WJEC (Wales) Biology GCSE

Topic 2.4 Variation and Evolution

Questions by Topic - Mark Scheme

1.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	asexual;			
	(iii)		2	2 x2x2x2x2x2; 64;; two marks for correct answer	2^6		
(b)	(i)		2	2 4 3 1 3 correct = 2;; 1/2 correct = 1; 0 correct = 0			
	(ii)		1	natural;			
			7				

2.

Question		Marking details	Marks Available
(b)	(i)	{Genetic composition/DNA/genes} of {gametes/sex cells} is {not identical/varies}; They inherit different {genes/DNA/chromosomes} from {both parents/at fertilisation};	2
	(ii)	Evolution/ natural selection/adaptation to environment/survival value/survival of the fittest/ref to disease resistance;	1

3.

Question			Marking details	Marks Available
(a)	(i)		The cows are <u>genetically</u> different/have different <u>genes</u>/ show <u>genetic</u> variation/ different ages/ variation in the milk producing genes; NOT different genetics/ sizes/ inherited it from their parents/ mutation	1
	(ii)		River field cows' milk production is higher/ ORA; there are <u>environmental</u> differences/ named environmental difference e.g. temperature/soil/nutrients/water content/ {richer/better <u>quality</u>} grass (must be comparative); 2nd mark only awarded if 1st is credited	2
	(iii)		Sperm (are used)/ two parents/ bull and cow;	1
(b)			Holstein; it has the {low<u>est/least</u>} fat content/ lower fat than the other cows; 2nd mark point only accessed if first correct sugar=neutral	2

Question 3 Total **[6]**

4.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i		2	<u>different</u> {size/ length/ depth/ width}; <u>different</u> shape;			They are all pointed
	ii		1	They can eat <u>different</u> types of food/prey;		More food	

5.

Indicative content

A mutation in one or more genes caused variation in the rat population. One variety became resistant to poison. This was an advantage to the resistant individuals and due to natural selection/ survival of the fittest to breed, allowed the resistant gene to be passed on to the offspring of the surviving rats. Success in Henderson Island will depend on the smaller population (small island) and killing all the rats initially.

5-6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3-4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1-2 marks
The candidate makes some relevant points, such as those in the Indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit

Question 5 Total

[6]

6.

Marking details	Marks Available
Indicative content Agouti/coat gene appeared as a mutation led to variation in the fur colour colour change was an advantage because of camouflage allowed the mutant to survive to breed mutant gene was passed on DNA comparison between modern deer mice and the remains of ancient ones. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. **Question 6 Total**	6 **[6]**

7.

Question			Marking details	Marks Available
(d)	(i)	I	{percentage/ %} <u>dark</u> sheep;	1
		II	correct plotting +/- $\frac{1}{2}$ small square;;	2
		III	<u>straight</u> line joining the plots;	1
	(ii)	I	as temperature rises the {%/ proportion} <u>dark</u> sheep falls; (NOT {number/ amount} of sheep/reverse argument)	1
		II	Any two from: (differential) predation/camouflage; disease; food; water; correct genetic reason; NOT different genes (NOT hunting)	max 2

Question 7 Total [11]

8.

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(a)	(i)		60/52 = 1.1538 : 1 appropriate number of significant figures – 1.15 = 2 marks 1.153/ 1.1538/ 1.16/ 1.2/ 60/52 1.154 = 1 mark		2		2	2	2
	(ii)		named environmental difference e.g. light/ water availability/ temperature		1		1		1
(b)			continuous (variation)		1		1		
			Question 8 Total	0	4	0	4	2	3

9.

	Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i		1	Discontinuous;			
	ii		1	No black <u>allele</u> in white turkeys/ white allele is recessive/ white turkey is homozygous recessive;	Homozygous expressed as symbols		gene

10.

Mark	Answer
6 QWC	Indicative content: Mutation of the (EPAS1) gene. This caused variation. The advantage/ survival value enabled breathing in low oxygen concentration/ increased ability of blood to take up oxygen. Natural selection/ survival of the fittest to breed took place. The mutated (EPAS1) gene was passed on. Reference to modern technology: Genetic profiling of 30000 year old remains and of modern Tibetans Genetic profiling needed for top band **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.

11.

Question	Marking details	Marks Available
(a)	(Radiation) causes mutation/ {damages/changes} the{genes/DNA/ chromosomes}; NOT mutation of cells or organs	1

12.

Question	Marking details	Marks Available
(a)	(2) 3 4 1 5; one mark for each number correctly positioned	4
(b)	Become extinct/ die out/ wiped out; NOT die (unqualified)/ become endangered	1
	Question 12 Total	**[5]**

13.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i	1	DNA;			
	ii	4	chloroquine killed (most) non-resistant Plasmodium ; resistant ones were at an advantage / OWTTE; (survived/selected) to breed/reproduce/ multiplied; {gene <u>for resistance</u> / <u>mutated</u> gene / <u>advantageous</u> gene} passed on;			
(b)		1	some non-resistant ones had survived the chloroquine previously/ (another) mutation had taken place;			
Total Mark		6				

14.

Mark	Answer
6 QWC	**Indicative content:** • The gene for sugar attraction was mutated. • This led to variation – some populations/ individuals/ cockroaches} were not attracted to sugar. • Those not attracted to sugar did not eat the poison so survived/ selective advantage/ natural selection • these then reproduce • And passed on the advantageous gene. No upper or middle band for those who describe{ resistance/ immunity} <u>to insecticide.</u> **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.
7	

15.

