

SI Microbiology - Full Discipline Demo

Microscopy for Microbiology

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Microbiology - Full Discipline Demo
Course	SI Microbiology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match the term with the best description.

Terms to match:

- Base
- Diaphragm
- Objective
- Ocular
- Stage

Descriptions to match with:

1. Lens at the top of the microscope through which the specimen is viewed
2. Flat support for microscope that contains power button in electric models
3. Platform that supports the slide or other material to be viewed
4. Controls the amount of light allowed on the specimen
5. Lens closest to the specimen that can be changed to increase or reduce magnification

Correct answers:

1 Ocular 2 Base 3 Stage 4 Diaphragm 5 Objective

Match each description with the correct type of microscope.

⚡ 0.2 nm resolution

⚡ $10^7\times$ magnification

⚡ Laser excites fluorescent material within a sample

⚡ Most common microscope used in teaching laboratories

⚡ Visible light reflects off object creating a 3D image

⚡ Visible light transmitted through an object producing a 2D image

⚡ Used for dissection

Compound Light	Confocal	Electron	Stereo
1	2	3	4

Correct answers:

- 1 Most common microscope used in teaching laboratories

Visible light transmitted through an object producing a 2D image
- 2 Laser excites fluorescent material within a sample
- 3 0.2 nm resolution $10^7\times$ magnification
- 4 Used for dissection Visible light reflects off object creating a 3D image

Categorize each statement as True or False.

⚡ Field of view is the range of depth that a specimen is in focus at a given time.	
⚡ Immersion oils form a bridge between the slide and lens minimizing light bending and image distortion.	
⚡ The total magnification for a compound microscope is the product of the magnifications of the ocular and objective lenses.	
⚡ A 100x immersion lens functions properly with or without immersion oil.	
True	False
1	2

Correct answers:

1

Immersion oils form a bridge between the slide and lens minimizing light bending and image distortion.

The total magnification for a compound microscope is the product of the magnifications of the ocular and objective lenses.

2

Field of view is the range of depth that a specimen is in focus at a given time.

A 100x immersion lens functions properly with or without immersion oil.

Exploration

A compound microscope is a type of optical microscope.

- ☒ True
☐ False



The ____ of a compound microscope is used to magnify the specimen.

- ☐ diaphragm
- ☐ revolving nosepiece
- ☒ objective lens
- ☐ fine focus knob

The ____ rotates the objective lenses of a compound microscope.

- ☐ diaphragm
- ☒ revolving nosepiece
- ☐ coarse focus knob
- ☐ arm

____ is the diameter of the circular image produced by the lenses of the microscope.

- ☐ Total magnification
- ☒ Field of view
- ☐ Depth of field
- ☐ Resolution

The total magnification of a specimen viewed through an ocular lens with 15x and an objective lens with 40x is ____.

- ☐ 65x
- ☐ 150x
- ☒ 600x
- ☐ 900x

All types of objective lenses can be used with immersion oil.

- ☐ True
- ☒ False

Exercise 1

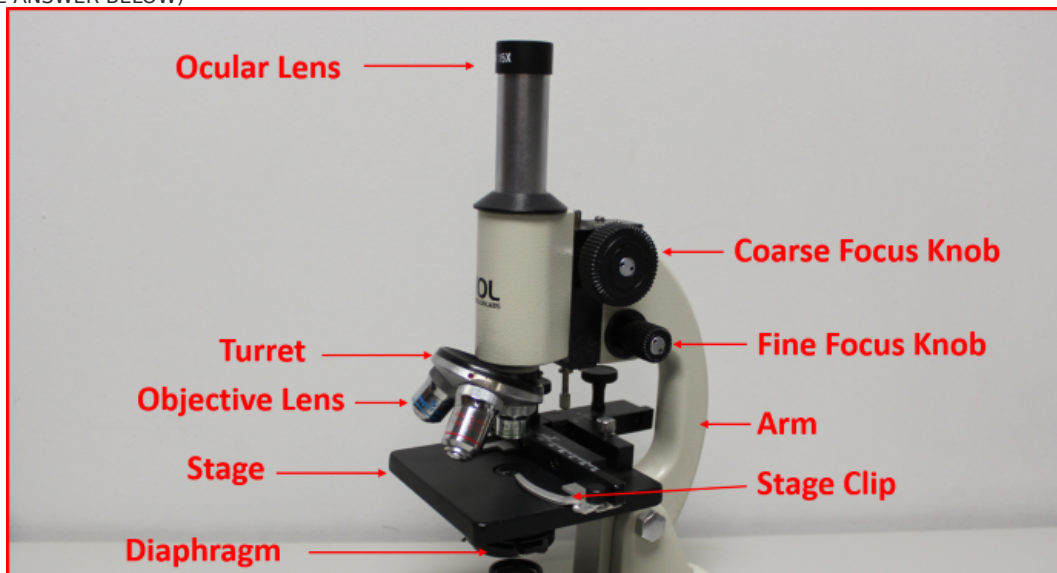
How did the field of view change as magnification increased when viewing the Letter e slide? Reference your calculations in Data Table 2 and Photos 2-5 in your answer.

