Question 3 (Answer: **A**)

- Lipids are made on the *smooth* endoplasmic reticulum, so that is required.
- Vesicles are needed to carry the lipid to the membrane for secretion.
- Mitochondria supply ATP for the secretion, so all three are involved.

Question 4 (Answer: **A**)

- The organelles shown are eukaryotic, so the ribosomes are 80S, not 70S.
- Antibodies are proteins made by plasma cells, which are animal cells – so this is not plant tissue.
- Rough ER with Golgi and vesicles is exactly the machinery for making and exporting antibodies.

Question 2 (Answer: **A**)

- Cholera is caused by a bacterium, so the cell is prokaryotic.
- Prokaryotes have circular DNA lying free in the cytoplasm, so 1 and 2 both apply.
- Their ribosomes are the smaller 70S type, so all three are present.

Question 5 (Answer: **B**)

- Read the micrograph for the giveaway features before deciding the cell type.
- A peptidoglycan wall belongs only to bacteria; histones and mitochondria belong only to eukaryotes.
- So the three cannot all be present – decide which pair goes together.

Question 2 (Answer: **B**)

- A density gradient separates structures by density, densest travelling furthest.
- Ribosomes are tiny and dense; nuclei are the largest and heaviest organelles.
- So read the order of the fractions to identify each structure by its relative density.

Question 7 (Answer: **B**)

- A virus has a nucleic acid core, which may be DNA *or* RNA, inside a protein coat.
- So features 1, 2 and 4 can all be present.
- No virus has ribosomes of any kind – it borrows the host's, so 3 is impossible.

Question 3 (Answer: **A**)

- Mitochondria and chloroplasts each have their own circular DNA.
- They also have 70S ribosomes and a double membrane.
- Those are prokaryotic features, which is the evidence for the endosymbiotic theory.

Question 4 (Answer: **C**)

- Work through the table column by column, deciding what each combination of structures means.
- A cellulose cell wall and chloroplasts together indicate a plant cell.
- No nucleus and no mitochondria indicates a prokaryote.

1(a)	*any **two** from:* *allow **oras*** **1** cilium composed of microtubules **or** microvillus, composed of microfilaments / contains actin (filaments) **;** **2** cilium 9+2 (microtubule) arrangement **;** **3** cilium has basal body **; A** has centrioles at the base **4** cilium shows synchronous, rhythm / movement **; A** whip-like / rhythmic, movement **5** cilium, moves / wafts, mucus **or** microvillus increases, surface area / SA, for, absorption / uptake / secretion **;** **A** increases SA to locate transport proteins AW **6** AVP **;** e.g. cilium has dynein (arms) cilium is, longer (10 µm) / wider (0.2 µm) **or** microvillus is, shorter (1 µm) / narrower (90 nm)
1(b)	*any **one** from*: protects (intestinal), epithelium / cells / lining **;** **A** examples of protection e.g. damage from stomach acid / digestion by enzymes **A** less likely for epithelial cells to be damaged / AW **A** traps, pathogens **or** (harmful), bacteria / microbes / microorganisms **I** dust **A** prevents, pathogens / AW, from reaching cells eases / reduces friction for, movement of, gut contents / substances (through digestive system) **;** habitat / nutrient source, for gut, microorganisms / flora **;** AW AVP **;** e.g. location for immune system cells **R** if stated as being in the gas exchange system
1(c)(i)	arteriole **; A** (small) artery
1(c)(ii)	*any **two** from:* (at arteriole end of capillary) high, <u>hydrostatic</u> / <u>blood</u>, pressure **;** **A** *ref. to* hydrostatic pressure gradient (ultra)filtration / described **;** e.g. fluid / plasma / water <u>and</u> solutes, forced / comes out of, capillaries / blood glucose / amino acids / ions, leave (blood) **or** (large / plasma) proteins remain (in blood) **;** **R** if stated, red blood cells / platelets, leave through, fenestrations / fenestrae / endothelial pores **or** pores / gaps / spaces, in, capillary wall / endothelium / between cells **;**
1(d)	*any **three** from*: *after, secreted / released, by enteroendocrine cells* transport of, peptide / GLP-1 / ligand, in, blood / circulation **;** to, <u>target cells</u> (which are cells of the, stomach / pancreas) **;** binding of, peptide / GLP-1 / ligand, to receptor **;** *context can be cell surface membrane or intracellular* *ref. to*, specificity / complementary **;** *must be in correct context of GLP-1 binding to receptor* (binding) triggers / sets off / AW, events within (target) cell (leading to the response) **;** **A** examples e.g. signal transduction / triggers enzyme cascade
1(e)(i)	prophase metaphase anaphase telophase **;** **R** if interphase or cytokinesis stated

