A-LEVEL
BIOLOGY

BIOL5 - Control in cells and in organisms
Mark scheme

2410
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Version : 1.0 Final

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Question	Marking Guidance	Mark	Comments
1(a)(i)	(In all organisms/DNA,) the same triplet codes for the same amino acid;	1	Accept codon/same three bases/nucleotides Accept plurals if both triplets and amino acids Reject triplets code for an amino acid Reject reference to producing amino acid
1(a)(ii)	64;	1	
1(b)	Splicing;	1	Ignore deletion references Accept RNA splicing
1(c)(i)	1. (Mutation) changes triplets/codons after that point/causes frame shift; 2. Changes amino acid sequence (after this)/codes for different amino acids (after this); 3. Affects hydrogen/ionic/sulfur bond (not peptide bond); 4. Changes tertiary structure of protein (so non-functional);	3 max	Accept changes splicing site 1. Ignore changes in sequence of nucleotides/bases 2. Accept changes primary structure 2. Reject changes amino acid formed/one amino acid changed 4 Neutral 3-D structure
1(c)(ii)	1. Intron non-coding (DNA)/only exons coding; 2. (So) not translated / no change in mRNA produced / no effect (on protein) / no effect on amino acid sequence; ***OR*** 3. Prevents/changes splicing; 4. (So) faulty mRNA formed; 5. Get different amino acid sequence;	2 max	Context is the **intron** Do not mix and match from alternatives 1. Neutral references to introns removed during splicing 1.and 2. Ignore ref. to code degenerate and get same/different amino acid in

			sequence 2. Accept does not code for amino acids 4. Accept exons not joined together/introns not removed

Question	Marking Guidance	Mark	Comments
2(a)	1. (Taxis is) movement towards/away from a stimulus / a directional response/movement (to a stimulus); 2. (Move towards) temperature they were used to/cultured in;	2 max	Movement towards temperature they were used to = 2 marks
2(b)	1. Hungry, so seeking food / in absence of food respond to temperature; 2. Move towards temperature they were used to/cultured in; 3. Associate (this temperature) with food; 4. (Then) stay in this temperature;	3 max	Ignore references to temperature and enzymes 1. Must be stated not inferred from other statements 3. Accept they think food is here 3. Stated not inferred
2(c)	1. (Dim) worms live in soil/dark/ affected by bright light / dim light is like normal environment/what they are used to; 2. (Even) because worms might move towards/away from bright light / to avoid creating light gradient / prevent worms showing phototaxis/ all parts of surface exposed to same light; 3. (Dim light) ensures heat from light not a variable/ heat from lamp could kill/dry out worms;	2 max	2. Accept to avoid kinesis due to light 3. not just to control variables/factors

Question	Marking Guidance	Mark	Comments
3(a)	1. (In myelinated) action potential/depolarisation only at node(s); 2. (In myelinated, nerve impulse) jumps from node to node/saltatory; 3. (In myelinated) action potential/impulse does not travel along whole length;	3	The question is about speed of transmission, not repolarisation or related matters 3. Accept converse for non-myelinated
3(b)	1. Probability of obtaining this difference by chance; 2. Is less than 5%/less than 0.05/less than one in twenty; 3. Difference is significant;	2 max	1. and 3. Reject 'results' once only 1. This statement often split round 2. 2. Accept is 4.7%/0.047 but reject less than 4.7%/0.047 2. Accept correct greater than 95%/greater than 0.95 arguments
3(c)	1. (All) dementia results lower (than control group)/non-dementia result higher; 2. Error bars do not overlap so differences are (possibly) significant; 3. Dementia may be due to other factors / not only due to a lack of myelin; 4. (Because) big/significant differences in myelin in different dementia; 5. Only small sample sizes/only one study/ more data required;	4 max	2. Neutral results 2. Accept not due to chance/statistically significant 2. In this context, accept references to standard deviation 3. Accept suitable named factor e.g. genetic 4. Not just 'different'

Question	Marking Guidance	Mark	Comments
4(a)	(Formation of glycogen) 1. Glucose concentration in cell/liver falls; 2. Below that in blood (plasma)/ higher in blood; 3. Creates/maintains glucose concentration/diffusion gradient; 4. Glucose enters cell/leaves blood by facilitated diffusion/via carrier(protein)/channel (protein);	2 max	4. Not just diffusion
4(b)	1. Insulin sensitivity similar to/not (significantly) different from those with diabetes; 2. Overlap of SDs; 3. Their sensitivity (to insulin also) improved by GBS;	2 max	1. No values for non-obese, so comparisons with 'normal' not possible 2. Accept SE
4(c)	1. Sensitivity (to insulin) does increase; 2. But large SD/ large variation (after GBS); 3. (So) some showing no/little change/ get worse; 4. Do not know what sensitivity to insulin is of non-diabetics (who are not obese);	3 max	This part of the question concerns spread of data, not overlap of SDs 2. Accept use of figures/use of SD values to make this point. 2. Ignore ref to SE 4. Accept 'normal' as non-diabetic

