

**T Level Technical Qualification in Health  
(603/7066/X)**

Paper B Elements 12–13

Paper number: **P001982**  
Assessment date: **Thursday 22 June 2023**Time allowed: **2 hours 30 minutes**  
Time: **1:00pm – 3:30pm****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 118.
- In questions **7, 8, 13, 19, 20** and **21**, you will be assessed on the quality of your written communication (QWC), specifically, your ability to:
  - use good English
  - express and organise ideas clearly and logically
  - use appropriate technical terms.
- You may use a calculator.

**Do not turn over until the invigilator tells you to do so.****Please complete / check your details below**

Student Name:

Provider Name:

Student Number:

Provider Number:



01P00198236



P001982

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   ~~**A**~~ **B**  

### Section A: Biology

This section is worth 42 marks, plus 6 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

- 1 Which **one** of the following is the gland responsible for the production of glucagon?

[1 mark]

- A Adrenal
- B Pancreas
- C Parathyroid
- D Thyroid

Answer \_\_\_\_\_



**2(a)** A researcher wishes to study the detailed structure of mitochondria.

Using your knowledge of the properties of transmission electron microscopes, explain **one** reason why a transmission electron microscope is likely to be more useful than a scanning electron microscope in this scenario.

**[2 marks]**

---

---

---

---

**2(b)** A technician working in a fertility clinic needs to examine how mobile individual sperm cells are in a semen sample.

Using your knowledge of the properties of light microscopes, explain **one** reason why a light microscope would be most suitable for this examination.

**[2 marks]**

---

---

---

---



**3** A patient is admitted to hospital following a car accident, with the following symptoms:

- severe bruising and swelling of the abdomen
- initial blood pressure of 88/56 mmHg which is continuing to fall steadily
- no external bleeding
- tests showing that liver and kidney function are declining rapidly.

State whether this would be classed as an injury only or whether it would be considered a trauma and justify your choice.

**[4 marks]**

---

---

---

---

---

---

---

---

---

---

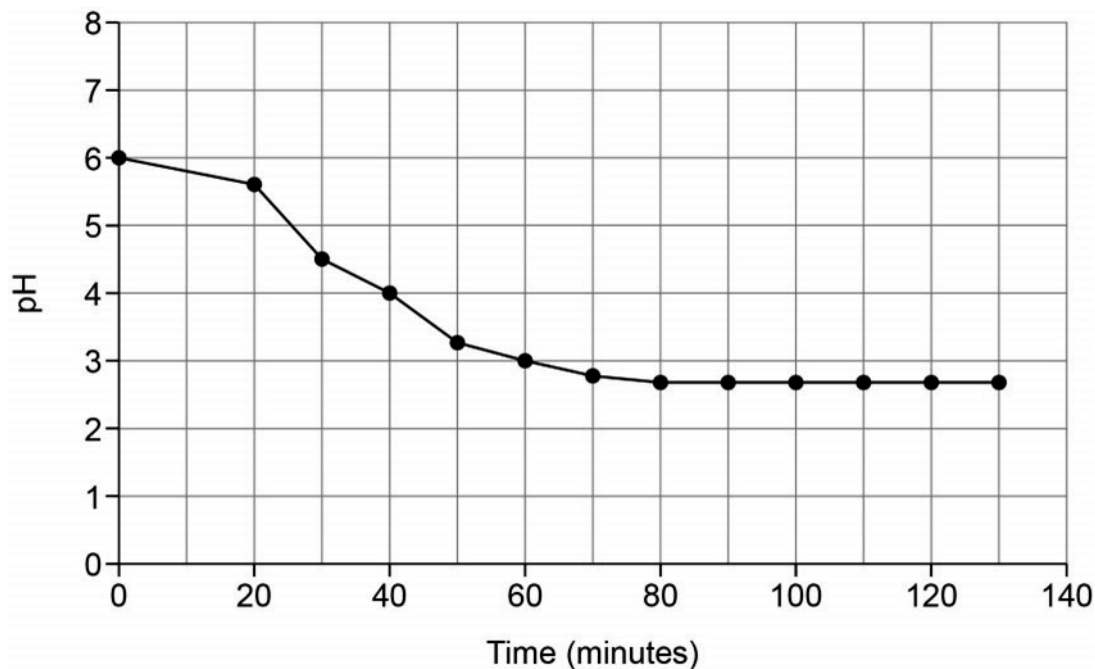


4(a) A student investigated the digestion of lipids in milk by the enzyme lipase, using the following procedure:

- 100ml of sterilised whole milk was maintained at 30°C in a water bath
- 5ml of lipase solution was added to the milk
- the pH of the mixture was measured every ten (10) minutes.

