



T Level Technical Qualification in Science

Core knowledge and understanding Paper A

Mark scheme

V1.0: Post-standardisation
P002410
11 December 2023
603/6989/9

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 student
- 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 students, who must receive the same treatment. You must mark the first student 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 students 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 student'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 assess students' work holistically. They consist of bands-based descriptors and indicative content.

Bands-based descriptors: each band is made up of several descriptors for across the AO range, AO1 to AO3, which, when combined, provide the quality of response that a student needs to demonstrate. Each band-based descriptor is worth varying marks.

The grids are broken down into bands, with each band having an associated descriptor indicating the performance at that band. You should determine the band before determining the mark.

Indicative content reflects content-related points that a student may make but is not an exhaustive list. **Nor is it a model answer.** Students may make all, some or none of the points included in the indicative content as its purpose is as a guide for the relevance and expectation of the responses. **Students must be credited for any other appropriate response.**

Application of extended response marking grids

When determining a band, you should use a bottom-up approach. If the response meets all the descriptors in the lowest band, you should move to the next one, and so on, until the response matches the band descriptor. Remember to look at the overall quality of the response and reward students positively, rather than focussing on small omissions. If the response covers aspects at different bands, you should use a best-fit approach at this stage and use the available marks within the band 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 student 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 other suitable responses a student may produce. It is not a requirement either that students must cover all the indicative content to be awarded full marks.

Assessment objectives

This assessment requires students to:

- AO1: Demonstrate knowledge and understanding of contexts, concepts, theories and principles in science
- AO2: Apply knowledge and understanding of contexts, concepts, theories and principles in science to different situations and contexts
- AO3: Analyse and evaluate information and issues related to contexts, concepts, theories and principles in science to make informed judgements, draw conclusions and address individual needs

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

Section A: Working within the science sector

This section is worth **25** marks, plus **3** marks for the quality of written communication (QWC) and use of specialist terminology.

<p>1 Which one of the following outlines the purpose of a person specification?</p> <p>A A detailed description of the role, including responsibilities, objectives and requirements</p> <p>B A profile of the necessary skills and attributes required for an individual to succeed in the role</p> <p>C The organisational policies and procedures which are relevant to the role being advertised</p> <p>D The relevant legislation an individual must apply specific to the role within a science laboratory</p> <p style="text-align: right;">[1 mark]</p>
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AO1 = 1 mark

Answer

B. A profile of the necessary skills and attributes required for an individual to succeed in the role (1).

<p>2 State the purpose of safeguarding policies in scientific workplaces.</p> <p style="text-align: right;">[1 mark]</p>

AO1 = 1 mark

Award **one** mark for the correct statement, up to a maximum of **one** mark:

- Ensuring the protection from harm of individuals, including those working within the organisation and visitors (1).

Do **not** award credit for responses referring to health and safety practices or regulations, or for responses discussing protecting organisations.

Accept any other suitable response.

3 Give two reasons why it is important to adhere to quality standards, quality management and audit processes when working within the science sector.

[2 marks]

AO1 = 2 marks

Award **one** mark for each reason given, up to a maximum of **two** marks:

- ensuring consistency (1)
- maintaining health and safety (1)
- monitoring processes and procedures (1)
- facilitating continuous improvement (1)
- facilitating objective, independent review (1).

Accept any other suitable response.

4 CheckCrete is a company that tests the composition of concrete. They have updated their employee handbook to include information about career development within the industry, as shown below:

At CheckCrete we actively support our colleagues' continuing development by providing access to the following development opportunities, subject to availability:

- option to enrol on a higher apprenticeship within the company
- professional registration with the appropriate organisation.

(a) Explain how accessing one of the development opportunities given in the handbook might support progression within this workplace.

[2 marks]

AO2 = 2 marks

Award **one** mark for each part of the explanation point, up to a maximum of **two** marks:

- A higher apprenticeship will develop the employees knowledge and skills of concrete/cement (1). This could allow them to meet criteria on job adverts for higher-paid jobs/positions (1).
- Gaining professional registration shows that the employee has met certain standards needed for registration (1). This is recognised by employers in the industry and will give them confidence in the employee's ability (1).

Accept any other suitable response.

(b) An employee suggests that the company should start offering internships for young people leaving school or college.

Justify the employee's suggestion.

[3 marks]

AO3 = 3 marks

Award **one** mark for each valid justification point, up to a maximum of **three** marks:

- An internship would benefit the young person as they are able to undertake work experience in the organisation (1). This will allow young people to gain experience/develop skills needed to gain a paid position in the future (1). The company would then be able to employ the young person if a position became available, as the internship shows the employer the young person is capable of performing in the role (1).
- Internships can benefit the employer as a cost-effective way for them to identify potential future employees (1). They allow companies to assess the skills, work ethic, and cultural fit of interns before making long-term hiring decisions (1). Interns can help boost productivity by assisting with routine tasks and projects, allowing full-time employees to focus on higher-level responsibilities (1).

Accept any other suitable response.

5 Scientific workplaces frequently use highly sensitive and expensive equipment. The manufacturers of this equipment provide a schedule for maintenance checks, which include cleaning and servicing for this equipment.

An employee decides not to carry out their maintenance check this week as they are too busy.

Explain two potential impacts of the employee not following the maintenance schedule correctly.

[4 marks]

AO2 = 4 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks per impact:

- The employee not carrying out the check may lead to injury of colleagues when using the equipment (1) due to potential faults not being caught as early as possible/the equipment not being cleaned as part of the maintenance check (1).
- The employee not carrying out the check may lead to the spread of infection between colleagues when using the equipment (1) due to potential faults not being caught as early as possible/the equipment not being cleaned as part of the maintenance check (1).
- The employee may cause samples being tested to be contaminated/higher chance of cross contamination due to parts not being cleaned/checked (1). This could cause build-up of reagents/samples which could lead to invalid results (1).

- The employee may cause the equipment to not work properly/have a reduced function leading to increased cost to the company (1) as any warranties may be voided if the maintenance schedule is not adhered to (1).

Accept any other suitable response.

6 A company undertaking commercial research and development in a range of scientific disciplines, including health, food and energy, has been taken over by a new chief executive. During a presentation to staff they make the following statement:

‘As an organisation we should spend more time and money on innovation within the disciplines we work in.’

Shareholders and the chief executive’s colleagues are concerned that this could reduce productivity.

Evaluate the statement made by the chief executive.

Your response should include reasoned judgements and conclusions.

