| Question Number | Answer | Mark |
|---|---|---|
| **1(a)** | Substance X = (DNA)primer(s) ;<br><br>Substance Y = (mono)nucleotide(s) ;<br><br>Substance Z = DNA strand(s) ; | **(3)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(b)(i)** | A ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(b)(ii)** | C ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(b)(iii)** | B ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(c)(i)** | 1. Idea that human enzymes will not work at {high / these/ above 37$^{o}$C eq} ;<br><br>2. reference to {denaturation /change in shape of active site}(at temperatures in PCR) ; | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(c)(ii)** | 1. (xylem / wood) made of dead material / has no {living material / cytoplasm / cell contents / nuclei / mitochondria} / eq ;<br><br>2. no {DNA / nucleic acid} present / eq ; | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **2(a)(i)** | C ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **2(a)(ii)** | B ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **2(a)(iii)** | C ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **2(b)** | ACCEPT any mark point from a clearly annotated diagram<br>1. reference to {granum / grana} ;<br>2. reference to (a granum is) a stack of {thylakoids / membranes} OR grana are connected by lamellae ;<br>3. reference to (thylakoids contain) {electron carriers / eq} / chlorophyll / photosystems ;<br>4. reference to (membranes contain) {ATPase / ATPase channel} ;<br>5. idea that {electron carriers / ATPase /eq} are associated with {thylakoid / thylakoid membranes} ; | **(3)** |

| Question Number | Answer | Mark |
|---|---|---|
| **2(c)** | 1. GALP is a 3C molecule / eq ;<br>2. reference to formation of {glucose / hexose/ 6C sugar} (from GALP) ;<br>3. idea of enzymes involved in the synthesis of {glucose / cellulose} ;<br>4. idea that cellulose consists of {ß-glucose / beta glucose } ;<br>5. joined by glycosidic bonds / eq;<br>6. reference to 1-4 (bonds) ;<br>7. reference to condensation reactions (between glucoses) ;<br>8. idea that cellulose is a long chain molecule e.g. polysaccharide, polymer ;<br>9. {unbranched / eq} molecule ; | **(5)** |

Question 3 & 4: N/A

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>Feature</th><th>Bacteria only</th><th>Viruses only</th><th>Both bacteria and viruses</th></tr>
<tr><td>Nucleic acid</td><td></td><td></td><td>✓</td></tr>
<tr><td>Cytoplasm</td><td>✓</td><td></td><td></td></tr>
<tr><td>Protein capsid</td><td></td><td>✓</td><td></td></tr>
</table>
1 mark each correct row ;;;
</td><td>(3)</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5(b)(i)</td><td>1. idea of (SCAG is) caused by {a bacterium / bacteria} ;<br><br>2. antibiotics {kill / stop reproduction / eq} of bacteria / are {bactericidal / bacteriostatic} ;</td><td>(2)</td></tr>
</table>

| Question Number | Answer | Mark |
|---|---|---|
| ***5(b)(ii) QWC** | Spelling of technical terms must be correct and the answer must be organised in a logical sequence<br><br>1. as age increases, acid secretion decreases / eq ;<br><br>2. as age increases (above 30) , stomach cancer increase / eq ;<br><br>3. as acid secretion decreases (below 120), stomach cancers increases / eq ;<br><br>4. idea that the {higher age groups (51+) have low acid and high cancer / lower age groups (up to 30) have high acid and low cancer} ;<br><br>5. Idea of {acid / low pH} (in stomach) kills {bacteria / *Helicobacter}* ;<br><br>6. reference to development of SCAG {inhibited / prevented / eq} (by low pH / more stomach acid) ;<br><br>7. idea of age affects the immune system ;<br><br>8. idea that the older you are acid-producing cells are less effective e.g. fewer acid-producing cells / cancer cells replace the acid-producing cells ;<br><br>9. idea that {acid / low pH} destroys cancer cells ;<br><br>10. idea that mutations (leading to cancer) more likely to occur with age ; | **(5)** |

Question 6: N/A

| Question Number | Answer | Mark |
|---|---|---|
| **7(a)** | C ; | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **7(b)(i)** | 1. {T helper / CD4 (positive)} (cell / lymphocytes) ;<br>2. phagocytic cells e.g. macrophages, dendritic cell ; | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **7(b)(ii)** | 1. reference to (HIV) binds to (CD4) receptors on cell (surface) ;<br>2. ref to CD4 (receptors on cells) ;<br>3. reference to {glycoprotein / gp120} on virus (surface) ;<br>4. reference to fusion of virus (envelope) with (cell surface) membrane ;<br>5. idea of phagocytosis (in macrophage / eq) ; | **(3)** |

| Question Number | Answer | Mark |
|---|---|---|
| **7(b)(iii)** | 1. reference to viral RNA ;<br><br>2. reference to production of (viral) DNA (using viral RNA as a copy) ;<br><br>3. correct ref to reverse transcriptase ;<br><br>4. reference to incorporation of viral DNA into host cell's {DNA /genome } / reference to provirus / eq ;<br><br>5. correct ref to integrase ;<br><br>6. reference to production of {viruses / viral RNA and proteins} / eq ;<br><br>7. idea of infection of further (T helper) cells ;<br><br>8. reference to destruction of (T helper) cells by T killer cells OR reference to cell lysis / eq ;<br><br>9. reference to lowering of immunity ;(to other diseases ;<br><br>10. credit reference to role of T helper cells in immune response e.g. produce cytokines, activate B cells / killer cells ;<br><br>11. death is caused by e.g. opportunistic disease, pneumonia , TB, Kaposi's sarcoma, cancer, dementia, extreme weight loss, meningitis, toxoplasmosis ; | **(6)** |