The results are shown in **Figure 1**.

**Figure 1:** a graph to show pH change over time



State the effect of lipase on lipids and explain why the student chose to measure pH changes to investigate lipid digestion.

[3 marks]

---

---

---

---

---

---

---



**4(b)** Give the time period where the rate of lipid digestion was highest. **[1 mark]**

---

---

**4(c)** Explain why sterilised whole milk was used rather than fresh whole milk. **[2 marks]**

---

---

---

---

**5** An athlete had been exercising vigorously. At the end of their exercise, their pulse rate was 180bpm. After resting for 20 seconds, their pulse rate had fallen by 18 to 162bpm.

Calculate the percentage reduction in heart rate over the 20 seconds.

Show your working.

**[2 marks]**

---

---

---

---



6 The human testes are outside the body cavity, the average temperature of the human testes is around 34°C.

‘The ovaries need to be maintained at body temperature in order to function efficiently, whereas the testes need to be at a slightly lower temperature.’

Using the information provided, discuss the validity of this statement.

[4 marks]

---

---

---

---

---

---

---

---

---

---



7 Patient A and Patient B are both significantly overweight and have high blood pressure. Neither patient appears to have any other health issues.

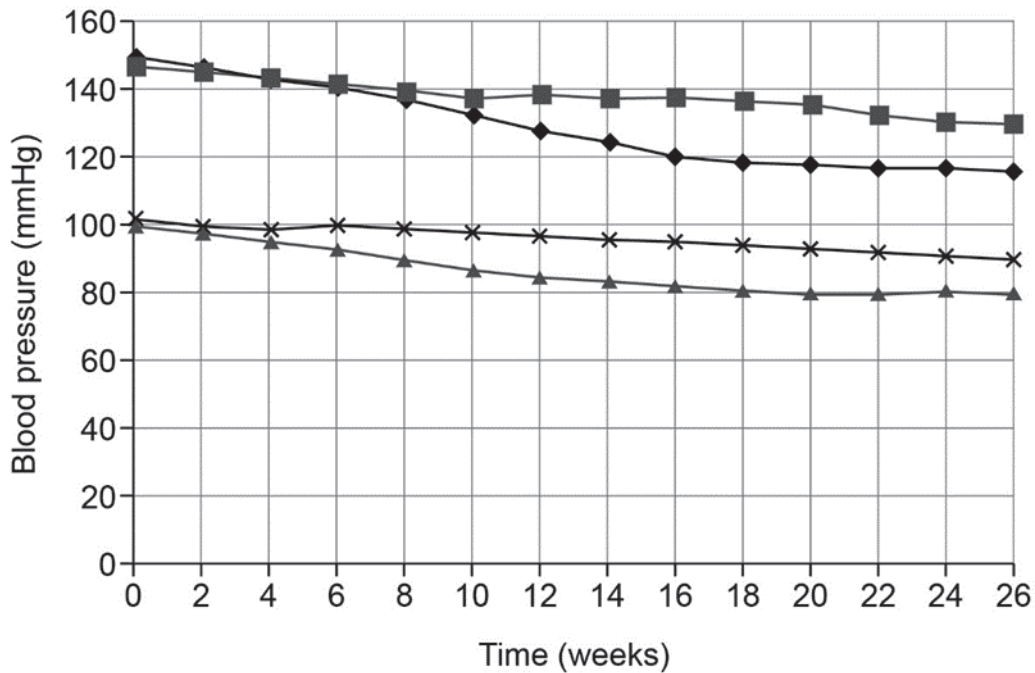
**Figure 2:** table showing details about the patients

	Patient A	Patient B
<b>Mass (kg)</b>	110	108
<b>Blood pressure (mmHg)</b>	150/100	147/102
<b>Age (years)</b>	45	43

Both patients wish to lower their blood pressure without the use of medication. They are both prescribed the same exercise routine, which they both perform three times per week over 26 weeks.

**Figure 3:** shows how their blood pressure changes over the 26 weeks.

◆ Person A Systolic blood pressure      ■ Person B Systolic blood pressure  
 ▲ Person A Diastolic blood pressure      ✕ Person B Diastolic blood pressure



A student analyses **Figure 3** and makes the following statement: 'Exercise is not a reliable way of lowering blood pressure, as Person B still has high blood pressure after 26 weeks.'

