OCR
Oxford Cambridge and RSA

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# GCSE (9–1)

## Biology A (Gateway Biology)

**J247/01:** Paper 1 (Foundation Tier)

General Certificate of Secondary Education

# Mark Scheme for November 2020

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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 available in RM Assessor**

| Annotation | Meaning |
|---|---|
|  | Correct response |
|  | Incorrect response |
|  | Omission mark |
| BOD | Benefit of doubt given |
| CON | Contradiction |
| RE | Rounding error |
| SF | Error in number of significant figures |
| ECF | Error carried forward |
| L1 | Level 1 |
| L2 | Level 2 |
| L3 | Level 3 |
| NBOD | Benefit of doubt not given |
| SEEN | Noted but no credit given |
| I | Ignore |

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

| Annotation | Meaning |
|---|---|
| **/** | alternative and acceptable answers for the same marking point |
| ✓ | Separates marking points |
| **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 |

## 2. 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.

The breakdown of Assessment Objectives for GCSE (9-1) in Biology A:

| | Assessment Objective |
|---|---|
| **AO1** | **Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.** |
| AO1.1 | Demonstrate knowledge and understanding of scientific ideas. |
| AO1.2 | Demonstrate knowledge and understanding of scientific techniques and procedures. |
| **AO2** | **Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.** |
| AO2.1 | Apply knowledge and understanding of scientific ideas. |
| AO2.2 | Apply knowledge and understanding of scientific enquiry, techniques and procedures. |
| **AO3** | **Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.** |
| **AO3.1** | Analyse information and ideas to interpret and evaluate. |
| AO3.1a | Analyse information and ideas to interpret. |
| AO3.1b | Analyse information and ideas to evaluate. |
| **AO3.2** | Analyse information and ideas to make judgements and draw conclusions. |
| AO3.2a | Analyse information and ideas to make judgements. |
| AO3.2b | Analyse information and ideas to draw conclusions. |
| **AO3.3** | Analyse information and ideas to develop and improve experimental procedures. |
| AO3.3a | Analyse information and ideas to develop experimental procedures. |
| AO3.3b | Analyse information and ideas to improve experimental procedures. |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 1 | | | C ✓ | 1 | 1.1 | |
| 2 | | | A ✓ | 1 | 1.2 | |
| 3 | | | D ✓ | 1 | 1.1 | |
| 4 | | | A ✓ | 1 | 1.1 | |
| 5 | | | D ✓ | 1 | 1.1 | |
| 6 | | | C ✓ | 1 | 1.1 | |
| 7 | | | D ✓ | 1 | 2.1 | |
| 8 | | | B ✓ | 1 | 2.2 | |
| 9 | | | B ✓ | 1 | 2.1 | |
| 10 | | | A ✓ | 1 | 1.1 | |
| 11 | | | B ✓ | 1 | 2.1 | |
| 12 | | | D ✓ | 1 | 2.2 | |
| 13 | | | B ✓ | 1 | 2.1 | |
| 14 | | | B ✓ | 1 | 1.1 | |
| 15 | | | C ✓ | 1 | 2.1 | |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>16</td><td>(a)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Structure</th></tr>
<tr><td>chlorophyll for photosynthesis</td><td>chloroplast ✓</td></tr>
<tr><td>enzymes for respiration</td><td>mitochondria ✓</td></tr>
<tr><td>receptor molecules for communication</td><td>cell membrane ✓</td></tr>
</table>
</td><td>3</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE<br>If answer = (×) 2000 award 2 marks<br><br>60(mm) ÷ 0.03(mm) ✓<br>= (×) 2000 ✓</td><td>2</td><td>2.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(use of a) stain ✓</td><td>1</td><td>1.2</td><td>ALLOW named stain e.g. iodine / methylene blue / eosin<br>ALLOW dye<br>IGNORE colouring</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>there are four different bases in DNA ✓</td><td>1</td><td>1.1</td><td>ALLOW nitrogenous bases<br>ALLOW names of the four bases / represents ATCG</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>phosphate (groups) ✓<br><br>sugars ✓</td><td>2</td><td>2 x 1.1</td><td>ALLOW correct answers in either order<br><br>ALLOW deoxyribose</td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | (d) | (i) | provide energy / release energy / produce ATP ✓ | 1 | 1.1 | |
| | | (ii) | carbon dioxide ✓<br><br>water ✓ | 2 | 1.1 | **ALLOW** correct answers in either order<br>**ALLOW** correct formulae in either order<br><br>**IGNORE** oxygen and glucose when shown as reactants<br>**IGNORE** energy |
