EDUCATION & TRAINING FOUNDATION

T-LEVELS
THE NEXT LEVEL QUALIFICATION

Formative assessment materials for T Levels in Engineering and Manufacturing

et-foundation.co.uk

Introduction

This resource has been developed to support providers delivering T Levels in Engineering and Manufacturing. In particular, it relates to the core content and prepares learners for the core exams.

These materials are designed to support formative, not summative, assessment. Summative assessment is used to accredit learning, for example, by awarding a grade or qualification. Formative assessment is used to support learning and is also known as assessment for learning. Formative assessment should be designed to determine where learners are on their learning journey and whether they are progressing at the level expected at a particular milestone. If they are not, then formative assessment provides learners with feedback on what they have or have not achieved, and guidance and activities to support further learning. Formative and summative assessments may use the same materials, but the response is different.

This resource has two sections:

1. Formative assessment questions

There are a range of questions covering the following common core components:

- Working in the engineering and manufacturing sectors (common core component 1)
- Engineering and manufacturing past, present and future (common core component 2)
- Engineering representations (common core component 3)
- Engineering and manufacturing control systems (common core component 10)
- Quality management (common core component 11)
- Health and safety principles and coverage (common core component 12)
- Business, commercial and financial awareness (common core component 13)
- Professional responsibilities, attitudes and behaviours (common core component 14)
- Stock and asset management (common core component 15)
- Continuous improvement (common core component 16)
- Project and programme management (common core component 17).

There are questions that address the following two assessment objectives:

AO2 – Apply knowledge and understanding of contexts, concepts, theories and principles to different situations and contexts.

AO3 – Analyse and evaluate information and issues related to contexts, concepts, theories and principles to make informed judgements.

Each question specifies:

- targeted content – the specification reference that the question is designed to assess
- the question itself

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- indicative content – an indication of the content a learner may provide in response to the question. This section also includes a bullet point specific to the assessment objective:
    - **applied** – highlights the key points that may be referred to in their application to the scenario
    - **issue** – relates to key points in the scenario that should be the focus of the response
- a model answer – an exemplar response that meets the targeted content and assessment objective.

When an awarding organisation produces summative assessment materials, it is essential they lead to valid and reliable outcomes. This means that learners are assessed on what they should be assessed on (validity) and the evidence is marked in a standardised way (reliability). This is why awarding organisations produce mark schemes – so examiners can apply the marking in a consistent way and no learner is penalised because of who is marking their work.

Mark schemes are not always appropriate for formative assessment in which learners do not benefit from just receiving a mark. Instead, learners need feedback and commentary to understand where there are gaps in their learning – not simply to know there is a gap. This feedback may come from their tutor or peers, or through self-reflection. It is essential that learners take on board the feedback they receive through formative assessment. Therefore, these materials do not include a mark scheme as they are not designed for summative assessment. The model answers are intended to be used to support formative assessment. Learners can use these for self-reflection or peer feedback as they represent what 'good' looks like.

2. Suggested development activities

There are 15 development activities in this resource. Each activity is linked to a common core component, which is referenced. The focus of the development activity is based on the 'what you need to learn' content of the targeted common core component.

The activities are designed to be given to learners electronically. Therefore, tables are not formatted for printing or completing by hand. When accessed electronically, the amount of space needed can be amended.

For each of the activities, there is an assumption that learning has already taken place and there has been some form of formative assessment. The development activities enable learners to reflect on their knowledge and understanding of key concepts. They can provide a useful revision tool when completed. It is not expected that all learners should receive a set of development activities. These can be given where formative assessment outcomes highlight inaccuracies in the responses given.

With each activity is a list of useful resources, including books and websites. The same list is provided for each activity.

Section one: Formative assessment questions

AO2 questions

AO2 Apply knowledge and understanding to different situations and contexts
This refers to the ability to use and apply knowledge and understanding of processes, procedures, generalisations, principles and theories to specified, concrete situations. AO2 is about being able to take the understanding of generalities (AO1b) and apply them to specific novel situations. It is more granular than the more extended synthesis/creation that may respond to an analysis (AO3a) of a complex holistic situation/brief.

Source: City & Guilds T Level Qualification in Engineering and Manufacturing specification.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
1.1 Key principles and methodologies in engineering and manufacturing design.

Question
A foundry company specialises in bronze sculpture castings using die casting. It is looking to expand into other types of casting approaches.

Explain how **two** other casting techniques would be suitable for producing these sculptures.

Indicative content

- Sand casting
- Investment casting
- Lost wax casting
- 3D printing
- Sintering
- **Applied** – casting bronze sculptures.

Model answer
Sand casting would work because the mould would be made of sand, and this could easily fit around a sculpture that is not uniform in shape. The mould could be used multiple times for batches of sculptures.

Investment casting would be suitable because it provides the highest level of detailed product as the liquid plaster material is fine enough to capture the detail that is usually found on a sculptured product.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
1.2 The role of maintenance, repair and installation in engineering.

Question
A factory operates 24 hours a day, seven days a week. It has a range of equipment that is maintained according to a detailed plan.

Explain **one** disadvantage of the factory using planned maintenance for this equipment.

Indicative content

- No consideration of usage
- Environmental changes
- Equipment used over long periods of time
- Age of equipment
- May be a waste of time – nothing needed
- Not responsive to the particular equipment
- **Applied** – 24/7 factory.

Model answer
The equipment will be working harder because it is being consistently used all the time. This means the degradation is likely to be higher than expected and there may be faults before the planned time for servicing. This could lead to the equipment not operating efficiently.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
1.3 Approaches to manufacturing, processing and control.

Question
An electronics manufacturing company has just received an order for 7,000 printed circuit boards (PCBs), which need to be completed in three months. This is in addition to its normal work, so the company will need to scale up production to meet the order.

Evaluate the most appropriate manufacturing process required to fulfil the order.

Indicative content
- Manual
- CAM
- Fully automated
- Robotic
- Cost
- Speed
- Quality
- Volume
- Resources available
- Time
- **Applied** – 7,000 additional PCBs to be produced.

Model answer
A one-off manufacturing process is not going to work. There are 7,000 PCBs to make, which would be time consuming if each were created individually. This would also add to the cost, making it uncompetitive.

Using a batch process is a possibility because it is relatively inexpensive. It is the same item 7,000 times, which leads to repeatability and the skill level is developed to be able to complete the task. This would be relatively easy to establish.

Setting up a mass production line is likely to be expensive, but if the orders will be repeated or there is similar business that could be gained, this could be a good idea as it would then be cost-effective to set up.

Without a firm commitment for repeat business, or the opportunity to modify the process to other lines, continuous manufacture is unlikely to be the most effective. It would be too expensive because extra equipment would be needed, and the revenue generated would not be enough to cover the cost.

Based on this evaluation, a batch process would be the most appropriate, especially from a cost point of view.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
2.3 Areas of innovation and emerging trends in engineering.

Question
A new settlement is to be created on a remote island in the Antarctic Ocean. The inhabitants will be conducting research into the effect of climate change on the native penguin population.

The island is currently home to penguins, and it is important that human migration does not have a negative impact on the penguin population.

Explain how **one** type of renewable energy could be used in this location.

Indicative content

- Renewables: wind, solar, tidal
- Environmental impact
- Access to supply
- Perception
- Waste
- Equipment
- Reliability
- **Applied** – remote location, environmental considerations.

Model answer
Wind would be good. Oceans are likely to be windy because they are open to the elements and where weather is generated. With no tall buildings or mountains to disrupt airflow, there will be a plentiful supply of wind. It also means the penguins will not be affected because this type of renewable energy will not bring a significant change to their environment.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
2.3 Areas of innovation and emerging trends in engineering.