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA







**DO NOT WRITE IN THIS AREA**

**DO NOT WRITE IN THIS AREA**

---

---

---

---

---

---

---



**DO NOT WRITE IN THIS AREA**

**DO NOT WRITE IN THIS AREA**

**This page is intentionally left blank.  
Please turn over for the next question.**







## Section B: Chemistry

This section is worth 20 marks, plus 3 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

- 9** Boron supplements can be used in our body to aid with healing wounds.
- Boron has 5 electrons in total: two in the inner shell and three in the outer shell.
- Which **one** of the following is the group that Boron belongs to in the periodic table?

[1 mark]

**A** 2

**B** 3

**C** 4

**D** 5

Answer \_\_\_\_\_

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



10 Atoms are made up of sub-atomic particles.

Which **one** of the following is the name(s) of the particle(s) you would find in the nucleus of an atom?

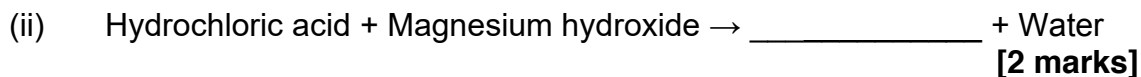
[1 mark]

- A Electrons only
- B Neutrons only
- C Protons and neutrons
- D Protons and electrons

Answer \_\_\_\_\_

11(a) Magnesium hydroxide is commonly used as a remedy for indigestion as it neutralises excess stomach acid.

Complete **both** two-word equations for the two neutralisation reactions below:



(i) \_\_\_\_\_

\_\_\_\_\_

(ii) \_\_\_\_\_

\_\_\_\_\_



**11(b)** Acetic acid is the main component in vinegar. Citric acid is found in citrus fruits.

State **two** properties of these acids.

[2 marks]

---

---

---

---

**11(c)** Whilst developing a new toothpaste in the laboratory, scientists reported the following pH values of some common household products:

- Acetic acid (vinegar): pH 2.5
- Citric acid (lemon juice): pH 4.5
- Sodium bicarbonate (baking soda): pH 8.0

With reference to the hydrogen ion concentration, compare the difference in pH between lemon juice and vinegar.

[2 marks]

---

---

---

---





**12** A pharmaceutical industry has been asked to purify a crude mixture of two components. A scientific team working for this industry has performed thin layer chromatography (TLC) using ether as a solvent. They noted that the spots on the chromatogram were very close together, with Spot 2 moving slightly further up the coated plate than Spot 1.

One scientist decides column chromatography should be the next step in the purification process.

Evaluate the accuracy of this statement and give a reason for your answer.

**[3 marks]**

---

---

---

---

---

---

---







**Section C: Physics**

This section is worth 20 marks, plus 3 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**14** Which **one** of the following is the correct definition of an electrical current? **[1 mark]**

- A** The energy of the charged particles that are moving
- B** The rate at which charged particles flow
- C** The strength of the force that is driving the charged particles
- D** The total number of charged particles that move

Answer \_\_\_\_\_

**15** A radioactive nucleus decays by ejecting a helium nucleus, consisting of 2 protons and 2 neutrons.

Name the type of radiation being ejected from the radioactive nucleus. **[1 mark]**

---

---



16 Electromagnets are used in MRI machines.

An experiment is set up in which a current of 2A is passed through a wire wrapped around a 10cm iron nail. An iron ball bearing is then placed at varying distances away from the electromagnet.

As the iron ball bearing gets further away from the electromagnet, the magnetic force it experiences decreases. The scientist therefore concludes that healthcare staff should not be concerned about any magnetic materials on their person, providing they keep a suitable distance away from the MRI machine.

Evaluate the strength of the scientist's conclusion.

