

Solutions

Each answer shows the steps, then the **result**.

2.1

- rough endoplasmic reticulum; Golgi body (Golgi apparatus); chloroplast; lysosome

2.2

- Any three of: cellulose cell wall; chloroplasts; large permanent vacuole (tonoplast); plasmodesmata

2.3

(a)

- 80S

(b)

- 70S

3.1 A

- A cell surface membrane, cytoplasm and ribosomes occur in all cells; the others are eukaryote-only

3.2 B

- Mitochondria (and chloroplasts) have a double membrane and their own circular DNA

3.3 A

- Prokaryotes have only 70S ribosomes; the cell surface membrane is in both, and a Golgi body and histone-wound linear DNA are eukaryote features

3.4

(a)

- Golgi body / Golgi apparatus; modifies and packages proteins/lipids into vesicles for secretion

(b)

- rough endoplasmic reticulum; makes (and transports) proteins

3.5

- Two differences, e.g. prokaryote has no nucleus while eukaryote has a true nucleus; prokaryote has 70S ribosomes while eukaryote has 80S; prokaryote has no membrane-bound organelles while eukaryote does. One similarity, e.g. both have a cell surface membrane / cytoplasm / ribosomes / DNA

3.6

- A nucleic acid core, either DNA or RNA; surrounded by a protein coat called a capsid; some have an outer phospholipid envelope / it is non-cellular with no organelles

3.7

(a)

- Eukaryotic. It has membrane-bound organelles — mitochondria and a Golgi body — which prokaryotes lack; it has rough endoplasmic reticulum, again absent in prokaryotes. (The absence of a cell wall additionally suggests an animal cell.)

(b)

- A secretory cell — for example a gland cell producing enzymes or hormones. The extensive rough ER means very high rates of protein synthesis; the many mitochondria supply the ATP for that synthesis and for moving the vesicles

(c)

- The gene is transcribed to mRNA in the **nucleus**; the mRNA is translated by **ribosomes** on the rough ER, and the protein enters the ER lumen; vesicles carry it to the **Golgi body**, where it is modified and packaged; Golgi vesicles then fuse with the **cell surface membrane**, releasing the protein by exocytosis

(d)

- A light microscope resolves only to about 200 nm, limited by the wavelength of light, so internal detail cannot be separated; its maximum useful magnification, about $\times 1500$, is far too low — electrons have a much shorter wavelength and resolve to about 0.5 nm