

Applied Science

Advanced Subsidiary GCE

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

Mark Scheme for January 2012

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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
not	= answers which are not worthy of credit
reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant
allow	= 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>maximum: 2 marks for risks & 2 marks for benefits</p> <p><i>risks – any two from:</i> can cause, mutations/cancer - dosage can accumulate / ionising radiation ✓ electric shock - needs a high voltage (supply) / electrical hazards ✓ potential for incorrect diagnosis - poor soft tissue resolution/ soft tissues not be seen clearly ✓</p> <p><i>benefits - any two from:</i> non-invasive, does not require surgery – is not painful, no post-surgery problems ✓ can readily identify, damage/problems, with bones - see bones / good bone resolution ✓ quick / does not take a long time to carry out – obtain results quickly / treated quickly ✓ (relatively) cheap – available in hospitals and some medical centres ✓ portable units available – can be, taken to patients/used outside of hospitals ✓</p>	4	<p>accept responses across the risk/explanation areas for each separate point</p> <p>ignore high dosage of radiation ignore damage to cells/embryos</p> <p>see broken bones = 1 mark ignore easy ignore untrained staff accept readily available</p>	
	(b)	(i)	<p><i>any one 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>Level 0 (0 marks) Candidate does not include sufficient valid points</p> <p>Level 1 (1 mark) Candidate shows a basic understanding of how an X-ray and ultrasound scanner can be jointly used to show internal features, including at least two valid points but with little or no clear explanation.</p> <p>Level 2 (2 - 3 marks) Candidate shows an understanding, explaining the basic principles of how an X-ray and ultrasound scanner can be jointly used to show internal features of the back and hip, including at least three valid points expressed clearly.</p> <p>Level 3 (4 marks) Candidate shows a high level of understanding and gives a full explanation of how an X-ray and ultrasound scanner can be jointly used to show internal features of the back and hip, including at least four valid points expressed clearly and logically.</p>	4	<p>valid points</p> <ul style="list-style-type: none"> • X ray (images formed to) show bones • ultrasound (images showing details of) soft tissues eg ligaments, tendons, blood vessels, nerves, cysts, tumours; - ignore organs • results can assist the diagnosis/ find the cause eg. damaged bones • results can assist the future treatment • accept other AVP <p>ignore 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>ignore limiting/less radiation/ short exposure</p> <p>ignore 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 ✓										
Total		13										

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

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 ✓ accept phonetic spelling accept atria = atrium allow chordae tendinae for H reject incorrect ref. to left or right AV
	(b)	atrioventricular / bicuspid and tricuspid valves, close ✓ semilunar / aortic and pulmonary valves, open ✓	2	OWTTE accept reference to correct letters from Fig. 3.1 ignore unqualified ref. to valves accept either order of response/ either named side apply independent marking points
	(c)	low blood pressure ✓ prevents backward flow of blood / prevents blood going the wrong way / would not return to heart ✓	2	ignore veins do not have a pulse
	(d)	increases the heart rate ✓ increases the strength of the pumping, stroke volume ✓	2	OWTTE accept 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 must be immediately before 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	accept 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; allow range from 54-60 (beats per minute) = 2 marks

