

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

Core knowledge and understanding

Paper A Elements: 1–10

Paper number: Sample

Specimen 2021

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 **2**, **6**, **9** and **13**, 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.
- In question **1(d)**, you will be assessed on your application of mathematics.
- You may use a calculator.

Please complete the details below clearly and in BLOCK CAPITALS.

Student name _____

Provider name _____

Student number

Provider number

To be completed by the examiner			
Question	Mark	Question	Mark
1 (a)		7	
1 (b)		8 (a)	
1 (c)		8 (b)	
1 (d)		8 (c)	
1 (e)		8 (d)	
2		9	
3		10	
4 (a)		11(a)	
4 (b)i		11(b)	
4 (b)ii		11(c)	
5 (a)		11 (d)	
5 (b)		12	
6		13	
			TOTAL MARK

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

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 ~~B~~ **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 (a) In a company's storage facility, heavy items should be stored:

[1 mark]

- A** On a reinforced area of the floor near to the entrance.
- B** On shelves which are strong enough for the weight and at elbow height.
- C** On shelves which are strong enough for the weight and at any level.
- D** On shelves which are strong enough for the weight at the back of the shelves.

Answer _____

1 (b) A section of a job advert states that each applicant must be:

- qualified to level 3 or higher in at least one science subject
- innovative and confident with excellent communication skills.

Explain whether the information provided is a person specification or a job description.

[2 marks]

1 (c)

A school science department purchases a container of a protease enzyme.

It is stored in its original container on a shelf in the science department prep room.

The shelf is directly opposite a south facing window.

The prep room is used for preparing all materials for class practical experiments, and cleaning and sterilisation of equipment.

Name **two** properties of enzymes and for **each** explain why the conditions described may not be suitable.

[4 marks]

1(d)

A buyer for a company has the chance to purchase a bulk order of a raw material every 20 weeks, at a reduced price.

Using the information in the table below, calculate the cost of the raw material and storage over a 20 week period at both the **bulk order price** and the **normal price**.

Show your working.

Normal unit price	Normal order size. 4 weekly	Average usage rate per week	Bulk order unit price	Bulk order size 20 weekly	Lifespan of product.	Storage cost per unit for 4 weeks	Storage cost per unit for 20 weeks
£5.75	1,000	250	£5.25	5,000	20 weeks	£0.50	£0.60

[4 marks]

1 (e)

Below is a new company's approach to implementing SOPs:

- human resources write all SOPs
- the SOPs are placed on the company intranet and website
- highly visible posters are also placed at the sites where the procedures will be carried out.

Assess what may be missing from the company's approach to implementing SOPs.

Your response should demonstrate:

- reasoned judgements about what may be missing from the company's approach.

[5 marks]

2

A consultant is responsible for the medical care of a 13 year-old child with learning difficulties who has received a severe leg injury.

The consultant wants to give an immediate blood transfusion and amputate the leg to prevent further suffering.

If untreated, the injury will leave the leg paralysed, cause continuous pain throughout life and cause secondary damage to other areas of the body.

Only one parent is at the hospital with the child and their religious beliefs prevent them from consenting to the procedures.

Evaluate the consultant’s proposed actions, considering the key principles below:

- autonomy and informed consent
- beneficence
- nonmaleficence.

Your response should demonstrate:

- reasoned judgements about the consultant’s proposed response.

[9 marks, plus 3 marks for QWC]

This is the end of section A.

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.

3 Which of these market research mechanisms would produce qualitative data?

[1 mark]

- A** Asking consumers how many disinfectant products they bought per month.
- B** Asking consumers to rate a range of disinfectant products by giving each one a score from 1–10.
- C** Asking consumers why they preferred one disinfectant product more than another.
- D** Asking consumers how much they spent on disinfectant products per month.

Answer _____

4 (a)

Company A produces a disinfectant spray called ‘Germsnomore’ and has not registered the trademark.

After 5 years company B starts to produce a disinfectant called ‘Germnomor’ marketed in very similar packaging.

