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Mark Scheme (Results)
Summer 2014

GCE Biology (6BI01)
Paper 01

Unit 1: Lifestyle, Transport, Genes and 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.
- 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 phosphodiester bonds ;	(1)

Question Number	Answer	Mark
1(a)(ii)	B 200 ;	(1)

Question Number	Answer	Mark
1(a)(iii)	C 0% thymine;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	1. contains {Ribose / 5C sugar / pentose} AND phosphate ; 2. reference to (nitrogenous) base / adenine / guanine / cytosine / uracil / eq ;	IGNORE references to bonds ACCEPT correctly labelled diagram which might use Pi 1. both components needed for the mark NOT deoxyribose, sugar with no 5C, phosphate head, P 2. NOT thymine, IGNORE A, G, C, U NOT plural bases if only referring to one mononucleotide	(2)

Question Number	Answer	Additional Guidance	Mark
1(c) *QWC	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)**	**QWC emphasis answer must be in a logical sequence** Penalise once for point out of sequence / context IGNORE descriptions of transcription ACCEPT AA for amino acid	
	1. reference to ribosome (attaches to mRNA) ;	1. ACCEPT rough endoplasmic reticulum, RER	
	2. idea that tRNA carries an amino acid ;	2. NOT amino acid**s** unless tRNA plural	
	3. idea of {anticodon codon interaction / complementary base pairing } between tRNA and mRNA ;	3. ACCEPT description of complementary base pairing	
	4. formation of hydrogen bonds (between the tRNA and mRNA) ;		
	5. reference to peptide bond (between amino acids) ;	5. ACCEPT peptide link	
	6. (peptide bond) formed by a condensation reaction ;	6. ACCEPT by an enzyme	
	7. idea that tRNA released from {mRNA / ribosome} ;		
	8. idea that ribosome {attaches to / detaches from / eq} {sequence / eq} on mRNA ;	8. ACCEPT ribosome moves along mRNA, a start codon / AUG, stop codon / UAA / UAG / UGA	**(5)**

Question Number	Answer	Additional Guidance	Mark
2 (a)	1. increasing ethanol concentration increases the intensity (of colour of the solution) / eq ; 2. idea that increase in intensity is non-linear e.g. greatest increase between 30 and 70% ethanol / less increase above 70% / less increase below 30% ethanol ; 3. intensity of colour higher in test 2 than test 1 (at all ethanol concentrations) / eq ; 4. credit correct manipulation of figures e.g. 0.1 increase from 0 to 30% in test 1 ;	1. ACCEPT positive correlation IGNORE descriptions of sequences of changes 2. ACCEPT greatest increase between 50 and 70, no increase above 70 in test 2 ACCEPT comments on gradient e.g. steeper IGNORE rapid / faster / slower 4. ACCEPT subtraction from identified test IGNORE quoted figures, unidentified test	**(3)**

Question Number	Answer	Additional Guidance	Mark
2 (b)	1. idea that ethanol causes the membrane to be {disrupted / eq} ; 2. idea that this is due (phospho)lipids dissolve in ethanol ; 3. idea that (membrane) proteins denatured by ethanol ; 4. comment on the disruption of the vacuole membrane / eq ; 5. idea that {betalain / pigment} can escape from the {cell / vacuole /eq } when the membrane is disrupted ;	1. IGNORE more permeable, more fluid ACCEPT gaps in the membrane 3. ACCEPT protein changes shape NB this also gains Mp1 5. ACCEPT dye	**(4)**

Question Number	Answer	Additional Guidance	Mark
2 (c)	1. beetroot cells may have been damaged when cutting / eq ; 2. idea that beetroot pieces not rinsed before being placed in ethanol solution ; 3. idea that colorimeter was not {calibrated / zeroed / eq} (properly) ; 4. idea that test 2 is done some time after test 1 OR beetroot left in solution longer than 20 minutes in test 2 ; 5. idea that different parts of the beetroot may have different pigment concentrations ; 6. smaller volume of ethanol used in test 2 ;	2. ACCEPT blotted IGNORE dried 5. IGNORE different beetroot	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (a)	1. genotype **AND** gametes of parents shown ; 2. genotypes of possible children correctly shown ; 3. genotypes clearly matched to phenotypes of possible children ; 4. (probability =) ¼ / 25% / 1 in 4 / 0.25 ;	1. gametes can be shown on Punnett Square 3. ACCEPT carrier as phenotype 4. ACCEPT incorrect probability but based on their cross	**(4)**