[12 marks, plus 3 marks for QWC]

AO1 = 4 marks

AO2 = 4 marks

AO3 = 4 marks

QWC = 3 marks

Band	Mark	Descriptor
4	10–12	<p>AO3: Evaluation of the chief executive's statement and concerns raised by colleagues and shareholders, and how they may affect the activity of the company is comprehensive, effective, and relevant, showing detailed understanding, and logical and coherent chains of reasoning throughout. Makes informed conclusions that are fully supported with rational and balanced reasoned judgements.</p> <p>AO2: Applied all relevant knowledge of factors affecting the activity of a company operating in the scientific sector and shows a detailed functional understanding. This is effectively linked to the science sector.</p> <p>AO1: A wide range of relevant knowledge and understanding of factors affecting the activity of the company is demonstrated, which is accurate and detailed. A wide range of appropriate technical terms are used.</p>
3	7–9	<p>AO3: Evaluation of the suggestions and concerns and how they may affect the activity of the company is in most parts effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Given conclusions are supported by reasoned judgements that consider most of the relevant arguments.</p> <p>AO2: Applied mostly relevant knowledge of factors affecting the activity of a company operating in the science sector, and this is linked to the science industry.</p> <p>AO1: Knowledge and understanding of factors affecting commercial activity of the company is in most parts clear and mostly accurate, although on occasion may lose focus.</p>
2	4–6	<p>AO3: Evaluation of the suggestions and concerns and how they may affect the activity of the company is in some parts effective and of some relevance, with some understanding and reasoning taking the form of generic statements with some development. Judgements are basic and brief; conclusions will have limited rationality and balance.</p> <p>AO2: Applied little but some knowledge of the factors affecting the activity of a company operating in the science sector. Linking to the science industry might be weak.</p> <p>AO1: Knowledge and understanding of factors affecting commercial activity of the company shows some but limited accuracy, focus and relevance.</p>
1	1–3	<p>AO3: Evaluation of the suggestions and concerns and how they may affect the activity of the company is minimal and very limited in effectiveness and relevance. Given brief conclusions are supported by judgements that consider only basic arguments and show little relevance to the question aims.</p>

		<p>AO2: Applied limited knowledge of the factors affecting the activity of a company operating in the science sector. Shows a very limited functional understanding of how this links to the food science industry.</p> <p>AO1: Knowledge and understanding of factors affecting commercial activity of the company shows very minimal accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that the indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** will be implicit through the level of evaluation and reasoned judgements and/or conclusions that the student provides.

AO1: Demonstration of the understanding of the importance and impact of innovation in the science sector, which may include:

- innovation leads to new developments
- innovation is necessary to solve large-scale problems
- healthcare challenges can be improved by innovative practices
- existing products and practices can be improved as a result of innovation
- innovation leads to the development of new products
- innovation leads to new scientific discoveries.

AO2: Application of the understanding of the importance and impact of innovation in the science sector, which may include:

- new developments lead to economic benefits, such as genetically modified crops resulting in higher productivity in food production/farming
- innovative approaches to large-scale problems, such as the development of renewable alternative energy resources, leads to higher financial income and reputational benefits for the company
- innovative improvements in healthcare practices lead to benefits for society as well as financial and reputational benefits for the company
- improving existing products, processes, and practices helps the organisation improve efficiency for example by using artificial intelligence to identify bottlenecks in workflows, and therefore productivity
- developing innovative new products such as new drugs or synthetic materials allows the company to develop new product lines and subsequently improve profitability
- new scientific discoveries such as uses of bioinformatics or gene editing lead to sources of work and therefore income for companies working in the science sector.

A03: Evaluation of the understanding of the importance and impact of innovation in the science sector, which may include:

- economic benefits from new developments: increased productivity can lead to increased income/improved profile and reputation in the science community. However, creating new developments involve significant upfront investment and come with risks of loss of reputation if these do not succeed
- tackling large-scale, high-profile issues such as renewable energy and global warming can address problems facing society and lead to reputational and financial benefits for the company. These also depend on significant financial investment and risk to fully develop these innovations and will divert resources within the company away from existing projects
- the development of innovative healthcare practices can improve public health, leading to a reduced burden on national health services and additional income streams for the company. This comes with additional risks associated with the investment needed in the development and testing of healthcare solutions, as well as potentially decreasing income from other product lines if these treatments become obsolete
- by improving products, processes, and practices through innovation organisations can improve their competitive advantage in the market by meeting changing customer needs and industry trends. This can be achieved by increasing efficiency, improving quality, and enhancing sustainability. However, this comes with potential risks to the organisation, including additional cost, risk of failure leading to reputational damage, and the challenge of overcoming organisational resistance to change
- innovative development of new products is important for the growth and sustainability of the organisation as this gives the organisation a competitive advantage by meeting new customer needs, leading to new potential growth opportunities and improving the perception of the organisation both commercially and within the science community. The risks associated with this include the risk to the financial investment required to drive innovation, and there is also the challenge of anticipating the changes to the market which influence the commercial impact of any new products
- new scientific discoveries can be driven by innovation, leading to the advancement of scientific knowledge, improvements to technology, which in turn can support the development of solutions to address global challenges. On the other hand, there are hazards associated with new scientific developments, including the potential for unintended consequences and ethical concerns.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning.

	A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

Section B: Ethics, data and managing personal information in the science sector

This section is worth **25** marks, plus **3** marks for quality of written communication (QWC) and use of specialist terminology.

<p>7 Which one of the following is an application of artificial intelligence in the recording and reporting of information and data?</p> <p>A Analysing and processing large data sets using bioinformatics tools B Blending data from multiple datasheets in preparation for analysis C Presenting research findings to a non-technical target audience D Storing information in cloud-based systems to enable easier data sharing</p> <p>[1 mark]</p>
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AO1 = 1 mark

Answer

A. Analysing and processing large data sets using bioinformatics tools

<p>8 Give two data collection methods which can be used in scientific investigations.</p> <p>[2 marks]</p>

AO1 = 2 marks

Award **one** mark for each method given, up to a maximum of **two** marks:

- focus groups
- open question surveys/interviews
- observation
- public databases
- journals and articles
- closed question surveys
- official statistics
- carrying out practical work and making observations.

Accept any other suitable response.

9 A local laboratory, testing the strength of wires, is taken over by a larger company. The chief scientist from the larger company wishes to convert the existing paper-based physical laboratory notebook system into an electronic laboratory information management system (LIMS), so that they can have easier data visualisation and searching.

The site is spread across a large area, so employees working on the same project in different departments may be across the site from each other.

(a) Explain an advantage and a limitation of using LIMS.

[4 marks]

AO2 = 4 marks

Advantages:

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- a LIMS would allow any employee to access the results/records from any investigation from anywhere on the large site (1). This is more convenient as less time would be wasted travelling across the site to access physical lab notebooks (1)
- a LIMS system would allow access to more than one employee at any time (1). This would be more convenient as only one person can use the physical lab notebook at any time meaning work could be delayed as if one employee needed it, another couldn't also use it (1)
- physical lab books can be accessed by anyone in the workplace whereas LIMS cannot (1) meaning it is more difficult to control access to potentially access data to use LIMS (1)
- a LIMS would keep track of who has made changes and when (1) which could reduce problems with the integrity and reliability of the data (1).