The field of view decreased as magnification increased when viewing the Letter e slide. As shown in Data Table 2, the field of view at 60x was 2.25 mm (0.99 for V-Scope) but only 0.225 mm at 600x (0.099 mm for V-Scope). When viewed under increasing magnification, less of the letter e appeared in the field of view. In Photo 2 the entire letter appeared, compared to Photo 5 where only a small portion of the e was displayed.

What is the purpose of adding a drop of oil to the slide when using the 100x oil immersion lens? How would the image appear if the oil had not been applied?

The oil was applied to form a bridge between the slide and lens, minimizing light bending and image distortion. Oil immersion lenses only function when used with immersion oil and will only produce distorted images when used in the absence of the oil.

Photo 1: Microscope Components
(SAMPLE ANSWER BELOW)





Data Table 1: Microscope Components (SAMPLE ANSWER BELOW)	
Component Name	Component Function
Arm	Connects the base to the head of the microscope
Base	Flat support for the microscope
Coarse Focus Knob	Quickly moves the stage up or down
Diaphragm	Controls the amount of light on the specimen
Fine Focus Knob	Slowly moves the stage up or down
Illuminator	Light source that shines on specimen
Objective Lens	Lens closest to the specimen used to magnify the image
Ocular Lens	Lens at top of microscope through which the specimen is viewed and additionally magnified.
Stage	Platform that supports the slide to be viewed
Stage Clip	Secures the slide in place
Revolving Nosepiece (turret)	Rotates the objective lenses, allowing for magnification to be changed

Data Table 2: Total Magnification and Field of View
(SAMPLE ANSWER BELOW)

Ocular Magnification	Objective Magnification	Total Magnification	Field of View (mm)	Field of View (μm)
15x (Data is for student microscope purchased with kit or V-Scope, Other microscopes may vary)	4x	60x	2.25 (0.99 V-Scope)	2250 (990 V-Scope)
15x	10x	150x	1.25 (0.38 V-Scope)	1250 (380 V-Scope)
15x	40x	600x	0.225 (0.099 V-Scope)	225 (99 V-Scope)
15x	100x	1500x	0.090 (N/A V-scope)	90 (N/A V-scope)

Photo 2: Letter e - 4x Objective
(SAMPLE ANSWER BELOW)

