## edexcel

Mark Scheme (Results)
Summer 2015

Pearson Edexcel GCE<br>in Biology (6BI01)<br>Paper 01 Transport, Genes \& Health

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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.

| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 1(a) | idea that the (RNA) nucleotides attach to this strand <br> OR <br> idea of \{nucleotide / base \} sequence that directs the synthesis of \{complementary sequence / mRNA / eq\} ; | ACCEPT complementary to RNA nucelotides, codes for mRNA, \{part of the DNA / antisense \} strand that the mRNA is built along, NOT DNA nucleotides, plural strands | (1) |


| Question <br> Number | Answer | Mark |
| :--- | :---: | :---: |
| $\mathbf{1 ( b ) ( i )}$ | D $\quad$ have a sugar-phosphate chain; | (1) |


| Question <br> Number | Answer | Mark |
| :---: | :---: | :---: |
| $\mathbf{1 ( b ) ( i i )}$ | C $\quad$ semi-conservative replication is possible ; | (1) |


| Question <br> Number | Answer | Mark |
| :---: | :---: | :---: |
| $\mathbf{1 ( b )}$ (iii) | A $10 \% ;$ | (1) |




| $\begin{array}{l}\text { Question } \\ \text { Number }\end{array}$ | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 2(a) | $\begin{array}{l}\text { 1. idea that both of these alleles need to be present in } \\ \text { order for the recessive phenotype to be expressed ; } \\ \text { AND any two of: } \\ \text { 2. different form of a gene / eq ; } \\ \text { 3. same locus / position / eq ; } \\ \text { 4. different base sequence / eq ; }\end{array}$ | $\begin{array}{l}\text { 1. ACCEPT not expressed in } \\ \text { presence of dominant } \\ \text { allele }\end{array}$ |  |
| 2. ACCEPT type of same gene |  |  |  |
| NOT just type of gene |  |  |  |$\}$


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 2(b) (i) | 1. genotypes and phenotypes of parents ; <br> 2. gametes clearly shown as individual alleles; <br> 3. offspring genotypes ; <br> 4. phenotypes correctly matched to genotypes ; | IGNORE gender <br> 1. \& 4. ACCEPT carrier/ normal / healthy / unaffected /sufferer as a phenotype <br> 2. NOT E.C.F. from 1. <br> 2. \& 3 can be awarded in a Punnett square <br> 3. and 4. can be awarded as E.C.F. from 2 | (4) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| $\mathbf{2 ( b ) ( i i )}$ | $0.5 / 1 / 2 / 1 \mathrm{in} 2 / 50 \% ;$ | IGNORE expressed as a ratio | (1) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| $\mathbf{3 ( a ) \text { (i) }}$ | 1. idea that you can see the \{ heart / internal organs / <br> eq\} ; | 1. ACCEPT they are transparent |  |
| 2. Daphnia \{are simple organisms / have less developed <br> nervous system / can't feel pain / eq\} ; | 3. idea that there are fewer ethical concerns because it <br> is an \{ invertebrate / eq\} ; | 3. NB. needs to be linked to <br> something about the Daphnia <br> and not just because it is a <br> Daphnia e.g. a simple organism <br> 4. ACCEPT easy to reproduce / <br> easy to keep / readily available / <br> eq; <br> 5. ACCEPT they are small so <br> chemicals can affect them quickly |  |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 3(a)(ii) | suitable variables identified ; <br> suitable control method; Examples: <br> - temperature ; heat shield ; <br> - volume of caffeine (solution) ; (use pipette to measure) stated volume e.g. $2 \mathrm{~cm}^{3}$; <br> - \{ age / species / source /size / gender \} of Daphnia ; hatched from eggs at the same time ; <br> - pre-treatment / acclimatisation ; same time ; <br> - reduce movement of Daphnia ; use of cotton wool strands ; <br> - method of measuring heart rate ; count number of heartbeats in 30 seconds / eq ; <br> - \{concentration / source\} of caffeine; one caffeine tablet in $10 \mathrm{~cm}^{3}$ of water ; | Other variables may be given e.g. stress, oxygen, pH <br> The methods shown are examples others may be seen <br> I GNORE water bath, room temperature etc <br> ACCEPT keep lamp off except when needed <br> DO NOT ACCEPT number of drops <br> ACCEPT water bath used in acclimatisation <br> DO NOT ACCEPT just stated concentration | (4) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 3(b) | 1. reference to mass flow ; <br> 2. name a suitable substance transported e.g. oxygen ; | 1. ACCEPT mass transport <br> 2. IGNORE oxygenated blood |  |
|  | 3. comment on \{blood pressure / fast movement of <br> blood to cells /eq\} ; <br> 4. idea of increased concentration gradient of solutes <br> e.g. oxygen ; | 3. IGNORE pump alone <br> 4. idea that diffusion alone would be too slow ; <br> exchange improved gaseous | 5. ACCEPT surface area to <br> volume ratio too small <br> 6. IGNORE activity level |


