

Mark Scheme (Results)

Summer 2014

GCE Biology (6BI05)
Paper 01R

Unit 5: Energy, exercise and coordination

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
 - ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
 - iii) organise information clearly and coherently, using specialist vocabulary when appropriate.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

() means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.

ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

| Question Number | Answer | Mark |
|------------------|--------|------------|
| 1 (a) (i) | D ; | (1) |

| Question Number | Answer | Mark |
|-------------------|--------|------------|
| 1 (a) (ii) | B ; | (1) |

| Question Number | Answer | Mark |
|--------------------|--------|------------|
| 1 (a) (iii) | D ; | (1) |

| Question Number | Answer | Additional guidance | Mark |
|------------------|--|---|------------|
| 1 (b) (i) | <ul style="list-style-type: none"> 1. Attaches bone to bone / eq 2. Allows (some) movement / eq ; 3. Idea that this gives added stability ; | <ul style="list-style-type: none"> 1. ACCEPT correctly named bones 2. ACCEPT ligaments limit movement 3. ACCEPT X-shaped / 2 ligaments | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|------------------------------|------|
| 1 (b) (ii) | <p>Any one from</p> <ol style="list-style-type: none"> 1. Small incision / wound 2. so reduced likelihood of {pathogen / eq} entry 3. Shorter recovery time 4. Reduced blood loss 5. Idea of less anaesthesia ; | 1. ACCEPT less tissue damage | (1) |

