OCR
Oxford Cambridge and RSA

# GCE

# Applied Science

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

Advanced Subsidiary GCE

# Mark Scheme for June 2018

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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.

**Annotations**

| Annotation | Meaning |
|---|---|
| **DO NOT ALLOW** | 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 |
| __ | Underlined words must be present in answer to score a mark |
| **ECF** | Error carried forward |
| **AW** | Alternative wording |
| **ORA** | Or reverse argument |

**Subject-specific Marking Instructions**

## INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i) UE</td><td>
<table>
<tr><th>Energy feature</th><th>Cellular respiration</th><th>Burning of fuels</th></tr>
<tr><td>Released by living organisms</td><td>✓</td><td></td></tr>
<tr><td>Requires a flame for ignition</td><td></td><td>✓</td></tr>
<tr><td>Released as heat</td><td>✓</td><td>✓</td></tr>
<tr><td>Release always needs oxygen</td><td></td><td>✓</td></tr>
<tr><td>Released as light</td><td></td><td>✓</td></tr>
</table>
</td><td>5</td><td>AO1</td><td>Award one mark for each correct row.</td></tr>
<tr><td></td><td></td><td>(ii) UE</td><td>ATP / Adenosine triphosphate;</td><td>1</td><td>A01</td><td>Allow phonetic spelling</td></tr>
<tr><td></td><td></td><td>(iii) UE</td><td>Any three from:<br>Muscle/cell, contraction;<br>Nerve/impulse, transmission / nerve impulses;<br>Active transport;<br>Metabolic processes;</td><td>3</td><td>A01</td><td>Allow exercise, running, movement<br><br>Allow any correctly named examples of metabolic processes eg sperm swimming, cilia moving, growth, cell division, digestion, excretion</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td>(b)</td><td>DC BA</td><td>
<table>
<tr><th>Feature to monitor</th><th>State of health</th><th>Fitness levels</th></tr>
<tr><td>The circulatory system</td><td>Any one from:<br>• Blood pressure<br>• Pulse rate / heart beat<br>• Blood vessels<br>• Arrhythmia / named eg<br>• Heart (efficiency)</td><td>Strength/size of heart;<br>Strength of heart/cardiac muscle;<br>Blood supply to skeletal/cardiac muscles;<br>Pulse rate, recovery period/during exercise /resting;<br>Lower pulse rate = fitter person;</td></tr>
<tr><td>The respiratory system</td><td>• Peak flow<br>• Tidal volume<br>• Breathing/ ventilation, rate<br>• Vital capacity<br>• Lungs/ respiratory tract</td><td>Strength of ventilation;<br>Breathing rate/tidal volume, during exercise;</td></tr>
<tr><td>The blood</td><td>• (Blood) cells<br>• Blood glucose<br>• Oxygen/CO2 levels</td><td>Lactate levels (during exercise) / indicators of oxygen debt<br>Oxygen-carrying capacity during exercise;</td></tr>
</table>
</td><td>6</td><td>A01 and A02</td><td>For state of health:<br><br>Allow named examples - tachycardia/ bradycardia/ sinus arrhythmia<br><br>For state of health:<br><br>Allow healthy/diseased, lungs/respiratory tract / normal/abnormal, cilia/goblet cell function / asthma / cystic fibrosis.<br><br>For state of health:<br><br>Allow presence/absence of bacteria/viruses/</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td><td></td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 2 | (a) | (i)<br>UE<br>CD<br>BA | *Any three across the following lists:*<br><br>**Spirometer**<br>Patient awake / voluntary action;<br>Records deep breaths;<br>One piece of equipment;<br>Nose clip / breathes only through mouth;<br>Mouth piece;<br>Air/oxygen, chamber/tank;<br>Exhaled carbon dioxide removed / soda lime used;<br>Readings, on a (kymo)graph/paper/chart/trace/using pen;<br>Medical grade oxygen;<br>Does not use sensors;<br><br>**Polysomnogram**<br><br>Rib cage movement recorded;<br>Elastic belt (sensor);<br>Nose sensor; | **3** | A02 | **Allow** vice versa for the poylsomnogram.<br>**Allow** unambiguous differences if equipment not named<br><br>**Allow** vice versa for the spirometer<br>**Ignore** medical grade **air**<br><br>**Ignore** monitors other body parts |
