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

Core knowledge and understanding

Paper B Elements 12–13

Paper number: PXXXXX

Specimen 2021 morning/afternoon

Time allowed: 2 hours 30 minutes

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

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 **9, 10, 15, 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.

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.

BARCODE - TQ/HEA/CKU/PAPERB

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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:
~~C~~
Answer **B**

Section A: Biology

This section is worth 42 marks plus 6 marks for quality of written communication (QWC).
Answer **all** questions in the spaces provided.

1 In epidemiology, which **one** of the following best describes the difference between incidence and prevalence?

[1 mark]

A Prevalence calculates the decline in new cases and incidence focuses on the rise of existing cases.

B Prevalence focuses on using smaller relevant data whereas incidence focuses on incidents creating data.

C Prevalence is the analysis of existing cases and incidence analyses new cases.

D Prevalence is the analysis of new cases and incidence analyses existing cases.

Answer _____

2 Identify the organelle responsible for energy release within cells **and** name this process.

[2 marks]

The organelle is: _____

_____

The process is: _____

_____

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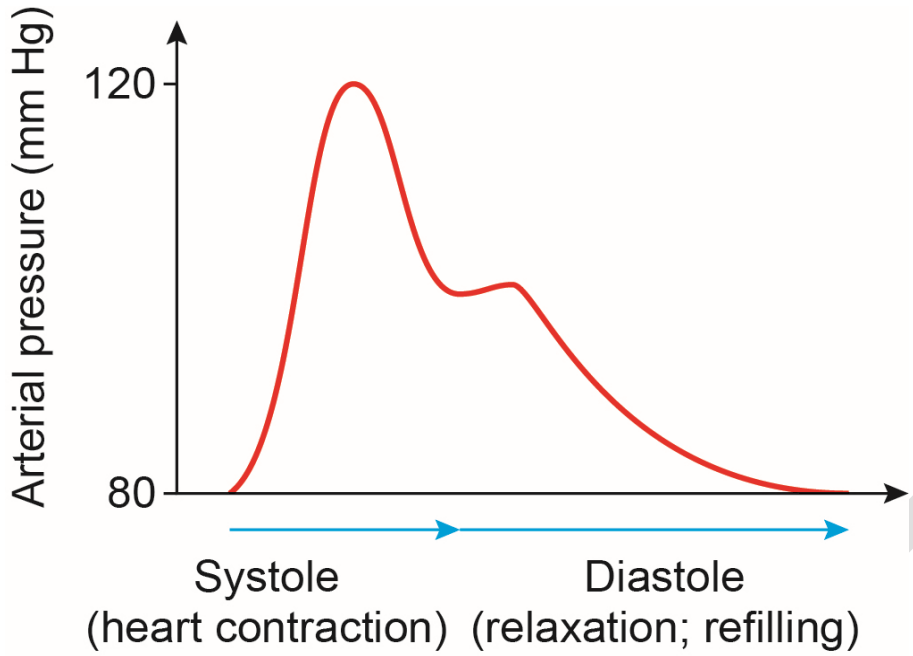
Figure 1. The graph shows the arterial blood pressure changing during a 55-year-old man's cardiac cycle



3 A student states that Figure 1 shows that in terms of their cardiovascular system, the 55-year-old man is healthy.

Give **three** pieces of information from the graph that support this statement.

Use approximate readings where required.

[3 marks]

Please turn over

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4 An overweight 68-year-old male smoker exercises less than 30 minutes per week. On climbing stairs, he experiences chest pains, is out of breath and feels exhausted.

Give **two** examples of physiological factors that are causing him to experience these symptoms.

For **both** physiological factors, explain why it causes these symptoms.

[4 marks]

5 During the transcription process, DNA is transcribed into messenger RNA using a sequence of base pairs.

Identify the missing base to complete the pairs in the table below:

DNA	**RNA**
Adenine	
Cytosine	Guanine
Guanine	Cytosine
Thymine	Adenine

[1 mark]

6 Identify **one** of the two stages of the body's response to a soft tissue injury.

[1 mark]

