Question			Answer	Marks	Guidance
1	(a)	(i)	polysaccharide **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** phonetic spelling **IGNORE** polymer **IGNORE** oligosaccharide
		(ii)	*similarity* chain / unbranched / glycosidic bonds / (contain) hexose / hex ring / O in each ring / CHO **;** *difference* *agarose has:* two types of (glycosidic) bond **or** two different, sugars / sugar residues / monosaccharides **or** disaccharide, monomer / subunit / AW **or** (residues) are alternately rotated / AW **or** straight chain **;**	**2**	**IGNORE** polysaccharides **IGNORE** 6-carbon ring **ACCEPT** 5-carbon ring Assume answer refers to agarose unless otherwise stated **ACCEPT** ora for any point **DO NOT CREDIT** references to any incorrect bond **ACCEPT** any suggestion of bonding to different numbered carbon atoms (as numbers are not given in diagram) **ACCEPT** 'alternating bonds' **IGNORE** refs to glucose **ACCEPT** 'flipped' / 'reflected' **ACCEPT** 'amylose is coiled'

Question			Answer	Marks	Guidance
	(b)		(bacteria) do not, make / have, correct <u>enzyme</u> (to digest agarose) **;** agarose, does not fit / not complementary to, <u>active site</u> (of bacterial enzymes) **;** bacteria unable to transport **,** substrate / enzyme , across membrane **;**	**1 max**	**DO NOT CREDIT** in incorrect context e.g. 'bacteria do not have amylase' or 'bacterial enzyme cannot break down amylose'
	(c)	(i)	<u>control</u> **;** compare with tube A / see what happened when there was no bacteria / show it was bacteria doing it / to show it does not break down on its own / to show that the nutrient solution does not break it down **;**	**2**	**ACCEPT** 'compare it with the other tube' **IGNORE** 'compare the tubes'

Question			Answer	Marks	Guidance
	(c)	(ii)	*idea that* some, starch / other polysaccharide / (reducing) sugar present in , nutrient solution / culture solution / bacteria (at start) **;** presence of some mutated , *E. coli* / bacteria , (that can break it down) **;** presence of (other) microorganism that can break it down **;**	**1 max**	**IGNORE** experimental error unqualified **IGNORE** any reference to temperature **IGNORE** other carbohydrate
		(iii)	replicate(s) / repeat(s) **;** more than one sample tested from each tube / sample each tube twice **;**	**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** 'do more tests' **IGNORE** 'disregard anomalous results' **IGNORE** 'compare with other results' **IGNORE** 'calculate mean'

Question			Answer		Marks	Guidance
	(d)	(i)	**1**	add, Benedict's (reagent) / $CuSO_4$ + NaOH / alkaline copper sulphate **;**	**5 max**	**1 ACCEPT** 'do Benedict's test' **1 DO NOT CREDIT** if adding acid / hydrolysing
			2	heat **;**		**2 ALLOW** boil **2 IGNORE** warm **2 ACCEPT** any temperature between 80°C and 100°C **2 ACCEPT** gently heat
			3	(forms) <u>precipitate</u> **;**		
			4	(colour changes from blue to), green / yellow / orange / brown / (brick) red **;**		
				concentration estimated from		Read as prose and mark the best suggestions
				EITHER		**5/6 DO NOT AWARD** if candidate is using a colorimeter
			5a	degree of colour change / use different colours **;**		**5a ACCEPT** 'the darker / redder , the more reducing sugar' **5a ACCEPT** in context of precipitate or supernatant
			6a	comparison (of final colour) with , standard / known, solution **;**		**6a** Answers must include the idea of comparison **6a ACCEPT** ref to calibration curve as long as not in context of colorimeter
				OR		
			5b	filter / centrifuge , **and** weigh precipitate **;**		
			6b	greater mass = more sugar present / use of a standard curve **;**		**6b ACCEPT** weight **6b ACCEPT** amount
				OR		
			5c	centrifuge **;**		
			6c	size **,** of pellet / colour of supernatant (liquid), indicates concentration **;**		**6c ACCEPT** mass

Question			Answer		Marks	Guidance
		(ii)			3 max	*Max 2 if any point out of sequence*
			1	add (hydrochloric) acid and boil **;**		**1 CREDIT** add hydrolytic enzyme **1 ACCEPT** heat
			2	add, (named) alkali / (sodium) carbonate / (sodium) hydrogencarbonate **;**		**2 CREDIT** 'neutralise' if not contradicted by named chemical
			3	then carry out reducing sugar test (again) / described **;**		
				Total	**17**	