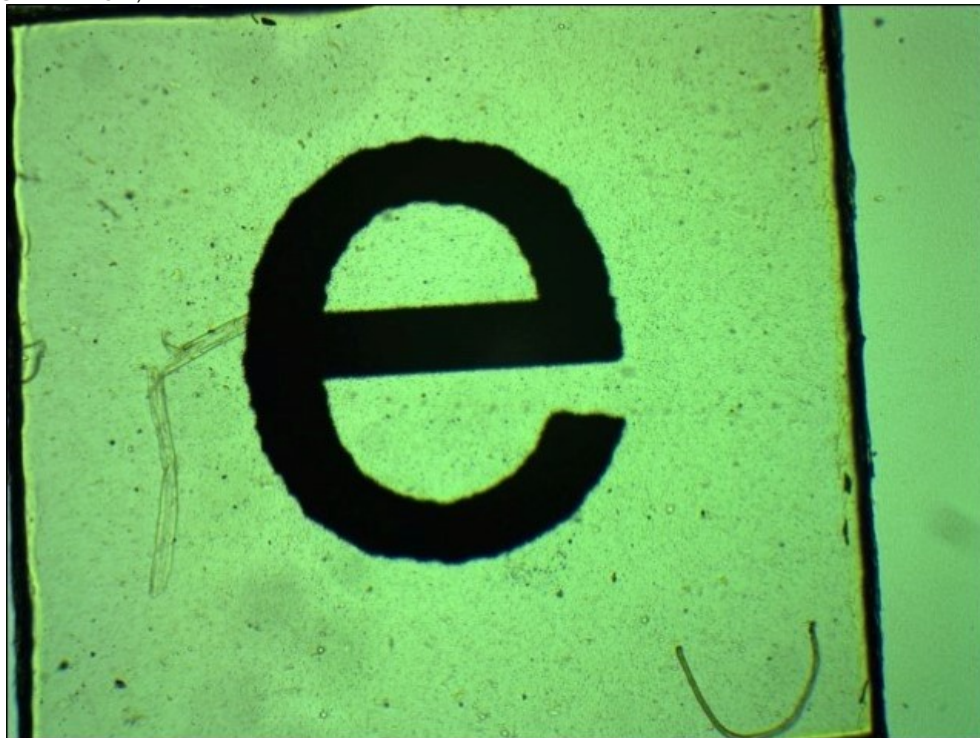


Photo 3: Letter e - 10x Objective
(SAMPLE ANSWER BELOW)



Photo 4: Letter e - 40x Objective
(SAMPLE ANSWER BELOW)

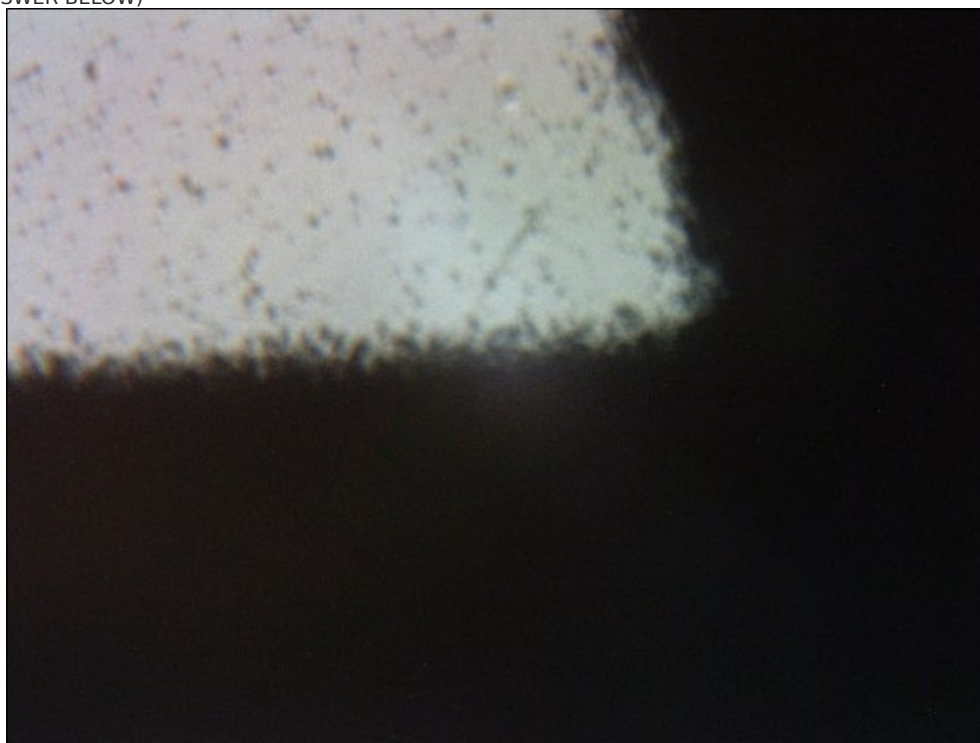
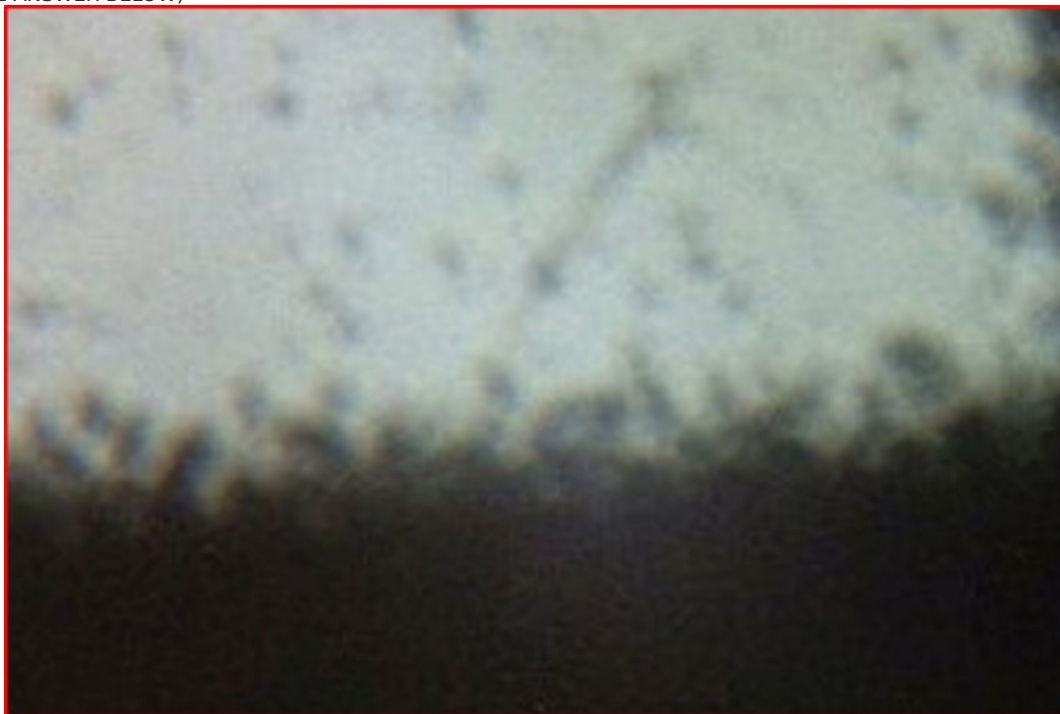


