Question			Expected Answers	Marks	Additional Guidance
1	(a)		1500 ;		**ACCEPT** 1400 **and** 300,000 for 1 max only
			500 000 ;	2	
	(b)		ability to see (two) objects (that are close together) as separate objects / AW ; see detail ;	2	**ACCEPT** ability to distinguish two objects **IGNORE** clarity / clear
	(c)	(i)	transports water (up plant) ;		**ACCEPT** alternative wording for transport e.g. movement **DO NOT ACCEPT** up **and** down **DO NOT ACCEPT** water and sugars
			transports, minerals / ions, (up plant) ;		**ACCEPT** alternative wording for transport **IGNORE** ref nutrients / solutes **DO NOT ACCEPT** sugars
			support (plant / stem / shoot) ;	1 max	**ACCEPT** keeps plant upright

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(ii)	*Functions:* **F1** (lignin), strengthens / thickens**,** the (xylem) <u>wall</u> **;** **F2** waterproofing (wall) / AW **;** **F3** (improving) adhesion of water (molecules) **;** **F4** (spiral) pattern allows flexibility / stretching / movement**;** **2 max**		**ACCEPT** support only if in specific context of supporting the xylem <u>wall</u> **ACCEPT** waterproofs cell **DO NOT ACCEPT** adhesion **and** cohesion when used together Flexibility / stretching must ref, *pattern* of lignin laid down i.e. spirals
			Explanation: **E1** prevents collapse of xylem **;** **E2** (water) under tension / at low pressure / negative pressure**;** **E3** reduces (lateral) loss of water, through wall **;** **E4** increases capillarity / AW **;** **E5** prevents stem breaking / AW **;** **2 max**	**3 max**	*Award mark(s) for function and explanation independently* **DO NOT CREDIT** loss of water unqualified

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(iii)	(pits) allow water to move, in / out / between, vessel(s) ; to bypass blockage ; supply water to other, tissues / (other types) cells / parts of plant ;	2 max	**ACCEPT** lateral movement for 'out' **ACCEPT** bypass air lock **ACCEPT** any named, tissue / cells e.g. to allow water to other tissues 1 mark to allow water out to other tissues 1 mark to allow water out of vessel to other tissues 2 marks
			Total	**10**	

Question			Expected Answers		Marks	Additional Guidance
2	(a)		prokaryotic	eukaryotic	4	
				as chromosomes / chromatin OR (genetic material) associated with, proteins / histones ;		**DO NOT ACCEPT** chromatid
				(diameter of cell) 20 – 40 **μm** ;		Figures must have correct units **ACCEPT** any figure(s) in range 10 – 100 μm
			(ribosomes) 18**nm** ;			**ACCEPT** any figure(s) in range 10 – 20 nm **ACCEPT** 70 S
			cell wall (present) ;			**DO NOT ACCEPT** sometimes or usually present
	(b)	(i)	flagellum / cilium / microtubule / microfilament / undulipodium ;		1	**ACCEPT** plurals
	(b)	(ii)	(*movement <u>inside cells</u> of*) chromosomes / chromatids (in cell division) ; (cytoplasm in) cytokinesis ; organelles / named organelle ; RNA (in protein synthesis) ; proteins ;		2 max	**DO NOT ACCEPT** mitosis / cell division e.g. centriole / vesicle / lysosome / mitochondrion / chloroplast / ribosome ensure that the proteins are being moved in cytoplasm by microtubules rather than by ER or in vesicles (mark given above)
			Total		7	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	**A** <u>smooth</u> endoplasmic reticulum / SER **B** nuclear, membrane / envelope **;** **C** mitochondrion **;** **D** nucleolus **;**	**4**	*mark first response on each line **only*** **ACCEPT** nucleus, membrane / envelope **ACCEPT** mitochondria **DO NOT ACCEPT** nucleous
	(a)	(ii)	(mitochondria) vary in shape **;** longer than wide **;** cut in different planes / angles / AW **;** just divided / growing **;** artefact / deformed during preparation of section **;**	**2 max**	 **ACCEPT** sausage shaped/long and thin **ACCEPT** if shown by drawing *need comparative statement* **ACCEPT** C has been cut in longitudinal plane, E has been cut in transverse, section / plane **ACCEPT** one cut horizontally, other cut vertically **ACCEPT** in different positions / one viewed from above the other from the side

