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# Mark scheme January 2003

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## GCE

### Biology/ Human Biology A

### Unit BYA2

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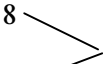
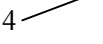
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**Unit 2: Making Use of Biology****Question 1**

- (a) (i) Correct sequence:
1. Interphase
  2. Prophase
  3. Metaphase
  4. Anaphase
  5. Telophase;
- 1
- (ii) Interphase; 1
- (b) Drawing: Two chromatids joined by centromere; [*If > 1 picture drawn, allow if all correct*]  
Chromatids attached to spindle fibre by centromere;
- Labels: Centromere + chromatid + spindle fibre correctly labelled; 3
- (c) (i) 8  Both correct;
- (ii) 4  1
- Total 6 marks
- 

**Question 2**

- (a) (i) tRNA / transfer-RNA; [*not 'transport-RNA'*] 1
- (ii) UAG; 1
- (b) Different tRNA/X for each amino acid / tRNA joins to one type of amino acid;  
mRNA determines which tRNA/X binds (to ribosome) / reference to  
codon-anticodon pairing/complementary base pairing;  
Sequence of bases (in mRNA) determines sequence of amino acids / sequence  
of codons/triplets determines sequence of amino acids; 3
- Total 5 marks
- 

**Question 3**

- (a) (i) LH peaks/is high (on day 12); 1
- (ii) Sperm can survive up to 2-7 days;  
Eggs can survive few hours/ up to 3 days;  
OR General idea of short-lived gametes (e.g. a few days) = max. 1 mark 2
- (b) (i) Inhibits (release of) FSH;  
Follicle does not develop/mature/grow/prevent ovulation/  
FSH causes follicles to develop; (*Allow: 'ovum not produced'*)  
[*Reject: reference to 'follicle production'*] 2
- (ii) Progesterone; 1
- Total 6 marks
-

**Question 4**

- (a) Active site has specific shape;  
Enzyme has complementary shape to glucose / only glucose fits/binds to/  
joins to enzyme/forms E-S complex; 2  
(‘Glucose fits active site’ = 2 marks)
- (b) Any **three** from:  
Enzyme easily recoverable at end of reaction / can be re-used;  
Product not contaminated with enzyme;  
(“easy to separate enzyme & product” = 1 mark)  
Enzyme more resistant to/not denatured by heat / can work at higher temperature;  
[Reject: ‘extreme temperatures’]  
Enzyme more resistant to/not denatured by extremes of pH  
[Allow: ‘high pH/low pH’]  
Can be used in continuous flow process; max 3
- Total 5 marks

**Question 5**

- (a) (i) Correct answer: 2.9/2.91/3;; [Reject ‘3.0’] = 2 marks  
Correct use of data but wrong answer:  
$$\frac{(743 - 722)}{722} \times 100 / \frac{21}{722} \times 100 / \frac{743}{722} \times 100 = X \rightarrow \text{Ans} = X - 100; = 1 \text{ mark}$$
 max 2
- (ii) Straw yield up AND grain yield down; 1
- (b) (i) Dissolves (in water/rain);  
Leaching / washed out of soil / washed into watercourse; 2
- (ii) Any **three** from:  
Algal bloom / more growth of algae / more plant growth; [Ignore eutrophication]  
Decreased light penetration/decreased photosynthesis causes death of water  
plants/of algae;  
Less oxygen released from water plants / from photosynthesis / from algae;  
Decomposition (of dead plant matter) uses oxygen / bacteria/saprobionts  
use oxygen; max 3
- Total 8 marks

**Question 6**

- (a) Any **two** from:  
 Protein / glycoprotein;  
 Made in response to a foreign chemical / an antigen;  
 Has structure/site(s) which bind (specifically) to antigen/to “foreign chemical”/ complementary to antigen/to ‘foreign chemical’;  
 Made by lymphocyte / plasma cell / B-cell; max 2
- (b) (i) 'A' antigen/'A'-type chemical on (surface of) group A cells / not present on group B cells / 'B' antigen (/eq.) is on B cells;  
 Only 'A' antigen/'A'-type chemical fits antibody / 'B' antigen/'B'-type chemical does not fit antibody [*Allow: 'protein' for antigen/eq.*] / 'A' and 'B' antigens/'A' and 'B'-type chemicals are different shapes; 2
- (ii) Separated clumps of RBCs / agglutination occurs;  
 [*Allow: 'some' agglutination*] [*Reject: 'clotting'*]  
 AB has 'A' antigen/'A'-type chemical; [*Allow: 'has A and B antigen'/eq.*]  
 [*Reject: 'some cells have A and some have B'*] 2