Question			Answer	Marks	Guidance
2	(a)		*magnification is* the number of times larger the image is compared to the object **;** *resolution is* ability to, distinguish / differentiate between, two separate points **OR** the, level / degree, of detail that can be seen **;**	2	**ACCEPT** alternative wording that implies quantitative comparison of image size with object size **DO NOT CREDIT** comparison of object to image (wrong way round) **ACCEPT** $\frac{\text{size of image}}{\text{size of object}}$ **or** $\frac{\text{size of image}}{\text{actual size}}$ **IGNORE** makes image bigger unqualified **IGNORE** ref to clarity **ACCEPT** 'how detailed the image is'
	(b)		*light* *50* - 200 nm / 0.05 - 0.2 μm **;** *TEM* 0.05 - 1.0 nm **;**	2	**Mark the first answer for 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** a single figure within the range Units are required for both light & TEM **ACCEPT** 0.00005 - 0.001μm or 5 x 10^{-5} - 1x10^{-3}μm
	(c)	(i)	3 dimensional / 3D, (image) **;** can see the surface (detail) **;**	1 max	**ACCEPT** has depth of field / contours

Question			Answer	Marks	Guidance

		(ii)	120 **;;**	2	**Award two marks for correct answer**
					if answer incorrect allow one mark for working:
					
					$\frac{3\,000\,000}{25\,000}$ or $\frac{3}{25\,000}$ or evidence that candidate is dividing 3mm or 3000000 nm by 25 000
					
					OR
					
					if 3mm incorrectly converted but still divided by 25000 then allow ecf for one mark eg:
					$\frac{3\,00000}{25\,000}$ = 12
					
					Note: If candidate has measured the pore as 4mm and carried out the calculation using this figure allow one mark ecf

		(iii)	allow communication between nucleus and cytoplasm **or** allow, molecules / named substances, to, enter / leave (the nucleus) **;**	1	**IGNORE** ref control **Note: the term 'substances' is not sufficient on its own** **DO NOT CREDIT** if named example is moving in wrong direction eg. RNA / mRNA / ribosomes, entering nucleus or DNA leaving nucleus

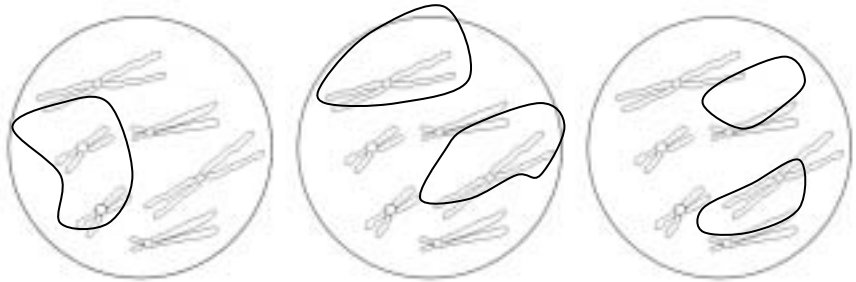
Question			Answer	Marks	Guidance
	(d)		(named) membranes / phospholipid bilayer **;** ribosomes **;** Golgi **;** endoplasmic reticulum / ER / RER / SER **;** cytoskeleton / microtubules / microfilaments / spindle fibres **;** centrioles **;** vesicles / lysosomes **;** mitochondria **;**	2 max	**Mark the first <u>two</u> suggestions** eg plasma / cell surface / nuclear / thylakoid / cristae / tonoplast, chloroplast membrane **DO NOT CREDIT** flagellum / chromosomes / chromatin / nucleolus **IGNORE** ref to molecules
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	nucleus / nuclear envelope / nuclear membrane / nucleolus **;** membrane bound organelles / named organelle **;** ribosomes larger **;** (large) cell size / 20μm wide **;**	**2 max**	**Mark the first <u>two</u> suggestions. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet** **ACCEPT** SER / RER / vesicle / cilia **DO NOT CREDIT** presence of ribosome / vacuole / flagellum / undulipodium
		(ii)	*Two marks for correct answer* 4500 **; ;**	**2**	**No tolerance in initial measurement = exactly 90mm** If answer is incorrect, allow one mark for correct working i.e. any measurement divided by 20 e.g. 8.9 / 20
		(iii)	**1** provides, strength / stability / support (cell) **;** **2** determines shape / changes shape / moves membrane (for endo / exocytosis) **;** **3** movement of, organelles / named organelle / RNA / protein / chromosomes / chromatids **;** **4** attachment to / hold, organelles / named organelle, in place**;** **5** make up, centrioles / spindle fibres **;**	**2 max**	**Mark the first <u>two</u> suggestions. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet** **IGNORE** structure **IGNORE** movement of (whole) cell e.g. vesicles, cilia, mitochondria, ribosome

