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 May/June 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.
Mark scheme abbreviations:

; separates marking points
/l alternatives answers for the same point
R reject
A accept (for answers correctly cued by the question, or extra guidance)
AW alternative wording (where responses vary more than usual)
underline actual word given must be used by candidate (grammatical variants accepted)
max indicates the maximum number of marks that can be given
ora or reverse argument
ecf error carried forward
I ignore
mp marking point (with relevant number)
1 (a) one mark for the stages of the cell cycle in the correct sequence 
one mark for correct matching of each stage with a cell

<table>
<thead>
<tr>
<th>stage of mitosis</th>
<th>label from Fig. 1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>prophase</td>
<td>A/H</td>
</tr>
<tr>
<td>metaphase</td>
<td>G</td>
</tr>
<tr>
<td>anaphase</td>
<td>C/E/F</td>
</tr>
<tr>
<td>telophase ;</td>
<td>B</td>
</tr>
</tbody>
</table>

(b) microtubules/spindle (fibres), attach to centromere/kinetochore (of chromosome during prophase); I metaphase arranging/aligning/orienting/AW, chromosomes at the equator/metaphase plate; R centre fibres, shorten/contract/retract; A microtubules disassemble/AW move/pull, (sister) chromatids/(daughter) chromosomes, to opposite poles/centrioles; idea that equal number of chromosomes in each daughter, nucleus/cell; [max 2]

c) maintaining number of chromosomes; ensuring genetic stability/maintaining genetically identical cells/AW; asexual reproduction; A vegetative reproduction/cloning cloning/clonal expansion, of (named) lymphocytes; A B/T cells replacement of (worn out/dead/damaged) cells; regeneration, of (named) tissues/organs; (wound) repair (of tissues); R repair of cells ref. to production of gametes; e.g. mitosis in gametogenesis/gamete production in plants R ‘copying of cells’ [max 2]
(d) (i) accept biological N fixation or Haber-Bosch process for mp1

1 either
   converts, (inorganic) nitrogen/dinitrogen/N₂, into organic nitrogen/ammonia/NH₃/ammonium/NH₄⁺; R if nitrate given
   or
   lightning converts, nitrogen/ammonia/NH₃/ammonium/NH₄⁺, into, nitrite/nitrate (ions);

2 reduces nitrogen/breaks triple bond;

3 makes (fixed) nitrogen available to, legumes/other organisms/community/ AW; A ref. to amino acids/proteins
   not to be awarded if it follows nitrification

4 increase soil fertility;

5 balances the loss of fixed nitrogen in, denitrification/ocean deposits; [max 2]

(ii) 1 idea of decay/decomposition;
   e.g. breakdown by, (saprophytic) bacteria/fungi

2 legumes eaten by, detritivores; A named detritivores

3 decomposers produce proteases;

4 to, hydrolyse/convert/change/AW, protein to amino acids;

5 amino acids are deaminated;

6 (amino acids) to, ammonia/NH₃/ammonium (ions)/NH₄⁺;

7 nitrifying bacteria/Nitrosomonas, convert ammonia to nitrite (ions);

8 nitrifying bacteria/Nitrobacter, convert nitrite to nitrate (ions);

   if mp7 or mp8 not awarded allow one mark for the following as mp9

9 (named) nitrifying bacteria convert, ammonia/ammonium, to nitrate (ions);

   mp10 only to be awarded following nitrification

10 nitrate (ions) used for making, amino acids/proteins (hence increase in growth of cereals);

[max 2]

[Total: 14]
2 (a) (i) X – (ciliated) epithelium;
Y – red blood cell/erythrocyte; [2]

(ii) cilia beat to move mucus (up the bronchiole/towards the mouth/away
from the lungs/AW);
mucus as a barrier to entry into (epithelial) cells;
mucus traps, pathogens/bacteria/microbes; accept in context of goblet cells
capillary/blood vessel, brings, phagocytes/macrophages (to engulf
bacteria); [max 3]

(b) (i) J – phagocytosis/endocytosis/described in terms of engulfing or forming
phagosome; [1]

(ii) digestion of bacteria/described;

to destroy bacteria/pathogen; A to prevent spread through the body
antigen, presentation/display on cell surface;
idea of selection of specific, B cells/T cells;
A recognition/binding of/activation of, appropriate B/T cells [max 2]

(c) 1 faster;
in context of whole secondary response

2 memory cells;
in context of production during the first response

3 idea that there are many more cells specific for this pathogen;

4 (so) increases chances of encountering pathogens more quickly/AW;

5 fast(er) production of, B lymphocytes/plasma cells/antibodies/helper (T)
cells/cytotoxic T cells/cytokines;

6 greater concentration of antibodies (in, blood/lymph) or greater numbers of, B/plasma, cells;
A more, antibodies/plasma cells/B cells

7 pathogen, removed/killed, faster;

8 person does not become ill/no symptoms;
A pathogen does not, spread through the body/infect cells/AW [max 3]
(d) (i) little/no/slower/weak, immune response; stated function of T-lymphocytes, does not occur/occurs slowly; e.g. release of cytokines/stimulating macrophages/stimulating B cells/ killing infected cells high susceptibility to infectious diseases; R ‘fighting disease’ [max 1]

(ii) pathogen not recognised, as non-self/foreign; pathogen is recognised as self; A non-foreign ignore antigen concealment [max 1]

(iii) no, antibodies/plasma cells/memory (B) cells, produced; no humoral response; no antigen presentation by B cells; [max 1]

[Total: 14]

