



A-Level Physics

Biological Measurement

Mark Scheme

Time available: 62 minutes

Marks available: 43 marks

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Mark schemes

1.

(a) potential axis: unit mV and suitable labelling of 0 and 1 for scale ✓

time axis suitable use of numbers from 0 to 0.6 / 1 ✓

2

(b) Possible answers to include:

electrodes are not non-reactive ✓

electrodes are not securely taped in place ✓

the patient is not relaxed or does not remain still ✓

the amplifier is not low noise ✓

the amplifier has damaged shielded leads / interference from other AC sources ✓

Any 3 points with reason and some extension to explain.

Be aware of the section 3.1 in the instructions to examiners.

If more than 3 answers given remember

'right + wrong = wrong'

3

[5]

2.

High Level (Good to excellent): 5 or 6 marks

The information conveyed by the answer is clearly organised, logical and coherent, using appropriate specialist vocabulary correctly. The form and style of writing is appropriate to answer the question.

The student accurately describes measures to ensure good contact between the electrodes and the skin including the use of conducting gel. The student will mention the need for more than one electrode and the need for the patient to remain relaxed and still. They will need at least two properties of the amplifier.

Intermediate Level (Modest to adequate): 3 or 4 marks

The information conveyed by the answer may be less well organised and not fully coherent. There is less use of specialist vocabulary, or specialist vocabulary may be used incorrectly. The form and style of writing is less appropriate. The student will include most measures to ensure good contact between electrodes and the skin. They should give a property of the amplifier and may mention the need for the patient to remain relaxed and still.

Low Level (Poor to limited): 1 or 2 marks

The information conveyed by the answer is poorly organised and may not be relevant or coherent. There is little correct use of specialist vocabulary. The form and style of writing may be only partly appropriate. The student will mention electrodes connected to the skin and might make some other sensible comments on the arrangement.

Points which might be considered include:

Attach more than one electrode

To reduce contact resistance

- *sandpaper skin to remove hairs and some dead skin*
- *apply conducting gel between electrode and skin*
- *securely attach electrode and stick / tape in place*

To remove unwanted signals

- *electrodes should be non-reactive*
- *patient to remain relaxed and still*
- *shielded leads / reducing interference from ac sources*

Properties of amplifier

- *large input impedance*
- *high gain*
- *low noise or differential amp*

[6]

3.

- (a) ECG trace to show:
 sec on x-axis and mV on y-axis (1)
 correct value on x axis (0.7 s to end of trace) (1)
 correct values on y axis (start at 0, highest point at 1 mV) (1)
 shape of curve (1)

4

- (b)

<i>precaution</i>	+	<i>explanation</i>
attach firmly		stop noise
remove dead skin/hair		reduce contact resistance
use conducting gel		remove air for better electrical contact
positioning of electrodes		to get largest pd

any two pairs (1) (1)

2

[6]

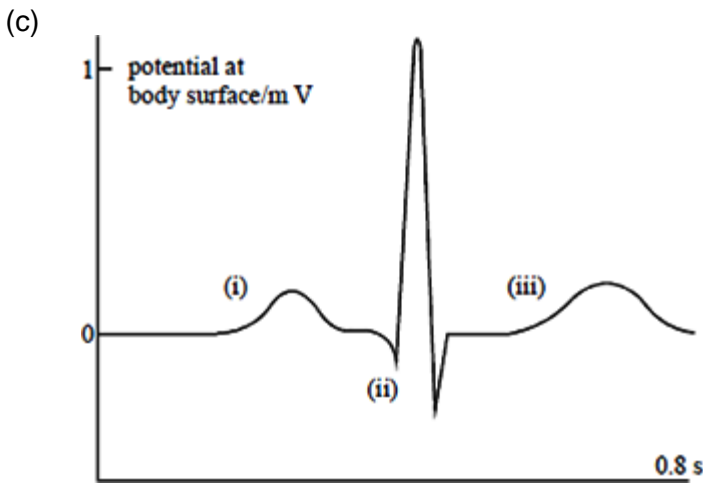
4.

- (a) electrodes made from a material which does not become polarised
 electrodes coated with conducting gel any two (2)
 hair and dead skin removed

2

- (b) high gain
 high input impedance any two (2)
 low noise

2



for waveform:
 suitable scales (1)
 correct shape (1)

for marking in correct position on waveform:
 atrial depolarisation (i) (1)
 ventricular depolarisation (ii) (1)
 ventricular repolarisation (iii) (1)

5

[9]

5.

- (a) pulse amplitude: 0.9 or 1.0 mV (1)

(1)

(b) $T = 0.7 \text{ s}$ (1)

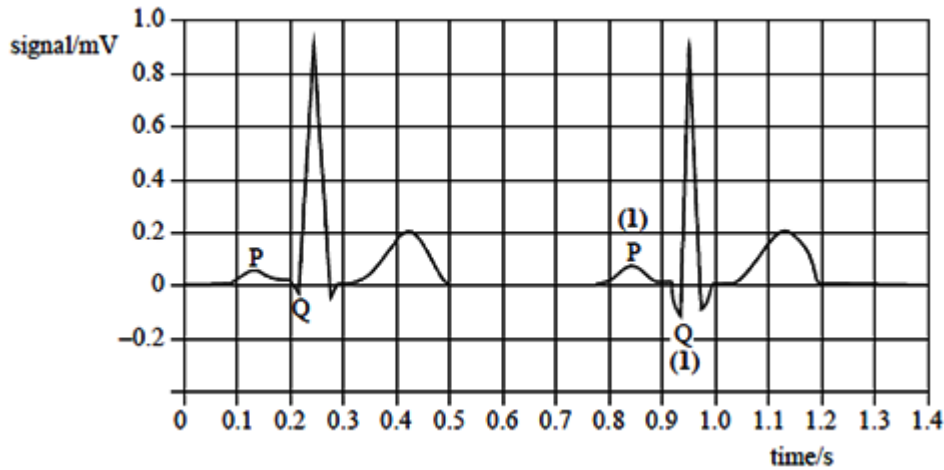
$$f = \frac{60}{0.7} = 86 \text{ min}^{-1} \text{ (1)}$$

(2)

(c) T would get shorter (1)
flat part of trace would shrink (1)

(2)

(d)



(2)

[7]

6.

(a) (i) y-scale: +1 to -0.2 V (1)
x-scale: 0 to 0.8 s (1)

(ii) position A: *event* - sino atrial node fires (1)
result - atria contracts (1)

position B: *event* - ventricular node fires (1)
result - ventricles contract (1)

6

(b) precaution: remove dead skin
[or use conducting/electrode gel] (1)
reason: to give best possible contact between person
and electrode (1)

2

(c) low noise (1)
high input impedance (1)
[or any other suitable property]

2
QWC 1

[10]