NCFE Level 1/2 Technical Award in Engineering (603/7006/3)

Examined assessment

Paper number: Sample assessment

Sample 2022

Mark Scheme

v1.0 Pre-Standardisation

This mark scheme has been written by the assessment writer and refined, alongside the relevant questions, by a panel of subject experts through the external assessment writing process and at standardisation meetings.

The purpose of this mark scheme is to give you:

- examples and criteria of the types of response expected from a learner
- information on how individual marks are to be awarded
- the allocated assessment objective(s) and total mark for each question.

Marking guidelines

General guidelines

You must apply the following marking guidelines to all marking undertaken throughout the marking period. This is to ensure fairness to all learners, who must receive the same treatment. You must mark the first learner in exactly the same way as you mark the last.

- The mark scheme must be referred to throughout the marking period and applied consistently. Do not change your approach to marking once you have been standardised.
- Reward learners positively giving credit for what they have shown, rather than what they might have omitted.
- Utilise the whole mark range and always award full marks when the response merits them.
- Be prepared to award zero marks if the learner's response has no creditworthy material.
- Do not credit irrelevant material that does not answer the question, no matter how impressive the response might be.
- The marks awarded for each response should be clearly and legibly recorded in the grid on the front of the question paper.
- If you are in any doubt about the application of the mark scheme, you must consult with your team leader or the chief examiner.

Guidelines for using extended response marking grids

Extended response marking grids have been designed to award a learner's response holistically and should follow a best-fit approach. The grids are broken down into levels, with each level having an associated descriptor indicating the performance at that level. You should determine the level before determining the mark.

When determining a level, you should use a bottom up approach. If the response meets all the descriptors in the lowest level, you should move to the next one, and so on, until the response matches the level descriptor. Remember to look at the overall quality of the response and reward learners positively, rather than focussing on small omissions. If the response covers aspects at different levels, you should use a best-fit approach at this stage and use the available marks within the level to credit the response appropriately.

When determining a mark, your decision should be based on the quality of the response in relation to the descriptors. You must also consider the relative weightings of the assessment objectives, so as not to over/under credit a response. Standardisation materials, marked by the chief examiner, will help you with determining a mark. You will be able to use exemplar learner responses to compare to live responses, to decide if it is the same, better or worse.

You are reminded that the indicative content provided under the marking grid is there as a guide, and therefore you must credit any other suitable responses a learner may produce. It is not a requirement either, that learners must cover all of the indicative content to be awarded full marks.

Assessment objectives

This unit requires learners to:

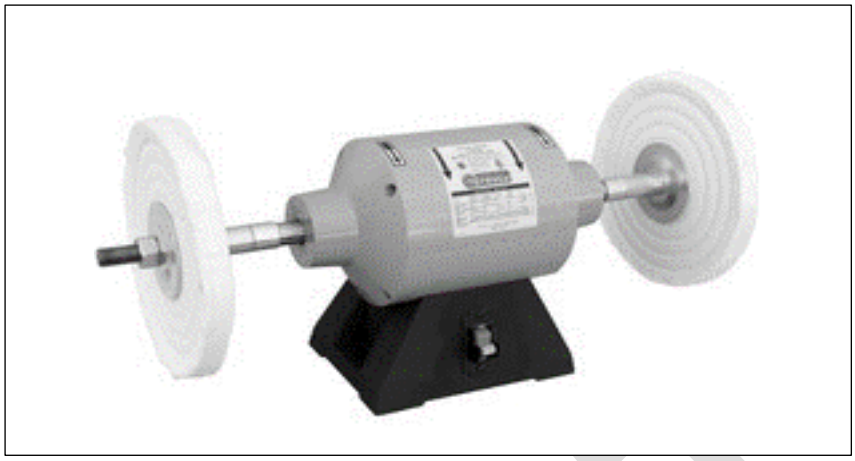
AO1	**Recall knowledge and show understanding.** The emphasis here is for learners to recall and communicate the fundamental elements of knowledge and understanding.
AO2	**Apply knowledge and understanding.** The emphasis here is for learners to apply their knowledge and understanding to real-world contexts and novel situations, including finding creative solutions.
AO3	**Analyse and evaluate knowledge and understanding.** The emphasis here is for learners to develop analytical thinking skills to make reasoned judgements and reach conclusions.