Photo 5: Letter e - 100x Objective
(SAMPLE ANSWER BELOW)



Exercise 2

Which microbe cells required the highest magnification power to properly observe? Reference Data Table 3 and Photos 6-11 in your explanation.

The yeast, spirillum, bacillus, and coccus all required the highest level of magnification to properly observe individual cells. Each of these cells were viewed at 1500x (600x for V-scope) as recorded in Data Table 3 and in Photos 8-11).

What is the approximate diameter of each of the cells in the Bacteria Coccus Form slide uploaded in Photo 11? Apply the formula from Exercise 1 and show your calculations in your explanation.

The diameter of most coccus bacteria are between 0.5 and 1.0 micrometers. Student calculations will vary based on the combinations of objective and ocular lenses used but should include the calculations derived from:

$$\text{High power FOV} = \text{Low power FOV} \times \left(\frac{\text{TM of low power}}{\text{TM of high power}} \right)$$

FOV = Field of view TM = Total magnification

Data Table 3: Prepared Slide Magnifications
(SAMPLE ANSWER BELOW)

Slide	Magnification
Amoeba	150x
Penicillium	600x

Yeast	1500x (600x V-scope)
Spirillum	1500x (600x V-scope)
Bacillus	1500x (600x V-scope)
Coccus	1500x (600x V-scope)

Photo 6: Amoeba Slide
(SAMPLE ANSWER BELOW)

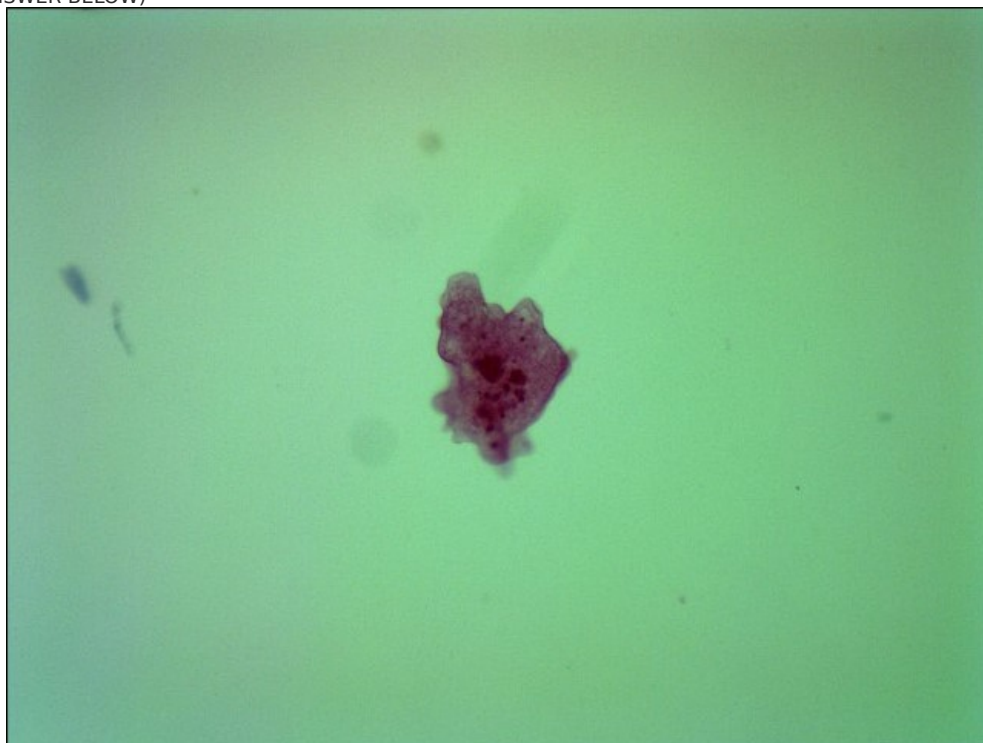


Photo 7: Penicillium Slide
(SAMPLE ANSWER BELOW)

