

# **Applied Science**

Advanced Subsidiary GCE

Unit **G622**: Monitoring the Activity of the Human Body

## **Mark Scheme for January 2012**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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## Annotations

Annotation	Meaning
	Correct point
	Incorrect point
	Benefit of the doubt
	No benefit of doubt given
	Error carried forward
	Omission mark
	Ignore
	Reject

Highlighting is also available to highlight any particular points on the script.  
Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= alternative and acceptable answers for the same marking point
✓	= separates marking points
<b>not</b>	= answers which are not worthy of credit
<b>reject</b>	= answers which are not worthy of credit
<b>ignore</b>	= statements which are irrelevant
<b>allow</b>	= answers that can be accepted
( )	= words which are not essential to gain credit
<u>    </u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording

Question		Answer	Marks	Guidance	
1	(a)	<p><b>maximum:</b> 2 marks for risks &amp; 2 marks for benefits</p> <p><i>risks – any <b>two</b> from:</i>            can cause, mutations/cancer - dosage can <b>accumulate</b> / <b>ionising</b> radiation ✓            electric shock - needs a <b>high voltage</b> (supply) / electrical hazards ✓            potential for incorrect diagnosis - <b>poor soft tissue</b> resolution/ soft tissues not be seen clearly ✓</p> <p><i>benefits - any <b>two</b> from:</i>  <b>non-invasive</b>, does not require surgery – is not painful, no post-surgery problems ✓            can readily <b>identify</b>, damage/problems, with bones - see bones / good bone resolution ✓  <b>quick</b> / does not take a long time to carry out – obtain results quickly / treated quickly ✓            (relatively) <b>cheap</b> – available in hospitals and some medical centres ✓  <b>portable</b> units available – can be, taken to patients/used outside of hospitals ✓</p>	4	<p><b>accept</b> responses across the risk/explanation areas for each separate point</p> <p><b>ignore</b> high dosage of radiation  <b>ignore</b> damage to cells/embryos</p> <p>see broken bones = 1 mark  <b>ignore</b> easy  <b>ignore</b> untrained staff  <b>accept</b> readily available</p>	
	(b)	(i)	<p><i>any <b>one</b> from:</i>            can give colour-enhanced images ✓            can show, real images/moving body parts ✓            3D images ✓            soft tissue (resolution) ✓</p>	1	OWTTE

Question	Answer	Marks	Guidance									
(ii)	<p><b>Level 0 (0 marks)</b> Candidate does <b>not</b> include sufficient valid points</p> <p><b>Level 1 (1 mark)</b> Candidate shows a basic understanding of how an X-ray and ultrasound scanner can be jointly used to show internal features, including at least <b>two valid points</b> but with little or no clear explanation.</p> <p><b>Level 2 (2 - 3 marks)</b> Candidate shows an understanding, explaining the <b>basic principles</b> of how an X-ray and ultrasound scanner can be jointly used to show internal features of the back and hip, including <b>at least three</b> valid points expressed clearly.</p> <p><b>Level 3 (4 marks)</b> Candidate shows a high level of understanding and gives a <b>full</b> explanation of how an X-ray and ultrasound scanner can be jointly used to show internal features of the back and hip, including <b>at least four</b> valid points expressed clearly and logically.</p>	4	<p><b>valid points</b></p> <ul style="list-style-type: none"> <li>• <b>X ray</b> (images formed to) show <b>bones</b></li> <li>• <b>ultrasound</b> (images showing details of) <b>soft tissues</b> eg ligaments, tendons, blood vessels, nerves, cysts, tumours; - <b>ignore</b> organs</li> <li>• results can assist the <b>diagnosis</b>/ find the cause eg. damaged bones</li> <li>• results can assist the future <b>treatment</b></li> <li>• <b>accept</b> other AVP</li> </ul> <p><b>ignore</b> refs. to further diagnostic testing</p>									
(c)	<p>one mark for each correct answer in each box</p> <table border="1"> <thead> <tr> <th>hazard</th> <th>risk</th> <th>safety</th> </tr> </thead> <tbody> <tr> <td>small space / enclosed space / restricted environment / patient is obese ✓</td> <td><i>[increased stress due to claustrophobia]</i></td> <td>sedate/calm, reassure patient / counselling / listen to music / safety button ✓</td> </tr> <tr> <td><i>[high radiation dose]</i></td> <td>cancer/damage to DNA/mutation ✓</td> <td>infrequent use ✓</td> </tr> </tbody> </table>	hazard	risk	safety	small space / enclosed space / restricted environment / patient is obese ✓	<i>[increased stress due to claustrophobia]</i>	sedate/calm, reassure patient / counselling / listen to music / safety button ✓	<i>[high radiation dose]</i>	cancer/damage to DNA/mutation ✓	infrequent use ✓	4	<p><b>ignore</b> limiting/less radiation/ short exposure</p> <p><b>ignore</b> ref. past exposure/ protective clothing</p>
hazard	risk	safety										
small space / enclosed space / restricted environment / patient is obese ✓	<i>[increased stress due to claustrophobia]</i>	sedate/calm, reassure patient / counselling / listen to music / safety button ✓										
<i>[high radiation dose]</i>	cancer/damage to DNA/mutation ✓	infrequent use ✓										
	<b>Total</b>	<b>13</b>										

