MARK SCHEME for the October/November 2012 series

9700 BIOLOGY

9700/22  Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners’ meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.
Mark scheme abbreviations:

; separates marking points
/ alternative answers for the same point
R reject
A accept (for answers correctly cued by the question, or by extra guidance)
AW alternative wording (where responses vary more than usual)
underline actual word given must be used by candidate (grammatical variants excepted)
max indicates the maximum number of marks that can be given
ora or reverse argument
mp marking point (with relevant number)
cef error carried forward
I ignore
AVP alternative valid point (examples given)
1 (a) **electron microscope**
   accept ora for **light microscope**
   1 higher resolution / better resolving power;
      A high only if further detail confirms understanding
   2 more easily able to distinguish between two (separate) points / AW;
      A if no comparative but mp 1 or relevant point in mp 3 gained
   3 AVP; able to see points closer together than 200 nm A range 100 – 300 nm
      can see points up to 0.5 nm (0.0005 \( \mu \)m) apart but LM is 200 nm (0.2 \( \mu \)m) A range
      0.2 – 1.0 nm
      electrons have shorter wavelength (than light)
      wavelength of electrons shorter than size of additional structures seen
      [max 2]

(b) **each feature must be briefly qualified to gain max 3**
penalise once if feature correct but not correctly qualified / or not qualified

1 detail of mitochondria; e.g. inner membrane / crist(a(e)
   double membrane
   ribosomes
   (circular) DNA

2 detail of chloroplasts; e.g. double membrane
   internal membranes
   thylakoid(s) / grana / intergranae / lamellae
   ribosomes

3 ribosomes, qualified; e.g. visible as small dots
   scattered throughout / in cytoplasm
   on RER

4 smooth endoplasmic reticulum / SER, qualified; e.g. no ribosomes / tubular / membranous

5 rough endoplasmic reticulum / RER, qualified; e.g. ribosomes / membranous / flattened cisternae;

4/5 endoplasmic reticulum / ER, qualified; e.g. smooth and rough / membranous / throughout cytoplasm

6 Golgi vesicles / secretory vesicles / lysosomes qualified;
   e.g. forming from Golgi
   ref. exocytosis (not for lysosomes)
   seen as (small) sacs / AW
   membranous

7 heterochromatin darker staining / euchromatin lighter staining;
   A chromosomes seen as heterochromatin and euchromatin

8 nucleus has, nuclear envelope / two membranes;

9 nuclear pores in nuclear envelope;

10 cell surface membrane, qualified; e.g. to the inside of the cell wall

11 **idea that** (cell) membranes are visible, qualified; e.g. thin / round / within organelles /
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<th>Paper</th>
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<td>GCE AS/A LEVEL – October/November 2012</td>
<td>9700</td>
<td>22</td>
</tr>
</tbody>
</table>

**named organelle**  

(c) *award two marks if correct answer is given, only one mark if \( \mu m \) (units) given*

\[ \times 1600; ; \]

**A** in range of \( \times 1400 \) to \( \times 1800 \)

\[(8000 / 5 \mu m)\]
\[7000 / 5 \mu m = (1400)\]
\[9000 / 5 = (1800)\]

*award one mark if correctly measured and divided by 5 \( \mu m \) but incorrectly converted*

*award one mark if incorrect measurement (e.g. whole cell) but correct formula used (i.e. divided by 5 \( \mu m \))*

(d) (i)  
1 amylopectin branched / AW; **ora**
2 amylose, spiral / spiralled / helix / helical; **ora**
   R \( \alpha \) – helix
   R coiled
   *allow ec from mps 1 and 2 to award mp 3*
3 amylose (\( \alpha \)) 1 – 4 linkages but 1 – 4 and 1 – 6 linkages in amylopectin / amylose
   has 1 – 4 linkages only;
   *accept from clearly labelled diagram(s)*

(ii) *any one valid; e.g.*
1 for chlorophyll, structure / synthesis / formation / AW
2 for ATP functioning A required for energy transfers
3 for enzyme, functioning / cofactor
4 signalling ion / regulates carbon fixation
5 for, DNA / RNA, synthesis
6 stabilises, DNA / RNA, structure
7 required in, translation / joining, small and large subunits (of ribosomes)

[Total: 10]
2 (a) (i) 1 obvious bilayer (of phospholipids) shown, phospholipid with single head and two tails; must have inner / outer membrane label(s) to gain mp 2 and 3 allow 1 mark if both glycoprotein and glycolipid on one side and no inner / outer label

