1.1 The Microscope in Cell Studies

Question Paper

Course	CIE A Level Biology
Section	1. Cell Structure
Topic	1.1 The Microscope in Cell Studies
Difficulty	Hard

Time allowed: 20

Score: /9

Percentage: /100

Question 1

The actual length of a cell structure is 6 µm.

A student was asked to write an equation that could be used to calculate the magnification of an electron micrograph of this cell structure. The student used the letters *q* to *u* in their equation.

q = The length of the cell structure in the image in cm

r = The length of the cell structure in the image in mm

s = 1000

$t = \frac{1}{6}$

u = 6

Which of the following would be the correct equation to calculate the magnification?

A. $\frac{q}{s} \times u$

B. $q \times s \times t$

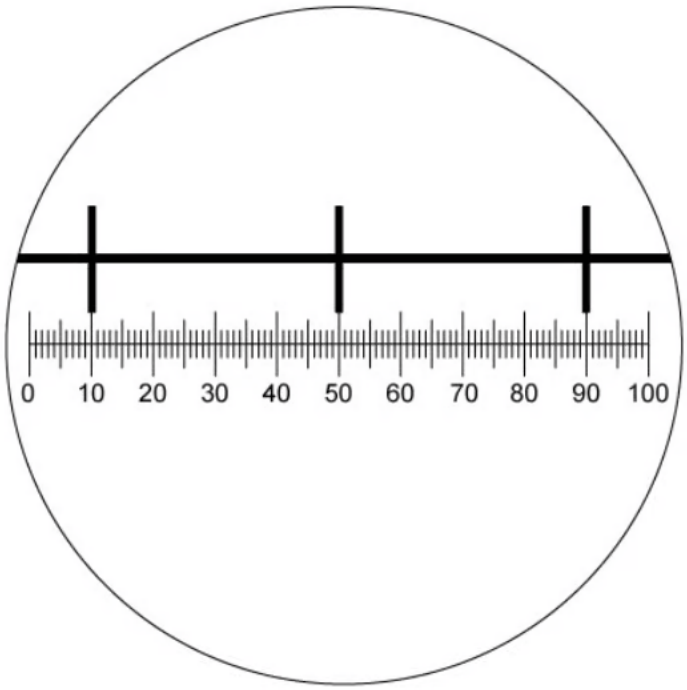
C. $\frac{r \times s}{u}$

D. $\frac{r}{s} \times u$

[1 mark]

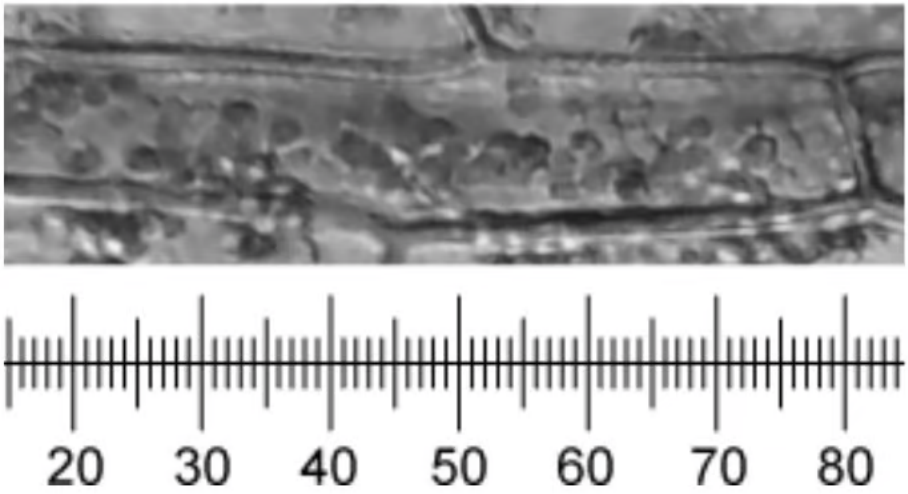
Question 2

A stage micrometer with small divisions of 0.1 mm was used to calibrate a graticule. This is shown in the diagram below.