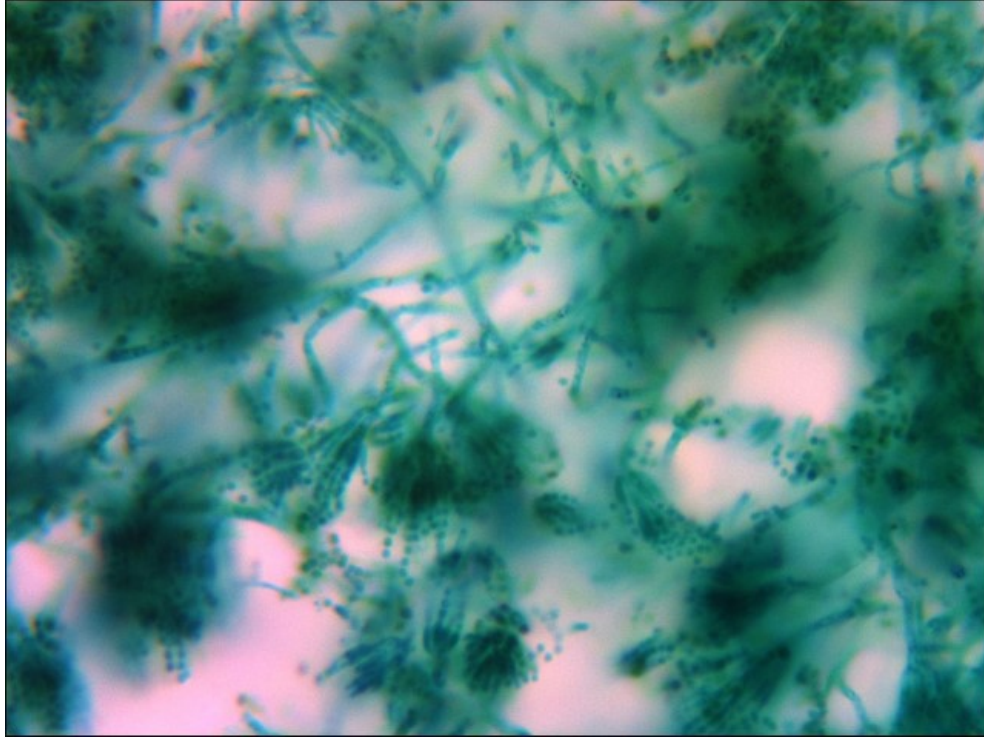


Photo 8: Yeast Slide
(SAMPLE ANSWER BELOW)

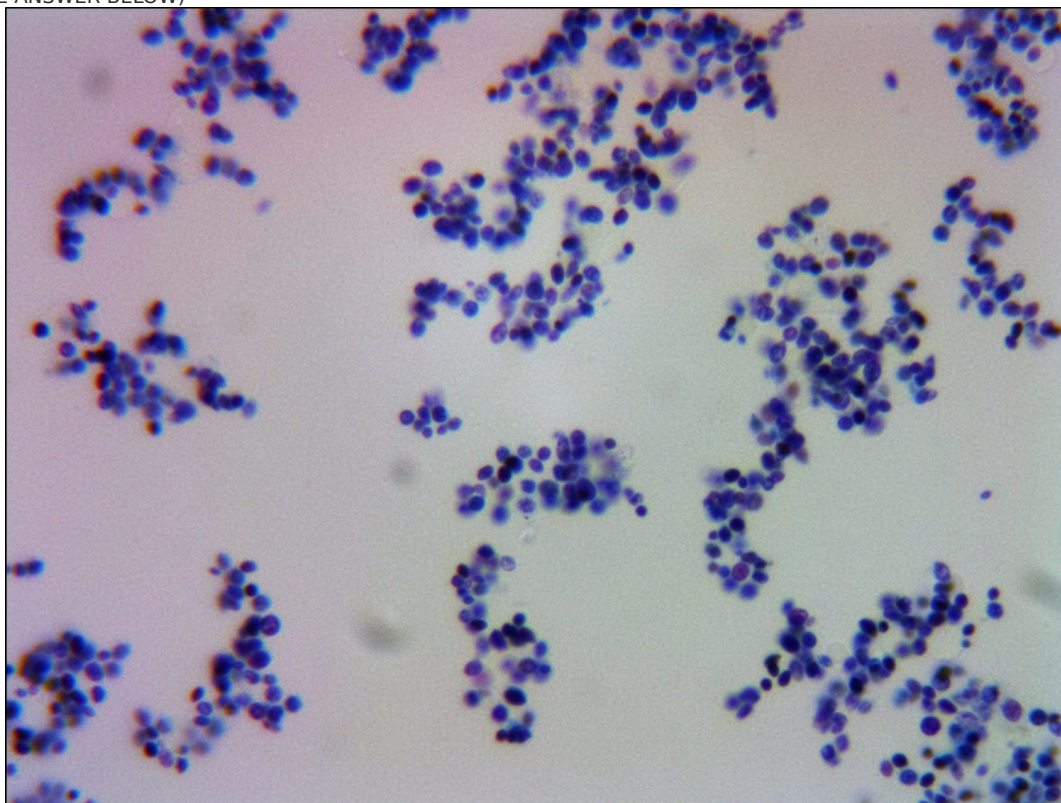
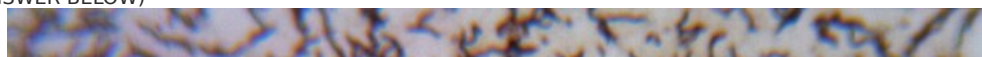