| Question Number | Answer | Additional guidance | Mark | | | | | | | | | |
|--------------------|--|---|-------------------|------------------------------------|---|--------------|---|-----|----------------|------------------|--|-----|
| 2 (a) | <table border="1"> <thead> <tr> <th>Labelled structure</th> <th>Name of structure</th> <th>One function of labelled structure</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>cerebellum ;</td> <td>Coordinates movement / balance / posture / fine motor control ;</td> </tr> <tr> <td>D ;</td> <td>Hypothalamus ;</td> <td>thermoregulation</td> </tr> </tbody> </table> | Labelled structure | Name of structure | One function of labelled structure | A | cerebellum ; | Coordinates movement / balance / posture / fine motor control ; | D ; | Hypothalamus ; | thermoregulation | | (4) |
| Labelled structure | Name of structure | One function of labelled structure | | | | | | | | | | |
| A | cerebellum ; | Coordinates movement / balance / posture / fine motor control ; | | | | | | | | | | |
| D ; | Hypothalamus ; | thermoregulation | | | | | | | | | | |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---------------------|------|
| 2(b) | <ol style="list-style-type: none"> 1. Heat (energy) from blood in capillaries / eq ; 2. Absorbed by sweat ; 3. Used to break H bonds in water ; 4. Ref to latent heat ; 5. (So) water evaporates ; 6. Taking heat from the body / eq ; | | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------|
| 2(c) (i) | <ol style="list-style-type: none"> 1. Ref to arrival of { impulse / action potential / eq } ; 2. Calcium ion {channels / eq } open in { pre-synaptic membrane / brain cell membrane / eq } ; 3. Calcium ions enter (brain cell) through {diffusion / down concentration gradient } ; 4. Causes (glutamate-rich) vesicles to {move towards / fuse with} pre-synaptic membrane / eq ; 5. {Neurotransmitter / glutamate} release through exocytosis ; | | (4) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|--|------------|
| 2 (c) (ii) | <ol style="list-style-type: none">1. Idea that the damaged areas can be identified on MRI scan ;2. Idea that these damaged areas are known to be areas associated with the release of glutamate ;3. Comparison with and without domoic acid ; | <ol style="list-style-type: none">3. ACCEPT in terms of brain regions or sea lions | (2) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------|
| 3(a) | <ol style="list-style-type: none"> 1. Mean time for group A much longer (compared with B) / eq ; 2. No overlap of data / eq ; 3. Idea that means for {B and C / eq} very close together ; 4. Range of data both overlap (for B and C) ; 5. Manipulated data used e.g. lowest time for group A is 154 sec and still higher than longest time for group B (@ 134 sec) or C (@ 133 sec) ; | | (4) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------|
| 3 (b) (i) | <ol style="list-style-type: none"> 4. Increases / eq ; 5. by {50% / 0.6 / 1.5x} ; | | (2) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---|------------|
| * 3 (b) (ii) | <p>(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. Idea that fatigue maybe due to less ATP ; 2. more <i>capillaries</i> supplies more <i>blood</i> / eq ; 3. idea of more <i>capillaries</i> gives greater surface area for exchange ; 4. this supplies { <i>oxygen</i> / <i>glucose</i> / eq } ; 5. for <i>aerobic</i> respiration / eq ; 6. Detail of <i>aerobic</i> respiration ; 7. (so) more ATP <i>made</i> / eq ; 8. (so) delays onset of fatigue / eq ; 9. By 34 seconds in {group A / those fed on epicatechin} ; | <p>QWC emphasis is spelling</p> <ol style="list-style-type: none"> 1. ACCEPT running out /running short 6. ACCEPT a description e.g. of oxidative phosphorylation 7. ACCEPT idea that more ATP present/available 8. ACCEPT ref to muscles can contract for longer 8. gains mp7 as well if states comparison e.g. 34s longer to fatigue | (5) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---|------|
| 4 (a) (i) | <ol style="list-style-type: none"> 1. An ethical comment ; 2. Idea that no embryo used (as somatic cells are body cells) ; 3. Limited supply of embryos /eq ; 4. iPS cells can be used in the same individual that provided the somatic cells ; 5. no immune response with iPS cells ; | <p>All converse as appropriate</p> <p>5. ACCEPT no rejection of cells/tissues/construct</p> | (2) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---------------------|------|
| 4 (a) (ii) | <ol style="list-style-type: none"> 1. Binds to another substance e.g. forming a transcription initiation complex, deactivating inhibitors ; 2. Bind to promoter region(s) (on DNA) ; 3. So no genes switched off / eq ; 4. Ref to RNA polymerase activity ; 5. (m)RNA production ; 6. {protein / eq} produced; 7. That allow cells to divide / undifferentiate / unspecialise ; | | (4) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|--|------------|
| 4 (b) | <ol style="list-style-type: none"> 1. Idea of same source of somatic cells used ; 2. Example of measuring outcome offered e.g. percentage conversion to iPS, amount of mRNA or protein product made ; 3. Use same time (for study) / eq ; 4. Run at same temperature / eq ; 5. Run at { same / optimum } pH ; | <p>3 ACCEPT as time taken to produce iPS</p> | <p>(3)</p> |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---------------------|------------|
| 5 (a) | <ol style="list-style-type: none">1. reference to phytochrome ;2. idea that day length is the environmental cue ;3. ref to critical period / photoperiod ;4. this is more than 12 hours light / less than 12 hours darkness / eq ;5. idea that different wavelengths of light are involved <p>OR</p> <p>Reference to interconversion of phytochromes e.g. because light supplies red light which converts P_R converted to P_{FR} ;</p> <ol style="list-style-type: none">6. Ref to florigen ; | | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|--|------|
| 5 (b) (i) | Both 1. chemicals ; 2. produced in cells / eq ; 3. idea that they move away from site of production ; 4. effect may be distant from production site / eq ; 5. long-term / permanent effect / example quoted / eq ; 6. involved in gene activation /eq ; | 5. ACCEPT both can control growth 6. ACCEPT: Both can have an effect on gene inhibition | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---------------------|------|
| 5 (b) (ii) | 1. idea that weeds affected because e.g. more sensitive, take up more ; 2. idea that (auxin / IAA) causes cell elongation ; | | (2) |