**[3 marks]**

---

---

---

---

---

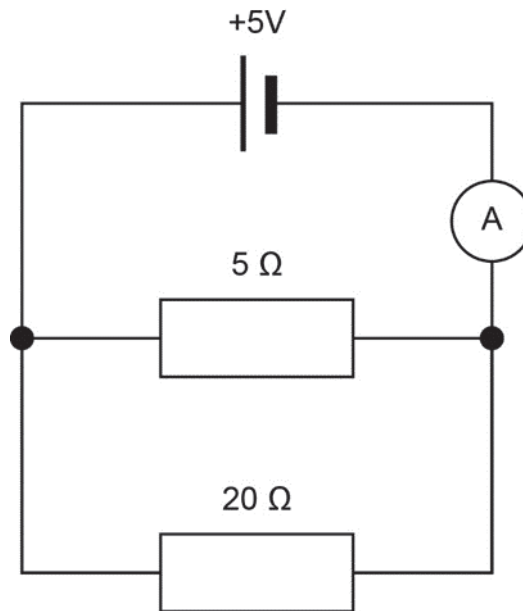
---

---



- 17 An electrical circuit is constructed containing 2 resistors. The resistors are arranged in parallel and connected to a 5V battery as shown in **Figure 6**.

**Figure 6:** A parallel circuit



Use the following equation:

$$\frac{1}{R_{\text{Total}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

Calculate the total resistance.

Show your working.

[3 marks]

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



**18** A soundwave travels through human tissue with a frequency of 1,000,000Hz, and a wavelength of 1.5mm.

Use the following equation:

$$v = f\lambda$$

Calculate the velocity at which the wave travels through the tissue.

Show your working and give your answer in m / s.

**[3 marks]**

---

---

---

---

---

---

---

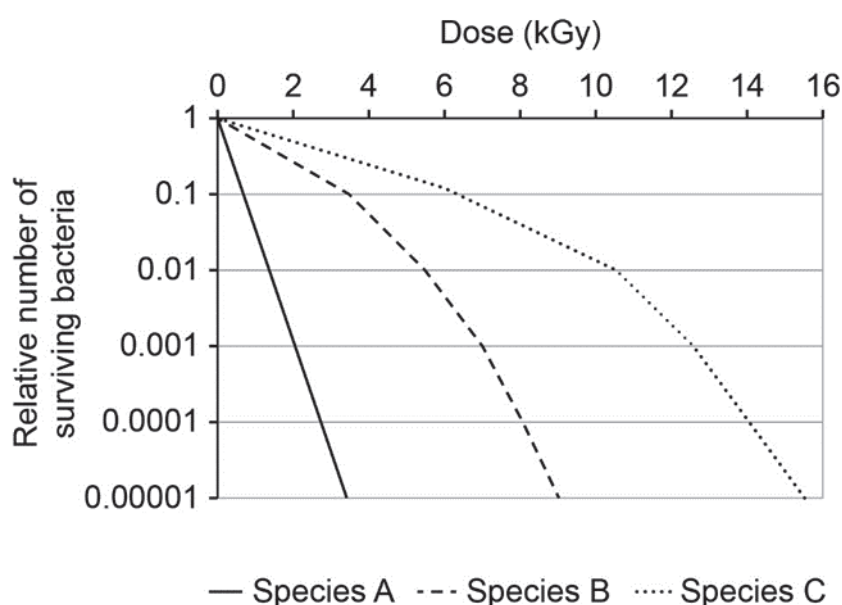


- 19 A scientist is developing new methods of preserving food that eliminates contaminating bacteria with radiation. This preservation method will allow hospitals to store food in case of emergency for long periods of time without the food expiring due to contaminating bacteria.

To investigate the effect of radiation on the survival of bacteria, samples of food are treated with gamma rays (irradiated).

The number of surviving bacteria of different, potentially dangerous species is recorded following irradiation treatment. The results of this experiment are shown in **Figure 7**.

**Figure 7:** A graph to show the effect of gamma radiation on different species of bacteria.



**Gray (Gy) is the unit of ionising radiation dose.**

Based on this experiment, the scientist concludes that all food should be treated with 6kGy of radiation, as it kills most bacteria that might be present in the food, and that higher levels of irradiation could make the food become radioactive.

Using your knowledge of radiation and its application to food preservation, evaluate this conclusion. Your response must include your own reasoned judgements and conclusions.

**[9 marks plus 3 for QWC]**

---

---







**DO NOT WRITE IN THIS AREA**

**DO NOT WRITE IN THIS AREA**

---

---



**DO NOT WRITE IN THIS AREA**

**DO NOT WRITE IN THIS AREA**

**This page is intentionally left blank.  
Please turn over for the next section.**



## Section D: Biology, chemistry and physics

This section is worth 18 marks, plus 6 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

- 20** Viruses enter living cells and cause damage. They are often specific to certain types of cells in the body; for example, viruses which cause respiratory tract infections will enter the cells of the respiratory tract and become concentrated there.

