience. This Statement encompasses a wide range of programmes, which are offered through many modes and patterns of study. Teaching, learning and assessment methodologies are justified in terms of the learning outcomes of the course components within degree programmes and the background of the students. The methods used are made explicit to students, are evaluated regularly, and modified when appropriate, in response to generic and subject-specific developments. The latter include developments related to the impact of materials on societal and environmental issues, and the former include developments related to new technology advancements, for example in Artificial Intelligence (AI).

3.3. Degree programme design is informed by industry practice, research, scholarship, an awareness of potential graduate destinations and the skills required to succeed. Due consideration is given, where appropriate, to the expectations of relevant professional, statutory and regulatory bodies.

3.4. Students cannot achieve a satisfactory understanding of materials science and/or engineering without a significant exposure to laboratory and practical work, and an involvement in a substantial project that is appropriate to the level of the qualification awarded. These activities develop in graduates both independence of thought and the ability to work effectively as individuals and/or members of a team.

3.5. Methods of assessment reflect the achievement of specified learning outcomes at module and programme levels and are also relevant to the achievement of accreditation requirements. There is a balance between the need to assess a student's understanding, knowledge and ability for the award of a qualification, and providing appropriate feedback that fosters a student's development. Where possible, assessment methods reflect the demands that graduates are likely to face in their future careers, including problem solving and the need to express technical material clearly and accurately. An important element of assessment is that students are given feedback in a timely manner to allow continuing personal development.

3.6. Examples of teaching and assessment methods which are appropriate for use within individual Materials course components are given below. However, these lists are neither prescriptive nor comprehensive, since imaginative innovation in teaching often plays a large role in motivating students and expanding their interest in the subject.

3.7. Where appropriate, alternative forms of assessment must be made available to support accessibility requirements and diverse learning profiles. Such adaptations must preserve alignment with the intended learning outcomes, the overarching aims of the module and programme, and any relevant professional, statutory, or regulatory body requirements. This approach supports inclusive assessment design while safeguarding academic standards and the integrity of the award.

Project work

3.8. Materials graduates are expected to have carried out a substantial group and/or individual project. These projects develop competence in investigating, managing the project and resources, functioning effectively as an individual and/or member of a team, and applying problem-solving skills, usually towards the solution of an open-ended and complex problem. The outcomes of such a project are typically communicated in a final report (often accompanied by a complementary presentation and/or interview) which, for example, demonstrates the ability to:

- understand the published literature on the topic of the investigation, encompassing both what is known and the limits of current knowledge
- use critical analysis in the evaluation of the current literature
- formulate the problem in appropriate terms and select appropriate methodologies to undertake investigation
- present findings in a clear and concise manner
- analyse findings qualitatively and quantitatively as appropriate, and use appropriate methods to assess the uncertainty of any quantitative results
- critically interpret and discuss findings in the light of current knowledge
- summarise the main conclusions and provide an accurate synopsis of the work undertaken
- provide recommendations for future work.

Professional experience

3.9. The opportunity for students to gain experience in or about the professional environment during the degree is highly recommended. This may be acquired via speakers from industry and commerce, materials-related work placements, site visits, or participation in external projects. Materials graduates are also expected to be familiar with the organisation and structure of business, the relevant legislative requirements and ethical professional behaviour.

Examples of teaching, learning and assessment methods

3.10. Examples of appropriate teaching, learning and assessment methods, for course components of materials programmes, are given below. These are intended to be illustrative and not exhaustive.

Teaching / study methods

- Lectures and direct teaching: live or recorded lectures (formal & interactive).
- Tutorials and academic support: tutorials (one-to-one & small group) and classes.
- Practical and experiential learning: laboratory classes (structured/open-ended), field trips/work visits and work placement training.
- Independent and guided learning: guided reading, e-learning tools and library/information retrieval tasks.
- Collaborative and peer learning: student study groups and peer mentoring.
- Applied and problem-based learning: case studies and problem-based learning.