Question			Expected Answers	Marks	Additional Guidance
	(a)	**(iii)**	*correct answer = two marks* 3.75 / 3.8 **;;** *if answer incorrect **ALLOW** one mark for correct working*	 **2**	**ACCEPT** if 3.75 or 3.8 is seen anywhere in response (even if later rounded to 4) **Max 1** if response is 4 with no working *how to award one mark for working e.g.* candidate shows correct calculation but wrong answer actual length = $\frac{20 \times 15}{80}$ **OR** candidate uses magnification (x4000) in calculation: actual length = 15000 / 4000 **;** length of C should be 15mm / 15000μm **ACCEPT** ecf for working mark if length of C is not measured correctly but incorrect figure is used in calculation correctly
	(b)		proteins moved to Golgi (apparatus / body) **;** processed / modified / AW **;** into <u>vesicles</u> **;** (vesicle) moved to, plasma / cell surface, membrane **;** (vesicles) <u>fuse</u> with membrane **;** <u>exocytosis</u> **;**	 **3 max**	e.g. carbohydrate group add **DO NOT ACCEPT** reprocessed idea that product of processing is placed into vesicles for transport **DO NOT ACCEPT** vacuole – but do not penalise more than once **DO NOT ACCEPT** 'cell membrane'
				[Total: 11]	

Question			Answer	Marks	Guidance
4	(a)				**Mark first three suggestions only** **DO NOT CREDIT** ref to cell signalling / cell recognition
			1 form / produce / make, compartments / organelles / named organelles (within a cell) / AW **;**		**ACCEPT** vesicles as compartments eg mitochondria, ER, nucleus, lysosomes, Golgi, chloroplast **ACCEPT** compartmentalisation **DO NOT CREDIT** 'to contain an organelle'
			2 isolation / AW, of, contents (of organelle) / substance / named substance / reactions / metabolic pathways **;**		eg of AW include hold / contain / store / separates eg of named substance: (hydrolytic) enzymes, hormones / chemical messengers **DO NOT CREDIT** separates cell contents
			3 site for attachment of, enzymes / other named molecules / ribosomes **;**		**IGNORE** ref to increasing surface area / ref to site for reactions to occur eg of other named molecules : receptors / electron carriers / photosystems / pigments
			4 provide selective permeability / described **;**		eg controls what can enter and leave an organelle **DO NOT CREDIT** in context of materials entering and leaving the cell
			5 creation of, concentration gradients / specific environments / described **;**	3 max	eg of specific environment = pH **IGNORE** moves substances in vesicles
	(b)	(i)	cytoskeleton / microtubule / microfilament **;** provide, pathways / tracks, (for movement) **;**		**ACCEPT** guide the vesicles
			(vesicle) moves along, <u>microfilaments</u> / <u>microtubule</u> **;**		Mp 3 or 4 scores 2 marks as they include mp 1 **IGNORE** moved by microtubules / microfilaments
			<u>microtubules</u>, extended / broken down **;**		
			uses, ATP / (metabolic) energy **;** AVP **;**	2 max	eg ref to (protein) motor / dynein / kinesin

Question			Answer	Marks	Guidance
		(ii)	receptor found only on, correct / target, (named) organelle **;** *idea that:* address protein provides a way of, labelling / identifying / recognising, the vesicle **;** protein / COPI / COPII, has a specific shape **;** (shape of) receptor and (address) protein are complementary **;**	2 max	**DO NOT CREDIT** statements that relate to events outside a cell (eg protein is a complementary shape to the receptor on the surface of a target cell) as the question is in the context of vesicles moving *within* cells. **ACCEPT** correct target organelle is identified for each vesicle **ACCEPT** receptor fits the shape of the, protein / COPI / COPII
	(c)		<u>exocytosis</u> **;** vesicle fuses / merges **;** (with), cell surface / plasma, membrane **;** discharging / releasing, enzyme / contents (to exterior) **;**	2 max	**IGNORE** bind / attach / join **IGNORE** ref to, cell membrane / phospholipid bilayer, unqualified **IGNORE** secretion alone as stated in question
			Total	**9**	

