Question Number	Answer	Additional guidance	Mark
1(a)(i)	1. an increase in temperature increases the permeability / eq ; 2. idea that increase in permeability is non-linear e.g. greatest increase between 40 and 60 ^{o}C, less change up to 40^{o}C ; 3. credit correct manipulation of figures e.g. 4.9 increase between 40 and 60 ^{o}C ;	2. NOT faster, slower, etc	(2)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	1. idea that increased kinetic energy increases movement of molecules ; 2. reference to phospholipids moving / eq ; 3. idea that (membrane) proteins denatured ; 4. idea that there is more {denaturation / disruption / eq} at {higher temperatures / above 40 ^{o}C } ; 5. idea that {betalain / pigment} can escape from the {cell / vacuole /eq } when the membrane is disrupted ; 6. comment on the disruption of the vacuole membrane / eq ;		(3)

Question Number	Answer	Additional guidance	Mark
*1(b)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. appropriate standardisation of source of beetroot tissue ; 2. standardisation of size of beetroot pieces / eq ; 3. need for {washing / rinsing / eq} {beetroot / eq} (thoroughly) ; 4. use of waterbath (to maintain / change temperature) ; 5. reference to repeats at each temperature / replicates / eq ; 6. se of temperatures {below 20 / above 90 ^{0}C / smaller intervals / eq }; 7. reference to one other suitable variable e.g. time beetroot pieces left between cutting and use ; 8. reference to {calibration / zeroing / eq} of colorimeter ;	QWC emphasis clarity of expression	(5)

Question Number	Answer	Additional Guidance	Mark
2(a)	1. proteins consist of amino acids joined together by peptide bonds; 2. credit reference to named bonds (between R groups) involved in holding {3D structure / eq} ; 3. carbohydrates consist of {monsaccharides / glucoses / eq} ; 4. reference to glycosidic {bonds / eq} between (adjacent) {glucose / eq} molecules ;		**(3) XP**

Question Number	Answer	Additional Guidance	Mark
2(b)	1. idea that the drugs could {bind to / alter shape of} {glycoproteins / gp120} ; 2. idea that drugs bind to {receptors / antigens} on membrane / eq ; 3. called CD4 (antigen / molecules) ; 4. preventing virus attaching to T (helper / $CD4^+$) cells / eq ;		**(3) XP**

Question Number	Answer	Additional Guidance	Mark
*2(c)	1. reference to reverse transcriptase ; 2. idea of formation of (viral) DNA ; 3. from (viral) RNA ; 4. reference to integrase ; 5. idea of integration of (viral) DNA into (host) DNA ; 6. idea that {T helper cells / eq} would be {destroyed / killed / burst / eq} (by virus particles leaving cell) ; 7. idea that more T (helper) cells would become infected ;	**QWC focussing on clarity of expression** 2. reject idea that RNA is {turned into / converted into} DNA 5. ACCEPT idea of {latency / formation of provirus / eq}	**(5) XP**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. {phosphate group / heads} are hydrophilic ; 2. Idea that heads can be attracted to water ; 3. {fatty acids / tails} are hydrophobic ; 4. Idea that tails orientate themselves away from water / eq ; 5. Idea of aqueous environment on both sides of the membrane ;	ACCEPT marks for annotated diagram, phonetic spelling OK IGNORE "water loving / hating" 1. CCEPT polar 2. t just facing water 3. CCEPT non polar 4. CCEPT repel water, face away from water, away from polar environment 5. CCEPT polar environment	**(3)**

Question Number	Answer	Mark
3(b)	B ; C ; A ;	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	1. both have a phospholipid bilayer and protein / eq ; 2. idea that the fluid mosaic model has {proteins within the phospholipid layer / protein channels } while the Davison – Danielli model has protein layer on the outside of the membrane only ; 3. reference to other components present in fluid mosaic model e.g. glycolipid, glycoprotein, cholesterol ;	1. CCEPT point pieced together in response 2. needs clear comparative atement re the position of the proteins in the two models, but can be expressed in a number of ways.	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	1. idea that molecules would not be able to diffuse through the (two) protein layers / eq ; 2. idea of no {channels / carriers / protein } for {facilitated diffusion / active transport / osmosis} ; 3. comment on fluidity of membrane / limits fusion of vesicles /eq ;	1. CCEPT osmosis in context of water passing through protein layer 2. CCEPT pumps for active transport 3. CCEPT endo/exocytosis	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. reference to phospholipid bilayer ; 2. correct orientation and structure of the phospholipids in the bilayer ; 3. explanation of why the phospholipids are orientated the way they are e.g. heads attracted to water OR tails repelled by water ; 4. proteins in the membrane (described / shown) ; 5. idea of two different locations of proteins e.g. extrinsic, intrinsic, transmembrane ; 6. glycoproteins / glycolipids (described / shown) ; 7. idea of cholesterol within the membrane (described / shown) ;	Read what is written on the lines first Accept points made on a clearly labelled diagram If diagram and description contradict then Mp not awarded 2. CCEPT heads on outside and each with two tails if drawn 2. N if gap between phospholipids is too large e.g. as large as a phopholipid in the diagram 3. CCEPT ref to heads being hydrophilic OR tails hydrophobic OR explained in terms of polarity 5. If only one protein located then still get Mp4	**(5) p**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. small ; 2. non-polar / non –charged ; 3. lipid soluble / eq ; 4. idea that they are recognised by (specific) protein receptors /eq ;	1. NOT 'size' alone 2. ACCEPT ref. to polar if correctly qualified 3. ACCEPT solubility in lipids NOT just 'solubility' NOT 'water soluble' ACCEPT 'fat soluble'	**(2) Grad**

Question Number	Answer	Additional Guidance	Mark
4(c)	Similarity any **one** from: 1. use {ca ier / channel} proteins **OR** 2. transport {hydrophilic / eq} molecules / named molecule ; Difference any **one** from: 3. dea that active transport requires {energy / ATP} / facilitated diffusion does not require {energy / ATP} **OR** 4. ac ve transport moves molecules against a concentration gradient / facilitated diffusion allows molecules to move down a concentration gradient / eq ;	1. IGNO protein unqualified IGNORE transport protein 2. CCEPT charged / polar	**(2) Grad**

Question Number	Answer	Additional guidance	Mark
5(a)	1. phospholipid (bilayer) ; 2. credit details of phospholipid bilayer ; 3. proteins ; 4. credit details of proteins ; 5. reference to other named membrane components ;	ALLOW a clearly labelled diagram 2. e. orientation because of hydrophobic and/or hydrophilic regions eg phospholipids are fluid 4. e.g. scription of channel/carrier protein structure or position. (Intrinsic, extrinsic or transmembrane) 5.e.g. glycolipid, cholesterol, glycoprotein, carbohydrate chain, glycocalyx	**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	**Solute P:** 1. (up to 30 minutes) the {concentration / number} of molecules of P increases inside the cell / eq ; 2. ref to {diffusion / facilitated diffusion}(of molecules of P into the cell) ; 3. down the concentration gradient (of P) / eq ; 4. {between 30 and 40 minutes / after 30 minutes } the {concentration / number} of molecules (of P) inside the cell stays the same / eq ; 5. concentration (of P) inside cell equals concentration outside cell / reaches equilibrium / eq ; **Solute R:** 6. solute R does not enter cell / eq ; 7. membrane is impermeable to R ;	IGNORE amount **max 4 marks for solute P** 2. N osmosis 3. ALLO high to low concentration NOT high to low concentration gradient 4. ALLO no net movement	**(5)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	six white circles inside and outside the cell and 4 black circles outside cell ;		**(1)**