2 glycoprotein labelled; A glycocalyx for one mark, must have inner / outer label

3 glycolipid labelled;

4 one type of protein drawn and labelled as protein; treat description as neutral

5 protein type qualified; e.g. if protein is labelled as integral / intrinsic must extend into hydrophobic core and be in phosphate head portion
   transmembrane / transport / carrier / channel / pore must extend across / through bilayer if channel protein must show channel
   peripheral / extrinsic aquaporin must be on surface / on one side
   gated protein

6 cholesterol, labelled; must extend into hydrophobic core
   if, circular / globular, must be smaller diameter than phospholipid head or have a single tail
   R if indistinguishable from a protein drawn on diagram

7 detail of phospholipid, labelled; e.g. phosphate / hydrophilic head fatty acid / hydrocarbon / hydrophobic tail saturated / unsaturated fatty acid tails

8 hydrophobic core, labelled; look for label to include both layers

9 AVP; e.g. cytoskeletal filaments [max 5]

(ii) fluid
   1 molecules (of membrane) move about / AW; A idea of membrane flowing
   2 further detail; ref. to phospholipid and protein molecules moving or ref. to (lateral) diffusion phospholipid and protein molecules move about = 2 marks

   mosaic
   3 protein molecules, interspersed / scattered / not a complete layer / AW;
   4 many / AW, different / AW (protein molecules); [max 3]

[Total: 8]
3 (a) (i) all arrow heads in correct direction (phytoplankton to herring / krill, krill to herring, herring and krill to whale); [1]

(ii) secondary / tertiary, consumer; A third / fourth (trophic level) [1]

(iii) 1 plenty of food available / AW; A feeding on more than one trophic level
   2 further detail; e.g. phytoplankton efficient at converting light energy phytoplankton blooms
       little / no competition
       ref. efficient feeding mechanism
   3 short food chains / fewer links of the food chain;
   4 less energy lost overall; A idea in terms of percent lost at each level
   5 few, indigestible / inedible parts; [max 3]

(b) 1 fat / blubber = triglyceride;
   2 fat / blubber / triglyceride, used as energy, store / reserve;
       decreases
   3 less fat in cells; ora
       A fewer fat-filled cells / less adipose tissue
   4 mobilised / respired / converted to fatty acids (A glucose), to release energy (during non-feeding season);
   5 energy (from fat mobilisation) used, qualified; e.g. for movement
       increases
   6 food eaten / during feeding season, conversion to, fat / AW (for storage);
   7 ref. thermal insulation;
       A idea of prevents heat loss R keeps it warm [max 2]

(c) 1 (good) solvent / AW; e.g. (many) ions / minerals dissolve (in water)
   A idea of (sufficient) dissolved respiratory gases (to support life)
   2 provides, buoyancy / support / AW;
       A idea of floating
   3 (buoyancy / support) enables some to attain a large size / supports large mass / enables phytoplankton to remain, near / at surface;
   4 high specific heat (capacity);
   5 qualified; aquatic environment, more temperature stable / slow to change temperature / helps whale to maintain constant body temperature
   6 ice, floats / less dense than water;
   7 acts as insulator / prevents heat loss from water / water is underneath allowing survival in the winter;
   8 transparent, for light penetration / for photosynthesis / for visual cues;
   9 (density changes causing convection) currents, maintain circulation of nutrients / make nutrients available to support phytoplankton;
   10 AVP; e.g. ref. to surface tension prevents sinking (small organisms) ref. to gamete movement [max 3]

[Total: 10]
4 (a) 

<table>
<thead>
<tr>
<th>name of disease</th>
<th>type of causative organism</th>
<th>name of causative organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>cholera</td>
<td>bacterium / bacteria</td>
<td>Vibrio cholerae</td>
</tr>
<tr>
<td>HIV / AIDS</td>
<td>virus</td>
<td>human immunodeficiency virus;</td>
</tr>
<tr>
<td>malaria</td>
<td>protoctist; protozoa / protista</td>
<td>Plasmodium, vivax / ovale / falciparum / malariae; Plasmodium (spp)</td>
</tr>
<tr>
<td>tuberculosis (TB)</td>
<td>bacterium / bacteria;</td>
<td>Mycobacterium tuberculosis</td>
</tr>
</tbody>
</table>

(b) (i) cholera;  
(ii) antibiotics / antibacterials / antimicrobial and one reason;  
e.g. kill / inhibit, bacteria  
bacterial infection / caused by bacterium  
do not kill humans  
A harmless to human / AW  