Question	Marking Guidance	Mark	Comments
5(a)	1. No/less oestrogen produced (by follicles/ovaries); 2. No/less negative feedback (by oestrogen); 3. On pituitary (gland);	2 max	1. Ignore references to corpus luteum and progesterone 2. Ignore oestrogen inhibits FSH but accept oestrogen inhibits release/production of FSH
5(b)(i)	1. (Less FSH so) fewer/no follicles develop; 2. (So) fewer follicles (will be) destroyed (by chemotherapy); 3. (So) more follicles left for later in life/after treatment; 4. (So) more eggs;	3 max	1. Neutral fewer eggs develop Accept converse statements Ignore references to LH and ovulation Accept for one mark statement of set/limited number of follicles present (at birth)
5(b)(ii)	(Artificial hormone,) 1. Similar shape/structure/binding site to normal hormone; 2. So binds to (same) receptor and stops normal hormone binding;	2	1. Reject same shape 1. Accept part of shape same as hormone/similar tertiary structure Reject references to active sites, <u>enzyme</u> inhibitors and substrates. Accept references to binding sites and competitive inhibition of hormone binding sites

Question	Marking Guidance	Mark	Comments
6(a)	1. (Phosphocreatine) provides phosphate/phosphorylates; 2. To make ATP;	2	1. Accept P_i or P in circle 1. Reject phosphorus 2. Accept: ADP + CP → ATP + C Neutral – provides ATP
6(b)	One suitable suggestion; eg 1. Genetic differences; 2. Level of fitness/amount of regular exercise done/mass of muscle; 3. Sex; 4. Ethnicity 5. Metabolic rate; 6. Number of fast/slow muscle fibres	1 max	Neutral lifestyle/diet/illness
6(c)	1. (From graph, phosphocreatine) takes longer to remake as people get older; 2. Fast muscle fibres used for rapid/brief/powerful/strong contractions; 3. Phosphocreatine used up rapidly during contraction/to make ATP; 4. Anaerobic respiration involved; 5. (As people get older) slower metabolic rate/slower ATP production/slower respiration; 6. ATP used to reform phosphocreatine; 7. Lots of phosphocreatine in fast fibres;	4 max	1. Accept positive correlation between age and time to re-form phosphocreatine

Question	Marking Guidance	Mark	Comments
7(a)	1. (Protein/molecule) that moves from cytoplasm to DNA; 2. (TF) binds to specific gene/genes/ to specific part of/site on DNA/ binds to promoter/RNA polymerase; 3. Leads to/blocks (pre)mRNA production / allows/blocks binding of RNA polymerase (to DNA)/allows RNA polymerase to work;	2 max	1. Accept 'it' as TF. 1. Accept moves into nucleus 2. Accept regulator/enhancer region 3. Ignore translation unless context wrong Max 1 if refer to oestrogen as a transcription factor
7(b)	1. (Binding to CREB) prevents transcription/mRNA formation; 2. (Binding of huntingtin) prevents production/translation of protein (that removes electrons/protons from NAD); 3. Fewer electrons to electron transport chain/electron transport chain slows/stops/ stops/slower oxidative phosphorylation; 4. Fewer protons for proton gradient; 5. Not enough ATP produced/energy supplied to keep cells alive / anaerobic respiration not enough to keep cell alive;	3 max	1. Accept that lack of protein leaves NAD reduced 5. Accept neurones require ATP for active transport of ions 5. Ignore references to resting potential
7(c)	1. CREB/protein is too large/is water soluble so cannot cross membrane/phospholipid bilayer; 2. Mitochondrion has two membranes/inner and outer membranes; 3. For each (different) membrane a (different) carrier required;	2 max	2. Accept cristae for inner membrane 3. Ignore reference to channel proteins

Question	Marking Guidance	Mark	Comments
8(a)	Reverse transcriptase;	1	
8(b)	1. Probe (base sequence) complementary (to DNA of allele A/where A is); 2. (Probe) binds by forming base pairs/hydrogen bonds; 3. So (only) this DNA labelled/has green dye/gives out (green) light;	2max	1. Accept gene A 3. Accept glows for green light
8(c)(i)	1. More probe binding/more cDNA/mRNA/more allele/gene A means more light; 2. DNA (with **A)** doubles each (PCR) cycle; 3. So light (approximately) doubles/curve steepens more and more (each cycle) /curve goes up exponentially/ increases even faster;	3	
8(c)(ii)	(**G** because) 1. (Heterozygous) only has half the amount of probe for **A** attaching / only half the amount of DNA/allele A (to bind to); 2. (So,) only produced (about) half the light/glow/intensity (of **H**) (per cycle of PCR);	2	1. Accept only one A to bind to 2. If reference to 'half' for point 1, allow 'less light' in 2.