Question Number	Answer	Additional Guidance	Mark
3 (b)	1. method for obtaining sample from baby described e.g. cheek swab, blood sample, heel prick, biopsy} ; 2. idea of extracting DNA (from cells) ; 3. test for presence of {normal / recessive / mutant / defective / MLD / eq} {gene / allele} ;	NOT Mp 1 and 2 if chorionic villus, amniocentesis, pre-implantation, etc 2. IGNORE testing DNA 3. ACCEPT even if method incorrect for Mp 1	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (c)(i)	1. idea of copy of {normal / functioning / eq} {gene / allele} now in cells ; 2. reference to transcription or translation of the {gene / allele} ; 3. idea that (normal) protein produced / cells function normally / eq ; 4. idea that stem cells produce more cells ;	1. NOT replaces / repairs faulty gene IGNORE dominant ACCEPT correct 4. ACCEPT mitosis, cell division	**(3)**

Question Number	Answer	Additional Guidance	Mark
3 (c) (ii)	1. idea of control (to see if the treatment made a difference) ; 2.idea that other variables controlled e.g. shared genes , environment ;	1. ACCEPT valid comparison IGNORE unqualified comparison 2. ACCEPT similar genes NOT genetically identical	**(2)**

Question Number	Answer	Additional Guidance	Mark
3 (d)	1. idea that risk from gene therapy very small ; 2. idea that consequences of the disorder more certain than risks of the therapy ; 3. idea that consequences of the disorder known while risks of the therapy are not known ; 4. idea that parents do not want their child to suffer the disorder e.g. will do anything to {treat / prevent / eq} the disorder, there is no other treatment available ; 5. idea that trial may lead to effective treatment e.g. could benefit others ;	2. ACCEPT more benefits than risks / idea that severity of the disorder makes it worth the risk 4. ACCEPT give the child a better quality of life / the best possible chance of a normal life / eq	**(2)**

Question Number	Answer	Additional Guidance	Mark
4 (a) (i)	Any **two** from: {mineral(s) / named mineral} ;; {vitamin(s) / named vitamin} ;; {carbohydrate / named soluble carbohydrate}; water ; antibodies ;	Allow two named minerals or vitamins allow salt, potassium, sodium, etc IGNORE nitrogen, NB minerals AND named mineral = 1 mark vitamins AND named vitamin = 1 mark NOT sugar, lactose, starch, fibre, glycogen IGNORE amino acids , fats, fatty acids, glycerol, cholesterol	**(2)**

Question Number	Answer	Additional Guidance	Mark
4 (a) (ii)	1. more protein AND more lipid ; 2. idea that protein is needed for making more tissue ; 3. idea that lipids are a source of energy ; 4. idea of greater energy imbalance (for seals) ; 5. idea that excess energy is needed for {weight gain / stored as fat / eq} ; 6. Credit manipulation of figures e.g. calculation of difference between human and seal milk ;	1. IGNORE simple quote of figures ACCEPT as separate comments 2. ACCEPT growth 6. e.g. 12.4%, 9.9 / 9.86x more protein, 32.7%, 9.6 / 9.61x more lipid IGNORE about 10x	**(4)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (i)	it contains no double bonds (in the hydrocarbon chain) / eq **;**	ACCEPT no carbon carbon double bonds, no kinked chains NOT carbon oxygen double bonds	**(1)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (ii)	<table><tr><th>Group</th><th>Total concentration of saturated fatty acids / mg per g milk</th><th>Total concentration of unsaturated fatty acids / mg per g milk</th></tr><tr><td>Vegan</td><td>325</td><td>**657**</td></tr><tr><td>Control</td><td>497</td><td>**466 ;**</td></tr></table>		**(1)**

