Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCE
in Biology (6BI01)
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 OR 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 Number	Answer	Mark
1(b)(i)	**D** have a sugar-phosphate chain ;	(1)

Question Number	Answer	Mark
1(b)(ii)	**C** semi-conservative replication is possible ;	(1)

Question Number	Answer	Mark
1(b) (iii)	**A** 10% ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	U G A A A G C G G G C U 1. both uracils correct ; 2. the rest of the sequence correct ;		(2)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>1 (d)</td>
<td>Any three from:
<table>
<tr><th></th><th>replication</th><th>transcription</th></tr>
<tr><td>1</td><td>uses DNA nucleotides</td><td>uses RNA nucleotides / eq ;</td></tr>
<tr><td>2</td><td>uses DNA polymerase / eq</td><td>does not use DNA polymerase / uses RNA polymerase ;</td></tr>
<tr><td>3</td><td>reference to semi-conservative</td><td>not semi-conservative / eq ;</td></tr>
<tr><td>4</td><td>(copies) both DNA strands / eq</td><td>(copies) only {one strand / template / gene / eq} ;</td></tr>
<tr><td>5</td><td>makes DNA double helix / eq</td><td>Makes single strand mRNA / eq ;</td></tr>
</table>
</td>
<td>Must be clearly comparative for the mark
IGNORE destination of the molecules

1. ACCEPT thymine / T, uracil / U comparison, deoxyribose and ribose, DNA and RNA bases
2. ACCEPT no ligase in transcription

4. ACCEPT whole DNA molecule unzipped for replication with only part for transcription
ACCEPT all {DNA / genome} copied in replication only part in transcription
5. NOT just produces DNA and mRNA
ACCEPT two {new strands of DNA / DNA molecules} compared to one mRNA (each time)
ACCEPT if clear what is being produced elsewhere in the response</td>
<td>(3)</td>
</tr>
</table>

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

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

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	0.5 / ½ / 1 in 2 / 50% ;	IGNORE expressed as a ratio	**(1)**

Question Number	Answer	Additional Guidance	Mark
3 (a) (i)	1. idea that you can see the { heart / internal organs / eq} ; 2. Daphnia {are simple organisms / have less developed nervous system / can't feel pain / eq} ; 3. idea that there are fewer ethical concerns because it is an { invertebrate / eq} ; 4. idea that they are abundant / used as fish food / eq ; 5. idea that they can absorb chemicals from the surrounding solution quickly ;	1. ACCEPT they are transparent 3. NB. needs to be linked to something about the *Daphnia* and not just because it is a *Daphnia* e.g. a simple organism 4. ACCEPT easy to reproduce / easy to keep / readily available / eq; 5. ACCEPT they are small so chemicals can affect them quickly	**(2)**

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

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

Question Number	Answer	Additional Guidance	Mark
4(a)	1. homozygous ; 2. channel / transport / transmembrane / intrinsic / globular ; 3. chloride / Cl^- / Cl ; 4. reproductive / eq ;	1. **ACCEPT** (a) homozygote 3. **DO NOT ACCEPT** chlorine	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. produces {thicker / stickier / more viscous / eq} mucus ; 2. blocking { trachea / bronchi / bronchioles / airway / eq} / eq ; 3. cilia are unable to move mucus out of lungs / eq ; 4. idea of reduced flow of {air / oxygen } to alveoli ; 5. idea of reduced concentration gradient for {oxygen / carbon dioxide} (in alveoli) ; 6. idea of loss of surface area / elasticity / eq ; 7. idea of reduced gaseous exchange ; 8. trapped bacteria may result in more respiratory infections / eq ;	1. ACCEPT sticky / thick in context, ACCEPT less water in mucus 2. IGNORE respiratory system ACCEPT alveoli 7. ACCEPT less O_2 diffuses into blood IGNORE larger diffusion pathway	**(4)**

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

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

Question Number	Answer	Mark
5(a)(i)	31.0 / 31.02 / 31 ;	(1)

Question Number	Answer	Additional Guidance	Mark
5 (a) (ii)	Obese class I / moderately obese ;	ACCEPT category based on answer to (ai)	(1)

Question Number	Answer	Additional Guidance	Mark
5(a) (iii)	(QWC – **Spelling of technical terms must be correct** and the answer must be organised in a logical sequence) 1. idea of damage to {*endothelium* / *endothelial lining*} of {*artery / arteries}* ; 2. reference to *inflammatory* response ; 3. leading to formation of {*atheroma / plaque / atherosclerosis* } ; 4. increased risk of blood clot formation / eq ; 5. ref to {loss of elasticity of *artery* / narrowing of *lumen* / eq } ; 6. idea of (*positive feedback* causing) further increase in blood pressure ;	QWC emphasis is spelling [penalise once only] 1. ACCEPT lining of *artery* IGNORE wall NOT vein 2. ACCEPT detail e.g. foam cells, white cells move into wall , macrophages etc 4. ACCEPT *thrombus* 5. ACCEPT hardening of *artery* wall, blocking of artery	(4)

