Question			Expected Answers	Marks	Additional Guidance
1	(a)		<table><tr><th>Animal</th><th>Plant</th><th>Yeast</th><th>Bacterium</th></tr><tr><td></td><td></td><td>budding</td><td></td></tr><tr><td>yes</td><td>yes</td><td>yes</td><td>no</td></tr><tr><td></td><td>cellulose</td><td></td><td>peptidoglycan</td></tr><tr><td>yes</td><td>yes</td><td>yes</td><td>yes</td></tr></table> ; ; ; ;	4	**Mark the first answer in each box.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **Award 1 mark for each correct row** **ACCEPT** tick / present & cross / not present / absent / none **IGNORE** ref to nucleoid **CREDIT** murein as alternative to peptidoglycan **ACCEPT** peptidoglycin **DO NOT ACCEPT** peptoglycan **ACCEPT** 'on RER' or 'in cytoplasm' for yes **ACCEPT** ref to size of ribosomes (large / 80S / 22nm in Eukaryotes, small / 70S / 18nm in bacteria)
	(b)	**(i)**	meristem(atic) **;**	1	**IGNORE** position in plant such as 'root tip', cambium
	(b)	**(ii)**	nucleus / nucleolus / chromatin **;** cytoplasm **;** cross / end, (cell) walls **;**	2 max	**Read through and award marks for correct features** **IGNORE** ref to other individual organelles / vacuole **IGNORE** nucleous **DO NOT CREDIT** 'two nuclei in one cell' **CREDIT** end plates **ACCEPT** no end walls / no nucleus / no cytoplasm **IGNORE** walls between cells

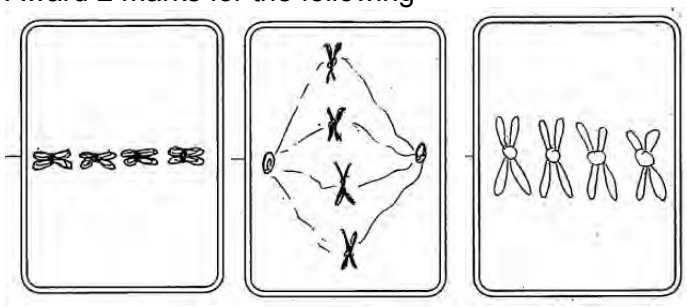
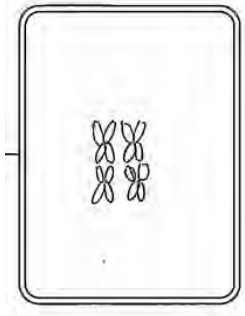
Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	thicker ; lignified ; contain (bordered) pits ;	 2 max	**IGNORE** stronger **CREDIT** have lignin /contain lignin / reinforced with lignin / impregnated with lignin **DO NOT CREDIT** have lignin on the walls / lined by lignin / surrounded by lignin **IGNORE** ref to pattern of thickening **IGNORE** 'pore'
	(c)		sieve (tube) element ; companion (cell) ; parenchyma ;	 2 max	**IGNORE** 'sieve tube' 'sieve cell' **ACCEPT** fibres / sclereids / sclerenchyma
			Total	**11**	

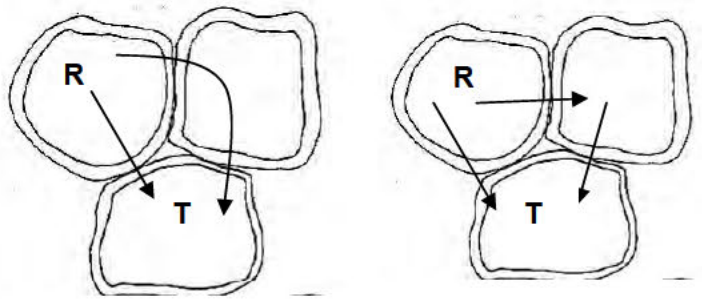
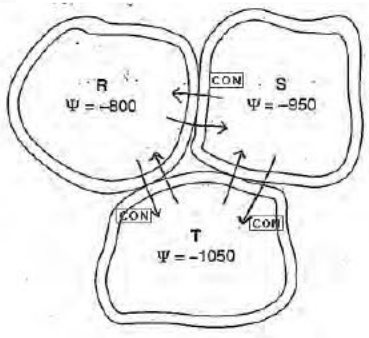
Question			Answer	Marks	Guidance
2	(a)	(i)	*division type 1* mitosis **and** *division type 2* meiosis **;**	1	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** correct spelling only **ACCEPT** correct spelling only **CREDIT** meiosis I **and** II **DO NOT CREDIT** meiosis I / meiosis II alone
2	(a)	(ii)	**A** (DNA) replication **;** **B** cytokinesis **;**	2	**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** stages of cell division **IGNORE** cell division / stages of cell division

