

### Biology A Paper 3 Mark Scheme

Question Number	Acceptable Answer	Additional Guidance	Mark
<b>1(a)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"> <li>• fraternal twins risk is lower (1)</li> <li>• because fewer alleles in common (1)</li> </ul>	Allow converse	<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>1(b)(i)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"> <li>• Identical twins being raised apart allows environmental factors to be investigated separately from genetic factors (1)</li> <li>• therefore may be able to determine relative amount of risk due to genetic variation / relative amount of risk due to environment (1)</li> </ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>1(b)(ii)</b>	An answer that makes reference to the following: <ul style="list-style-type: none"> <li>• twins have more in common than shared genetics / shared uterine environment (1)</li> <li>• twins may be raised in similar environments(1)</li> </ul>	Ignore reference to sample size	<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>1(c)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• Parkinson's symptoms arise due to low dopamine levels (1)</li> <li>• transmission of nerve impulses disrupted causing lack of control of {muscle movements / tremors} (1)</li> <li>• schizophrenia drugs lower {neurotransmitter / dopamine} levels (1)</li> </ul> <p>Plus two from:</p> <ul style="list-style-type: none"> <li>• therefore less dopamine in synaptic / knob secreted into cleft / diffuses across cleft (1)</li> <li>• therefore less dopamine available to bind to receptors (1)</li> <li>• therefore no/little change in membrane structure / permeability of post- synaptic cell (1)</li> <li>• therefore fewer sodium ions enter postsynaptic cell (1)</li> <li>• therefore less depolarisation of postsynaptic cell (1)</li> </ul>		<b>(5)</b>

(Total for Question 1 = 11 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
<b>2(a)</b>	larvae show no significant preference for light over dark side (1)	Allow vice versa Must have NO in hypothesis.	<b>(1)</b>
<b>2(b)(i)</b>	Acceptable Answer calculation of expected frequency 10 and 10 (1) $(O-E)^2/E$ for both light and dark sides $49 \div 10 = 4.9$ (1) sum = 9.8 (1)	Additional guidance	<b>(3)</b>
<b>2(b)(ii)</b>	Acceptable Answer An answer that makes reference to the following: <ul style="list-style-type: none"> <li>higher than 3.84 therefore Chi square value as high as 9.8 arise by chance alone less than 1 in 20 / 0.05 therefore there is a significant difference (1)</li> </ul>	Additional guidance allow ECF for incorrect value of Chi allow converse if calculated of Chi is lower than 3.84	<b>(1)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>2(c)</b>	<p>An explanation that makes reference to five of the following:</p> <ul style="list-style-type: none"> <li>• use of dead tissue containing toxin and dead tissue not containing tissue so valid comparison can be made (1)</li> <li>• {young larvae of same length / fly eggs} allowed access to both types of dead tissue so they have same potential for growth (1)</li> <li>• reference to time scale before growth of larvae measured to allow time for growth to occur (1)</li> <li>• length measured for several larvae to ensure reliability (1)</li> <li>• control of {temperature / type of tissue / age of tissue / species of larvae} because these factors affect growth (1)</li> <li>• recognition that comparison of results may show under or over estimate of time of death (1)</li> </ul>		<b>(5)</b>

(Total for Question 2 = 10 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
<b>3(a)</b>	Measurement in 5.1 cm / 51 mm correct (1) $51 \div 60 = 0.85$ mm (1)	need to measure on paper	<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>3(b)(i)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"> <li>• very high heart rate makes it difficult to count (1)</li> <li>• so greater chance of error (1)</li> </ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>3(b)(ii)</b>	Calculation of mean = 55 (1) Answer = $55 \div 20.2 = 2.72$ (1)		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>3(b)(iii)</b>	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> <li>• control of variables (1)</li> <li>• returning fleas to ambient temperature for specified time (1)</li> <li>• acclimatisation (1)</li> <li>• use smaller intervals (1)</li> </ul>		<b>(3)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>3(c)</b>	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• undeveloped nervous system so don't feel pain and there aren't ethical issues (1)</li> <li>• unethical to use any living organism in an experimental procedure (1)</li> <li>• relativism would state that it is acceptable under certain circumstances to use invertebrates (i.e. if there is potential benefit to human health) (1)</li> <li>• absolutism promotes use of invertebrates under any circumstance or under no circumstance (1)</li> </ul>		<b>(4)</b>