Question Number	Answer	Additional Guidance	Mark
4 (b) (iii)	1. idea that animal products have a higher proportion of saturated fats than plant material ; 2. credit correct manipulation of figures to illustrate differences in milk content ;	1. ACCEPT converse / saturated come from {meat / dairy} / unsaturated from plants 2. e.g. 172 mg per g milk more saturated in control, 191 mg per g milk more unsaturated from vegans ACCEPT ECF for figure use from 4bii	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (a)	1. cardiac / myogenic ; 2. atrioventricular ; 3. left atrium ; 4. pulmonary artery ; 5. semilunar ;	1. IGNORE smooth 2. ACCEPT bicuspid, tricuspid, mitral IGNORE cuspid, AV 3. NOT atrium alone ACCEPT left auricle, left atria	**(5)**

Question Number	Answer	Additional Guidance	Mark
5 (b)	<table><tr><th>Arteries</th><th>Capillaries</th></tr><tr><td>1. thick wall / multiple cell layers</td><td>1. {thin / thinner / one cell thick} wall / eq ;</td></tr><tr><td>2. (lots of) collagen</td><td>2. {little / no } collagen / eq ;</td></tr><tr><td>3. (lots of) muscle</td><td>3. no muscle / eq ;</td></tr><tr><td>4. (lots of) elastic tissue</td><td>4. no elastic tissue / eq ;</td></tr><tr><td>5. no pores</td><td>5. pores present / eq ;</td></tr><tr><td>6. narrow lumen</td><td>6. narrow(er) lumen / lumen one cell wide / eq ;</td></tr></table>	Answers must be comparative for credit – i.e. 1 mark for each correct row on the table. IGNORE references to surface area, length 1. ACCEPT thinner wall NOT reference to cell wall IGNORE capillaries are one cell thick if not in clear context of 1. or 6. 3. and 4. NOT more or less 5. IGNORE porous , permeable 6. ACCEPT artery lumen wider than the capillary, artery lumen narrower in relation to diameter of vessel	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (c) (i)	1. prevent the formation of a {blood clot / thrombus / embolism / eq} / eq ; 2. idea that it reduces 'stickiness' of platelets ; 3. idea that clotting factors {not synthesised / inhibited / eq} ; 4. idea that (risk of) blood vessels becoming blocked is reduced OR idea that blood can flow normally in arteries ;	1. IGNORE 'thin the blood' ACCEPT prevents blood clotting 2. ACCEPT effectiveness of platelets reduced 3. ACCEPT named clotting factor e.g. fibrinogen, thromboplastin, prothrombin,	**(2)**

Question Number	Answer	Additional Guidance	Mark
5 (c) (ii)	(internal) bleeding / haemorrhage / stomach ulcers / eq ;	ACCEPT rashes, nausea, vomiting, hair loss, diarrhoea, irritation to stomach lining	**(1)**

Question Number	Answer	Mark
6(a) (i)	D ready-to-eat cereal have a higher BMI than those people who ate cooked cereal;	(1)

Question Number	Answer	Mark
6(a) (ii)	A every group sampled in the investigation indicates that they were overweight;	(1)

Question Number	Answer	Mark
6(a) (iii)	B kgm^{-2};	(1)

Question Number	Answer	Mark
6(a) (iv)	A a larger sample size ;	(1)

Question Number	Answer	Additional Guidance	Mark
6(b)	1.(Use subjects with) {same / similar / eq } {levels of activity / exercise / eq } ; 2.{same / similar / eq }{volume / mass / energy content } of breakfast ; 3.{same / similar / eq }{volume / mass / energy content } of other {meals / drinks} during the day ; 4. same duration of trial / eq ; 5. control of other health factors e.g. smoking , fitness, stress. 6. same starting {mass / BMI} / eq ; 7. same type of breakfast (for each participant throughout the Investigation) / eq ; 8. (body) mass measured at same time of day / eq ;	IGNORE gender, age, office workers ACCEPT control of variable for same / similar 2. IGNORE amount, quantity 5. IGNORE pregnancy	**(2)**