Question			Answer	Marks	Guidance
2	(b)		**A1** independent assortment / random segregation **,** of (homologous) chromosomes / bivalents; **A2** in **,** metaphase I / meiosis I **;** **A3** *of* chromatids in **,** metaphase I I / meiosis I I **;** **A4** (so) homologous chromosomes , have different alleles / come from different parents **;** **A5** produces large number of allele combinations **;** **C1** crossing over / (formation of) chiasma(ta) **;** **C2** in **,** prophase I / meiosis I **;** **C3** (so) chromatids will have new combination of alleles **;** **C4** amount of variation depends on distance between crossover points **;** **M1** mutation **;** **M2** changes the (DNA) nucleotide/ base, sequence **;** **M3** DNA checks (during duplication) did not recognise damage **;** **M4** *idea of* differences in (named) protein(s) **;** **N1** non-disjunction **;** **N2** homologous chromosomes do not separate (in metaphase I) **;** **N3** one **,** more / less **,** chromosome present **;** **F1** random, mating / fusion of gametes/ fertilisation **;** **F2** gametes are not genetically identical; **F3** produces large number of (allele) combinations **;**	**8 max**	**A1 ACCEPT** Random assortment / independent segregation **A2 /A3 DO NOT CREDIT** metaphase /meiosis, I **and** II **A2 /A3 ACCEPT** correct anaphase stage linked to segregation **A2** must be in context of independent assortment / random segregation **A4/ A5 DO NOT CREDIT** genes **A4 ACCEPT** pairs of chromosomes / maternal **and** paternal chromosomes, have different alleles/ come from different parents **A5 ACCEPT** different combinations of, chromatids /chromosomes, in gametes **CREDIT** figures e.g. for humans 2^{23} possible combinations **C1 DO NOT CREDIT** between sister chromatids **C2 DO NOT CREDIT** prophase / meiosis, I **and** II **C2** must be in context of crossing over **C3 ACCEPT** shuffles / swaps/exchanges, alleles on chromatids **C4** e.g. more variation the further apart the crossovers occur **M2 IGNORE** **'**pairs' **M2 CREDIT** deletion,/substitution/ addition, of, base / nucleotide **M3 ACCEPT** proof reading did not recognise damage **M4** e.g. change in, amino acid sequence/primary structure **N1 CREDIT** inversion / translocation (chromosome mutation) **N2 CREDIT** description of inversion / translocation **N3 CREDIT** examples of chromosome changes e.g. Trisomy 21 **F2 ACCEPT** gametes are genetically different **F3 DO NOT CREDIT** produce large number of gene combinations

Question			Answer	Marks	Guidance
			QWC ;	1	**Awarded for one change and consequence of that change** **Award if ONE of the following has been awarded** mp **A1 or A2 or A3** **and** mp **A4 or A5** **OR** mp **C1 or C2** **and** mp **C3 or C4** **OR** mp **M1 or M2** **and** mp **M3 or M4** **OR** mp **N1 or N2** **and** mp **N3** **OR** mp **F1 or F2** **and** mp **F3**
			Total	**12**	

Question			Answer	Mark	Guidance
3	(a)	(i)	mitosis ;	1	**CREDIT** correct spelling only **ACCEPT** binary fission
		(ii)	in the grex / 3 ;	1	
	(b)	(i)	cell signalling ;	1	
		(ii)	1 attraction of cell(s) to folic acid from bacteria ; 2 attraction of cells to each other by cAMP ; 3 coordinated movement in grex ; 4 differentiation / described, of (grex / slime mould) cells in response to DIF ;	2 max	**NOTE** must name the chemical involved for description (except mp 3 coordinated movement) **ACCEPT** attraction of cells to bacteria by folic acid **IGNORE** makes cells stick together
		(iii)	contains , receptors / glycoproteins / glycolipids / glycocalyx ; for , folic acid / cAMP / DIF ;	2	**DO NOT CREDIT** *consists* of receptors
	(c)		17 (hours) ;	1	
			Total	**8**	

4	**(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.  **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.  If contradictory arrows to the above are drawn, apply CON for each arrow going from low Ψ to high Ψ. e.  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**	

Question			Answer	Marks	Guidance
5	(a)		metaphase **I and** metaphase **II ;** prophase **I ;** anaphase **II ;** telophase **II ;** anaphase **I ;**	5	**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**
	(b)		to, **halve** chromosome number / **reduce from** 2n **to** n **;** to separate homologous pairs (of chromosomes) **and** sister chromatids **;** because, DNA (previously) replicated / chromosomes are two chromatids at start **;**	2	**IGNORE** all references to mitosis **CREDIT 'from** diploid **to** haploid' **ACCEPT 'from** 46 **to** 23 chromosomes' **IGNORE** halve, genetic material / DNA **ACCEPT** genetic, material / information
	(c)	**(i)**	sequence / order, of bases / nucleotides **;**	1	**CREDIT** base pairs **DO NOT CREDIT** amino acid sequence
		(ii)	different, primary / secondary / tertiary, structure **;** (protein) shorter due to, deletion / stop codon **OR** longer due to, insertion / duplication **;** (protein) unchanged due to, silent mutation / non-coding DNA altered **;** (function is) lost / worse / better **;**	3	**ACCEPT** different <u>sequence</u> or <u>order</u> of amino acids **ACCEPT** different 3D folding or 3D shape for 'silent' **CREDIT** 'neutral' or a description of more than one triplet coding for one amino acid **IGNORE** different / altered function **ACCEPT** idea that change is harmful
			Total	**11**	