AQA

A-LEVEL
BIOLOGY

BIOL2 – The variety of living organisms

Mark scheme
June 2016

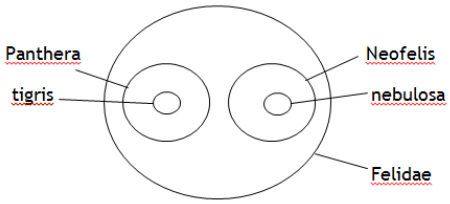
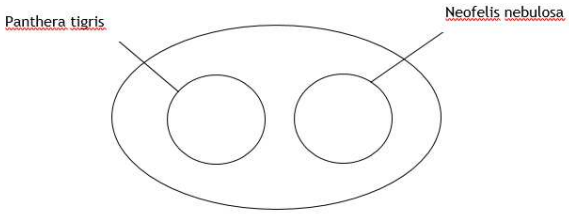
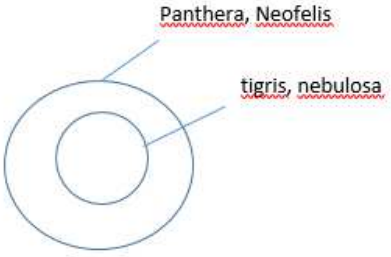
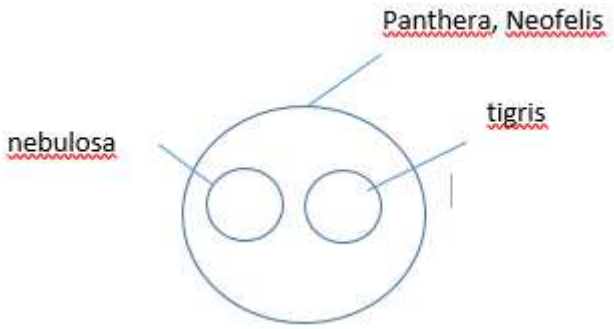
Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Question	Marking Guidance	Mark	Comments
1(a)(i)	(Grouped according to) evolutionary links/history/relationships / common ancestry;	1	Ignore: closely related, factors, characteristics Ignore: genetically similar
1(a)(ii)	1. Able to reproduce; 2. To produce fertile offspring;	2	1. Accept: smallest taxonomic group/groups of organisms with same genes/ chromosomes/same number of chromosomes 1. Accept: Breed for 'reproduce' 1. Ignore: Mate 1. Reject: genetically identical. 1. Ignore: similar genes/chromosomes 2. Ignore: that are 'viable'
1(b)	Phylum Class Family Genus;	1	Accept: pleural answers phyla / genera / families Accept phonetic answers phyllem/phylem/fylum/fyla/phylae/phyli/jenus/ jenera/familys All 4 in correct order for 1 mark

1(c)	1. Two circles/with two inner circles with no overlap; 2. Labels correct;	2	 = 2marks Or  = 2 marks OR  = 1 mark OR  = 1 mark 2. Ignore underlining / capitals 2. Accept: P tigris/ N nebulosa 2. Accept: phonetic spelling

1(d)	1. South China and Sumatran tigers share a more recent common ancestor; 2. (because) identical/same/matching (nucleotide) sequences;	2	1. Accept: more closely related (statement must be comparative) 1. Accept: a labelled hierarchy. Accept converse for Siberian tiger eg Siberian is less closely related to South China AND Sumatran tigers 

Question	Marking Guidance	Mark	Comments
2(a)	Quaternary (structure);	1	Accept: phonetic spelling eg quarternary/quarternery /4° Award no mark for quaternary as part of a list.
2(b)	423;	1	
2(c)	1. Oxyhaemoglobin formed/ haemoglobin is loaded/ uptakes/associates/binds with oxygen in area of higher ppO_2 / in gas exchange surface/lungs/gills; 2. (oxygen) unloaded/dissociates from/released (in area of lower ppO_2 / in capillaries/to cells/tissues);	2	Reference to "react with" = max 1 1. Accept: reversible interaction with oxygen Ignore: Haemoglobin is carried / contained in red blood cells
2(d)(i)	56(%);	1	Accept responses in the range 54-58(%)
2(d)(ii)	1. (Anaemia curve shifted to right) haemoglobin has lower affinity for oxygen / binds less tightly; 2. releases more oxygen / oxygen is released quicker / oxygen dissociates/ unloads more readily to muscles/tissues/cells; 3. (For) respiration;	3	Assume reference is to haemoglobin of anaemia unless stated 3. Accept: even with a lower haemoglobin concentration / meet demand for ATP/energy;