Photo 9: Spirillum Slide
(SAMPLE ANSWER BELOW)



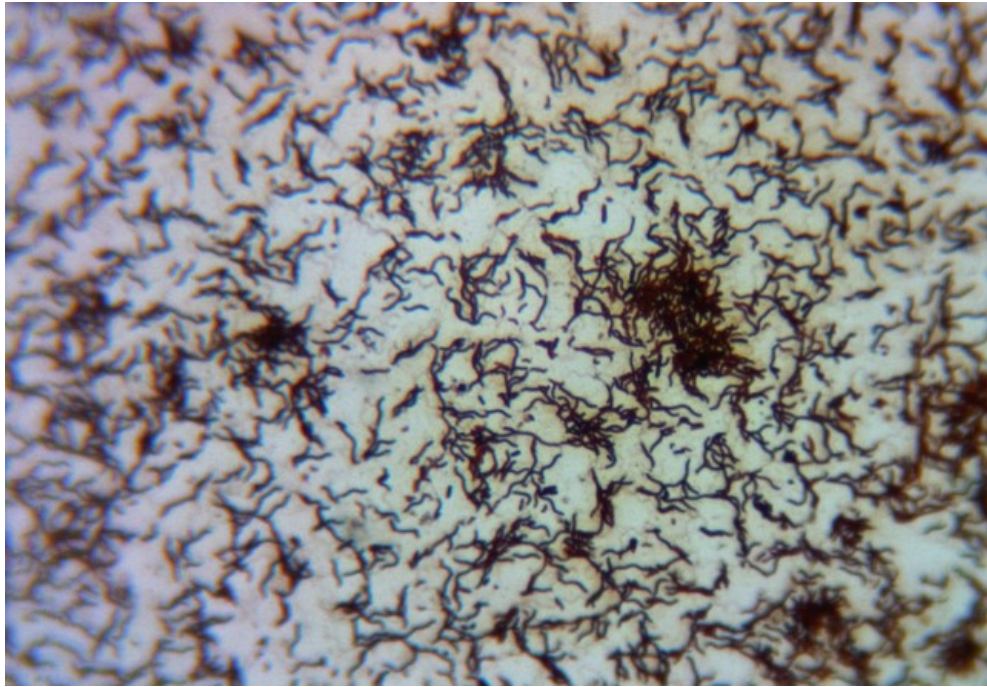
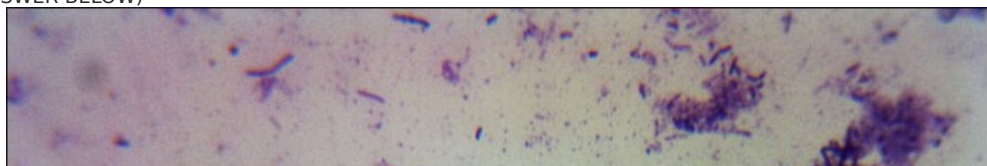


Photo 10: Bacillus Slide
(SAMPLE ANSWER BELOW)



