Consultation version

Process engineer integrated degree apprenticeship Occupation summary

Process engineers work in a variety of industries including bioprocess, chemical, energy and utilities, environmental engineering, food and drink, green energy production, manufacturing, materials, and pharmaceuticals.

In process operations inputs are variable, conditions are changeable, products are created involving chemical reactions or transformations, and systems require material transport and degradation control. Processes can be discrete, known as batch, or continuous. Processes may be based in a variety of settings including factories, industrial plants, or external environments.

Our society heavily relies on the work of process engineers. They create products and systems that are essential for powering the modern world and have a vital role in supporting the UN's Sustainable Development Goals (SDGs). The food and drink we consume, the energy and fuels we use, and the medicines we take all depend on their technical skills.

Process engineers apply knowledge of physical, chemical and biological transformations to design, develop, and optimise processes and products. They develop solutions to key industrial challenges in environmental impact, reliability, quality, efficiency, and health and safety. They conduct tasks to support health and safety compliance. Plan work, manage engineering tasks or projects, and ensure the completion of documentation and technical literature for the engineering function. Leading or contributing to problem solving activities and continuous improvement initiatives is also part of the role.

Their work often involves working with other engineers, scientists, operational teams, quality control teams, and management. They may also have contact with customers, contractors, and other stakeholders such as regulatory authorities.

They are responsible for working safely, efficiently, and sustainably. They must ensure compliance with health and safety regulations and procedures. Products or systems must be robust, cost-effective, meet customer requirements, and support business demands. They must comply with codes of conduct and regulatory frameworks. In addition, they must operate and act responsibly in line with principles of sustainable development and carry out responsibilities in an ethical manner.

Typical job titles:

- Biochemical engineer
- Chemical engineer
- Environmental engineer
- Operations engineer
- Plant engineer

- Plant manager
- Process engineer
- Process systems engineer
- Production manager
- Production supervisor
- Systems engineer

Typical entry requirements

Individual employers will set their own selection criteria for process engineer apprentices based on their job role. Typically, this will include a level 3 qualification or equivalent with mathematics and science content for example, physics or chemistry. Other relevant prior experience may also be considered as an alternative.

This standard is a logical progression route from:

- Level 3-5 engineering and manufacturing apprenticeships
- T Level and A Level qualifications in science and engineering subject areas
- Other Level 3 qualifications such as Higher National Certificate (HNC), Higher National Diploma (HND) BTEC, City & Guilds or Cambridge Technicals in science and engineering

Typical duties

D1: Ensure compliance with regulations and site operational safety procedures within the process environment. For example, risk assessment and method statement, change control, permit to work, and other safe systems of work.

D2: Ensure compliance with regulations and structured process safety assessments. Participate in structured process hazard assessments. For example, HAZOP, Hazardous Area Classification, and basis of safety and process hazard reviews.

D3. Plan work and resources to enable implementation of process engineering tasks and projects.

D4. Contribute to the design and operation of process engineering operations. For example, equipment installation and validation, monitoring and optimising plant, equipment and manufacturing assets, and troubleshooting in process operations.

D5. Contribute to the development of process engineering solutions. For example, build mathematical models.

D6. Implement design solutions for processes and contribute to their evaluation.

D7. Develop and ensure accuracy of technical data: calculations, process engineering datasheets, and drawings. For example, mass and energy balances, flow rates, process flow diagrams, piping and instrumentation diagrams, equipment scale-up sizing calculations, topographical surveys, chemical and biological composition, and network performance.

D8. Manage engineering tasks or projects including managing teams or the input of others such as stakeholders and contractors into work. This includes a commitment to equity, diversity and inclusion (EDI) principles and the maintenance of ethical standards.

D9. Lead on or contribute to structured problem-solving activities. For example, provide support in root cause analysis, quantitative methods, and mathematical approaches to address issues such as quality, chemical, process, mechanical, electrical and instrumentation, and reliability.

D10. Lead on or contribute to continuous improvement initiatives. For example, to enhance scale of production, product quality, process efficiency, reliability, process safety, operational safety, and environmental impact.

D11. Ensure the completion of documentation and technical literature for the engineering function. For example, technical investigations, equipment appraisals, specifications, operating procedures, incident investigations and reporting.

D12. Maintain and extend personal process engineering knowledge and practice. For example, assist in training operational staff and provide technical support on safety, environmental, and quality aspects.

Core knowledge

Health and safety

K1. Health and safety management regulations and requirements: Construction Design Management (CDM), risk assessment and method statement, change control, human factor reviews, occupational hygiene awareness, permit to work, and safe systems of work. CDM – Construction Design Management.

K2. Hazard management strategy assessment and methods: HAZOP, Hazardous Area Classification, and basis of safety and process hazard reviews.

K3. Environmental Protection Act – requirements on businesses.

Sustainability

K4. UN Sustainable Development Goals. Concepts and practices of sustainable engineering and development. Environmental impact measurement.

Codes of conduct

K5. Impact of operating environment on regulatory compliance.

K6. Ethical issues and principles in engineering.

Underpinning mathematics

K7. Mathematical principles and techniques that underpin engineering principles.

Underpinning science

K8. Core science to enable the understanding of process engineering principles.

Process engineering principles and practice

K9. Aspects of applied physics and chemistry to enable the understanding of process engineering principles.

K10. Principles of material and energy balances.

K11. Engineering principles relevant to reactive and non-reactive processes.

K12. Principles of system dynamics in determining process performance and response to changes.