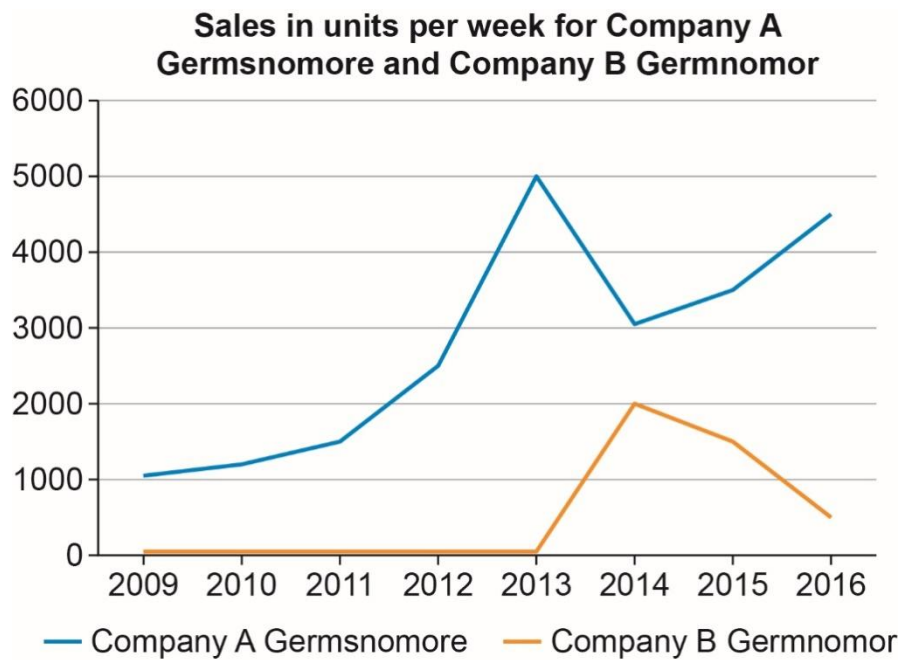
The graph shows the sales of each disinfectant as units sold per week over 8 years.

Give **one** possible reason for the change in sales of Company A:

i) between 2013 and 2014

and

ii) between 2014 and 2016



[2 marks]

4 (b)i

How can the company protect a new antibiotic to prevent other companies from producing it?

[1 mark]

4 (b)ii

On average it is a 5 year process to bring a new antibiotic to market.

Describe **two** aspects of this process which could be considered to be intellectual property.

[2 marks]

5 (a)

Researchers planted five wheat plants with a companion bean plant and five wheat plants without, to see if companion planting increased yield.

The seeds from the five plants in each condition were collected, dried and weighed.

The weights of these seeds are shown in the table below.

	Weight of seeds in grams					Mean
A. With companion plant	52	12	3	31	2	20
B. Without companion plant	17	23	19	17	24	20

Researchers concluded that companion planting does not increase yield.

Evaluate the researcher’s conclusions.

Your response should demonstrate:

- reasoned judgements and/or conclusions.

[6 marks]

5 (b)

Two companies carry out clinical trials of a hay fever drug.

In both, the participants were either given the drug or a placebo.

Company A had 1000 participants, neither the researchers nor the participants are aware of who was receiving the drug or the placebo. The participants were screened for other drugs in their system, which could affect the trial.

Company B had 100 participants, and the researchers knew who had received the drug or placebo, the participants did not. The participants were not screened.

Explain which of the two trials is more likely to lead to reliable conclusions about the effects of the drugs.

[4 marks]

6

A director of a petrochemical company states that, “Companies gain more from the positive effects of social media than they lose from the negative effects.”

Evaluate this statement.

Your response should demonstrate:

- consideration of the impact of social media
- reasoned judgements and/or conclusions about the statement.

[9 marks, plus 3 marks for QWC]

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.

7 Below is a selection of work regulations:

- w.** Personal Protective Equipment (Enforcement) Regulations 2018
- x.** Control of Substances Hazardous to Health (COSHH) Regulations 2002
- y.** The Special Waste Regulations 1996
- z.** Health and Safety at Work etc Act 1974

A company needs a procedure to manage waste products that it regards as special waste.

Which of the regulations listed would the company need to consider?

[1 mark]

- A** z only
- B** w, x, y and z
- C** y only
- D** w and z only

Answer _____

8 (a) Bacteriophages are viruses that infect bacteria. They have adapted to only infect bacterial cell walls and cannot attach to any other type of cell. They attach to the cell wall, inject their DNA, the virus reproduces and the cell dies.

Based on this information, explain whether bacteriophages should be regarded as a biohazard.

[2 marks]

8 (b) Pathogen X caused an epidemic in 2003, resulting in around 8000 cases with 774 deaths.

The epidemic was brought under control using containment measures.

Pathogen X is regarded as a biohazard level 3.

In 2004, there was another smaller outbreak linked to a medical research facility.

Pathogen Y caused an epidemic in 2020 with 13 000 000 cases and 600 000 deaths.

Explain why Pathogen Y is also designated a biohazard level 3.

[2 marks]

8 (c)

A research laboratory is working to produce a vaccine to protect against a virus. Cultures of the virus are stored in the laboratory.

Below are two possible containment measures the laboratory could use:

- the laboratory could be kept at an air pressure negative to atmosphere
- the laboratory must contain all of its own equipment needed for the research.

Evaluate these measures to determine their effectiveness in virus containment.

Your response should demonstrate:

- reasoned judgements and/or conclusions about the effectiveness of the measures.

[6 marks]

8 (d)

Five strategies for promoting health and safety at work are shown below:

- encouraging individuals to take reasonable care of their own and others' safety
- following organisational policies and standard operating procedures (SOPs), including site-specific emergency procedures
- completing statutory training
- ensuring working environments are clean, tidy and hazard-free
- modelling good practice (for example, washing hands and wearing appropriate PPE).

