



General Certificate of Education

Human Biology 5413

Specification A

BYA3 Pathogens and Disease

Mark Scheme

2006 examination - January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

BYA3

Question 1

- | | | |
|-----|---|---------|
| (a) | Interphase/S-phase; | 1 |
| (b) | A D C E B; | 1 |
| (a) | Attachment of chromosomes/chromatids/centromeres;
Separation of chromosomes/chromatids/centromeres; | 2 |
| (d) | Halves chromosome number/makes haploid;
Diploid/full number restored at fertilisation;
<i>Allow correct reference to variation for one mark</i> | max 2 |
| | | Total 6 |
-

Question 2

- | | | |
|---------|---|---------|
| (a) | Restriction (enzyme/endonuclease); | 1 |
| (b) | Move towards anode/move because charged;
Different rates of movement related to charge/size; | 2 |
| (c) (i) | Piece of DNA;
Single stranded;
Complementary to/binds to known base sequence/gene; | max 2 |
| (ii) | DNA invisible on gel/membrane;
Allows detection; | 2 |
| | | Total 7 |
-

Question 3

- | | | | |
|-----|------|---|---------|
| (a) | (i) | Suckers/
Female lies in groove in male/permanent copulation; | 1 |
| | (ii) | Coats itself in host molecules/antigens;
Tegument/protective layer around outside; | 2 |
| (b) | | Increasing chance of some of the offspring reaching a new host; | 1 |
| (c) | (i) | The greater the <i>Schistosoma</i> infection the greater the incidence of anaemia/ “the more anaemic the children”; | 1 |
| | (ii) | Parasite feeds on/destroys red blood cells;
Loss of blood as result of tissue damage by parasite/eggs; | 2 |
| | | | Total 7 |
-

Question 4

- | | | | |
|-----|-------|---|---------|
| (a) | | Injection of antigens/toxoids;
(Antigen from) attenuated microorganism/non-virulent microorganisms/dead microorganisms/isolated from microorganism;
Stimulates the formation of memory cells; | max 2 |
| (b) | (i) | Antibodies are specific to mumps antigen;
2 nd antibodies specific to mumps antibody; | 1 |
| | (ii) | Removes unbound 2 nd antibodies;
Otherwise enzyme may be present/may get colour change anyway/false positive; | 2 |
| | (iii) | No antibodies to bind (to antigen);
Therefore 2 nd antibody (with the enzyme) won't bind;
No enzyme/enzyme-carrying antibody present (after washing in step 4); | max 2 |
| | | | Total 7 |
-

Question 5

- (a) GCAAUG;
Allow one mark if T instead of U, i.e. GCAATG 2
- (b) (i) DNA is edited/introns present in DNA; 1
Allow reference to “junk” or non-coding DNA
- (ii) 220;
allow 218 or 219, allow 2
Three bases/nucleotides code for one amino acid;
Correct explanation for 218 or 219; 2
- (c) mRNA has no base-pairing, tRNA has base-pairing/ mRNA linear, tRNA cloverleaf shape;
mRNA has no binding site for amino acids, tRNA has;
mRNA different for each gene/many kinds, only few/20/64 kinds of tRNA;
Accept mRNA longer/larger/more nucleotides than tRNA max 2
- Total 7
-

Question 6

- (a) Reference to sterile technique/specific point related to sterile technique;
Sample removed from tie and transferred to agar/medium;
Incubate;
Look for colonies / bacterial growth on medium; 4
- (b) Experienced similar conditions except for patient contact;
Test whether patient contact increases number of bacteria present/
Test whether bacteria come from patients/
See if people without patient contact have bacteria on ties; 2
- Total 6
-

Question 7

- (a) Stimulates memory cells;
Secondary response;
Antivenom / antibodies produced quicker; max 2
- (b) Passive immunity;
No memory cells produced;
Antivenom breaks down / destroyed; max 2
- (c) Could transfer disease/Allergy/Immune response to antibodies from animal; 1
- Total 5
-

Question 8

- (a) 1. Cut gene out of cell/make gene using mRNA/obtain gene with restriction enzymes;
2. Cut DNA using restriction enzyme / plasmid cut with restriction enzyme;
3. Correct reference to sticky ends;
4. Join DNA using ligase/insert gene into vector;
5. Plasmid/named vector transferred to cell;
6. Method of transfer e.g. heat shock;
7. Reference to marker gene;
8. Select bacteria containing new gene; max 6
- (b) Cells can metastasise/break off;
Spread to other parts of the body;
Remaining cells continue to divide;
Forming a new tumour/secondary; max 2
- (c) Antibodies specific;
Normal cells have different antigen/cancer cell has particular antigen;
Enzyme only present in cancer cells;
Drug only activated at/near cancer cells; max 3
- (d) All cells contain DNA;
Would stop/inhibit DNA replication in normal cells;
Stops/inhibits cell division;
Named example on growth/repair e.g. no new blood cells made/no wound healing; 4

Total 15

Question 9

- (a) 1. High fat diet/high salt diet/lack of exercise/age/gender;
TWO risk factors for one mark
Not hypertension as this is given later
 2. Atheroma forms under endothelium/in artery wall;
 3. Atheroma may narrow lumen of artery;
 4. Atheroma increases blood pressure;
 5. Atheroma promotes clotting;
 6. Details of effect of atheroma on clotting;
 7. Blood clot lodges in coronary artery;
 8. Reduced blood supply to heart muscle;
 9. Reduced oxygen/glucose supply leading to cell death; max 6
- (b) (i) 1. Reduces heart rate;
 2. Keeps heart rate stable/reduces variation in heart rate;
 3. Nullifies external stimulus; 2
Individual points must be supported with information from the graph
If no information quoted max 1 mark
- (ii) Similar shape to adrenaline/noradrenaline;
 Fits into receptors;
 On cardiac muscle/wall of artery;
 Preventing adrenaline/noradrenaline binding; max 3
- (iii) To ensure change in heart rate due to beta blocker and not person's behaviour/knowing may affect heart rate; 1
- (c) (i) Beta blockers reduce mortality (following myocardial infarction)/
 Greater reduction in the older group; 1
- (ii)
$$\frac{\text{Deaths with placebo} - \text{deaths with beta blocker}}{\text{Deaths with placebo}} \times 100$$
 2
- Total 15