

**Applied Science**

Advanced Subsidiary GCE

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

**Mark Scheme for January 2013**

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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.

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## Annotations

Annotation	Meaning
	Tick
	Cross
	Benefit of doubt
	Error carried forward
	Example/Reference
	Ignore
	Not answered question
	Benefit of doubt not given
	Large dot (Key point attempted)
	Reject
	Contradiction
	Error in no. of significant figures
	Unclear
	Omission mark

**Abbreviations, annotations and conventions used in the detailed Mark Scheme** (to include abbreviations and subject-specific conventions).

<b>Annotation</b>	<b>Meaning</b>
/	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>accept</b>	answers that can be accepted
( )	words which are not essential to gain credit
—	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Question		Answer	Marks	Guidance
1	(a)	no damage / not harmful / safer ✓ no, surgery/cuts/scars ✓ not painful / no anaesthetic / less stressful ✓ quick(er) / less time in hospital ✓ no/reduce, chance of, infection/complications ✓	2	<b>ignore</b> less expensive / no known side effects <b>ignore</b> not penetrating the skin <b>ignore</b> not stressful
	(b)	<p><b>[Level 0]</b> Candidate includes <b>fewer than two</b> valid points <i>(0 marks)</i></p> <p><b>[Level 1]</b> Candidate shows a basic understanding of how X-ray radiography can be used to show internal features, including at least <b>two valid points</b> but with little or no explanation. <i>(1 mark)</i></p> <p><b>[Level 2]</b> Candidate shows an understanding, explaining the basic principles of how X-ray radiography can be used to show internal features, including <b>at least three</b> valid points expressed clearly and logically. <i>(2–3 marks)</i></p> <p><b>[Level 3]</b> Candidate shows a high level of understanding and gives a full explanation of how X-ray radiography can be used to show internal features, including <b>at least four</b> valid points expressed clearly and logically. <i>(4–5 marks)</i></p>	5	<p><b>valid points</b></p> <ul style="list-style-type: none"> <li>• X-ray/radiation passes through/into body</li> <li>• X-ray film/image recorded/stored/printed</li> <li>• image dark where most gets through/X-ray exposes the negative/film</li> <li>• bones/metal/implants, appear white or light grey /shadow image <b>OR</b> soft tissue/gas, appear dark</li> <li>• X-rays have a very short wavelength</li> <li>• bones/metal/implants/denser material, absorbs more X-rays/radiation / soft tissues absorb less X rays/radiation <b>OR</b> different tissues absorb different amounts of X-rays</li> <li>• bones/metal/implants, give better resolution/show up more clearly</li> <li>• ignore references to generation of X-rays</li> </ul>

Question		Answer	Marks	Guidance
	(c) (i)	<p>any <b>one</b> from</p> <p>shows detailed/clear, soft tissues/muscles ✓</p> <p>good resolution of soft tissues/muscles ✓</p> <p>gives 3D image ✓</p>	1	<p><b>accept</b> any correctly named soft tissue e.g. ligaments</p> <p><b>ignore</b> accurate / seen easily</p>
	(ii)	<p>any <b>two</b> from:</p> <p>uses magnetism/magnet ✓</p> <p>metal/implant, attracted/moves ✓</p> <p>metal/implant, may damage, tissues/blood vessels/equipment ✓</p> <p>metal/implant, affects quality of image ✓</p>	2	<p><b>ignore</b> unqualified reference to metal implants</p> <p><b>accept</b> metal/implants attracted/moves to magnet = 2 marks</p> <p><b>accept</b> general reference to unsafe/harmful</p> <p><b>accept</b> metal implants heat up</p>
	(d)	<p><b>risk</b> – cancer / cell/tissue/DNA damage/mutation / accumulative dose ✓</p> <p><b>safety precaution</b> –leave area / go out of room / wear a <b>lead</b> apron / stand behind <b>lead</b> screen / wear badge to register radiation ✓</p>	2	<p><b>ignore</b> references to the <b>patient</b></p> <p><b>ignore</b> stand behind a <b>glass/safety</b> screen</p> <p><b>ignore</b> protective clothing unqualified</p>
<b>Total</b>			<b>12</b>	