Question	Marking Guidance	Mark	Comments
3(a)	Number of species in a community;	1	Accept: Number of species in a habitat/area/ ecosystem Accept: Species richness Accept: All the species for number of species Ignore: Variation/diversity Reject: in a population
3(b)	1. Number of (organisms of) each species; 2. Total number of organisms (of all species) / Total number of species;	2	Accept 'population' for number and accept individual for organism. 1. Accept 'species richness' 2. Idea of grand total of all organisms, not just number of different species
3(c)	1. Described effect of sewage (eg oxygen depletion/is toxic/kills); 2. Prevents some/many <u>species</u> colonising/ reproducing/remaining; 3. Sewage is food source for (individuals of) some/a few/<u>species</u>; 4. (So) increase only in their numbers;	Max 2	1. Accept: increase in BOD 1. Accept: eutrophication/description of eutrophication 2. Accept: only a few species survive
3(d)(i)	1. Results are not repeatable / are not representative / unreliable / conflict / contradict; 2. Can't make any conclusions;	2	1. Accept: different / don't agree 1. Ignore: not valid/not reproducible/inaccurate
3(d)(ii)	Do repeat<u>s</u> to find a pattern/distribution/mean (of index of diversity);	1	Accept: use a different technique to obtain more reliable evidence; Need idea of more than one repeat Accept: calculate an average Accept: at different times Accept: Statistical test to see if results differ significantly

Question	Marking Guidance	Mark	Comments
4(a)(i)	Spiracle;	1	Accept: Spiracles
4(a)(ii)	Tracheole/trachea;	1	Accept: Tracheoles/tracheae Ignore: System
4(b)	1. Oxygen used in (aerobic) respiration; 2. (so) oxygen (concentration) gradient (established); 3. (so) oxygen <u>diffuses</u> in;	3	2. Accept description of gradient 2 and 3. Accept: Oxygen moves down a <u>diffusion</u> gradient for 2 marks Ignore: 'along gradient idea' unless direction is made clear 2. Reject: Gradient in wrong direction Ignore: movement through gas/water
4(c)	1. Abdominal pumping/pressure in tubes linked to carbon dioxide release; 2. (Abdominal) pumping raises pressure in body; 3. Air/carbon dioxide pushed out of body /air/carbon dioxide moves down pressure gradient (to atmosphere);	3	MP1 relates to description of link shown in graphs 2. Needs idea of causation, not just description of correlation 3. Reject: ref to concentration gradients/diffusion

