Question Number	Answer	Mark
1(a)	Substance X = (DNA)primer(s) ; Substance Y = (mono)nucleotide(s) ; 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} ; 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 ; 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 1. reference to {granum / grana} ; 2. reference to (a granum is) a stack of {thylakoids / membranes} OR grana are connected by lamellae ; 3. reference to (thylakoids contain) {electron carriers / eq} / chlorophyll / photosystems ; 4. reference to (membranes contain) {ATPase / ATPase channel} ; 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 ; 2. reference to formation of {glucose / hexose/ 6C sugar} (from GALP) ; 3. idea of enzymes involved in the synthesis of {glucose / cellulose} ; 4. idea that cellulose consists of {ß-glucose / beta glucose } ; 5. joined by glycosidic bonds / eq; 6. reference to 1-4 (bonds) ; 7. reference to condensation reactions (between glucoses) ; 8. idea that cellulose is a long chain molecule e.g. polysaccharide, polymer ; 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} ;

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 1. as age increases, acid secretion decreases / eq ; 2. as age increases (above 30) , stomach cancer increase / eq ; 3. as acid secretion decreases (below 120), stomach cancers increases / eq ; 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} ; 5. Idea of {acid / low pH} (in stomach) kills {bacteria / *Helicobacter}* ; 6. reference to development of SCAG {inhibited / prevented / eq} (by low pH / more stomach acid) ; 7. idea of age affects the immune system ; 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 ; 9. idea that {acid / low pH} destroys cancer cells ; 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) ; 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) ; 2. ref to CD4 (receptors on cells) ; 3. reference to {glycoprotein / gp120} on virus (surface) ; 4. reference to fusion of virus (envelope) with (cell surface) membrane ; 5. idea of phagocytosis (in macrophage / eq) ;	**(3)**

Question Number	Answer	Mark
7(b)(iii)	1. reference to viral RNA ; 2. reference to production of (viral) DNA (using viral RNA as a copy) ; 3. correct ref to reverse transcriptase ; 4. reference to incorporation of viral DNA into host cell's {DNA /genome } / reference to provirus / eq ; 5. correct ref to integrase ; 6. reference to production of {viruses / viral RNA and proteins} / eq ; 7. idea of infection of further (T helper) cells ; 8. reference to destruction of (T helper) cells by T killer cells OR reference to cell lysis / eq ; 9. reference to lowering of immunity ;(to other diseases ; 10. credit reference to role of T helper cells in immune response e.g. produce cytokines, activate B cells / killer cells ; 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} ; 2. (bacteria) not stained ; 3. idea of bacteria already {removed / destroyed} e.g. phagocytosis ; 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: 1. idea of fewer {lymphocytes / eq} ; 2. reference to {lymphocytes / eq} no longer needed / eq ; 3. (as) {antibiotics / drugs} {kill / destroy / eq} bacteria ; Or: 4. more {lymphocytes / eq} ; 5. idea of clonal expansion (of lymphocytes) / eq ; 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 ; 2. (therefore there will be) more bacteria / eq ; 3. (therefore there will be) more {lymphocytes / eq} ; 4. (more lymphocytes due to) clonal expansion / eq ;	**(2)**

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

Question Number	Correct Answer	Mark
9 (b)(i)	Two marks for correct answer 0.8 (mm min^{-1}) ;; if incorrect allow one mark for correct working 1. 48 ; OR 1. 12 ; 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 ; 2. reference to anaerobic respiration ; 3. carbon dioxide produced is absorbed / eq ; 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 ; 2. use same mass / express results per unit mass / eq ; 3. temperature changes / eq ; 4. control temperature using a water bath / eq ; 5. pressure may affect volume of gas / eq ; 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 **Muscle** / **Muscle contracted when**: **Holding steady** / **Lifting upwards** Extensor: X Flexor: X X ;;	**(2)**

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

Question Number	Correct Answer	Mark
10 (c)	1. idea that muscles cannot extend themselves ; 2. need opposing muscle to extend / eq ; 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 ; 2. Z lines closer together ; 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) 1. reference to {*vesicles* / *t-tubules* / *sarcoplasmic reticulum*} contain *calcium ions* ; 2. {binds / eq} to *troponin* ; 3. *tropomyosin* moves exposing binding sites / eq ; 4. for *myosin* /eq ; 5. needs ATP to remove *calcium ions* / eq ; 6. ATP provides energy for changing shape of *myosin* / eq ; 7. ATP is required to {break cross bridges / eq} ; 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 ; 2. H^+ ions pumped into inter membrane space / eq ; 3. reference to energy needed (for pump) / eq ; 4. reference to movement of electrons along ETC /eq; 5. (ETC on) inner membrane / cristae;	**max (3)**

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