The weightings of each assessment objective can be found in the qualification specification.

Q	Marking guidance	Total marks

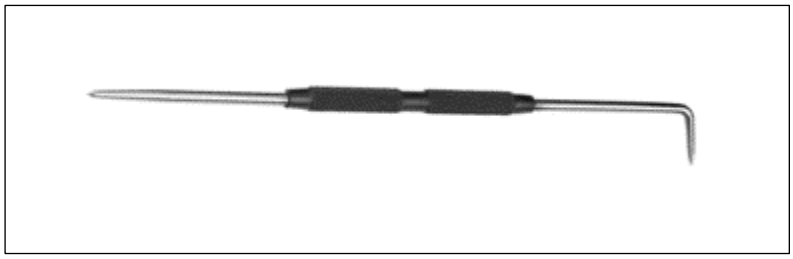
Section A **Total for this section: [33 marks]**

1	**The image below shows a prosthetic running blade which is an advanced type of prosthesis used by amputee athletes to replace a missing body part.**  **State the engineering discipline which is responsible for the development of prosthetic running blades.** Award **one** mark for any **one** of the following: • BioMedical Engineering • BioEngineering • Bio • Medical.	**1** **AO1=1**

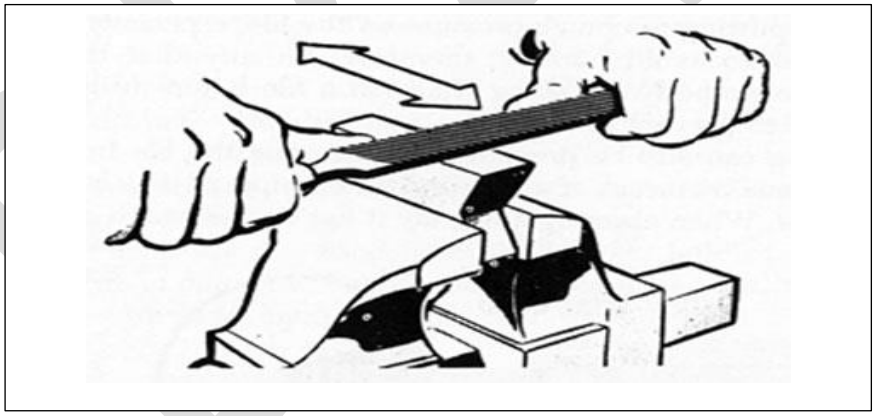
2	**The image below shows a machine commonly found in an engineering workshop.**  **Identify which one best describes its function.** **A** Buffing materials **B** Polishing materials **C** Sanding materials **D** Sharpening tools **Answer:** A: Buffing materials	**1** **AO1=1**

3	**Identify which one activity would the manual handling operations regulations be most likely to apply to.** **A** Ensuring a work area is free from obstructions **B** Handling and storing chemicals in a locked cabinet **C** Lifting then moving a heaving box from one location to another **D** Setting up a fixed machine for a practical task **Answer:** C: Lifting then moving a heaving box from one location to another	**1** **AO1=1**

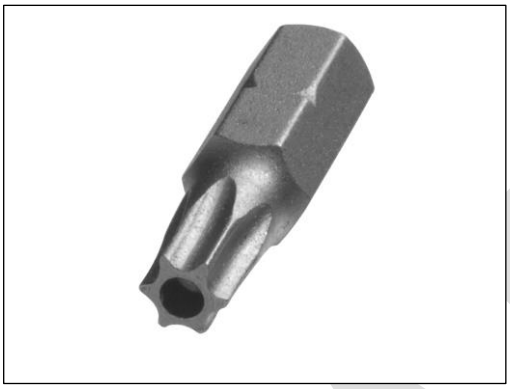
4	**Identify which one of the following is a softwood.** **A** Ash **B** Balsa **C** Cedar **D** Oak **Answer:** C: Cedar	**1** **AO1=1**