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>5(a)</td><td><table><tr><th></th><th>Cell B</th><th>Cell C</th><th>Cell D</th></tr><tr><td>homologous chromosomes are present</td><td>✓</td><td>✓</td><td></td></tr><tr><td>a stage of mitosis</td><td></td><td>✓</td><td></td></tr></table>;;</td><td>2</td><td>Mark horizontally
1 mark for each correct row</td></tr>
<tr><td>5(b)</td><td>1. (Chromosomes consist of) two chromatids connected at centromere;
2. (Because) DNA has replicated;
OR
3. K is on equator of spindle;
4. (because) attached at centromere;</td><td>2</td><td>Mark as pairs, do not mix and match
1. Accept sister chromatids for two chromatids
3. Ignore ‘middle’
Ignore - reference to meiosis / bivalents / homologous pairs</td></tr>
<tr><td>5(c)</td><td>1. Crossing over / exchange of alleles /lengths of DNA / recombination;
2. Between (chromatids of) homologous chromosomes;</td><td>2</td><td>1. Accept: description of crossing over eg sections of chromatids break and re-join
1. Accept: reference to chiasma/ chiasmata
2. Accept: ‘between non-sister chromatids’
2. Accept: ‘bivalent’ for homologous
Ignore: genes exchanged</td></tr>
<tr><td>5(d)</td><td>1. Separation/segregation of pairs/homologous chromosomes;</td><td>1</td><td>Accept: result of meiosis I / result of division of cell B
Accept: pulled to opposite poles for ‘separation’
Ignore ref to chromatids</td></tr>
<tr><td>5(e)</td><td>(DNA) replication taking place/not finished;</td><td>1</td><td>Accept: They are cells in S phase</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
6(a)	1. Thin slice/section; 2. Put on slide in water / solution / stain; 3. Add cover slip;	Max 2	3. Accept: 'between two slides'
6(b)	200 (µm);; OR 1. Divide image length by key length eg 64/16=4; 2. Multiply by 50 eg 4x50;	2	Accept for 2 marks answers in the range of 185-217 (µm) Max 1 mark for responses not within the range. 1. Accept measurements in the ranges 63-65mm and 15-17mm
6(c)	1. Select large number of cells / select cells at random; 2. Count number of chloroplasts; 3. Divide number of chloroplasts by number of cells;	3	1. Accept: > 3 for "large number" 1. Accept: many fields of view for 'large number of cells' 1. Accept: all cells in field of view 3. Ignore: 'calculate the mean'
6(d)	Organ;	1	Reject organ system

Question	Marking Guidance	Mark	Comments
7(a)	Locus;	1	Accept: Loci
7(b)	Differences in DNA / differences in base sequence of DNA;	1	Accept: Number of different alleles / size/variation in gene pool Reject: genes
7(c)	1. Jack Russell (genetic) diversity is (significantly) greatest; 2. Bull terrier (genetic) diversity is (significantly) smallest / is most inbred; 3. Miniature terrier and Airedale terriers are similar; 4. Standard deviations do not overlap / do overlap with correct ref to significance;	Max 3	1-3 Do not credit just a list of values 4. Reference to significance must be relevant to examples given
7(d)	1. (Bull terrier) breeding has included a genetic bottleneck/ small population/more inbreeding/ greater selection (pressure); 2. Reduced number of different alleles/size of gene pool; Or 3. Miniature (terrier) breeding has included more outbreeding/less selection (pressure); 4. Increased number of different alleles/larger gene pool/more variety of alleles;	2	1. Accept: Founder effect 2. Reject: decrease in number of genes 2. Ignore ref to mutations 4. Reject: If genes used instead of alleles 4. Reject: lower frequency of alleles 4. Ignore ref to mutations

Question	Marking Guidance	Mark	Comments
8(a)	1. Time taken to reach maximum blood flow varied widely/significantly; 2. Quickest after a carbohydrate-only meal; Or Slowest after a protein-only meal;	2	1. Must be emphasis on idea of 'widely'. Mention only of 'vary' is insufficient. Ignore use of numbers unless a comparison is given. Ignore: any mention of a correlation between maximum percentage increase in blood low and time taken to reach maximum increase in blood flow.
8(b)	1. More blood flows to (skeletal) muscles (during exercise); 2. (supplying) more oxygen / glucose / removing more carbon dioxide/ lactic acid/ heat; 3. For high (rate of) respiration / to meet increased demand for energy/ATP; OR Prevents anaerobic respiration/lactic acid build up;	3	1 and 2. Idea of 'more' is needed. More blood to muscles delivering oxygen = 2 marks 3. Accept reduces/delays for prevent