| Question Number | Answer | Additional guidance | Mark | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---------------------|-----------------|--|--|---------|-------|-------|--|---|---|-----|---------------------------------|---|---|-----|---|---|---|-----|--------------------------------------|-----|---|---|--|------------|
| 6 (a) | <table border="1"> <thead> <tr> <th data-bbox="434 373 810 512" rowspan="2">Feature</th> <th colspan="3" data-bbox="810 373 1319 440">Type of neurone</th> </tr> <tr> <th data-bbox="810 440 981 512">Sensory</th> <th data-bbox="981 440 1151 512">Relay</th> <th data-bbox="1151 440 1319 512">Motor</th> </tr> </thead> <tbody> <tr> <td data-bbox="434 512 810 616">Found only in the central nervous system</td> <td data-bbox="810 512 981 616" style="text-align: center;">☒</td> <td data-bbox="981 512 1151 616" style="text-align: center;">☒</td> <td data-bbox="1151 512 1319 616" style="text-align: center;">☒ ;</td> </tr> <tr> <td data-bbox="434 616 810 719">Cell terminates at the effector</td> <td data-bbox="810 616 981 719" style="text-align: center;">☒</td> <td data-bbox="981 616 1151 719" style="text-align: center;">☒</td> <td data-bbox="1151 616 1319 719" style="text-align: center;">☒ ;</td> </tr> <tr> <td data-bbox="434 719 810 863">Pre-synaptic membrane not found in the central nervous system</td> <td data-bbox="810 719 981 863" style="text-align: center;">☒</td> <td data-bbox="981 719 1151 863" style="text-align: center;">☒</td> <td data-bbox="1151 719 1319 863" style="text-align: center;">☒ ;</td> </tr> <tr> <td data-bbox="434 863 810 986">impulse moves away from the receptor</td> <td data-bbox="810 863 981 986" style="text-align: center;">☒ ;</td> <td data-bbox="981 863 1151 986" style="text-align: center;">☒</td> <td data-bbox="1151 863 1319 986" style="text-align: center;">☒</td> </tr> </tbody> </table> | Feature | Type of neurone | | | Sensory | Relay | Motor | Found only in the central nervous system | ☒ | ☒ | ☒ ; | Cell terminates at the effector | ☒ | ☒ | ☒ ; | Pre-synaptic membrane not found in the central nervous system | ☒ | ☒ | ☒ ; | impulse moves away from the receptor | ☒ ; | ☒ | ☒ | | (4) |
| Feature | Type of neurone | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Sensory | Relay | Motor | | | | | | | | | | | | | | | | | | | | | | | |
| Found only in the central nervous system | ☒ | ☒ | ☒ ; | | | | | | | | | | | | | | | | | | | | | | | |
| Cell terminates at the effector | ☒ | ☒ | ☒ ; | | | | | | | | | | | | | | | | | | | | | | | |
| Pre-synaptic membrane not found in the central nervous system | ☒ | ☒ | ☒ ; | | | | | | | | | | | | | | | | | | | | | | | |
| impulse moves away from the receptor | ☒ ; | ☒ | ☒ | | | | | | | | | | | | | | | | | | | | | | | |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|-------------------|---------------------|------|
| 6 (b) (i) | Hydrolysis / eq ; | | (1) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---|------|
| 6 (b) (ii) | <ol style="list-style-type: none"> 1. Supplies energy to allow opsin <u>and</u> retinal to combine ; 2. To (re)form rhodopsin ; 3. Use in the transport of ions e.g. to allow Na⁺ to be pumped out of cell ; | 3. ACCEPT role of ATP in calcium ion uptake | (2) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------------|
| 6 (b) (iii) | <ol style="list-style-type: none"> 1. Reference to actin and myosin interacting ; 2. ATP binds to myosin head causing {bond / cross-bridge / eq} between actin and myosin to break / eq ; 3. ATP {breaks / hydrolyses} into ADP and P_i {releasing energy that is stored in myosin head / causing myosin head to reset / eq} ; 4. Myosin head binds to actin / {bond / cross-bridge forms} between actin and myosin / eq ; 5. P_i is released from myosin head / eq ; 6. Energy in myosin head causes it to move / eq ; 7. Idea that actin slides along ; 8. ADP is released at this time / eq ; 9. Role of ATP in transport of calcium ions back to sarcoplasm / eq ; | | (5) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|-------------------------|------|