A slide of a plant cell was placed on the stage in place of the stage micrometer.

What is the width of the chloroplast below?



A. 100 µm

B. 50 µm

C. 10 µm

D. 0.5 mm

[1 mark]

Question 3

Cells can vary considerably in their diameter.

Typical diameters of cells are:

- Eukaryotic cells, such as a white blood cell 1.5×10^{1} µm
- Prokaryotic cells, such as *Streptococcus* 7.5×10^{2} nm

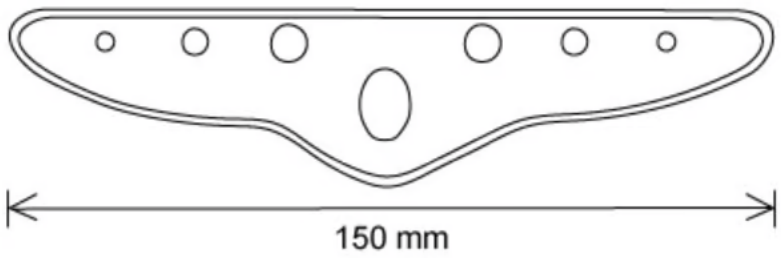
Use these measurements to find the maximum number of each cell that could fit along a 1 cm line.

	Number of white blood cells	Number of *Streptococcus* cells
A	6.7×10^{0}	1.3×10^{2}
B	6.7×10^{1}	1.3×10^{3}
C	6.7×10^{2}	1.3×10^{4}
D	6.7×10^{3}	1.3×10^{5}

[1 mark]

Question 4

A light microscope with an eyepiece lens of x5 and an objective lens of x8 was used to draw the diagram of a transverse section through a leaf, as shown below.



The actual length of the leaf is 7.5 mm. What is the magnification of the diagram?

A. x40

B. x20

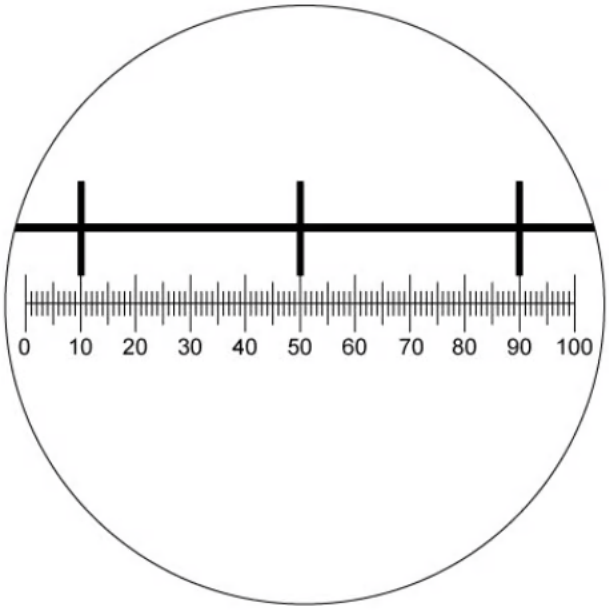
C. x8

D. x5

[1 mark]

Question 5

The diagram below is viewed through an eyepiece with a graticule showing the stage micrometer below. The stage micrometer has divisions 0.1 mm apart.



The eyepiece is then used to examine a blood smear.

How many of the graticule divisions will cover the diameter of a white cell of 12.5 µm?

A. 1

B. 4

C. 5

D. 10

[1 mark]

Question 6

A light microscope is used to observe a specimen under green light with a wavelength of 510 nm.

