A-Level Physics

Biological Measurement

Question Paper

Time available: 62 minutes
Marks available: 43 marks

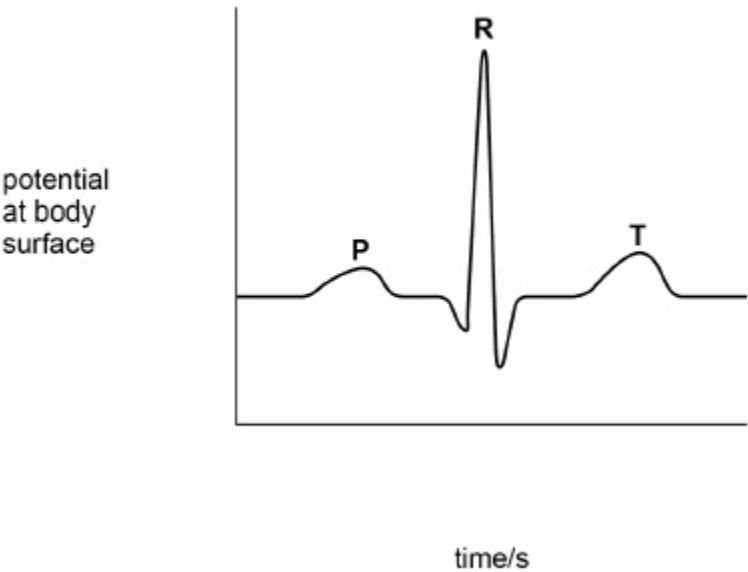**1.** (a) **Figure 1** shows an ECG trace for a healthy person.

Complete **Figure 1** by adding a suitable unit and scale to the potential axis, and a suitable scale to the time axis.
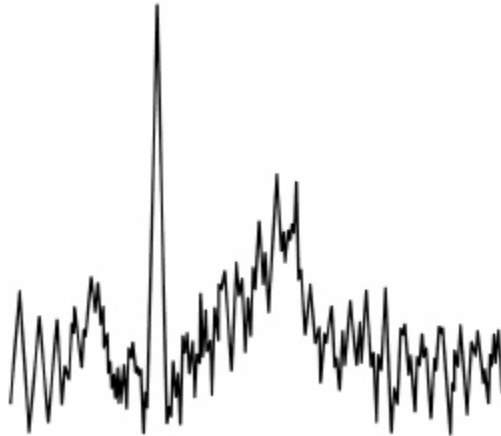
Figure 1

(2)

(b)   **Figure 2** shows a faulty ECG trace which was obtained for another healthy person.

Figure 2

Discuss **three** possible reasons why this faulty trace was obtained.

_____

_____

_____

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_____

(3)
(Total 5 marks)

2. An ECG trace is to be obtained for a healthy patient. Describe the procedure involved to ensure that a good trace is obtained. Your answer should include reference to:

- connections to the body
- how unwanted signals are avoided
- some properties of the amplifier used.

The quality of your written communication will be assessed in your answer.