Limitations:

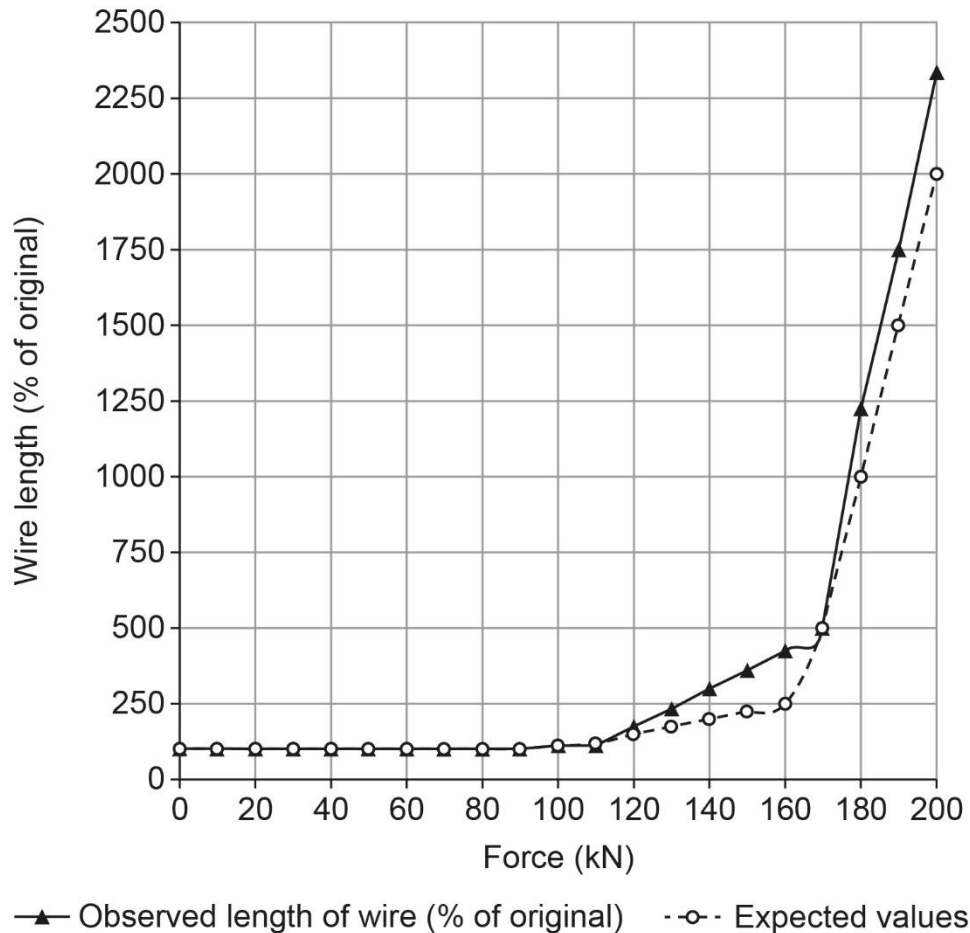
Award **one** mark for each explanation point, up to a maximum of **two** marks:

- physical lab books are safe from computer system failure/hacking (1), making these more robust and reliable in situations where computer systems may be vulnerable (1)
- physical lab books can be used in conditions that would be unsuitable for electronic equipment (1), meaning they can be used in a wider range of situations, such as remote from power/internet connectivity and are therefore more versatile (1)
- LIMS can be expensive to setup and maintain (1), meaning they may not be viable for small/new organisations who need to invest their money directly into scientific research equipment/personnel (1).

Accept any other suitable response.

(b) In testing batches of wire, the company measures the force at which the wire begins to deform and the force at which the wire breaks. An example of their data is shown in Figure 1.

Figure 1: Observed results and expected results for force against wire length.



(i) Identify which statistical test should be used on these data.

[1 mark]

AO1 = 1 mark

Award **one** mark for correctly identifying the appropriate statistical test, up to a maximum of **one** mark:

- Chi square test

(ii) The chief scientist notices a potential anomaly in the data at a force of 170 kN and suggests that the team compares their data to published work before moving onto the next stage of the investigation.

Assess the chief scientist's suggestion to compare their data to published work.

Your response should include reasoned judgements and a conclusion.

[3 marks]

AO3 = 3 marks

Award **one** mark for each assessment point, up to a maximum of **three** marks:

- comparing results to published work is a valid way to review work and may help the team to make decisions based on the review (1). It might provide the team with confidence in their results as published work has been through many peer reviews and checks (1). However, published work might contradict/disagree with their data (1)
- alternatively, could compare the data with the hypothesis (1) which could indicate if a deviation from a pattern is expected at this value (1) which would then inform the next steps to be taken (1).

Accept any other suitable response.

10 In 1998, a published paper from a study suggested a link between the MMR (measles, mumps, and rubella) vaccine and autism. The study was later discredited as it was believed that the author had not acted with integrity within his work. The journal that had published this issued a complete retraction of this paper.

Explain how researchers who disproved this paper would have demonstrated integrity whilst working in their scientific research.

[2 marks]

AO2 = 2 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- researchers maintained ethical standards such as objectivity despite potential financial gain if more favourable results were published (1). This ensured results and interpretations are free from bias and therefore reliable (1)
- researchers followed organisational codes of practice/regulatory guidance despite how the investigation was carried out by the author (1) which ensured experimental design is appropriate and therefore conclusions are accurate and reliable (1).

Accept any other suitable response.

11	<p>Whilst working in a research laboratory a scientist is not following company policies relating to responsible use of IT systems.</p> <p>Using your knowledge and understanding of relevant legislation, confidentiality, and security measures, evaluate the importance and potential impact of responsible use of IT systems in a research laboratory.</p> <p>Your response should include reasoned judgements and conclusions.</p> <p style="text-align: right;">[12 marks, plus 3 marks for QWC]</p>
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AO1 = 4 marks
AO2 = 4 marks
AO3 = 4 marks
QWC = 3 marks

Band	Mark	Descriptor
4	10–12	<p>AO3: Evaluation of the importance of the responsible use of IT systems and services, and how they may affect the activity of the company is comprehensive, effective, and relevant, showing detailed understanding, and logical and coherent chains of reasoning throughout. Makes informed conclusions that are fully supported with rational and balanced discussion.</p> <p>AO2: Applied all relevant knowledge of factors affecting the use of IT systems in a company operating in the scientific sector and shows a detailed functional understanding. This is effectively linked to the science sector.</p> <p>AO1: A wide range of relevant knowledge and understanding of the importance of the responsible use of IT systems and services is demonstrated, which is accurate and detailed. A wide range of appropriate technical terms are used.</p>
3	7–9	<p>AO3: Evaluation of the importance of the responsible use of IT systems and services and how they may affect the activity of the company is in most parts effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Discussion is supported by reasoned judgements that consider most of the relevant arguments.</p> <p>AO2: Applied mostly relevant knowledge of factors affecting the use of IT systems in a company operating in the science sector, and this is linked to the science industry.</p> <p>AO1: Knowledge and understanding of the importance of the responsible use of IT systems and services is in most parts clear and mostly accurate, although on occasion may lose focus.</p>