- Projects and research work: individual and group projects.
- Reflective and conceptual development: reflective journals and concept mapping.

Assessment methods

3.11. The aims and requirements for each assessment must be clearly defined through transparent marking criteria, and relevant feedback must be provided for all students in a timely manner. Assessment must be designed to ensure the highest possible standards while also preventing opportunities for academic misconduct, such as plagiarism, contract cheating and inappropriate use of AI tools. Policies and procedures published by the higher education providers for safeguarding academic integrity must also be actively promoted and applied consistently.

3.12. Assessment must focus on student learning and must enable students to demonstrate their full range of abilities, both theoretical and practical. All assessments must align to the learning outcomes. The higher education provider must offer a range of assessment methods that are accessible to all students and must also make reasonable adjustments for disabled students. A diversity of innovative assessment methods is encouraged. Flexibility of assessment can improve accessibility to learning for a diverse community.

3.13. Typical assessment methods can include the following.

- Examinations: written (timed or untimed, closed or open-book, digital or physical), verbal and/or non-verbal (by portfolio), laboratory-based or practical or computer-aided.
- Coursework and written assignments: essays, problem-solving tasks, case studies and critical reviews of literature.
- Reports and project outputs: laboratory reports, work-placement reports and project reports.
- Presentations and communication [live or recorded]: verbal and/or non-verbal presentations and examinations and poster presentations.
- Reflective assessment: learning logs/portfolios, reflective statements on self-learning and professional development.
- Practical and applied assessment: practical examinations of digital or physical prototypes.
- Peer, self and engagement-based: self-assessment, peer assessment, in-class participation and contribution.

4. Benchmark standards

Introduction

4.1 This Subject Benchmark Statement sets out the threshold (and, where appropriate, typical and excellent) standards that a student has demonstrated when they are awarded a bachelor's degree with honours, an integrated master's degree or a postgraduate taught master's degree.

4.2 Demonstrating these standards over time shows that a student has achieved the range of knowledge, understanding and skills expected of graduates in Materials. The vast majority of students will perform significantly better than the threshold standards. Each higher education provider has its own method of determining what appropriate evidence of this achievement will be and should refer to Annex D in [The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies](#). This Annex sets out common descriptions of the four main degree outcome classifications for bachelor's degrees with honours – 1st, 2:1, 2:2 and 3rd.

4.3 The benchmark standards are defined relative to the appropriate [Frameworks for Higher Education Qualifications FHEQ Level 6 or 7](#) or in Scotland, [SCQF Level 10 or 11](#), specifications and associated descriptors. As such, their application to an individual degree programme is necessarily contextual. Many Materials degree programmes in the UK are accredited by the Institute of Materials, Minerals and Mining or other UK professional engineering institutions acting under licence from the Engineering Council. Alternatively, some degree programmes (for example Materials Chemistry) are accredited by professional scientific institutes such as the Royal Society of Chemistry. For degrees that are accredited the learning outcomes, or key requirements defined by the profession to support development of competences required for professional registration, apply.

4.4 Some bachelor's, integrated master's or postgraduate taught master's degrees may be joint programmes with Materials (often designated using 'and' in the degree title) or programmes with a minor component of Materials (often designated using 'with' in the degree title). Materials degree programmes may alternatively have a title that reflects a specialism (such as Materials Chemistry or Biomaterials). In these cases, programmes must meet the benchmark standards of FHEQ Level 6 or 7/SCQF Level 10 or 11, meet the criteria of the higher education provider and are expected to meet some of the threshold benchmark standards of a single-discipline degree in Materials. If they are accredited by a professional body, then that body may also have requirements for threshold standards.

4.5 Minimum threshold standards are not intended to specify universal competence standards for a discipline. If a provider chooses to develop competence standards (as defined by the Equality Act 2010) as part of a programme specification these can be informed by the relevant Benchmark Statement and the recommendations of professional, statutory and regulatory bodies. In these circumstances providers must also follow the most recent [Advice Note to Higher Education](#) from the Equality and Human Rights Commission.