5	**The image below shows a marking out tool.**  **State the name of this tool.** **Answer**: Engineers Scriber or Scriber	**1** **AO1=1**

6	**Identify which one of the following saws would be the most appropriate tool to use when cutting a 12mm aluminium round bar.** **A** Coping Saw **B** Hacksaw **C** Scroll Saw **D** Tenon Saw **Answer**: B (Hacksaw)	**1** **AO1=1**

7	**The image below illustrates a modification technique.**  **Name the technique being used to modify the piece of metal**. **Answer:** Draw filing **N.B** Filing on its own will not be accepted.	**1** **AO2=1**

8	**Identify which one of the following the initials CNC stand for.** **A** Computer number capability **B** Computer number capacity **C** Computer numerical containment **D** Computer numerical control **Answer:** D: Computer numerical control	**1** **AO1=1**

9	**The image below shows a screwdriver bit.**  Identify which **one** of the following is the name of this bit. **A** Allen **B** Philips **C** Slot **D** Torx **Answer:** D: Torx	**1** **AO1=1**

10	**The image below shows a number of the same type of engineering component.**  **Identify which one of the following is the name of this component.** **A** Bolt **B** Nail **C** Rivet **D** Screw **Answer:** C: Rivet	**1** **AO1=1**

11	**State two safety features found on a metal lathe.** **Award one mark for each correct safety feature identified to a maximum of two marks from the list below:** • a guard (1) • micro switches (1) • emergency stop switch/button **or** emergency foot **or** knee switches/button (1).	**2** **AO1=2**

12	**State two types of personal protective equipment required when using a soldering iron in an engineering workshop.** • safety glasses or goggles (1) • apron or coveralls (1). Clothing will not be accepted as an answer. **Accept any other suitable response.**	**2** **AO2=2**

13	**As consumers become more environmentally aware, engineers have had to look at better ways to manufacture products.** **One example of this is a fleece top which can be fabricated from just eight plastic bottles, by shredding the plastic and turning it into polyester thread.** **Identify and explain one environmental benefit of using recycled materials in the production of a fleece top.** **AO2** Award **one** mark for identification of a benefit. • Reducing raw extraction of cotton (1). **AO3** Award up to **two** marks for explaining benefit**.** • Reducing the use of natural resources is more environmentally friendly (1) and something which is waste is being reused (1). • Using more sustainable resources would protect the environment (1) and reduce the use of oil-based plastics (1). **Accept any other suitable response**	**3** **AO2=1** **AO3=2**

14	**Electric vehicle sales are projected to reach 45 million worldwide by 2040. Currently the infrastructure for fossil fuel propelled vehicles is based around access to fuel refilling stations throughout the road network. Fossil fuel powered vehicles can expect to travel between 400–600 miles before they require to refuel. Electric vehicles can expect to travel between 200–300 miles before they need to re-charge.** **State two advantages and two disadvantages of current electric car design and related infrastructure.** **Advantages:** • no petrol/diesel costs (1) • low maintenance (1) • reduced noise pollution (1) • cost effective to run (1). **Disadvantages:** • few recharging points (1) • short driving range (1)	**4** **AO2=4**

	• reduced speed (1) • recharging times 4–6 hours (1) • not as much choice of models as petrol/diesel cars (1). **Accept any other suitable response.**	