| | | (ii)<br>BA | (Patient must be awake to) breathe in, as much as possible/deeply;<br>(and then) breathe out, as much as possible/deeply; | **2** | A02 | **Allow** to consciously override breathing reflex = 1 mark<br>**Ignore** as hard as possible |
| | | (iii)<br>UE | 15 – 18;<br>Decrease/lower/less; | **2** | A01 | **Allow** a correct single value within the range<br>**Ignore** will change<br>**Allow** range or single value within 12 - 14 |
| | (b) | 1xEU<br>2xCD<br>1xAB | **Oxygen levels** – lower /low;<br><br>**Carbon dioxide levels** - higher / high<br><br>**Explanation for either or both**<br><br>Less, air/correctly named gas, will travel along respiratory tract / reach alveoli;<br>Less, gaseous exchange/diffusion; | **2**<br><br>**2** | A01 and A02 | A/W<br><br>A/W<br>**Allow** any correctly named part of respiratory |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>Less, air/correctly named gas, inhaled/exhaled:</td><td></td><td></td><td>tract<br><br>Allow $CO_2$ trapped in body</td></tr>
<tr><td></td><td>(c)</td><td>(i)<br>UE</td><td><table><tr><td>Systolic</td><td>135</td><td>36</td></tr><tr><td>Diastolic</td><td>85</td><td>10</td></tr></table></td><td>2</td><td>A01</td><td>Award 1 mark for each correct column.<br><br>Allow ecf for the difference column.<br><br>Do not allow 135/85 in single box.</td></tr>
<tr><td></td><td></td><td>(ii)<br>BA</td><td>Less energy, used/needed / energy conserved for when awake;<br><br>Any one from:<br><br>Blood pressure is directly related to, heart beat/cardiac cycle;<br>Heart is, working/contracting, less;</td><td>2</td><td>A02</td><td>Allow energy not wasted.<br>Do not allow no energy</td></tr>
<tr><td></td><td></td><td>(iii)<br>UE</td><td>60 – 80;<br>(Patient pulse rate is) 82 / higher;</td><td>2</td><td>A01</td><td>Ignore single values</td></tr>
<tr><td></td><td></td><td>(iv)<br>UE<br>DC<br>BA</td><td>36.8 / 36.5 – 37.2;<br><br>Any two from:<br><br>Blood/core, temperature affected by metabolic activity;<br>Rate of, metabolic/chemical/enzyme, activity lower / reaction rate/energy use, lower;<br>Less, muscle contraction/exercise/body movement;<br>Heat production drops;<br>Heart rate/blood pressure, drops;<br>Reduced distribution of (warmer) blood;</td><td>3</td><td>A01 and A02</td><td>Allow any correct single value within range<br><br>Ignore to reduce heat loss.<br>Do not allow no/less energy produced<br><br>Ignore no movement, body not working as hard<br>Ignore no heat generated</td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (v)<br>UE | *Any two from:*<br>Finger sensor clipped into position / cannot hold clinical thermometer in place;<br>Finger sensor gives continuous readings;<br>Blood/capillary network close to skin surface at fingertip; | **2** | A01 | A/W<br>**Ignore** no need to waken patient / reference to digital thermometers |
| | | | **Total** | **22** | | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 3 | (a) | (i) UE | WBC = 8.1<br>RBC = 4.5 | 2 | A02 | **Allow** one mark **max.** for correct addition only (40.5 [WBCs] **AND** 22.5 [RBCs])<br>Check space below if table not completed. |
| | | (ii) UE | *Any two from:*<br><br>WBCs = one value/D is, out of range/outlier/higher than normal values;<br>RBCs = one value/E is, out of range/outlier/lower than normal values;<br>Small sample size;<br>Values D and/or E will affect the, mean/result; | 2 | A02 | **Ignore** anomaly<br><br>**Ignore** anomaly<br><br>A/W |
| | | (iii) UE DC | Patient D has leukaemia **AND** patient E has anaemia;<br>Leukaemia/D has a high WBC count **AND** anaemia/E has a low RBC count; | 2 | A01 and A02 | **Allow** high(est) WBC = D and low(est) RBC = E |