Question Number	Answer	Additional Guidance	Mark
5 (b)	Explanations should be linked to the medical advice. 1. reduce energy intake / increase activity / follow calorie controlled diet / eq ; 2. idea of change in balance of energy budget ; 3. lower {weight / BMI / obesity level / eq} / reduce risk of {atherosclerosis / diabetes / eq} ; OR 4. statins / sterols / reduce { cholesterol / saturated fats / eq} in diet / eq ; 5. reduce blood cholesterol levels ; 6. idea of reducing risk of atherosclerosis / eq ; OR 7. eat more fruit / vegetable / vitamins / moderate alcohol intake / eq ; 8. reference to antioxidants ; 9. they protect against free radical damage / reduce damage to cells / eq ; OR 10. anticoagulants / platelet inhibitory drugs / warfarin / aspirin / eq ; 11. prevent blood clot formation / eq ; 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 IGNORE smoking, salt intake 1. **NOT** just healthier diet ACCEPT regular exercise / lower {fat / carbohydrate } intake 2. **ACCEPT** lowers LDL / HDL ratio 3. and 6. **ACCEPT** reduces chance of atheroma / blood clot / eq 4. **ACCEPT** improve HDL/LDL ratio **IGNORE** increase HDL (unless instead of LDL) 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 ; and any two from 2. death rate for Poland has{ increased / eq} (overall) ; 3. limitations of the data due to number of countries / eq ; 4. limitations due to timescale of data / eq ; 5. limitations due to men only data / eq ;	1. **ACCEPT** all except Poland / eq **IGNORE** separate descriptions of data for Finland, UK and Italy 2. **IGNORE** decreased after 1990	**(3)**

Question Number	Answer	Additional Guidance	Mark
6 (a)	1. idea of formation of secondary or tertiary structure ; 2. idea of bonding between R groups ; 3. named bond e.g. ionic, disulfide, hydrogen ;	1. **ACCEPT** e.g. alpha helix, beta pleated sheet, globular structure **ACCEPT** folding (of primary structure) **IGNORE** 3D shape 2. **ACCEPT** hydrophilic R groups go to outside/ hydrophobic R groups go to inside / eq 3. **DO NOT ACCEPT** peptide	**(3)**

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

Question Number	Answer	Additional Guidance	Mark
6 (b) (ii)	there were {anomalies / sources of error / random error / measurement inconsistencies / lack of precision / lack of accuracy / eq} ;	**ACCEPT** example of random error e.g. volume **IGNORE** systematic error, outliers	**(1)**

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

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 Number	Answer	Additional Guidance	Mark
7(b)	nitrogen ;	**IGNORE** N if it is the only response	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. glycosidic bond correctly drawn ; 2. molecule of water shown to be produced ; 3. remaining groups around disaccharide drawn correctly ;	1. **IGNORE** labelling of bond 2. **ACCEPT** water named or formula 3. **DO NOT ACCEPT** two separate glucose molecules NB: check carefully H on C5	**(3)**

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

Question Number	Answer	Mark
8(a) (i)	ACCEPT answers between 0.14 and 0.15 inclusive ;	**(1)**

Question Number	Answer	Mark
8(a) (ii)	ACCEPT answers between 13.4 and 13.6 inclusive ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)	1. pressure increases from 0 to 3.3 during {atrial systole / ventricular diastole / from 0 to 0.14s / eq} ; 2. pressure increases to {14.5 / 14.4} {during ventricular systole / from 0.14s / eq}; 3. pressure decreases to 0 (during diastole) / eq ;	IGNORE units 1. ACCEPT between 3 and 3.5, to 0.12 to 0.14s 2. ACCEPT calculated increase e.g. 11.2 (range 11 to 11.5), from 0.12s 3. ACCEPT calculated decrease e.g. 14.5 (range 14 to 14.5)	**(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) 1. {pressure changes / maximum pressures} are smaller in the atrium than the ventricle / eq ; 2. the atrium has less (cardiac) muscle than the ventricle ; 3. the atrium does not have to push the blood as far as the ventricle has to / eq ; 4. the increase in pressure happens in the atrium before the ventricle / eq ; 5. idea that atrial systole has to happen before ventricular systole in order for the ventricle to fill with blood ; 6. idea that increase in atrial pressure causes increase in {pressure / volume } in ventricles ; 7. appropriate reference to effect of atrioventricular valve (AV) (on pressure) ; 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. NOT just a description of the cardiac cycle ACCEPT converse in each statement 1. ACCEPT higher pressure in V than A in context of pumping distance ACCEPT piecing together for MPs 1, 2, 3 5. ACCEPT delay at AVN / eq 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 8. e.g. compare maximum pressures exerted	**(5)**

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