Question			Answer	Marks	Guidance
2	(a)	(i)	<p><b>type 1 diabetes (causes)</b> diminished production of insulin/ damage to pancreas/ inefficient pancreas function/ due to autoimmunity/ inherited ✓</p> <p><b>type 2 diabetes (causes)</b> limited response to (resistance to) insulin/ linked to genetic factors, heredity/ obesity ✓</p>	2	<p>OWTTE</p> <p><b>accept</b> given too many steroids</p> <p><b>ignore</b> ref. to sedentary lifestyle/diet <b>accept</b> pregnancy</p>
		(ii)	<p><b>type 1 diabetes (treatment)</b> <b>insulin</b> (injections) ✓</p> <p><b>type 2 diabetes (treatment)</b> dietary adjustment/ fewer sugars/carbohydrates in diet/ <b>insulin</b> (injections)/ healthy/special, diet ✓</p>	2	<p>OWTTE</p> <p><b>reject</b> insulin tablets <b>ignore</b> unqualified injections <b>allow</b> other valid answers eg metformin tablets <b>reject</b> insulin tablets <b>ignore</b> ref. to exercise</p>
	(b)		<p><i>any two from:</i> patient must be, starved of food/fasting, for 6 - 14 hours/ overnight ✓ record blood glucose levels at end of starvation period (before test period) ✓ give patient a glucose/ sugar drink ✓ record/monitor, blood glucose levels, during the test period/ every half an hour ✓</p>	2	<p><b>ignore</b> unqualified fasting</p> <p><b>accept</b> ref. to repeating glucose tests</p>
	(c)		<p>biosensor must be in contact with <b>blood</b> ✓</p>	1	<p>OWTTE</p> <p><b>ignore</b> prick finger without ref. to blood <b>accept</b> any realistic technique used to put blood in contact with the biosensor <b>ignore</b> ref. to clinistix</p>
	(d)		<p><i>any one from:</i> excess, sugar/carbohydrate/fats, in diet causes <b>problems in insulin production</b> ✓ cells/body, <b>less able to respond to insulin levels/</b> less sensitive to insulin ✓</p>	1	
<b>Total</b>				<b>8</b>	