| | (b) | (i) UE DC | <table><tr><td>**B**</td><td>**D**</td><td>**E**</td><td>**A**</td><td>**C**</td></tr></table><br>*Correct pairs:*<br><br>B before D<br>D before E<br>E before A<br>A before C | 3 | A02 | 4 correct pairs = 3 marks<br>3 correct pairs = 2 marks<br>1 or 2 correct pairs = 1 mark<br><br>Each letter must **immediately** follow the previous letter in each pair. |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)<br>DC</td><td>Any three from:<br><table><tr><th>Hazard</th><th>How to minimise the risk of this hazard</th></tr><tr><td>Microbes/ bacteria/pathogens</td><td>Wear gloves/goggles / follow correct procedures / receive training / re-sterilise or dispose of inoculum loop/bacteria spreader correctly / seal petri dish</td></tr><tr><td>Sharps/needles/ glassware</td><td>Safely dispose of, needles/sharps / use only sterilised, needles/sharps / clear breakages / training</td></tr><tr><td>Electricity (microscopes, autoclave)</td><td>Avoid placing blood samples in direct contact with the electrical appliance/microscope / follow correct procedures when using an autoclave / receive training</td></tr><tr><td>Heat (autoclave, molten agar)</td><td>Wear (heat-resistant) gloves/ protective clothing / follow correct procedures / receive training</td></tr><tr><td>Spillage (blood, agar)</td><td>Clean spillage/ suitable, footwear/clothing / sealed tubes / lid on petri dish</td></tr></table></td><td>3</td><td>A01</td><td>One mark for each correct row<br>Only award the ‘minimising the risk’ mark if linked to a correct hazard.<br><br>Allow A/W for each response.</td></tr>
<tr><td></td><td></td><td>(iii)<br>UE<br>DC</td><td>Destroyed / autoclaved / incinerated / sterilised / placed in a safe bin;<br>Microbes/bacteria/pathogens, present;<br>(Microbes/bacteria/pathogens) cause, disease/infection / prevent contamination;</td><td>3</td><td>A01</td><td>Ignore microbiological materials (given in Q)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td><td></td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 4 | (a) | (i) UE DC | Uses a magnet / is magnetic;<br><br>*Any two from:*<br><br>Harm/injure the patient;<br>Damage the scanner;<br>Affect/interrupt, image formation; | **3** | A01 | **Allow** earrings ripped out |
| | | (ii) DC | *Any three from:*<br><br>CAT gives high resolution of bones / MRI gives good soft tissue resolution;<br>CAT uses radiation/X rays/is ionising/harmful/ causes cancer / MRI uses magnetism/magnetic field/non-ionising/less harmful/;<br>CAT is relatively quick to use/5 minutes / MRI takes longer to use/ 15 minutes – up to 2 hours;<br>CAT has a wide opening/less claustrophobic/causes less anxiety/less noisy / MRI has a limited opening/claustrophobic/may cause anxiety/noisy;<br>CAT less expensive;<br>CAT can be used with metal implants; | **3** | A01 | **Ignore** references to non-invasive / 3D vs 2D<br><br>**Ignore** portability |
| | | (iii) UE DC BA | <table><tr><td>Brain</td><td>✓</td></tr><tr><td>Tongue</td><td>✓</td></tr><tr><td>Vertebra</td><td></td></tr><tr><td>Skin</td><td>✓</td></tr><tr><td>Skull</td><td></td></tr><tr><td>Fatty tissue</td><td>✓</td></tr></table> | **3** | A01 | 4 correct responses = 3 marks<br>3 correct responses = 2 marks<br>1 or 2 correct responses = 1 mark<br><br>**Deduct** one mark for each tick placed in the vertebra and/or skull boxes. |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | (b) | (i) DC BA | **[Level 3]** Candidate shows a high level understanding of how ultrasound scanners are used to generate an image **and** how they are particularly beneficial when exploring damage to blood vessels, including **at least six** valid points. The explanation follows a clear logical order.