Minimum threshold level

4.6 For the purposes of this Statement for accredited programmes, the learning outcomes or key requirements set out in the relevant documents of the accrediting bodies must be interpreted as the minimum threshold standards. For engineering programmes accredited by professional bodies such as the Institute of Materials, Minerals and Mining under licence from the Engineering Council then the relevant edition of the [Accreditation of Higher Education Programmes](#) provides required learning outcomes. These can be read in

the context of the generic competence statements for Incorporated Engineer (IEng) and Chartered Engineer (CEng) in the [UK Standard for Professional Engineering Competence and Commitment \(UK-SPEC\)](#). Science programmes (such as Materials Chemistry) may be accredited by bodies such as the Royal Society of Chemistry which specify key requirements for Chartered Chemist (CChem). Typically, multidisciplinary and bachelor's Materials Chemistry programmes are only accredited to partially meet the academic criteria for Chartered Chemist (CChem), whereas integrated master's programmes in Materials Chemistry fully meet these criteria. Non-accredited degrees (undergraduate or postgraduate) are expected to meet similar threshold standards.

Bachelor's degree with honours

Threshold level (3rd class degree)

4.7 Students graduating with a bachelor's degree with honours in Materials must demonstrate at least a threshold-level of attainment across all outcome categories. Threshold-level attainment typically maps onto that associated with a 3rd class honours degree. Criteria for achievement at threshold level must be in line with the higher education provider's common or generic marking schemes for undergraduate programmes and the sector-recognised standards that are in use in each of the nations of the UK. If the programme is accredited, the threshold must also be determined by the relevant professional engineering or science institution(s).

4.8 On award of a BEng or BSc honours degree in a Materials subject, graduates are expected to demonstrate the following.

- Knowledge and understanding: a coherent knowledge and understanding of the Materials discipline or specialisation and its practical application.
- Problem solving: the ability to identify relevant scientific or engineering problems, select the appropriate tools and go on to create safe, secure and sustainable solutions designed to meet defined needs.
- Analysis: the skill to select and apply quantitative and computational analysis techniques recognising the limitations of the methods employed.
- Delivery/skills/practice: creativity, innovation, teamworking and communication.
- Values and principles: an appreciation of professional and commercial scientific or engineering practice, ethics and global social responsibility.

Typical level (2.2 or 2.1 level)

4.9 Criteria for achievement above the threshold level at 2:1 and 2:2 honours must agree with the higher education provider's common or generic marking schemes for undergraduate programmes and the sector-recognised standards that are in use in each of the nations of the UK.

Excellent level (1st class)

4.10 Criteria for excellent level (usually 1st class honours) must agree with the higher education provider's common or generic marking schemes for undergraduate programmes and the sector recognised standards that are in use in each of the nations of the UK.

Integrated Master's degree

4.11 A graduate who has reached the integrated master's degree (MEng or MSci) with honours threshold level has demonstrated the capabilities and skills of the typical

bachelors with honours level and has met the requirements of the FHEQ/SCQF based on the higher education provider's common or generic marking schemes for undergraduate programmes. They also have:

- gained a working knowledge of a variety of experimental, mathematical and/or computational techniques applicable to current research or applications in Material Science
- undertaken an extended investigation
- encountered research level material.

4.12 On award of an MEng or MSci degree in Materials, a graduate is expected to demonstrate the capabilities and skills of the integrated master's threshold level and be able to evidence significant progress towards gaining the capabilities and skills of a typical master's graduate, as outlined below in 4.15.

Postgraduate master's degree

Threshold level (pass)

4.13 Students graduating with a postgraduate master's degree in Materials must demonstrate at least a threshold level of attainment across all relevant outcome categories. Threshold level attainment typically maps onto that associated with a pass award. Criteria for achievement at threshold level must agree with the higher education provider's common or generic marking schemes for the relevant master's programme. If the programme is accredited, the threshold must also be determined by the relevant professional engineering or science institution(s).

