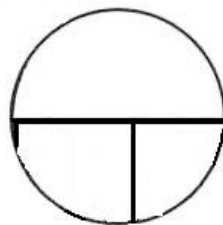
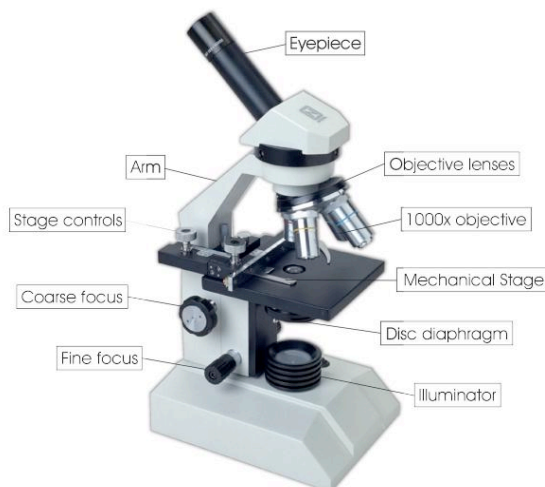


**PART 1: Microscopy** (You are given a microscope with a 10 X ocular and 4, 10, and 40 X objectives.)

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 a 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)?



**Diagram of stage with millimeter ruler (10X objective)**



**Microbe A (10X objective)**

**PART 2: Types of Microscopes**

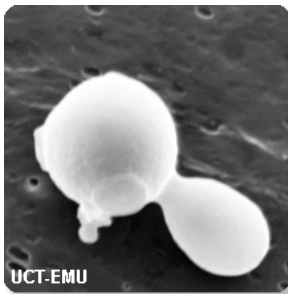
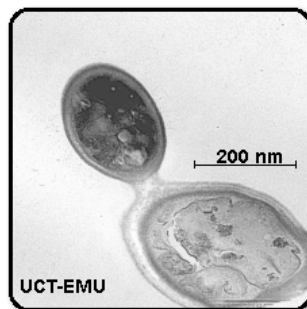
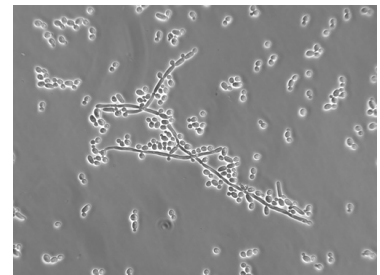
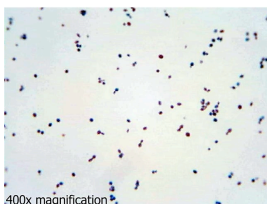
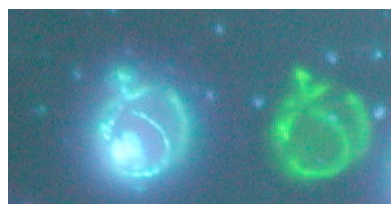
- Key:**
- A. Light microscope**
  - B. Phase Contrast Microscope**
  - C. Florescent Microscope**
  - D. Scanning Electron Microscope**
  - E. Transmission Electron Microscope**

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?

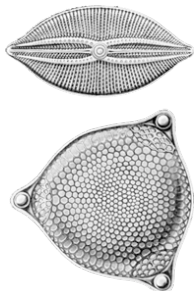
**A****B****C****D****E**

**PART 3: Relative Size of Microbes**

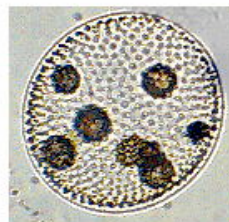
21. How many micrometers (mcm) are in a millimeter (mm)?
22. How many nanometers (nm) are in a micrometer (mcm)?
23. How many nanometers (nm) are in a millimeter (mm)?

Use the microbe images for questions 24-30.

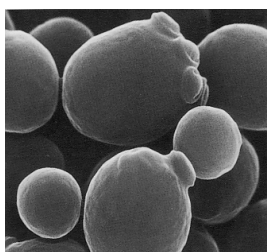
24. What is the size of a **Volvox** in **nanometers**?
25. What is the size of a **yeast** in **nanometers**?
26. What is the size of a **halobacterium** in **nanometers**?
27. What is the size of a **coccus** in **nanometers**?
28. How many **viruses** would fit across the diameter of a **coccus**?
29. How many **viruses** would fit across the diameter of a **yeast**?
30. How many **viruses** would fit across the diameter of a **Volvox**?