15	**The image below shows a row of wind turbines. The blades of a wind turbine are fabricated from glass reinforced plastic (GRP).**  **Explain one property of glass reinforced plastic which makes it a suitable material for this purpose.** Award **one** mark for a correct property identified: • mechanical strength (1) • light weight (1) • corrosion resistant (1) • flexible (1) • thermal insulation (1) • high weight to strength ratio (1) • non-corrosive (1) • electrical insulation (1) • hardness (1) • UV resistant (1) • chemical resistance (1). Award **up to three marks** for an accurate explanation of the identified property: • **mechanical strength:** high strength to weight ratio (1) which means this can function well under the extreme weather conditions (1) moving freely without damage or breakages (1) • **light weight:** allows the wind to move the blades with ease (1) to generate power (1), it also avoids instability and the tower being top heavy (1)	**4** **AO2=4**

	• **corrosion resistant:** can withstand extreme temperatures, salt air, UV rays often associated with the locations of wind farms, especially off-shore. Corrosion resistance (1) offers a longer life expectancy than alternative materials (1), such as stainless steel (1). **Accept any other suitable response.** **NB: An accurate explanation of a property that has been incorrectly named will be awarded.**	

16	**The image below shows a standard household milk pan.**  **The pan section is fabricated from a non-ferrous metal and the handle from a thermoset polymer.** **Explain why these materials have been selected to construct the milk pan based on their properties and characteristics.** **AO1** Award **one** mark for each reason why the materials have been used, up to a maximum of **two** marks. **Properties and characteristics of non-ferrous metal pan** • Thermal conductivity (1) • High melting point (1) • Non-corrosive (1). **Properties and characteristics of thermoset polymer handle** • Thermal insulator (1) • Dark colour (1) • Smooth finish (1) • Will not soften or melt (1) • Lightweight (1). **AO2**	**4** **AO1=2** **AO2=2**

	Award **one** mark for each application of why material is used, up to a maximum of **two** marks. **Properties and characteristics of non-ferrous metal pan** • Heat up and retain heat well to perform its desired function (1) • Does not soften when exposed to high temperature of hob top (1) • Will not rust, washing up and dishwasher safe providing longevity of product (1). **Properties and characteristics of thermoset polymer handle** • Will not heat up or retain heat and burn user (1) • Will retain shape when exposed to high temperature of hob top (1) • Ease of use, especially when full (1).	

17	**Describe two activities which should be undertaken in setting up and preparing a pillar drill for use.** Award **one** mark for each correct descriptive point to a maximum of **two** marks for each activity: • ensure area is clear from debris (1) and there is no damage to the machine. (1) • Fit the drill bit into the chuck of the pillar drill and tighten it using a key (1) • pull guard across (1) to cover the drill bit (1) • adjust the table to the correct position (1) so that the desired cut will be achieved (1) • adjust the table to the correct height (1) so that the desired cut will be achieved (1). **Accept any other suitable responses.**	**4** **AO1=4**

Section B **Total for this section: [14 marks]**

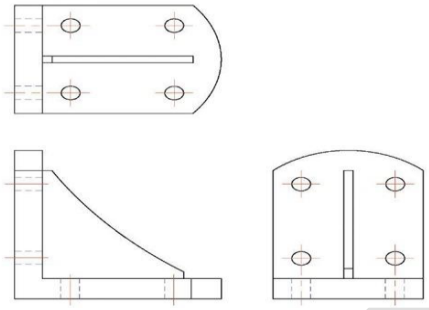
18	**Identify which one unit would be used to measure current?** **A** Ampere **B** Candela **C** Degrees **D** Seconds **Answer:** A: Ampere	**1** **AO1=1**
19	**Identify which one SI base unit of measurement would be best to use in a technical drawing of yacht.** **A** Kilogram (kg) **B** Kilometre (Km) **C** Metre (m) **D** Millimetre (mm) **Answer:** C: Metre (m)	**1** **AO1=1**
20	**An engineering company needs to modify the shape of plastic sheeting into various shapes and sizes.** **State two ways in which the shape and size of plastic can be modified.** Award **one** mark for each of the following up to a maximum of **two** marks: • cutting (1) • drilling (1) • bending (1).	**2** **AO2=2**
21	**The total power input to a power station is 672 MW. The useful power output is 536 MW. Making use of the relevant supplied equation, calculate the efficiency of this power station.** **Show your workings out and round up to the nearest whole unit.** **AO1** • Correct selection of equation from a given list. Efficiency (%) = (useful energy out ÷ total energy in) x 100 (1).	**3** **AO1=1** **AO2=2**

	AO2 • Correct application of equation using the figures given. (536/672)*100 (1) • Correct answer. 80% (1).	

