Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)			*MP 1 awarded for observation that the stain was no longer in the surrounding solution and not for the % of cells containing the stain.*
			1 at low temperatures, all stain is in cells **OR** no stain in surrounding solution **;**		**ACCEPT** the stain is not evenly distributed between cells and solution **ACCEPT** stain doesn't move out of cells
			2 (taken up / held) against**,** diffusion / concentration**,** gradient **;**		**ACCEPT** *up* the diffusion gradient
			3 at high temperature stain not held in cells **;**		**ACCEPT** solution now contains stain **ACCEPT** 0% = none / no cells (stained) *MP **1** and **3** - must be stated rather than inferred from quoted figs*
			4 at high temperature enzymes denatured so no ATP for active transport (of stain) **;**		**IGNORE** 'enzymes denatured' alone **CREDIT** active transport / carrier, proteins denatured **ACCEPT** mitochondria stopped working so no ATP produced
			5 use of correct comparative figs to illustrate a point **;**		e.g. 97% at 30°C but 0% at 80°C **IGNORE** figs without units
			AVP **; ;**	max 2	

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(ii)	cells, dead / not respiring ; no, (metabolic) energy / ATP, to take up stain ; AVP ;	max1	**DO NOT CREDIT** 'burst' as these cannot be seen **ACCEPT** inhibitor present / membrane impermeable **ACCEPT** no functioning mitochondria
1	(b)	(i)	(membrane) structure disrupted ; (phospho)lipid bilayer, melts / more fluid ; (membrane) proteins / carrier molecules, denatured / unable to function ; (membrane) becomes more permeable ;	max 1	*Mark first suggestion and if correct award mark – if further answers contradict first answer do not award mark.* **ACCEPT** damaged, destroyed, break down **IGNORE** *membrane,* denatured / more fluid **IGNORE** lipid *molecules* melt **ACCEPT** lose shape for denatured **ACCEPT** leaky **IGNORE** refs to bonds breaking

Question			Expected Answers	Marks	Additional Guidance
1	(b)	(ii)	membrane <u>permeable</u> (to stain) **;** methylene blue, leaked out of cells / released to solution **;** by diffusion / down concentration gradient **;**	max 2	**IGNORE** leaky **ACCEPT** stain / blue / pigment, moved out **IGNORE** lost *colour* / *colour* moved out (it is in stem of question) **ACCEPT** by active transport (assuming thermostable enzymes) blue / stain, diffuses out = 2 marks
1	(c)		*accuracy* take readings at intermediate temperatures (between 50 °C – 70 °C) **;** *reliability* take more, readings at each temperature / repetitions **;**	2	*Mark first suggestion only* **DO NOT CREDIT** wider temperature range OR more temperatures unqualified OR more regular intervals **ACCEPT** take readings every 5 degrees / °C **ACCEPT** ref. to haemocytometer **ACCEPT** colorimeter used to measure colour intensity of blue solution **DO NOT CREDIT** ref to use of c<u>a</u>lorimeter **ACCEPT** repeat experiment (ideally 3 readings for each temperature) , increase the number of cells observed **ACCEPT** replica / replicate for repeat

Question			Expected Answers	Marks	Additional Guidance
1	(d)		nucleus divides / mitosis ; *idea of* : cell, swells on one side / bulges ; nucleus / cytoplasm / organelles, move into, bud / bulge ; pinches off / cell wall forms, (so bud becomes a separate cell) ;	max 2	**ACCEPT** asexual reproduction / cloning **IGNORE** cell splits, ref to genetically identical cells **IGNORE** *bud* forms on side **IGNORE** replicated DNA enters bud **ACCEPT** cytokinesis **IGNORE** two cells are formed / bud separates unqualified
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		partially / selectively **;** (facilitated) diffusion **OR** osmosis **;** plasma **;** phospholipids **;** cholesterol **;**	**5**	**DO NOT ACCEPT** semi **ACCEPT** differentially **ACCEPT** plasma cell

