SOLUTIONS

Microscope Worksheet:
Calculating Magnification. Converting Measurements, Estimating cell size, Calculating Field of View, Scale

1. Calculate total magnification: Ocular x Objective

Ocular	Objective	Total Magnification
10X	4X	40X
15X	10X	150X
5X	12X	70X
10X	10X	100X
10X	40X	400X

2. What are the possible magnifications of a microscope with an ocular marked 10X and objectives marked 5X, 15X, 30X and 60X?

Magnification = (ocular power) x (Objective Power)

= (10X) • (5X) = 50X
= (10X) • (15X) = 150X
= (30X) • (30X) = 300X
= (10X) • (60X) = 600X

3. Convert the following measurements: 1mm = 1000μm
   a. 9.2 mm = 9200 μm
   b. 5900 μm = 5.9 mm
   c. 0.083 mm = 83 μm
   d. 61000 μm = 61 mm

4. Estimating cell size: Divide the field of view by the number of cells that occupy the diameter.
   a. The field of view is 2500um. If a cell takes up 1/5 of the field of view, how long is the cell?
   b. A student counts 50 cells across the diameter of the field of view, and there are 70 rows of cells. If the diameter of the field of view is 3500 μm, what is the length and width of the cells?

#4
a) # of cells that will fit = 5
FoV = 2500μm
Est Size = 2500μm / 5 = 500μm

a) Length = FV / #across = 3500μm / 50 = 70μm
width = FV / #high = 3500μm / 70 = 50μm

5. Calculate the field of view: Use a ratio. As magnification increases, field of view decreases.
   a. (1:1) Low power: 4X = 4500 μm = 4.5 mm
   b. (2:5) Medium power: 10X = 1800 μm = 1.8 mm
   c. (1:10) High Power: 40X = 450 μm = 0.4 mm

#5
b) $\frac{FV_{MP}}{FV_{LP}} = \frac{M_{LP}}{M_{HP}}$ → ratio is $\frac{4x}{10x} = \frac{2}{5}$

$FV_{MP} = \frac{2}{5} \times 4500\mu m = 1800\mu m$

c) $\frac{FV_{HP}}{FV_{LP}} = \frac{M_{LP}}{M_{HP}}$ → ratio is $\frac{4x}{40x} = \frac{1}{10}$

$FV_{HP} = \frac{1}{10} \times 4500\mu m$

$= 450\mu m$

6. Scale: Divide diagram size by actual size.
   a. An organism has an actual length of 0.050mm. If you draw a diagram which is 75.0mm, what is the magnification?
   b. An organism has an actual length of 0.060mm. If you draw a diagram which is 36mm, what is the magnification?
   c. An object has an actual length of 0.025mm. If you use a scale of 1:1000, what will be the size of the drawing?
   d. An organism has an actual length of 0.033mm. If you use a scale of 1:250, what will be the size of the drawing?

Magx = Diagram Size / Actual size

#6

a) Magnification = 75.0 mm / 0.050 mm = 1500X

b) M = 36 mm / 0.060 mm = 600X

c) Diagram Size = Magnification x Actual size
= 1000 x 0.025mm = 25 mm

d) D.S = M. x A.S.
= 250 x 0.033 mm = 8.25 mm