BIOLOGY
Paper 2 AS Level Structured Questions
SPECIMEN MARK SCHEME

MAXIMUM MARK: 60
**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` maximum number of marks that can be given
- `ora` or reverse argument
- `mp` marking point (with relevant number)
- `ecf` error carried forward
- `I` ignore
- `AVP` alternative valid point (examples given as guidance)
1  (a) 2,3,1,4 ;

(b)  
(i) nuclear envelope, disassembling / fragmenting / breaking down / forming vesicles;  
A membrane for envelope  R disappears  

(ii) telomere ;

(c)  
(i) resolving power, not high enough / poor / low / 250 nm / 0.25 µm / half the wavelength of light (used);  
A resolution for resolving power  
resolution limited by wavelength of light ;  
microtubule (diameter) too small to interfere with light waves / AW ;  

(ii) forms part of, spindle / spindle fibres ;  
attachment to centromeres / chromosomes / chromatids ;  
detail ; e.g. movement of, sister chromatids / (daughter) chromosomes, to (opposite) poles / spindle fibres shortening at anaphase  

(iii) monomer  
protein / tubulin, composed of / AW, amino acid, monomers / building blocks / sub-units;  
A protein / tubulin, composed of / AW, amino acids joined, together / by peptide bonds  
macromolecule  
protein / tubulin, is a large molecule, composed of / AW, many / AW, amino acids / smaller molecules ;

[Total: 9]
2 (a) arrow from W to any xylem vessel element; e.g.

(b) through cytoplasm / cytoplasmic pathway;
via plasmodesmata; in context of parenchyma to endodermal cell or
endodermal cell to pericycle cell through, endodermis / endodermal cells / passage cells;
water moves down water potential gradient;
parenchyma cell higher water potential than, adjacent cell / endodermal cell / xylem vessel element; A idea of overall higher water potential in soil (solution) than in xylem / (external) atmosphere around leaf
diffusion (through cytoplasm / plasmodesmata) or osmosis in context of across vacuolar membranes;
ref. to cohesive nature of / hydrogen bonding between, water molecules; [max 4]

(c) (i) iodine in potassium iodide (solution); A iodine solution [1]

(ii) amylose, spiral / spiralled / helix / helical; R α-helix R coiled
amylopectin branched;
compact / AW;
qualified; e.g. for maximum storage
(so) insoluble / osmotically inactive / inert;
amylopectin, many free ends (so easily supplies glucose);
(amylose / amylopectin / starch) contain glucose for immediate use as respiratory substrate (on hydrolysis); [max 4]

[Total: 10]
3 (a)  \( P = \) right, atrium / auricle;
\( Q = \) aorta;  

(b)  \( SAN \) to max 2
pacemaker / sets rate of heart beat / responsible for rhythmic contraction;
sends out, impulses / waves of excitation;
initiates / brings about / \( AW \), heart beat / contraction of the heart / atrial contraction / atrial systole;
\( Purkyne \) tissue to max 2
conducts, impulses / waves of excitation, down septum to, ventricles / apex of heart / base of heart;
conducts, impulses / waves of excitation through ventricle walls;
to cause, ventricular contraction / ventricular systole (from base upwards);
\textbf{to an overall max 4}  

(c)  \textit{closed}
blood, contained / \( AW \), in, blood vessels / arteries, veins and capillaries;
\textit{double}
blood, travels through / \( AW \), the heart twice during one, complete circuit / circulation;
or
pulmonary and systemic, circulation / systems / circuits;  \textbf{A description}  

(d)  (i)  oxygen in(to blood), carbon dioxide out (of blood);
diffusion / from a high(er) concentration to a low(er) concentration;
through alveolar wall and capillary, endothelium / wall;
oxygen enters red blood cells;
oxygen taken up by haemoglobin; \( AW \)  

(ii)  carbon monoxide (in inhaled smoke) binds to haemoglobin / carboxyhaemoglobin formed;
carbon monoxide competes with oxygen, haemoglobin binding sites / \( AW \);
haemoglobin has a higher affinity for carbon monoxide than oxygen;  

\textbf{[Total: 13]}
4 (a) (i) protein / peptide, hormones; too large to cross membrane; hydrophilic / water soluble; A not, hydrophobic / lipid soluble unable to pass through hydrophobic core / AW, of phospholipid bilayer; [max 2]

(ii) chemicals released are circulating hormones; hormones combine with cell surface receptors; on target cells / cells where transcription is triggered; action of kinases and phosphatases (within the cell) lead to (specific) response; specific response = transcription / production of mRNA; [max 3]

(b) (i) optimum is, pH 5 / between pH 4–5.5; A optimum pH value between 4–5.5 increasing activity as pH increases to, optimum / pH 5; decreasing activity as pH increases above, optimum / pH 5; active, over a wide pH range / between pH 1–9; [max 2]

(ii) low pH equivalent to high, hydrogen ion / H+, concentration; hydrogen / ionic, bonds, disrupted / broken / AW; active site shape, changed / AW; A active site no longer complementary to substrate ref. to partial denaturation / some enzymes denatured; (active site change so) decreases effective collisions / fewer enzyme substrate complexes formed; (only) some (phosphatase) enzymes active / all enzymes partly active; [max 3]

(c) (i) in (sodium) alginate (beads) / encapsulation; A other named methods, e.g. entrapment / trapped in pores of silica gel adsorption onto, clay / glass / resin (within) polymer / partially permeable membrane, microspheres covalent bonding to support, material / collagen [1]

(ii) any one acceptable suggestion, e.g. enzyme / phosphatase, can be reused; enzyme / phosphatase, easily recovered; enzyme / phosphatase, doesn't contaminate, DNA / product; less purification of product / DNA, required; A less downstream processing required enzyme / phosphatase, longer shelf life / AW; enzyme / phosphatase, more stable to, temperature / pH; [max 1]

(d) similarities both have, pentose / 5C sugar; both have, organic / nitrogenous, base; A both have purine (base) both have phosphate; differences (ATP) ribose not deoxyribose; (ATP) adenine not guanine; (ATP) three phosphates, not one; [max 4]

[Total: 16]
(a) one mark each row

<table>
<thead>
<tr>
<th>statement</th>
<th>measles</th>
<th>smallpox</th>
<th>malaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>caused by a virus</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>caused by <em>Plasmodium</em></td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>eradicated by vaccination</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>transmitted by contaminated water</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

(b) *idea that* viruses have no, sites / targets, where antibiotics can work; viruses have no, cell walls / ribosomes / cell membranes; A have different enzymes *idea that* even if antibiotics could affect viruses, they are within cells, antibiotics cannot reach them; [max 1]

[Total: 5]
6  (a) antigen-presenting cell; A description e.g. macrophage that has phagocytosed pathogen and has antigens on surface vaccine containing antigen ;  

(b) transcription, translation, RER / rough endoplasmic reticulum / Golgi (body) ;  

(c) (i) soluble in, blood / plasma / tissue fluid / lymph ; tertiary / quaternary, structure allows formation of, variable site ; AW idea of easier to transport (than fibrous proteins) ;  

(ii) more than one, polypeptide ; (antibodies have) two heavy and two light, polypeptides / chains ;  

(d) hybridoma (cell) ;  

[Total: 7]