Antiviral drugs must be designed to be able to pass through the cell surface membrane, so that they can destroy or neutralise the virus.

A pharmaceutical research scientist used a gamma emitting radioactive tracer to investigate the ability of three different drugs, A, B and C to enter cells. All three drugs are new and still in development.

They used the following method:

- each of the three drugs was chemically attached to the same type of radioactive tracer
- equal sized samples of live tissue from the respiratory tract of rats were isolated and placed in each of three Petri dishes
- each of the three Petri dishes was filled with a fluid designed to keep the cells within the tissue alive
- **1ml** of a 1% solution of drug A was added to the first Petri dish
- the process was repeated with drugs B and C and the remaining Petri dishes
- the Petri dishes were maintained at **37°C** for **30** minutes
- after **30** minutes, the fluid was poured away and the concentration of the radioactive tracer in the tissue was measured.

**Figure 8:** shows the results and information regarding the chemical make-up of each drug.

	<b>Drug A</b>	<b>Drug B</b>	<b>Drug C</b>
<b>Chemical features of the drug</b>	Lipid based	Not lipid based	Not lipid based but encapsulated in a lipid membrane
<b>Relative concentration of the radioactive tracer in the tissue</b>	15	3	14

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA





**DO NOT WRITE IN THIS AREA**

**DO NOT WRITE IN THIS AREA**

---

---

---

---

---

---

---

---

---

---



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**This page is intentionally left blank.  
Please turn over for the next question.**



21 Lactose intolerance is caused by an inability of the small intestine to produce the enzyme lactase.

Lactose intolerance can be managed by avoiding the consumption of dairy products. However, there is evidence that consuming a quantity of lactase supplement before eating dairy products can prevent the symptoms developing.

The enzyme lactase will break down the disaccharide lactose into the monosaccharide's glucose and galactose. Glucose and galactose both have the same molecular formula.

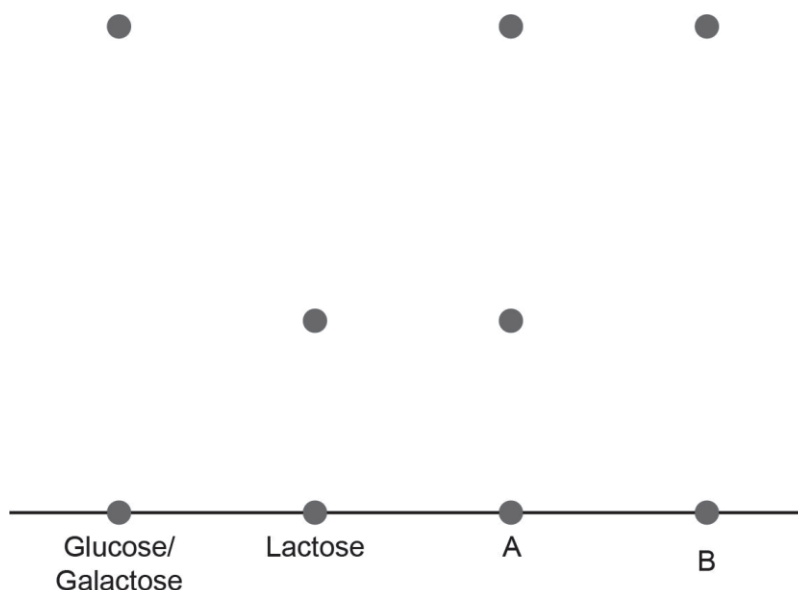
If lactase is consumed it will be exposed to the acidic conditions of the stomach.

A student investigated the relative activity of two different commercially available forms of lactase supplements, A and B, after exposure to hydrochloric acid.

They use the following method:

- 10ml of 1M HCl was placed into each of two test tubes A and B
  - tubes A and B were placed in a water bath at 37°C
  - the amount of each form of lactase recommended by the supplier was added to each test tube
  - after ten minutes, bile salts, which neutralise the acid, and one gram of lactose was then added to each tube
  - after a further ten minutes a sample was removed from each tube and analysed using paper chromatography
  - the chromatograms were developed using reagents which would highlight only glucose, galactose, and lactose.
- The results are shown in **Figure 9**.

**Figure 9:** chromatogram of lactose digestion products









DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**This page is intentionally left blank.**



35P00198236

# Document information

All materials in this publication is © NCFE.

'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

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

All the material in this publication is © NCFE.



36P00198236