**diatom-200 mcm**



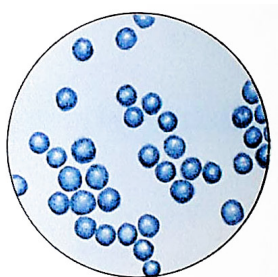
**Volvox-800 mcm**



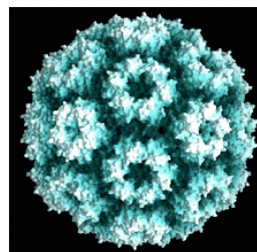
**yeast-10 mcm**



**halobacterium – 2 mcm**



**Coccus – 1 mcm**



**Virus – 50 nm**

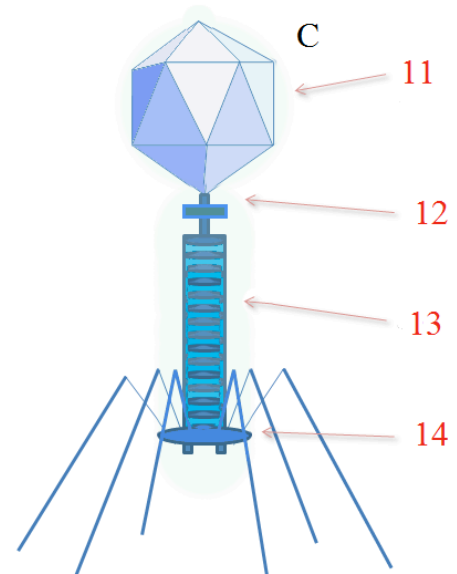
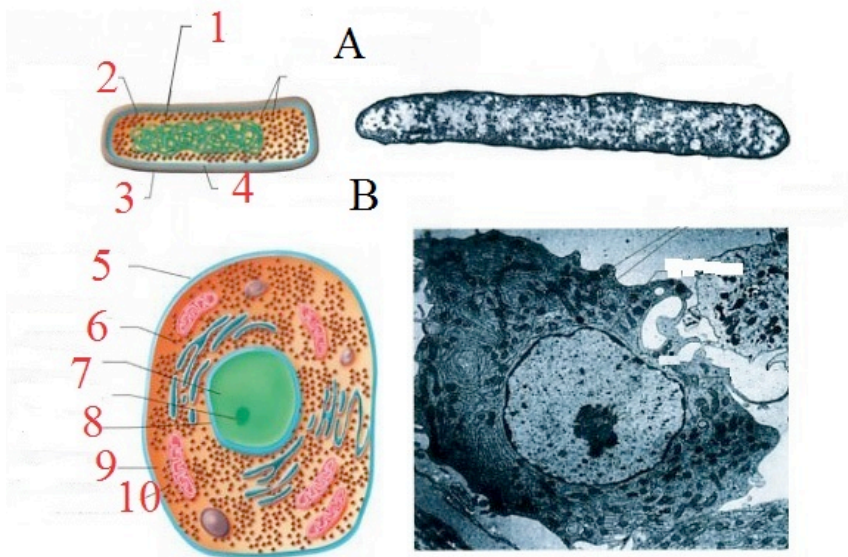
**PART 4: Cell Types**

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)

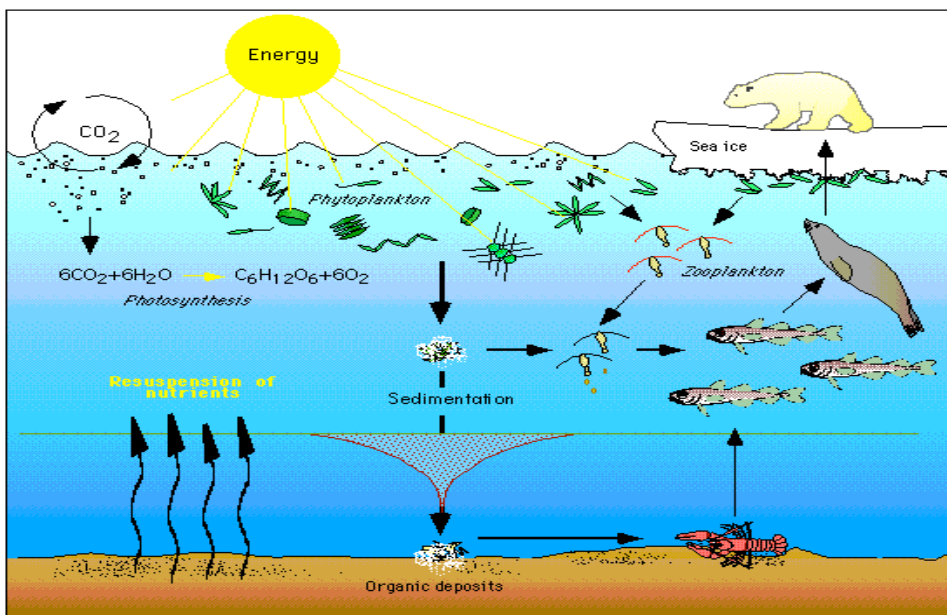
- 61. Baker's Yeast
- 62. Diatoms that form diatomaceous earth
- 63. Oil eating microbes
- 64. Cheese making Lactobacillus
- 65. Sporozoa causing Malaria
- 66. Dinoflagellates that cause red tide
- 67. Paramecium
- 68. Zooplankton in the ocean
- 69. Ruin  $\frac{1}{4}$  to  $\frac{1}{2}$  of fruits and vegetables per year
- 70. Used in sewage treatment plants to breakdown sewage