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(i)	production of vesicles / packaging proteins ; modification of / processing of / adding carbohydrate to , proteins ; production of lysosomes ;	max 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** **ACCEPT** lipids **IGNORE** ref to transport / secretion / exocytosis / substances / materials **DO NOT CREDIT** stores proteins **ACCEPT** makes glycoproteins
	(a)	(ii)	allow movement (of substances) in or out of nucleus ; correctly named substance (entering or leaving nucleus) ; ref to correct destination of substance ;	max 2	**IGNORE** messages / information / communication **IGNORE** name of substance for MP 1 **IGNORE** ref to mechanism of movement e.g. RNA / (m)RNA / (r)RNA (t)RNA / polymerase nucleotides / ribosomes / helicase / proteins / (steroid) hormones **IGNORE** ref nutrients **DO NOT CREDIT** if incorrect direction of movement described (e.g. RNA into nucleus **or** RNA in and out of nucleus) **DO NOT CREDIT** DNA as named substance ***Note*** 'allows mRNA out of nucleus' = **two marks** e.g. RNA to ribosomes or RER helicase to DNA polymerase to , DNA / gene nucleotides to DNA (steroid) hormones to , DNA / gene / chromosome

Question			Expected Answer	Mark	Additional Guidance
	(a)	(iii)	contain / release **,** lysins / lytic enzymes / hydrolytic enzymes / digestive enzymes **;** digest / break down **,** organelles / foreign objects / toxins / cells / pathogens **;** apoptosis / autolysis / described **;**	**max 1**	**DO NOT CREDIT** 'engulf' **DO NOT CREDIT** 'lysosomes are digestive enzymes' **ACCEPT** destroy **ACCEPT** ref to digestion of contents of phagocytic vesicle **IGNORE** ref to (unwanted) substances / materials / food **IGNORE** ref to acrosomes
	(b)		*idea of* more than one (type of) tissue **;** working together / performing a function(s) **;**	**2**	**ACCEPT** named examples of tissues **ACCEPT** job or task

Question	Expected Answer	Mark	Additional Guidance
(c)			allow **F** marks even if **C** mark not quite accurate
	C1 thin / **squamous**, **<u>epithelium</u>** ; **C2** thin **<u>endothelium</u>** (of capillary) ;		**C1/C2** **IGNORE** ref to alveolus / alveolar wall / capillary wall , without ref to epithelium / endothelium
	F1 (provides) short **diffusion** distance / described ;		**F1** **ACCEPT** diffusion barrier , thin / one cell thick **IGNORE** refs to speed or rate of diffusion **IGNORE** ref to reduces diffusion distance alone – must be in context of short distance **DO NOT CREDIT** ref to thin , cell walls / membranes
	F2 ref to **surfactant** (from epithelial cells) , reducing surface tension / preventing alveoli collapsing ;		**F2** **IGNORE** ref to moisture
	C3 blood / red blood cells / **erythrocytes** ;		**C3** **IGNORE** (named) blood vessel **ACCEPT** blood supply / supply of blood
	F3 transports (named) gas(es) , to / from , exchange surface / alveoli ; **C4** diaphragm / intercostals , **muscles** ;		**F3** **IGNO** ref to lungs **IGNORE** description of gas exchange
	F4 (maintains / creates) **diffusion** / **concentration** , **gradient** ;		**F4** This can be awarded in context of **F3** or **C4**
	C5 **ciliated** epithelium / **goblet** cells / ciliated cells ; **F5** *idea of:* protection from / removal of , dust / bacteria / pollen / spores ;		**F5** **AC PT** trap , dust / bacteria / pollen / spores **IGNORE** dirt / germs
	C6 **cartilage** ; **F6** hold airway open ;		
	C7 smooth **muscle** ;		***continued***

Question	Expected Answer	Mark	Additional Guidance
continued			
	F7 constrict / control diameter of , airway / blood vessel ;		**F7** **ACCEPT** narrows lumen
	C8 elastic , fibres / tissue ; **F8** for recoil / aiding ventilation ;		**C8** **IGNORE** elastin / elasticated **F8** **ACCEPT** prevent alveoli bursting
	C9 **macrophage** / **neutrophil** ; **F9** engulf / destroy pathogens **or** protect from infection ;	**max 4**	**C9** **IGNORE** ref to white blood cell unqualified
	QWC ;	**1**	Any **three** with correct spelling and a suitable context from: **epithelium / epithelial**, **endothelium,** **cartilage,** **diffuse / diffusion,** **gradient,** **goblet,** **ciliated,** **concentration,** **squamous,** **macrophage,** **neutrophil,** **surfactant,** **muscle,** **erythrocyte**
	Total	**[11]**	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		visible / can be seen / increase contrast **;** named example of what is now visible (after staining) **;**	2	*First mark is for 'seeing' and the second mark is for 'recognising' what can now be seen.* **ACCEPT** see detail **IGNORE** ref to resolution **ACCEPT** recognise different *types* of white blood cell **ACCEPT** can (now) see**,** nucleus / organelles / named organelles **IGNORE** recognise parts inside red blood cell **IGNORE** can now see red blood cells (already visible) 'can now see red and white blood cells' = 2 marks
	(b)	(i)	3D shape can be seen / greater depth of field **;** can see**,** surface features / detail **;**	max 1	**DO NOT CREDIT** shape alone **ACCEPT** 'you can see what is on the surface' **IGNORE** 'you see the surface better' because this needs further clarification i.e. features, shape, named structure
		(ii)	smaller / named, organelle (becomes visible) **;** shapes / details of organelles **;**	max 1	**ACCEPT** named structure(s) such as lysosome, RER, mitochondrion, ribosome, Golgi , vesicle, nucleolus **DO NOT CREDIT** nucleus or chloroplast (already visible)

