PART 1: Microscopy  
(You are given a microscope with a 10 X ocular and 4, 10, and 40 X objectives.)

1. What is the highest magnification possible with this microscope?

2. What is the range of magnification for this microscope?

3. A student prepares a slide with the letter "d" and positions it on the stage in the normal reading position. When viewed, how will the "d" will appear? Draw it on your answer sheet.

4. Which part of this microscope is used to control the amount of light coming to the image from the light source?
   (A) objective  (B) diaphragm  (C) ocular  (D) fine adjustment

5. What part of this microscope holds and rotates the objectives?
   (A) stage  (B) body tube  (C) coarse adjustment  (D) nosepiece  (E) fine adjustment knob

6. When observing an object under low power and then switching to high power, the image under high power will appear
   (A.) smaller and brighter  (C.) smaller and darker
   (B.) larger and brighter  (D.) larger and darker

7. Using the hands of the clock to describe places on the field of view, if an object appears to be moving toward 1 o’clock, what direction is it actually moving?

8. Examine the diagram of the stage with millimeter ruler from a 10X objective. What is the diameter of this field of view (the diagram) in millimeters? in micrometers or mcm?

9. Examine the Photo of Microbe A taken under low power. What type of microbe is Microbe A? (virus, protozoa, algae, fungi, bacteria)

10. What is the approximate length of one of Microbe A cells that is not reproducing in micrometers (mcm)?
PART 2: Types of Microscopes

Key:  
A. Light microscope  
B. Phase Contrast Microscope  
C. Florescent Microscope  
D. Scanning Electron Microscope  
E. Transmission Electron Microscope

Use the above key to identify the type of microscope being described in questions 11-15.

11. Produces extremely detailed 3-D images.

12. Produces very detailed 2-D images of very thin stained specimens.

13. Can observe live specimens in normal color and background as they move about a slide.

14. Can observe live specimens contrasted against a gray background.

15. Uses dyes to show florescence under UV rays?

Use images A-E in answering questions 16-20. Each image is of yeast taken from a different type of microscope.

16. Which image is from a light microscope?

17. Which image is from a phase contrast microscope?

18. Which image is from a florescent microscope?

19. Which image is from a scanning transmission microscope?

20. Which image is from a transmission electron microscope?
PART 3: Relative Size of Microbes

21. How many micrometers (mcm) are in a millimeter (mm)?

22. How many nanometers (nm) are in a micrometer (cmc)?

23. How many nanometers (nm) are in a millimeter (mm)?

Use the microbe images for questions 24-30.

24. What is the size of a Volvox in nanometers?

25. What is the size of a yeast in nanometers?

26. What is the size of a halobacterium in nanometers?

27. What is the size of a coccus in nanometers?

28. How many viruses would fit across the diameter of a coccus?

29. How many viruses would fit across the diameter of a yeast?

30. How many viruses would fit across the diameter of a Volvox?
PART 4: Cell Types

Use Diagrams A, B, and C to help you answer the following questions

31. Which diagram (A,B,or C) is acellular?
32. Which diagram (A,B,or C) is a prokaryotic cell?
33. Which diagram (A,B,or C) is a eukaryotic cell?

For questions 34-39, indicate which cell type (A, B, or C) would fit each of the following microbes

34. fungi
35. virus
36. algae (Plant-like protist)
37. bacteria
38. protozoa (Animal-like protest)
39. Archaea

40. Which of the following would be found in all three diagrams?
   A. endoplasmic reticulum
   B. ribosomes
   C. vacuole
   D. DNA or RNA
PART 5: Major Groups of Microbes

A. Prion
B. Archeae
C. Bacteria
D. Fungi
E. Algae (Plant-like protists)
F. Protozoa (Animal-like protists)
G. Virus

For questions 41-50, use the above key to identify the appropriate group of microbes being described.