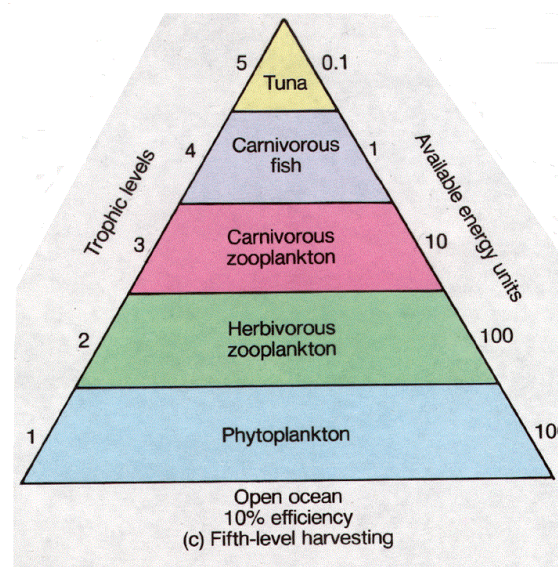
**PART 8: Microbes and Ecology**

**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**

*Drawn by Christopher Krembs*

**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

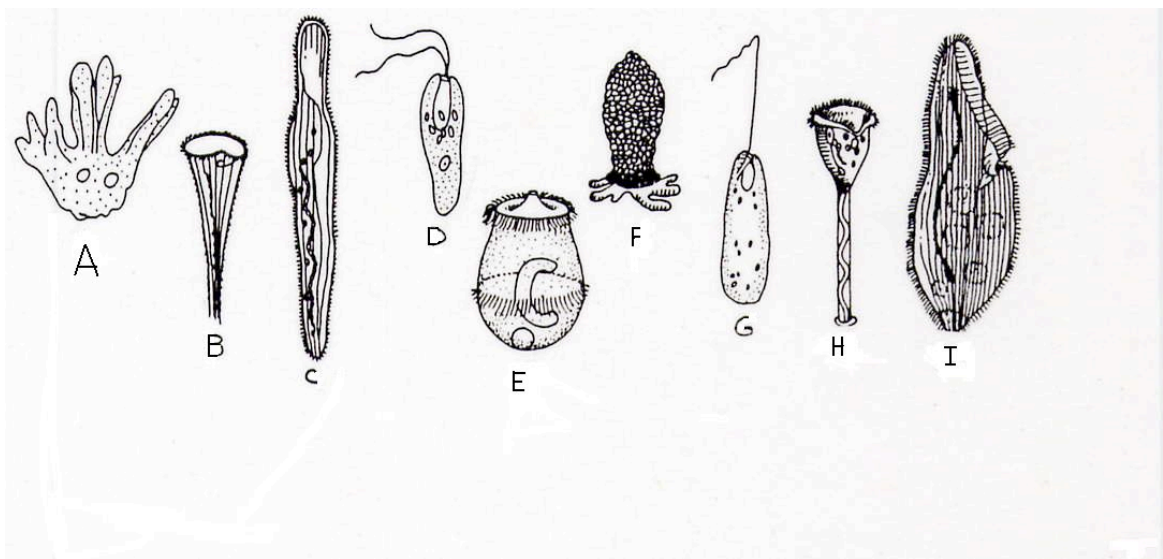


**PART 10 : Dichotomous Key**

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. \_\_\_\_\_  
7. \_\_\_\_\_  
8. \_\_\_\_\_  
9. \_\_\_\_\_  
10. \_\_\_\_\_

