

SI Forensics - Full Discipline Demo

Introduction to Microscopy - Forensics

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Forensics - Full Discipline Demo
Course	SI Forensics - 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:

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

Answer boxes:

-
-
-
-
-

Correct answers:

1 Ocular 2 Base 3 Stage 4 Diaphragm 5 Objective

Diagram illustrating the characteristics of different microscopy techniques:

- 0.2 nm resolution
- $10^7\times$ magnification
- Laser excites fluorescent material within a sample
- Visible light reflects off object creating a 3D image
- Visible light transmitted through an object producing a 2D image.
- Used to examine fine details of macroscopic items

Microscopy Techniques:

Compound Light	Confocal	Electron	Stereo
1	2	3	4

Correct answers:

- 1 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 to examine fine details of macroscopic items
- 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.	
⚡ Higher magnifications produce a shallower depth of field.	
⚡ The total magnification for a compound microscope is the product of the magnifications of the ocular and objective lenses.	
True	False
1	2

Correct answers:

1 Higher magnifications produce a shallower depth of field.

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.

Exploration

_____ is the minimum distance at which two distinct points in a specimen can be seen as separate structures.

- ☐ Magnification
- ☒ Resolution
- ☐ Illumination



Examples of optical microscopes include ____ microscopes.

- ☐ stereo
- ☐ compound
- ☐ confocal
- ☒ All of the above

✓

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

- ☐ diaphragm
- ☐ turret
- ☒ objective lens
- ☐ All of the above

✓

The ____ rotates the objective lenses of a compound microscope.

- ☐ diaphragm
- ☒ turret
- ☐ 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

✓

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

- ☐ 65x
- ☐ 150x
- ☒ 600x

✓

Exercise 1

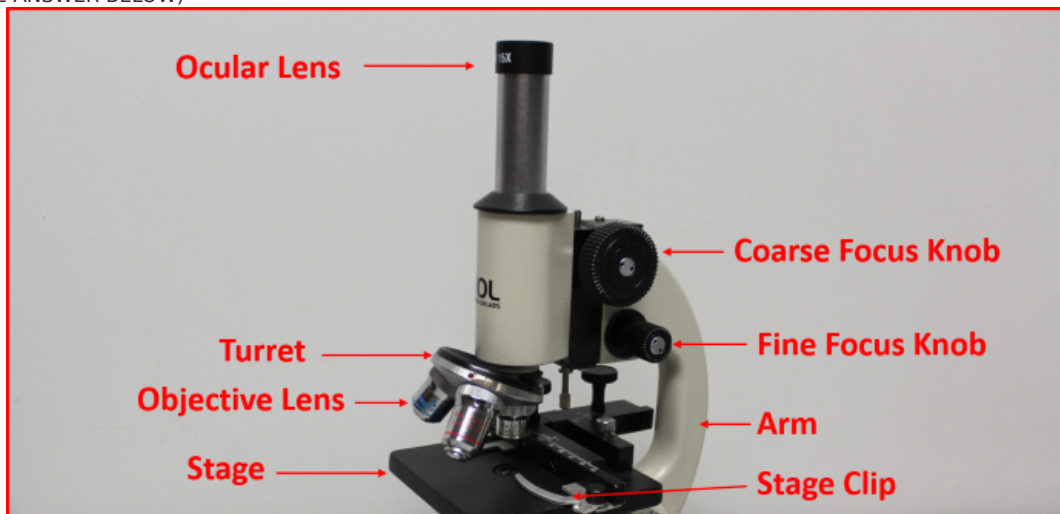
How does the compound microscope used in this exercise differ from a stereo microscope? Reference the specific components of your microscope in your answer.

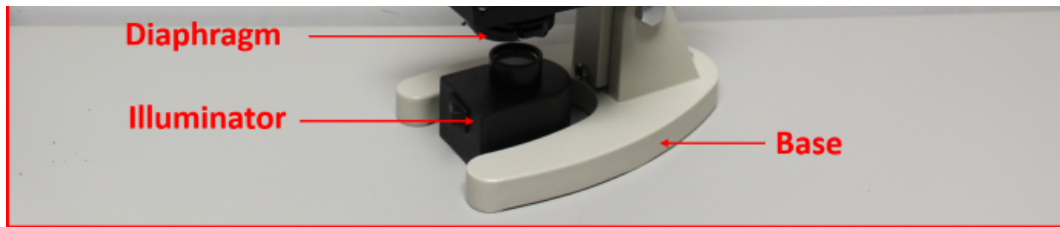
The compound microscope used in this exercise contains a turret with three objective lenses, an adjustable stage, an illuminator with a diaphragm and condenser that shines light through a specimen. The images provided by the compound microscope appear in 2D. A stereo microscope lacks a turret with multiple objectives, has lower total magnification, and illuminates specimens from above a fixed platform. The images provided by a stereo microscope appear in 3D.

