T-LEVELS | Institute for Apprenticeships & Technical Education

To be completed by the examiner			
Question	Mark	Question	Mark
1		14 (a)	
2		14 (b)	
3		15	
4 (a)		16	
4 (b)		17	
5		18	
6		19	
7		20 (a)	
8		20 (b)	
9		21	
10		22	
11 (a)		23	
11 (b)			
12			
13		TOTAL MARK	

T Level Technical Qualification in Science (603/6989/9)

Core knowledge and understanding

Paper A

Specimen Assessment Materials (SAMs)

Specimen: 2022 **Morning/Afternoon**

Time allowed: 2 hours 30 minutes

Student instructions

- Use black or blue ink.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- Read each question carefully.
- You **must** write your responses in the spaces provided. There may be more space than you need.
- You may do rough work in this answer book. Cross through any work you do not wish to be marked.

Student information

- The marks available for each question are shown in brackets. This is to help you decide how long to spend on each question.
- The maximum mark for this paper is **112**.
- In questions **5, 12, 17 and 23**, you will be assessed on your quality of written communication (QWC) and use of specialist terminology. Specifically, your ability to:
  - use good English
  - express and organise ideas clearly and logically
  - use appropriate technical terms.
- You may use a calculator.

Please complete the details below clearly and in BLOCK CAPITALS.

Student name _____

Provider name _____

Student number | | Provider number | |

Do not turn over until the invigilator tells you to do so.

NCFE CACHE

BARCODE - TQ/SCI/CKU/PAPERA

For the multiple-choice questions, write **A, B, C** or **D** in the answer space. Do **not** circle **A, B, C** or **D** in the question.

For example:
Answer **C**

If you change your mind about an answer, you must put a cross through your original answer and then write your new answer next to it.

For example:
Answer ~~**C**~~ **B**

Section A: Working within the science sector

This section is worth 25 marks, plus 3 marks for QWC and use of specialist terminology.
Answer **all** questions in the spaces provided.

1 When applying for a job to become a metrologist, an apprentice is sent a job description to help them decide whether the role is suitable for them.

Which **one** of the following would be included in a job description?

[1 mark]

A The benefits available for the role

B The responsibilities that would go with the role

C The salary for the role

D Who to send your application to when it is completed

Answer _____

2 A former apprentice in a food manufacturing company is now qualified, but they are ambitious and looking for future promotion and opportunities for a job with more responsibilities.

Give **one** action they could take to improve their chances of progression in their current sector.

[1 mark]

3 A laboratory science student has done work experience in a testing lab, analysing samples and using statistics to calculate the significance of results.

They then took part in client presentations to feed back the results and pitch for further work. After completing their training, they decide they would not like to work in a laboratory.

They state, 'All the jobs in science need me to work in a lab, so I will need to change career direction.'

Explain **two** ways the student could still use the skills they have gained in their work experience outside the science sector.

[4 marks]

4 For their whole first month in the job, a new biomedical scientist in a hospital lab has been analysing skin swabs from wounds and ulcers for bacterial contamination. The workload is very large and they are stressed by what they are being asked to do, finding it difficult to keep on top of everything.

To reduce the amount of time taken to do each test, the scientist has stopped cleaning the bench thoroughly in between tests.

4 (a) Explain **two** possible consequences of their actions. [4 marks]

4 (b) For one of your chosen consequences, explain how this might affect patients in the longer term. [3 marks]

[7 marks]

5 A trainer in a company that stores and manages radioactive waste is trying to produce a training session that covers the importance of standard operating procedures (SOPs) for all its employees – including cleaners, truck drivers and radioactive monitoring technicians.

Evaluate the importance of staff training and of using SOPs in this workplace.

Your response should demonstrate reasoned judgements and conclusions.

[12 marks, plus 3 marks for QWC]

Examiner use only

This is the end of section A.

DO NOT WRITE IN THIS SPACE

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

This section is worth 25 marks, plus 3 marks for QWC and use of specialist terminology.
Answer **all** questions in the spaces provided.

6 Which of the following is a method for ensuring the results of an experiment are a true reflection of the actual effect being examined in a scientific setting?

Select **one** from the list below:

[1 mark]

A Standard deviation

B Tabulate raw data

C Using controlled variables

D Using Spearman's rank

Answer _____

7 A cosmetic formulation scientist works in the lab at the head office of a company, but also does most of the data inputting and report writing from an office behind the busy reception of the building. The office has two glass walls and two shiny, white reflective walls to give a clinical feel to make the brand seem 'scientific' to customers.

The department are conducting a review after a leak of the data from a recent formulation of an eye cream resulted in their cream being copied by another brand.

Explain **one** way the head of department can ensure information the scientist is working on cannot be accessed by unauthorised personnel.