Question
A company designs racing bikes. It has been commissioned to design the next model of bike for the Olympics.

Explain **two** reasons why artificial intelligence (AI) would be useful for the development of this design.

Indicative content

- Computer-aided design (CAD)
- Calculations
- Optimal materials
- Properties – strength, density
- Speed
- Sustainability
- Innovation/originality
- **Applied** – racing bikes for the Olympics.

Model answer
One reason is that AI can produce ideas beyond current thinking. Humans are more likely to follow existing designs, but AI can be innovative and invent something new and radical, which may create a completely different type of bike.

AI in CAD can mean that calculations around design elements, like load paths and materials usage, can be done quicker and more efficiently than existing systems. As a result, this would give more accurate proposals for optimal requirements for materials, for example, the bike could be lighter and therefore faster.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
3.1 Plan and prepare processes, resources, scope, technology, tools and equipment to complete client expectations.

Question
A designer in a ventilation manufacturing company has been asked to produce drawings for a new bespoke system.

Explain **three** types of drawings that will need to be produced.

Indicative content

- Parts drawing
- Section drawing
- General arrangement drawings
- Assembly drawing
- Rendered drawing
- Schematic diagrams
- Unable to use existing drawings
- System has different parts that need to come together
- Fault diagnosis
- Bespoke – not off the shelf
- **Applied** – bespoke system.

Model answer
General arrangement drawings will be required as there are different parts to a system, and they will need to show how they go together.

Parts drawings will be required as it is a bespoke system, so some parts will need to be designed specifically for the system.

Schematic diagrams will be needed to help the client diagnose minor faults.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
10.1 Principles and applications of control system theory.

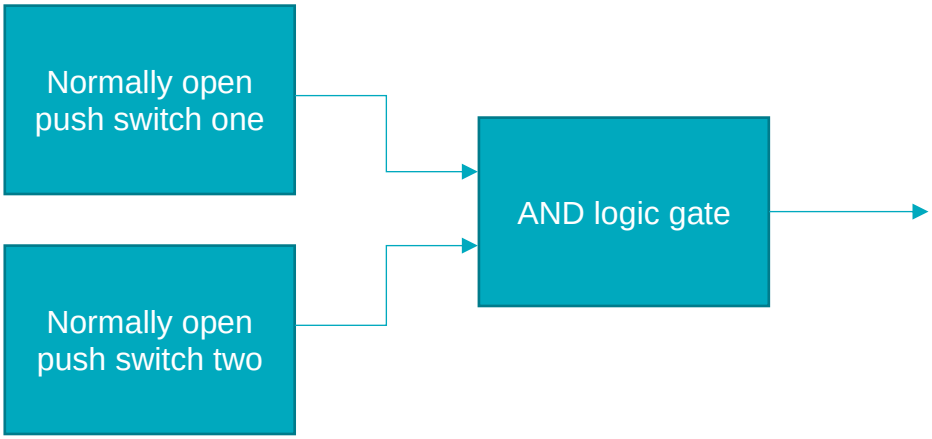
Question
A manufacturing company has a large press. In order to start, it requires two separate controls to be operated simultaneously by two operators.

Draw a system diagram for the start system.

Indicative content

- System block drawings
- Switches
- Normally open
- AND logic gates
- **Applied** – simultaneous system.

Model answer



Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
10.2 How sensors and actuators are used in automation control systems.

Question
An automated system needs to sort ferrous metal products moving down a conveyor by size. Products more than 600mm in height need to be moved to another conveyor.

a) Explain **two** suitable sensors that could be used to detect the product.

b) Explain **one** suitable actuator that could be used to move any products more than 600mm.

Indicative content
- Proximity switches
- Inductive
- Capacitive
- Light gate
- Broken beam
- Linear solenoids
- Pneumatic cylinders
- Light
- Height
- Ferrous materials
- **Applied** – move products of a specific size.

Model answer
a)
A suitable sensor would be an inductive proximity sensor because this type of sensor changes state when a ferrous metal object passes close to it and would identify the product.

Another suitable sensor would be a light gate. This would focus on the height of the product. If the sensor were set at 600mm, the sensor would be blocked from receiving light at that point, changing the state of the sensor.

b)
A pneumatic cylinder would be a suitable actuator if it were connected to a diverter gate. This is because it needs to move some products from one conveyor to another and be retracted so other products continue down the same conveyor. Pneumatic systems enable the cylinder to move in this way.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
11.1 Quality standards, assurance, control and improvement.

Question
A manufacturer of engineered components is expanding and recruiting an assistant designer to support the designer who has been in post for 10 years.

Explain **two** document management processes that should be introduced to support the design team.

Indicative content

- Version control
- Privacy controls
- Confidentiality
- Security
- File naming conventions
- **Applied** – expansion of a design team.

Model answer
One process that should be introduced is version control. As two people are likely to be working on designs, one will need to know which is the latest version. This was not required when there was only one designer because they would always know, but now there are two people it needs to be clearer.

There will need to be clear naming conventions for all documents so that each person in the team uses the same approach. This will make it easier for each of them to know, for example, which document is a drawing, which is a contract etc.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
11.1 Quality standards, assurance, control and improvement.

Question
A company has designed an innovative new electrical unit which it considers meets the sustainability agenda. However, it does not meet British standards because it has a non-standard plug and is not earthed.

Explain **one** reason why this product needs to meet British standards.

Indicative content

- Safety
- Electrical
- Connection to power supplies
- Commercial implications – customers may not be willing to buy it
- **Applied** – non-standard plug.

Model answer
One of the key requirements for meeting British standards is safety. If the product is non-standard, it may not be safe. If it does not meet British standards, then consumers will consider it unsafe – even though it might be – and will not buy it. This will mean the investment into the design and production of a prototype has been wasted.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
12.1 The main requirements of key health and safety legislation applicable to engineering activities.

Question
A new mechanical power press operator has received a basic introduction to the Health and Safety at Work etc. Act 1974 as part of the company induction.

Explain **two** further safety regulations that should be included in their induction before they operate the press.

Indicative content

- Management of Health and Safety at Work Regulations (MHSAWR) 1999
- Provision and Use of Work Equipment Regulations (PUWER) 1998
- Personal Protective Equipment at Work Regulations (PPE) 1992
- Control of Noise at Work Regulations 2005
- Manual Handling Operations Regulations (MHOR) 1992 (amended 2002)
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013
- Noise
- Lifting
- Heavy equipment
- Safety guards
- Risks
- Controls
- **Applied** – press operator safety requirements.

Model answer
As they are working on a mechanical press, it would generate a lot of noise. They would therefore need to be aware of the Control of Noise at Work Regulations. This would show them that if the noise were above a certain level, it is a legal requirement for hearing protection to be worn. Covering that regulation would also indicate the damage that noise can do to them and the protective measures that can be taken to reduce the risk to their hearing.

As this is a job role where the risk of serious injury is high, they would need to be aware of the RIDDOR. They need to be familiar with this because there are certain types of accidents and near misses that need to be reported, and because there is a high risk of injury there is a higher chance that reporting may be needed.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
12.1 The main requirements of key health and safety legislation applicable to engineering activities.

Question
An employee has an accident at work while using a lathe. Two of their fingers need to be amputated in hospital.

Describe the procedures that must be followed to record **and** report this incident.

Indicative content

- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013
- Responsibilities for compliance with regulations and legislation
- Designated responsible person
- Recording in an accident book
- Reporting online
- Reporting and recording timelines
- Accident severity – amputation
- Role of Health and Safety Executive (HSE)
- **Applied** – injury requiring amputation.