22	**If a car increases in velocity from +5 m/s to +15 m/s in 3 seconds, what is its acceleration?** **Show your workings out and round up to one decimal place.** **AO1** • Correct selection of equation from a given list. Acceleration = Change in velocity ÷ Time (1). **AO2** • Correct application of equation using the figures given. Acceleration = 10 m/s ÷ 3s (1) • Correct answer. 3.3 m/s (1).	**3** **AO1=1** **AO2=2**

23	**Describe two elements that should be found in a project planning risk assessment.** Award **one** mark for each element stated up to a maximum of **two** marks: • hazard (1) • risk (1) • control measures (1). Award up to **two** marks for an accurate description: • (a hazard) is something that could cause harm in the workplace (1) • (a risk) is how likely a person is to be hurt if they are exposed to a workplace hazard (1) • (a control measure) is something put in place to remove a hazard or reduce risk (1). **Award any other suitable response**.	**4** **AO1=4**

Section C **Total for this section: [15 marks]**

24	**The image below illustrates an engineering drawing of a support bracket.**  **State the projection that has been used to produce this engineering drawing.** **Answer:** Third angle projection	**1** **AO1=1**

25	**Other than title, state two pieces of information that would be found in the title block of an engineering drawing**. Award **one** mark for the following to a maximum of **two** marks: • drawing reference number (1) • author (1) • drawing number (1) • date (1 • materials (1) • scale (1) • sheet number (1) • system of measurement (1) • projection (1). **NB** Do not award a mark for title.	**2** **AO1=2**

26	**A laser cutter is a computer-aided machine (CAM) often found in an engineering workshop.** **Justify the need for full training prior to using this computer-aided machine.** Award up to **two** marks for each point of justification. • It is a health and safety requirement as it reduces the risk of injury to individuals (1) and reduces the risk of damage to the piece of equipment (1). **Accept any other suitable response.**	**2** **AO3=2**

27	**You are an engineer working for a local electrical engineering company that specialise in renewable energy. You have been asked to draft engineering drawings for a new wind turbine.** **Explain why you would apply scale in this engineering drawings.** **AO2** Award up to **two** marks for application: • the wind turbine will need to be scaled down (1) • scaling is required so that it can fit onto the page. (1) **AO3** Award up to **two** marks for analysis and evaluation: • accurate use of scale will provide clearly defined and accurate measurements so that the wind turbine can be built/manufactured (1) • accurate use of scale will ensure ease of communicating the design/product (1). **Accept any other suitable response**	**4** **AO2=2** **AO3=2**

28	**You are employed as a civil engineer and are currently working on a new bridge project. The bridge will be used as a transport link and will carry around 8,000 vehicles every day.** **Analyse two reasons why it is important to include annotations in a freehand sketch of the bridge.** **AO2** Award **one** mark for each reason why annotation is important in a freehand sketch, up to a maximum of **two** marks. . • As a bridge incorporates several materials, annotations provide information of the specific material required for each element of the bridge (1) • As a bridge requires many different engineering processes, annotations provide information on the specific manufacturing details which might require extra information to make the processes clear (1). **AO3** Award **two** mark for each analytical point on why annotation is important in a freehand sketch. • This would ensure that no error is made when allocating materials to the final manufacturing (1). As the bridge transports a large number of vehicles, long term safety is important and this can only be achieved by the correct selection of materials (1) • This would ensure that materials are joined in the way intended by the designer and the piece will be correctly made (1). This will ensure that the bridge does not develop faults after being used and stressed in the future (1). **Accept any other suitable response.**	**6** **AO2=2** **AO3=4**

