

Biotechnology and Genetic Engineering

Mark Scheme 4

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Biotechnology and Genetic Engineering
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 4

Time Allowed: 63 minutes

Score: /52

Percentage: /100

1	(a)	<p>full marks may be possible from a fully annotated genetic diagram</p> <p>females are XX, males are XY ;</p> <p>female gametes are X, male gametes are X or Y ;</p> <p>ref to random fusion of gametes / shown in a Punnett square or alternative ;</p> <p>1:1 / 50:50 / described, shown / stated ;</p>	[4]																	
	(b)	<p>ref to, identify / separate, sperm with X (chromosome) ;</p> <p>semen / sperm, inserted / injected, into, uterus / oviduct ;</p> <p>at / around time of, ovulation / AW ;</p>	max [2]																	
	(c)	<table><tr><td>1</td><td>formula milk is, similar / closer in composition, to human milk ;</td></tr><tr><td>2</td><td>any nutrient with similar quantities in formula and human milk ;</td></tr><tr><td>3</td><td><i>idea that</i> human milk meets requirements of human babies ; <i>comparisons with cow's milk</i></td></tr><tr><td>4</td><td>formula supplies less protein which is harder to digest ;</td></tr><tr><td>5</td><td>formula supplies more iron, for haemoglobin formation / to prevent anaemia ;</td></tr><tr><td>6</td><td>formula supplies more vitamin D for, absorption of calcium / formation of bone / for strong bones / prevention of rickets ;</td></tr><tr><td>7</td><td>formula supplies more vitamin A, for immune system / retina / rods / vision in dim light / prevention of night blindness ;</td></tr><tr><td>8</td><td>use of comparative figures <u>with correct units</u> ;</td></tr></table>	1	formula milk is, similar / closer in composition, to human milk ;	2	any nutrient with similar quantities in formula and human milk ;	3	<i>idea that</i> human milk meets requirements of human babies ; <i>comparisons with cow's milk</i>	4	formula supplies less protein which is harder to digest ;	5	formula supplies more iron, for haemoglobin formation / to prevent anaemia ;	6	formula supplies more vitamin D for, absorption of calcium / formation of bone / for strong bones / prevention of rickets ;	7	formula supplies more vitamin A, for immune system / retina / rods / vision in dim light / prevention of night blindness ;	8	use of comparative figures <u>with correct units</u> ;	max [4]	
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	(d)	<p>biological / made by cells ;</p> <p>catalyst / speeds up the rate of a reaction ;</p> <p>made of protein ;</p>	max [2]																	

<p>1 (e)</p>	<p>1 lysozyme is active in, 1/pH 4.0/acid ;</p> <p>2 <u>cell walls</u>, broken down/digested/destroyed in tube 1 ;</p> <p>3 no (bacterial) growth in tube 1 ;</p> <p>tubes 1 and 4 – the effect of type of bacteria</p> <p>4 lysozyme, destroys /AW, bacteria, A/in tube 1 ;</p> <p>5 lysozyme does not, destroy/AW, bacteria, B/in tube 4 ;</p> <p>6 ref to specificity to bacteria A/bacteria B is resistant ;</p> <p>ignore bacteria are immune</p> <p>7 <i>idea that</i> nothing in (cell wall of) bacteria B for lysozyme to digest ;</p> <p>tubes 1 and 2 – the effect of boiling</p> <p>8 lysozyme denatured (by boiling) ;</p> <p>9 lysozyme not, active ;</p> <p>10 <i>idea that</i> tube 2 is a control to show that lysozyme is responsible for no growth in tube 1 ;</p>	<p>max [6]</p>	
<p>(f)</p>	<p>1 gives (passive) <u>immunity</u> ;</p> <p>2 defends against, infection/illness/disease/pathogens/AW ;</p> <p>3 ref to diseases that the mother has had ;</p> <p>4 any one function of antibodies ;</p>	<p>max [2]</p>	