Question			Answer	Marks	Guidance
2	(a)	(i)	<p><b>goblet cells</b> – produce <u>mucus</u> ✓ mucus traps, bacteria/dust/dirt/particles/pathogens ✓</p> <p><b>cilia</b> – move the <u>mucus</u> ✓ <i>any one from</i> <b>up</b>, towards mouth/ trachea / <b>away</b> from lungs ✓ where it can be swallowed/coughed out ✓</p>	4	<p>mark responses to goblet cells and cilia under own headings <b>ignore</b> reference to germs</p> <p><b>reject</b> cilia filter <b>ignore</b> get rid of mucus <b>ignore</b> remove from body(unqualified)</p>
		(ii)	<p><b>either</b> cartilage ✓ maintain an open, lumen/airway/ trachea, / prevent, lumen/airway/trachea, collapse / give flexibility ✓</p> <p><b>or</b> (smooth/involuntary) muscle ✓ contracts to constrict / change the lumen diameter ✓</p>	2	<p><b>OWTTE</b></p> <p>function mark only given if structure correct</p>
	(b)		<p><i>any five from:</i> rib cage, lowers/moves inwards ✓ sternum lowers ✓ (external) intercostal muscles relax ✓ <u>internal</u> intercostal muscles contract <b>during forced breathing</b> ✓ diaphragm (muscles) relax ✓ diaphragm returns to dome shape/raises ✓ rib cage/thorax/lung volume, decreases ✓ rib cage/thorax/lung pressure, increases ✓</p>	5	<p><b>accept</b> muscles that move the ribs = intercostal</p>

Question		Answer	Marks	Guidance
	(c) (i)	tidal volume = 0.5 – 0.75 (dm <sup>3</sup> ) ✓ breathing rate = 12 (bpm) ✓ VR = 6 to 9 (dm <sup>3</sup> min <sup>-1</sup> ) ✓	3	any correct VR = 3 marks
	(ii)	<u>5</u> (dm <sup>3</sup> ) ✓	1	
	(iii)	breathes more quickly/breathing rate increases/peaks (and troughs) get closer together ✓ tidal volume increases / peaks (and troughs) get bigger / breathing more deeply ✓	2	<b>accept</b> responses in either order <b>ignore</b> breathing, harder/heavier <b>accept</b> increased ventilation rate = 2 marks
	(d) (i)	<i>any two from:</i> large surface area ✓ thin walls / one cell thick ✓ good blood supply ✓ moist / water film ✓ surfactant ✓	2	OWTTE <b>reject</b> thin cell walls <b>ignore</b> thin  <b>accept</b> monophospholipid layer on (alveolar) surface



Question	Answer	Marks	Guidance
(ii)	<p><b>[Level 0]</b> Candidate includes <b>fewer than two</b> valid points <i>(0 marks)</i></p> <p><b>[Level 1]</b> Candidate shows a limited understanding of gaseous exchange in the lungs, including at least <b>two valid points</b> but with little or no explanation. <i>(1 mark)</i></p> <p><b>[Level 2]</b> Candidate shows an understanding, explaining the basic principles of gaseous exchange in the lungs, including <b>at least three</b> valid points expressed clearly and logically. <i>(2 - 3 marks)</i></p> <p><b>[Level 3]</b> Candidate shows a high level of understanding and gives a full explanation of gaseous exchange in the lungs, including <b>at least four</b> valid points expressed clearly and logically. <i>(4 marks)</i></p>	4	<p><b>valid points</b></p> <ul style="list-style-type: none"> <li>• diffusion</li> <li>• oxygen enters blood /leaves alveolus/lungs</li> <li>• RBCs/haemoglobin, carry oxygen</li> <li>• carbon dioxide leaves blood / enters alveolus/lungs</li> <li>• inhaled air contains oxygen and carbon dioxide</li> <li>• less oxygen in the blood/more in alveolus/lungs</li> <li>• more carbon dioxide in blood/less in alveolus/lungs</li> <li>• exhaled air contains less oxygen/more carbon dioxide (than inhaled air)</li> <li>• diffusion/concentration gradient/from high to low concentration</li> <li>• blood flow maintains diffusion/concentration gradient</li> <li>• gases dissolved in, moisture film/blood</li> </ul>
	<b>Total</b>	<b>23</b>	