Model answer
All workplace accidents must be recorded in the workplace accident book as soon as possible. Owing to the severity of the accident, which resulted in the amputation of two fingers, the RIDDOR requires the incident to be reported. The designated responsible person, usually a manager and not the employee involved, must report the incident to the HSE and complete the RIDDOR forms online within 10 days of the incident.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
13.3 Financial and economic concepts.

Question
An engineering company has been offered a contract to produce a component for a machine. A cash flow forecast has been created, as shown in Figure x.

	Month 1	**Month 2**	**Month 3**
Money in	£20,000	£20,000	£20,000
Money out			
Cost of goods	£20,000	£15,000	£5,000
Overheads	£5,000	£5,000	£5,000
Cash flow	-£5,000	0	£10,000

Figure x

Explain why it is predicted that cost of goods would decrease over the lifetime of the project.

Indicative content

- Cash flow
- Fixed costs
- Variable costs
- Contract terms
- Profit
- Loss
- Initial outlay
- **Applied** – interpretation of cost of goods content in a cash flow forecast.

Model answer
In order to manufacture the component, it is likely that the company will need to buy materials in advance for use later in the project. This means that over the duration of the project, the company will be using materials that are already paid for.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
14.1 Professional conduct and responsibilities in the workplace.

Question
Two operatives of a manufacturing production line have had a disagreement that involved them using aggressive language with each other. Their line manager is scheduled to have a disciplinary meeting with them.

Explain **two** positive attributes that should be referred to in the disciplinary meeting.

Indicative content
- Interpersonal skills
- Constructive criticism
- Active listening
- Communication
- Conflict resolution
- Social skills
- Language use
- Effect on safety
- Effect on efficiency
- **Applied** – disagreements on a production line.

Model answer
One attribute would be about interpersonal skills. This is how people relate to each other orally and using body language. It is important because the production line can be noisy, so it is important to ensure the body language stays positive and is used to convey a message.

Another attribute is constructive criticism. If the disagreement were about work, and one person was unhappy with the work of another, it is important to consider how to give feedback in a way that is constructive and supportive, and not just negative and personal. This is especially important when working in a safety critical environment, where workers need to be focused on their job.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
14.1 Professional conduct and responsibilities in the workplace.

Question
A quality manager and an operative have a disagreement that relates to the ethnicity of the operative.

Explain how equality, diversity and inclusion (EDI) policies can be used to protect **both** members of staff in this instance.

Indicative content

- Protected characteristics
- Equality
- Diversity
- Inclusivity
- Reasonable adjustments
- Professional conduct
- **Applied** – operative ethnicity.

Model answer
An EDI policy should protect the quality manager by ensuring they have received EDI training about how to benefit from a diverse workforce.

An EDI policy should also protect the employee by making explicit reference to protected characteristics like ethnicity. The policy should ensure that employees from diverse ethnic backgrounds are not discriminated against and do not feel bullied because of their ethnicity. The policy would give an employee grounds to complain or raise a grievance against a member of staff who shows some form of intolerance. In this case, the employee can go to a more senior member of staff about the quality manager.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
15.1 Stock and inventory management principles and practices.

Question
During an audit, a plant and heavy equipment manufacturing company had 15 of the biggest generators they make in stock, ready for dispatch to customers. There is a six-week lead time from the order of new stock parts for the generators to delivery. The company produces five of these generators a week.

Explain **two** implications of this stock level.

Indicative content
- Demand
- Stock turnover
- Cost of inventory
- Write down
- Minimum stock levels
- Supply chain
- Packaging
- Storage
- Availability
- Supply chain
- **Applied** – specific stock levels.

Model answer
The company will run out of stock generators in three weeks if production has to stop for any reason, for example, parts are unavailable. As a result, customer orders will not be dispatched in a timely manner.

The holding of high-value stock costs the organisation money because it has to buy and pay for parts and their storage. This means the company will have poor cash flow while waiting for money to come in from customers.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
15.1 Stock and inventory management principles and practices.

Question
A medium sized manufacturer of cycles is looking to expand but has limited storage available. It is looking to use a just-in-time (JIT) stock system to support this.

Explain **one** benefit and **one** limitation of the manufacturer using this stock system.

Indicative content
- Reduce inventory
- Reduce storage requirements
- Improved cash flow
- Reactive process
- Delivery schedules
- Control of supply chain
- Problems not predictable
- **Applied** – expansion of a manufacturing business.

Model answer
One benefit of JIT is that there is no need to have lots of parts in stock. The parts arrive as they are required in the manufacturing process. As a result, the storage of large quantities of parts is not needed. This company has limited space for storage, so the JIT stock system will mean that space can be used to manufacture instead.

One limitation is that as the manufacturing capacity expands, problems may arise that had not been anticipated. The company may find that this lack of predictability makes it difficult to forecast exactly what stock is required from the supply chain and when. As a result, there may be times when it is unable to continue manufacturing because it is waiting for parts.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
16.1 Continuous improvement principles and practices.

Question
A large manufacturing company produces rivets in large quantities. Most of the products go through four processes that are based in different areas of the building. These are:

- forming
- heat treatment
- polishing
- packaging.

The business recognises the need to improve its performance and profitability, particularly in terms of waste reduction.

Explain **one** process that could be applied across the whole business.

Indicative content

- 8-waste process
- Kaizen
- Lean manufacturing
- Functional areas of the business:
    - administration
    - transportation and logistics
- Waste reduction focus
- **Applied** – reference to waste reduction across the whole business and not just the four processes.

Model answer
The ideal choice would be the 8-waste process. This covers a wide range of business areas, not just processing. This is because the 8-waste process includes aspects like transportation and overprocessing, which relate to documentation, as well as the manufacturing side.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
17.1 Principles of project management.

Question
A UK manufacturing company has recently contracted with a component supplier in southern Europe. It has previously used a local supplier.

Explain **two** ways this change of supplier would increase the cost risks associated with the project.

Indicative content
- Transport
- Logistics
- Currency
- Taxation
- Additional documentation – time and expertise
- **Applied** – use of international supplier.

Model answer
The components must travel further, including overseas. This means there will need to be at least two methods of transport rather than one, which increases the risk that the cost of transportation will rise.

The costs will be related to another currency, probably the Euro, and the contract will state that the supplier pays in pounds or Euros. If there is a change in exchange rate, then costs will increase for either the supplier or the manufacturing company. Either way, this increases the cost risks because it will either cost the manufacturing company or the supplier more, which may make the supplier back out of the contract or want to renegotiate it.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

AO3 questions

AO3 Analyse and evaluate information and issues

Complex thinking that distinguishes patterns and relationships; breaking material into constituent parts; determining how constituent parts are related to one another and holistically; inferring underlying assumptions, conditions, relevance or causation.

The ability to analyse and evaluate the interrelated issues arising from a complex scenario to propose a best solution or predict impacts, etc. For example, considering a response to a work-related problem or issue, like one related to income generation or performance management.

Source: City & Guilds T Level Qualification in Engineering and Manufacturing specification.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
1.2 The role of maintenance, repair and installation in engineering.
2.3 Areas of innovation and emerging trends in engineering.
10.1 Principles and applications of control system theory.
10.2 How sensors and actuators are used in automation control systems.

Question
A maintenance company specialises in the planned maintenance of onshore wind turbines. It is considering an expansion of the business to include the planned maintenance of offshore turbines, providing it can do this profitably.

Discuss how the use of technology can help the company to provide an effective planned maintenance service for this proposed expansion.

