Question 19 (Answer: **A**)

- A centromere holds the two sister chromatids of one chromosome together.
- In prophase and metaphase there are still 46 chromosomes, so 46 centromeres.
- At anaphase each centromere splits, giving 92.

Question 21 (Answer: **A**)

- Put the stages in the order the chromosomes move: condensing, lining up, separating, re-forming nuclei.
- Metaphase is the one with chromosomes in a single line across the equator.
- Anaphase follows, with V-shaped chromatids being pulled to the poles.

Question 22 (Answer: **D**)

- Mitosis is the division of the *nucleus*: prophase, metaphase, anaphase and telophase.
- Interphase happens before mitosis begins.
- Cytokinesis divides the cytoplasm afterwards, so only prophase is part of mitosis itself.

Question 23 (Answer: **A**)

- A centromere is where the spindle fibres attach and where the sister chromatids are held together.
- Count the cells in telophase and divide by the total number of cells shown.
- The proportion in a stage reflects how long that stage lasts.

Question 23 (Answer: **C**)

- In metaphase the chromosomes are lined up in a single plane across the equator.
- In anaphase they are already separating towards the poles.
- In interphase no individual chromosomes are visible at all.

Question 21 (Answer: **A**)

- No chromosomes visible means interphase, so that stage comes before condensation.
- Two visible chromosomes each with two chromatids means prophase or metaphase.
- DNA replication must therefore come earlier, and cytokinesis last.

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 **;**