3 (a) increased/faster, movement/diffusion, of, assimilates/amino acids/sucrose/water/solutes/ions/molecules; I substances/particles/carbohydrates I freely/easily/efficiently I osmosis (because) more, (symplast) pathways/passages/AW; accept in context of blockage of some plasmodesmata
correct ref. to symplast pathway in context of an advantage;
e.g. of complex plasmodesmata;
from companion cell into sieve tube (elements)/when loading sucrose into phloem
AVP; e.g. selectivity/control/regulation, of movement [max 2]

(b) 1 mass flow; A pressure flow

2 sucrose/solutes/assimilates/sugars, decreases, water potential/solute potential; A symbol(s) Ψ

3 water enters (sieve tubes), down water potential gradient/by osmosis;

4 increase in/high(er), hydrostatic pressure;

5 unloading/removal, of sucrose at the sink lowers the (hydrostatic) pressure;

6 movement (from source to sink) is by gradient in (hydrostatic) pressure; [max 4]

[Total: 6]
4 (a) enzyme A uses 'lock and key' and enzyme B uses induced fit;
   enzyme A/lock and key and enzyme B/induced fit
   enzyme A/lock and key, (shape of) active site is complementary/AW, to
   (shape of) substrate (molecule);
   enzyme B/induced fit, has an active site that, moulds around/ AW, the
   substrate; [3]

(b) (i) 1 P is β-pleated sheet, Q is α-helix;
   accept if P and Q are identified by a description
   determined by, coiling/folding/sequence, of amino acids/polypeptide;
   A primary structure for sequence of amino acids
   stabilised/held/AW, by hydrogen bonds;
   between C = O and H–N (of peptide bonds);
   A carbonyl/carboxyl group, and, amine/amino group
   ref to, parallel/anti-parallel, nature of β-pleated sheet; [max 3]

(ii) 1 catalyses reaction between carbon dioxide and water to form carbonic acid;
   A correct, formulae/equation
   very fast reaction;
   in (cytoplasm of) red blood cell/erythrocyte;
   (so there are) hydrogen ions/protons, and hydrogen carbonate ions;
   hydrogen ions promotes oxyhaemoglobin dissociation/AW;
   e.g. reduces affinity of haemoglobin for oxygen/(oxy)haemoglobin
   gives up oxygen more readily
   increases supply of oxygen to (respiring) tissues;
   carbon dioxide is transported as hydrogen carbonate ions;
   in the plasma; A carbon dioxide diffuses from red blood cell to plasma
   AVP; e.g.
   carbonic anhydrase catalyses reverse reaction in the lungs
   ref to hydrogen carbonate ions as buffer in plasma (as a
   consequence of reaction)
   R buffering action of haemoglobin in red blood cells [max 4]

[Total: 10]
5 (a)

<table>
<thead>
<tr>
<th>structural feature</th>
<th>triglyceride</th>
<th>phospholipid</th>
</tr>
</thead>
<tbody>
<tr>
<td>phosphate (group) / contains phosphorus</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>nitrogen</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>charged / polar</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>(number of) fatty acids</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>number of ester bonds</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>number of phosphate ester bonds</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Award one mark for any of the following comparisons:

- number of double bonds (in hydrocarbon chain)
  - 0
  - 1
- number of saturated fatty acids / ORA
  - 3
  - 1
- presence of double bonds
  - ✗
  - ✓
- presence of unsaturated fatty acids
  - ✗
  - ✓

(max 2)

(b) Answer may be phrased in the context of amylase / trypsin
Ignore anything before Golgi, e.g. shuttle vesicles from RER

1. Vesicles form from ‘pinch off’, Golgi (apparatus / body / complex);
2. Vesicles move, through cytoplasm / to cell (surface) or plasma membrane;
3. Role of cytoskeleton / microtubules in movement of vesicles;
4. Energy / ATP, is required (movement of vesicles / fusion with membrane);
5. Vesicle fuses with / AW, cell (surface) / plasma, membrane;
   I bind / attach A join / merge / becomes part of
6. Exocytosis / vesicle ‘opens up’ so that enzyme molecules are released;
7. Ref to fluid nature of, membranes / phospholipid bilayer, that makes this possible;

(max 4)
(c)

<table>
<thead>
<tr>
<th>role of water</th>
<th>property of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>solvent for glucose and ions</td>
<td>dipolar/polar; description of polarity of water</td>
</tr>
<tr>
<td>transport in the xylem</td>
<td>hydrogen bonding; cohesion/adhesion</td>
</tr>
<tr>
<td>helps to decrease body temperature in humans</td>
<td>high latent heat of vapourisation / high specific heat (capacity) / high enthalpy heat of vapourisation / lots of energy required for evaporation</td>
</tr>
</tbody>
</table>

[3]

[Total: 9]

6  (a)  P – thymine; R thiamine/thiamin/thyamine
    Q – cytosine;
    R – guanine;
    S – uracil;

(b) 1 copy of the, DNA/gene, (coding) for a, polypeptide/globin; A protein

2 travels from, DNA/nucleus/chromosome, to ribosome;
   A mRNA made in nucleus, attached to ribosome so movement is implied

3 for translation/for (haemo)globin production;

4 mRNA codes for, sequence/order, of amino acids; A for primary structure

5 idea that (nucleotide/base) sequence is a series of codons;

6 base pairing/AW, between codon on mRNA and anticodon on tRNA;
   e.g. of AW
   hydrogen bonds between bases
   examples of base pairing: A–U/C–G
   R binding between bases

[Total: 7]