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Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2012 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
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<th>Mark Scheme abbreviations:</th>
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1 (a) pulmonary artery; A pulmonary arteries

(b) phagocyte / macrophage;
   A neutrophil / polymorphonuclear leucocyte R PMN
   R leucocyte / white blood cell unqualified
   R any incorrect qualification

(c) B-lymphocyte / (effector) B (cell) / plasma (cell); R lymphocyte alone
   R effector cell unqualified

(d) goblet (cell);

(e) cartilage; ignore plates / rings

[Total: 5]

2 (a) 1 electron microscope has, higher / AW, resolution (than LM) / ora;

2 explanation of resolution as ability to differentiate between two points (close together);

3 ref. to (internal) membranes (of A and B) which cannot be seen in LM;
   A named membranes e.g. cristae, grana

4 AVP; e.g.
   (resolution of) EM is 0.5 nm (0.0005 µm) and LM is 200 nm (0.2 µm)
   A 0.5 to 1 nm (0.001 µm)
   resolution is equal to half the wavelength (of medium used)
   ref. to shorter / AW, wavelength (of electrons) / ora (must have a comparison)
   ref. to, width of membranes / distance apart of membranes, e.g. width of membranes
   in A and B is 7 nm (+/- 1)

[Max 3]
(b) C – rough endoplasmic reticulum; **penalise once only for ER instead of endoplasmic reticulum**
   D – ribosome; **A** ribosomes ignore 70S
   E – smooth endoplasmic reticulum; **A** smooth ER if full term used for C

award one mark if **E** = rough endoplasmic reticulum and **C** = smooth endoplasmic reticulum

(c) any one relevant e.g.

store of / holds, cell sap; **R** if contains organelles
store of / holds, water / ions / named ion(s) / minerals / salts / pigments / (named) sugars;
   **R** substances / molecules
   **R** storage unqualified
pushes chloroplast to edge of cell;
gives, turgidity / turgor pressure / hydrostatic pressure / support / AW;
   **A** makes, firm / rigid
   **A** controls / maintains, turgidity
   **R** gives shape / strengthen
store of / holds, waste (products)

**R** reactions occur in vacuole, unqualified

(d) no marks for identifying **F** and **G**
   if only **F** or **G** described max 3
   if **F** and **G** incorrectly identified, accept mark points correctly linked to membrane and wall to max 3

1. **F** partially permeable **A** selectively permeable
   and **G** (fully / freely / AW), permeable / porous;

   **F** is partially permeable **cell surface membrane**

2. phospholipid (bilayer);

3. permeable to, lipid-soluble molecules / oxygen;
   **A** other terms for lipid-soluble
   **treat reference to water as neutral**

4. impermeable to, water-soluble / AW, molecules / ions / AW;
   **A** other terms for water-soluble
   **treat reference to water as neutral**

5. aquaporins / proteins, provide (increased) permeability to water;

6. transport proteins provide permeability to, ions / polar molecules;
   **A** channel / pore / carrier, proteins

   **G** is permeable cell wall

7. cellulose;

8. fibres;

9. ref. to, spaces / gaps / holes / pores, (between, fibres / other cell wall components);

   [max 4]
(e) 1 allows transport of, water / sucrose / amino acids / organic substances / ions / minerals / salts / lipids / hormones / ATP, (from cell to cell / between cells);
  R if linked to an incorrect transport mechanism e.g. sucrose moves by osmosis
2 without crossing, membranes / walls ; A without going through protein channels
3 this is movement through the symplast ;
4 any e.g. ; companion cell to (phloem) sieve tube (element / cell) between mesophyll cells
   mesophyll cell to companion cell
cortical cell to cortical cell / across cells of the cortex
cortical cell to endodermal cell
dermal cell to, pericycle cell / xylem / phloem
   ignore between sieve tube elements
5 allows, communication / signalling, between cells ;

[Total: 14]

3 (a) (i) no mark if no units used at all
   L – 3.6 kPa ; award the mark if units only used once
   M – 4.5 kPa ; A in range 4.45 to 4.55

(ii) ignore any similarities
   1 to the right / lower (affinity) / qualified ; e.g. lower percentage saturation
   2 at, higher / lower, partial pressures, small(er) difference in percentage saturation
      (than others) ; A ora
   3 comparative data quote ; must refer to L and M
      allow ecf from (i)

(b) 1 at partial pressures in the tissues ; where oxygen is unloaded from Hb
   2 haemoglobin is less saturated (than L) ;
   3 because, haemoglobin / Hb, dissociates more readily ;
      A idea of unloading oxygen more readily even if Hb not mentioned
   4 to compensate for, fewer / less effective, red blood cells / Hb ;

[Total: 14]
(c) 1 haemoglobin less well saturated (in lungs at high altitude);
2 data quote from Fig. 3.1; \( A \) 80–90% saturated at ‘about 7.5 kPa’
3 produce more red blood cells / increase in number of RBCs;
4 more haemoglobin;
5 *idea* of compensates for, smaller volume of oxygen absorbed / lower saturation (of haemoglobin);

