

Subject: Unifying Concepts in Biology
Code: 2806/01

Session: January Year: 2002

Mark Scheme

MAXIMUM MARK	60
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ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.
 - x = incorrect response (errors may also be underlined)
 - ^ = omission mark
 - bod = benefit of the doubt (where professional judgement has been used)
 - ecf = error carried forward (in consequential marking)
 - con = contradiction (in cases where candidates contradict themselves in the same response)
 - sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Mark Scheme Page 3 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
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Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit <u> </u> = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument
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Question	Expected Answers	Marks
1 (a) (i)	for carbon fixation; carbon dioxide combines with, a carbon acceptor / RuBP / AW; formation of carbon-carbon, bonds / links; similarity with photosynthesis explained; synthesis of organic molecules;	2 max
(ii)	hydrogen bonds, weak / broken at high temperatures; easily broken by, molecular collisions / vibration; at temperatures greater than about 60 ⁰ C; disulphide bonds covalent; much stronger than hydrogen bonds;	2 max
(b)	enzymes extracted from them not, destroyed / denatured, easily; can be used at high temperatures / high temps used in (some) industrial processes; as a result the reaction is completed more quickly; gene / DNA, coding for these enzymes can be transferred to other organisms; AVP; example e.g. washing powders	2 max
(c)	no light / no sunlight / darkness; no source of, food / energy; reference to small amount of, detritus / organic matter, reaching floor of ocean; reference to cold away from vents; AVP;	2 max

Mark Scheme Page 4 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
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(d) the bacteria;
because no, photosynthesis / green plants / algae;
bacteria, fix carbon / are autotrophs / are producers; **2 max**

(e) *accept any reasonable suggestion*

each group of vents isolated / organisms cannot breed with others from
other vents;

separated from other groups by miles of ocean;

organisms only survive near vents / conditions for vent organisms not
found elsewhere;

very unlikely to travel between vents;

have evolved / have been selected / are adapted to the local environment;

reference, to long period of time / isolation;

AVP;

2 max

[Total: 12]

Mark Scheme Page 5 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
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Question	Expected Answers	Marks
2 (a) (i)	260 nm;	1
(ii)	DNA does not absorb UV strongly at these wavelengths; maximum absorption over this range of wavelengths is about 10%; most of the, energy / UV, passes through the DNA without affecting it; only if energy is absorbed can the DNA be, damaged / chemically changed; chemical change / damage to DNA, changes nucleotide / base sequences; ref. to changes in, codons / amino acids, coded for; AVP;	3 max
(b)	mutation in cells of skin; ref. to Malpighian layer; in genes which control, development / growth / cell division; oncogenes / tumour suppressor genes / named example; these cells divide uncontrollably; and produce a tumour; mutant / cancer, cells may, move / spread; AVP;	3 max
(c)	reference to melanin; may absorb UV; thus shielding DNA from UV; genotypes with fair skin synthesise less melanin; people with, fair / pale skin, may spend more time exposed to the sun;	2 max
(d)	gonads / gametes, of plants and animals not exposed to UV / only somatic cells exposed; not all mutations result in observable changes in phenotype; many mutations are recessive; mutations may be in DNA which does not code for, protein / amino acid sequence; most mutations are disadvantageous; may be lethal; (rapidly) eliminated by natural selection; some mutations are beneficial; so will be selected and the mutant phenotype increase in frequency; AVP;	3 max
[Total:		12]