Indicative content
- Networked wireless communication and data transmission
- Types of sensors/parameters being sensed
- Performance monitoring
- 24/7 data streaming
- Use of historic data to predict future performance
- Alert levels preset
- Automated shutdowns
- False reading
- **Issue** – access / environment issues.

Model answer
Offshore wind farms operate in a challenging environment. Access is difficult and expensive, which could affect the profitability of the expansion. Poor weather conditions can prevent engineers getting to the turbines and add to the safety risk, so controls that need to be in place may add to costs.

Getting access for inspection, transporting engineers and technicians to remote sites to evaluate a problem and decide what remedial action to undertake, can account for 80 to 90 per cent of the cost of offshore maintenance operations. Minimising the need for human intervention is a key route to maximising the potential and minimising the cost.

Instead of human interaction, a variety of sensors could be used to continuously monitor the offshore wind farm and data, then transmit it wirelessly to a central control station. Examples of conditions that could be sensed include vibration, component temperatures, torque and power output. Algorithms would contiguously interrogate the data and be able to recognise the early signs of a potential issue, based on previous observations.

Remote monitoring by sensors would also ensure that potential problems are picked up early, when the intervention required is minimal and before major damage has occurred, so reducing the costs. In addition, regular scheduled maintenance could be arranged in expected good weather windows, again reducing risks to costs and safety but still ensuring a high standard of maintenance is achieved.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Sensors can monitor events or changes in the structural conditions that might affect safety or increase risk. They can then use this to schedule repair and maintenance activities or improve incident management and incident response efforts.

Data gathered from offshore wind power generation plants during their operation and use will help to develop methods of improving the operation and maintenance of wind farms. The performance of the main wind turbine components is monitored in real time and interventions can be automated, helping to maximise turbine lifespan.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
11.1 Quality standards, assurance, control and improvement.

Question
An organisation has been manufacturing electric motor parts that are used in industrial applications in the water/waste management and petrochemical sectors. The organisation has produced these parts for many years and recently introduced some automation into the manufacturing processes to reduce the number of staff needed in the facility. The manufacture of the bearings has been automated, which required a significant amount of investment in equipment. The expectation was that production and profit would increase as labour costs reduced. Unfortunately, there has been a reduction in quality of the bearings produced, which has led to customer complaints and loss of orders.

Discuss the improvement processes the organisation should introduce for this situation.

Indicative content
- Root cause analysis
- Failure mode and effects analysis (FMEA)
- Plan-do-check-act (PDCA)
- Pareto analysis
- Cause and effect diagrams
- Quality circles
- Staff reduction
- Complaints
- Automation
- **Issue –** changes in manufacturing processes causing issues in quality.

Model answer
The first stage is to carry out a root cause analysis to understand what is going wrong with the process and what has led to a reduction in customer satisfaction. A review is also needed into the process that resulted in the move to automation. While this will not necessarily resolve the current issue, it will support future decision-making so that similar issues do not arise.

There are other improvement processes, but these are not appropriate for this situation. For example, FMEA is a process used for identifying all possible failures in a manufacturing process or product, and there is potentially an issue with the process in this scenario. However, FMEA would normally be used to identify potential risks in a new process rather than retrospectively look at how an issue arose. A root cause analysis would therefore be more effective in this situation.

Once the root of the problem has been identified, a process like plan-do-check-act (PDCA) should be used so the rectification actions that are implemented can be constantly reviewed and their impact evaluated. This is important because it is clearly not happening currently. It is only through customer complaints that the company has become aware of quality issues. There should be quality processes in

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

place, including employees with quality responsibilities, to ensure that these issues are identified before products are dispatched to customers.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
14.1 Professional conduct and responsibilities in the workplace.
14.3 Human factors in engineering and manufacturing contexts.

Question
A small company produces engineered components using lathes. One of the female operatives has recently been diagnosed with a condition that requires them to use the toilet regularly. The cause of the condition has been identified as stress, and their work is a contributing factor. This was discussed with the managing director who has agreed that the member of staff can take extra breaks.

In the past two months, the supervisor has noticed the quantity of products produced by the member of staff has declined. At a performance review meeting they were given new targets, which the employee considers unfair because the workload is more than other staff carrying out the same job and does not take account of their condition. In fact, it is adding to their stress and causing the condition to worsen.

Discuss how the introduction of an equality, diversity and inclusion (EDI) policy could be used to find a resolution to this issue.

Indicative content
- Equality Act
- Protected characteristics
- British values
- Professional conduct
- Organisational policies, purposes, benefits and limitations
- Implications to staff, management and company
- Mental health services
- Small and large businesses
- Operation of a lathe
- Roles and responsibilities of different levels of staff
- **Issue** – potential unfair treatment of a member of staff.

Model answer
If an EDI policy exists then it needs to be followed, otherwise staff can face disciplinary action. A small company is not required to develop a policy, but it is helpful to set out expectations and processes. Policies are usually developed to ensure that legal requirements are met. In this case, an EDI policy would support compliance with the Equality Act. This is about discrimination in law. A disability is a protected characteristic in law, which means that someone with a disability is protected. If an employee requires reasonable adjustments because of a disability, the employer must put them in place to enable the staff member to work more effectively. The member of staff got that agreement from the managing director, so they were complying with the law. The problem is that another member of staff is potentially discriminating against them. If the company had an EDI policy, the employee would know what to do and how the situation could be resolved. The same applies to the supervisor. The supervisor may need training or they might not have been informed about what was agreed between the managing director and employee.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

EDI policies are put in place to ensure that every member of staff can work in a safe environment without fear of prejudice or unfair discrimination. Staff conduct is also covered by EDI because if one staff member discriminates against another, they are liable to face disciplinary measures, as discussed above. It is therefore in the interest of all staff to receive EDI training so they understand what it means, and what is acceptable and unacceptable in the workplace. The requirement for training would normally be part of any policy.

The policy can often refer to the support that should be provided for staff, and this is something that has not necessarily been put in place for this employee. Reasonable adjustments have been made in terms of toilet breaks, but the cause of the condition as potentially work-related stress or stress in general has not been included. Often, an EDI policy would include reference to support services, like mental health support, which would help this member of staff.

In terms of different organisational levels in the company, those joining at entry or apprentice level should receive support and training from their supervisors to complete their training programme and be treated fairly. At a managerial or director level, there is a responsibility to not abuse their position and treat staff in a way that complies with EDI policy. Those staff are also responsible for dealing with any breaches of the policy in a fair and just manner to all parties, and remaining objective and impartial. It is not clear from the information provided that the supervisor in this case is acting fairly and, if there were a policy, they are likely to be in breach of that policy.

EDI policies therefore have the potential to change and update outdated workplace behaviours and perspectives which are not compliant with today's viewpoints when it comes to EDI.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
13.3 Financial and economic concepts.

Question
A limited company has been making novel solar panels for two years. The product is based around the panel being able to deform to the shape of the surface on which it is mounted. This means the panel can be mounted on things like truck roofs or car bonnets.

The company has a healthy order book but is having difficulties fulfilling the orders in time. It has some money on deposit in the bank, but this is not enough to buy the equipment it needs to increase the manufacturing volume. It has conducted market research which has revealed that a significant number of competitor companies are also heading to market with similar, but cheaper, products.

Discuss how the company could finance the increase in its manufacturing volume.

Indicative content
- Healthy order book
- Money on deposit
- Limited company – shareholders
- Financially responsible
- Competition
- Budgeting
- **Issue** – lack of funding for expansion.