| | | (iii) | exothermic ✓ | 1 | 1.1 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 17 | (a) | (i) | electric heater ✓ | 1 | 2.2 | **ALLOW** electric incubator / <u>electric</u> (water) bath |
| | | (ii) | wear goggles / tie (long) hair back / secure loose clothing ✓ | 1 | 1.2 | **ALLOW** wear gloves / use gauze under flask / use heatproof mat<br>**IGNORE** face mask / do not touch hot equipment |
| | | (iii) | **Any two from:**<br>difficult to keep constant/regulate temperature ✓<br><br>uneven heating of flask creating hot/cold spots ✓<br><br>human error in reading thermometer ✓ | 2 | 2.2 | **ALLOW** water may overheat<br>**ALLOW** may become hot and denature enzyme<br>**ALLOW** flask may have slightly raised temperature<br>**ALLOW** temperature in water bath may not reflect temperature in the flask |
| | (b) | (i) | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 32 award 2 marks**<br><br>34 + 29 + 33 = 96 ✓<br><br>96 ÷ 3 = 32 ✓ | 2 | 2.2 | **ALLOW** answer in the space under the table but answer on answer line in table takes preference<br><br>**ALLOW** ECF for mean calculation |
| | | (ii) | temperature ✓ | 1 | 2.1 | |
| | | (iii) | identifies variability in each point plot /<br>gives an estimate of level of uncertainty ✓ | 1 | 1.2 | **ALLOW** can plot range/error bars<br>**ALLOW** large error bars variability is high/ORA<br>**ALLOW** high variability then reliability is low/ORA<br>**ALLOW** idea of the spread of data at each point and possibly identify/eliminate outlier/anomaly<br>**ALLOW** ranges overlap the data at those 2 points isn't significantly different |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (iv) | **Any two from:**<br>as temperature increases enzyme activity increases ✓<br><br>optimum enzyme activity between $25^0$C and $35^0$C enzyme activity ✓<br><br>but somewhere between $30^0$C and $35^0$C enzyme activity starts to decrease ✓<br><br>idea decrease in rate (after $35^0$C) due to denaturing ✓ | **2** | **3.1a** | **ALLOW** idea that as temperature increases/gets higher so does rate of (enzyme) reaction / gas release / ORA<br>**ALLOW** higher temperature the faster the enzyme activity<br><br>**ALLOW** enzyme starts to denature above $30^0$C/between $30^0$C and $35^0$C |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 18 | (a) | | distance of lamp/light source ✓ | 1 | 2.2 | **ALLOW** light intensity<br>**IGNORE** the lamp with no mention of distance or intensity |
| | (b) | (i) | **Any two from:**<br>bubbles are different sizes / has different volume of gas ✓<br><br>some bubbles may also be missed/miscounted ✓<br><br>so volume at each point may not be representative of rate ✓ | 2 | 2.2 | **ALLOW** amount of oxygen varies / bubbles burst<br>**IGNORE** the pondweed could be different sizes |
| | | (ii) | **Any two from:**<br>measure volume (of gas released) ✓<br><br>names a suitable apparatus for measuring for volume ✓<br><br>use a heat sink ✓ | 2 | 2x 3.3a | **IGNORE** measure amount<br><br>**ALLOW** e.g. measuring cylinder / gas syringe / Audus apparatus /graduated pipette |
| | (c) | (i) | axes correctly labelled, including units ✓<br><br>all points correctly plotted ✓ ✓<br><br>suitable line of best fit drawn ✓ | 4 | 4 x 2.2 | **ALLOW** +/- half a square<br>all points correctly plotted<br>0 to 1 correct point plotted = 0 mark<br>2 to 4 correct points plotted = 1 mark<br>All 5 correct points plotted = 2 marks<br><br>**ALLOW** line of best fit based on plotted points<br>**IGNORE** dot to dot line |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (ii) | further lamp is from the plant photosynthesis reduced / ORA ✓<br><br>example of a decrease from data e.g. at 10cm 30 bubbles given off and at 40cm only 2 bubbles ✓<br><br>**OR**<br><br>photosynthesis stops in very low light ✓<br><br>by 50 cm there are no bubbles ✓<br><br>**OR**<br><br>idea that rate of photosynthesis decrease is a non-linear relationship ✓<br><br>e.g. nearly double the number of bubbles at 10cm compared to 20cm but not double elsewhere ✓ | **2** | **3.2b** | **IGNORE** type of gas mentioned in bubbles<br>**ALLOW** description of decrease in bubbles e.g. further lamp the less bubbles<br>**ALLOW** there is a negative correlation |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 19 | (a) | (i) | Oestrogen **AND** Progesterone ✓ | 1 | 1.1 | |
