

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

## Core knowledge and understanding

### Paper B

Paper number P00XXXX

**Date** **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 118.
- In questions **4 (b), 6, 10, 11, 14 (b) and 16**, you will be assessed on your quality of 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.

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

Please complete the details below clearly and in BLOCK CAPITALS.

Student name \_\_\_\_\_

Provider name \_\_\_\_\_

Student number

Provider number

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: Body systems 1

This section is worth 35 marks, plus 6 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

**1 (a)** In which **one** of the following processes can small, non-polar molecules pass through the membrane?

**[1 mark]**

- A** Active transport
- B** Diffusion
- C** Facilitated diffusion
- D** Osmosis

Answer \_\_\_\_\_

**Please turn over for the next question.**

1 (b) Figure 1 shows the fluid-mosaic model of a cell surface membrane.

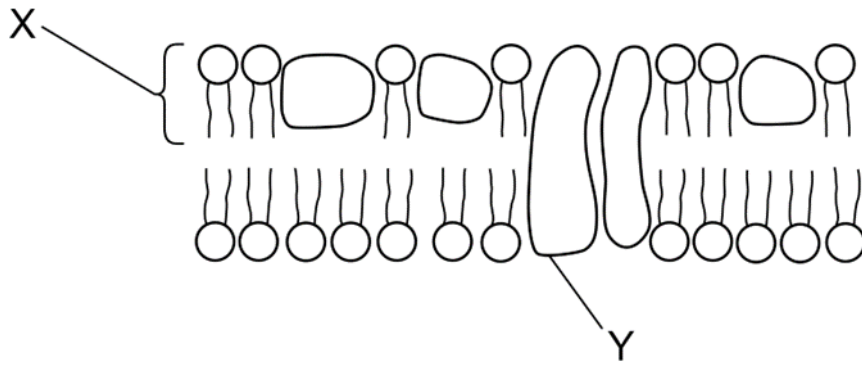


Figure 1: structure of a cell membrane

Name the molecules labelled X and Y.

[2 marks]

Molecule X

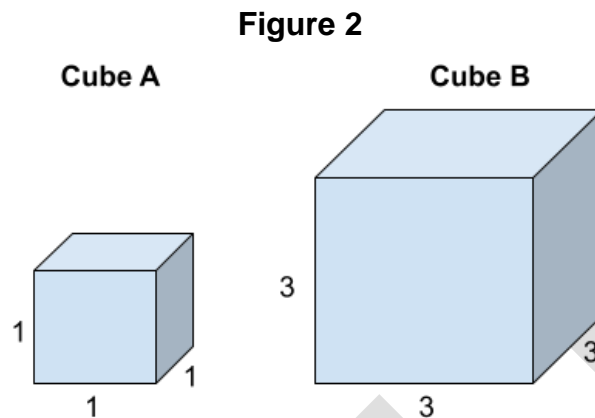
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Molecule Y

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**2** **Figure 2** shows two cubes that are being used to model the effect of surface area to volume ratio on the rate of exchange.

The surface area to volume ratio for cube A is 6:1.



All measurements provided are in cm

The volume of cube B is  $27 \text{ cm}^3$ . Calculate the surface area to volume ratio of cube B and choose which cube would have the greatest rate of exchange.

**[3 marks]**

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**3** There are four main categories of large molecules in the body, all with their own distinct purpose and structure. One of these categories of large molecules contains carbon, oxygen and hydrogen, and forms cell membranes.

Give the name of this large molecule category.

**[1 mark]**

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**4** A patient presents with chronic bronchitis, which is the long-term inflammation of the airways, that is one of the conditions known as chronic obstructive pulmonary disease (COPD).

**(a)** Explain **two** effects that long-term chronic bronchitis can have on the respiratory system and blood oxygen levels.