2	4–6	<p>AO3: Evaluation of the importance of the responsible use of IT systems and services and how they may affect the activity of the company is in some parts effective and of some relevance, with some understanding and reasoning taking the form of generic statements with some development. Judgements are basic and brief; the discussion will have limited rationality and balance.</p> <p>AO2: Applied little but some knowledge of the factors affecting the use of IT systems in a company operating in the science sector. Linking to the science industry might be weak.</p> <p>AO1: Knowledge and understanding of the importance of the responsible use of IT systems and services shows some but limited accuracy, focus and relevance.</p>
1	1–3	<p>AO3: Evaluation of the importance of the responsible use of IT systems and services and how they may affect the activity of the company is minimal and very limited in effectiveness and relevance. Brief discussions are supported by judgements that consider only basic arguments and show little relevance to the question aims.</p> <p>AO2: Applied limited knowledge of the factors affecting the use of IT systems in a company operating in the science sector. Shows a very limited functional understanding of how this links to the science industry.</p> <p>AO1: Knowledge and understanding of the importance of the responsible use of IT systems and services very minimal accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that the indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** will be implicit through the level of evaluation and reasoned judgements and/or conclusions that the student provides.

AO1: Demonstration relevant knowledge and understanding of the importance of the responsible use of IT systems and services, which may include:

- Data Protection Act 2018:
 - Controls the use of personal information by organisations, businesses or the government.

- **GDPR 2018:**
 - Provides a set of principles with which any individual or organisation processing sensitive data must comply.
- **Confidentiality can be ensured by:**
 - logging out of a system when leaving the screen
 - protecting login and password information
 - being aware of the surroundings
 - using secure internet connections
 - using privacy screen filters.
- **Security measures can protect data by:**
 - controlling access to information (for example, levels of authorised logins and passwords)
 - allowing only authorised staff into specific work areas
 - requiring regular and up-to-date staff training in complying with data security
 - making regular back-ups of files
 - using up-to-date cyber security strategies to protect against unintended or unauthorised access
 - ensuring that back-up data is stored externally (for example, cloud-based or separate servers).

AO2: Application of relevant knowledge of factors affecting the use of IT systems in a company operating in the scientific sector, which may include:

- when working in research, compliance with data protection legislation protects participants from their personal data being used inappropriately
- when working in research, compliance with data protection legislation protects the organisation from prosecution and from reputational harm as the data could be taken out of context or be seen as controversial
- taking care to log out of systems when not working at the screen reduces the risk of someone gaining unauthorised access to the results of the research being undertaken, opportunistically or accidentally
- the use of long and complex passwords which are changed frequently reduces the risk of someone guessing a password and gaining access to systems, in a research laboratory there may be competing organisations/teams that would benefit from gaining access to your data
- keeping username and password information secure reduces the chances of someone gaining unauthorised access to data and information, in a research laboratory there may be competing organisations/teams that would benefit from gaining access to your data
- maintaining an awareness of the surroundings makes it more difficult for anyone to oversee someone typing in security information and subsequently gain unauthorised access to systems, in a research laboratory there may be competing organisations/teams that would benefit from gaining access to your data
- maintaining the security of internet connections reduces the likelihood of hackers/competing teams/competing organisations gaining unauthorised access to IT systems
- privacy screen filters reduce the angles at which a digital screen is visible, making it more difficult for people to view screens without authorisation, which will keep data secure in a research facility/laboratory
- some IT systems can require additional security such as physically restricting who has access to specific areas of the workplace or providing people with different levels of

systems access depending on their job role. This allows for additional protective measures within the research laboratory and also allows changes to be made as the organisation develops and/or as people change job roles

- IT technologies are always changing and developing, including the approaches taken by malicious attacks, therefore maintaining up to date training and security approaches is important to keep abreast of developments and to try and prevent unauthorised access to systems by opposing teams/competing organisations.

AO3: Evaluation of the importance of the responsible use of IT systems and services, and how they may affect the activity of the company, which may include:

- responsible use of IT systems ensures the integrity and security of scientific data. By implementing proper data management protocols, encryption techniques, and access controls, researchers can safeguard research findings and sensitive information. This is important because it protects the credibility of scientific research, reduces the likelihood of data breaches or loss, and maintains the confidentiality of proprietary data
- responsible IT practices address ethical considerations and ensure compliance with legal and ethical guidelines. It includes obtaining informed consent, protecting research subjects' privacy, and handling sensitive data appropriately. This is important because it promotes transparency, accountability, and responsible conduct in scientific research. This in turn helps to develop trust amongst scientific researchers and the wider public
- these also help ensure compliance with data protection laws, such as the General Data Protection Regulation (GDPR). This is important because it helps safeguard the rights of individuals, prevents unauthorised access or misuse of data, and allows the organisation to avoid the legal consequences of not adhering to these such as prosecution or damage to their reputation.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

Section C: Health and safety in the science sector

This section is worth **25** marks, plus **3** marks for quality of written communication (QWC) and use of specialist terminology.

12	Which one of the following is the correct purpose of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)?
	A Controls the storage, transport, and disposal of hazardous waste (waste stream) to ensure it is appropriately managed and any risks are minimised
	B Defines employers' duties to report serious workplace accidents, occupational diseases and specified dangerous occurrences ('near misses')
	C Defines employers' responsibilities to provide appropriate personal protective equipment (PPE) to reduce harm to employees, visitors, and clients
	D To reduce death, damage and injury caused by fire by placing legal responsibilities on employers to carry out a fire risk assessment
	[1 mark]

AO1 = 1 mark

Answer

B. Defines employers' duties to report serious workplace accidents, occupational diseases and specified dangerous occurrences ('near misses')

13	The Health and Safety Executive publish a 5-step process for risk assessment.
(a)	Give steps 4 and 5 of the Health and Safety Executive's 5 steps to risk assessment.
	[2 marks]

AO1 = 2 marks

Award **one** mark for each correct step identified, up to a maximum of **two** marks:

- (step 4) recording findings and implementing them, including completing risk assessment documentation (1)
- (step 5) reviewing your assessment and updating if necessary (1).

Accept any other suitable responses.

13 A scientist working in a commercial microbiology laboratory has begun to assess the risks associated with following aseptic technique. Part of the risk assessment is shown in Figure 2. The risk matrix (Figure 3) is also shown on page 22, for reference.

(b) Complete the risk assessment using the table in Figure 2.