| | | (ii) | prevent ovum/egg release ✓ | 1 | 1.1 | **ALLOW** disrupts menstrual cycle preventing pregnancy<br>**ALLOW** stops egg maturation<br>**ALLOW** higher level responses e.g. inhibiting FSH / follicles do not develop |
| | (b) | | method 2 because less women get pregnant (in a year) ✓ | 1 | 3.2a | **ALLOW** rate of pregnancy for method 2 is lower / ORA<br>**ALLOW** Method 2 because there are more pregnancies in Method 1 |
| | | | idea that method 1 has failures due to incorrect usage / ideas about medically supervised implants remove user error ✓ | 1 | 3.2b | **ALLOW** you do not have to remember to take the pill in method 2 / ORA |
| | (c) | (i) | **Any two from:**<br><br>wide range of success amongst methods / some methods more successful than others ✓<br><br>sterilisation/IUD is the most successful ✓<br><br>male condom/cervical cap the least successful ✓<br><br>cervical cap has the widest range of success rates ✓ | 2 | 2 x 3.2b | **ALLOW** idea of wide range of reliability/effectiveness amongst methods / some methods more reliable/effective than others<br><br>**IGNORE** just listing of percentage order<br>**IGNORE** references to hormonal methods<br><br>**ALLOW** rate of pregnancy for male condom/cervical cap is the highest (in the graph)<br><br>**IGNORE** diaphragm |
| | | (ii) | it is permanent / idea reversible success is limited ✓ | 1 | 2.1 | **ALLOW** its irreversible / idea that ability to become pregnant/have a baby in future is compromised / they may change their mind |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | **(iii)** | barrier to sperm / sperm cannot swim into uterus/womb ✓ | **1** | **2.1** | **ALLOW** stops sperm coming into contact with the egg<br>**ALLOW** captures/traps/blocks sperm/semen<br>**ALLOW** prevents sperm getting through vagina |
| | | **(iv)** | (cap less successful) as it covers smaller area (of cervix) / less efficient barrier / ORA ✓<br><br>so idea that more chance of sperm getting through (into uterus/womb) ✓ | **2** | **2 x 2.1** | <br><br><br>**ALLOW** fewer sperm able to be destroyed before uterus/womb |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 20 | (a) | (i) | (sensory) receptor ✓ | 1 | 2.1 | **IGNORE** neurone |
| | | (ii) | brain ✓<br><br>motor ✓ | 2 | 1.1 | **ALLOW** CNS<br><br>**IGNORE** relay |
| | (b) | | fatty acids are obtained by breaking down/digesting larger molecules ✓<br><br>idea (originates) from lipids ✓ | 2 | 2.1 | **ALLOW** using lipase / enzyme<br><br>**ALLOW** triglycerides<br>**ALLOW** lipids/fats/oils |
| | (c) | (i) | **Any two from:**<br>idea it affects enzymes (action/structure) ✓<br><br>high temperature causes active site to change shape / active site denatures ✓<br><br>stops them working ✓ | 2 | 1.1 | **ALLOW** enzymes are heat sensitive/denature<br><br>**ALLOW** enzymes cannot bind to substrate molecules<br>**IGNORE** cells denature<br><br>**ALLOW** enzymes no longer catalyse reaction |
| | * | (ii) | Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.<br><br>**Level 3 (5–6 marks)**<br>Demonstrates knowledge of homeostasis.<br>**AND**<br>Applies knowledge of a skin mechanism for maintaining body temperature in different environments.<br>**AND**<br>Analyses information to comment on the effect of exposing skin. | 6 | **2 x 1.1**<br>**2 x 2.1**<br>**2 x 3.1a** | **AO1.1 Demonstrate knowledge and understanding of skin and homeostasis**<br>• need to keep constant internal temperature, despite the different external temperatures<br>• person A needs to lose heat to the environment / person B needs to reduce heat lost to the environment<br>• person A gains heat from the environment / person B loses heat to the environment<br>• person A will be in danger of overheating / person B will be in danger of becoming too cold. |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | | *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 2 (3–4 marks)**<br>Demonstrates knowledge of homeostasis **and** applies knowledge of a skin mechanism for maintaining body temperature in different environments.<br>**OR**<br>Demonstrates knowledge of homeostasis **and** analyses information to comment on the effect of exposing the skin.