**[4 marks]**

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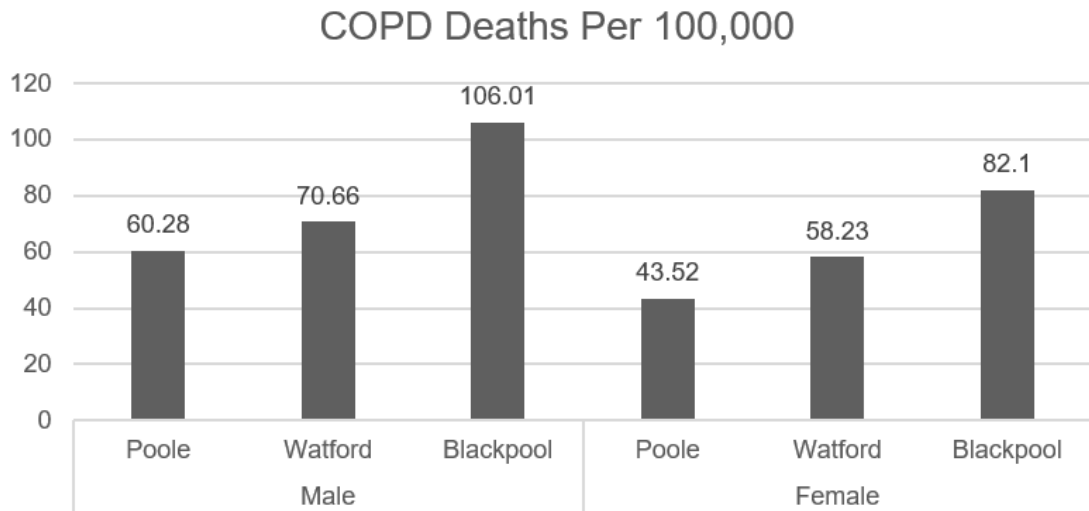
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(b) Chronic obstructive pulmonary disease (COPD) is the second most common lung disease in the UK – around 4% of people over 45 have diagnosed COPD.

**Figure 3** shows the deaths caused by COPD per 100 000 of people diagnosed with COPD for males and females in three towns in England.



**Figure 3:** COPD deaths per 100 000

The data was obtained from GP records of patients who were being treated for COPD and was collected between 2017 and 2019.

A data scientist analysed the data shown in **Figure 3** and made the following conclusions:

- Men are more likely to be diagnosed with COPD than women.
- Treatment of COPD is more effective in women.
- The higher number of deaths caused by COPD in Blackpool may be linked to high levels of air pollution in Blackpool.

Using your knowledge of COPD and understanding from **Figure 3**, evaluate the accuracy of the data scientist's conclusions.

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

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SAMPLE

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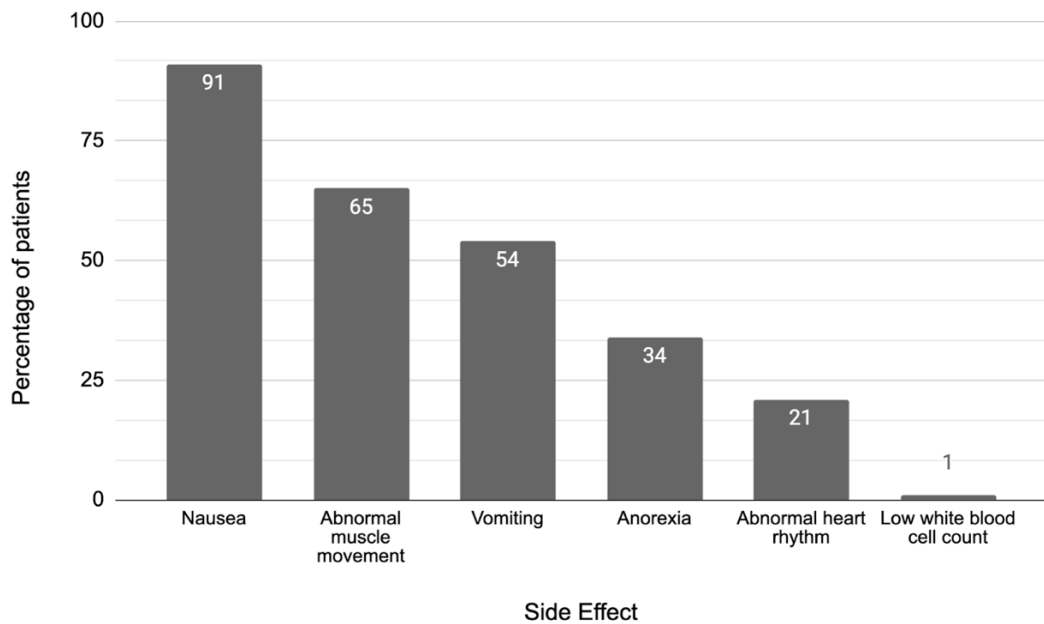