Question			Expected Answers	Marks	Additional Guidance
2	(b)				***Look for <u>description</u> not list of functions***
			1 (acting as) **antigens** ; 2 identification / **recognition**, (of cells) as, self / non-self / AW ; 3 **cell signalling** / described ; 4 **receptor** / binding site, for, **hormone** / (chemical) signal / (medicinal / named) drugs ; 5 ref. to **receptor** / binding site / trigger, on transport proteins / AW ; 6 cell **adhesion** / to hold cells together (in a tissue) ; 7 attach to water molecules (to stabilise membrane / cell) ; **4 max** for description		*Do not credit repetition of same point* **ACCEPT** foreign for non-self **ACCEPT** description e.g. communication *between* cells / cell responds to, chemical / signal, *from another cell* **ACCEPT** description of *attachment process* for receptor / binding site **DO NOT ACCEPT** molecule unqualified **ACCEPT** binding site for foreign antigen **ACCEPT** ref to receptors on ion channels **ACCEPT** bind to other cells for cell adhesion
			QWC: **three** technical terms used and spelt correctly ;	**5 max**	Any **three** from: receptor, antigen, hormone, <u>cell</u> signal(ling), adhesion, recognition, <u>facilitated</u> diffusion, <u>active</u> transport
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	**D** cholesterol **;** **E** protein / glycoprotein / intrinsic protein / protein channel / protein pump / transport protein / carrier protein **;** **F** phospholipid (bilayer) / phospholipid head **;**	3	**ACCEPT** polypeptide chain **DO NOT ACCEPT** amino acid chain **DO NOT ACCEPT** extrinsic protein **DO NOT ACCEPT** lipids / bilayer
3	(a)	(ii)	**D** stabilise the membrane OR maintain / affect / control / AW, fluidity OR reduces permeability to, polar / charged, particles **;** **E** allow communication across membrane OR allow, polar / charged, particles to pass through membrane **;** **F** to act as a barrier (to, polar / charged, particles) / select what enters or leaves cell **;**	3	***mark independently of (a)(i) i.e. NO ecf*** **DO NOT ACCEPT** refs to rigidity / support / strength **ACCEPT** reduces / affects, lateral movement of phospholipids **ACCEPT** cell recognition / receptor site / cell signalling / cell attachment **ACCEPT** (acts as) selectively permeable or partially permeable membrane **ACCEPT** allows small / fat soluble molecules to pass through **DO NOT ACCEPT** separates inside from outside
3	(b)	(i)	communication between cells / AW **;** cell, recognition / identification **;** cells work together / coordination between action of different cells **;** to trigger, response / reaction (inside the cell) **;**	**2 max**	**ACCEPT** example to illustrate the point, e.g. action of hormone / cytokines
3	(b)	(ii)	(receptor) specific shape / described **;** complementary to (shape of), trigger / named trigger / communicating **;** molecule **;** (trigger / AW) binds / attaches to receptor **;**	**2 max**	**ACCEPT** tertiary structure **DO NOT ACCEPT** ref to active site **ACCEPT** fits / idea of lock & key in correct context **DO NOT ACCEPT** 'matches' **DO NOT ALLOW** joins / bonds / links / combines / fits

Question			Expected Answers	Marks	Additional Guidance
3	(c)	(i)	cell surface / plasma, membrane damaged ; pigment, released / leaks out ; pigment, absorbs / takes up, the light ;	2 max	**ACCEPT** description of damage e.g. proteins denatured / phospholipids separate / bilayer melts **DO NOT ACCEPT** bilayer becomes 'more fluid' **DO NOT ACCEPT** 'cell membrane' unqualified **ACCEPT** 'cell contents' for pigment **DO NOT ACCEPT** 'no light transmitted' 'solution is opaque'
3	(c)	(ii)	*Mark first response on each numbered line. Only return to extra points on first or second line if no response in line two or three* more samples at each temperature ; same / fixed, volume of water ; all samples same, size / surface area ; ref to further cutting to increase surface area ; pieces, rinsed / blotted, after cutting ; more (intermediate) temperatures ; same beetroot used / same part of beetroot used ;	3 max	 **ACCEPT** repeats **ACCEPT** collect average / mean results **DO NOT ACCEPT** mass **ACCEPT** any method of cutting to provide larger surface area **ACCEPT** list of figures of additional temps between 0-100 **DO NOT ACCEPT** wider range of temperatures / more evenly spaced temperatures **DO NOT ACCEPT** leave for longer **DO NOT ACCEPT** idea of control
			Total	15	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>
<table>
<tr><th>description</th><th>letter</th></tr>
<tr><td>an animal cell that has been placed in water</td><td>N ;</td></tr>
<tr><td>an animal cell that has been placed in a strong sugar solution</td><td>K ;</td></tr>
<tr><td>a plant cell that has been placed in water</td><td>L ;</td></tr>
<tr><td>a plant cell that has been placed in a strong sugar solution</td><td></td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>4</td><td>(b)</td><td></td><td>water moves out of cell ;
by osmosis ;

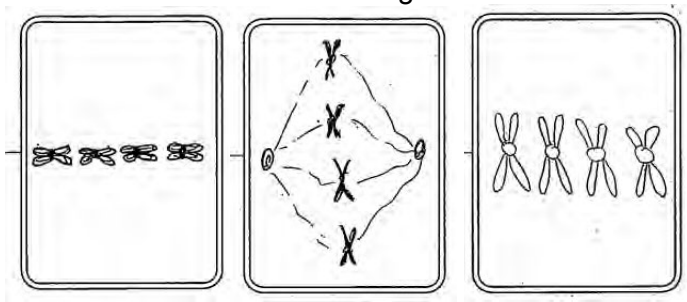
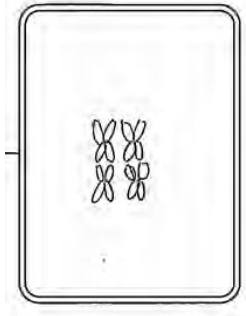
cell has, higher / greater / less negative, water potential (than surrounding solution) / ORA ;