Model answer
The company can get money from the bank. It is likely that a healthy order book and money on deposit – no overdraft – will show that it has good financial responsibility and is potentially low risk. This should mean there is a high chance of getting a loan. With good financial responsibility, the rates of the loan should be more favourable than if the company were not as financially strong. However, there will still be interest rates applied to the loan, and the loan is likely to be over a relatively long term. The cost of servicing this debt as a proportion of turnover is a variable, and an increase in productivity may not be able to compensate for this. One issue though is the competition. The bank would need to see the market research the company has conducted, which would show the high level of competition. This may lead the bank to question the viability of the expansion. The company would need to show how it is planning to compete against these other businesses to maintain high orders for the product.

An alternative would be for the company to seek investment from its shareholders. But, as a limited company rather than public limited company, it is likely to have a relatively small number of shareholders and they may not have the capital needed for this type of investment.

However, the company needs a solution now. If it waits too long, the market will be saturated by the competition, and it will not be able to adapt quickly enough. In this scenario, a bank loan looks the most favourable option because raising capital through a share issue may take too long. The company may move the structure in

place to be able to allow this to happen. In the medium to long term, a share issue or disposal of assets could potentially be used to reduce the debt burden.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
14.2 Continuous professional development (CPD) and professional recognition.
14.3 Human factors in engineering and manufacturing contexts.

Question
A company services rail industry infrastructure. Its 200+ employees have been there for many years with low staff turnover, and long-standing employees are the norm. The average length of service is 13 years, with most engineering staff recruited initially as apprentices. The workforce is relatively young and most employees have a minimum of 20 years before retirement. Productivity is relatively high.

There have been two significant changes in the business during the last three months. The organisation has recently won a contract to implement the electrification of the rail network and it has been taken over by another engineering company. The new company has reviewed the recent staff appraisal reports and noted there is relatively high absenteeism and poor punctuality. In addition, many staff feel left behind by advances in technology and are anxious they lack the skills needed for this new contract.

Evaluate how CPD can motivate staff to be effective on the new contract.

Indicative content
- Definition of CPD
- Types of CPD
- Relationship between CPD and staff motivation
- Relationship between CPD and performance
- Professional recognition of CPD
- Human factors
- Relationship between anxiety and performance (causes of human error)
- Professional standards for engineering, as set out by the Engineering Council
- **Issue** – staff potentially unskilled for a new contract.

Model answer
CPD will allow the staff to upskill and have the competence needed to work with new equipment and systems that are likely to be introduced for the new contract. The development of expertise through CPD is likely to give them greater job satisfaction because they will feel more competent in their work. It may also motivate them to work better in a given timescale and environment, reducing absences and improving punctuality if they are more motivated. The level of competence they will be able to demonstrate should then reduce anxiety about their job and give them confidence that even with a change of ownership, they are still able to make a positive contribution to the company.

The issue is how to organise it. In reality, it will take time for 200+ employees to be upskilled. The CPD will take staff away from their normal job, which may have an impact on performance for existing contracts. CPD is also costly for the company. It may be more efficient and cost-effective for the company to look at recruiting new staff who have the skills needed to work on the new contract initially. These staff may come from the new company. This may not motivate existing staff, but it will be

important to balance meeting the requirements of the new contract with existing contracts.

The new company could use its staff to mentor existing staff to work on the new contract. This would be less costly and may be more timely. It would also support change management, as existing staff would learn about the new company's processes.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
11.1 Quality standards, assurance, control and improvement.
14.3 Human factors in engineering and manufacturing contexts.

Question
A company has made engine blocks using casting processes for high-end classic cars for many years. The company has recently been taken over by a much larger organisation that makes engines for racing cars. These engines are highly specialised but have a similar manufacturing process to those used for classic cars. It was this that made the company attractive for a takeover.

To facilitate this change to the business, some upskilling of the workforce is required.

There are two main areas of focus:

- requirements of the racing industry, as there are different standards and requirements needed to meet the quality regulations
- the new ethos and behaviours of the parent company.

Discuss how change management opportunities can be used to motivate staff about the change of parent company.

Indicative content

- Culture of quality
- Right first time
- Quality standards
- Human factors – characteristics
- Potential causes of human error
- Design of the workplace
- **Issue** – managing change.

Model answer
The two companies should have a positive quality culture. One currently produces components for high-end classic cars and the other for racing cars. Both organisations need high-quality resources. This should be used to support staff as they potentially move to new systems. The culture of quality is already there, it just may be a different way of processing this.

It must be acknowledged that staff should not be treated as one person, but that each member of staff has different characteristics. Staff should be engaged at the earliest opportunity so they can help identify what they think would be most valuable to them personally. What staff want should be aligned with the needs of the business, and the correlations should be identified and pursued. Individual engagement in the change process will enable staff to feel valued, and contribute to increased motivation to achieve success.

The wants of staff should be aligned with a skills matrix to ensure that the needs of the company can be met through the developments identified by staff. If they feel engaged in the process, the staff are less likely to feel like change has been imposed on them and are more likely to benefit from it.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

One aspect of the change may mean the factory needs to be redesigned, even if the same processes are used. The expansion of work and the potential need to separate the two different outcomes (for racing cars and classic cars) may lead to a change in the environment. Again, staff should be consulted and their thoughts and concerns considered so the environment they work in is conducive to improving morale and output.

A process to record these requirements needs to be put in place and reviewed. If the changes that are implemented do not result in improvements, alterations should be considered so that less than optimal behaviours and practices do not get engrained as they will be much more difficult to change later.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
13.3 Financial and economic concepts.
17.3 Project planning and control.

Question
An aerospace company is expanding. It has been contracted to manufacture a new helicopter. Some of the component manufacture will be outsourced, but most will be manufactured by the company and then assembled on site. A new facility is required as there is insufficient space for assembly in its current factory. The existing factory will be used for some of the component manufacture, but all assembly will be at the new facility.

The corporate management team has approved a budget of £20 million. Land has been secured from the local council, with agreement that there will be 10 new apprentices recruited each year for the next five years. Outline planning permission has been given, though full planning consent is still needed.

Identify the resources and planning methods required for this project. From this work, analyse and evaluate the benefits and limitations of the different methods and how these can be used by organisations to ensure the project parameters are met.

Develop a risk management plan for this project.

Indicative content
- Contents of a risk management plan
- Project risks
- Commercial risks
- Financial risks
- Contingencies
- **Issue** – risks associated with new project.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Model answer

Risk management plan

Risk	Risk assessment	Risk response	Monitoring
Over budget Construction projects are often over budget: two-year timescale, inflationary pressures, external factors affecting cost.	Moderate likelihood. High negative consequences.	Agree construction phases, with budgets for each phase. Work to allow 10 per cent contingency minimum to budget. Monitor budget closely. Work with financial adviser to identify potential economic and financial changes.	Monthly budget monitoring. Monthly meeting with construction contractor.
Building not to specification Adjustments to design – as a result of planning requirements, costs, availability of materials etc. – could lead to insufficient space or inefficient organisation of production.	Low likelihood. Moderate negative consequences.	All amendments to design to be agreed by engineering manufacturing leads to ensure no negative impact. Link with budget impacts in terms of materials etc. Prioritise requirements, for example, space for assembly.	Monitor building against priority checklists. Monthly meeting with construction contractor. Monthly meeting with manufacturing leads.
Planning permission Local authority could deny or delay planning permission or require changes to design, which has a negative impact on the project.	Low likelihood. High negative consequences.	Engage architect with history of positive outcomes. Already established relationship with local authority through provision of land and outline planning permission. Start process for recruitment of apprentices to demonstrate organisational commitment to requirements.	Initial meeting with planning officer to identify potential issues – include construction company. Agree timelines.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Helicopter components manufactured but unable to assemble As some components are manufactured elsewhere, they are not affected by the new building. Could be paying for the manufacture of these components but unable to recoup costs because the building needed for the helicopter assembly is not ready.	Moderate likelihood. High negative consequences.	Review manufacturing contracts and internal commitments for helicopter components to ensure phased approach.	Agree scale of manufacture for new helicopter.
Logistics access issues Building may be complete but the surrounding infrastructure not in place. Could have an impact on components arriving or shipping assembled helicopters.	Moderate likelihood. High negative consequences.	Identify alternative access approaches – use of different transportation options.	Separate project plan and work package focused on investigating alternatives. Results within six months and review when options available.