Total 6 marks

**Question 7**

- (a) Deoxyribose; [*Allow: 'pentose'/'5-carbon sugar'*]  
 Phosphate /phosphoric acid; [*Allow: 'PO<sub>4</sub>'/'P'/'Pi - ignore charge'*]  
 [*Reject: 'phosphorus'*] 2
- (b) (i) 1<sup>st</sup>: On diagram: '-' at top and '+' at bottom (no mark)  
 2<sup>nd</sup>: Opposite charges attract / DNA fragments move towards + electrode; 1
- (ii) EITHER: Correct answer = 710 to 890 (in range) = 2 marks;;  
 OR: either X = 4.45 to 4.7 cm → 1500 to 1600  
 /or Y = 6.4 to 6.65 cm → 710 to 790 = 1 mark; 2
- (iii) DNA = 2 chains / joined by linking of 2 bases / A with T and G with C/ purine pairs with pyrimidine;  
 Bases are a constant distance apart / nucleotides occupy constant distance/  
 each base-pair is same length / sugar-phosphate is a constant distance; 2
- (iv) mRNA is single-stranded; 1
- (c) 4; 1

Total 9 marks

**Question 8**

- (a) (i) 0–30/40 (in range); 1
- (ii) A has high(er) rate of photosynthesis in bright light / rate still increasing in bright light / light still limiting at high intensity;  
A has high(er) rate of photosynthesis at high temperature / B slows above 30°C / rate still increasing/temperature still limiting at high temperature; 2
- (b) (i) Keeps CO<sub>2</sub> concentration low (in cell X) / maintains concentration gradient;  
Allows (more) CO<sub>2</sub> to diffuse in; 2
- (ii) Any **two** from:  
C<sub>4</sub> compound has high concentration in X / low in Y;  
C<sub>4</sub> compound diffuses into Y;  
C<sub>4</sub> compound is converted into C<sub>3</sub> compound + CO<sub>2</sub> (in Y);  
Use of energy to transfer C<sub>3</sub> compound into cell X; max 2
- (iii) High temperature/high light intensity causes (potentially) high rate of photosynthesis;  
Uses up CO<sub>2</sub> from the air / CO<sub>2</sub> becomes a limiting factor / CO<sub>2</sub> build-up prevents CO<sub>2</sub> becoming limiting / stomatal closure may limit supply of CO<sub>2</sub> from the outside air; 2
- (c) Rice: Any **three** from:  
Hollow / aerenchyma / air spaces;  
Shallow roots;  
Tolerance for ethanol;  
Can respire anaerobically;  
Low oxygen concentration in the environment / in water;
- Sorghum: Any **three** from:  
Extensive/dense root system (to obtain water); [*Ignore: 'deep'*]  
Thick wax layer / thick cuticle (to reduce water loss);  
Few / sunken stomata (to reduce water loss);  
Tolerates high temperature / has heat-shock proteins;  
Specialised method of photosynthesis / C<sub>4</sub> photosynthesis;  
Rolling up of leaves; max 6

Total 15 marks

**Question 9****Quality of Language**

*The answer to this question requires continuous prose. Quality of language should be considered in crediting points in the mark scheme. In order to gain credit, answers must be expressed logically in clear scientific terms.*

**(a) Restriction enzyme:**

Any **four** from:

Cuts (source) DNA / cuts gene;

Cuts plasmid;

By hydrolysis;

Same restriction enzyme used (to cut each type of DNA);

Acts on specific base sequence;

Staggered cut / leaving sticky ends / OR add sticky ends to the cut DNA / shown on annotated diagram;

Complementary base pairing between 2 DNA molecules (at sticky ends);

Ligase:

Splices/joins DNA pieces / forms covalent bonds;

By condensation;

max 6

**(b)**

Any **two** from:

DNA / plasmid / genes / resistance gene / chromosomes copied;

Each daughter cell receives a copy / cells are produced by cloning / cells are a clone;

All cells are produced by mitosis;

max 2

**(c) (i)**

Shows which cells/bacteria have taken up the plasmid / which cells/bacteria have taken up the gene;

Only modified cells/bacteria / cells/bacteria with the plasmid survive in presence of the antibiotic/are resistant (to antibiotic);

2

**(ii)**

Not needed here since can select using herbicide in the growth medium / herbicide kills non-modified cells/tissue/plant;

1

**(d)**

Benefit:

Expect better yield of crop plant / reference weeds compete for water/minerals/ 'nutrients'/light; [Allow: 'for CO<sub>2</sub>'/ 'for O<sub>2</sub>']

Can kill weeds specifically / in presence of (resistant) crop plant;

Problem:

EITHER:

Herbicide/its breakdown products could accumulate up food chains;

Herbicide/its breakdown products may be toxic to other organisms;

OR:

Pollen with resistance gene could pass to (related) weed species;

(Could no longer use herbicide as) weeds become resistant;

max 4

Total 15 marks