

## QUESTION 1: N/A

Question	Marking Guidance	Mark	Comments
2(a)(i)	Decreases;	1	Accept any word that means a decrease e.g. shorter/narrower/smaller etc
2(a)(ii)	Nothing / stays the same length / does not change;	1	
2(b)	<ol style="list-style-type: none"> <li>Two marks for correct answer of 29545-30455;</li> <li>One mark for incorrect answers in which candidate clearly divides measured width by actual width;</li> </ol>	2	<p>Correct answer = 2 marks outright. Range allows for a 1mm error in measuring</p> <p>Ignore rounding up</p>
2(c)	<p>(Idea ATP is needed for:)</p> <ol style="list-style-type: none"> <li>Attachment/cross bridges between actin and myosin;</li> <li>'Power stroke' / movement of myosin heads / pulling of actin;</li> <li>Detachment of myosin heads;</li> <li>Myosin heads move back/to original position / 'recovery stroke';</li> </ol>	3 max	<ol style="list-style-type: none"> <li>Accept the role of ADP in attachment</li> <li>Not just 'filaments slide' as given in the question stem</li> </ol>

Question	Marking Guidance	Mark	Comments
3(a)(i)	1. LH increases/peaks after oestrogen increases/peaks; <b>OR</b> 2. Oestrogen increases/peaks before LH increases/peaks;	1	Need the idea of 'after' or 'before' Neutral: LH increases as oestrogen increases Neutral: oestrogen causes LH to be released as in stem of the question
3(a)(ii)	Progesterone falls / progesterone returns to start / progesterone not maintained;	1	Accept: FSH increases at end of the cycle
3(b)(i)	1. FSH inhibited; 2. Follicle not stimulated / ripened / does not grow; 3. LH inhibited; 4. Ovulation prevented / egg/ovum not released;	4	2. Accept: egg not ripened <b>Q</b> Neutral: egg/ovum not produced Only penalise if a <u>direct</u> incorrect statement is made e.g. LH inhibited so follicle not ripened = 1 mark FSH and LH inhibited so follicle not ripened and ovulation prevented = 4 marks
3(b)(ii)	Will not forget to take Implanon / may forget to take an oral contraceptive / does not have to be taken daily / not affected by illness/vomiting;	1	Neutral: ref. to lasting longer / acting quicker Neutral: 'constantly released' as given in the stem of the question Reject: oral contraceptives are digested Neutral: refs. to cost

Question	Marking Guidance	Mark	Comments
4(a)	<ol style="list-style-type: none"> <li>(Oxygen/carbon dioxide) detected by chemoreceptors / (pressure) detected by baroreceptors;</li> <li>Medulla/cardiac centre involved;</li> <li>More impulses to SAN/along sympathetic nerve;</li> </ol>	3	<ol style="list-style-type: none"> <li>Accept a valid equivalent e.g. cardioacceleratory centre</li> <li>Neutral: signals/messages Accept: acceleratory nerve Need idea of 'more impulses' directly, not by implication</li> </ol>
4(b)(i)	<ol style="list-style-type: none"> <li>To ensure results are due to omega-3/fatty acids (only) / not due to something else in the oil;</li> <li>Placebo linked to mental/psychological effect;</li> </ol>	1 max	<p>Neutral: Idea of comparing groups/results</p> <p>Neutral: reference to a control group / placebo (unqualified)</p>
4(b)(ii)	<ol style="list-style-type: none"> <li>Lower/greater change of heart rate for Group A;</li> <li>(Differences) are real / reliable / significant / not due to chance;</li> <li>As bars do not overlap / values are not shared;</li> </ol>	3	Ignore references to methodology

## QUESTION 5: N/A

Question	Marking Guidance	Mark	Comments
6(a)	<ol style="list-style-type: none"> <li>1. <u>Adenylate cyclase</u> activated / cAMP produced / second messenger produced;</li> <li>2. Activates enzyme(s) (in cell);</li> <li>3. (So) glycogenolysis/ gluconeogenesis occurs / glycogenesis inhibited;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>3. Neutral: 'glucose produced' as given in the question stem</li> </ol> <p>Accept: correct descriptions of these terms</p>
6(b)(i)	<ol style="list-style-type: none"> <li>1. Glucose/sugar in food would affect the results;</li> <li>2. Food/eating would affect blood glucose (level);</li> <li>3. (Allows time for) blood glucose (level) to return to normal;</li> </ol>	1 max	<ol style="list-style-type: none"> <li>1. Accept references to starch / carbohydrate</li> <li>3. Neutral: allows time for insulin to act</li> </ol>
6(b)(ii)	Type 2 diabetes is a failure to respond to insulin / still produces insulin / is not insulin-dependent;	1	
6(b)(iii)	<p>(For) – 3 max</p> <ol style="list-style-type: none"> <li>1. Avoids injections / pain of injections;</li> <li>2. Long(er) lasting / permanent / (new) cells will contain/ express gene;</li> <li>3. Less need to measure blood sugar / avoids the highs and lows in blood sugar;</li> <li>4. Less restriction on diet;</li> </ol> <p>(Against) – 3 max</p> <ol style="list-style-type: none"> <li>5. Rats are different to humans;</li> <li>6. May have side effects on humans;</li> <li>7. Long(er) term effects (of treatment) not known / may have caused effects after 8 months;</li> <li>8. (Substitute) insulin may be rejected by the body;</li> </ol>	4 max	<p>A maximum of three marks can be awarded for each side of the argument</p> <p>Ignore references to methodology e.g. sample size not known</p> <ol style="list-style-type: none"> <li>6. Accept: virus may be harmful / disrupt genes / cause cancer</li> </ol>