Question			Expected Answers	Marks	Additional Guidance
	(b)	(i)	differentiation **;**	**1**	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**. **DO NOT CREDIT** specialisation
		(ii)	**1** (many) **lysosomes** / vesicles containing enzymes **;** **2** (many) microfilaments / microtubules **OR** ref to, extensive / well developed, cytoskeleton **;** **3** (many) **ribosome**s / (a lot of) **rough endoplasmic reticulum** / (a lot of) RER **;** **4** (many) **mitochondria ;** **5** (lots of) **Golgi ;** **6** (many) receptor (sites) on, **cell surface / plasma , membrane ;** **QWC ;**	**3 max** **1**	**Max 2 marks for content if no reference is made at least once to large numbers of named organelles / receptors** **IGNORE** reasons or explanations **IGNORE** lobed nucleus **IGNORE** many enzymes **IGNORE** lysomes **ACCEPT** lyosomes **DO NOT CREDIT** lysosomes are enzymes **IGNORE** ref glycoproteins / glycolipids unqualified TWO terms used appropriately and spelt correctly: **lysosome(s), ribosome(s), rough endoplasmic reticulum, mitochondria / mitochondrion, Golgi/golgi, microfilaments/microtubules / cytoskeleton, cell surface membrane / plasma membrane.**
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	**A** = plasma / cell surface**,** membrane **;** **B** = DNA / chromosome / chromatin / genetic material **;**	2	**DO NOT CREDIT** membrane, cell membrane **DO NOT CREDIT** chromosome**s** (do not accept plural) **CREDIT** loop of / circle of, DNA **DO NOT CREDIT** plasmid, RNA **ACCEPT** nucleoid
	(a)	(ii)	production of ATP **;** aerobic respiration **;**	max 1	**ACCEPT** named stages of aerobic respiration e.g. Krebs cycle, oxidative phosphorylation, ETC, chemiosmosis, link reaction, substrate level phosphorylation **DO NOT CREDIT** glycolysis, ATP *for* respiration **DO NOT CREDIT** *produce* energy (in form of ATP) **IGNORE** provide / release energy unqualified
	(a)	(iii)	protein synthesis / translation **;** photosynthesis / described **;**	2	**ACCEPT** production / creation, of proteins / polypeptides, assembly of proteins from amino acids **IGNORE** autotrophic nutrition **DO NOT CREDIT** absorption of light unqualified
	(b)		large surface area to volume ratio **;** small so demand for**,** O_2 / CO_2**,** is low **;** *idea of:* diffusion (alone) is adequate to meet needs **;**	2	**ACCEPT** large SA**:**Vol or large SA/Vol **ACCEPT** small Vol**:**SA ratio or small Vol/SA **DO NOT CREDIT** large surface area alone **IGNORE** gases alone, nutrients **ACCEPT** *idea of* : body SA large enough to meet needs by diffusion **ACCEPT** idea of : diffusion distance short

Question	Expected Answers	Marks	Additional Guidance
(c)	<table><tr><th>cell / tissue</th><th>function in the lungs</th><th></th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td>recoil **OR** return to original**,** size / shape **OR** to help expel air **OR** prevents alveoli bursting</td><td>;</td></tr><tr><td></td><td>waft / wave / move / AW**,** mucus</td><td>;</td></tr><tr><td></td><td>secrete / release / produce, mucus</td><td>;</td></tr><tr><td></td><td>constrict the airway / AW</td><td>;</td></tr></table>	4	**IGNORE** stretch / expand **ACCEPT** ref to lungs, alveoli, airways recoiling etc **DO NOT CREDIT** ref trachea / bronchi recoiling **ACCEPT** transport / remove**,** mucus **DO NOT CREDIT** dirt particles without ref to mucus **DO NOT CREDIT** excrete mucus **ACCEPT** narrows lumen OR controls, airflow / diameter, of airways **DO NOT CREDIT** ref to alveoli OR greater airflow
	Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	**(a)**	**(i)**	*plant cell* **/** *Y***,** *has*: a wall **;** chloroplasts **;** vacuole **;**	max 2	Credit reverse argument **ACCEPT** thylakoid**,** discs / membranes OR granum(a) **IGNORE** chlorophyll
	(a)	**(ii)**	**A1** a vacuole **;** **E1** to take up water / to become turgid **;** **A2** cell wall thicker on one side **;** **E2** causes**,** cell to bend / open stoma(ta) **;** **A3** mitochondria **;** **E3** generates ATP (for active transport) **;**	max 2	*Mark adaptation (A) as stand-alone* *Ensure explanation (E) stated is appropriately linked to adaptation* **DO NOT CREDIT** curved cell wall / thick cell wall unqualified **ACCEPT** close stoma(ta) if adaptation correct **IGNORE** ref to chloroplasts
	(b)	**(i)**	two homologous chromosomes circled **;**	1	**ACCEPT** one circle around both chromosomes or two circles The two chromosomes must be of same length 

	(b)	**(ii)**	*three* chromosomes, one from each pair **;** chromosomes drawn as one bar **;**	2	*Chromosomes should be of different lengths however if two are of similar length, look for different centromere position to award mark* **ACCEPT**  **DO NOT CREDIT** two joined together at centromere 
			Total	**7**	