(Total for Question 3 = 13 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
<b>4 (a)</b>	<p>An explanation that makes reference to five of the following:</p> <ul style="list-style-type: none"> <li>• at {low concentrations / up to 200 mg} there is a rapid increase in faecal fat content (1)</li> <li>• drug binds to enzyme and alters the shape of the active site (1)</li> <li>• drug acts as a non-competitive inhibitor (1)</li> <li>• prevents enzyme {substrate / product} complex formation (1)</li> <li>• prevents hydrolysis of {fat / triglyceride} (1)</li> <li>• less fatty acids / glycerol absorbed (1)</li> <li>• at {high concentrations / above 200 mg} there is a levelling at {25 to 30%} no further effect above 400 mg because all enzymes inhibited (1)</li> </ul>		<b>(5)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>4(b)</b>	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> <li>• placebo used which allows for a comparison to ensure validity (1)</li> <li>• error bars given which allow for indication of true mean (1)</li> <li>• measurements taken for a long time to see if effects continued (1)</li> <li>• more people used so reliability improved (1)</li> <li>• measured the desired outcome (change in body mass) not an indirect measure (faecal fat) (1)</li> </ul>		<b>(4)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>4(c)(i)</b>	$80 \div 31.25 = 0.032$ (1) height = $\sqrt{0.032}$ (1) = 1.6 m (1)		<b>(3)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>4(c)(ii)</b>	BMI is calculated within a range on a scale of values / body mass is a definite value (1)		<b>(1)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>4(c)(iii)</b>	<p>An explanation that makes reference to five of the following:</p> <ul style="list-style-type: none"> <li>• high blood pressure causes damage to endothelium (1)</li> <li>• atherosclerosis leads to narrowing of lumen of arteries (1)</li> <li>• heart disease as a result of narrowing of coronary arteries (1)</li> <li>• stroke as a result of reduced blood flow to brain (1)</li> <li>• joint damage caused by increased body mass leading to damage of the cartilage (1)</li> <li>• type 2 diabetes caused by reduced sensitivity of insulin receptors (1)</li> </ul>		<b>(5)</b>

(Total for Question 4 = 18 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
<b>5 (a)</b>	<p>An answer that makes reference to two of the following:</p> <ul style="list-style-type: none"> <li>• because females smoke fewer cigarettes / inhale less (1)</li> <li>• because females smoke different lower tar cigarettes (1)</li> <li>• because smoke for fewer years /started smoking later (1)</li> </ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>5 (b)</b>	Correlation shows an association or relationship but no causal link (1)		<b>(1)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>5 (c)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• nicotine stimulates adrenaline release which increases {heart rate / blood pressure} (1)</li> <li>• {high blood pressure / toxins} damages endothelium (1)</li> <li>• reference to {inflammatory response / plaque formation} (1)</li> </ul>		<b>(3)</b>

Indicative content	
Question Number <b>*5(d)</b>	<p>Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>Candidates are expected to reach a decision/judgment on whether tobacco smoke is the primary cause of kidney cancer.</p> <ul style="list-style-type: none"> <li>Idea that tobacco smoke is a risk factor for kidney cancer: carcinogens from tobacco smoke can travel in the bloodstream to the kidney and are taken up by kidney cells.</li> <li>Carcinogens cause mutation of the DNA in the kidney cells, for example p53 gene, leading to uncontrolled mitosis, and tumour formation.</li> <li>Idea of risk of kidney cancer correlating with more than one factor, not just smoking.</li> <li>Linkage of environmental factors (e.g. diet, weight, alcohol consumption, age) to increased risk of cancer-causing mutations.</li> <li>Inheritance of genetic mutations, and increased risk of cancer.</li> <li>The requirement for studies to establish correlations and causal links.</li> </ul>
<b>Level</b>	<b>Mark</b>
	<b>Descriptor</b>
	0 No rewardable material
Level 1	1–3 Demonstrates isolated elements of biological knowledge and understanding. Provides little or no reference to a range of scientific ideas, processes, techniques and procedures. Scientific argument may be attempted, but fails to link biological concepts and/or ideas in order to support decision/conclusion. Limited attempt to address the question.