Question	Marking Guidance	Mark	Comments
7(a)	1. (Seedlings) respond to light / are phototropic; <b>OR</b> 2. (Only) measuring the effect of gravity / response to gravity;	1	Reject: <u>roots</u> are positively phototropic / grow towards light Neutral: 'to control a variable' Neutral: light affects growth/results
7(b)	1. (Cells in) root tip detect gravity / respond to gravity; <b>OR</b> 2. IAA/auxin is produced in the root tip;	1	Must refer to root tip and not just the root
7(c)(i)	1. IAA/auxin moves to lower side / more IAA/auxin on lower side; 2. Lower side grows less/slower / upper side grows more /faster / inhibits growth on lower side;	2	Accept: references to 'cell elongation' instead of 'growth' Note: if auxin is placed at upper side, mark point 2 can still be awarded Need idea of 'less/slower' or 'more/faster' for mark point 2
7(c)(ii)	1. Less IAA/auxin (produced); 2. Lower side grows more/faster / less inhibition of growth on lower side;	2	2. Must refer to the lower side

Question	Marking guidelines	Mark	Comments
8(a)(i)	Stickleback + caddis fly (larva) + stonefly (larva);	1	All three required for mark. In any order.
(a)(ii)	<ol style="list-style-type: none"> <li>(With fewer fish) reduced predation / not being eaten results in more freshwater shrimps;</li> <li>Increased competition for food/resources / more producers eaten by shrimps / more shrimps eating producers;</li> <li>Less food/resources for mayfly;</li> </ol>	2 max	Principles <ol style="list-style-type: none"> <li><u>Effect of</u> fish on shrimps</li> <li><u>Effect of</u> shrimps on producer</li> <li><u>Effect of</u> food on mayfly</li> </ol>
(b)(i)	<ol style="list-style-type: none"> <li>Two marks for correct answer in range 16.8 to 18.9;;</li> <li>One mark for incorrect answer in which candidate divides 19 to 21 by 111 to 113;</li> </ol>	2	Ignore additional decimal places. Working shown in mm. Accept working in cm/2mm squares (10/56) for 1 mark.
(b)(ii)	<ol style="list-style-type: none"> <li>Single-celled producers are more digestible / contain less cellulose (than plants) / less energy lost in faeces;</li> <li>All of producer eaten/parts of plant not eaten;</li> <li>Less heat/energy lost / less respiration;</li> </ol>	2 max	3. May refer to either trophic level
(c)	<ol style="list-style-type: none"> <li>Photosynthesis/light dependent reaction/light independent reaction;</li> <li>Carbon-containing substances;</li> </ol>	2	Allow organic substance or named organic substance

Question	Marking guidelines	Mark	Comments
9(a)	Nitrification;	1	Accept nitrifying. Do not accept nitrogen fixing.
(b)	1. Uptake (by roots) involves active transport; 2. Requires ATP/ aerobic respiration;	2	Reject all references to bacteria
(c)(i)	1. Not enough time / fast flow washes bacteria away; 2. (Not all/less) ammonia converted to nitrate/less nitrification;	2	"Not enough time for bacteria to convert all the ammonia to nitrate" gains 2 marks
(c)(ii)	1. Algal bloom / increase in algae; 2. Algae block light / plants/algae die; 3. Decomposers/saprobionts/bacteria break down dead plant materials; 4. Bacteria/decomposers/saprobionts use up oxygen in respiration / increase BOD; 5. Fish die due to lack of oxygen;	3 max	4. Accept alternatives such as microbes/ saprophytes.