Mark Scheme Page 6 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
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Question	Expected Answers	Marks
3 (a) (i)	2 = denitrification; 3 = nitrogen fixation; 4 = decay / decomposition/ putrefaction / ammonification; A decomposers	3
(ii)	lignin; chlorophyll; DNA; RNA; nucleic acid (<i>do not credit if given with DNA and / or RNA</i>); nucleotides (<i>do not credit if given with any named example</i>); NAD / NADP; ATP / ADP; AVP;; e.g. purines, pyrimidines, adenine, guanine, cytosine, uracil, thymine, IAA / auxin	2 max
(b)	<p>1 lower yields of milk without inputs;</p> <p>2 fewer cows could be kept;</p> <p>3 it would not be possible to dispose of organic waste produced in other locations without X;</p> <p>4 costs would be lower without inputs;</p> <p>5 milk would fetch higher price if labelled as organic;</p> <p>6 nitrogen fixation (process 3) would need to exceed the amount of nitrogen in the, output / produce / milk;</p> <p>7 if soil fertility was to be maintained;</p> <p>8 there would be less leaching;</p> <p>9 which would prevent eutrophication;</p> <p>10 explanation of eutrophication;</p> <p>11 Y are synthetic / artificial / inorganic, fertilisers;</p> <p>12 their production uses fossil fuel;</p> <p>13 which produces CO₂ when burnt;</p> <p>14 reference to global warming,</p> <p>15 fertilisers cause a few productive grasses to become dominant;</p> <p>16 competition causes loss of biodiversity;</p> <p>17 reference to milk shortage / increased price if inputs were prevented on a large scale;</p> <p>18 reference to milk surplus in developed countries as a result of inputs;</p> <p>19 material in W could be used for other purposes / example;</p> <p>20 replacing X by Y undesirable;</p> <p>21 AVP;</p> <p>22 AVP;</p>	8 max
	Q - clear well organised answer using specialist terms;	1
		9 max
		[Total: 14]
Question	Expected Answers	Marks

Mark Scheme Page 7 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
-----------------------------------	------------------------------------	---------------------------	---------------------	-------------------------

- 4 (a) (i)** the colonies on dishes **A** and **B** are in the same positions because cells from each colony on **A** have reproduced and formed a colony on **B**; a small number of the many cells picked up by the felt were resistant to streptomycin;
ref. to mutation;
resistant / mutant cells had been transferred to the streptomycin agar in **C**;
these cells had reproduced to form three colonies;
other cells transferred to dish **C** did not reproduce / were killed;
ref to selection; **3 max**
- (ii)** resistant colony developed from **Y** but not **X**;
mutation is a rare event;
unlikely that a new mutation occurred during transfer of cells from area **X** to dish **C**; **1 max**
- (iii)** the antibiotics are chemically different;
different genes would be involved in resistance;
mutation in one gene does not cause mutation in another gene;
unlikely that both genes would mutate in cells from the same / neighbouring colony; **2 max**
- (b)** a large population of bacteria is likely to contain a few mutant cells that are resistant to any antibiotic;
use of an antibiotic will create a selection pressure;
kills sensitive cells while resistant ones survive and reproduce;
antibiotics should not be used in routine / trivial / casual way;
ref to antibiotic resistance in named bacteria;
antibiotics may become, useless / ineffective;
antibiotics should be rotated;
kept for use as last resort;
AVP;; **2 max**

[Total: 8]

Mark Scheme Page 8 of 8	Unit Code 2806/01	Session January	Year 2002	Version Final
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Question	Expected Answers	Marks
5 (a) (i)	triglyceride; (A fat or oil but not lipid)	
(ii)	phospholipid;	2
(b)	a series of chemical reactions in which the product of one reaction becomes the, substrate / starting point, for the next; each reaction is (usually) controlled / catalysed by a specific enzyme; results in the synthesis or breakdown of compounds; any named example;	3 max
(c)	it is smaller; A more mobile half the size / glycerol=3C whilst glucose = 6C; passage / transport proteins, may be more plentiful for glycerol;	2 max
(d)	<ol style="list-style-type: none"> 1 water enters / leaves, cells by osmosis; 2 water moves from tissue fluid to blood by osmosis; 3 dissolved substances / glucose / glycerol / other named plasma solutes, decrease the water potential of blood; 4 so influence the movement of water to / from cells / tissues; 5 concentration of dissolved substances is regulated to keep the water potential of the blood constant; 6 substances (such as glucose / glycogen / other named substance) are substrates for enzymes; 7 increased concentration increases the rate of reaction; 8 increased concentration increases the rate of diffusion; 9 may affect rate of active transport; 10 increased concentration may reach kidney threshold (idea); 11 higher than normal concentration may, be toxic / cause damage; 12 example of adverse effect of diabetes; 13 decreased concentration may result in starvation / metabolic failure; 14 ref. to hypoglycaemia / diabetic coma; 15 AVP; e.g. ref to pH optima of enzymes 16 AVP; <p>A solute potential for water potential</p>	7 max
		[Total: 14]