Level	Mark	Descriptor
Level 2	4–6	<p>Demonstrates adequate biological knowledge and understanding with selection of some biological facts/concepts to support the argument or decision/conclusion being made.</p> <p>Scientific reasoning occasionally supported through the linkage of a range of scientific ideas, processes, techniques and procedures.</p> <p>Scientific argument is partially developed. Attempts to synthesise and integrate relevant knowledge with linkages to biological concepts and/or ideas, leading to a notional scientific argument or decision/conclusion based on evidence.</p>
Level 3	7–9	<p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to support the argument or decision/conclusion being made.</p> <p>Scientific reasoning supported throughout by sustained linkage of a range of scientific ideas, processes, techniques or procedures.</p> <p>Scientific argument is well developed and logical. Demonstrating throughout the skills of synthesising and integrating relevant knowledge with consistent linkages to biological concepts and/or ideas, leading to nuanced and balanced scientific argument or decision/conclusion based on evidence.</p>

(Total for Question 5 = 15 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(a)(i)</b>	49 182 000 x 0.05 (1)  2 459 100 (1)	Correct answer gains full marks	<b>(2)</b>
Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(a)(ii)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"> <li>• can dilate bronchioles /airways (1)</li> <li>• therefore allowing more oxygen into lungs /alveoli (1)</li> </ul>		<b>(2)</b>
Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(a)(iii)</b>	An explanation that makes reference to the following: <ul style="list-style-type: none"> <li>• sympathetic neurotransmitters are released at the SAN (1)</li> <li>• therefore if beta-2 agonists are present the SAN will increase its rate of stimulation (1)</li> <li>• so impulses will spread faster and more often over the atria (1)</li> <li>• therefore the heart muscle will contract more often which increases the heart rate (1)</li> </ul>		<b>(4)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6 (b)</b>	<p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> <li>• HGH binds to receptor in cell surface membrane (1)</li> <li>• activation of messenger molecule in cytoplasm (1)</li> <li>• reference to protein kinase cascade (1)</li> <li>• transcription factor produced (1)</li> <li>• gene for IGF-1 switched on (1)</li> </ul>		<b>(4)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6 (c)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• occur naturally / would have some present in body (1)</li> <li>• therefore difficult to detect additional HGH (1)</li> </ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(d)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• no need for blood transfusion (1)</li> </ul> <p>plus any one from:</p> <ul style="list-style-type: none"> <li>• therefore no risk of rejection / agglutination/ delay in {tissue/blood} typing (1)</li> <li>• they supply the oxygen requirements for the body (1)</li> </ul>		<b>(2)</b>
<b>6(e)</b>	<p>Acceptable Answer</p> <p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> <li>• reference to {sodium ion channels / voltage gated sodium ion channels} (1)</li> <li>• binding blocks movement of sodium ions into neurone (1)</li> <li>• membrane is not depolarised (1)</li> <li>• action potential is not generated (1)</li> <li>• no impulses conducted to brain (1)</li> </ul>	<p>Additional guidance</p> <p>Accept more sophisticated answers that refer to the effect on calcium ion movement</p>	<b>(4)</b>

Number			
<b>6 (f)</b>	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"> <li>• (they) increase the removal of {water/salts} from blood (1)</li> <li>• (removal of water) lowers blood volume and therefore pressure (1)</li> <li>• (removal of salt) lowers uptake of water into blood (by osmosis from tissue fluid) and therefore blood pressure (1)</li> </ul>		<b>(2)</b>
Question Number	Acceptable Answer	Additional guidance	Mark
<b>6 (g)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• normal ratio is 1:1 (1)</li> <li>• taking testosterone and epitestosterone in equal measures maintains this ratio (1)</li> <li>• therefore it is not possible to detect cheats (1)</li> </ul>		<b>(3)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(h)</b>	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• drug E has been retained in the gas phase longer (1)</li> <li>• because it has {greater solubility / smaller mass} (1)</li> </ul>	Accept more sophisticated answers related to charge	<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(i)</b>	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"> <li>• longitudinal monitoring / to be followed over time (1)</li> <li>• therefore can identify individual differences in naturally occurring drug concentrations (1)</li> <li>• therefore can see pattern or link to competition / injury / look for changes (1)</li> </ul>		<b>(2)</b>

Question Number	Acceptable Answer	Additional guidance	Mark
<b>6(j)</b>	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• the absolutist's view would be that they should never be used (1)</li> </ul> <p>plus any one from:</p> <ul style="list-style-type: none"> <li>• because of the damage to the body by the side effects (1)</li> <li>• athletes should compete using their innate {anatomical / physiological} abilities / fair competition should be promoted (1)</li> </ul> <p>and</p> <ul style="list-style-type: none"> <li>• the rationalist's view would be that their use is acceptable if there is a justifiable outcome (1)</li> </ul> <p>Plus any one from:</p> <ul style="list-style-type: none"> <li>• because it is a personal choice (1)</li> <li>• because it could help to overcome the inequalities in {training / medical support} (1)</li> </ul>		<b>(4)</b>

(Total for Question 6 = 33 marks)

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