*also accept the following adaptations*
6 increase in haematocrit / AW / decrease in plasma volume;
   \( A \) increase in RBCs per unit volume
   \( R \) decrease in blood volume
7 increase in, breathing rate / tidal volume / heart rate / stroke volume;
8 increase in, capillary density / number of mitochondria / myoglobin / respiratory enzymes, in muscle;
9 ref. to (increased) secretion of, erythropoietin / EPO;
10 increase in (2,3), BPG / DPG, in red blood cells; \( A \) rightward shift in curve [max 4]

(d) 1 not caused by (named type of) pathogen / non-infectious / non-transmissible / non-communicable / AW;
2 genetic / inherited / AW, disease; \( A \) caused by a mutation / AW
   \( A \) ‘passed down from parent(s)’
   \( R \) idea of congenital diseases
   \( R \) ‘you get it from your mother’
3 ref. to, no immune response / no antigen(s);
4 affects all red blood cells so vaccine would lead to their destruction; [max 2]

[Total: 13]
4 (a) *this can be answered in the context of penicillinase*

1. complementary shape;
2. substrate, fits into / enters / binds to / with, active site; 
   - enzyme-substrate complex / ESC
3. ref. to specificity;
4. lock and key / induced fit; 
   - description of induced fit
5. ref. to temporary bonds form with, active site / R groups (of amino acid residues);

(b) *shown to max 2*

secondary structure;
- \(\alpha\) / alpha, helix; 
- R ‘helix’ / helical structure unqualified by alpha
- \(\beta\) pleated sheet;
- tertiary structure / folding; 
  - ignore 3D shape or structure
- globular;

*not shown to max 2*

amino acids / primary structure / sequence of amino acids;
- (types of) R groups;
- bonds / named bonds; 
  - A peptide
- quaternary structure;
- prosthetic group;

(c) (i) one lower peak inside line than uncatalysed;
- start and finish at, dotted lines / same energy levels as uncatalysed;

(ii) activation (energy) / (energy of) activation;

(d) 1. do not prescribe for viral diseases;
2. only use when necessary / do not overprescribe;
3. only available on prescription / not available ‘over the counter’;
4. people must, complete the course / take as instructed;
   - R take a long course
5. test to find out which is most appropriate antibiotic to use;
   - A use most, appropriate / effective, antibiotics
   - A use narrow-spectrum antibiotics
6. details of sensitivity test;
7. rotate / AW, antibiotics / use in combination; 
   - R use many antibiotics
8. do not use same antibiotics for humans and animals;

[Total: 11]
5 (a) ignore Y
   X = mitosis ;
   Y = meiosis / mitosis

(b) 1 chromosome number is halved / 2n → n / diploid → haploid ;
   A 2 sets of chromosomes → 1 set of chromosomes

   explanation to max 1
   2 restore diploid number on fusion ; R restore full set if not qualified
   3 avoids number doubling with each generation ;
   4 allows expression of (recessive) alleles / AW ;
   5 allows variation / new combinations of chromosomes ;

(c) if only use formulae, these must be correct – otherwise ignore

   1 nitrification / nitrifying / oxidation ;
   2 ammonium ions to nitrite ions ;
   3 nitrite ions to nitrate ions ; A one mark for ammonium to nitrate
   4 one named microorganism in correct context
      Nitrosomonas / Nitrobacter ; R Rhizobium
   5 ammonium / nitrate / AW, absorbed by plants / leached / AW ;
      R used by plant

   max 3

(d) 1 ammonium ions are (positively) charged ; A hydrophilic / polar / water-soluble
   2 cannot pass through, phospholipid bilayer / membrane ;

   either
   3 active transport ;
   4 moved against concentration gradient ;
   or
   3 facilitated diffusion ;
   4 moves down its concentration gradient ;

   max 2

[Total: 8]
6 (a) (i) hydrogen bonds drawn onto Fig. 6.1

lines must go between O-H, N-H as follows

- two lines between A and T H — O and N — H ;
- three lines between C and G H — O and N — H and O — H ; [2]

(ii) 1 hydrogen bonds hold (two), polynucleotides / strands / chains, together ;
- A hold, (complementary) nucleotides / base pairs, together
- A ora e.g. prevents, unwinding / strand separation
- 2 (many hydrogen bonds) give stability / DNA is stable molecule / DNA is long lasting / AW ; ignore ref. to strength
- 3 can be broken for, transcription / replication ;
- 4 ref. to (double) helix ; [2]

(b) 1 (named) base / nucleotide, pairing ;
- 2 purine – pyrimidine ;
- 3 percentage of A = percentage of T ; A very similar
- 4 percentage of C = percentage of G ; A very similar
- 5 data quote in support ; [max 3]

(c) (i) idea that

- percentages of, A and T / C and G, are not the same / three percentages are similar; [1]

(ii) single-stranded DNA / not double-stranded / not a double helix ;
- A may be other bases ; [1]

[Total: 9]