| 7(a) | <ol style="list-style-type: none"> 1. Chromosomes / eq (continue to) condense ; 2. Nuclear envelope breaks down ; 3. Spindles (fibres) form ; 4. Nucleolus breaks down / eq ; | 1 IGNORE become visible | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------|
| 7(b) | <ol style="list-style-type: none"> 1. (pH sensitive cells) detect a change in blood pH / eq ; 2. These are in the {carotid body / carotid artery / aortic body / aorta / medulla } ; 3. Alter impulse rate to brain / eq ; 4. Ref to cardiac centre ; 5. in medulla ; 6. Change impulse rate of SAN ; | | (4) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|--|------------|
| 7(c) | <ol style="list-style-type: none"> 1. Idea that reproduce rapidly / {robust/hardy} so many can be formed rapidly ; 2. Easy to culture / eq ; 3. (HeLa cells) susceptible to disease / HPV / eq ; 4. Genome known / eq ; 5. Idea that they have no Hayflick limit ; | <ol style="list-style-type: none"> 2. ACCEPT cheaper (as continual supply) 3. ACCEPT other named disease 4 ACCEPT ref to (HeLa) cells are human | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|--|------------|
| * 7(d) | <p>(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. Phospholipid bilayer ; 2. Idea of its hydrophobic properties inhibit movement of ions across membrane ; 3. Na⁺ gated channel present ; 4. To allow Na⁺ to enter during depolarisation / to open when local currents occur ; 5. K⁺ channels ; 6. To allow K⁺ to diffuse ; 7. Sodium–potassium pump / eq ; 8. To {export Na⁺/ import K⁺} ; 9. Role of pump in neurone membrane ; 10. Idea that only parts of the membrane may be involved e.g. nodes of Ranvier ; | <p>QWC emphasis is logical sequence IGNORE myelin sheath comments?</p> <p>3. ACCEPT voltage-gated / protein channels</p> <p>9 ACCEPT role with regard to the resting potential ; 10. ACCEPT salutatory condition ;</p> | (6) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|------------------------------------|------|
| 7(e) | <ol style="list-style-type: none"> 1. Idea of double stranded only in HeLa ; 2. Idea of too many H bonds in HeLa / {complementary bases / base pairs} ; 3. Thymine only found in HeLa genetic material / uracil only in poliovirus ; 4. Sugar present in HeLa is deoxyribose / ribose in poliovirus / eq ; | 1 ACCEPT double helix in HeLa only | (3) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---|------|
| 7(f) | <ol style="list-style-type: none"> 1. brown shown as dominant / white shown as recessive e.g. use of upper and lower case; <p>Parental generation:</p> <ol style="list-style-type: none"> 2. both types shown as homozygous ; <p>F1:</p> <ol style="list-style-type: none"> 3. All shown as heterozygous ; <p>F2:</p> <ol style="list-style-type: none"> 4. Genetic diagram to show that 75% are brown / 25% are white ; | <p>This could be gleaned from gametes</p> <p>4. Diagram should show genotypes</p> | (4) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|-----------------------------------|------|
| 7(g) | <ol style="list-style-type: none"> 1. Allow continual division (of hybrid) ; 2. Idea of continual production of (monoclonal) antibodies ; | 1. ACCEPT division is rapid / eq; | (2) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------|
| 7(h) | <ol style="list-style-type: none"> 1. Modification of {genome / DNA / eq} ; 2. Ref to the addition of {genetic material / eq} from another {organism / species / eq} / eq ; | | (2) |

| Question Number | Answer | Mark |
|-----------------|------------------|------|
| 7(i) | D (2^{50}) ; | (1) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|----------------------------|------|
| 7(j) | <p>Any two for 1 mark:</p> <p>Carbon/hydrogen/oxygen/nitrogen ; ;</p> | ACCEPT as chemical symbols | (2) |

Ofqual




Llywodraeth Cynulliad Cymru
Welsh Assembly Government



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