



QUESTION WORKBOOK

# Biological measurement

Medical physics · Year 13

AQA 3.10.3.1

17 questions · 51 marks

NAVY SCREEN EDITION

**SECTION A** · Warm-up

**A1** State what is meant by the resting potential of a muscle cell, and state what happens to it during an action potential. [2]

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**A2** State what the P wave and the QRS complex of a normal ECG each represent. [2]

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**A3** State what the T wave represents, and state why it is broader and lower than the QRS complex. [2]

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**A4** On an ECG trace, successive R spikes are 0.60 s apart. Calculate the heart rate in beats per minute. [2]

**A5** State two requirements of the amplifier in an ECG machine, and give a reason for each. [2]

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- A6** State the approximate size of the potential difference an ECG machine detects between two skin electrodes. [1]

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## SECTION B · Standard

- B1** Explain how the electrical activity of the heart produces a potential difference that can be detected at the skin. [3]

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- B2** Explain why the amplifier of an ECG machine must have a very high input impedance. [3]

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- B3** An ECG amplifier turns a 1.2 mV input into a 2.4 V output. Calculate its voltage gain. The output cannot exceed 5.0 V: calculate the largest input the amplifier can handle without distorting the trace. [3]

- B4** Explain why the QRS complex of a normal ECG is much larger than the P wave, and state why the repolarisation of the atria is not seen as a separate feature. [3]

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- B5** An ECG is printed on paper moving at  $25 \text{ mm s}^{-1}$ . Successive R spikes on the printout are 20 mm apart. Calculate the interval between beats and the heart rate in beats per minute. [3]

- B6** A normal ECG shows a flat section of about 0.15 s between the end of the P wave and the start of the QRS complex. Explain what is happening during this time. [3]

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- B7** State why a conducting gel is used between an ECG electrode and the skin, and why several electrodes are attached rather than two. [3]

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## SECTION C · Stretch

- C1** Describe fully how an ECG trace is obtained, from the electrical event in the heart muscle to the trace on the display. [6]

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- C2** On an ECG trace, R spikes occur at 0.72 s, 1.50 s, 2.20 s and 2.95 s. Calculate the three intervals between beats, the mean heart rate, and comment on whether the rhythm shown is regular. [5]

- C3** Explain why 50 Hz interference appears on an unscreened ECG, and explain how the machine is designed to reject it. [4]

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- C4** A student says that an ECG shows the heart pumping. Explain why this description is wrong, and state what has to be true of a trace for it to be called normal. [4]

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