| $\begin{array}{l}\text { Question } \\ \text { Number }\end{array}$ | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :---: |
| 4(a) | $\begin{array}{l}\text { 1. homozygous ; } \\ \text { 2. channel / transport / transmembrane / intrinsic / } \\ \text { globular ; }\end{array}$ | 1. ACCEPT (a) homozygote |  |$]$


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 4(b) | 1. produces \{thicker / stickier / more viscous / eq\} mucus ; <br> 2. blocking \{ trachea / bronchi / bronchioles / airway / eq\} <br> 3. cilia are unable to move mucus out of lungs / eq ; | 1. ACCEPT sticky / thick in <br> context, <br> ACCEPT less water in mucus <br> 2. IGNORE respiratory system <br> ACCEPT alveoli |  |
| 4. idea of reduced flow of \{air / oxygen \} to alveoli ; <br> 5. idea of reduced concentration gradient for \{oxygen / <br> carbon dioxide\} (in alveoli) ; <br> 6. idea of loss of surface area / elasticity / eq ; | 7. idea of reduced gaseous exchange ; <br> 8. trapped bacteria may result in more respiratory infections <br> / eq ; | 7. ACCEPT less O2 diffuses into <br> blood <br> IGNORE larger diffusion pathway |  |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 4(c) (i) | 1. chorionic villus sampling / amniocentesis ; <br> 2. idea that (fetal) \{cells / DNA\} are obtained from <br> appropriate source \{ placenta / amniotic fluid / eq \} ; | 1. ACCEPT CVS <br> DO NOT ACCEPT chronic <br> 2. ACCEPT from embryo |  |
|  | 3. (cells / DNA) tested for presence of \{CFTR / recessive <br> / faulty / mutant / eq\} \{allele / gene \} / eq ; | 3. ACCEPT test for cystic <br> fibrosis allele or gene |  |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 4 (c) (ii) | Any of the following paired points <br> 1. idea that it may result in a miscarriage / choice of an abortion ; <br> 2. $\{$ killing / eq\} is $\{w r o n g /$ unethical / eq\}; <br> OR <br> 3. idea of risk of false \{positive / negative\} ; <br> 4. comment on consequence e.g. healthy fetus may be aborted / parents not prepared for child with cystic fibrosis / eq ; <br> OR <br> 5. if cystic fibrosis or some other abnormality may be found ; <br> 6. comment on possible problems with \{future employment / insurance / what constitutes a serious condition\} / eq ; <br> OR <br> 7. who has right to decide if tests should be performed / eq <br> 8. \{implications of medical costs / disagreements over next step\} ; <br> OR <br> 9. issues relating to confidentiality of \{parents / child\} / eq ; <br> 10. idea that \{some other abnormality may be found / paternal DNA does not match / other family members have right to know results ; | 1. ACCEPT can \{harm / damage / kill\} the fetus <br> 2. ACCEPT fetus has right to life / distress to parents / genetic discrimination / eugenics <br> 3. ACCEPT it isn't 100\% accurate <br> 4. ACCEPT parents did not have choice of abortion | (2) |


| Question <br> Number | Answer | Mark |
| :--- | :--- | ---: |
| $\mathbf{5 ( a ) ( i )}$ | $31.0 / 31.02 / 31 ;$ | $(1)$ |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :---: | :--- | :--- | :---: |
| $\mathbf{5 ~ ( a ) ~ ( i i ) ~}$ | Obese class I / moderately obese ; | ACCEPT category based on <br> answer to (ai) | (1) |



| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 5 (b) | Explanations should be linked to the medical advice. <br> 1. reduce energy intake / increase activity / follow calorie controlled diet / eq ; <br> 2. idea of change in balance of energy budget ; <br> 3. lower \{weight / BMI / obesity level / eq\} / reduce risk of \{atherosclerosis / diabetes / eq\} ; <br> OR <br> 4. statins / sterols / reduce \{ cholesterol / saturated fats / eq\} in diet / eq ; <br> 5. reduce blood cholesterol levels ; <br> 6. idea of reducing risk of atherosclerosis / eq ; <br> OR <br> 7. eat more fruit / vegetable / vitamins / moderate alcohol intake / eq ; <br> 8. reference to antioxidants ; <br> 9. they protect against free radical damage / reduce damage to cells / eq <br> OR <br> 10. anticoagulants / platelet inhibitory drugs / warfarin / aspirin / eq ; <br> 11. prevent blood clot formation / eq ; <br> 12.reduces risk of blocking artery / eq ; | NB: if more than one piece of medical advice given, mark the one which has the best explanation <br> IGNORE smoking, salt intake <br> 1. NOT just healthier diet ACCEPT regular exercise / lower \{fat / carbohydrate \} intake <br> 2. ACCEPT lowers LDL / HDL ratio <br> 3. and 6. ACCEPT reduces chance of atheroma / blood clot / eq <br> 4. ACCEPT improve HDL/LDL ratio IGNORE increase HDL (unless instead of LDL) <br> 10. DO NOT ACCEPT drugs to treat blood pressure e.g. beta blockers | (3) |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 5 (c) | 1. idea that death rates decrease over time for three of the countries ; <br> and any two from <br> 2. death rate for Poland has\{increased / eq\} (overall) ; <br> 3. limitations of the data due to number of countries / eq ; <br> 4. limitations due to timescale of data / eq ; <br> 5. limitations due to men only data / eq ; | 1. ACCEPT all except Poland / eq <br> I GNORE separate descriptions of data for Finland, UK and Italy <br> 2. IGNORE decreased after 1990 | (3) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 6 (a) | 1. idea of formation of secondary or tertiary structure ; | 1. ACCEPT e.g. alpha helix, beta <br> pleated sheet, globular structure <br> ACCEPT folding (of primary |  |
| structure) |  |  |  |
| IGNORE 3D shape |  |  |  |$\quad$| 2. ACCEPT hydrophilic R groups |
| :--- |
| go to outside/ hydrophobic R |
| groups go to inside / eq |$\quad$ (3) $\quad$ 3. DO NOT ACCEPT peptide |  |
| :--- |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 6 (b) (i) | 1. as the enzyme concentration increase the rate of reaction <br> increases / eq ; <br> 2. idea that enzyme lowers activation energy / provides <br> alternative reaction pathway ; <br> 3. idea that the higher concentration of enzyme means that <br> more active sites are available ; <br> 4. more chance of a collision between \{enzyme / active site <br> \} and substrate ; <br> 5. reference to \{enzyme - substrate complex / specific <br> interaction between enzyme active site and substrate \} ; <br> 6. idea that substrate is in excess / enzyme concentration is <br> limiting factor ; | ACCEPT bacteria as substrate <br> r. ACCEPT enzyme increases |  |


| Question <br> Number | Answer | Additional Guidance |  | Mark |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{6 ( b ) ( \text { (i) }}$ | there were \{anomalies / sources of error / random error / <br> measurement inconsistencies / lack of precision / lack of <br> accuracy / eq\} ; | ACCEPT example of random <br> error e.g. volume <br> IGNORE systematic error, <br> outliers |  |  |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| $\mathbf{6 ( c )}$ | 1. idea that this increased temperature changes the <br> bonding in the enzyme ; <br> 2. the active site is \{denatured / changes shape\} ; <br> 3. the substrate no longer fits into the active site / the <br> enzyme no longer \{catalyses the reaction / lowers the <br> activation energy / eq\} ; | IGNORE enzyme is denatured <br> ACCEPT bonds are broken | 3. ACCEPT no enzyme substrate <br> complex can form / eq |