[4 marks]

Figure 2: Risk assessment

Person carrying out risk assessment:	J Mitchell Junior scientist	Those at risk			Key			
Venue:	Microbiology lab	Own staff	VENUE staff	ORGANISERS	OWN	VEN	ORG	
Work activity:	Aseptic technique	Visitors	PUBLIC	CONTRACTORS	VIS	PUB	CON	
		All persons on site			AOS			
Hazard	Who might be harmed?	Likelihood	Severity	Total risk	Control measures	Likelihood	Severity	Total risk
Skin irritation caused by use of sterilisation fluids.	OWN	4	1	4	Use most dilute solutions available. PPE – disposable gloves to be worn	3	1	3
Burns caused by use of Bunsen burner to flame wire loop.	OWN	4	2	8				

Figure 3: Risk matrix

Likelihood							Action
Almost certain	5	5	10	15	20	25	20 - 25 STOP
Highly likely	4	4	8	12	16	20	12 - 16 URGENT
Likely	3	3	6	9	12	15	8 - 10 ACTION
Unlikely	2	2	4	6	8	10	4 - 6 MONITOR
Extremely improbable	1	1	2	3	4	5	1 - 3 NO ACTION
		1	2	3	4	5	
		Minimal	Minor injury	7 day + Injury	Serious injury	Severe / fatal injury	
		Severity					

AO2 = 4 marks

Award **one** mark for a suitable control measure, up to a maximum of **one** mark:

- ensure wire loop has wooden handle to reduce conduction of heat to hand (1)
- hold wire loop at a distance to avoid burns from flame (1)
- use of alternative equipment, for example, single-use, pre-sterilised loop (1)
- use of PPE such as heatproof gloves (1).

Award **one** mark for each calculation of residual risk, up to a maximum of **three** marks:

- likelihood: any number less than 4 (1)
- severity: 2 or less (1)
- residual risk: correctly calculated, between 0 and 6 (1).

- 14** A trainee school laboratory technician comes into the preparation room and discovers a broken bottle on a wooden bench. There is a liquid spilled on the bench, the benchtop is bubbling and a vapour is being emitted.
- The technician immediately gets paper towels and places them onto the spillage to soak up the liquid. They dispose of the paper towels in the general waste bin and return to their previous work.
- Assess the actions of the technician.

[6 marks]

AO3 = 6 marks

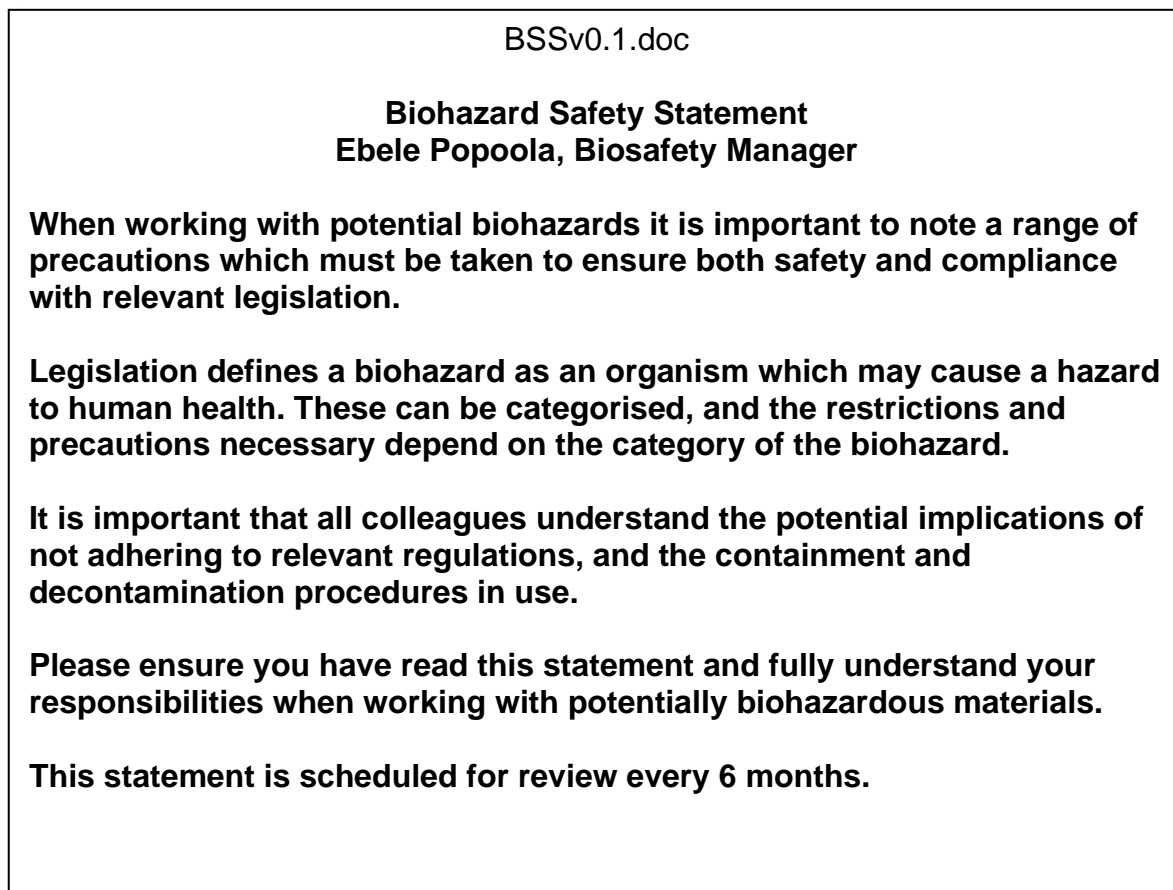
Award **one** mark for each analysis point, up to a maximum of **six** marks:

- The trainee should not have attempted to clean up the spillage with paper towels as the desk was bubbling and vapours were being emitted/it could have burned their skin (1). If they knew what the liquid was, they may have been able to consult the relevant policy to clean up safely, for example, dilute it with water (1). However, it may be more appropriate to seek help as they are a trainee (1).
- The trainee should have secured the area (1) to ensure school children/other staff do not get hurt (1). This also reduces the likelihood of litigation as a result of injuries (1).
- The trainee should not have attempted to clean up the spillage alone as they could have been injured (1). They should have reported the incident to a senior member of staff, in line with company policy (1) ensuring accurate records are kept (for example, for RIDDOR purposes) (1).
- The trainee should not have put the used paper towels into a general waste bin (1). This could cause a reaction with other waste products in the bin/injury to a cleaner that is not aware of the chemical in the general waste (1). The trainee should consult the relevant SOP/policy/senior member of staff in order to dispose of the used paper towels appropriately, in order to avoid further injury/issues (1).

Accept any other suitable response.

- 15** A biosafety manager is in charge of a food science laboratory that handles biohazardous material. They are writing a biohazard safety statement to outline the key features relating to health and safety when working with biohazards. The first draft has been circulated to colleagues for comments (Figure 4).

Figure 4: Biohazard Safety Statement



With reference to health and safety, evaluate the extent to which this statement covers the most important aspects of working in a biohazardous environment.

Your response should include reasoned judgements and conclusions.