41. Important zooplankton

42. Have cell walls and chloroplasts – primary producers in many aquatic environments

43. Acellular cluster of DNA or RNA encased in a protein - many types cause diseases

44. Proteinaceous infectious particles – cause disease

45. Yeast are examples of these microbes

46. Some species are extremophiles – living in extremes of pH, temperature, salinity as well as heat, acid and toxic gases

47. Organized by mode of transportation as cilia, flagella, pseudopods

48. Many are edible and cultivated world wide – others are major decomposers in the soil

49. Cause the flu and the common cold

50. Prokaryotic rods, spheres, or spirals - some can cause disease

PART 6: Microbes and Food

For questions 51-55, use the key of microbes to identify the microbe used in making the following foods – some foods may include more than one microbe type.

Key:  A. yeast   B. Bacteria   C. mushrooms   D. Algae

51. Yogurt

52. Bread

53. Cheese

54. Wine

55. Pepperoni Pizza
For questions 56-60, determine whether the statement is true or false.

56. When yeast produce alcohol, oxygen is used.
57. Sauerkraut are made by controlled fermentation of cabbage.
58. Bacteria and fungi play a key role in food spoilage.
59. Microbes are used in the production of chocolate.
60. Lowering the temperature of food increases mold growth.

PART 7: Important Microbes

Use the Key of Microbes to identify the Microbe Group to which each of the important microbes belong

A. Bacteria
B. Fungi
C. Virus
D. Algae (Plant-like protists)
E. Protozoa (Animal-like protists)

61. Baker’s Yeast
62. Diatoms that form diatomaceous earth
63. Oil eating microbes
64. Cheese making Lactobacillus
65. Sporozoa causing Malaria
66. Dinoflagellates that cause red tide
67. Paramecium
68. Zooplankton in the ocean
69. Ruin ¼ to ½ of fruits and vegetables per year
70. Used in sewage treatment plants to breakdown sewage
PART 8: Microbes and Ecology

Examine the Ocean Food Web and Ocean Energy Pyramid when answering questions 71-80.

71. Which type of organisms would be the primary producers and carry out photosynthesis?

72. Which of the following types of microbes could be primary producers in the ocean? – Cyanobacteria, protozoa, fungi, algae

73. Which of the following types of microbes could be zooplankton? – Cyanobacteria, protozoa, fungi, algae

74. Which of the following types of microbes could be decomposers for the ocean ecosystem? – bacteria, protozoa, fungi, algae

75. What do carnivorous zooplankton eat?

76. What do herbivorous zooplankton eat?

77. Which types of microbes will eat any dead and decaying material that drops to the bottom of the ocean? – bacteria, protozoa, fungi, algae

78. What percent of the energy available to each trophic level will be still available to the next trophic level?

79. If 8000 energy units were produced by the phytoplankton, how many units would be available for the Carnivorous zooplankton?

80. If 8000 energy units were produced by the phytoplankton, how many units would be available for the tuna?

Food Web

Energy Pyramid
PART 9: Microbes and Disease

Key:

A. Fungi
B. Virus
C. Bacteria
D. Protozoan
E. Prion

Use the above key to indicate which type of microbe causes the disease listed in questions 81-90.

81. Typhus
82. Herpes
83. Tetanus
84. Ringworm
85. Anthrax
86. Athlete’s foot
87. Mad Cow Disease
88. Mononucleosis
89. Lyme Disease
90. Malaria
PART 10 : Dichotomous Key

For questions 91-100, identify the specimen & give the name from the key

91. What is specimen A?
92. What is specimen B?
93. What is specimen C?
94. What is specimen D?
95. What is specimen E?
96. What is specimen F?
97. What is specimen G?
98. What is specimen H?
99. What is specimen I?
100. Where would you find these organisms living?