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 2-4 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 4 where only a small portion of the e was displayed.

Photo 1: Microscope Components
(SAMPLE ANSWER BELOW)





Data Table 1: Microscope Component Functions
(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 in larger increments
Diaphragm	Controls the amount of light on the specimen
Fine Focus Knob	Slowly moves the stage up or down in smaller increments
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

Turret	Rotates the objective lenses, allowing for magnification to be changed
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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)

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

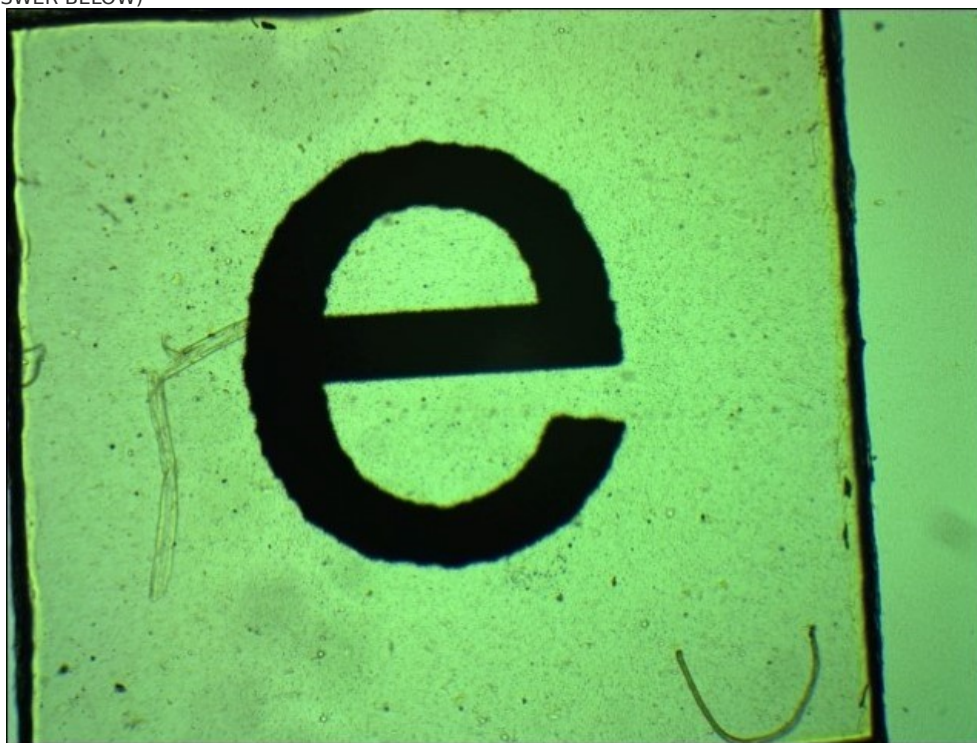
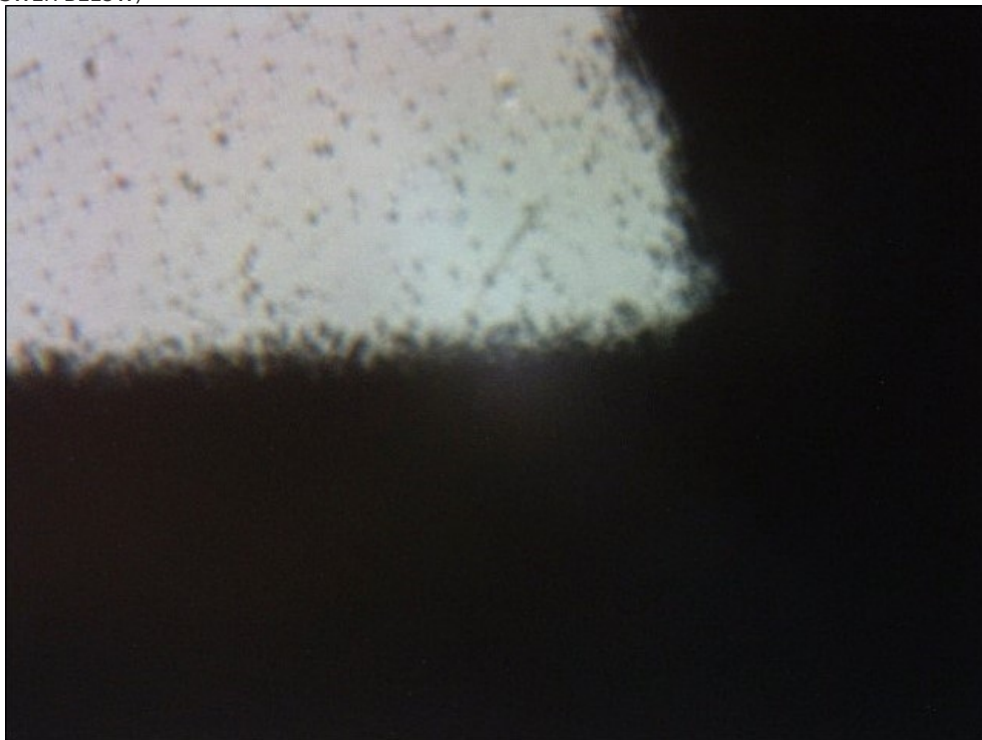