_____

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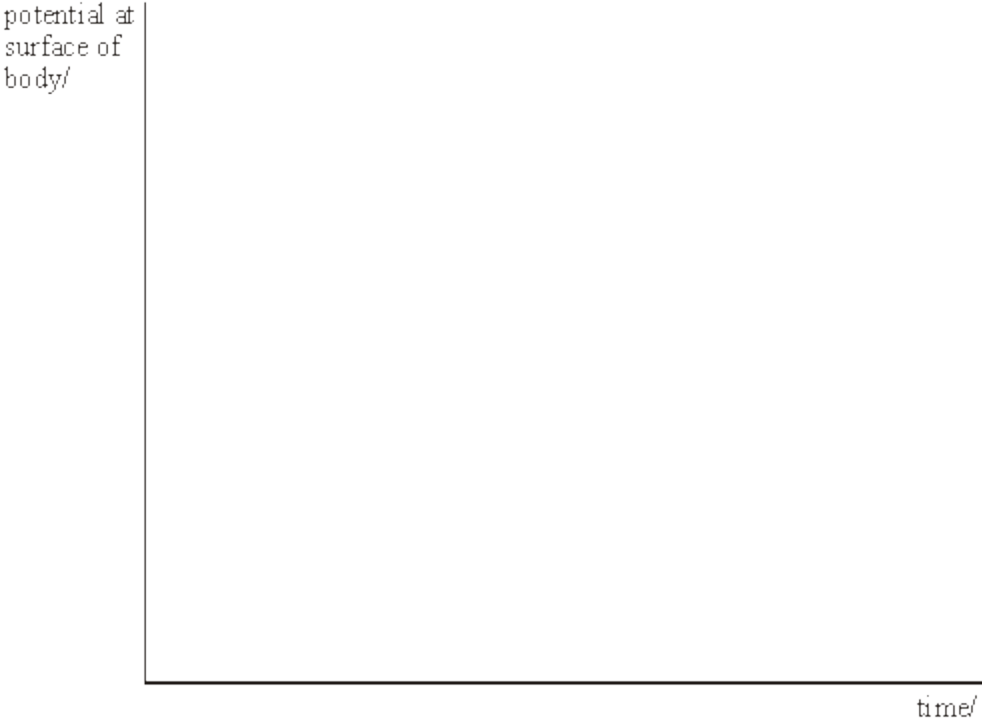
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(Total 6 marks)

3. (a) Sketch a graph of the ECG trace for a healthy heart. Label each axis with appropriate units and scales.

potential at surface of body/

time/

(4)

(b) When obtaining such a trace, electrodes are attached to the patient. State and explain **two** precautions which should be taken when attaching the electrodes to ensure reception of the best signal.

precaution 1:

_____

_____

_____

_____

precaution 2:

_____

_____

_____

_____

(2)
(Total 6 marks)

4. Electrodes are attached to the chest of a healthy person and a normal ECG waveform is obtained.

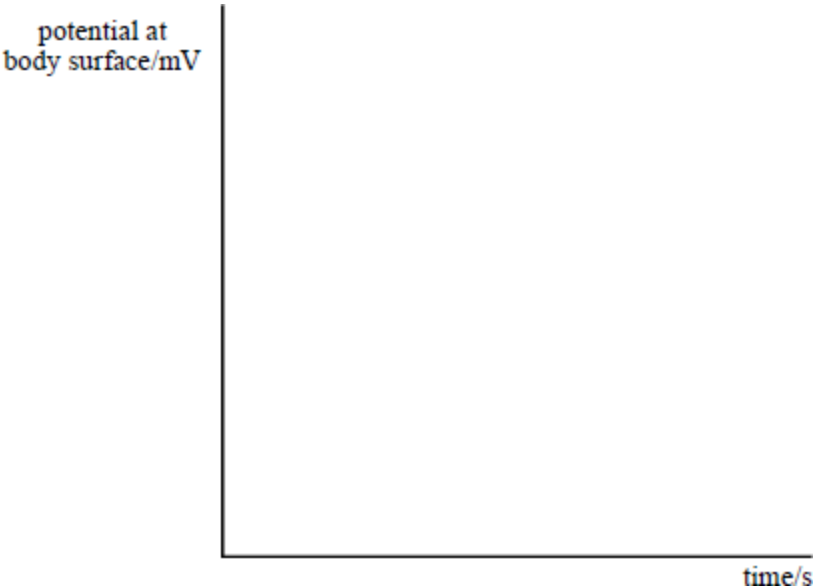(a) State **two** ways of ensuring good electrical contact between the electrodes and the person.

_____

_____

_____

_____

(2)

(b) State **two** properties of the amplifier needed to amplify the signal from the electrodes.