K13. Industrial control systems and suitable applications of instrumentation and process control.

Process engineering design

K14. Principles of process engineering design.

Project management

K15. Business operations and industrial finance: capital and operating expenditure, feasibility studies, and comparison, process, plant and project economics.
K16. Project management techniques: budgeting, time management, planning and prioritising tasks, organising resources, engaging and managing stakeholders, and risk management. Management of change.

Operational risk management

K17. Principles of risk management in operational processes.

Communication and interpersonal skills

K18. Verbal communication techniques: influencing, negotiation, and presentation. IT applications for communication and presentations.

Equity, diversity and inclusion

K19. The Equality Act: requirements on organisations. Social inclusion practices. Reasonable adjustments to support accessibility. The impact of unconscious bias.

Problem solving and continuous improvement

K20. Systems based problem solving tools and techniques.
K21. Continuous improvement principles and techniques. Business process management and lean.

Documentation

K22. Documentation, engineering drawings, and technical literature requirements. IT applications for technical report writing.

Digital

K23. Digital engineering and principles of computer aided design and process simulation; computer aided engineering and engineering informatics packages.

Information and communications technology

K24. General Data Protection Regulation (GDPR). Cyber security.

Core skills

Health and safety

S1. Conduct risk assessment, apply and monitor health and safety requirements in compliance with regulations, standards, and guidelines.
S2. Conduct process hazard management strategy assessment and implement measures.
S3. Apply and promote environmental procedures in compliance with regulations, standards, and guidelines.

Sustainability

S4. Apply sustainability principles in design and operation with consideration to immediate and life cycle environmental impacts.

Codes of conduct

S5. Comply with and manage work within operating environment’s regulations.
S6. Apply ethical principles in engineering for example, honesty and integrity.

Underpinning mathematics

S7. Apply mathematical models to explore engineering principles, taking into consideration their relevance and limitations.

Underpinning science

S8. Apply knowledge of core science in process engineering contexts. For example, in the selection of materials of construction, corrosion protection, and design of novel products.

S9. Identify the inputs and factors influencing the process.

Process engineering principles and practice

S10. Apply process engineering principles to the design and operation of unit operations for reactive and non-reactive processes.

S11. Evaluate the environmental and societal impact of processes and products.

S12. Apply principles of material and energy balances to process systems engineering contexts.

S13. Design, plan and undertake experimental work. Critically interpret, analyse and report on experimental data using mathematical techniques.

S14. Recognise the need for quality management systems, quality control and continuous improvement.

S15. Select and apply qualitative and quantitative data analysis methods to inform decision making, recognising their limitations.

Process engineering design

S16. Apply process engineering knowledge and design principles to develop quantitative designs for processes with justification for design choices and decisions.

Project management

S17. Apply project management and change management techniques.

Operational risk management

S18. Identify operational risks.

Communication and interpersonal skills

S19. Exchange information and provide advice to technical and non-technical personnel for example, colleagues, contractors, and stakeholders; using a range of communication methods.

S20. Negotiate with and influence others; manage conflict.

Equity, diversity and inclusion

S21. Apply and promote policies and practices to support equity, diversity and inclusion.

Problem solving and continuous improvement

S22. Apply a systems approach to solving engineering problems appreciating complexity, interaction, integration, and a structured approach to safety, health and sustainability.

S23. Use continuous improvement principles and techniques. For example, process mapping to identify improvements.

S24. Apply engineering principles to wider contexts. For example, apply process mapping tools to project management.

Documentation

S25. Prepare written communications, documents and reports on technical matters.

Digital

S26. Use computational packages to simulate engineering processes and interpret results.

Information and communications technology

S27. Comply with GDPR and cyber security requirements.

CPD

S28. Plan development activity for self and others to meet personal and organisational objectives. Carry out and record planned and unplanned CPD activities. Evaluate CPD outcomes against plans made.

Core behaviours

B1. Take personal responsibility for and promote health and safety and wellbeing.
B2. Take personal responsibility for and promote sustainable working practices.
B3. Take personal responsibility for and promote ethical principles.
B4. Collaborate with others for example, within teams, with professionals from associated scientific and engineering disciplines, and external stakeholders; being constructive, showing respect and promoting inclusion.
B5. Take responsibility for the quality of work and enable others to work to high standards. For example, decisive, self-reliant, and motivated.
B6. Respond and adapt to work demands and situations. Recognise limitations, seek input from others and escalate issues when required.
B7. Combine technical and non-technical skills to find solutions to complex problems.
B8. Committed to maintaining and enhancing competence of self and others through Continued Professional Development (CPD).

Qualifications

A Bachelor's degree that fully aligns to the knowledge, skills and behaviours in the process engineer occupational standard.

Typical duration

60 months

Professional recognition [TBC]

This occupational standard aligns with the following professional recognition:

- The Institution of Chemical Engineers (IChemE) for Incorporated Engineer (IEng). Upon successful completion of the apprenticeship and receipt of the apprenticeship certificate, individuals are eligible to apply for IEng through a shortened application route. It will need to confirm that the IEng requirements have been met. Individuals also need to be a member of a professional body

licensed by the Engineering Council to be awarded this status. Further information is on the IChemE's website.
- Institution of Engineering and Technology (IET) for Incorporated Engineer (IEng).

Progression routes

Process engineers may progress to senior engineer, management or specialist technical roles, Masters or PhD qualifications, and Chartered Engineer accreditation.