Photo 3: Letter e - 10x Objective
(SAMPLE ANSWER BELOW)



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



Competency Review

_____ microscopes reflect visible light off the surface of macro organisms to create a 3D image.

- ☒ Stereo ✓
- ☐ Compound
- ☐ Confocal
- ☐ Electron

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

- ☐ Electron
- ☒ Compound ✓
- ☐ Confocal
- ☐ Stereo

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

- ☐ True
- ☒ False ✓

Most compound microscopes have a ____ objective lens.

- ☐ 4x
- ☐ 10x
- ☐ 40x
- ☒ All of the above

✓

Field of view decreases as magnification increases.

- ☒ True
- ☐ False

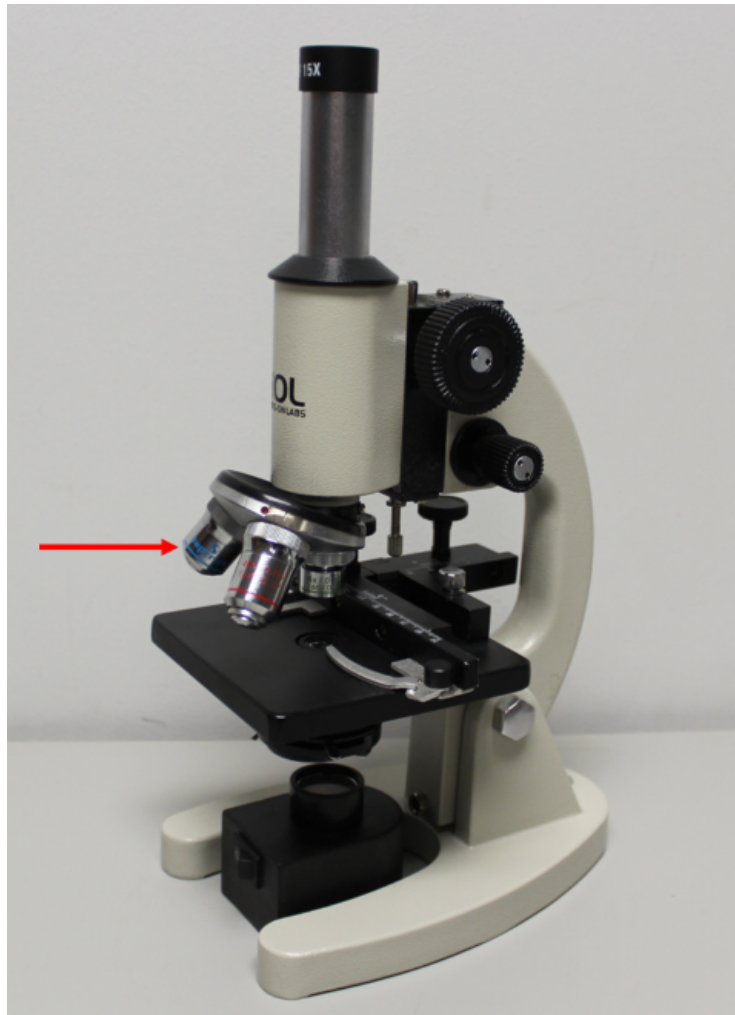
✓

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

- ☒ True
- ☐ False

✓

The microscope feature indicated in the figure is a(n) ____.



- ☐ 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
- ☐ 2 mm



Extension Questions

Discuss one potential use for each of the four major types of microscopes in a forensics laboratory.

(SAMPLE ANSWER BELOW)

Student answers will vary. Sample answers:

A stereo microscope may be used to aid in the examination of the finer details of pieces of evidence such as fingerprint minutiae or handwriting samples. A compound microscope may be used to examine the composition fiber or mineral samples or the refractive index of glass shards. A comparison microscope may be used to compare fiber or mineral samples or the refractive index of glass shards from two different sources. An electron microscope may be used to investigate highly minute structures in soil or fiber samples.