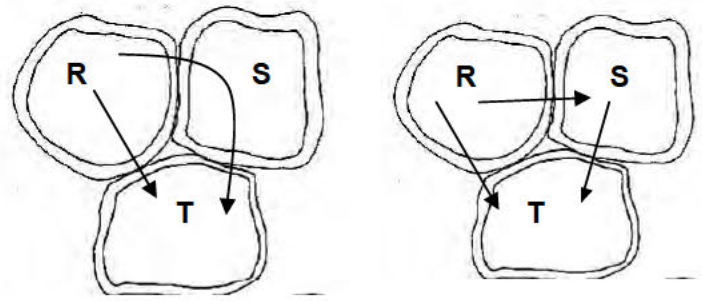
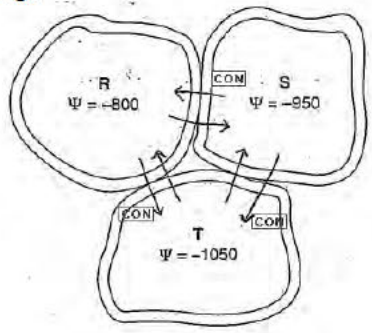
(water moves) down water potential gradient/from high to low water potential ;</td><td>3 max</td><td>note: this is explain not describe

ACCEPT Ψ for water potential
must be comparative – DO NOT ACCEPT high alone

DO NOT ACCEPT across or along water potential gradient
DO NOT ACCEPT ref to water concentration anywhere
IGNORE ref to solute potentials</td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
4	(c)		*small, non-polar substances* **diffuse** (through membrane / **phospholipid bilayer**) **;** *large substances* (using), **transport** / **carrier**, proteins **;** **endocytosis** / **phagocytosis** / described **;** *polar substances* through, pore / **channel**, proteins **;** (using), transport / carrier, proteins **;** *general – must be used in correct context, each **once only*** ref to **facilitated diffusion ;** ref to **active transport** / use of ATP **;** ***4 max*** QWC – technical terms spelled **AND** used in correct context **;** ***1***	**5 max**	**ACCEPT** diffusion / diffuses **ACCEPT** protein pump **DO NOT ACCEPT** channel proteins here **ACCEPT** pinocytosis apply only to large / polar substances apply only to large / polar substances **DO NOT ACCEPT** ref to active transport with channel proteins (three from: phospholipid / bilayer / diffusion / facilitated diffusion / active transport / transport protein / carrier protein / channel protein / pinocytosis / endocytosis / phagocytosis) if protein spelled incorrectly throughout, only penalise once
				[Total : 11]	

5	**(a)**	**(i)**	mitosis / mitotic **;**	**1**	Correct spelling only
		(ii)	four chromosomes on equator **;** (each chromosome as) two sister chromatids **;**	**2**	If the image is unclear then pencil or a different colour may have been used - RAISE AN EXCEPTION Award 2 marks for the following  **DO NOT CREDIT** mp 1 if nuclear membrane shown **DO NOT CREDIT** mp 1 if homologous chromosomes paired e.g.  **DO NOT CREDIT** mp 2 if sister chromatids are not joined (at centromere)

		(iii)	arrow from R to T ; arrow from R to S **AND** arrow from S to T OR arrow from R to S to T ;	**2**	e.g.  If contradictory arrows to the above are drawn, apply CON for each arrow going from low Ψ to high Ψ. e.g.  gets 0
	(b)		this is where cambium / meristem / xylem / phloem / vascular bundle, is found ; mitosis/cell division, occurs in cambium (to produce new cells for growth) ; new cells, differentiate / specialise, (into xylem and phloem) ; xylem supplies water for, (cell) elongation / (cell) growth ; phloem supplies, sugars / assimilates, for, energy / growth /respiration ;	**max 2**	**CREDIT** from a labelled diagram **CREDIT** description of position being close to the edge of trunk **DO NOT CREDIT** responses that suggest that cambium etc. are in or outside bark OR under cut surface **ACCEPT** cambium differentiates **IGNORE** nutrients

	(c)		tip / apex, of, shoot / root **;** meristem **;** bud **;**	**max 1**	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** root or shoot unqualified **ACCEPT** behind root tip
	(d)		allow <u>oxygen</u> to reach, cells / tissues (under bark) **;** for (aerobic) respiration **;** animals transport oxygen in, blood / circulation / transport system **;** plants do not transport (much) oxygen in transport system **;** *idea that* (oxygen not supplied from leaves as) stomata only open in day / no leaves in winter **;**	**max 2**	**IGNORE** refs to need for CO_2 / photosynthesis throughout **ACCEPT** correct formula O_2 **DO NOT CREDIT** oxygen for photosynthesis **ACCEPT** gas(es) for oxygen **ACCEPT** gas(es) for oxygen
			Total	**10**	