1(e)(ii)	*any **three** from*: *ref. to nucleus / nucleolus, is neutral* presence of, vesicles / vacuoles, qualified **;** e.g. many / secretory / Golgi **A** storage vesicles correct *ref. to* exocytosis **;** **A** fusion of, vesicle / vacuole, with cell surface membrane much / high proportion of / a lot of / AW, rough endoplasmic reticulum **;** **I** ER / RER / rough ER **A** many ribosomes rough endoplasmic reticulum / ribosomes, site of, peptide / polypeptide / protein / enzyme, synthesis **;** **ecf** *for abbreviating rough endoplasmic reticulum previously* AVP **;** e.g. presence of mitochondria to provide, ATP / energy, for, protein synthesis / movement of vesicle to cell surface membrane / exocytosis *mp2 can also be awarded here **only** if ref. has been made within response to vesicles / vacuoles*
1(e)(iii)	Paneth cell is, differentiated / specialised (for, secretion / its function) **or** stem cells are, undifferentiated / not differentiation / not specialised **;**

1(a)(i)	*explanation* semi-conservative replication / DNA replication / S phase, has occurred **;** **R** if replication stated to occur in, G_1 / G_2 **I** chromatin replicates *difference between chromatin in G1 and G2:* *(allow ecf from mp1 if stated replication occurs in G2)* *Any **one** from:* double the / doubling in, quantity / number / amount, of, chromatin / DNA **;** **A** chromatin has doubled sister / two identical, chromatids (formed, instead of one structure) **;** **A** two chromatids joined at the centromere (in G2) (each) chromosome with 1 DNA molecule (in G1) has 2 DNA molecules (in G2) **;** *allow double, helix/ helices for molecule(s)* *treat as neutral ref. to chromatin / chromosome, state / behaviour* *e.g. decondensed / diffuse*

1(a)(ii)	*any **three** from*: *check diagram to see if points can be awarded* description of nucleus as having any **two** listed structures **;** two from: nuclear envelope, nuclear pore(s), nucleolus, nucleoplasm *correct spelling* detail of nuclear envelope **;** e.g. two membranes / double membrane *accept from diagram* encloses / protects, chromatin / DNA / chromosomes / genetic information / genetic material outer membrane continuous with rough endoplasmic reticulum outer membrane with ribosomes (on outer surface) controls exit and entry of substances *if nuclear envelope not stated,* **A** the nucleus is surrounded by a double membrane **or** a double membrane encloses, chromatin / AW **or** (it is) double-membrane bound / bound by a double membrane detail of nuclear pore(s) **;** e.g. allows (m)RNA to, pass through / leave / AW (nucleus) allows ribosomal subunits to leave (nucleus) allows entry of proteins prevents exit of DNA (small) channel / passage, through the nuclear envelope *can be shown on a diagram, with a label* detail of nucleolus **;** e.g. spherical *can be shown as circle on diagram, labelled nucleolus* one / can be more than one synthesis of, rRNA / ribosomal subunits **A** ribosomes densely staining / dense region / condensed region *allow shaded in on a diagram, labelled nucleolus* AVP **;** e.g. nucleoplasm is fluid surrounding chromatin

1(b)(i)	**R** *the mp if feature of cellulose stated and, is incorrect / is not neutral* *for mps 1, 3, 4 can accept 'cellulose does not have ..'* *any* ***four*** *from*: *starch has* **1** (monomer of) alpha glucose / α-glucose / α-1,4 (glycosidic) bond **;** **I** glucose / glycosidic bond / 1, 4 bond *(all shared with cellulose)* **2** monomers / glucose, orientated the same way / AW **;** **ora** for cellulose i.e. monomers rotated 180° to each other **I** cellulose / cellulose molecule, rotates 180° **3** made of, two different polysaccharides / two different polymers / amylose and amylopectin **;** **4** amylopectin / starch, has (α-1,4 and) α-1,6 (glycosidic) bonds **;** **A** 1-6 *if alpha noted elsewhere* **A** link / linkage, for bonds **R** 'can have α-1,4 or α-1,6 bonds' **5** amylose, helical / coiled **R** α-helix **or** amylopectin branched **;** *if both are stated, allow mp3 as well* **A** starch, is branched / has branching (v cellulose, not branched / linear) **R** 'starch can be helical or branched' **6** no, hydrogen / H, bonds, to hold together / between / AW, molecules / polysaccharides **;** **A** cellulose has ……. **7** AVP **;** e.g. forms, starch, grains / granules **A** 'cellulose does not have ..' does not have microfibrils / fibrils / fibres **A** 'cellulose has..'

1(b)(ii)	**1** (different) mAbs have, different / specific, antigen binding sites / variable regions **; I** active site **2** (each) mAb has complementary shape for, binding / AW, antigen (combining with / attaching to) **or** mAbs are / a mAB is, specific / complementary, to particular, antigen(s) **;** **3** *idea that* a (particular) pectin / RG-I , has different, shapes / conformations / antigens, in its structure **;** **4** *idea of* (using) different / specific, (sets / combinations, of) mAbs to, recognise / identify / locate / use for, different pectins / types of RG-I / a particular RG-I **;** **5** *ref. to* studying development e.g **;** changes occurring / side chains added, during development need different mAbs some mAbs may be specific to side chains not yet added can help to show when modifications occur **6** AVP **;** e.g. reason to use more than one mAB • some mAbs may bind to more than one type of pectin • other cell wall components, may have, similar structures / same side chains • some areas of RG-I may be out of reach for a specific mAb • can, obtain information about / investigate, shape / structure of the particular pectin