Question Number	Answer	Additional Guidance	Mark
6 (c)	1. those subjects who ate no breakfast had a higher mean BMI than those who ate { fruit and vegetables / ready-to-eat cereal / cooked cereal / breads / most breakfasts } ; 2. Reference to suitable calculated difference to illustrate point 1 ; 3. idea that {metabolic rate / eq} may be lower for those who skip breakfast ; 4. appropriate comment on balance between intake and energy use ;	IGNORE units 1. ACCEPT 3rd highest BMI 2. e.g. 1.5 above cooked cereal, 0.5 above fruit and veg, 0.5 above breads, 0.85 above ready-to-eat cereal 3. ACCEPT converse 4. ACCEPT may eat more during the day (due to more hunger) / eq	**(2)**

Question Number	Answer	Additional Guidance	Mark
6 (d)	1. People who eat cooked cereals have the lowest BMI of all groups / eq ; 2. credit correct manipulation of figures ; 3. idea that lower BMI helps to reduce blood pressure ; 4. idea that dietary fibre can't be digested ; 5. idea that dietary fibre helps {lower absorption of cholesterol / increase excretion of cholesterol / eq} ; 6. {lower cholesterol / eq} reduces risk of {atherosclerosis / eq } ;	IGNORE HDL/LDL references 2. e.g. 0.4 above healthy weight 6. ACCEPT converse	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. glycerol drawn correctly with three OH groups ; 2. 3 fatty acids ; 3. fatty acid(s) have COOH included at the end ;	Mp1 and 3 ACCEPT OH / HO NOT double bond to OH 2. ACCEPT 3x one fatty acid stated ACCEPT R or zig-zag chain for fatty acid chain	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. idea of energy imbalance ; 2. loss of weight / eq ; 3. reduced metabolic rate / eq ; 4. lack of protein / reduced insulation / eq ; 5. idea that they will need to eat more {carbohydrate / protein / eq} for energy balance ;	2. ACCEPT lower BMI 3. ACCEPT fatigue 4. ACCEPT muscle wastage, Malnourishment, reduced immune system	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c) *QWC	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)**	**QWC emphasis clarity of expression**	
	1. idea that there is a change in the {DNA sequence / base sequence of a gene / eq } ;	1. IGNORE mRNA	
	2. change in amino acid / change in primary structure of { protein / enzyme } ;		
	3. reference to different R groups ;		
	4. leading to different {type / position / eq} bonding ;	4. ACCEPT named bond e.g. hydrogen, ionic, disulphide NOT peptide	
	5. idea of change in folding e.g. different 3D structure ;	5. ACCEPT change to tertiary structure	
	6. idea of change in {shape / properties} of the active site ;		
	7. idea of {lipid / substrate / eq} does not fit in the enzyme's active site ;	7. ACCEPT no enzyme-substrate complex made	**(5)**

Question Number	Answer	Additional Guidance	Mark
8 (a)	1. (oxygen) is a {small / non polar} (molecule) ; 2. (oxygen) is able to diffuse (through phospholipid bilayers) ; 3. cell surface membrane has a phospholipid bilayer ;	1. NOT if large or polar ACCEPT uncharged	**(2)**

Question Number	Answer	Additional Guidance	Mark
8 (b)	1. chloride ions are charged ; 2. idea that (chloride ions) are NOT able to diffuse through {a phospholipid bilayer / artificial membrane} ; 3. idea that (chloride ions) need a {carrier / channel / transport / eq } protein (to move across a membrane) ; 4. reference to {active transport / facilitated diffusion} ; 5. reference to CFTR channel protein (present in epithelial cells) ;	IGNORE chlorine 1. IGNORE chloride ions are big / polar 3. ACCEPT transmembrane	**(3)**

Question Number	Answer	Additional Guidance	Mark
8 (c)	1. the cell membrane is more permeable to water (than the artificial membrane) ; 2. idea that water can move across the phospholipid bilayer ; 3. idea that water can also move through channel proteins ;	IGNORE references to rates or concentration gradients 1. NOT artificial membrane is impermeable to water 3. ACCEPT transmembrane proteins, aquaporins	**(2)**

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