[2 marks]

_____

_____

_____

_____

8 The number of rare newts feeding at two different sites were counted to see if there was a difference between a protected area (site A) and an open site (site B) over a period of time. The results are shown in **Figure 1**.

Number of newts at site A	12	8	22	13	15	16	10	8	16	17
Number of newts at site B	12	25	28	27	15	22	19	21	23	18

Figure 1: Results of the newt count

Suggest which statistical test you would use to determine if there was a significant difference between the numbers of newts feeding at the two sites.

Explain your choice.

[2 marks]

9 Whilst writing an article for a science journal on integrity in the science industry, a science journalist starts by explaining that it is important for employees to follow organisational codes of practice in the workplace.

Outline **two** other ways an employee can show integrity in the science industry.

[2 marks]

10 An environmental scientist is monitoring the health of a pond in the grounds of a stately home. The site is having landscaping work carried out and the scientist has been instructed to share their data with the landscaping team. The readings were taken weekly across the month of March and are shown in **Figure 2**.

Variable	Week 1	Week 2	Week 3	Week 4
Temperature (°C)	1.0	1.3	2.8	2.0
Pond species observed in sample	Pond skater (2) Water boatmen (3) Tench (6)	Diving beetle (1) Pond skater (2) Tench (2)	Water midge (4) Pond skater (5) Water flea (2) Tench (2) Carp (1)	Water boatmen (1) Water flea (5) Pond skater (2) Tench (4)

Figure 2: Results of the environmental survey

The scientist is considering the following options for sharing the data with the landscaping team:

- bar chart
- box and whisker plot
- line graph.

Using **Figure 2**, discuss the most appropriate option for displaying **each** variable.

[4 marks]

11 A firm doing calibration and testing of measurement equipment for the building industry has just appointed a new managing director. They have a meeting with all employees on their first day and say that they are not going to be too nice because 'mean bosses get better results'.

The union representative has issues with this as they feel it shows a lack of respect in the workplace and they are worried about the effect on staff in the firm.

11 (a) Give **two** reasons why respect is important in the workplace.

[2 marks]

11 (b) Discuss the possible consequences of lack of respect in the workplace to this business.

[3 marks]

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12 In a quality control laboratory for a clothes dye manufacturer, all data from a team of two part-time technicians is currently recorded in lab notebooks. The notebooks are then kept in a storeroom after 1 year. The two members of staff work different days of the week and so need to be able to easily share their data between them.

The manager is currently looking at whether to switch to an electronic laboratory information management system (LIMS) and has made the following recommendations to the company leadership team:

'I think we should continue using lab notebooks as we can more easily share data and notebooks are not able to be wiped. Plus, they are much cheaper.'

Evaluate the manager's recommendations, considering the advantages and disadvantages of electronic and paper-based systems.

Your response should demonstrate reasoned judgements and conclusions.

[9 marks, plus 3 marks for QWC]

This is the end of section B.

Section C: Health and safety in the science sector

This section is worth 25 marks, plus 3 marks for QWC and use of specialist terminology.
Answer **all** questions in the spaces provided.

13 A chemical company has a set of material safety data sheets for all the chemicals it uses.

Identify the purpose of material safety data sheets:

[1 mark]

A To allow chemicals to be ordered and restocked in time for their next use

B To allow risk assessments to be done in line with Control of Substances Hazardous to Health Regulations 2002 (COSHH)

C To comply with regulations around moving and handling

D To make sure disposal records are kept for a number of years

Answer _____

14 A case study from the health and safety executive detailed a workplace accident.

Prior to the accident, a worker was using highly flammable cellulose thinners in an open-topped container to wash paint-spraying equipment.

14 (a) Give **two** items of personal protective equipment (PPE) you could wear when using flammable substances.

[2 marks]

14 (b) In the incident being examined by the health and safety executive, while working with the flammable substance the employee knocked the container over, splashing the thinners over their trouser leg and canvas shoe.

They then went into a nearby room to clean themselves, but the room happened to contain drying ovens. These ignited the flammable vapours coming from the thinners, which set their trouser leg and shoe on fire, causing serious burns to their leg and foot.

Suggest **three** actions the employer must take in response to the accident with regards to the Dangerous Substances and Explosive Atmospheres Regulations 2002.

[3 marks]

Please turn over for the next question.

Examiner use only

15 A containment level 2 laboratory handles a hazard category 2 biohazard and their procedures for the storage and use of the biohazard they handle include:

- 1 hour training course at start of employment
- biological agents must be stored securely in a biosafety cabinet
- only authorised personnel have keys to access the storage unit
- a chart is signed when the biological agents are used, or the cabinet accessed.

Evaluate these measures to determine their effectiveness in ensuring the biohazards are safely stored and accounted for at all times.

Your response should demonstrate reasoned judgements and conclusions.