Please turn over

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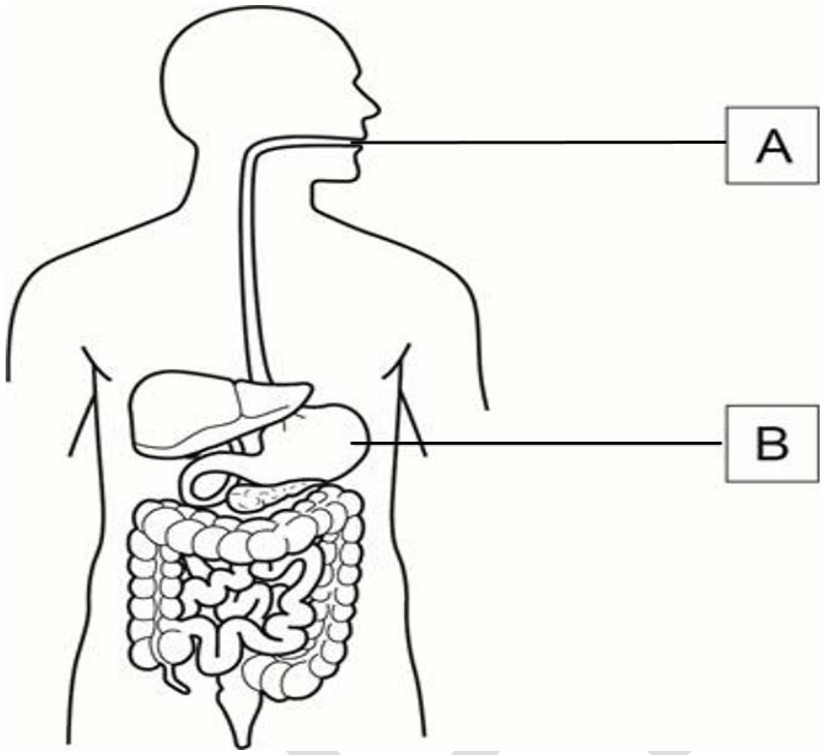
Figure 2. The digestive system



There are many functions working together in the human digestive system, one of these is mechanical digestion.

7 Give **two** ways in which mechanical digestion breaks down food at point A.

Give **one** way in which mechanical digestion breaks down food at point B.

[3 marks]

Please turn over

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8 An amateur runner is planning to take part in a charity marathon.

To help get a good race time, the runner is considering completing the race without stopping for any drinks. A friend advises against this as the weather will be hot during the marathon.

Evaluate the friend's advice.

[6 marks]

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Examiner use only

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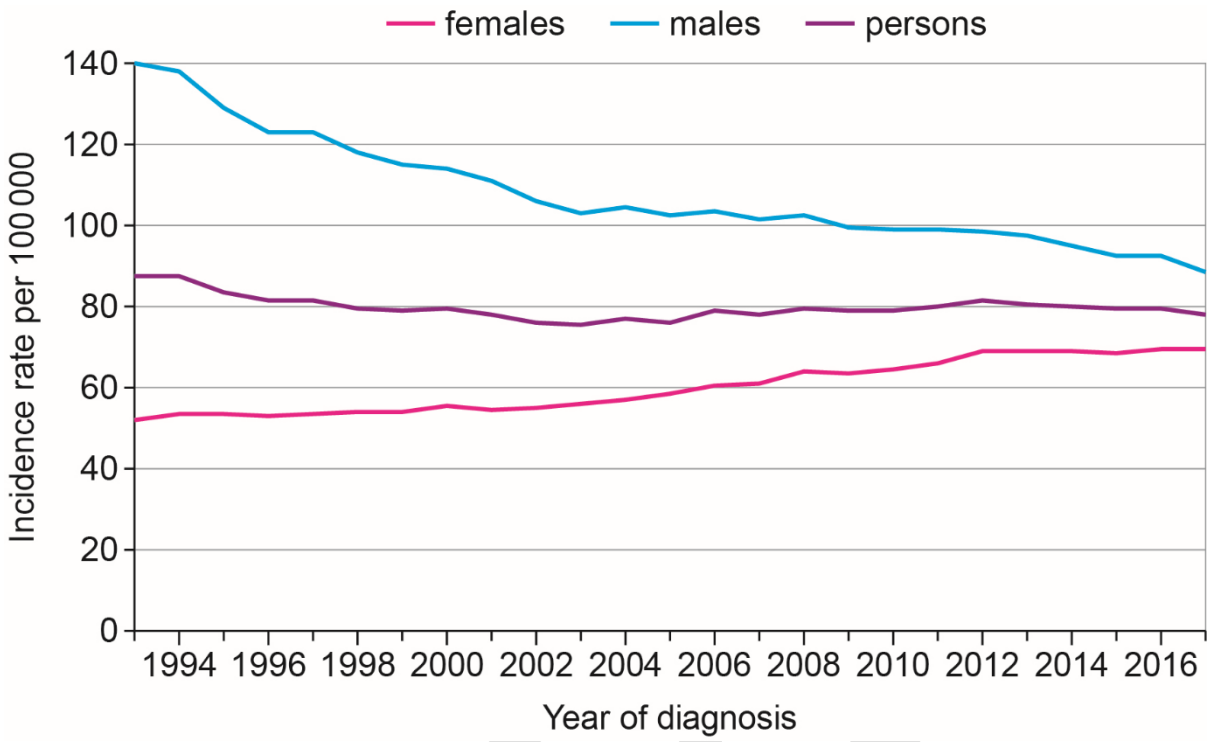
Figure 3. Lung cancer incidence statistics in the UK 1993–2017