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>9(a)</td><td>
<table>
<tr><th>Part of ecosystem</th><th>Mean rate of carbon dioxide production/ cm^3m^{-2} s^{-1}</th><th>Percentage of total carbon dioxide production measured by the scientists</th></tr>
<tr><td>Leaves of plants</td><td>0.032</td><td>25.0</td></tr>
<tr><td>Stems and roots of plants</td><td>0.051</td><td><u>39.8</u></td></tr>
<tr><td>Non-photosynthetic soil organisms</td><td>0.045</td><td><u>35.2</u></td></tr>
</table>
2 correct = 2 marks;;
Adding rates to get 0.128 = 1;</td><td>2 max</td><td>If rounded to 40 and 35 in table;
• but working shows decimal points, then award 2 marks
• but no working shown, then 1 max.</td></tr>
<tr><td>9(b)</td><td>1. Data only include (heterotrophic) soil organisms;
2. Doesn’t include animals (above ground)/other (non-soil) organisms;
3. Doesn’t take into account anaerobic respiration;</td><td>2 max</td><td>Award points in any combination
Accept for 1 mark idea that CO_2 for leaves doesn’t take into account photosynthesis – not told in dark until 9(d)</td></tr>
<tr><td>9(c)</td><td>All three of following = 2 marks;;
Two of them = 1 mark;
Volume of carbon dioxide given off
(From known) area/ per m^2/m^{-2}
In a known/set time</td><td>2</td><td>Ignore ‘amount’/concentration of CO_2
Accept per second/per unit time</td></tr>
<tr><td>9(d)</td><td>1. (In the light) photosynthesis/in the dark no photosynthesis;
2. (In light,) carbon dioxide (from respiration) being used/taken up (by photosynthesis);</td><td>2</td><td></td></tr>
</table>

9(e)(i)	(Rate of respiration) 1. In soil under trees (always) higher; 2. In soil under trees does not rise between 06.00 and 12.00 /in the middle of the day/ peaks at 20:00-21.00/in the evening; 3. In soil **not** under trees, peaks at about 14:00-15:00/in middle of day;	2 max	Assume "it" means soil under trees 1. Accept converse for soil not under trees Accept 'in the shade' means under the trees 2. and 3. No mm grid, so accept 'between 18.00 and 24.00' or 'between 12.00 and 18.00'

9(e)(ii)	<u>(Between 06.00 and 12.00</u>, (No Mark)) Respiration higher in soil under tree, (No mark) 1. Tree roots carry out (a lot of) respiration; 2. More/there are roots under tree; ***OR*** 3. More food under trees; 4. So more active/greater mass of/more organisms (carrying out respiration); ***OR*** Soil not under trees respiration increases (No mark) 5. Soil in sunlight gets warmer; 6. Enzymes (of respiration) work faster;	2 max	Do not mix and match mark points. No list rule Accept converse for soil not under trees Accept converse for soil not under trees Accept converse for soil under trees

9(f)(i)	1. Photosynthesis produces sugars; 2. Sugars moved to roots; 3. (Sugars) are used/required for respiration;	2 max	2. Do not penalise named sugars other than sucrose

9(f)(ii)	Takes time to move sugars to roots;	1	Look for movement idea in (f)(i) – can carry forward to (ii)

Question	Marking Guidance	Mark	Comments
10(a)	**Cells and organisms carry out exchanges with their external environment <u>to maintain their internal environment</u>.** **Topic areas** **H -** Homeostasis (concept of) **D -** Digestion and absorption **C -** Cells **L -** Lung function **G -** Gas exchange **W -** Passage of water through plant **Nc -** Nutrient cycles **R -** Response to stimuli **N-** Neurones **T -** Temperature control **Tf** - tissue fluid and its formation **B -** Control of blood glucose concentration **Nf -** Negative feedback **Gn -** Gene expression		The topics listed contain material that could be made relevant to the title. Writing about these topics in a general sense may not address the question. Candidates may make correct use of material from other topics. A* includes where candidates use information about a topic in the specification but go beyond what is expected for our A level.

Question	Marking Guidance	Mark	Comments
10(b)	**<u>How energy is transferred</u> within and between organisms**. **Topic areas** **P -** Photosynthesis **Ec -** Energy transfer through ecosystems **F -** Food production **D –** Digestion (as in fuel) **Ab -** Absorption (by cells) **Mt -** Mass transport **R -** Respiration **A -** ATP **Sr -** Stimuli and responses **Mc -** Muscle contraction **N -** Nerve impulses		The topics listed contain material that could be made relevant to the title. Writing about these topics in a general sense may not address the question. Candidates may make correct use of material from other topics. A* includes where candidates use information about a topic in the specification but go beyond what is expected for our A level.