Targeted content
12.6 Principles and practices relating to environmental legislation and considerations.

Question
A battery manufacturing company has recently expanded its operation. As a result, the amount of waste it produces has increased significantly. This includes plastics, metals, composites and paper, some of which are classed as controlled waste. A lot of this is going to landfill.

The company wants to reduce the amount of waste that goes to landfill.

Discuss factors the company should consider in reducing overall waste.

Indicative content
- Environmental Protection Act 1990
- Pollution Prevention and Control Act 1999
- Clean Air Act 1993
- Radioactive Substances Act 1993
- Controlled Waste (England and Wales) Regulations 2012
- Hazardous Waste (England and Wales) Regulations 2005
- Dangerous substances
- Production processes
- Procurement
- Storage
- Implications of waste disposal
- **Issue** – reducing landfill waste.

Model answer
One key consideration is legislation. The company needs to reduce its waste in line with legislation, particularly the Controlled Waste (England and Wales) Regulations, because it appears that some of the waste it produces is controlled. In addition, it is likely that with battery production there will be hazardous waste. This type of waste must be segregated from non-hazardous waste and not mixed. Records need to be kept. Hazardous waste should not be going to landfill.

Using legislation can help to classify waste, and identify what can and cannot go to landfill legally.

The company should also look at its production processes, storage and procurement because these could be leading to excess waste. For example, if components are delivered in lots of packaging, this is creating excess waste. Contracts can be amended to ensure that packaging is limited. Suppliers need to be worked with to reduce excess waste by introducing things like multi-use packaging and moving away from polymer films to cardboard, which is much easier to recycle and better for the environment.

Using a JIT stock control system can also reduce waste because there is limited storage where consumables go out of date and cannot be used. The company

should look at every stage and the interactions of each process that creates waste in the first place, and a mechanism to reduce this must be considered and implemented.

The company should also carry out an audit of the type of waste that is produced so it can consider each item separately, rather than having a single approach.

The company also needs to look at the way it treats waste on site. It is much more economical to bail cardboard than it is to move it as a bulky, lightweight material. The use of specialists to remove waste also needs to be considered. This may be costly but carrying out a cost-benefit analysis will show whether there are ways of reducing the waste which are cheaper or more expensive than using specialists. In addition, the company could look at processes to recycle on site. The best methods to reduce waste are always going to be around recycling on site.

The nature of the business also needs to be considered. If the company produces batteries to go into applications that are perceived to have positive environmental impact, then it would not be good for customers to think the process used to manufacture the batteries produces large amounts of toxic waste and other material that end up in landfill.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
1.1 Key principles and methodologies in engineering and manufacturing design.

Question
A technician engineer has been asked to optimise the design of a shelving unit which is currently ineffective.

Currently, the shelving unit is manufactured in batches of 1,000. It holds industrial castings that need to be stored before further processing.

The shelving unit consists of three shelves, four shelving supports and 12 shelving rods. The shelving rods are positioned into 10mm deep blind holes in the shelving supports and then welded into place. The current size of the three shelves is 1,000mm long by 400mm wide; the client does not want this changed.

The shelves are made from folded sheet and are located onto the shelving rods through the two holes in each side. The shelves, shelving supports and shelving rods are made from low-carbon steel that is spray painted. For flexibility, the company wants the shelves to be easily assembled and dissembled to enable them to be moved if required.

The client is aware that the current shelving unit design has a number of issues, but the redesign has been triggered by feedback from users about the shelving rods bending or breaking, making the unit unusable and dangerous.

The client had intended the life cycle of the shelving unit to be five years.

The client believes the source of the issues is that the current shelving unit:
- can be unstable as it bends and flexes
- is not robust enough to hold the mass of the castings placed on it
- is difficult to assemble and disassemble
- is often damaged and misused
- makes it difficult to place and pick up some castings.

Sometimes, the issues also result in damage to the castings that are held on the shelves.

The client has asked for an alternative solution for the shelving unit that takes into account the most efficient use of materials and manufacturing processes.

Create a product design specification (PDS) for this redesign of the shelving unit, which identifies the key considerations needed for the redesign, as listed below.

Justify the PDS, making clear to the client why the revised PDS meets requirements.

Indicative content
- Types of manufacturing processes
- Materials used in engineering and manufacturing
- Scale of manufacture
- Heat treatments and surface treatments

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- Types of materials and uses
- Causes of material failure and their prevention
- Cost of materials and processing
- Safety considerations when designing products for engineering and manufacturing use
- **Issue** – meeting specification requirements.

Model answer

	Requirement	**Justification**
Function	It must be able to hold industrial castings.	This is the key purpose of the shelving unit.
	It must be easy to assemble and dissemble.	This is a key requirement of the client.
Materials	It must use a material which is strong and durable, like medium carbon steel or a polymer.	The materials need to be strong, cost-effective, able to be easily processed and easily sourced. This can be achieved with medium carbon steel or a polymer.
Manufacturing processes	It must use a simple manufacturing process, which meets the function of the product and is cost-effective, like folded sheet for the shelves and shelving supports, and manufacturing of the shelving rods by machining.	The manufacturing process needs to meet the function of the product and be cost-effective. It also needs to be a simple process, which can be easily undertaken to reduce costs.
Finishes	It must have a finish which protects the shelving, like painted or dip coated, or be made from a material which is self-finished as part of the production process.	Needs to protect and reduce corrosion, especially when moved, to ensure it meets the life cycle requirements.
Size	It must be no greater than 1,500mm x 1,000mm x 400mm.	This incorporates the requirements of the client. Must be robust enough to hold the mass of castings and be stable. This needs to be taken into consideration in the size of the design.
Cost	It must be cost-effective for the client.	This is a key requirement of the client as they have asked for the solution to take into account the most effective use of materials and manufacturing processes.
Manufacturing volume	It must be possible to manufacture in batches of 800.	This is a key requirement of the client as it is clearly stated in the brief.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Safety	It must be safe to use to store the castings and when moved and reassembled.	This is a key requirement of the client because it is clearly stated in the brief. One of the client's main concerns is its instability and safety after being moved, so this aspect needs to be rigorously tested.
Life cycle	It must be expected to last for a minimum of 10 years.	This is a key requirement of the client, as stated in the brief. This would reduce costs and waste.
Sustainability	It must be made from materials which can be recycled.	This is a key requirement of any design. If medium carbon steel or polymers were used, they would be suitable for recycling.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Targeted content
2.2 Significant technological advances in engineering from a historical perspective.

Question
The United Nations has set 17 sustainable development goals (SDGs) to be achieved in the world by 2030. One of these is 'zero hunger'.

Extreme hunger and malnutrition remain a huge barrier to development in many countries. There were 821 million people estimated to be chronically undernourished, as of 2017, often as a direct consequence of environmental degradation, drought and biodiversity loss. More than 90 million children under five are dangerously underweight. Undernourishment and severe food insecurity appear to be increasing in almost all regions of Africa, as well as in South America.