<br>***(5 - 6 marks)***<br><br>**[Level 2]** Candidate shows an understanding of how ultrasound scanners are used to generate an image **and** how they are particularly beneficial when exploring damage to blood vessels, including **at least four** valid points. The explanation follows some logical order.<br>***(3 – 4 marks)***<br><br>**[Level 1]** Candidate shows a basic understanding of how ultrasound scanners are used to generate an image **and/or** how they are particularly beneficial when exploring damage to blood vessels, including at least **two valid points** but with little or no explanation. With little evidence of a logical order.<br>***(1 – 2 marks)***<br><br>**[Level 0]** Candidate includes **fewer than two** valid points.<br>***(0 marks)*** | **6** | A01 and A02 | **Valid scientific points:**<br><br>**Image generation**<br><br>• use of gel to, reduce (air) gap between probe and skin/exclude air/prevent reflection<br>• probe emits (sound) waves<br>• (sound waves) pass into patient's body<br>• (sound waves) bounce off/reflected<br>• (reflected sound waves) detected by probe<br>• image formed<br>• on a screen/computer<br><br>**Benefits when examining damaged blood vessels**<br><br>• good soft tissue resolution<br>• 3D image formed<br>• to show different views of blood vessels<br>• real time/moving images formed / can show the movement of blood along vessels / the pulsation of blood<br>• may reveal the site of blood loss<br>• may show damaged valves |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)<br><br>1xEU<br>1xCD<br>2xAB</td><td>Any two rows from:<br><table><tr><th rowspan="2">Feature</th><th colspan="2">Comparison</th></tr><tr><td>Artery</td><td>Vein</td></tr><tr><td>Thickness of vessel wall</td><td>Relatively thick</td><td>Relatively thin</td></tr><tr><td>Lumen</td><td>Narrow / small</td><td>Wide / large</td></tr><tr><td>Smooth muscle / elastic tissue / fibrous layer / collagen layer</td><td>Thick(er)</td><td>Thin(ner)</td></tr><tr><td>Valves</td><td>Absent (with exception of pulmonary artery)</td><td>Present</td></tr><tr><td>Endothelium</td><td>Crenated/folded</td><td>Smooth</td></tr></table></td><td>4</td><td>A01</td><td>Award one mark for the correct feature and one mark for the correct comparison (along each row).<br><br>Ignore location of structures</td></tr>
<tr><td></td><td></td><td>(iii)<br>BA</td><td>Any one from:<br>Blood under great(er) /high(er) pressure;<br>Pulse maintained in the artery;</td><td>1</td><td>A02</td><td>Allow vice versa for veins.<br>Do not allow more blood<br>Ignore no valves to stop backflow</td></tr>
<tr><td></td><td>(c)</td><td>BA</td><td>Any two from:<br><br>May not recover from, intervention/surgery;<br>Surgery could, cause complications/affect quality of life;<br>Views of the patient or patient’s family / not of sound mind;<br>Prioritise treatment of younger patients / cost effectiveness;<br>May become increasingly anxious;<br>Home environment / carer availability of the patient;<br>Has patient signed DNR form;<br>Take pulse / check heart activity / check for pacemaker;<br>Physical condition / fitness / current medication;</td><td>2</td><td>A02</td><td>Allow other realistic suggestions<br><br>Ignore age unqualified</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>22</td><td></td><td></td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 5 | | DC<br>BA | **[Level 3]** Candidate shows a high level understanding of how the incidence of type 2 diabetes could be reduced **and** consideration of the importance of monitoring blood-sugar levels for patients with diabetes, including **at least six** valid points. The explanation follows a clear logical order.