Question		Answer	Marks	Guidance
3	(a)	A <i>(vena cava)</i> B <u>right</u> atrium/auricle C tricuspid/atrioventricular/ AV <u>valve</u> D <i>(aorta)</i> E pulmonary artery F <u>left</u> atrium/auricle G bicuspid/atrioventricular/ AV/mitral <u>valve</u> H <u>left</u> ventricle	3	5 or 6 correct = 3 marks ✓ ✓ ✓ 3 or 4 correct = 2 marks ✓ ✓ 1 or 2 correct = 1 mark ✓  <b>accept</b> phonetic spelling <b>accept</b> atria = atrium <b>allow</b> chordae tendinae for H <b>reject</b> incorrect ref. to left or right AV
	(b)	atrioventricular / bicuspid and tricuspid valves, <b>close</b> ✓ semilunar / aortic and pulmonary valves, <b>open</b> ✓	2	OWTTE <b>accept</b> reference to correct letters from Fig. 3.1 <b>ignore</b> unqualified ref. to valves <b>accept</b> either order of response/ either named side <b>apply</b> independent marking points
	(c)	low blood pressure ✓ prevents backward flow of blood / prevents blood going the wrong way / would not return to heart ✓	2	<b>ignore</b> veins do not have a pulse
	(d)	increases the heart rate ✓ increases the strength of the pumping, stroke volume ✓	2	OWTTE <b>accept</b> greater volume of blood passes through heart with each beat increased cardiac output = 2 marks
	(e)	(B), F, C, D, (G), E, I, H, (A)  F before C, C before D, E before I, I before H letter <b>must</b> be <b>immediately before</b> corresponding letter	3	four links correct = 3 marks three links correct = 2 marks two links correct = 1 mark one or no links correct = 0 marks
	(f)	(i) ECG, electrocardiograph ✓	1	<b>accept</b> phonetic spellings/ electrocardiogram
		(ii) (heart beat rate =) $60 \div 1$ to 1.1 ✓  = 54.5 (beats per minute) ✓	2	calculation based on 5-5.5 squares on graph paper / 1s to 1.1s between each beat; <b>allow</b> range from 54-60 (beats per minute) = 2 marks

Question		Answer	Marks	Guidance
	(iii)	<p><b>for trace X any two from:</b></p> <p>faster heart beat rate/ beats are closer together ✓</p> <p>has an irregular pattern ✓</p> <p>only one clear ridge between spikes (not clear points P and T) ✓</p> <p>spikes (points R) are higher / greater / clear variation in height of spikes ✓</p> <p>troughs (points S) are deeper / greater ✓</p>	2	<p><b>allow</b> vice versa for <b>trace Y</b> but only for a different feature.</p> <p><b>accept</b> correct ref. to P, Q, R, S and T stages</p> <p>must state the trace (either X or Y) clearly, if not, 1 mark max</p>
	(iv)	(ventricular) fibrillation/ VF / myocardial infarction / heart attack / cardiac arrest ✓	1	
	(v)	another heart attack / cardiac arrest / die ✓	1	<b>accept</b> the heart will stop
(g)	(i)	<p><b>Level 0 [0 marks]</b> Candidate does <b>not</b> include sufficient valid points</p> <p><b>Level 1 [1 mark]</b> Candidate shows a basic understanding of how to use a digital sphygmomanometer, including at least <b>two valid points</b> but with little or no clear explanation.</p> <p><b>Level 2 [2 - 3 marks]</b> Candidate shows an understanding, describing the <b>basic principles</b> of how to use a digital sphygmomanometer, including <b>at least three</b> valid points expressed clearly.</p> <p><b>Level 3 [4 marks]</b> Candidate shows a high level of understanding and gives a <b>full</b> explanation of how to use a digital sphygmomanometer, including <b>at least four</b> valid points expressed clearly and logically.</p>	4	<p><b>valid points</b></p> <ul style="list-style-type: none"> <li>• relax/ comfortable/ sit down;</li> <li>• attach to wrist/ (upper) arm (with strap)</li> <li>  <b>ignore</b> lower arm</li> <li>• hold wrist to heart height/ rest arm on table/ flat surface;</li> <li>• <b>switch on to pump up/ tighten</b> (wrist) band;</li> <li>• record/check/look at, values/readings;</li> </ul> <p><b>ignore</b> ref. to manual type</p>
	(ii)	(120mmHg) systolic pressure / systole ✓ (80mmHg) diastolic pressure / diastole ✓	2	<p><b>ignore</b> ref. to ventricular/atrial</p> <p><b>allow</b> phonetic spellings</p>
<b>Total</b>			<b>25</b>	