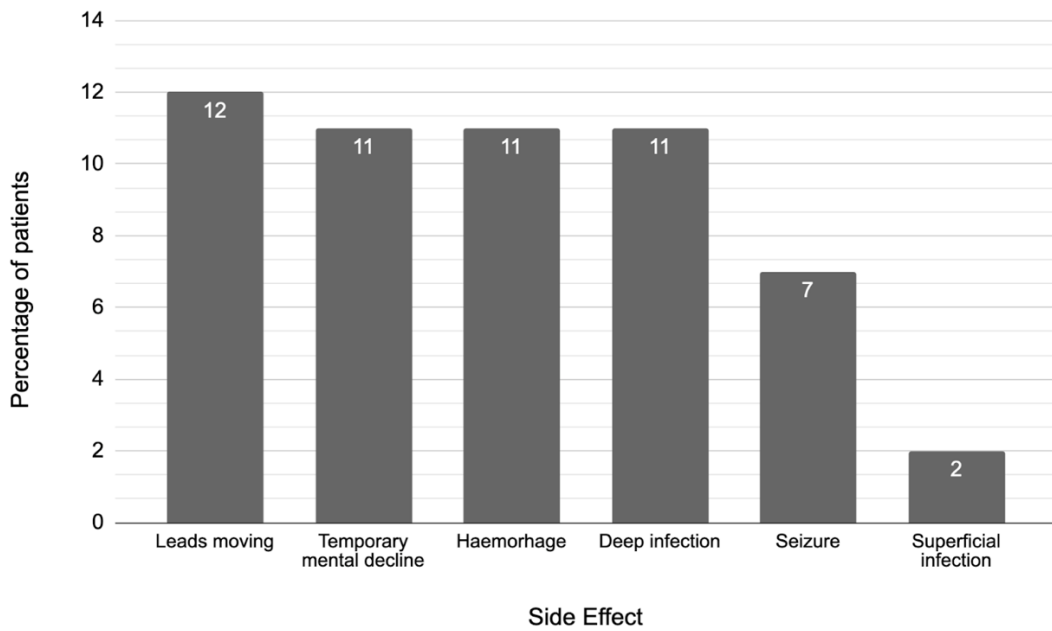
**6** Parkinson's disease (PD) is a condition that affects neurones in the brain.

Levodopa is the most prescribed medicine for PD. The majority of patients respond well to the treatment and find it very effective for managing their symptoms. However, involuntary muscle movement will develop in around 75% of patients after 10 years of treatment.

Deep brain stimulation (DBS) is suitable for some PD patients. Of the patients that have received DBS for PD, around 80% felt it improved their symptoms, but there is limited data of long-term outcomes.



**Figure 4:** Frequency of some side effects associated with Levodopa – Yahr, M. D. et al. (1969) 'Treatment of Parkinsonism With Levodopa'. Archives of Neurology. 21(4)



**Figure 5:** Frequency of some side effects associated with deep brain stimulation – Morishita, T. et al. (2017) ‘Postoperative lead migration in deep brain stimulation surgery: Incidence, risk factors, and clinical impact’. PLOS One. 12(9)

Using the information provided and your own knowledge, evaluate the statement:

‘Levodopa is the safest and most effective treatment for Parkinson’s disease’.

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

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SAMPLE

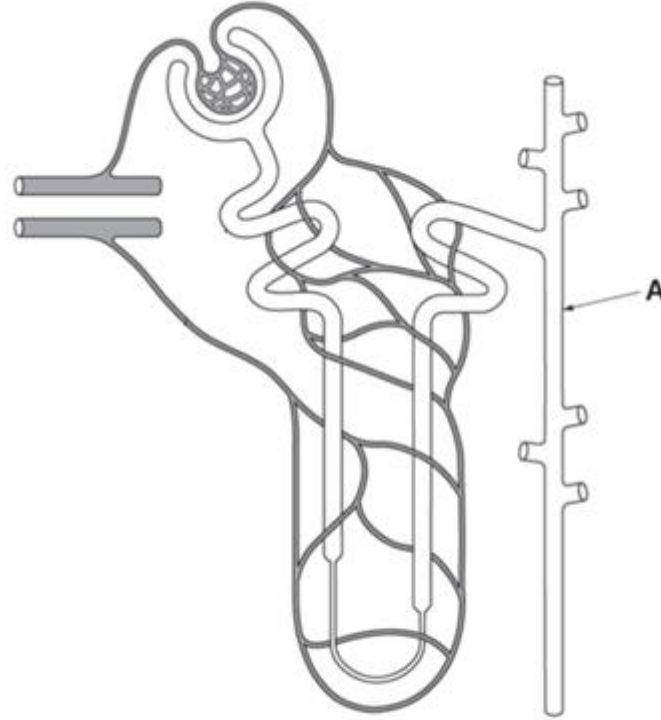
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SAMPLE

**Section B: Body systems 2**

This section is worth 35 marks, plus 6 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

**7 (a)** **Figure 6** shows a single nephron, with its blood supply, from a kidney.



**Figure 6:** Structure of the nephron

Name the part of the nephron labelled A.