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(a)	(i)		(16.8 - 12.3)/12.3 x 100 (1) 36.59-37 = 2 marks 36.58/ 36.5/ 36 = 1 mark		2		2	2	
	(ii)		site A because it has the greater spread of bars/more bars/ greater spread of mass Allow use of data			1	1		1
	(iii)		sampled at random			1	1		1
	(iv)		so that the {work/results/experiments} can be {verified/confirmed/reproduced}/ to see if they get the {same/different} results/ to compare results/ /to test reproducibilty	1			1		1
(b)			Any three (x1) from • Have an adaptation/ characteristic • Which gives them an advantage • For survival • So they are able to reproduce / produce offspring/ pass on the advantageous {genes/ alleles}		3		3		
			Question 15 total	1	5	2	8	2	3

16.

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
16									
	(b)	(ii)	5%/5.0%/4.97%/4.970%/4.9697/ 4.969696969697% = 2 marks Accept 4.9696 recurring If answer incorrect or incorrect rounding accept 82/1650 x 100 or 4.96= 1 mark		2		2	2	
	(d)		Any four (x1) from: 1. Mutation 2. (in a gene) that gave rise to resistance to chemical/ pyrethroid / pesticides 3. allowed some (Varroa) to survive/non-resistant (varroa) died / survival of the fittest 4. that breed and pass {advantageous / resistance} gene on to next generation/ that /breed and pass the mutation on 5. natural selection	2	2		4		
			Question 16 total	2	6	3	11	2	3

17.

	Marks Available
Marking details	
Indicative content	6

A gene mutates.
This resulted in variation.
The variation reduced water loss.
This {was an advantage/ had survival value} (in the desert.)
Resulted in natural selection/ survival of the fittest to breed
(Advantageous altered) gene was passed on.

5 – 6 marks
The candidate constructs an articulate, integrated account
correctly linking relevant points, such as those in the indicative
content, which shows sequential reasoning. The answer fully
addresses the question with no irrelevant inclusions or significant
omissions. The candidate uses appropriate scientific
terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some
relevant points, such as those in the indicative content, showing
some reasoning. The answer addresses the question with some
omissions. The candidate uses mainly appropriate scientific
terminology and some accurate spelling, punctuation and
grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the
indicative content, showing limited reasoning. The answer
addresses the question with significant omissions. The
candidate uses limited scientific terminology and inaccuracies in
spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant
answer worthy of credit.

18.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i	1	A has the highest % survival/ lowest percentage killed;			
	ii	3	8; No decrease in % survival above this concentration; Increased cost/ environmental reasons;			
(b)		2	Any **two** from time; age; temperature;			
(c)		4	Any four from: • {code/ gene/ allele} has mutated; • producing variation; • Producing a different protein; • This gave survival value/ was an advantage (to the mutants); • The mutated allele/ gene was passed on(to future generations);			
Total Mark		10				

19.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(c)			1	insects **and** mammals; *either order.*			letters
			1	*BOTH required for the mark* animal; 2nd MP linked to first - cannot access second mark if wrong organisms or no organisms given in first marking point If B and E given for first marking point – no credit, but can award second mark if correct			

20.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i						
	ii		2	larger; more slits/number slits from 3 to 5;			
	iii						
	iv		1	no {shells/fossils} {in top layer/ in layer A/ in that layer}/ no shells after {5 million years/ 2 million years}/ last found in layer B;			
(b)			1	(Charles) Darwin;	(Alfred) Wallace		
Total Mark			6				

21.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	i		1	Nn;	heterozygous		
	ii		2	He does not have cystic fibrosis therefore must have a {**N**/dominant allele} / He has to have a {**N**/dominant allele} to give to {the child without cystic fibrosis/ child **3**}; Has to have a {**n**/recessive allele/ allele for cystic fibrosis } to give to {child with cystic fibrosis/ child **4**} {child **4**/ child with cystic fibrosis} has to have a {**n**/recessive allele} from him;			
(b)	i		1	Nn;	heterozygous		
	ii		2	She does not have cystic fibrosis and therefore must have a{ **N** allele/dominant allele}/ person **3** gets { **N** allele/dominant allele} from person **2**; Her mother has {cystic fibrosis/ **nn**} and therefore must give one {**n** allele/recessive allele}/ person **3** gets {**n** allele/recessive allele} from person **1**;			
(c)			1	25%;			
Total Mark			7				

				Marks Available
22.	Question	Marking details		
	(a) (i)	Nn;		1
	(ii)	Nn;		1
	(b)	50(%);		1
	(d)	Family tree only shows the {chance/probability} of having CF;		2
		{Profile/ analysis/it} shows the (presence of)		
		{alleles/mutation/gene};		
		NOT the genotype		

23.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	$25 \times 25 = 625$ $\times 4 = 2\,500$ Answer = 1 in 2 500 or 1/2500 or 1:2500 or 0.04<u>%</u> or 0.0004 or 4×10^{-4}; Correct answer = 2 marks Incorrect answer but evidence of correct working = 1 mark			
(b)			1	They produce {increased / more/ build up/ thick} mucus;		Sticky mucus	Too much mucus
(c)							
(d)							
	(ii)		1	Lung cells with introduced alleles wear out and are replaced by cells with cf allele / owtte;			
(e)			1	To check there are no side effects / check there are no long term (harmful) effects;	To check that it is safe		

24.

(b) *White hair:* Idea of camouflage/ blending in/ match environment;

NOT hide/ disguise

Thick hair: Insulation/ traps (warm) layer of air/ keeps heat <u>in</u>/ let out less body heat;

NOT keep it warm/ so it doesn't get cold

Small ears: Idea of reduced surface area/ {reduces/ less} heat loss;

NOT stop heat escaping/ no heat loss/ keeps heat in (can be neutral if used with reduced surface area)

[3]

(c) Universal/ unique/ unchanging/ they all use the same name/ same in all languages/ international/ common name is different in different languages;

[1]