Question			Expected Answers	Marks	Additional Guidance
	(c)		*This is a QWC question* **1** fetal <u>haemoglobin</u> has a higher **affinity** (for oxygen) (than adult haemoglobin) **;** **2** (fetal Hb) takes up oxygen in low(er) **partial pressure** of oxygen **;** **3 placenta** has low partial pressure of oxygen **;** **4** at low partial pressure of oxygen / in placenta**,** adult (oxy)haemoglobin will **dissociate** / AW **;**	max 3	**IGNORE** oxyhaemoglobin for haemoglobin **ACCEPT** Hb for <u>haemoglobin</u> (but not HbO) **ACCEPT** fetal Hb becomes *more* saturated at a *low(er)* partial pressure of oxygen **ACCEPT** ppO_2 / pO_2 / oxygen tension / O_2 concentration, for partial pressure of oxygen **ACCEPT** in placenta mother's haemoglobin, releases its oxygen / saturation drops
			QWC (two terms used in correct context and spelt correctly)**;**	max 1	Any **two** terms from the following**:** affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated

Question			Expected Answers	Marks	Additional Guidance
	(d)	(i)	curve to right of curve A ; appropriate sigmoid shape ;	2	Curve should start at 0% on y axis and reach at least 80% on y axis
	(d)	(ii)	**1** (actively respiring tissue) needs / requires, *more* oxygen ; **2** for aerobic respiration / to release *more* energy ; **3** (actively respiring tissue produces) *more* CO_2 ; **4** haemoglobin involved in transport of CO_2 ; **5** less haemoglobin available to combine with O_2 ; **6** (Bohr shift) causes *more* oxygen to be released ;	max 2	*idea* of '*more*' should be clear as shown (MP 1,2,3,6) **ACCEPT** make *more* ATP **ACCEPT** produces *a lot* of CO_2 / as CO_2 levels rise **CREDIT** detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc **DO NOT CREDIT** oxygen released *more* quickly / quicker **ACCEPT** oxygen released *more*, readily / easily 'More CO_2 produced so more O_2 released' = 2 marks
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	collection / group, of cells (of one or more types) ;	2 max	**IGNORE** ref similar cells
			(cells), working together **OR** with, common / same, function ;		**ACCEPT** a group of cells with a function = 2 marks
			specialised (cells) ;		**DO NOT CREDIT** differentiated
	(a)	(ii)	squamous / ciliated ;	1	**ACCEPT** endothelium / columnar **DO NOT ACCEPT** cilia, goblet cell, ciliated *cells*
	(b)		(organ is) a collection of tissues / named tissues ;	2	Look for idea of more than one tissue **ACCEPT** two or more correctly named tissues from: epithelium, elastic, glandular, smooth muscle, blood, nervous, cartilage, connective
			(working together) to enable gas exchange / AW ;		**DO NOT ACCEPT** perform a function unqualified – we want to know *what* function (can be named or described) **DO NOT ACCEPT** respiration **IGNORE** breathing

Question			Expected Answers	Marks	Additional Guidance
	(c)	(i)	(*release of energy*) mitochondria ;	1	
		(ii)	*(movement of cilia)* cytoskeleton ;	1	**ACCEPT** mitochondria if not used in **(i)**
		(iii)	*(secretion of mucus)* Golgi (vesicle) ;	1	**ACCEPT** cytoskeleton if not used in **(ii)** **ACCEPT** Golgi body / apparatus **DO NOT ACCEPT** Golgi vessel
			Total	**8**	