4.14 On award of an MSc in Materials, graduates are expected to demonstrate the following.

- Knowledge and understanding: a systematically practical and conceptual knowledge and understanding of the Materials discipline or specialisation, informed by the forefront of the academic discipline.
- Problem solving: the ability to critically identify complex scientific or engineering problems, select the appropriate tools and go on to create safe, secure and sustainable solutions designed to meet defined needs applicable to their own research or advanced scholarship.
- Analysis: the skill to comprehensively select and apply quantitative and computational analysis techniques in the absence of complete data, critically evaluating the limitations of the methods employed and apply originality in the application of this knowledge.
- Delivery/skills/practice: demonstrate high levels of creativity, innovation, effective teamworking, leadership, self-direction and communication together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline.
- Values and principles: a highly developed appreciation of professional and commercial scientific or engineering practice, ethics and global social responsibility, with the exercise of initiative and decision-making in complex and unpredictable situations.

Typical level (merit)

4.15 Criteria for typical achievement (merit) above threshold level must be in line with the higher education provider's common or generic marking schemes for MSc programmes.

Excellent level (distinction)

4.16 Criteria for excellent level (distinction) must be in line with the higher education provider's common or generic marking schemes for MSc programmes.

Generic skills

4.17 Materials graduates are required to have good professional judgement, exercise critical thought and, after experience in a role, take responsibility for the management and direction of projects. The curriculum of a Materials degree includes opportunities for students to develop generic skills, for example:

- identify issues, questions and problems in materials contexts
- apply knowledge and understanding to provide evidenced conclusions
- work with a range of data, including qualitative and quantitative experimental data, and apply appropriate statistical methods
- critically engage with digital technologies, including data analysis tools, computational simulation platforms and, where appropriate, generative AI tools, to collate, analyse, select and present information
- evaluate and use generative AI tools critically and responsibly, understanding their capabilities, limitations and the ethical implications of their use
- demonstrate intellectual independence, including undertaking tasks with appropriate autonomy, conducting self-directed research and exercising critical judgement
- identify and examine ethical, professional and societal responsibilities relevant to materials practice
- appreciate and engage in contemporary debates relating to sustainability, equity and social responsibility as they apply to materials science and engineering
- demonstrate awareness of health and safety, sustainability and environmental issues
- demonstrate entrepreneurship and an awareness of issues related to intellectual property and its protection
- work collaboratively, including in group or team settings and interdisciplinary projects
- communicate effectively and appropriately, verbally and in writing, to both technical and non-specialist audiences
- identify and articulate gaps in their own knowledge and acquire new knowledge independently, understand, analyse and synthesise knowledge and information from diverse sources
- reflect on their own progress and development and engage with life-long learning
- make appropriate use of feedback to further their intellectual development
- demonstrate awareness of academic and professional integrity and of ethical considerations
- understand the importance of wellbeing, mental health and emotions and their relationship with learning and the professional workplace.

5. List of references and further resources

- Engineering Council (2020): [Accreditation of higher education programmes](#)
- Engineering Council (2020): [UK standard for professional engineering competence and commitment: UK-SPEC](#)
- Engineering Council (2025): [Guidance on assessment of student work, and reasonable adjustments on recognised programmes](#)
- Engineering Council (2026): [Guidance on ethical principles](#)
- Engineering Professors' Council (2024): [Engineering ethics toolkit](#)
- Engineering Professors' Council (2025): [Inclusive employability toolkit](#)
- Engineers Without Borders (2025): [Reimagined degree map for the 21st century](#)
- Equality and Human Rights Commission (2024): [Advice note to higher education](#)
- QAA (2018): [Enterprise and entrepreneurship education: guidance for UK higher education providers](#)
- QAA (2024): [Frameworks for higher education qualifications of UK degree awarding bodies](#)
- QAA (2026): [Quality code](#)
- QAA (2026): [Glossary](#)
- QAA (2026): [Generative artificial intelligence](#)
- SCQF (2026): [The framework](#)
- UK Government (1995): [The seven principles of public life](#)

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