Question		Answer	Marks	Guidance																													
4	(a)	<table border="1"> <thead> <tr> <th rowspan="2">structure</th> <th colspan="4">feature</th> </tr> <tr> <th>cartilage</th> <th>goblet cells</th> <th>smooth muscle</th> <th>cilia</th> </tr> </thead> <tbody> <tr> <td>trachea</td> <td>(✓)</td> <td>(✓)</td> <td>(✓)</td> <td>(✓)</td> </tr> <tr> <td>bronchus</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>large bronchiole</td> <td>X or ✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>alveolus</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> </tr> </tbody> </table>	structure	feature				cartilage	goblet cells	smooth muscle	cilia	trachea	(✓)	(✓)	(✓)	(✓)	bronchus	✓	✓	✓	✓	large bronchiole	X or ✓	✓	✓	✓	alveolus	X	X	X	X	3	<p>one mark for each correct row (below the completed top row)</p> <p><b>must</b> show ticks/crosses – no mark for a row if boxes are blank</p>
structure	feature																																
	cartilage	goblet cells	smooth muscle	cilia																													
trachea	(✓)	(✓)	(✓)	(✓)																													
bronchus	✓	✓	✓	✓																													
large bronchiole	X or ✓	✓	✓	✓																													
alveolus	X	X	X	X																													
	(b)	<u>diffusion</u> ✓	1	<b>accept</b> phonetic spellings																													
	(c)	<p><i>any <b>two</b> from:</i></p> <p>efficient/effective, high/quick, <b>rate</b>/ of, gas exchange/diffusion ✓</p> <p>short, <b>distance</b> / path / AW ✓</p> <p>(so that), diffusion/concentration, <b>gradient</b> is, high/steep ✓</p>	2	<p><b>accept</b> high rate of movement of correctly named gas in correct direction</p> <p><b>ignore</b> gas exchange occurs more 'easily'</p> <p><b>ignore</b> ref to number of cells / cell thickness or short space</p> <p><b>ignore</b> short gradient</p>																													
	(d)	<p>contract</p> <p>downwards</p> <p>upwards <b>and</b> outwards (either order)</p> <p>increases</p> <p>decreases</p>	4	<p>five correct responses = 4 marks</p> <p>four correct responses = 3 marks</p> <p>three correct responses = 2 marks</p> <p>two correct responses = 1 mark</p> <p>one or no correct responses = 0 marks</p>																													

Question		Answer	Marks	Guidance												
	(e) (i)	(male) <u>5-6</u> ✓ (female) <u>4-5</u> ✓	2	<b>accept</b> ranges or values within the correct ranges												
	(ii)	air will only, enter/leave, from the mouth/not from the nose/not from the atmosphere ✓ this will lead to, <b>unreliable/false</b> , results ✓	2	OWTTE ignore ref. to accurate results												
	(iii)	breathe in as deeply as possible ✓ then breathe out as deeply as possible ✓	2	OWTTE must be in correct order stop marking if return to normal breathing between the two stages												
	(f) (i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>tidal volume/ dm<sup>3</sup></th> <th>breathing rate/ breaths min<sup>-1</sup></th> <th>lung ventilation <u>dm<sup>3</sup> min<sup>-1</sup></u> ✓</th> </tr> </thead> <tbody> <tr> <td>Arthur</td> <td>(0.5)</td> <td>(12)</td> <td><b>6.0</b> ✓</td> </tr> <tr> <td>Ranjit</td> <td>(0.2)</td> <td><b>30</b> ✓</td> <td>(6.0)</td> </tr> </tbody> </table>		tidal volume/ dm <sup>3</sup>	breathing rate/ breaths min <sup>-1</sup>	lung ventilation <u>dm<sup>3</sup> min<sup>-1</sup></u> ✓	Arthur	(0.5)	(12)	<b>6.0</b> ✓	Ranjit	(0.2)	<b>30</b> ✓	(6.0)	3	one for each correct value in the table, including the mark for correct lung ventilation units  <b>reject</b> dm <sup>3</sup> per min <sup>-1</sup>
	tidal volume/ dm <sup>3</sup>	breathing rate/ breaths min <sup>-1</sup>	lung ventilation <u>dm<sup>3</sup> min<sup>-1</sup></u> ✓													
Arthur	(0.5)	(12)	<b>6.0</b> ✓													
Ranjit	(0.2)	<b>30</b> ✓	(6.0)													
	(ii)	<i>any one from:</i> 0.2 compared with 0.4 – 0.5 ✓  <b>much</b> smaller/lower/very low, half or less than half the volume ✓	1	OWTTE <b>must</b> ref. to both values <b>ignore</b> refs. to Arthur <b>reject</b> is smaller/lower												
	(iii)	the <b>maximum speed</b> of expiration/ <b>maximum peak flow rate</b> ✓	1	OWTTE <b>ignore</b> unqualified ref. to speed/rate <b>allow</b> peak <u>expiratory</u> flow rate												