The SDGs aim to end all forms of hunger and malnutrition by 2030, to ensure that everyone – especially children – has sufficient and nutritious food all year. This involves promoting sustainable agriculture, supporting small-scale farmers, and offering equal access to land, technology and markets. It also requires international co-operation to ensure investment in infrastructure and technology to improve agricultural productivity.

Visit the United Nations Development Programme (UNDP) website to find out more.

Discuss how the engineering and manufacturing sectors can use technological advances to support the achievement of zero hunger.

Indicative content
- Smart materials
- Sustainable energy supplies
- Automation
- Robotics
- **Issues** – achieving zero hunger.

Model answer
A key way for engineers to support the achievement of zero hunger is through robotics. One difficulty with crop production is waste. If the world could maximise the crops that were produced and minimise waste, there would be more food available to eat. For example, there is waste in the use of water that help crops to grow. This is water that could be used for other purposes, like in manufacturing to provide employment that gives people wages to buy food. If water could be conserved by robots more precisely and accurately watering the crops, the crops would grow more effectively and there would be more food to go around.

Another way engineers can support the achievement of zero hunger is through efficient logistics and transportation. Engineers have been able to develop green transportation and logistics solutions to benefit communities that are isolated or in hard-to-reach locations and environments where food is not easily grown. For example, using drones to transport food to mountainous areas. New energy production, using solar panels or water-based power, can be used to facilitate autonomous transport systems.

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

Section two: Suggested development activities

1.1 Key principles and methodologies in engineering and manufacturing design

Focused revision elements:

- How different types of manufacturing processes influence the design of engineered products.

Casting is a key process used in engineering and manufacturing, especially for the forming of metallic structures with complex parts.

From the types of casting processes in the table below, identify the key features of the processes, and the advantages and disadvantages of using these processes. This task can be completed individually or in pairs.

Types of casting processes	Features of processes	Advantages	Disadvantages
Manufacture of a car engine block			
One-off bracket to hold a light on a bulkhead			
Bespoke gear for heritage gearbox			

When completing the task, focus on applying your answer. What is it about the situation that you need to take account of?

Once this is task is completed, you have shown that you can apply your learning to different situations.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

–

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

1.2 The role of maintenance, repair and installation in engineering

Focused revision elements:

- The role and purpose of maintenance, repair and installation.
- The advantages and disadvantages of different approaches to maintenance.
- Approaches to monitoring and the reasons for carrying out monitoring.
- The reasons for and implications of shutdown and servicing.
- The reasons for commissioning activities.

Planned maintenance of machinery is a crucial activity in engineering and manufacturing to ensure that the machinery is safe and functions correctly. This needs to be planned carefully so it has minimum disruption to production, especially in models which have continuous production.

Complete the following table either individually or in pairs.

Equipment	Frequency of usage and service	Maintenance activities required	Implications if service is not carried out
A bicycle used by a teenager to get to and from school			
A bicycle used by an elite road racing athlete to train daily			
A lawnmower used weekly during the summer for a small garden			
A lawnmower used regularly by a professional gardener			
A power tool used by a maintenance engineer in a factory			
A pneumatic power tool used by an aerospace engineer to install rivets			

Now, you will need to complete a further task. Select one of the pieces of equipment. Explain what drawbacks and issues could be encountered when completing planned

maintenance on that piece of equipment, used in each way given. Remember that ‘explain’ means to give reasons, so do not just state the issues and drawbacks.

Once this task is completed, you have considered the situation in your answer, which means you have applied your learning.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

:

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

1.3 Approaches to manufacturing, processing and control

Focused revisions elements:

- Examples of products made at different scales of manufacture.
- Relationship between manufacturing volumes and processes – what is the difference between one-off, batch and continuous production?
- Why would a manufacturer use the different manufacturing volumes and processes? When would they be appropriate and not appropriate?

Different manufactured products will have different scales of production. This can depend on a range of requirements from both the client and manufacturing teams.

Individually or in pairs, explain the different manufacturing and production requirements for the following products:

- different models of a car, produced by a well-known manufacturer
- two litre milk bottles
- mobile phone
- bespoke, composite prosthetic leg
- laptop computer
- bearing for a pump.

Produce a slide deck, using software like PowerPoint, with one slide for each product.

Remember to give reasons on the slide deck to clearly explain your rationale.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

2.3 Areas of innovation and emerging trends in engineering

Focused revision elements:

- How innovation and emerging trends are evolving and could influence manufacturing.
- Environmental considerations, social and economic development.
- What conditions are needed when thinking about where to locate renewable energy?
- What environmental impacts need to be considered?
- What are the limitations of renewable energy?

Using a map of the British Isles as a starting point, identify the appropriate types of renewable energy which could be situated in these locations:

- Orkney Islands
- Kent
- Swansea Bay
- Snowdonia
- Birmingham.

Justify why they are suitable. ('Justify' means you have to give detailed reasoning to convince someone that your suggestion is correct.)

Once completed, review again, considering the environmental impacts and the limitations of the renewable energy type you have identified. Annotate the map with this information.

When this task is completed, you have applied your understanding of renewable energy.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

3.1 Drawings and information conveyed by drawings

Focused revision elements:

- The characteristics of, the purposes of, and audiences for different drawing types.

In pairs, find images of each of these types of drawings:

- computer-aided design models
- freehand sketch
- isometric
- orthographic
- exploded view
- block diagram
- flow chart
- circuit diagram
- schematic.

Produce a collage that shows each type of drawing.

On the image of each type of drawing, highlight the characteristics that differentiate it from the others.

Annotate your collage with details of the typical purposes and audiences for each type of drawing.

Individually, create three different scenarios where a drawing is needed. Pass your scenarios to the person you have been working with and ask them to tell you which type of drawing should be used and why. If necessary, ask probing questions until you feel confident they have selected the correct drawing and given a good explanation.

Your partner will then ask you about the three scenarios they have created.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921?
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

–

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

10.2 How sensors and actuators are used in automation control systems

Focused revision elements:

- The purpose and function of the different types of sensors and actuators.
- Applications and uses of sensors and actuators.

In pairs, complete the table below. For each type of sensor, describe the operating principles, application, advantages and disadvantages.

Sensors	Operating principles	Application	Advantages	Disadvantages
Light proximity				
Inductive				
Hall effect				
NTC				

You should then apply the same task to the following table:

Sensors	Operating principles	Application	Advantages	Disadvantages
Hydraulic				
Pneumatic				
Electrical rotary				
Linear				
Stepper motors				

Once these two tasks are completed, produce a short scenario that describes when these sensors and actuators would be best used.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

11.1 Quality standards, assurance, control and improvement

Focused revision elements:

- The main principles, purposes, advantages and disadvantages of different approaches to quality improvement.

Quality improvement is a systematic approach that uses specific methods and tools to achieve measurable improvements in quality.

In pairs, you will need a sheet of large paper, like flipchart paper, and pens. You should produce a mind map. In each corner of the paper, write one of the following:

- failure mode and effects analysis (FMEA)
- quality circles
- Pareto analysis
- cause and effect diagrams.

Referring to your notes, produce a revision guide that shows the principles, purpose, advantages and disadvantages.

Once this task is completed, you will need to consider how to apply your knowledge to engineering and manufacturing contexts.

Interview two other T Level learners who have started their industry placement. You want to know about any quality issues they have observed. Based on the information provided, apply what you have learnt from your revision guide to explain which quality improvement method/tools should be applied.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

12.1 The main requirements of key health and safety legislation applicable to engineering activities

Focused revision elements:

- The main requirements of current key legislation, how to access it and how it affects their own activities in the workplace.