_____

_____

(2)

(c) Sketch, on the axes below, the waveform that you would expect to obtain. Label the axes with appropriate scales.
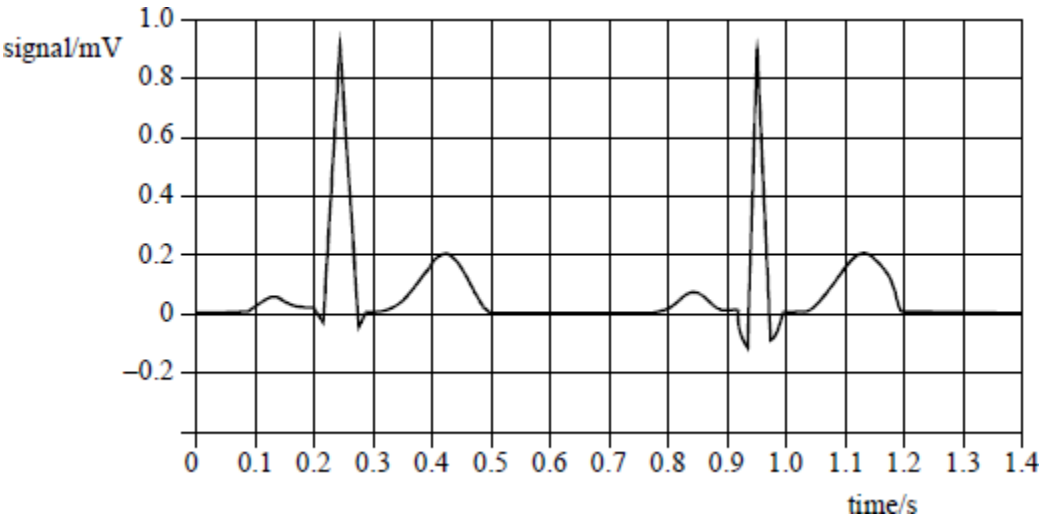
potential at
body surface/mV

time/s

Mark on the waveform where the following occur:

(i) atrial depolarisation

(ii) ventricular depolarisation

(iii) ventricular repolarisation.

(5)
(Total 9 marks)

5.

The graph above shows a normal electrocardiogram (ECG) signal obtained at the surface of the skin of a patient.

(a)　What is the amplitude of the main pulse in the signal?

_____

(1)

(b)　Find the period of the heart beat and from it calculate the pulse rate per minute.

_____

_____

_____

_____

(2)

(c)　What changes would you expect to see in the electrocardiogram if the patient began to take exercise?
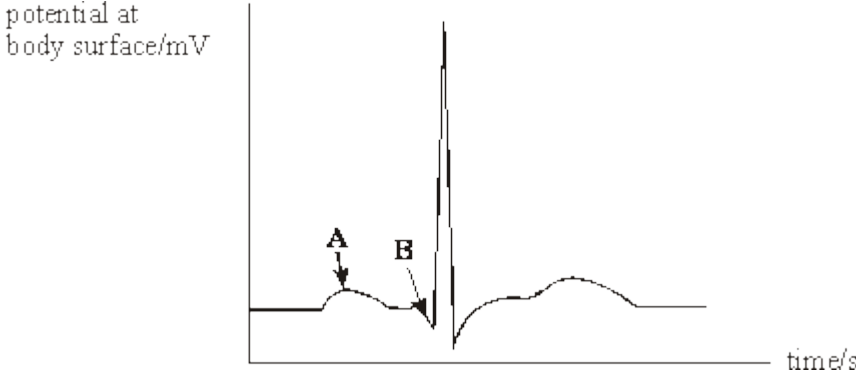
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(2)

(d)　On the graph, label with a P the points where atrial contraction occurs and with a Q the points where ventricular contraction starts.

(2)
(Total 7 marks)

6. Electrodes are placed on the surface of a body to record an ECG trace for a healthy person. The trace obtained for one heartbeat is shown.

potential at body surface/mV

time/s

(a) (i) Label approximate scales on each axis.

(ii) State what electrical event happens at points **A** and **B** and the physical change that results.

Position **A**:

electrical event _____

_____

physical change _____

_____

Position **B**:

electrical event _____

physical change _____

_____

(6)

(b) State, giving a reason, **one** precaution you would take when attaching the electrodes to the surface of the skin to ensure a good signal is obtained.

_____

_____

(2)

(c)   The amplifier used must have a high gain. State **two** other properties of the amplifier.

property 1 _____

property 2 _____

_____

(2)
(Total 10 marks)