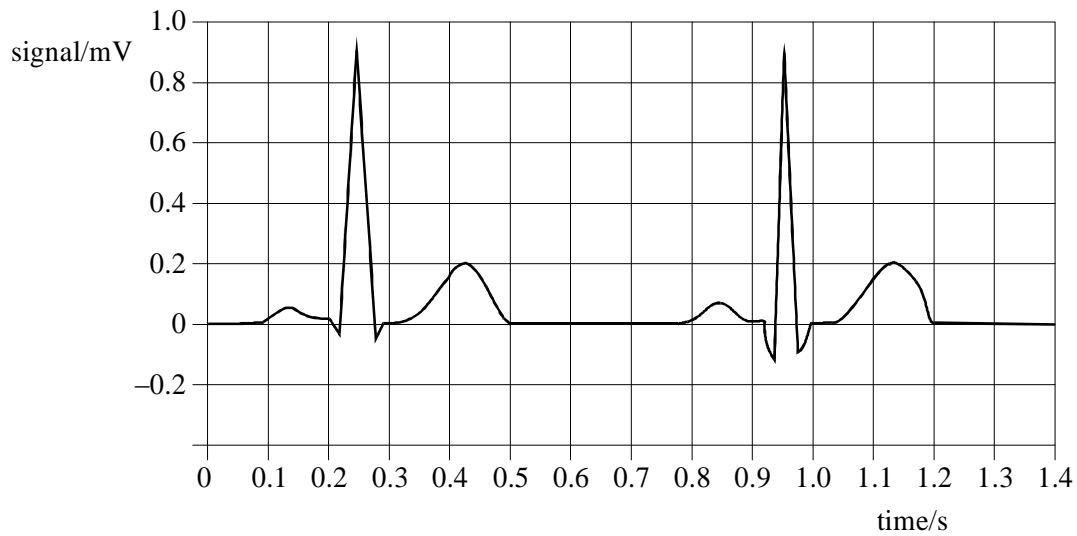


ECG - Medical Physics Option

1.



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?

.....

.....

.....

(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)

ECG - Medical Physics Option

2. 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.

.....
.....
.....
.....

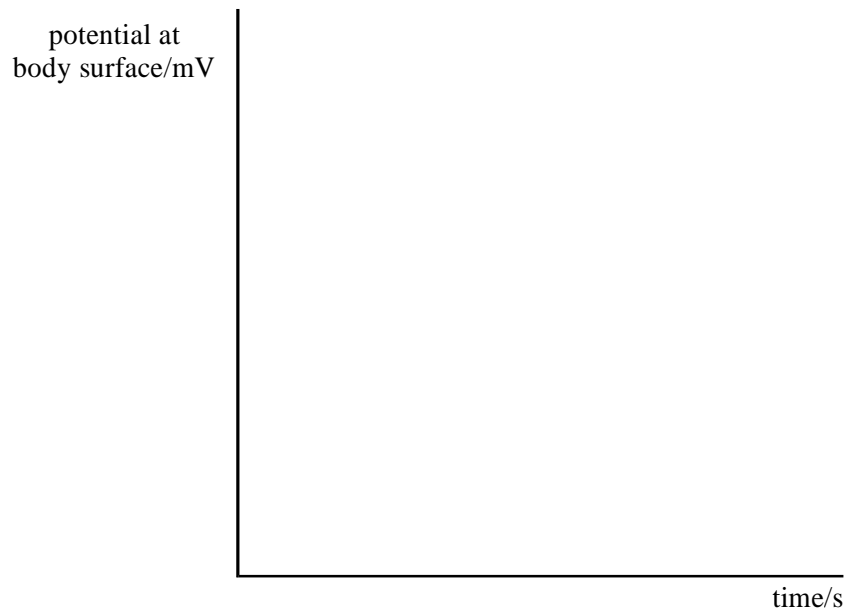
(2)

(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.



Mark on the waveform where the following occur:

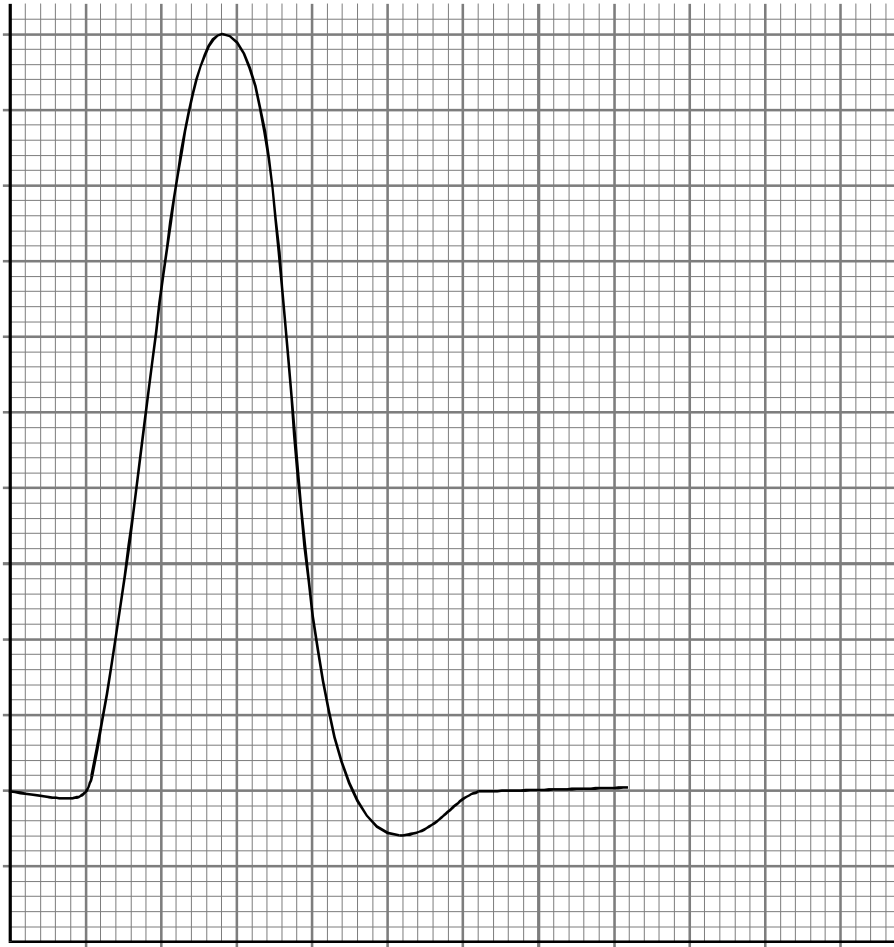
- (i) atrial depolarisation
- (ii) ventricular depolarisation
- (iii) ventricular repolarisation.

(5)

(Total 9 marks)

ECG - Medical Physics Option

3. The graph shows the variation of membrane potential difference with time of a nerve fibre, known as an action potential.



- (a) Complete the graph by adding suitable axes, units and scales.

(3)

- (b) Describe the processes involved in the production of such an action potential when a nerve is stimulated.

You may be awarded marks for the quality of written communication in your answer.

.....
.....
.....
.....
.....
.....
.....

(3)

(Total 6 marks)

ECG - Medical Physics Option

4. (a) Describe the response of the heart to the action potential originating at the sino-atrial node.

You may be awarded marks for the quality of written communication in your answer.

.....

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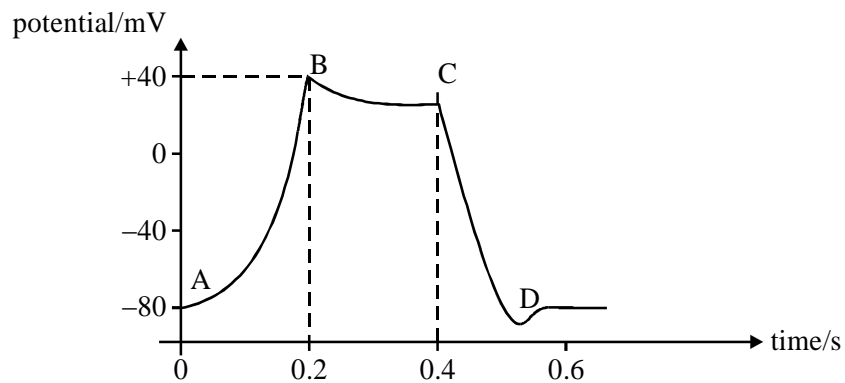
.....

.....

.....

(4)

- (b) The cell membrane action potential changes with time as shown.



The change in action potential results from ion movement in the same way as does the change of action potential across a nerve membrane. AB is a region of depolarisation. CD is a region of repolarisation.

- (i) Describe the ion movement which produces depolarisation.

.....

.....

- (ii) Describe the ion movement which produces repolarisation.

.....

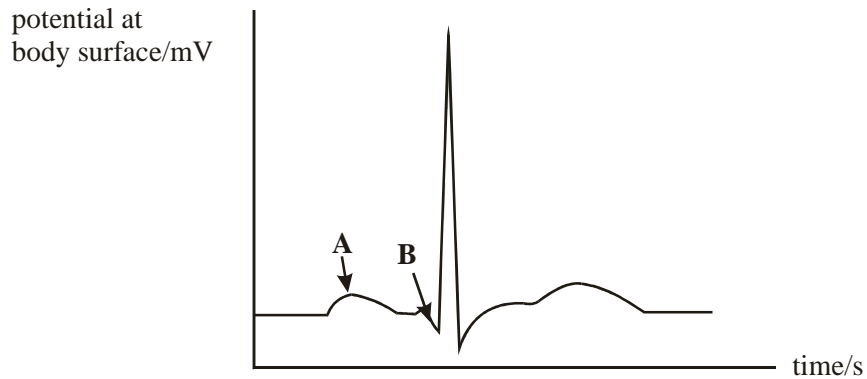
.....

(3)

(Total 7 marks)

ECG - Medical Physics Option

5. 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.



- (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)

ECG - Medical Physics Option

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



(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)