9 A scientist claims that smoking habits have changed, and that there will be a reduction in the number of cases of lung cancer in the UK by 2030.

Evaluate this statement using the information in Figure 3.

Your answer should demonstrate:

- the use, and limits of, epidemiology as a method
- reasoned judgements and conclusions about the impact of health promotion.

[9 marks plus 3 for QWC]

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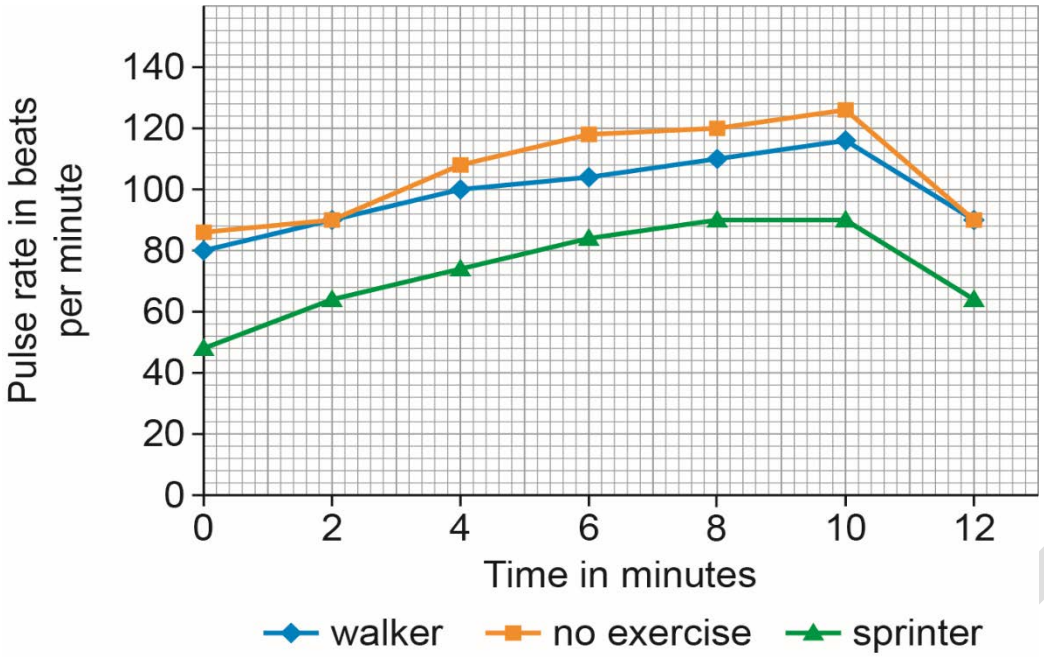
Figure 4. The effects of exercise on heart rate



10 Figure 4 shows the recorded heart rates of three different people with different fitness levels during a 10 minute brisk walk that is followed by a 2 minute period of rest.

Hafsa says she thinks that sprinting is the best form of exercise as it makes your muscles work harder. However, Ahmed strongly disagrees, saying he believes that regular walking with a dog is much better.

Do you agree with Hafsa or Ahmed? Justify your answer using the information in the graph and with reference to the homeostatic response.

[12 marks plus 3 for QWC]

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Examiner use only

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Examiner use only

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Section B: Chemistry

This section is worth 20 marks plus 3 marks for quality of written communication (QWC).
Answer **all** questions in the spaces provided.