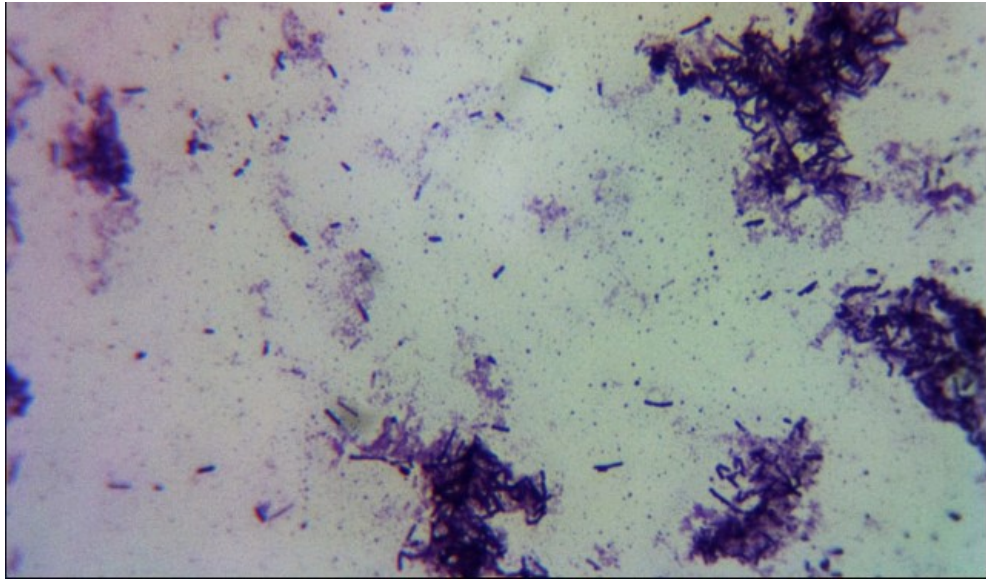
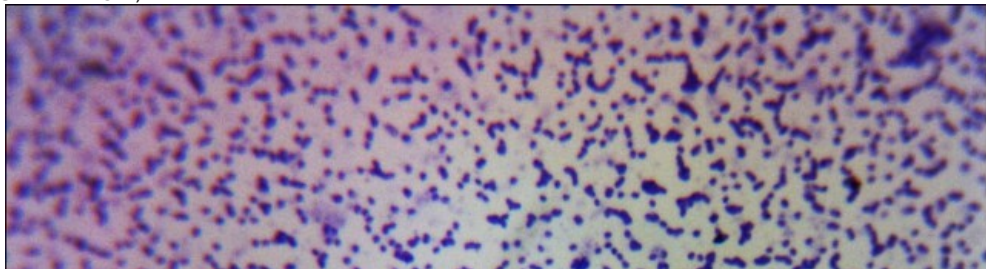
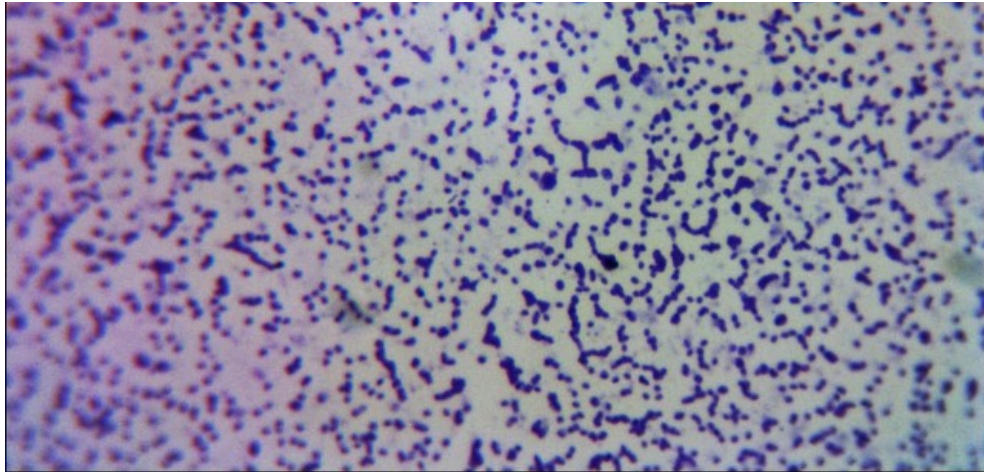


Photo 11: Coccus Slide
(SAMPLE ANSWER BELOW)





Competency Review

Transmission and scanning ____ microscopes have resolutions of approximately 0.2 nm (0.0002 μm).