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

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>must 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	accept phonetic spellings																													
	(c)	<p><i>any two from:</i></p> <p>efficient/effective, high/quick, rate/ of, gas exchange/diffusion ✓</p> <p>short, distance / path / AW ✓</p> <p>(so that), diffusion/concentration, gradient is, high/steep ✓</p>	2	<p>accept high rate of movement of correctly named gas in correct direction</p> <p>ignore gas exchange occurs more 'easily'</p> <p>ignore ref to number of cells / cell thickness or short space</p> <p>ignore short gradient</p>																													
	(d)	<p>contract</p> <p>downwards</p> <p>upwards and 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	accept 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, unreliable/false , 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/ dm³</th> <th>breathing rate/ breaths min⁻¹</th> <th>lung ventilation <u>dm³ min⁻¹</u> ✓</th> </tr> </thead> <tbody> <tr> <td>Arthur</td> <td>(0.5)</td> <td>(12)</td> <td>6.0 ✓</td> </tr> <tr> <td>Ranjit</td> <td>(0.2)</td> <td>30 ✓</td> <td>(6.0)</td> </tr> </tbody> </table>		tidal volume/ dm ³	breathing rate/ breaths min ⁻¹	lung ventilation <u>dm³ min⁻¹</u> ✓	Arthur	(0.5)	(12)	6.0 ✓	Ranjit	(0.2)	30 ✓	(6.0)	3	one for each correct value in the table, including the mark for correct lung ventilation units reject dm ³ per min ⁻¹
	tidal volume/ dm ³	breathing rate/ breaths min ⁻¹	lung ventilation <u>dm³ min⁻¹</u> ✓													
Arthur	(0.5)	(12)	6.0 ✓													
Ranjit	(0.2)	30 ✓	(6.0)													
	(ii)	<i>any one from:</i> 0.2 compared with 0.4 – 0.5 ✓ much smaller/lower/very low, half or less than half the volume ✓	1	OWTTE must ref. to both values ignore refs. to Arthur reject is smaller/lower												
	(iii)	the maximum speed of expiration/ maximum peak flow rate ✓	1	OWTTE ignore unqualified ref. to speed/rate allow peak <u>expiratory</u> flow rate												

Question		Answer	Marks	Guidance
	(iv)	<p>three from:</p> <p>take a deep breath / full breath in ✓</p> <p>then breathe out at rapid/hard/maximum force ✓</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>ignore maximum exhalation</p> <p>reject average of 3 readings</p>
	(v)	<p>400 – 600</p> <p><u>dm³min⁻¹</u></p>	2	<p>accept any single value or smaller range within the range 400 - 600</p> <p>must have correct units</p>
	(vi)	oxygen levels increase and carbon dioxide levels decrease ✓	1	OWTTE
Total			27	

Question			Answer	Marks	Guidance
5	(a)	(i)	$(28.7 - 1.3) \div 1.3 \times 100 \checkmark$ = 2107.69 or 2107.7 or 2108 \checkmark	2	correct response = 2 marks accept up to two decimal places
		(ii)	<p>ATP change: decreases 4.0 to 3.2/ by 0.8/ 20(%) \checkmark any one from: insufficient, oxygen/glucose, delivered (to muscles) \checkmark glycogen/glucose reserves used up (in muscles) \checkmark (ATP) used in muscle contraction \checkmark (ATP) is source of energy \checkmark</p> <p>glycogen change: decreases 83.6 to 55.1/ by 28.5/ 34.1(%)\checkmark any one from: contracting muscles need energy \checkmark respiration rate increases \checkmark broken down to release glucose (for respiration) \checkmark</p> <p>lactic acid change: increases 1.3 to 28.7 / by 27.4 / 2107.7(%) (ecf from 5[a][i]) \checkmark any one from: anaerobic respiration taking place (releases lactic acid) \checkmark insufficient, oxygen/glucose, (delivered to muscles) \checkmark aerobic respiration insufficient \checkmark</p>	1 1 1 1 1 1	<p>correct change must be stated for each OWTTE for explanations accept ref. to data change in the explanation text units if quoted must be correct can allocate mark for correct explanation even if data not provided</p> <p>ignore used up energy</p> <p>if ecf is a decreased value – can give a mark if correct explanation states that lactic acid decreases due to aerobic respiration</p>
	(b)		(lactic acid), is toxic/ poisonous/ causes muscle fatigue \checkmark	1	reject cramp ignore harmful/ dangerous/ hazardous/ painful

Question		Answer	Marks	Guidance								
	(c)	<p><i>any two from:</i> nerve impulse (transmission) ✓ active transport ✓ metabolic reactions ✓</p>	2	<p>OWTTE</p> <p>accept named, reactions/processes, eg sperm swimming, cell division ignore digestion</p>								
	(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	<p>OWTTE</p> <p>ignore blood count/ white blood cells</p> <p>accept blood sugar = glucose</p>								
	(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	<p>each precaution must be related to the correctly named risk</p> <p>accept other correct risks/precautions</p>
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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Total			17									
Paper Total			90									

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