| Question Number | Answer | Mark |
| :---: | :---: | :---: |
| 7(a)(i) | A a hydrogen bond | (1) |
| Question Number | Answer | Mark |
| 7(a)(ii) | D a peptide bond; | (1) |
| Question Number | Answer | Mark |
| 7(a)(iii) | D glucose ; | (1) |
| Question Number | Answer | Mark |
| 7(a)(iv) | C glycerol ; | (1) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{7 ( b )}$ | nitrogen; | IGNORE N if it is the only <br> response | (1) |


| Question <br> Number | Answer | Additional Guidance | Mark |
| :--- | :--- | :--- | :--- |
| 7(c) | 1. glycosidic bond correctly drawn ; <br>  <br> 2. molecule of water shown to be produced ; <br> 3. remaining groups around disaccharide drawn <br> correctly; | 1. I GNORE labelling of bond <br> 2. ACCEPT water named or <br> formula |  |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 7 (d) | 1. idea that water can form \{hydrogen bonds / eq\} ; <br> and any one from <br> 2. water is a solvent / \{ions / polar molecules / eq \} can \{dissolve / be transported / eq \} in water <br> 3. reference to cohesion/adhesion <br> 4. idea of hydrogen bonds holding water together as a liquid, so that it can move in mass flow systems <br> 5. suitable ref. to specific heat capacity <br> 6. idea of distribution of thermal energy around body <br> 7. reference to high latent heat of vaporisation ; | 1. ACCEPT water is slightly charged, description of charges on O and /or H IGNORE polar/ dipole as stated in Q stem <br> 2. ACCEPT named polar molecule IGNORE non polar molecules dissolving <br> 3. ACCEPT specific example e.g. surface tension on a pond <br> 5. ACCEPT thermal buffer / needs a lot of energy to change the temperature / eq <br> IGNORE pH buffer | (2) |


| Question <br> Number | Answer | Mark |
| :--- | :--- | :--- |
| $\mathbf{8 ( a )}$ (i) | ACCEPT answers between 0.14 and 0.15 inclusive |  |
| $;$ | (1) |  |


| Question <br> Number | Answer | Mark |
| :--- | :--- | :--- |
| $\mathbf{8 ( a ) ( i i )}$ | ACCEPT answers between 13.4 and 13.6 inclusive |  |
| ; |  |  |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 8(b) | 1. pressure increases from 0 to 3.3 during \{atrial systole / ventricular diastole / from 0 to 0.14 s / eq\} ; <br> 2. pressure increases to $\{14.5 / 14.4\}$ \{during ventricular systole / from $0.14 \mathrm{~s} / \mathrm{eq}\}$; <br> 3. pressure decreases to 0 (during diastole) / eq ; | IGNORE units <br> 1. ACCEPT between 3 and 3.5, to 0.12 to 0.14 s <br> 2. ACCEPT calculated increase e.g. 11.2 (range 11 to 11.5), from 0.12s <br> 3. ACCEPT calculated decrease | (3) |


| Question Number | Answer | Additional Guidance | Mark |
| :---: | :---: | :---: | :---: |
| 8 (c) | (QWC - Spelling of technical terms must be correct and the answer must be organised in a logical sequence) <br> 1. \{pressure changes / maximum pressures are smaller in the atrium than the ventricle / eq ; <br> 2. the atrium has less (cardiac) muscle than the ventricle; <br> 3. the atrium does not have to push the blood as far as the ventricle has to / eq ; <br> 4. the increase in pressure happens in the atrium before the ventricle / eq ; <br> 5. idea that atrial systole has to happen before ventricular systole in order for the ventricle to fill with blood; <br> 6. idea that increase in atrial pressure causes increase in \{pressure / volume \} in ventricles; <br> 7. appropriate reference to effect of atrioventricular valve (AV) (on pressure) ; <br> 8. credit correct comparative manipulation of figures to illustrate a marking point ; | QWC emphasis on clarity of expression Marking points are for comparing what is happening in L.A. and L.V. and giving reasons for these. <br> NOT just a description of the cardiac cycle ACCEPT converse in each statement <br> 1. ACCEPT higher pressure in $V$ than $A$ in context of pumping distance <br> ACCEPT piecing together for MPs 1, 2, 3 <br> 5. ACCEPT delay at AVN / eq <br> 7. E.g. when pressure in the atrium exceeds pressure in the ventricle the AV valve opens preventing further significant rise in the pressure in the atrium <br> 8. e.g. compare maximum pressures exerted |  |