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>8(a)</td><td>
<table>
<tr><th>Description</th><th>True</th><th>False</th></tr>
<tr><td>B and T cells are formed in the bone marrow</td><td>✓</td><td></td></tr>
<tr><td>B cells stimulate T cells to produce clones of memory cells</td><td></td><td>✓</td></tr>
<tr><td>T helper cells produce chemicals that destroy pathogens</td><td></td><td>✓</td></tr>
<tr><td>B and T cells are able to form clones by mitosis</td><td>✓</td><td></td></tr>
</table>
1 mark each correct row ;;;;
</td><td>(4)</td></tr>
</table>

| Question Number | Answer | Mark |
|---|---|---|
| **8(b)** | 1. (bacteria are) too small / reference to limitation of {magnification / resolution} ;<br><br>2. (bacteria) not stained ;<br><br>3. idea of bacteria already {removed / destroyed} e.g. phagocytosis ;<br><br>4. idea that bacteria are not present in the blood e.g. only a small {region / sample} shown, reference to local infection ; | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **8(c)(i)** | Either:<br>1. idea of fewer {lymphocytes / eq} ;<br>2. reference to {lymphocytes / eq} no longer needed / eq ;<br>3. (as) {antibiotics / drugs} {kill / destroy / eq} bacteria ;<br>Or:<br>4. more {lymphocytes / eq} ;<br>5. idea of clonal expansion (of lymphocytes) / eq ;<br>6. idea that the antibiotics have not killed all the bacteria yet ; | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **8(c)(ii)** | 1. idea that a placebo has no effect ;<br>2. (therefore there will be) more bacteria / eq ;<br>3. (therefore there will be) more {lymphocytes / eq} ;<br>4. (more lymphocytes due to) clonal expansion / eq ; | **(2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **9 (a)** | 1. carbon dioxide produced in respiration / eq ;<br>2. affects {volume / pressure} of gas / eq ;<br>3. allows measurement of oxygen used / eq ; | **max (2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **9 (b)(i)** | Two marks for correct answer<br>0.8 (mm $min^{-1}$) ;;<br>if incorrect allow one mark for correct working<br>1. 48 ; OR 1. 12 ;<br>2. ÷ 60 to give answer ; OR 2. ÷ 15 to give answer | **(2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **9 (b)(ii)** | 1. no oxygen available/no oxygen uptake ;<br>2. reference to anaerobic respiration ;<br>3. carbon dioxide produced is absorbed / eq ;<br>4. no (net) change of {volume / pressure} of gas ; | **max (2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **9 (b)(iii)** | 1. {mass / eq} of organism may differ ;<br>2. use same mass / express results per unit mass / eq ;<br>3. temperature changes / eq ;<br>4. control temperature using a water bath / eq ;<br>5. pressure may affect volume of gas / eq ;<br>6. use of control with no organisms, at the same time / eq ; | **max (4)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **10 (a)** | Mark for each correct row<br><br>**Muscle** / **Muscle contracted when**: **Holding steady** / **Lifting upwards**<br>Extensor: X<br>Flexor: X X<br><br>;; | **(2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **10 (b)** | tendons ; | **(1)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **10 (c)** | 1. idea that muscles cannot extend themselves ;<br>2. need opposing muscle to extend / eq ;<br>3. antagonistic muscle allows control (of movement) / eq ; | **max (2)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **(d)** | 1. all fibres same length and width as original ;<br>2. Z lines closer together ;<br>3. more overlap of actin and myosin ; | **(3)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| ***10(e) QWC** | (QWC – Spelling of technical terms *(shown in italics)* must be correct and the answer must be organised in a logical sequence)<br><br>1. reference to {*vesicles* / *t-tubules* / *sarcoplasmic reticulum*} contain *calcium ions* ;<br><br>2. {binds / eq} to *troponin* ;<br><br>3. *tropomyosin* moves exposing binding sites / eq ;<br><br>4. for *myosin* /eq ;<br><br>5. needs ATP to remove *calcium ions* / eq ;<br><br>6. ATP provides energy for changing shape of *myosin* / eq ;<br><br>7. ATP is required to {break cross bridges / eq} ;<br><br>8. ATP for synthesis of *neurotransmitter* / eq ; | **max (5)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **11 (a)** | ATPase / ATP synthetase ; | **(1)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **11(b)** | 1. ($H^+$ ions) from reduced NAD / eq ;<br>2. $H^+$ ions pumped into inter membrane space / eq ;<br>3. reference to energy needed (for pump) / eq ;<br>4. reference to movement of electrons along ETC /eq;<br>5. (ETC on) inner membrane / cristae; | **max (3)** |

| Question Number | Correct Answer | Mark |
|---|---|---|
| **11(c)** | 1. $H^+$ ions follow diffusion gradient / eq ;<br>2. idea that this causes an energy change or makes energy available ;<br>3. ATP is formed / eq ;<br>4. idea that this occurs on stalked particles ;<br>5. ATP is energy source for (biological processes) / eq ; | **max (2)** |