(iii) 1 vaccinated children, are immune / AW;  
ignore resistant  
2 herd effect;  
3 explained; e.g. sufficient / AW, vaccinated / immune, to prevent spread (to susceptible individuals)  
4 example of another factor that became effective; e.g. less money spent on drugs so more for better diet  
prevention method described to avoid, food / water, contamination  

(c) (i) 1 bacterial (surface) antigens / epitopes, act as, non-self / foreign antigens;  
2 human cells have self antigens;  
3 (antigens are), proteins / polysaccharides;  
4 (non-self antigen) will trigger phagocytosis / phagocytes have receptor (only) for, bacterial / non-self, antigens / proteins; ora for self antigens  
5 ref. to non-self and self antigens containing different sequences of amino acids / self antigens are products of body’s genotype / AW;  
6 idea that phagocytes bind to antibodies complexed with (non-self) antigens (and human cells will not have bound antibody);  

(ii) any reasonable; e.g.  
mechanism to prevent, phagosome formation / lysosome fusion with phagocytic vacuole  
able to withstand attack by (hydrolytic) enzymes  
contain enzyme inhibitors  
able to degrade (hydrolytic) enzymes  
protective capsule  

[4]  
[1]  
[1]  
[1]  
[max 2]  
[max 3]  
[max 1]
(iii) reduction in numbers of T (h) lymphocytes; \( \text{A CD}_4 \) (cells) macrophages
ref. to role of T(h) cells e.g. enhanced humoral response, increase macrophage action;
lowered immune system / poor immune response / AW; e.g. unable to produce sufficient
T/B cells / insufficient stem cells available

[Total: 14]

5 (a) 1 complementary bases / base pairing, hold(s) strands together / AW;
2 (because of) many hydrogen bonds;
\( \text{R} \) if between adjacent nucleotides
\( \text{if mp 1 and 2 not awarded} \)
1/2 hydrogen bonds hold strands together;
3 sugar-phosphate backbone / AW, with covalent / phosphodiester, bonds;
4 double helix structure protects bases;
5 AVP; coiling protects from, chemical / enzyme, attack

[max 2]

(b) 1 (information is) ref. (different) sequence / order of bases / nucleotides (in the
polynucleotide strand);
\( \text{A} \) described in terms of sequence of bases
2 DNA / gene, contains / AW, information for the synthesis of a, polypeptide / protein /
enzyme;
3 idea that (coded because) information becomes sequence of amino acids;
4 idea that information passed on (cell to cell / parent to offspring);

[max 2]

(c) (late) interphase / S phase / synthesis phase;

[1]

(d) 1 different sequence of bases / nucleotides;
2 (as a result of) mutation;
3 base substitution;
4 CTT replaced by CAT;
\( \text{A} \) GAA replaced by GUA (for mRNA codon)
5 glu(tamate) substituted by val(ine);

[max 3]

(e) 1 increasing concentration of ara-ATP decreases enzyme activity;
\( \text{can be comparison between 0 and 5 / 20 or between 5 and 20} \)
\( \text{A} \) ref. to rate of DNA synthesis for enzyme activity
2 ara-ATP acting as an inhibitor;
3 substrate unable to bind with active site / fewer enzyme-substrate complexes (formed);
4 further detail;
\( \text{for either competitive} \)
e.g. competes with substrate for (binding to) the active site / similar, structure / shape, as
substrate or complementary shape to active site
\( \text{or non-competitive inhibition} \)
e.g. binds to site other than active site / changes shape of active site

[max 3]

[Total: 11]
6  (a) one mark each correct label to max 3;;;  

(b) X marked over coronary artery section before graft joins;  

(c) cure for, coronary artery disease / atherosclerosis in artery;  
A arteriosclerosis  
so less risk of, myocardial infarction / heart attack / AW;  
prevention of coronary artery disease to avoid bypass surgery  
one example; e.g. no smoking  
increase exercise  
low, (saturated) fat / cholesterol, diet  
reduce alcohol consumption  
reduce salt intake  
statins  
avoid, excessive / AW, sugar  
avoid obesity  

ref. to difficulties in getting people to change lifestyle to prevent;  
disadvantage of, surgical procedure / cure;  
accept ora prevention  
e.g. invasive / painful  
costly medical  
lost time / money, by absence from work  
risk of complications / graft rejection / infection  
risk / graft becoming diseased / collapsing  

AVP; e.g. idea that as cure is available, more difficult to encourage prevention  

[Total: 7]