Question		Answer	Marks	Guidance
	(iv)	<p><b>three</b> from:</p> <p>take a deep breath / full breath in ✓</p> <p>then breathe out at rapid/hard/maximum <b>force</b> ✓</p> <p>ensure, sitting down/relaxed, at start ✓</p> <p>sterilise/clean, the mouthpiece ✓</p> <p>ensure lips sealed around mouth piece ✓</p> <p>zero the equipment ✓</p> <p>obtain highest of 3 readings ✓</p> <p>hold equipment horizontal ✓</p>	3	<p>mark first three instructions and then stop marking</p> <p><b>ignore</b> maximum exhalation</p> <p><b>reject</b> average of 3 readings</p>
	(v)	<p>400 – 600</p> <p><u>dm<sup>3</sup>min<sup>-1</sup></u></p>	2	<p><b>accept</b> any single value or smaller range within the range 400 - 600</p> <p>must have correct units</p>
	(vi)	oxygen levels increase <b>and</b> carbon dioxide levels decrease ✓	1	OWTTE
<b>Total</b>			<b>27</b>	



Question		Answer	Marks	Guidance								
	(c)	<p><i>any two from:</i>            nerve impulse (transmission) ✓            active transport ✓            metabolic reactions ✓</p>	2	OWTTE  <b>accept</b> named, reactions/processes, eg sperm swimming, cell division <b>ignore</b> digestion								
	(d)	<p><i>any two from:</i>            red (blood) cell count / Hb / iron levels ✓            oxygen/carbon dioxide, levels ✓            lactic acid levels ✓            glucose levels ✓</p>	2	OWTTE <b>ignore</b> blood count/ white blood cells  <b>accept</b> blood sugar = glucose								
	(e)	<table border="1"> <thead> <tr> <th>risk to physiologist</th> <th>safety precaution</th> </tr> </thead> <tbody> <tr> <td>(infection from) needle stick injury/ pricking own skin ✓</td> <td><i>any one from:</i> safe disposal of needle ✓ training ✓ use of new/sterile needle ✓</td> </tr> <tr> <td>infection via, damaged/broken, skin / cut ✓</td> <td><i>any one from:</i> wear safety plaster ✓ wear gloves ✓</td> </tr> <tr> <td>injury from sudden reaction of patient ✓</td> <td><i>any one from:</i> calm/reassure the patient ✓ training ✓</td> </tr> </tbody> </table>	risk to physiologist	safety precaution	(infection from) needle stick injury/ pricking own skin ✓	<i>any one from:</i> safe disposal of needle ✓ training ✓ use of new/sterile needle ✓	infection via, damaged/broken, skin / cut ✓	<i>any one from:</i> wear safety plaster ✓ wear gloves ✓	injury from sudden reaction of patient ✓	<i>any one from:</i> calm/reassure the patient ✓ training ✓	4	each precaution <b>must</b> be related to the correctly named risk  <b>accept</b> other correct risks/precautions
risk to physiologist	safety precaution											
(infection from) needle stick injury/ pricking own skin ✓	<i>any one from:</i> safe disposal of needle ✓ training ✓ use of new/sterile needle ✓											
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injury from sudden reaction of patient ✓	<i>any one from:</i> calm/reassure the patient ✓ training ✓											
		<b>Total</b>	<b>17</b>									
		<b>Paper Total</b>	<b>90</b>									

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