Question		Answer	Marks	Guidance												
3	(a)	<u>9.0</u> mmol dm <sup>-3</sup> ✓	1													
	(b)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>type 1 diabetes</th> <th>type 2 diabetes</th> </tr> </thead> <tbody> <tr> <td>can be induced by obesity</td> <td></td> <td>✓</td> </tr> <tr> <td>Islet of Langerhans malfunction</td> <td>✓</td> <td></td> </tr> <tr> <td>treated by dietary means in the early stages</td> <td></td> <td>✓</td> </tr> </tbody> </table>		type 1 diabetes	type 2 diabetes	can be induced by obesity		✓	Islet of Langerhans malfunction	✓		treated by dietary means in the early stages		✓	2	3 correct rows = 2 marks 2 correct rows = 1 mark 1 or 0 correct rows = 0 marks
	type 1 diabetes	type 2 diabetes														
can be induced by obesity		✓														
Islet of Langerhans malfunction	✓															
treated by dietary means in the early stages		✓														
	(c) (i)	food is likely to contain <b>glucose / glucose</b> (in food) will affect results ✓	1	OWTTE response <b>must</b> include reference to glucose/sugar/carbohydrate												
	(ii)	for comparison / to see change ✓	1													
	(iii)	<u>84</u> ✓	1													

Question	Answer	Marks	Guidance
(iv)	<p><b>(1)</b> <b>Person A</b></p> <p><i>any two from:</i>            started at, lowest (concentration)/4.5 – 5.0 (mmol dm<sup>3</sup>) ✓            little change / reached 5.2 – 5.5 (mmol dm<sup>-3</sup>) ✓            returns to original/normal ✓            shortest time / 120 minutes, to return to original/normal ✓</p> <p><b>(2)</b> <b>Person B</b></p> <p><i>any two from:</i>            large increase / reached 8.5 – 9.5 (mmol dm<sup>-3</sup>) ✓</p> <p>decreases after 60 minutes ✓            level did not fall back to original/normal ✓</p> <p><b>(3)</b> <b>Person C</b></p> <p><i>any two from:</i>            started at ,highest/above normal (concentration)/10.0 (mmol dm<sup>-3</sup>) ✓            continue to increase / does not fall ✓            highest ( concentration ) reached/13.0 – 14.0 (mmol dm<sup>-3</sup>) ✓</p>	<p>2</p> <p>2</p> <p>2</p>	<p><b>reject</b> no change in glucose level</p> <p><b>accept</b> steeply <b>ignore</b> quickly</p> <p><b>ignore</b> starts high (unqualified)</p>



Question		Answer	Marks	Guidance
4	(a)	pulse rate range = <u>60 to 80</u> ✓ blood pressure = <u>133/85</u> ✓	2	
	(b)	(first reading/133 mmHg is) systolic ✓ (second reading/85 mmHg is) diastolic ✓	2	<b>accept</b> systolic and diastolic = 2 marks <b>reject</b> diastolic and systolic <b>reject</b> atrial systole / diastole
	(c)	<i>any three from:</i> patient relaxed / sitting/ at rest ✓ wrap/secure the cuff/band around the (upper) arm <b>and</b> pump up cuff ✓ release pressure <b>and</b> wait for first pulse ✓ continue to release pressure and wait for continuous flow ✓ use of stethoscope to detect pulse ✓	3	<b>reject</b> sphygmomanometer around arm
	(d)	irregular (PQRS)shape/amplitude ✓ irregular, (heart) beats/rate/frequency ✓	2	<b>ORA</b> <b>accept</b> unclear = irregular <b>ignore</b> rhythm <b>accept</b> unqualified irregular = 1 mark only <b>accept</b> clear, labelled diagram = 1 mark