**[1 mark]**

**Part A** \_\_\_\_\_

(b) Selective reabsorption occurs in the proximal convoluted tubule.

Describe **one** way in which the cells of the proximal convoluted tubule are adapted for reabsorption.

[1 mark]

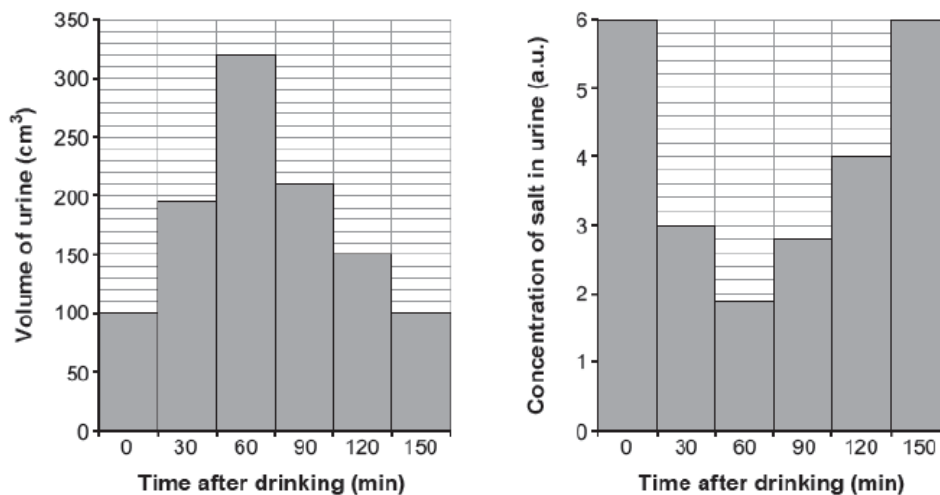
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A patient gave a sample of urine and then rapidly drank 1000 cm<sup>3</sup> of distilled water.

Urine was then collected at regular intervals, and the volume of each sample and its salt concentration were measured.

The results are shown in **Figure 7**.



**Figure 7:** Volume of urine and salt concentration after drinking distilled water

**(c)** Using knowledge of osmoregulation, **explain** the relationship between water intake and the volume of urine produced and its salt concentration.

**[4 marks]**

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**8 (a)** State the structure within the nephron which surrounds a mass of blood capillaries known as the glomerulus.

**[1 mark]**

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**(b)** A 52-year-old patient has been diagnosed with chronic kidney disease (CKD). Their doctor has suggested that they should start dialysis immediately and may require a kidney transplant in the future.

The patient considers the option of a kidney transplant and the option of dialysis.

Evaluate the potential impact of each course of treatment.

**[6 marks]**

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**9** A new skin patch is being developed for people who have type 1 diabetes. The skin patch is placed directly on the skin and can take readings automatically.

The patch can be worn 24 hours a day and sends readings to a monitor automatically to replace the need for manual testing.

It measures the level of glucose in their blood.

The device takes a measurement every 60 seconds.

The monitor sounds an alarm if the blood sugar level gets too high or too low.

Explain **two** reasons why using the new monitor is an improvement on manual monitors.

**[4 marks]**

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**10** As people get older, they become less fertile. Production of sperm slows, and they become less motile with more changes to chromosomes. The number of ova reduces with age and are more likely to have changes to chromosomes. Eventually, ovaries stop releasing eggs.

Related health complaints that can affect fertility also increase with age (for example, uterine fibroids).

In vitro fertilisation (IVF) treatment means it is now possible for people in their 60s to have children, but not everyone thinks this is a good idea.

Evaluate reasons for and against people in their 60s having IVF treatment to have children.

