SOLUTIONS

Unit 1: Cell Structure

1.1: The microscope in cell studies

1. **C**
   The actual cell size is 1 μm, and magnifying it 50,000 times gives 1 μm × 50,000 = 50,000 μm, which equals 50×10^1 mm. Hence, the correct answer is option C.
2. **A**
   Each eyepiece graticule division equals 0.1 mm ÷ 100 = 1.0×10^{-3} mm. Thus, 4 divisions = 4.0×10^{-3} mm = 1.0×10^1 μm.
3. **B**
   Prokaryotic cells typically have diameters ranging from 1×10^3 nm (1 μm) to 5 μm, which fits the range in option B.
4. **A**
   Calibrating the eyepiece graticule with a stage micrometer allows it to be used for accurate measurements of specimen size under a microscope.
5. **A**
   Calibration using a stage micrometer is essential to accurately convert eyepiece graticule units into actual measurements, such as micrometers.
6. **A**
   The electron micrograph shows a eukaryotic cell without a cell wall, indicating it is an animal cell. Plant cells have a cell wall, which is absent in this image.
7. **C**
   The resolution of light microscopes is limited by the wavelength of visible light, which is too large to distinguish the fine structure of cristae. Electron microscopes, with higher resolution, can reveal these details.
8. **D**
   Mitochondria are responsible for energy release through cellular respiration, so they are likely to retain the blue stain, indicating active energy release.
9. **D**
   The magnification is ×24,000, and the real diameter of the virus particle is calculated by dividing the image size by the magnification. The given answer indicates that the virus particle has a diameter of 1.5×10^2 nm.
10. **D**
    Magnification is calculated by multiplying the magnifications of the eyepiece and objective lens. The combination of ×15 eyepiece and ×100 objective gives the greatest magnification (15 × 100 = 1500).
11. **B**
    Light microscopes with a resolution of 0.25 μm (250 nm) can see Mimivirus and Pandoravirus, which are 680 nm and over 1000 nm respectively, but not typical viruses, which are smaller (20–150 nm). Electron microscopes can view all three.
12. **C**
    100 divisions in 10 mm gives each division a value of 0.1 mm. The cell spans 12 divisions, so the actual length of the cell is 12 × 0.1 = 1.2 mm or 360 μm.