Evaluate the effectiveness of **each** strategy for keeping staff healthy and safe in the workplace.

Your response should demonstrate:

- reasoned judgements and/or conclusions about the effectiveness of each strategy.

[5 marks]

9

A chemical spill has taken place. A 50 litre container of a liquid was kept in a laboratory storeroom at the back of a busy laboratory. Someone knocked over the container and the lid was damaged. Approximately 15 litres of the liquid spilled and some entered a drain.

A science technician described how they would clean up a chemical spill. Below is a list of bullet points which summarises the science technician's description:

- put on PPE
- lift the container and replace the lid
- place a spill sock around the spillage
- spread absorbent pellets and spread all over the spillage
- transfer the pellets from the spill into a suitable bag
- clean the area with spill pads
- transfer the used spill socks and pads into the same bag
- seal securely and label as hazardous
- place the bag in the designated waste management area
- inform supervisor.

Evaluate the techniques stated by the science technician, in relation to the regulations below.

- Control of Substances Hazardous to Health (COSHH) 2002
- Hazardous Waste (England and Wales) 2005.

Your response should demonstrate:

- reasoned judgements and/or conclusions about the techniques.

[9 marks, plus 3 marks for QWC]

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.

10 A technician uses light microscopy to examine material.

They place the material on a microscope slide. They then stain the material to make the image clearer and to highlight particular features.

What is the name of this method?

[1 mark]

- A** Differential staining
- B** Gram staining
- C** Simple staining
- D** Mordant staining

Answer _____

11 (a) A medical technician is using a haemocytometer slide to carry out a blood cell count.

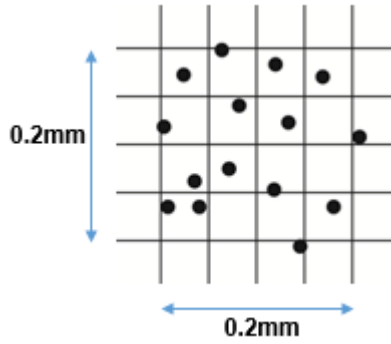
What assumptions must the technician make about the distribution of cells in the counting area before the count takes place?

[2 marks]

11 (b)

The diagram below shows a haemocytometer slide and the distribution of red blood cells.

How many red blood cells would be included in the count? Explain your answer.



[2 marks]

11 (c) The blood sample being counted has come from a patient with the disease hepatitis C.

Using your knowledge of aseptic technique, identify **two** actions the technician could take to protect herself in this situation and explain why these actions would be effective.

[4 marks]

11 (d) **Cryogenic equipment** and **glove boxes** are two pieces of equipment, commonly used in laboratories.

Describe their use when undertaking scientific techniques.

[2 marks]

12

Two examples of scientific literature sources are:

Source 1

A scientific paper published in 'Nature', an established and respected scientific journal.

Source 2

A scientific article published in a national newspaper, written by a respected university professor.

A teacher working with their class states that the first source is much more reliable than the second, and that the second has no value.

Evaluate the teacher's statement.

Your response should demonstrate:

- reasoned judgements and/or conclusions about the validity of the teacher's statement.

[5 marks]

13

Tributyltin (TBT) is used on the hulls of ships. It is toxic to most marine life.

A biology student investigated the effects of different concentrations of TBT on the reproductive rate of dog whelks.

Dog whelks inhabit rocky seashores and feed on mussels, barnacles and limpets.

The research method is described below:

Five 50 litre glass aquariums containing sea water with different concentrations of TBT were set up next to a large window as shown in the table below:

	1	2	3	4	5
Concentration of TBT ngL^{-1}	0	3	6	9	12

10 male and 10 female whelks collected from a shore close to a busy port, were placed in each aquarium.

Each aquarium contained the same number of live mussels.

The water is collected from the same shore and is constantly filtered, aerated and maintained at 10°C .

The aquariums were inspected daily, and any hatchlings removed and counted.

The investigation ran from January 1st to December 31st in one year.

Evaluate the student's methodology to determine if this approach would produce reliable results.

Your response should demonstrate:

- reasoned judgements about the outlined methodology and/or conclusions about the effectiveness and reliability of this methodology.

[9 marks, plus 3 marks QWC]

This page is intentionally left blank.

This page is intentionally left blank.

Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.

Copyright in this document belongs to, and is used under licence from, the Institute for Apprenticeships and Technical Education, © 2020-2021.

'T-LEVELS' is a registered trade mark of the Department for Education.

'T Level' is a registered trade mark of the Institute for Apprenticeships and Technical Education.

'Institute for Apprenticeships & Technical Education' and logo are registered trade marks of the Institute for Apprenticeships and Technical Education.

Owner: Head of Assessment Design

Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Published.		2020
v1.1	NCFE rebrand.		September 2021