11 Which **one** of the following does the pH scale measure?

[1 mark]

A Hydrogen atoms

B Hydrogen compounds

C Hydrogen ions

D Hydrogen neutrons

Answer _____

12 Which **one** of the following is the organic compound which provides energy?

[1 mark]

A Arginine

B Adenosine monophosphate

C Adenine

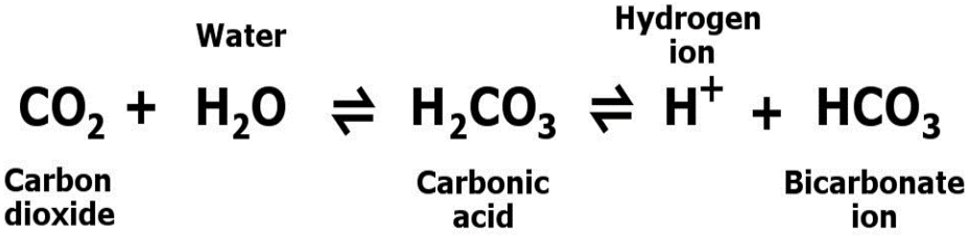
D Adenosine triphosphate

Answer _____

Please turn over for the next question.

Examiner use only

Figure 5. Carbonic acid-bicarbonate buffer system

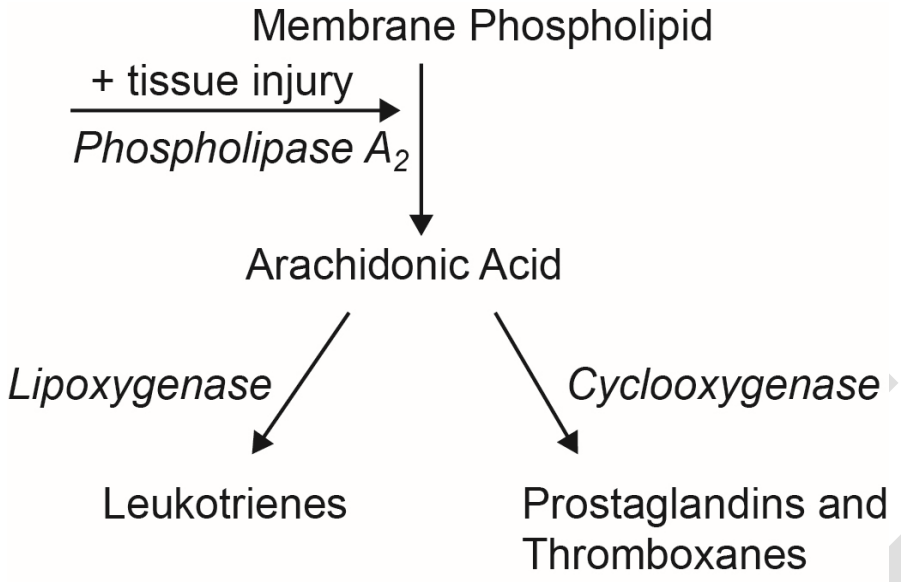


13 A student suffers from a panic attack that causes them to hyperventilate. Using the equation in Figure 5, give **five** ways in which this could cause a disturbance in the student's pH levels.

[5 marks]

Please turn over

Figure 6. Arachidonic acid pathway following soft tissue injury



14 Following an injury during a netball game, one of the players asks their coach for some pain killers. The coach only has ibuprofen and knows the injured player uses a steroid inhaler to control their asthma. The coach checks their phone and finds that steroids are phospholipase A2 inhibitors and that ibuprofen is a cyclooxygenase inhibitor.

Discuss the possible effects of giving the player ibuprofen.

[4 marks]

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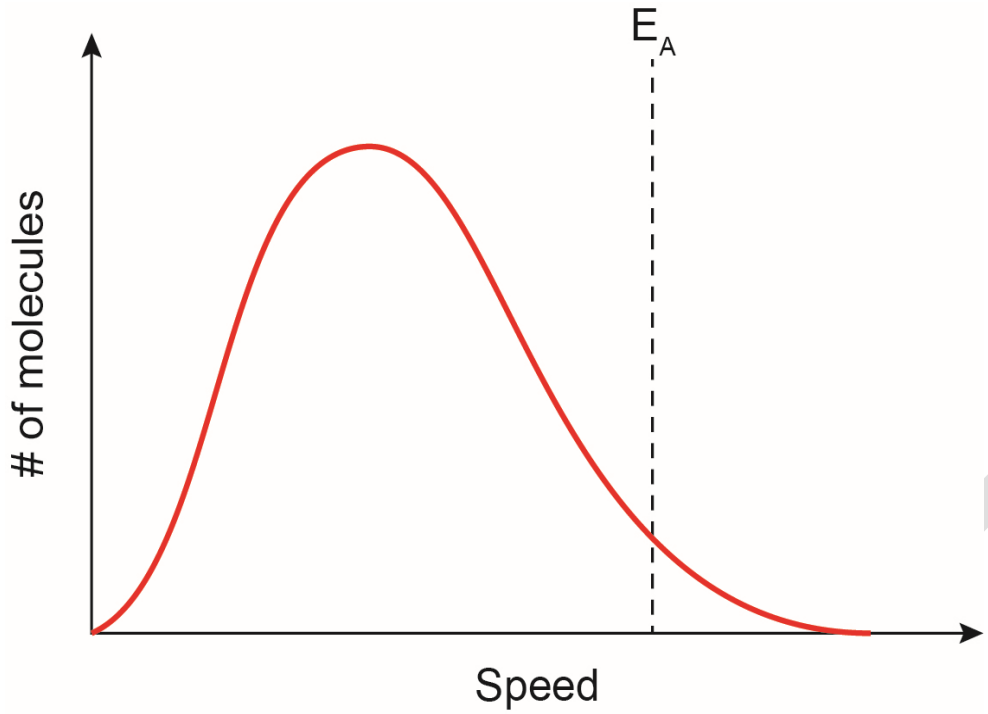