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



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SAMPLE



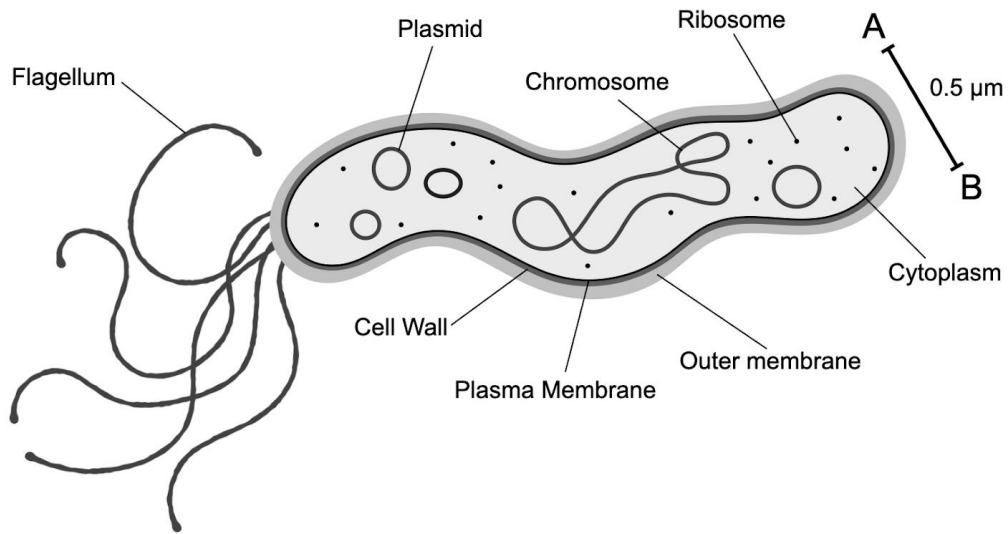


**Section C: Body systems 3**

This section is worth 30 marks, plus 6 marks for QWC and use of specialist terminology. Answer **all** questions in the spaces provided.

**12** Just under half of people in the UK have an organism called *Helicobacter pylori* (*H. pylori*) living in their stomachs.

Most people that have it are unaffected, but in about 15% it causes stomach ulcers, inflammation and indigestion. It is also strongly linked to increased risks of developing stomach cancer.



**Figure 10:** Features of *Helicobacter pylori* (*H. pylori*)

**(a)** Identify what type of basic cell type the micro-organism *H. pylori* is and give **one** feature that justifies your decision.

**[2 marks]**

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(b) The distance between points A and B on **Figure 10** is 18 mm under magnification and represents the width of the cell.

The actual width of the cell is 0.5  $\mu\text{m}$ .

The equation used to calculate magnification is:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of object}}$$

**1 mm = 1000  $\mu\text{m}$**

Calculate the magnification used in this diagram.

Show all workings out within your response.

**[3 marks]**

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(c) *H. pylori* is transmitted by saliva, vomit and faecal contamination of food or water.

Explain **one** way of reducing the spread of *H. pylori* in a population.

**[2 marks]**

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**13** A patient has been diagnosed with uterine fibroids.

Fibroids are non-cancerous tumours made up of muscular and connective tissues from the wall of the uterus and they will not invade nearby tissue or spread around the body.

Name the category of tumour that the patient has been diagnosed with.

**[1 mark]**

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**14** Radioactive iodine is a nuclear medicine treatment for an overactive thyroid and certain thyroid cancers.

A small dose of radioactive iodine is swallowed and absorbed into the bloodstream. It will build up in the thyroid gland and begin destroying its cells.

Radioactive iodine emits radiation as beta particles and gamma rays.

**(a)** Identify what a beta particle is.

**[1 mark]**

**A** 2 neutrons and 2 protons

**B** A high-speed electron

**C** Electromagnetic radiation

**D** A helium nucleus

Answer \_\_\_\_\_





**15** A patient who is a 25-year-old woman with a strong family history of breast cancer plans to discuss predictive genetic testing on the NHS with her GP.

An inherited mutation in the BRCA1 gene is the leading risk factor for developing breast or ovarian cancers.

BRCA1 is known as a tumour suppressor gene.

Tumour suppressor genes help to prevent the uncontrolled division of damaged or abnormal cells.

Assess to what extent a mutation in the patient's BRCA1 gene could result in the formation of breast cancer.

**[3 marks]**

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**Please turn over for the next question.**





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Owner: Head of Assessment Design

## Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Published.	June 2023	26 June 2023
v1.1	Sample added as a watermark	November 2023	22 November 2023