[12 marks, plus 3 marks for QWC]

AO1 = 4 marks
AO2 = 4 marks
AO3 = 4 marks
QWC = 3 marks

Band	Mark	Descriptor
4	10–12	<p>AO3: Evaluation of the importance of adhering to health and safety regulations when working with biohazards, and how these may affect the activity of the company is comprehensive, effective, and relevant, showing detailed understanding, and logical and coherent chains of reasoning throughout. Makes informed conclusions that are fully supported with rational and balanced discussion.</p> <p>AO2: Applied all relevant knowledge of factors affecting the implementation of health and safety regulations in a company operating with biohazards and shows a detailed functional understanding. This is effectively linked to the science sector.</p> <p>AO1: A wide range of relevant knowledge and understanding of adhering to health and safety regulations when working with biohazards is demonstrated, which is accurate and detailed. A wide range of appropriate technical terms are used.</p>
3	7–9	<p>AO3: Evaluation of the importance of adhering to health and safety regulations when working with biohazards and how these may affect the activity of the company is in most parts effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Discussion is supported by reasoned judgements that consider most of the relevant arguments.</p> <p>AO2: Applied mostly relevant knowledge of factors affecting the implementation of health and safety regulations in a company operating with biohazards, and this is linked to the science industry.</p> <p>AO1: Knowledge and understanding of the importance of adhering to health and safety regulations when working with biohazards is in most parts clear and mostly accurate, although on occasion may lose focus.</p>
2	4–6	<p>AO3: Evaluation of the importance of adhering to health and safety regulations when working with biohazards and how they may affect the activity of the company is in some parts effective and of some relevance, with some understanding and reasoning taking the form of generic statements with some development. Judgements are basic and brief; the discussion will have limited rationality and balance.</p> <p>AO2: Applied little, but some knowledge of the factors affecting the implementation of health and safety regulations in a company operating with biohazards. Linking to the science industry might be weak.</p> <p>AO1: Knowledge and understanding of the importance of adhering to health and safety regulations when working with biohazards shows some but limited accuracy, focus and relevance.</p>

1	1–3	<p>AO3: Evaluation of the importance of adhering to health and safety regulations when working with biohazards, and how they may affect the activity of the company is minimal and very limited in effectiveness and relevance. Brief discussions are supported by judgements that consider only basic arguments and show little relevance to the question aims.</p> <p>AO2: Applied limited knowledge of the factors affecting the implementation of health and safety regulations in a company operating with biohazards. Shows a very limited functional understanding of how this links to the science industry.</p> <p>AO1: Knowledge and understanding of the importance of adhering to health and safety regulations when working with biohazards shows very minimal accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that the indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** will be implicit through the level of evaluation and reasoned judgements and/or conclusions that the student provides.

AO1: Demonstration of the understanding of the importance of health and safety best practice and regulation in the science industry, which may include:

- Control of Substances Hazardous to Health (COSHH) regulations defines a biohazard as a microorganism, cell culture or human endoparasite, whether or not genetically modified, which may cause infection, allergy, toxicity, or otherwise create a hazard to human health
- There are 4 hazard groups in relation to biohazards:
 - category 1: unlikely to cause human disease
 - category 2: can cause human disease and may be a hazard to employees, unlikely to spread to the wider population and there are usually effective vaccines or other treatments available
 - category 3: can cause human disease and may be a serious hazard to employees, it may spread to the wider population but there are usually effective vaccines or other treatments available
 - category 4: causes severe human disease and is a serious hazard to employees, it is likely to spread to the wider population and there are usually no effective vaccines or other treatments available.
- risks associated with not adhering to COSHH regulations when handling biohazards including risks to health, spread of disease, and risks to the environment
- containment measures to mitigate these risks including the use of appropriate PPE, the location of the laboratory and access control, and laboratory facilities such as HEPA filters, showers, and specific waste disposal facilities and processes

- decontamination techniques which could be useful when working with potential biohazards include sterilisation, disinfection, and incineration.

AO2: Application of the understanding of the importance of health and safety best practice and regulation in the science industry, which may include:

- the manager's statement refers to relevant legislation, however it does not specify which pieces of legislation might be relevant, such as COSHH
- it is important to know which pieces of legislation are relevant so that employees can understand the risks associated with not adhering to COSHH regulations
- the statement refers to restrictions and precautions based on the biohazard categories but does not state what the categories of biohazard are or which category of biohazard the employees will be using
- it is important to know which categories of biohazard are going to be in use so that appropriate containment and decontamination can be planned, such as the use of appropriate PPE.

AO3: Evaluation of the importance of health and safety best practice and regulation in the science industry, which may include:

- employees need to know which aspects of COSHH legislation they are required to work within because this will enable them to understand the measures they need to take to prevent exposure to biohazards and how to handle materials appropriately, which does not feature in the statement above
- directing the employees to the specific categories of biohazard they are working with/policies surrounding their use will benefit them as understanding and properly handling the 4 categories of biohazard is essential to producing appropriate risk assessments, which does not feature in the statement above
- employees' understanding of the dangers of working with biohazardous materials is important so that they understand that these can cause serious health problems, including infections and diseases if not handled properly, and the containment and decontamination measures required to mitigate these risks, which does not feature in the statement above.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

Section D: Scientific methodology, equipment and techniques

This section is worth **25** marks, plus **3** marks for the quality of written communication (QWC) and use of specialist terminology.

<p>16 Which one of the following states the purpose of a negative control when identifying faults in experimental techniques?</p> <p>A To confirm that no other variable is responsible for positive results in the test</p> <p>B To identify if there is a relationship between two variables in which one variable increases as the other decreases, and vice-versa</p> <p>C To minimise the effects of unwanted variables on the outcome of the test</p> <p>D To produce a known result which can be used to ensure that any negative results are true negatives and not a result of an issue with equipment or reagents</p>	<p>[1 mark]</p>
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AO1 = 1 mark

Answer

A. To confirm that no other variable is responsible for positive results in the test

<p>17 A new technician is working in a laboratory which uses a range of different chemicals in different experiments. The work they are initially asked to undertake includes handling phenol (a toxic and corrosive crystalline solid) and another experiment requiring them to handle compressed chlorine gas (a toxic oxidising agent which is also harmful to the environment).</p> <p>Explain how the technician should handle these chemicals.</p>	<p>[4 marks]</p>
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AO2 = 4 marks

Award **one** mark for each explanation point, up to a maximum of **four** marks:

- relevant safety sheets should be checked for each chemical (1) which will inform the technician what the hazards are and how the chemicals should be handled (1)
- phenol can be handled with gloves (1) to prevent contact with skin which would lead to cell damage due to corrosive nature and/or direct toxicity through absorption through skin (1)
- chlorine cylinders should be stored at the temperature specified by the manufacturer (1) to reduce the risk of the cylinder leaking or exploding if the temperature of the gas is too high (1)
- chlorine gas is toxic so containment needs to be managed, for example using a fume cupboard (1) to reduce the risk of harm due to inhalation and/or release into the environment (1).

Accept any other suitable response.

18 A metrology technician has been asked by a scientist working in their laboratory to investigate an analytical balance which has been showing inconsistent results. By comparing this to other balances, the scientist has determined that this one is faulty and asks the technician if they can help resolve this.