Protozoa specimens

Dichotomous Key to Selected Protozoa

1. Pseudopods for locomotion .................. 2
1. Other means for locomotion .................. 3
2. Dome-shaped shell around cell ............... Diffugia
2. Without shell, many small nuclei .......... Pelomyxa
3. Cell has flagella .............................. 4
3. Cell has cilia ................................. 5
4. One flagellum ................................. Peranema
4. Two flagella ................................. Chilomonas
5. Cilia on stalk ................................ Vorticella
5. Cilia not on stalk ............................ 6
6. Cilia covering cell ............................ 7
6. Cilia in two bands .......................... Didinium
7. Cell is cone-shaped ......................... Stentor
7. Cell is elongated ............................ 8
8. Cigar-shaped cell with flattened end ...... Spirostonum
8. Pear-shaped cell ............................. Blepharisma
MICROBE MISSION

SAMPLE 2

TEAM NUMBER
SCHOOL

STUDENT NAMES: (PLEASE PRINT)

1. __________________________
2. __________________________

RAW SCORE
RANK

BE SURE TO INCLUDE APPROPRIATE UNITS WITH ALL ANSWERS!!!

PART 1: Microscopy

1. ________________
2. ________________
3. __________
4. ______
5. ______
6. ______
7. ______
8. ________________
9. ________________
10. ________________

PART 2: Microscope Types

11. ______
12. ______
13. ______
14. ______
15. ______
16. ______
17. ______
18. ______
19. ______
20. ______

PART 3: Relative Size

21. ________________
22. ________________
23. ________________
24. ________________
25. ________________
26. ________________
27. ________________
28. ________________
29. ________________
30. ________________

31. ______
32. ______
33. ______
34. ______
35. ______
36. ______
37. ______
38. ______
39. ______
40. ______

PART 4: Cell Types

PART 5: Major Groups

41. ______
42. ______
43. ______
44. ______
45. ______
46. ______
47. ______
48. ______
49. ______
50. ______

TOTAL Parts 1-5 ______
TOTAL Parts 6-10 ______
TIE-BREAKER ______
RAW SCORE ______
### PART 6: Microbes & Food

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### PART 7: Important Microbes

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### PART 8: Microbes & Ecology

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### PART 9: Microbes & Disease

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### PART 10: Dichotomous Key

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**TOTAL PARTS 6-10**
### Answer Key

**Student Names:** (Please Print)

1. ____________________________  
2. ____________________________

*BE SURE TO INCLUDE APPROPRIATE UNITS WITH ALL ANSWERS!!!*

### Part 1: Microscopy

1. 400X  
2. 40X to 400X  
3. P  
4. B (Diaphragm)  
5. D (Nosepiece)  
6. D (larger & darker)  
7. 7 o’clock  
8. ~1.5 mm ~1500 mcm  
9. protozoa  
10. ~500 mcm

### Part 4: Cell Types

31. C  
32. A  
33. B  
34. B  
35. C  
36. B  
37. A  
38. B  
39. A  
40. D

### Part 2: Microscope Types

11. D  
12. E  
13. A  
14. B  
15. C  
16. D  
17. C  
18. E  
19. A  
20. B

### Part 5: Major Groups

41. F  
42. E  
43. G  
44. A  
45. D  
46. B  
47. F  
48. D  
49. G  
50. C

### Part 3: Relative Size

21. 1000 mcm  
22. 1000 nm  
23. 1,000,000 nm  
24. 800,000 nm  
25. 10,000 nm  
26. 2,000 nm  
27. 1,000 nm  
28. 20  
29. 200  
30. 16,000
**Answer Key**

**PART 6: Microbes & Food**

51. B
52. A
53. B
54. A
55. A, B, C
56. false
57. true
58. true
59. true
60. false

**PART 9: Microbes & Disease**

81. C
82. B
83. C
84. A
85. C
86. A
87. E
88. B
89. C
90. D

**PART 7: Important Microbes**

61. B
62. D
63. A
64. A
65. E
66. D
67. E
68. E
69. B
70. A

**PART 10: Dichotomous Keys**

91. Pelomyxa
92. Stentor
93. Spirostonum
94. Chilomonas
95. Didinium
96. Diffugia
97. Peranema
98. Vorticella
99. Blepharisma
100. in water (pond)

**PART 8: Microbes & Ecology**

71. phytoplankton
72. cyanobacteria algae
73. protozoa
74. bacteria fungi
75. herbivorous zooplankton
76. phytoplankton
77. bacteria & fungi
78. 10%
79. 80 energy units
80. 0.8 energy units