Section D **Total for this section: [18 marks]**

29 **Analyse the importance of COSHH in a construction environment and analyse the possible impact of not adhering to the COSHH regulations with regards to the identified risks.**

9

AO1=3

AO2=3

AO3=3

Level	Marks	Description
2	7–9	**AO3 – Excellent** analysis of the importance of COSHH and impacts of not adhering to the regulation that is **comprehensive** and **highly relevant**. Supported with **excellent** justifications are **comprehensive** and **highly detailed**. **AO2 – Excellent** application of knowledge and understanding of COSHH and impacts of not adhering to the regulation that is **comprehensive** and **highly detailed** and **highly relevant** to the question. **AO1 – Excellent** recall of knowledge and understanding of COSHH and impacts of not adhering to the regulation that is **comprehensive**. Subject specific terminology is used **consistently** throughout.
2	4–6	**AO3 – Good** analysis of COSHH and impacts of not adhering to the regulation that is **detailed** and **mostly relevant**. Supported with **good** justifications that are **detailed**. **AO2 – Good** application of knowledge and understanding of COSHH and impacts of not adhering to the regulation that is **detailed** and **mostly relevant** to the question. **AO1 – Good** recall of knowledge and understanding of COSHH and impacts of not adhering to the regulation that is **mostly detailed**. Subject specific terminology is used, but not always consistently.
1	1–3	**AO3 – Limited** analysis of COSHH and impacts of not adhering to the regulation. Supported with **limited** justifications that have **minimal detail** and are **mostly superficial**.

		AO2 – Limited application of knowledge and understanding of COSHH and impacts of not adhering to the regulation that has **minimal detail** and are **mostly superficial**. With **minimal relevance** to the question. **AO1 – Limited** recall of knowledge and understanding of COSHH and impacts of not adhering to the regulation that has **minimal detail**. Subject specific terminology is often **inappropriate**, and a lack of understanding is evident.
	0	No rewardable material.

It is not a requirement that the learner formulate a response specifically against each assessment objective as laid out in the indicative content (IC).

A learner's demonstration of recall (AO1) and application (AO2) of knowledge and understanding can be implied through the learner's ability to analyse the question topic required of AO3.

Indicative content:

Examiners are reminded that indicative content reflects content-related points that a learner may make but is not an exhaustive list, nor is it a model answer. Learners may make all, some or none of the points included in the indicative content. Learners must be credited for any other appropriate response.

AO1 – Learner will recall knowledge and understanding of COSHH

- The purpose of COSHH: understand the dangers of different substances hazardous to health.

COSHH covers the following:

- products containing chemicals or biological agents
- fumes
- dusts
- vapours
- gases.

AO2 – Learner will apply knowledge and understanding of COSHH and its impacts

	Importance of COSHH in a chemical engineering environment: • identifying what the health hazards could be • producing a risk assessment to prevent harm to health • providing control measures to reduce harm to health • providing information, instruction and training for employees and other relevant people • ensure staff are making use of control measures • check and maintain all control measures to ensure they are in good working order • HR provision to provide monitoring of health in appropriate cases • emergency plan. **AO3 – Learners will analysis the importance of COSHH and impacts of not adhering to the regulation** Possible impact of not adhering to the COSHH regulations: • a person could be at increased risk of a health defect or injury, worst case death • an employee could face disciplinary action for failing to follow the guidelines • an employer could face legal action, resulting in a fine or stop on trading • an employer could face civil action, resulting in a compensation pay out and financial losses • damage to equipment from incorrect use/storage of substances, resulting in financial losses • loss or wastage of product due to incorrect use/storage of substances resulting in financial losses. **Accept any other suitable response.**	

30

Chemical engineering has led to new products and projects which have solved problems and had an impact on the modern world.

Assess the problems solved and the impact of developments in chemical engineering on the modern world.