(i) Explain the potential causes of these faults. [2 marks]

(ii) Explain how the technician should isolate and solve the fault the scientist is experiencing. [2 marks]

AO2 = 4 marks

(i) Award **one** mark for each explanation point, up to a maximum of **two** marks:

- there could be an issue with the calibration of the balance, for example, it may not have been calibrated correctly (1). This would lead to the measurements given by the balance being too high or too low (1)
- there could be an electrical fault in the balance, perhaps as a result of poor maintenance (1). This could lead to the balance incorrectly measuring the mass, or displaying the incorrect numbers which correspond to the mass being measured (1).

(ii) Award **one** mark for each explanation point, up to a maximum of **two** marks:

- the technician should test the equipment to identify and define the problem, examining possible causes (1). This will enable them to understand what the fault is and plan what remedial action or changes are needed to be made (1)
- the changes required to remedy the issue should be made, and the situation should be monitored (1) to fix the issue and ensure the changes made are effective in the longer term and/or to prevent the problem from recurring (1).

Accept any other suitable response.

19 Whilst discussing the use of aseptic technique, a student makes the following statement:

‘Aseptic technique is essential when working with microorganisms because it protects the scientist from contamination with dangerous microorganisms.’

Discuss the accuracy of the student’s statement.

Your response should include reasoned judgements and a conclusion.

[4 marks]

AO3 = 4 marks

Award **one** mark for each discussion point, up to a maximum of **four** marks:

- aseptic technique is important to protect the samples being worked with from cross contamination with other microorganisms from the scientist and/or the external environment (1) and in addition, surfaces and equipment should be sterilised before use to remove further sources of contamination, which suggests the student's statement is accurate (1)
- some aseptic techniques are required to prevent the potentially hazardous microorganisms from escaping into the environment, such as the use of a downflow cupboard or working in a negative pressure room (1). However, aseptic technique includes decontamination techniques to ensure waste and other materials leaving the laboratory are sterilised (for example, by being autoclaved before disposal), which suggests the student's statement is accurate (1)
- aseptic technique alone will not protect the scientist from contamination (1). The scientist will need to ensure they are also adhering to the relevant SOPs and risk assessments, which suggests the student's statement is not fully accurate (1)
- the response is not fully accurate because aseptic technique is essential for other reasons than protecting the scientist (1) such as preventing other microorganisms from contaminating the sample (1).

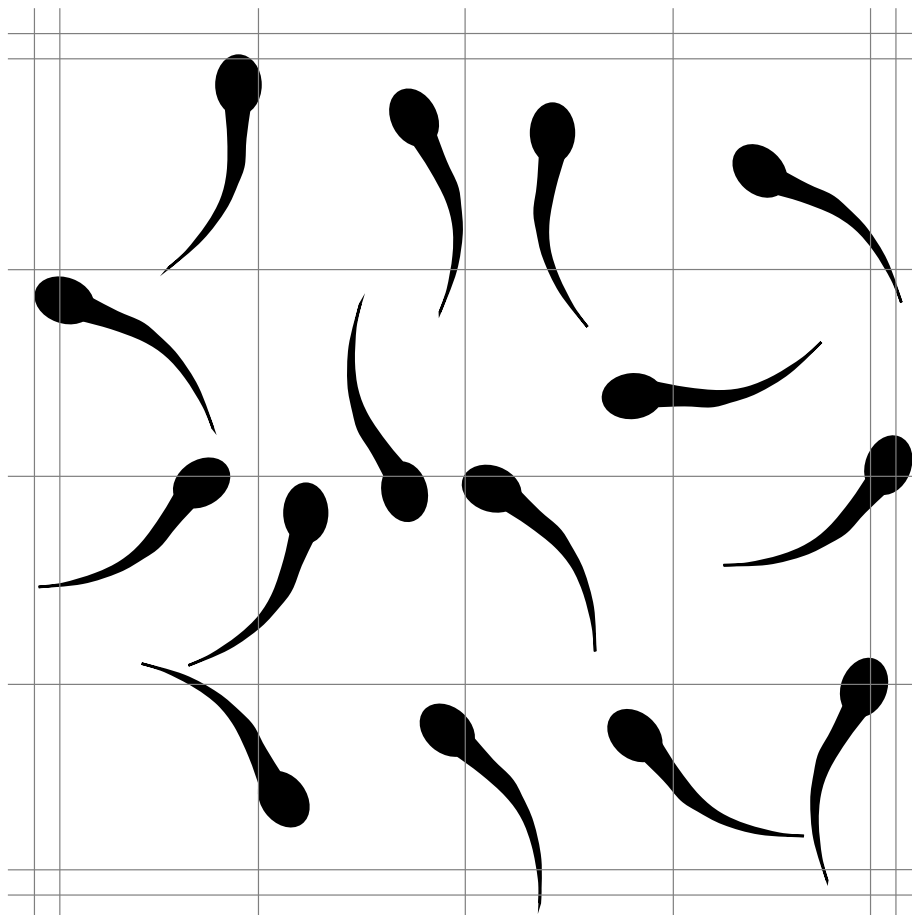
Accept any other suitable response.

20 In a scientific investigation a scientist is attempting to count sperm cells from patient samples using a light microscope. The standard operating procedure is shown below:

1. Dilute the sample by taking 0.01 ml and adding this to 99.99 ml of sterile saline solution.
2. Use a micropipette to transfer 10 μl of the diluted sample to haemocytometer chamber.
3. Place the haemocytometer onto the microscope stage and count the number of sperm cells visible.
4. Calculate the number of sperm cells per ml of the original sample.

The results obtained from the microscopy is shown below, in Figure 5:

Figure 5: view of sperm sample in haemocytometer under light microscopy.
Visible volume = 1 μl .



The scientist calculates the sperm count as shown below:

Number of sperm cells visible: 15
 Volume of haemocytometer: 1 μ l
 Cell count per ml of diluted sample: $(15 \div 1) \times 1000 = 15,000$ cells per ml
 Dilution of sample: 0.01%
 Cell count per ml of original sample = $15,000 \times 10,000 = \underline{150,000,000}$ cells per ml

Using your knowledge of experimental design and sampling techniques, evaluate the scientist’s methodology and analysis of results.

You do not need to include any additional knowledge relating to sperm or sperm counts.

Your response should include reasoned judgements and conclusions.