15 The graph shows how the molecular energy is distributed, where E_A is the activation energy the molecule needs to break or form bonds.

Three different jars contain identical gasses. Each jar is heated to a different temperature – 30 °C, 80 °C and 300 °C.

Using the principles of collision theory, explain how the curve helps us to understand how temperature can affect any rates of chemical reactions in the different jars.

Your response should demonstrate:

- concepts of activation energy
- conclusions of changes to molecular energy distribution and the rates of chemical reactions when changing temperature.

[9 marks plus 3 for QWC]

Please turn over

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Examiner use only

Section C: Physics

This section is worth 20 marks plus 3 marks for quality of written communication (QWC).
Answer **all** questions in the spaces provided.

16 In electro surgery, a generator converts mains alternating current to a radio frequency.

Select the correct frequency that the generator would convert the current to.

[1 mark]

A 50 Hz

B 100 Hz

C 500 Hz

D 1000 kHz

Answer _____

Please turn over for the next question.

Examiner use only

17

Figure 8. Drug label for Iodine-131

Drug name: Radioiodine (Iodine-131)
Atomic properties:

- Neutrons 78
- Protons 53
- Isotope mass 130.906 u
- Excess energy 971 keV
- Physical half-life 8 days 0 hours
- Biological half-life 66 days
- Biological half-life in hyperthyroidism 38 days

17 (a)

$$\frac{1}{T_{effective}} = \frac{1}{T_{physical}} + \frac{1}{T_{biological}}$$

Use the formula above to calculate the effective half-life of Iodine-131 in a person without hyperthyroidism.

Show your workings. Give your final answer to 1 decimal place.

[3 marks]

Please turn over

17 (b) A pregnant woman with thyroid cancer is considering radioiodine treatment (Iodine-131).

Analyse the risk to the woman of **not** taking radioiodine.

[3 marks]

18 (a) Ultrasound waves are generated at a frequency of 15MHz (15,000,000Hz). While performing a scan, these waves pass through 2 different tissues, muscle and fat.

Calculate the wavelength of the sound waves in each tissue, given that the wave speed in each is:

- Muscle: $V_{Muscle} = 1600\, ms^{-1}$
- Fat: $V_{Fat} = 1450\, ms^{-1}$

Assume that the frequency remains constant. Give the answer to 3 significant figures.

[2 marks]

18 (b) Ultrasounds are often used to create images inside the body for monitoring an existing condition or to diagnose a condition.

Explain **two** limitations of using an ultrasound to diagnose a condition. **[2 marks]**

Examiner use only

19 A pregnant woman is involved in a road traffic collision. She is unconscious when she is admitted to the local emergency department.

The staff consider the options, including using an X-ray machine and the MRI scanner.

Evaluate the use of these diagnostic tools to investigate the extent of her injuries.

Your response should demonstrate:

- the usefulness of the tools for this patient
- reasoned judgements about the benefits and risks of the different tools in this situation.

[9 marks plus 3 for QWC]

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Please turn over for the next section.

Examiner use only

Section D: Biology, chemistry and physics

This section is worth 18 marks plus 6 marks for quality of written communication (QWC).
Answer **all** questions in the spaces provided.