[3 marks]

Please turn over for the next question.

DO NOT WRITE IN THIS SPACE

16 A toxic chemical spill from a plastics factory was discovered when the local environment agency did a random ground water check in a neighbouring area. The spill is the company's first offence; it was an accident and no one was seriously harmed, so their chief executive thinks they will only receive a fine.

Discuss the other possible consequences of breaching environmental legislation.

Your response should demonstrate reasoned judgements and a conclusion determining the most probable outcome for the company.

[7 marks]

17 A jewellery design company has ordered some nitric acid to use for etching patterns onto metal necklaces and earrings. They estimate using 100 cm^3 of the acid a day and currently employ five designers.

Moderately concentrated nitric acid is corrosive and can cause severe skin burns and eye damage.

Using your knowledge of the Health and Safety Executive's 5 Steps to Risk Assessment, discuss the elements the company will need to consider when carrying out their risk assessment for this chemical and the importance of adhering to the 5 steps in a workplace.

Your response should demonstrate reasoned judgements and / or conclusions.

[9 marks, plus 3 marks for QWC]

This is the end of section C.

Section D: Scientific methodology, equipment and techniques

This section is worth 25 marks, plus 3 marks for QWC and use of specialist terminology.
Answer **all** questions in the spaces provided.

18 An electrician is called in to carry out a portable appliance test (PAT) on the electrical items in a laboratory for safety. As part of the test, they check the insulation around the live parts of a hot plate to make sure its resistance is high enough to stop the user being electrocuted.

Choose the piece of equipment they would be most likely to use:

[1 mark]

A An analytical balance

B A multimeter

C A pH meter

D A thermometer

Answer _____

19 A student is measuring 15 cm^3 of sodium hydroxide solution in order to further dilute it.

Identify **one** piece of suitable equipment they could use to measure this volume of liquid.

[1 mark]

20 The chief executive officer (CEO) of an international scientific company is considering whether to apply for accreditation of the International Organization for Standardization (ISO) standards in scientific settings for their brand-new testing laboratory in the UK.

The CEO states, 'We won't be able to do any testing for other countries if we do not have accreditation.'

20 (a) Explain **one** other benefit to the new laboratory business in gaining the accreditation.

[2 marks]

20 (b) Evaluate the CEO's statement.

Your response should demonstrate reasoned judgements and / or conclusions about the validity of the CEO's statement.

[3 marks]

21 A school has ordered a cylinder of hydrogen to use in a series of new experiments. The school science technician needs to find an appropriate area to store the cylinder. They are considering putting it in a locked outside store that is currently empty or in a locked cupboard adjoining a classroom in the school building.

Using your knowledge of compressed gases, discuss factors that need to be taken into consideration when making this decision.

Your response should demonstrate reasoned judgements and a conclusion about the best storage facility to use.

[4 marks]

22 A food scientist has set up a pilot plant to start producing a new flavour of sauce. Part of the checks on the sauce are to make sure there is low bacterial contamination in the jars of sauce after 6 months. They have decided to test some samples of sauce on nutrient agar plates using aseptic techniques, after first thoroughly preparing the room and surfaces, plus washing hands and wearing personal protective equipment (PPE).

They have detailed the following steps in handling the equipment:

- flame a wire loop in a Bunsen flame
- take off the lid of the sauce and place top down
- dip the loop into the sauce
- spread thinly on the agar plate.

The lead food scientist has said: 'These measures will not be enough to provide accurate results due to the limited measures taken to reduce contamination. There are other procedures that would help to reduce the possibility of contamination further.'

To what extent is their statement justified about the steps taken to reduce the chances of contamination affecting the results?

Your response should demonstrate reasoned judgements and conclusions about the effectiveness of the measures and any suggested improvements.

[5 marks]

23 A scientific laboratory (with three full-time laboratory technicians) is asked to test 5,000 patient urine samples for traces of protein for a research study. They will use a small quantity of biuret reagent (irritant to skin and eyes) for each test and have 8 weeks to complete the study.

	Volume of reagent needed per sample (cm^3)	**Number of samples that can be processed each day**	**Patient information**	**Equipment required**
For each laboratory technician	5	100	Patient number (details not recorded)	5 cm^3 digital pipette and disposable tips Sample vial
Laboratory manager checks	5	10	Patient number (details not recorded)	5 cm^3 digital pipette and disposable tips Sample vial

Figure 3: Shows the staff, their capacity and the required equipment and reagents

Using the information in **Figure 3** and your knowledge of experimental design and planning, discuss the steps the laboratory manager must take in planning the work and the need to follow each step.

[9 marks, plus 3 marks for QWC]

This is the end of Paper A.

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Document information

Owner: Head of Assessment Design

Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Additional specimen assessment materials		November 2022
v1.1	Sample added as a watermark	November 2023	21 November 2023