Question		Answer	Marks	Guidance
	(e) (i)	<p>any <b>three</b> from:</p> <p>sound waves enter the body ✓</p> <p>gel, provides an air-tight seal/prevents reflection / coupling gel is used ✓</p> <p>(waves) reflected/bounced back / echo ✓</p> <p>waves form an image ✓</p>	3	<p><b>ignore</b> ultrasound without reference to waves</p> <p><b>accept</b> pass through = enter</p>
	(ii)	<p>any <b>two</b> from:</p> <p>non-invasive / does not require surgery ✓</p> <p>shows, real-time/3D, images ✓</p> <p>good soft tissue resolution / soft tissue seen clearly ✓</p> <p>portable / readily available ✓</p> <p>no ionising radiation / non-ionising ✓</p> <p>no known side effects / safe / not harmful ✓</p>	2	<p><b>ignore</b> harmful (radiation)</p>
	(iii)	<p>confirming pregnancy / monitoring foetal development ✓</p> <p>monitoring blood flow through vessels ✓</p> <p>viewing tumours ✓</p>	1	<p><b>ignore</b> unqualified pregnancy</p> <p><b>reject</b> any therapeutic use eg shattering kidney / gall stones</p>
	(f)	<p><b>for...</b></p> <p><b>at least one</b> from:</p> <p>may improve quality of life / respond well to treatment ✓</p> <p>less resources / money then needed in long term ✓</p> <p><b>against...</b></p> <p><b>at least one</b> from:</p> <p>may, die/not cope, with surgery/complications during surgery/not improve quality of life ✓</p> <p>resources/money, could be directed to younger patients ✓</p> <p>risk of anaesthesia ✓</p> <p>hospital infections ✓</p> <p>may be confused / have dementia / unable to give informed consent ✓</p>	3	<p><b>must</b> have at least one argument for and one against to obtain 3 marks</p> <p><b>ignore</b> too old</p>
		<b>Total</b>	<b>18</b>	

Question		Answer	Marks	Guidance						
5	(a)	<table border="1"> <thead> <tr> <th>Site of cellular respiration</th> <th>label</th> </tr> </thead> <tbody> <tr> <td>aerobic</td> <td>C</td> </tr> <tr> <td>anaerobic</td> <td>E</td> </tr> </tbody> </table>	Site of cellular respiration	label	aerobic	C	anaerobic	E	2	
Site of cellular respiration	label									
aerobic	C									
anaerobic	E									
	(b)	glucose ✓ carbon dioxide <b>and</b> water ✓ 2 ✓	3	<b>accept</b> correct formulae  <b>ignore</b> ATP/energy						
	(c)	diffusion ✓  <b>oxygen -</b> <b>at least one</b> from: enters blood at <b>alveoli/lungs</b> ✓ in RBCs ✓ forms oxyhaemoglobin ✓  <b>glucose</b> <b>at least one</b> from: enters blood at (small) <b>intestine/liver</b> ✓ dissolved/ in solution ✓ in <b>plasma</b> ✓	3	<b>must</b> have one reference to oxygen and one to glucose to achieve 3 marks  <b>accept</b> air space = alveoli						
	(d) (i)	<b>athlete 3</b> <i>any one</i> from: lactate levels <b>after exercise</b> are, highest/higher/very high ✓ lactate levels show <b>greatest</b> increase ✓ lactate levels very high compared to others ✓ lactate level is 7 (mmol dm <sup>-3</sup> ) ✓	1	<b>must</b> identify correct athlete to obtain mark <b>ignore</b> high levels unqualified						
	(ii)	<i>any two</i> from: less oxygen available ✓ <b>decrease</b> in aerobic respiration ✓ <b>increase</b> in anaerobic respiration ✓ oxygen debt ✓	2	<b>reject</b> no oxygen available <b>accept</b> shift of aerobic to anaerobic = 2 mark  <b>ignore</b> cramp						

Question		Answer	Marks	Guidance
	(e)	<p><i>any three from:</i>            correctly named type of thermometer                eg oral, rectal, ear (tympanic), band, clinical ✓            correct use of thermometer ✓            correct reference to time left in contact with body ✓            correct method of reading the value ✓</p>	3	<p><b>ignore</b> digital / electrical unqualified  <b>ignore</b> mercury thermometer</p> <p><b>accept</b> reading value from digital display</p>
	(f)	<p>(i) <b>performance-enhancing drugs</b>            (anabolic) steroids / testosterone / beta-blockers /            anabolic androgenic steroids (or named) / caffeine /            erythropoietin(EPO) ✓</p> <p><b>recreational drugs</b>            cannabis / amphetamines / cocaine / caffeine / methadone /            morphine / diamorphin (heroin) / alcohol / ecstasy ✓</p>	2	<b>accept</b> other correct examples of drugs
		<p>(ii) <i>any two from:</i>            more, oxygen/oxygenated blood ✓            more aerobic respiration/less anaerobic respiration,                in muscle cells ✓            more, ATP/energy ✓            active for longer / less lactic acid/fatigue ✓</p>	2	
			<b>Total</b>	<b>18</b>
			<b>Paper total</b>	<b>90</b>



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