Health and safety legislation exists to safeguard the health, safety and welfare of employers, employees and anyone else who may be exposed to hazards as a result of work activities. It ensures that the risk of harm is eliminated by placing obligations on various duty holders.

Working in pairs, review your notes on legislation and regulations. For each of the following, describe the main requirements:

- Health and Safety at Work etc. Act (HASAWA) 1974
- Management of Health and Safety at Work Regulations (MHSAWR) 1999
- Provision and Use of Work Equipment Regulations (PUWER) 1998
- Personal Protective Equipment at Work Regulations (PPE) 1992
- Control of Noise at Work Regulations 2005
- Manual Handling Operations Regulations (MHOR) 1992 (amended 2002)
- Lifting Operations and Lifting Equipment Regulations (LOLER) 1998
- Work at Height Regulations (WAHR) 2005 (amended 2007)
- Electricity at Work Regulations 1989
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013
- Control of Substances Hazardous to Health (COSHH) Regulations 2002 (amended 2004)

If you are not sure from your notes, carry out internet research or read through a textbook.

When you are clear about the requirements, select three pieces of legislation. Produce a poster to show situations in engineering and manufacturing where the legislation you have chosen will be applied. The poster should be designed for use in an engineering workshop.

Once this task is completed, you should be confident about the main requirements of the key legislation and regulations which need to be applied in the workplace.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

12.4 Risk assessment

Focused revision elements:

- The stages of risk assessment.

The HSE recommends a five-step risk assessment process.

In pairs, produce a slide deck using software like PowerPoint, describing the five stages of a risk assessment.

For each stage of the risk assessment, give an example of how it is applied in engineering and manufacturing.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

13.3 Financial and economic concepts

Focused revision elements:

- The meaning of the stated financial concepts and their implications for the operation of a business.

Complete the following table, which contains different financial terms. Start by completing it from your existing knowledge. Then, if needed, refer to your notes to fill in any gaps. If you still have gaps, you may need to carry out research or discuss it with your tutor.

Term	Definition	Implications for the operation of the business
Overheads		
Fixed costs		
Variable costs		
Inventory		
Outlay		
Cash flow		

Once this task is completed, consider the following situations:

1. A self-employed individual who makes bespoke motorcycle parts for clients.
2. A limited company providing maintenance for small factories on local industrial estates.
3. A limited company making components for use in helicopters. The contract is with an overseas company for the next 10 years.
4. A small engineering workshop that has recently expanded because its business development manager has secured a number of new contracts.

For each situation, select the financial term you think is the most important for that business to consider. Justify your choice.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

14.1 Professional conduct and responsibilities in the workplace

Focused revision elements:

- How behaviour and personal conduct in the workplace influence interactions with people.
- How to seek advice and guidance, where necessary.
- Expectations for reputation and ethical behaviour in the workplace.

In small groups, discuss possible situations that you have observed or experienced, which may require a member of staff to attend a disciplinary meeting.

In your group, select one of the examples you have discussed. You are required to role play a disciplinary meeting associated with that example. Each person in the group should take one of the following roles:

- operative one, who is accused of a disciplinary matter
- operative two, who is a witness to events
- line manager of operative one
- other relevant representative(s) like trade union, human resources or client.

Each person should prepare the information they will need for the role play. This may include referring to legislation, examples of good practice and typical disciplinary actions that could be taken.

The role play should last between five and 10 minutes.

Once you have completed the role play, discuss in your groups those things that were difficult and challenging. Reflect on how you would behave or say things differently next time.

When you have finished, produce a short individual report to represent the views of the role you took. The report should highlight key points covered in the meeting.

Once this task is completed, you will be able to apply this knowledge when reviewing how employees should behave in a professional manner.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

14.1 Professional conduct and responsibilities in the workplace

Focused revision elements:

- The main duties of an organisation regarding equality, diversity, accessibility and inclusion.
- Expectations for reputation and ethical behaviour in the workplace.

In small groups, list the nine protected characteristics stated in the Equality Act 2010. Give examples for each characteristic of when employees or organisations have not taken this into account in the workplace.

Select one of the protected characteristics and produce a poster to highlight to staff in engineering and manufacturing how to ensure they comply with legal requirements.

When you have completed that task, outline how understanding this has enabled organisations to develop policies and procedures to support all staff.

Once this task is completed, you will be able to consider how to apply this knowledge to answering questions.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

15.1 Stock and inventory management principles and practices

Focused revision elements:

- Key issues, risks, advantages and disadvantages associated with the different practices.

Complete the following table. For each stock inventory and management practice, describe the key issues, risks, advantages and disadvantages.

Stock inventory and management practice	Key issues	Risks	Advantages	Disadvantages
Just-in-time				
Made to stock				
Made to order				

Once you have completed this task, describe a scenario where the stock inventory and management practice is most suitable. Highlight the key points about the scenario that show it is the most suitable. Use the highlighted sections to produce a revision guide.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com
- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

16.1 Continuous improvement principles and practices

Focused revision elements:

- How the eight categories of wastes affect the performance of engineering activities.

For this activity, you need a large sheet of paper, like flipchart paper, and pens. On the paper put each of the following eight categories of waste:

- excess production
- waiting
- overprocessing
- transportation
- inventory
- motion
- defects
- unused talent.

For each category, you will describe measures needed to reduce waste, so make sure you leave enough space between each one.

When you have completed the activity, select three categories of waste. Produce a poster for a workshop or design office to explain the impact on the company if waste is not reduced.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

17.1 Principles of project management

Focused revision elements:

- Types of risk and how these are managed throughout the life of a project.

Risks need to be considered at all stages of a project. As well as identifying the risk, engineers need to be able to identify the controls which could be put in place to reduce that risk.

In pairs, produce a slide deck using software like PowerPoint. On your slide deck, allocate at least one slide for each of the following types of risk:

- cost and budget
- quality
- safety
- reputation
- project
- resources
- communication
- changes.

For each type of risk, give an example of what may occur. Try to use images to show the severity of the risk, if possible. Give an example of how each of the risks can be managed and reduced.

For this task, you need to review your class notes and/or the following helpful resources:

- Engineering and Manufacturing T Level: Core, Anderson P et al, (2023) ISBN 978-1398360921
- My Revision Notes: Engineering and Manufacturing T Level, Buckenham A et al, (2024) ISBN 978-1398385191
- Engineering Technologies Level 3, Tooley M, (2017) ISBN 978-1138674929
- BTEC National Engineering Student Book: For the 2016 specifications, Buckenham A, (2017) ISBN 978-1292141008
- BTEC Level 3 National Engineering Student Book, Cooke E et al, (2010) ISBN 978-1846907241
- BTEC National Engineering Level 3, Tooley M, Dingle L, (2010) ISBN 978-0123822024
- AQA AS/A-Level Design and Technology: Product Design, Potts W et al, (2017) ISBN 978-1510414082
- OCR Design and Technology for AS/A Level, Grundy J et al, (2017) ISBN 978-1510402652
- Edexcel A Level Design and Technology for Product Design: Resistant Materials, 3rd edition, Attwood J et al, (2009) ISBN 978-0435757786

- https://raeng.org.uk/education-and-skills/schools/stem-resources
- https://www.qmul.ac.uk/library/library-skills/resource-guides-by-subject/engineering-and-materials-science/useful-websites
- https://www.engineeringtoolbox.com

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

- https://www.engineering.com/home
- https://www.roymech.co.uk

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.

PRODUCED BY

Weston College of Further and Higher Education

FUNDED BY

This resource is funded by the Department for Education

Weston College has produced this resource on behalf of the Education and Training Foundation. This programme is funded by the Department for Education.