8(c)	**Immediate effect of exercise after meal** 1. Meal increases blood flow in (mesenteric) artery AND exercise decreases blood flow in (mesenteric) artery; **Overall effect on blood circulation** 2. Insufficient blood (flow to small intestines / muscles); **Effect on blood flow of type of meal** 3. Carbohydrate meal quick(er) / during exercise; OR Protein/fat meal slow(er) / after exercise; **Effect of reduced blood flow on cells** 4. (More) anaerobic (respiration) / lactic acid produced; OR less aerobic respiration; **Consequence for person of changed blood flow** 5. Less absorption (of digested food) / faeces contains digested food; 6. Cramp / indigestion / discomfort / fatigue;	Max 4	Look for **ideas** in each of 5 areas MP1 might be spread throughout the answer 1. Will relate to information given in the tables 2. Accept: Blood diverted away/shunted Ignore: references to 'strain on heart', 'heart disease', 'cardiovascular diseases' Ignore: references to controlling variables and reliability 6. Ignore: references to digestion

8(d)	1. (blood flows from kidney along) renal vein to vena cava; 2. (along) vena cava to right atrium/side of heart; 3. (along) pulmonary artery to lungs; 4. (along) capillaries to pulmonary vein; 5. (along) pulmonary vein to left atrium/side of heart; 6. (along) aorta to renal artery (to kidney); 7. Blood may pass through several complete circuits before returning to kidney;	6 max	Reject: 'blood vessel pumps' only once. Ignore: references to valves Ignore: references to heart action/cardiac cycle Accept: labelled diagram must include directional arrows

Question	Marking Guidance	Mark	Comments
9(a)	1. Type of feed affects (antibiotic) resistant bacteria (in animals); 2. (Antibiotic) resistant bacteria infect /are passed on to animals/farmer / resistant bacteria are passed between animals; 3. Incidence of (antibiotic) resistant bacteria differs in chickens and turkeys; 4. Incidence of (antibiotic) resistant bacteria differs in chicken farmers and turkey farmers;	Max 2	Accept: null hypotheses Accept predictions, for example 1. More antibiotic resistant bacteria form in animals fed with antibiotics in their food 2. Accept: bird to bird/bird to human/human to human 2. Accept: A link (exists) between (antibiotic) resistance in animals and their keepers/farmers – as lowest level QWC 3 & 4 Accept: a comparison, eg 'more resistant bacteria in chickens than turkeys'
9(b)(i)	1. Large(r) percentage of resistant bacteria in turkeys/low(er) percentage of resistant bacteria in chickens; 2. Large(r) percentage of resistant bacteria in turkey farmers/low(er) percentage of resistant bacteria in chicken farmers;	2	Accept: E coli for bacteria Ignore: number, eg. ignore 'more'/'fewer' turkeys/chickens
9(b)(ii)	1. (More) antibiotic in turkey feed kills (more) non-resistant bacteria / resistant bacteria survive; 2. (Resistant bacteria) reproduce / pass on gene for resistance;	2	1. Accept: Antibiotic creates selection pressure 1. survive must be explicit, not implied by 'reproduce'
9(c)	(Human) faeces contain pathogens;	1	Accept harmful organisms
9(d)	1. Large number of farms / farmers (surveyed) / 46; 2. so results are (likely to be) representative / can identify anomalous results;	2	'Reliable' is used in the question stem 2. Ignore: reproducible / accurate / valid / reliable 2. Accept: valid explanation of replicates minimising effects of chance
9(e)	1. (DNA) hybridisation (of gene for resistance in bacteria taken from bird and farmer); 2. (Identical) strands separate at	2	Mark in pairs, do not mix and match.

	high(est) temperature; OR 3. Compare base/nucleotide sequence (of gene for resistance in bacteria taken from bird and farmer); 4. (Identical strains) have identical/same base sequences		Accept: bacteria in bird and farmer/both types of bacteria have identical base sequences = 2 marks

Question	Marking Guidance	Mark	Comments
9(f)	1. (Antibiotic use has) increased cases of bacterial resistance; 2. Transfer/horizontal transmission of (resistance) gene to pathogens/harmful bacteria; 3. (Antibiotic) resistant bacteria cause harm / medical treatments less effective; 4. Avoids side effects on animals; 5. Increased demand for organic food; 6. Antibiotic/resistant bacteria could be present in human food; 7. High cost of antibiotics; 8. Legislation has controlled antibiotic use;	4 Max	1. Accept: number 2. Accept: conjugation 3: Accept: superbug 8. Accept: EU/government guidelines