[12 marks, plus 3 marks for QWC]

AO1 = 4 marks

AO2 = 4 marks

AO3 = 4 marks

QWC = 3 marks

Band	Mark	Descriptor
4	10–12	<p>AO3: Evaluation of the scientific methodology and analytical techniques used by the scientist is comprehensive, effective, and relevant, showing detailed understanding, and logical and coherent chains of reasoning throughout. Makes informed conclusions that are fully supported with rational and balanced discussion.</p> <p>AO2: Applied all relevant knowledge of factors affecting scientific methodology and analytical techniques to the information given and shows a detailed functional understanding. This is effectively linked to the science sector.</p> <p>AO1: A wide range of relevant knowledge and understanding of scientific methodology and analytical techniques, which is accurate and detailed. A wide range of appropriate technical terms are used.</p>
3	7–9	<p>AO3: Evaluation of the scientific methodology and analytical techniques used by the scientist is in most parts effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Discussion is supported by reasoned judgements that consider most of the relevant arguments.</p> <p>AO2: Applied mostly relevant knowledge of factors affecting scientific methodology and analytical techniques to the information given, and this is linked to the science industry.</p>

		AO1: Knowledge and understanding of scientific methodology and analytical techniques is in most parts clear and mostly accurate , although on occasion may lose focus.
2	4–6	<p>AO3: Evaluation of the scientific methodology and analytical techniques used by the scientist is in some parts effective and of some relevance, with some understanding and reasoning taking the form of generic statements with some development. Judgements are basic and brief; the discussion will have limited rationality and balance.</p> <p>AO2: Applied little but some knowledge of factors affecting scientific methodology and analytical techniques to the information given. Linking to the science industry might be weak.</p> <p>AO1: Knowledge and understanding of the importance of scientific methodology and analytical techniques shows some but limited accuracy, focus and relevance.</p>
1	1–3	<p>AO3: Evaluation of the scientific methodology and analytical techniques used by the scientist is minimal and very limited in effectiveness and relevance. Brief discussions are supported by judgements that consider only basic arguments and show little relevance to the question aims.</p> <p>AO2: Applied limited knowledge of factors affecting scientific methodology and analytical techniques to the information given. Shows a very limited functional understanding of how this links to the science industry.</p> <p>AO1: Knowledge and understanding of the importance of scientific methodology and analytical techniques shows very minimal accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that the indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** will be implicit through the level of evaluation and reasoned judgements and/or conclusions that the student provides.

AO1: Demonstration of the understanding of scientific methodology and analytical technique, which may include:

- effective experimental design and planning by:
 - managing time efficiently
 - ensuring sufficient resources
 - ensuring safety throughout the experiment
 - addressing ethical considerations where appropriate
 - minimising errors

- the importance of a hypothesis and/or performance criteria in experimental design includes:
 - defining outcomes that can be tested
 - deciding on variables:
 - independent
 - dependent
 - controls
 - clarifying the experimental objective
- the principles that inform sampling techniques:
 - avoiding bias
 - ensuring a large enough sample size to produce valid results
 - practical constraints
- the need for reliable, verifiable, and accurate recording in order to ensure that:
 - data or information is repeatable
 - data or information is relevant to the experimental purpose
 - data or information truly reflects the results obtained
- how to evaluate a scientific methodology and make recommendations for improvement, including:
 - reflecting on experimental design
 - assessing the reliability of methods, and precision, accuracy, repeatability and reproducibility of results
 - identifying areas for improvement
 - making recommendations for future improvement
- The sample for haemocytometry should be prepared by dilution and then loaded into the haemocytometer chamber. Capillary action draws the sample into the chamber, which is a rectangular shape carefully calibrated to a known size/volume with etched markings on the surface.
- Using a light microscope, the slide is placed under the objective lens, and the grid on the haemocytometer is brought into focus. The cells within the grid are counted, and the number is used to calculate the concentration of cells in the original sample. To count the cells, it is best to count the cells in at least 4 of the smaller squares within the grid which increases the accuracy of the count. Some cells may be in line with the etched markings on the haemocytometer – for consistency, those in contact with the top or left edges should be counted and those on the bottom or right edges should be excluded.

AO2: Application of the understanding of scientific methodology and analytical technique, which may include:

- One important aspect of good experimental design is the completion of a risk assessment, which is particularly important when working with body fluids as they could cause infection if they enter the scientist's body such as via a cut.
- Good experimental design also includes a consideration of ethical matters, such as the storage and use of human gametes in scientific studies. This is important when undertaking sperm counts as the patient who has provided the sample needs to be fully informed about what the sample will be used for.
- A hypothesis or performance criteria are important in this analysis because it is important to define what the intended outcome of the analysis is and what the intended objectives are.

- A sufficiently large sample large sample has been taken. This provides a balance between the manageability of counting the total sperm count in 1 ml and having a representative sample which would give an accurate result.
- The counting and data recording techniques used in the analysis should be checked and tested to ensure that they are providing consistently accurate results and any necessary recommendations for improvement are made. This ensures that the lab is providing the best possible quality in their analyses allowing accurate diagnostic evaluation to be made by medical staff.

A03: Evaluation of scientific methodology and analytical technique, which may include:

- The method presented does not include any repeat readings, which means the results could include errors and/or anomalous results.
- The analysis seems to be being undertaken by one scientist, meaning there is no comparison or quality check. This means that the results could be inaccurate and any errors would not be detected quickly.
- The method does not specify which sperm cells should be counted. This means other scientists using the same method could interpret this differently and produce inconsistent results. This needs to be standardised in line with SOPs – by convention those in contact with the top or left edges should be counted and those on the bottom or right edges should be excluded.
- No information is provided about the magnification to be used on the microscope. Whilst this shouldn't impact the actual counts achieved, if magnification is not consistent some sperm cells may be invisible or unclear, which could make the count inaccurate.
- The dilution of the sample is undertaken in one single step. This involves measuring very small volumes, which can be difficult to complete with high levels of accuracy. Serial dilution would be preferable as the volumes involved are more manageable and therefore less likely to be affected by errors.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. Or The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

Assessment objective grid

Section A Working within the science sector

Question Number	AO1	AO2	AO3	QWC	Total
1	1				1
2	1				1
3	2				2
4 (a)		2			2
4 (b)			3		3
5		4			4
6	4	4	4	3	15
Total	8	10	7	3	28
Totals required	5-10 marks	8-14 marks	5-12 marks	X	28
Kil	x				

Section B

Ethics, data and managing personal information in the science sector

Question Number	AO1	AO2	AO3	QWC	Total
7	1				1
8	2				2
9 (a)		4			4
9 (b) (i)	1				1
9 (b) (ii)			3		3
10		2			2
11	4	4	4	3	15
Total	8	10	7	3	28
Totals required	5-10 marks	8-14 marks	5-12 marks	3	28
Kil	X				

Section C
Health and safety in the science sector

Question Number	AO1	AO2	AO3	QWC	Total
12	1				1
13 (a)	2				2
13 (b)		4			4
14			6		6
15	4	4	4	3	15
Total	7	8	10	3	28
Totals required	5-10 marks	8-14 marks	5-12 marks	3	28
Kil	X				

Section D
Scientific methodology, equipment and techniques

Question Number	AO1	AO2	AO3	QWC	Total
16	1				1
17		4			4
18 (i)		2			2
18 (ii)		2			2
19			4		4
20	4	4	4	3	15
Total	5	12	8	3	28
Totals required	5-10 marks	8-14 marks	5-12 marks	3	28
Kil	X				

Document information

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