Figure 9. ECG 1 – normal ECG

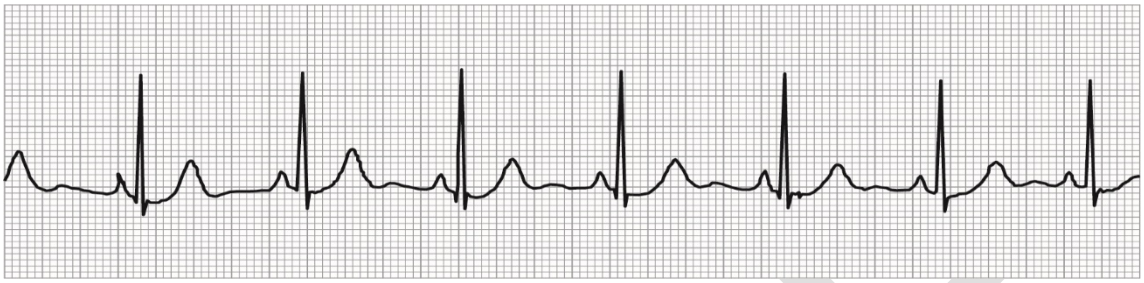


Figure 10. ECG 2 – atrial fibrillation

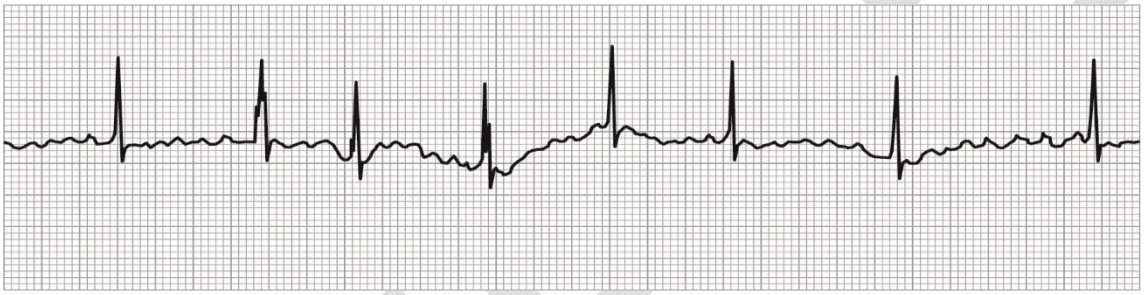
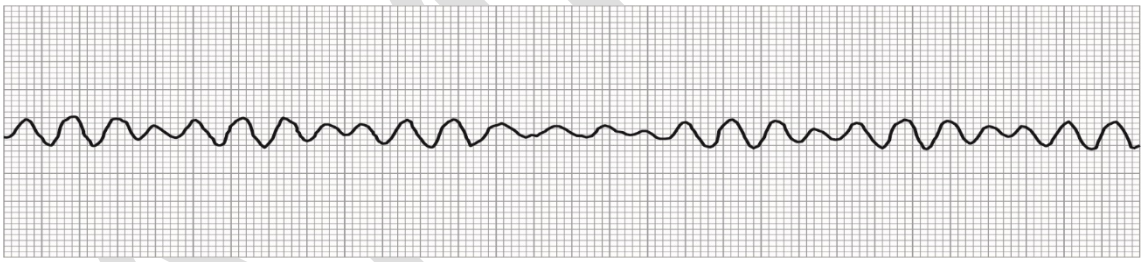


Figure 11. ECG 3 – ventricular fibrillation



20 Figures 9, 10 and 11 show different electrocardiograms (ECGs). The first is a typical healthy ECG, the second indicates the person has atrial fibrillation (AF) and the third is of somebody in ventricular fibrillation (VF). Fibrillation describes rapid and irregular contractions of the cardiac muscle fibres that are not synchronised.

"Atrial fibrillation is not usually life-threatening whereas ventricular fibrillation is."

Evaluate the above statement.

Your response should demonstrate:

- interpretation of ECGs in terms of cardiac electrical activity
- consideration of the mechanical cardiac function in the different conditions.

[9 marks plus 3 marks for QWC]

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21 A patient with breast cancer has been referred for external beam radiation therapy. They have been advised that the radiation will hopefully reduce the development of the cancer.

Evaluate the benefits and risks of using therapeutic radiation for the patient.

Your response should demonstrate:

- the principles of the mechanism of therapeutic radiation
- considerations about the impact on normal function of the cardiac, respiratory or digestive system.

[9 marks plus 3 for QWC]

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Document information

The T Level Technical Qualification is a qualification approved and managed by 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
v1.2	Sample added as a watermark	November 2023	21 November 2023