Question	scheme		Guidance
2 (a) (i)	<p><i>any two suitable examples</i></p> <p>flood ; tsunami / tidal wave ; monsoon ; volcanic eruption ; A volcano(es) earthquake ; typhoon / hurricane / storm / cyclone ; fire ; drought ; crop / animal, disease ; R disease unqualified plague of pests of, crops / animals ; (e.g. locusts) AVP ;</p>	[max 2]	R snowstorms / tornadoes / landslides / avalanches / mudslides
(ii)	<p>drought ; soil erosion ; desertification ; salinity of soils ; global warming ; rise in sea levels ; AVP ;</p>	[max 1]	R volcanoes / volcanic eruptions R famine R drying up of land
(b)	<p>1 overall increase (over the time period of Fig. 6.1) ; 2 natural disasters, fluctuates / described / irregular ; 3 human induced, increase ; 4 comparative data quote for named cause <i>or for</i> total causes ; 5 sudden onset increase / ora ; 6 economic factors increase / ora ; 7 comparative data quote for same cause ;</p>	[max 5]	<p>2 increase + decrease is minimum</p> <p>4 with year and number of shortages for each quote</p> <p>7 as for 4</p>

Question	scheme		Guidance
2 (c)	1 land needed for, building / urbanisation / AW ; 2 (so) not enough land to grow crops ; 3 increase in food production damages land ; 4 salination ; 5 desertification / erosion ; 6 overgrazing ; 7 not enough water ; 8 <i>idea that</i> increase in demand for food makes food too expensive for poorer people to buy ; 9 richer nations take more of food / food crops exported (for foreign currency) / agricultural land used for, cash crops / non food crops ; 10 difficult to distribute food ; 11 increased competition / conflict, if food production stays the same while population increase ; 12 AVP ; e.g. food production does not keep up with population growth, increase population leads to increase pollution	[max 3]	3 A overcultivation 7 disruption to water supply <i>or</i> e.g. such as dams
(d)	1 suitable named crop plant or domesticated animal ; 2 suitable feature to improve ; 3 select individuals for breeding ; 4 select offspring that show improvement ; 5 use these for future breeding / AW ; A 'repeat the process'	[max 4]	R genetic modification R 'cows bred together' A cattle with high milk yield are bred together / high yielding corn are bred together = 3 marks R cow for milk x bull for meat
(e)	transfer of, a gene / an allele, from one species to another ; A 'type of organism' <i>or</i> 'from one variety to another'	[1]	
[Total: 16]			

- 3 (a) *idea that* gene(s) are transferred ; **A** genetic information / DNA **R** chromosome from one, species / organism, to another, species / organism ; [2]
- (b) DNA / RNA / nucleic acid ; [1]
- (c) (i) testosterone ; **R** spellings with 'oge' [1]
- (ii) voice will break / AW ;
 hair on, chest / face / under arms / in pubic area / around sex organs ;
 shoulders broaden ;
 muscle develops ;
 penis enlarges ;
 testes / scrotum, enlarge ; } **A** genitals, grow / enlarge
 produce, sperm / seminal fluid / AW ;
 named behavioural change ; [max. 2]
- (d) (i) (x axis) time / years / months ;
 (y axis) number of toads / number of individuals / population / AW ;
R 'toads' unqualified **A** 'amount of toads'
 S shaped curve ;
 exponential / log, phase labelled on straight part of curve (bracket or line) ; [4]
- (ii) (lack of) food / prey ; **A** fewer scarab beetles
 ref. to habitat change or damage ;
 change in temperature / global warming ;
 ref. to pollution ;
 (bacterial) disease / parasite ;
 (lack of) breeding places ;
 shortage of water / drought ; [max. 1]

*put ticks and
crosses in a
column on
right hand
side of
answer*

(e) (i) *ignore references to virus*



- i. arrows must point from food to feeder (even if incorrect organisms) ;
- ii. all five organisms included in correct order with lines even if no arrows ;
A if more organisms included

[2]

- (ii)** *no other answers are acceptable*
(carnivore) cane toad + dingo + crocodile ;
(herbivore) scarab beetle ;
(producer) sugar cane ;

[3]

[Total: 16]

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