<br>**OR**<br>Applies knowledge of a skin mechanism for maintaining body temperature in different environments **and** analyses information to comment on the effect of exposing skin.<br><br>*There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*<br><br>**Level 1 (1–2 marks)**<br>Demonstrates knowledge of homeostasis.<br>**OR**<br>Applies knowledge of a skin mechanism for maintaining body temperature in different environments.<br>**OR**<br>Analyses information to comment on the effect of exposing skin.<br><br>*There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant***.**<br><br>**0 marks**<br>*No response or no response worthy of credit.* | | | **AO2.1 Apply knowledge and understanding of the mechanisms in skin for maintaining body temperature in different environments**<br>• cold environment reduces sweating /decreases blood flow to the skin (vasoconstriction) / shivering / body hairs rise<br>• warm environment increases sweating / increases blood flow to the skin (vasodilation) / body hairs on skin lie flat<br><br>**AO3.1a Analyse information and ideas to interpret the effect of exposing / covering skin in different environments**<br>• person A body less covered/more exposed skin in warmer conditions increases heat loss/allows sweat to evaporate<br>• person B body covered/less exposed skin in colder conditions reduces heat loss/stops sweat evaporating |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 21 | (a) | (i) | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 3 : 1 award 2 marks**<br><br>24 : 8 or 3 ✓<br><br>3 : 1 ✓ | **2** | **2.2** | **ALLOW** answer in the table but answer on answer line takes preference |
| | | **(ii)** | higher SA:V ratio faster rate of diffusion / ORA ✓ | **1** | **3.2b** | **ALLOW** positive correlation<br>**ALLOW** reference to less time instead of faster rate<br>**IGNORE** they are directly proportional |
| | | **(iii)** | reduces (total) SA of alveoli/air sacs /<br>reduces SA : Vol ratio of alveoli/air sacs ✓<br><br>so diffusion (of oxygen) reduced ✓ | **2** | **2 x 3.1a** | <br><br><br>**ALLOW** harder for oxygen to diffuse<br>**IGNORE** oxygen cannot diffuse into the blood in emphysema |
| | **(b)** | | sickle red blood cells release/take up/carry/deliver/transport less oxygen ✓<br><br>sickle cells have a smaller surface area (to vol ratio) /<br>tend to get stuck in blood vessels/capillaries /<br>cannot pass through blood vessels/capillaries so easily ✓ | **2** | **1.1**<br><br>**2.1** | **IGNORE** less oxygen binds to RBCs / sickle cells cannot carry oxygen<br><br>**IGNORE** references to smaller volume / less Hb / less space on the RBCs |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | (c) | | cells absorb water ✓<br><br>by osmosis ✓<br><br>red blood cells/cytoplasm swells /<br>increased pressure in the cell/on the cell membrane /<br>cell membrane ruptures/bursts ✓ | 3 | 3 x 1.1 | **IGNORE** references to water potential<br><br>**IGNORE** just cell bursts |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>22</td><td>(a)</td><td>(i)</td><td>The higher the BMI then the higher the mass of urea (in urine) / ORA ✓</td><td>1</td><td>2.1</td><td>ALLOW positive correlation<br>IGNORE they are directly proportional<br>IGNORE linear relationship</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE<br>If answer = 0.0016 (g/cm$^3$) award 2 marks<br><br>1.6 ÷ 1000 ✓<br>= 0.0016 (g/cm$^3$) ✓</td><td>2</td><td>2.2</td><td><br><br><br><br>ALLOW 1.6 x $10^{-3}$</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>idea that there is a greater increase in mass of urea as BMI increases in Fig 22.2/second graph ✓<br><br>idea that first graph/22.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓</td><td>2</td><td>2 x 3.2b</td><td>ALLOW larger mass of urea per BMI gained<br>ALLOW line is steeper/higher gradient in Fig22.2<br>IGNORE higher BMI for greater mass of urea<br><br>ALLOW second graph does not follow the line of best fit so closely</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>Bowman’s capsule</td><td>1</td></tr><tr><td>Collecting duct</td><td>5</td></tr><tr><td>Proximal convoluted tubule</td><td>2</td></tr><tr><td>Loop of Henlé</td><td>3</td></tr><tr><td>Second coiled region</td><td>4</td></tr></table>✓✓✓</td><td>3</td><td>3 x 1.1</td><td>5 before 2 ✓<br>2 before 3 ✓<br>3 before 4 ✓</td></tr>
</table>

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