**PART 4: Cell Types**

31. \_\_\_\_\_  
32. \_\_\_\_\_  
33. \_\_\_\_\_  
34. \_\_\_\_\_  
36. \_\_\_\_\_  
37. \_\_\_\_\_  
38. \_\_\_\_\_  
39. \_\_\_\_\_  
40. \_\_\_\_\_

**PART 2: Microscope Types**

11. \_\_\_\_\_  
12. \_\_\_\_\_  
13. \_\_\_\_\_  
14. \_\_\_\_\_  
15. \_\_\_\_\_  
16. \_\_\_\_\_  
17. \_\_\_\_\_  
18. \_\_\_\_\_  
19. \_\_\_\_\_  
20. \_\_\_\_\_

**PART 5: Major Groups**

41. \_\_\_\_\_  
42. \_\_\_\_\_  
43. \_\_\_\_\_  
44. \_\_\_\_\_  
45. \_\_\_\_\_  
46. \_\_\_\_\_  
47. \_\_\_\_\_  
48. \_\_\_\_\_  
49. \_\_\_\_\_  
50. \_\_\_\_\_

**PART 3: Relative Size**

21. \_\_\_\_\_  
22. \_\_\_\_\_  
23. \_\_\_\_\_  
24. \_\_\_\_\_  
25. \_\_\_\_\_  
26. \_\_\_\_\_  
27. \_\_\_\_\_  
28. \_\_\_\_\_  
29. \_\_\_\_\_  
30. \_\_\_\_\_

**TOTAL PARTS 1-5** \_\_\_\_\_

**TOTAL PARTS 6-10** \_\_\_\_\_

**TIE-BREAKER** \_\_\_\_\_

**RAW SCORE** \_\_\_\_\_

**PART 6: Microbes & Food**

- 51. \_\_\_\_\_
- 52. \_\_\_\_\_
- 53. \_\_\_\_\_
- 54. \_\_\_\_\_
- 55. \_\_\_\_\_
- 56. \_\_\_\_\_
- 57. \_\_\_\_\_
- 58. \_\_\_\_\_
- 59. \_\_\_\_\_
- 60. \_\_\_\_\_

**PART 9: Microbes & Disease**

- 81. \_\_\_\_\_
- 82. \_\_\_\_\_
- 83. \_\_\_\_\_
- 84. \_\_\_\_\_
- 85. \_\_\_\_\_
- 86. \_\_\_\_\_
- 87. \_\_\_\_\_
- 88. \_\_\_\_\_
- 89. \_\_\_\_\_
- 90. \_\_\_\_\_

**PART 7: Important Microbes**

- 61. \_\_\_\_\_
- 62. \_\_\_\_\_
- 63. \_\_\_\_\_
- 64. \_\_\_\_\_
- 65. \_\_\_\_\_
- 66. \_\_\_\_\_
- 67. \_\_\_\_\_
- 68. \_\_\_\_\_
- 69. \_\_\_\_\_
- 70. \_\_\_\_\_

**PART 10: Dichotomous Key**

- 91. \_\_\_\_\_
- 92. \_\_\_\_\_
- 93. \_\_\_\_\_
- 94. \_\_\_\_\_
- 95. \_\_\_\_\_
- 96. \_\_\_\_\_
- 97. \_\_\_\_\_
- 98. \_\_\_\_\_
- 99. \_\_\_\_\_
- 100. \_\_\_\_\_

**PART 8: Microbes & Ecology**

- 71. \_\_\_\_\_
- 72. \_\_\_\_\_
- 73. \_\_\_\_\_
- 74. \_\_\_\_\_
- 75. \_\_\_\_\_
- 76. \_\_\_\_\_
- 77. \_\_\_\_\_
- 78. \_\_\_\_\_
- 79. \_\_\_\_\_
- 80. \_\_\_\_\_

**TOTAL PARTS 6-10** \_\_\_\_\_

**ANSWER KEY**

TEAM NUMBER \_\_\_\_\_  
 SCHOOL \_\_\_\_\_

STUDENT NAMES: (PLEASE PRINT)

1. \_\_\_\_\_  
 2. \_\_\_\_\_

RAW SCORE \_\_\_\_\_  
 RANK \_\_\_\_\_  
 POINTS \_\_\_\_\_

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

**PART 1: Microscopy**

1. 400X
2. 40X to 400X
3. P
4. B (Diaphram)
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 7: Important Microbes**

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

**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

**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 10: Dichotomous Keys**

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