- ☐ stereo
- ☐ compound
- ☐ confocal
- ☒ electron



_____ microscopes transmit visible light through an object producing a 2D image in an eyepiece.

- ☐ Electron
- ☒ Compound ✓
- ☐ Confocal
- ☐ Scanning

The fine focus knob is used to initially focus on a specimen at low power.

- ☐ True
- ☒ False ✓

Most compound microscopes have a 4x, 10x, and 40x objective lens.

- ☒ True ✓
- ☐ False

Field of view decreases as magnification increases.

- ☒ True ✓
- ☐ False

Compound microscopes have an inherently shallow depth of field, on the order of only a few micrometers.

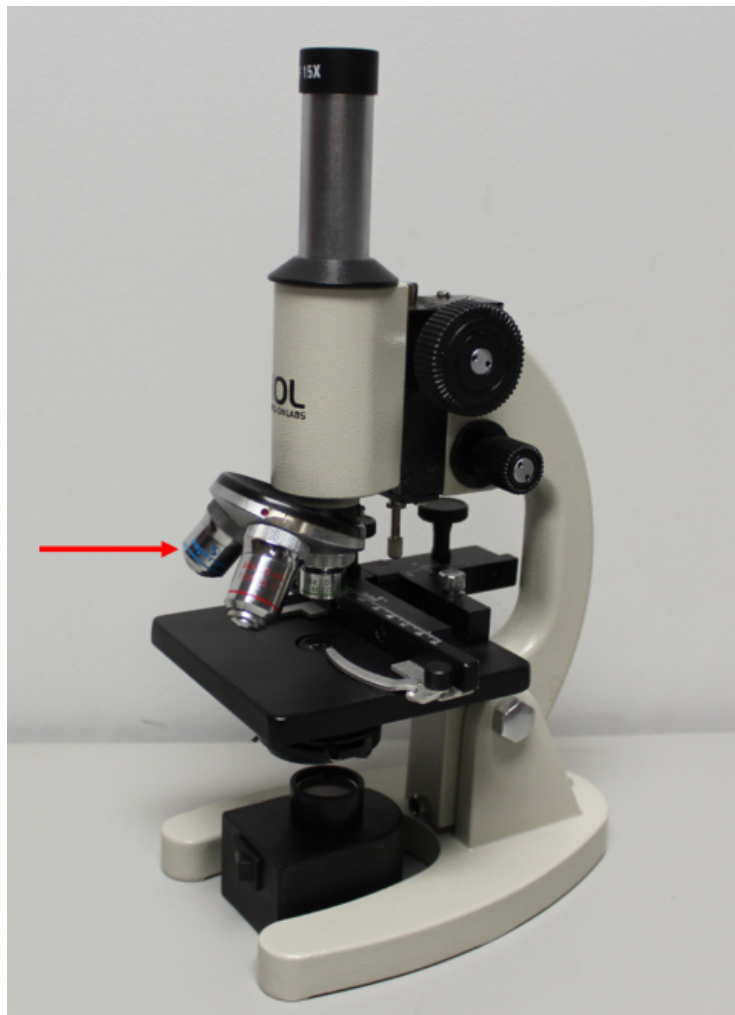
- ☒ True ✓
 - ☐ False
-

The use of a ____ objective lens on a compound light microscope requires a drop of immersion oil to the slide being viewed.

- ☐ 4x
- ☐ 10x
- ☐ 40x
- ☒ 100x



The microscope feature indicated in the figure is the ____.



- ☐ ocular lens
- ☒ objective lens
- ☐ condenser
- ☐ diaphragm



A compound microscope with a 2 mm field of view for the 4x objective and 15x ocular lens combination will have a ____ field of view for the 40x objective and 15x ocular lens combination.

- ☐ 20 mm
- ☐ 1 mm
- ☒ 0.2 mm ✓
- ☐ 0.01 mm

Yeast and bacteria cells are best observed using the 10x objective of a compound light microscope.

- ☐ True
- ☒ False ✓

Extension Questions

In 1918 the Spanish Flu infected almost one third of the world and was thought to be caused by bacteria even though scientists could not view the microbe under the compound microscopes available at that time. Today, we realize the Spanish Flu was caused by an H1N1 virus 80 to 120 nm in diameter. Apply your knowledge of microscopy to explain why scientists were not able to identify the Spanish Flu with an optical microscope. (SAMPLE ANSWER BELOW)

The compound microscope used by the scientists is restricted to 2000x magnification and can only be used for viewing of microbes as small as 200 nm in size. The virus particle at 80-120 nm is too small to be observed with a compound optical microscope. Scientists would have needed the 0.2 nm resolving power of the electron microscope to view microbes as small as the virus.