Mark each point independently. Accept alternative correct responses. Underlined words are required. [1] per bullet point unless stated. ★ = Higher Tier only.

Question 1 [4 marks]

Context: A student is investigating plant cell structure using a light microscope....

Q: A student wants to observe onion epidermal cells using a light microscope. Describe how the student should prepare a sli...

• Peel a thin layer of epidermis from the onion using forceps [1]

• Place the epidermis flat on a clean glass slide and add 2 drops of iodine solution [1]

• Lower a coverslip at 45° (using a mounted needle) to avoid trapping air bubbles [1]

• Place slide on microscope stage and start at the lowest magnification objective [1]

[4 marks]

Question 2 [3 marks]

Q: The student draws a cell from a slide. The image of the cell is 54 mm long. The actual length of the cell is 0.03 mm. Ca...

• Magnification = image size divided by actual size [1]

• 54 divided by 0.03 [1]

• = x1800 [1]

Note: Award 2 marks if correct substitution but arithmetic error. Do not penalise for writing magnification as a decimal.

[3 marks]

Question 3 [3 marks]

Q: The student switches from the x10 objective lens to the x40 objective lens. The cells appear blurry at x40. Explain why ...

• Changing to a higher power objective brings the objective closer to the slide / changes the focal length [1]

• The image is out of focus because the focal length has changed [1]

• Student should use the fine focus adjustment wheel to sharpen the image [1]

[3 marks]

Question 4 [2 marks]

Q: State TWO differences between the light microscope and the electron microscope.

• Light microscope uses light / electron microscope uses a beam of electrons [1]

• Electron microscope has higher resolution / can distinguish finer detail / cannot be used with living specimens [1]

• Electron microscope has greater magnification [1] — accept any two valid differences

[2 marks]

Question 5 [3 marks]

Q: A student measures a cell on a diagram as 27 mm wide. The magnification is x900. Calculate the actual width of the cell....

• Actual size = image size divided by magnification [1]

• = 27 divided by 900 = 0.03 mm [1]

• = 0.03 x 1000 = 30 µm [1]

Note: Award 2 marks if correct calculation but incorrect unit conversion. 1 mm = 1000 µm must be applied.

[3 marks]

Question 6 ★ Higher Tier [3 marks]

Q: Explain why scientists use electron microscopes rather than light microscopes to study the internal structure of mitocho...

• Electron microscopes have much higher resolution than light microscopes [1]

• Resolution of electron microscope is approximately 0.1 nm — can distinguish structures inside organelles [1]

• The mitochondria are too small / their internal membranes are too close together to be resolved by a light microscope [1]

[3 marks]

END OF QUESTIONS — Total: 18 marks