9

AO1=3

AO2=3

AO3=3

Level	Marks	Description
2	7–9	**AO3 – Excellent** assessment of the impact of chemical engineering on the modern world that is **comprehensive** and **highly relevant**. **AO2 – Excellent** application of knowledge and understanding of the impact of chemical engineering on the modern world that is **comprehensive** and **highly detailed** and **highly relevant**. **AO1 – Excellent** recall of knowledge and understanding of the impact of chemical engineering on the modern world that is **comprehensive**. Subject specific terminology is used **consistently** throughout.
2	4–6	**AO3 – Good** assessment of the impact of chemical engineering on the modern world that is **detailed** and **mostly relevant**. **AO2 – Good** application of knowledge and understanding of the impact of chemical engineering on the modern world that is **detailed** and **mostly relevant** to the question. **AO1 – Good** recall of knowledge and understanding of the impact of chemical engineering on the modern world that is **mostly detailed**. Subject specific terminology is used, but not always consistently.
1	1–3	**AO3 – Limited** assessment of the impact of chemical engineering on the modern world that has **minimal detail** and is **mostly superficial**. **AO2 –** Limited application of knowledge and understanding of the impact of chemical engineering on the modern world that has **minimal detail** and is **mostly superficial**. **AO1 – Limited** recall of knowledge and understanding of the impact of chemical engineering on the modern world that has

		minimal detail. Subject specific terminology is often **inappropriate**, and a lack of understanding is evident.
	0	No rewardable material.

It is not a requirement that the learner formulate a response specifically against each assessment objective as laid out in the indicative content (IC).

A learner's demonstration of recall (AO1) and application (AO2) of knowledge and understanding can be implied through the learner's ability to analyse the question topic required of AO3.

Indicative content

AO1 – Learner will recall knowledge and understanding of chemical engineering

Problems solved:

- antigenic - to provide immunity against diseases
- antiseptics - to prevent germ growth
- analgesic - to reduce pain
- food preservers - increase the life span of food
- alternative to fossil fuel, for example, bio-ethanol – reducing environmental impact.

Impact:

- lengthening life span
- improving quality of life
- reducing or removing discomfort
- reducing or avoiding the risk of spread of infectious diseases
- curing illness
- ensuring that food stays fresh longer - reducing waste
- reducing levels of climate change.

AO2 – Learner will apply knowledge and understanding of chemical engineering

- Chemical engineering has provided many vaccinations against diseases that would otherwise cause people to be unwell. A recent example of this is the chemical engineering at AstraZeneca produced a vaccination against COVID-19.
- Chemical engineers have produced bio-ethanol fuel to be used in domestic fireplaces as an alternative to coal burning.
- Chemical engineers have produced medication to lengthen life span. This is well demonstrated with medication to lengthen the life of those people with HIV/AIDS.

	AO3 – Learners will analysis the problems solved and impact of chemical engineering • By providing vaccination against COVID-19, chemical engineers have enabled the population to return to work and therefore get the economy moving again. • By developing alternatives to fossil fuels, chemical engineers have reduced the reliance on fossil fuels and therefore helping to improve the environment. • By creating medication, chemical engineers have improved the quality of people's lives and given them more time with their families and enabled them to work longer. **Accept any other suitable response.**	

Assessment objective grid

Question	AO1	AO2	AO3	Total
Section A				
1	1			1
2	1			1
3	1			1
4	1			1
5	1			1
6	1			1
7		1		1
8	1			1
9	1			1
10	1			1
11	2			2
12		2		2
13		1	2	3
14		4		4
15		4		4
16	2	2		4
17	4			4
Total	**17**	**14**	**2**	**33**
Section B				
18	1			1
19	1			1
20		2		2
21	1	2		3
22	1	2		3
23	4			4
Total	**8**	**6**	**0**	**14**
Section C				
24	1			1
25	2			2
26			2	2
27		2	2	4
28		2	4	6
Total	**3**	**4**	**8**	**15**
Section D				
29	3	3	3	9
30	3	3	3	9
Total	**6**	**6**	**6**	**18**
Total	**32**	**30**	**16**	**80**