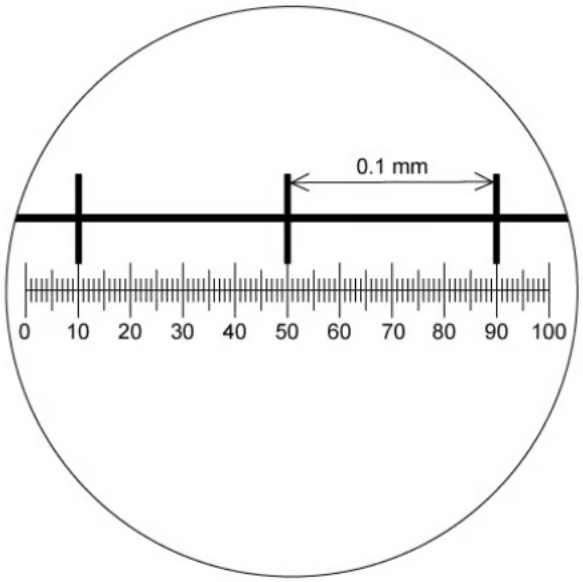
If the same specimen, with all other conditions kept constant, is viewed under red light with a wavelength of 650 nm, what effect would this have on the magnification and resolution of the microscope?

	magnification	resolution
A	stays the same	increased
B	stays the same	decreased
C	increased	decreased
D	decreased	increased

[1 mark]

Question 7

The diagram below shows a view through a microscope eyepiece with a graticule scale and a stage micrometer using a magnification of x400.



Using the magnification of x400, a chloroplast was measured to be 4 eyepiece graticule divisions in length.

How long is the chloroplast?

A. 4.0×10^{2} µm

B. 2.5×10^{-1} µm

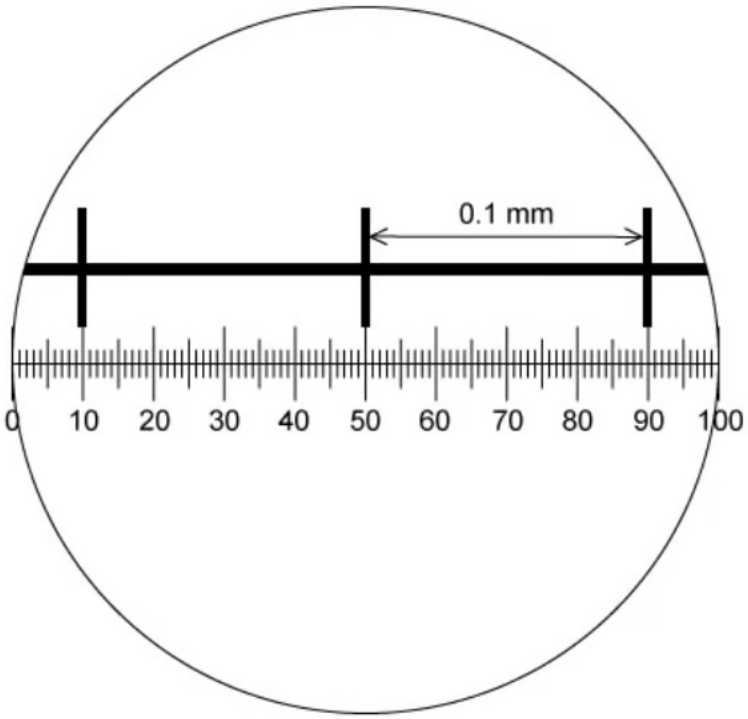
C. 2.5×10^{-2} µm

D. 1.0×10^{1} µm

[1 mark]

Question 8

The diagram below shows a view through a microscope eyepiece with a graticule scale and a stage micrometer, with divisions 0.1 mm apart.



What is the area of the field of view at this magnification? ($\pi = 3.14$)

A. $\pi \times 250 \times 250 = 2.0 \times 10^5\ \mu m^2$

B. $\pi \times 50 \times 50 = 7.9 \times 10^3\ \mu m^2$

C. $\pi \times 12.5 \times 12.5 = 4.9 \times 10^2\ \mu m^2$

D. $\pi \times 125 \times 125 = 4.9 \times 10^4\ \mu m^2$

[1 mark]

Question 9

A student was using an eyepiece graticule with 100 small divisions. The stage micrometer they were using had a scale with 50 divisions, each of them 0.04 mm apart.

Using a x40 objective lens, the whole length of the stage micrometer lined up with 15 divisions of the eyepiece graticule.

What is the length of the 100 division scale of the eyepiece graticule at this magnification?

A. 750 µm

B. 75 µm

C. 13 mm

D. 1.3 mm

[1 mark]