<br>***(5 - 6 marks)***<br><br>**[Level 2]** Candidate shows an understanding of how the incidence of type 2 diabetes could be reduced **and** consideration of the importance of monitoring blood-sugar levels for patients with diabetes, including **at least four** valid points. The explanation follows some logical order.<br>***(3 – 4 marks)***<br><br>**[Level 1]** Candidate shows a basic understanding of how the incidence of type 2 diabetes could be reduced **and/or** consideration of the importance of monitoring blood-sugar levels for patients with diabetes, including at least **two valid points** but with little or no explanation. With little evidence of a logical order.<br>***(1 – 2 marks)***<br><br>**[Level 0]** Candidate includes **fewer than two** valid points.<br>***(0 marks)*** | **6** | A01 and A02 | **Valid scientific points:**<br><br>**Reducing incidence of type 2 diabetes in the community**<br>• usually found in older people<br>• also in children / young adults<br>• linked to obesity/high BMI<br>• associated with a high sugar/glucose intake/diet<br>• constant/prolonged exposure (to high glucose intake)<br>• reduced sensitivity to insulin levels<br>• high blood/plasma sugar/glucose levels<br>• may be linked to intake of 'fast food'<br>• processed foods often contain high levels of sugar<br>• (incidence could be reduced if) sugar intake is reduced in the diet<br>• balanced/ healthy diet can help<br>• good fitness levels/exercise/healthy lifestyle can help<br>• public health/NHS programmes/community groups/sugar tax<br>• type 2 linked to low diversity of gut bacteria<br><br>**Importance of monitoring blood sugar levels**<br>• involves taking a blood sample<br>• using a biosensor<br>• can then inject insulin<br>• if level is too high<br>• can adjust sugar intake /change diet |
| | | | **Total** | **6** | | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 6 | (a) | (i) DC BA | ELISA;<br>Change in colour /fluorescence; | 2 | A01 | **Allow** correct reference to monoclonal antibodies. |
| | | (ii) DC | **Labelled samples**<br>*Any one from:*<br><br>Avoid confusion with other samples / identity of sample;<br>Poorly labelled/unlabelled samples could lead to misleading results;<br>Patient may be given a false result;<br>Patients could be untreated / transfer virus to others;<br>Samples can be retained for future use/as a back-up;<br><br>**Sealed samples**<br>*Any one from:*<br><br>To avoid loss of blood from the container;<br>To avoid, contamination/spread of, disease/infection; | 1<br><br>1 | A02 | |
| | | (iii) UE | ***FOR ONE MARK**, any **TWO** from:*<br><br>Name;<br>Date;<br>Use of blood sample eg. back-up, for blood cell counts, for microbial analysis/blood test; | 1 | A02 | **Allow** other relevant suggestions.<br>**MUST** give two correct facts for one mark<br>**Ignore** name of doctor |

<table>
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<tr><td></td><td>(b)</td><td>(i)<br>DC</td><td>Equipment — Normal functional assessment values<br>Digital sphygmomanometer — 0.4 – 0.5 $dm^3$<br>Peak flow meter — litres $min^{-1}$<br>Electronic spirometer — 120/80 mmHg</td><td>2</td><td>A01</td><td>3 correct lines = 2 marks<br><br>1 or 2 correct lines = 1 mark</td></tr>
<tr><td></td><td></td><td>(ii)<br>UE<br>DC</td><td><table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Use fingers/stethoscope;</td></tr><tr><td>2</td><td>Location of pulse (e.g.wrist, neck, ankle);</td></tr><tr><td>3</td><td>Count/record (pulse/beats) for 30 seconds (maximum 1 minute) and multiply value accordingly;</td></tr></table></td><td>3</td><td>A01</td><td>A/W<br><br>Ignore refs to multiple readings<br>Ignore references to use of cuff or electronic monitoring</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Overall total</td><td>90</td><td></td><td></td></tr>
</table>

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