Question	Marking guidelines	Mark	Comments
10(a)(i)	<ol style="list-style-type: none"> <li>1. Same breed so similar alleles;</li> <li>2. Controls/removes variable/so genes not a factor / only temperature affects results / rate of growth affected by genes;</li> </ol>	2	<ol style="list-style-type: none"> <li>1. Allow different alleles have different effects</li> <li>2. Accept idea worded in such terms as inherited.</li> </ol>
(a)(ii)	<ol style="list-style-type: none"> <li>1. Different growth rates / gained different biomass / grew different amount;</li> <li>2. Not due to temperature / the independent variable;</li> </ol>	2	<p>Allow "more food for growth"</p> <p>Ignore references to efficiency of conversion.</p>
(b)(i)	Rise then fall with peak at 20° C;	1	Do not accept 0.85 as alternative to 20.
(b)(ii)	<ol style="list-style-type: none"> <li>1. Temperature may be between 10 and 30/10 and 20/20 and 30;</li> <li>2. Intervals are 10°C/large/not small/should be smaller/should be intermediates;</li> </ol>	2	No mark for yes or no.
(c)(i)	<ol style="list-style-type: none"> <li>1. Growth rate decreasing / conversion staying same/ decreasing;</li> <li>2. (Scientists would be) looking for high growth rate/ conversion / data shows unlikely to improve growth/yield;</li> <li>3. Wastes time/resources/would not relate to farming conditions;</li> </ol>	2 max	<p>3. Ignore cruelty to pigs</p>
(c)(ii)	<ol style="list-style-type: none"> <li>1. Will lose more heat / not as much energy used to maintain body temperature;</li> <li>2. Heat resulting from respiration/more respiration;</li> <li>3. More food used in respiration;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>1. Must be a comparative statement</li> <li>Accept energy as equivalent to heat in the context of this question</li> <li>2. Do not credit answers relating to energy made in respiration</li> </ol>



(d)	<p><b>In support</b></p> <ol style="list-style-type: none"> <li>Food <b>B</b> produces greater mass than control/greater than 100%;</li> </ol> <p><b>But</b></p> <ol style="list-style-type: none"> <li>Error bars for <b>B</b> mean <b>B</b> could be no better / not different from control;</li> <li>Overlap of error bars for <b>B</b> and <b>A</b>;</li> <li><b>A</b> no better than/not different from <b>B</b>;</li> </ol> <p><b>Experimental limitations</b></p> <ol style="list-style-type: none"> <li>Experiment only ran for 10 days;</li> <li>Experimental conditions /breed of pig may not be the same as on the farm;</li> <li>No information about cost;</li> </ol>	4 max	<p>Read standard deviation as standard error</p> <ol style="list-style-type: none"> <li>Must refer to control</li> </ol>    <p>4. Neutral: "Results not significant". Mark must compare <b>A</b> to <b>B</b></p>
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Question	Marking guidelines	Mark	Comments
11(a)	<ol style="list-style-type: none"> <li>1. Releases energy in small / manageable amounts;</li> <li>2. (Broken down) in a one step / single bond broken;</li> <li>3. Immediate energy compound/makes energy available rapidly;</li> <li>4. Phosphorylates/adds phosphate;</li> <li>5. Makes (phosphorylated substances) more reactive / lowers activation energy;</li> <li>6. Reformed/made again;</li> </ol>	4 max	<ol style="list-style-type: none"> <li>1. Accept less than glucose</li> <li>2. Accept easily broken down</li> <li></li> <li>4. Do not accept phosphorus or P on its own</li> <li></li> <li>6. Must relate to regeneration</li> </ol>
(b)	<ol style="list-style-type: none"> <li>1. Substrate level phosphorylation / ATP produced in Krebs cycle;</li> <li>2. Krebs cycle/link reaction produces reduced coenzyme/reduced NAD/reduced FAD;</li> <li>3. Electrons released from reduced /coenzymes/ NAD/FAD;</li> <li>4. (Electrons) pass along carriers/through electron transport chain/through series of redox reactions;</li> <li>5. Energy released;</li> <li>6. ADP/ADP + Pi;</li> <li>7. Protons move into intermembrane space;</li> <li>8. ATP synthase;</li> </ol>	6 max	<ol style="list-style-type: none"> <li>Accept alternatives for reduced NAD</li> <li>2. Accept description of either Krebs cycle or link reaction</li> <li></li> <li></li> <li>5. Allow this mark in context of electron transport or chemiosmosis</li> <li>6. Accept H<sup>+</sup> or hydrogen ions and cristae</li> <li>7. Allow description of movement through membrane</li> <li>8. Accept ATPase. Reject stalked particles</li> </ol>

(c)	<ol style="list-style-type: none"><li>1. In the dark no ATP production in photosynthesis;</li><li>2. Some tissues unable to photosynthesise/produce ATP;</li><li>3. ATP cannot be moved from cell to cell/stored;</li><li>4. Plant uses more ATP than produced in photosynthesis;</li><li>5. ATP for active transport;</li><li>6. ATP for synthesis (of named substance);</li></ol>	5 max	<ol style="list-style-type: none"><li>1. In context of in photosynthetic tissue/leaves</li></ol>
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