

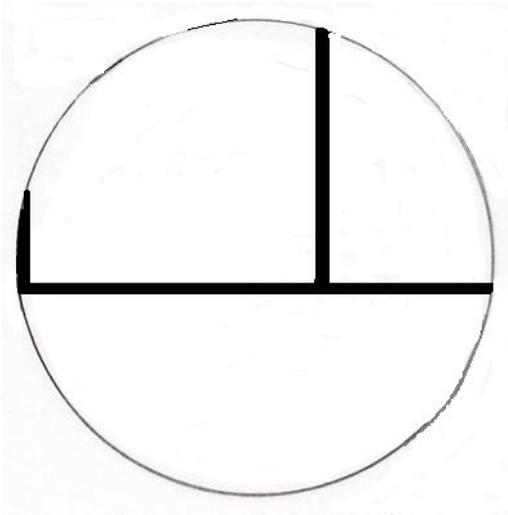
CELL BIOLOGY – SAMPLE 2

STATION A: MICROSCOPY

1. What is the range of magnification of the microscope at this station?
2. If a slide with FJ is placed in the normal reading position on this microscope, how will the FJ appear when observed under the lowest power of this microscope? Draw it on your answer sheet.
3. Refer to the diagram with the metric ruler in the field of view of the 10X objective. What is the diameter of this field of view in millimeters? in micrometers?
4. Assume that Diagram A was obtained by photographing these organisms in the same 10X field of view as the metric ruler, what is the approximate length of organism A in micrometers?
5. What would be the diameter of the high power field of view (40X) on this microscope in micrometers? (Remember that it must be calculated using the diameter of the 10X field of view from question 3 because it is less than 1 millimeter.)
6. If 160 cells were visible under the 10X field of view, how many cells should be visible under the 40X field of view of the same microscope?
7. Which diagram (B or C) is from a scanning electron microscope? How do you know?
8. What is the approximate area of the micrograph labeled diagram B?
9. Examine the slide under the microscope? Is the organism on the slide larger or smaller than organism A of diagram A?
10. How would you determine the third dimension of the organism on the slide.

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STATION A: MICROSCOPY



Stage with Metric Ruler - 10X objective



Diagram A

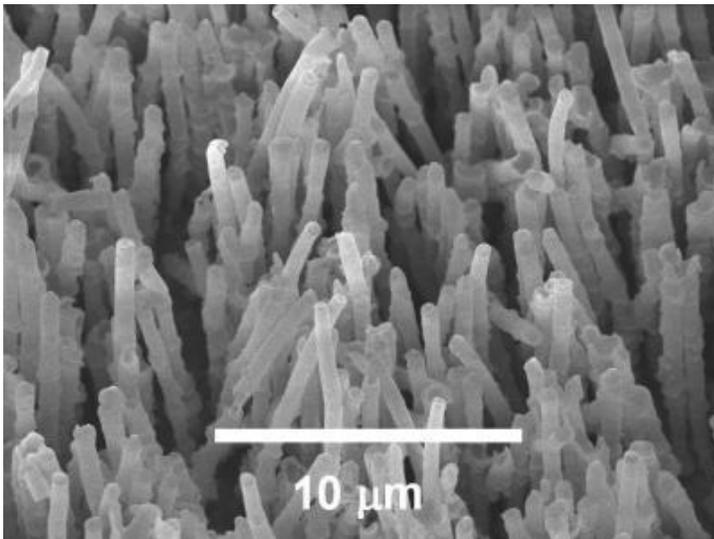


Diagram B

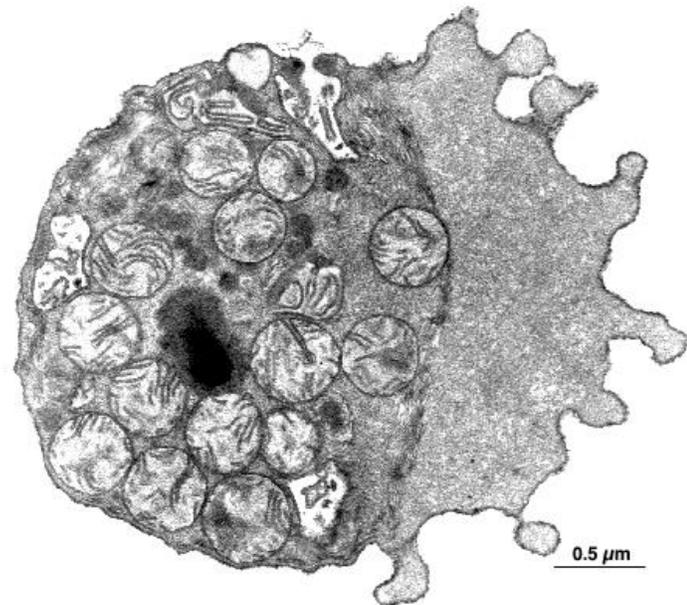


Diagram C

CELL BIOLOGY – SAMPLE 2

STATION B: TECHNIQUES/EQUIPMENT

Match the following techniques/equipment with a possible use. Each numbered question will have only one answer. Some answers may be used more than once, others not all. Use capital letters.

- A. Electrophoresis
- B. Centrifugation
- C. Light microscope
- D. Scanning electron microscope
- E. Transmission electron microscope
- F. Metric ruler
- G. Spectrophotometer
- H. Paper chromatography
- I. Answer not given

- 11. Examining the surface of cells.
- 12. Looking at the internal structure of chloroplasts.
- 13. Watching cells with flagella move.
- 14. Determining the speed of snails.
- 15. Separating proteins based on charge.
- 16. Determining how much of a colored product is produced.
- 17. Separating pigments of a leaf.
- 18. Determining how much water a plant needs.
- 19. Determining which kinds of cell have the largest number of lysosomes.
- 20. Isolating nuclei from cells.

CELL BIOLOGY – SAMPLE 2

STATION C: ORGANELLES/STRUCTURES

Refer to the cell models (1 and 2) and the letters on the organelles for each model in answering the questions.

- 21. Which model (1 or 2) is a plant cell? How can you tell?**
- 22. Two of the organelles represented on these models contain their own DNA which is similar to that of bacteria and they can reproduce independent of the rest of the cell. Name these two organelles.**

For questions 23-30, the function of an organelles will be given. Name the organelle and then list the number from the models which represent that organelle. If it has a letter on both models, list them both

- 23. Control center of the cell**
- 24. Internal transport system and site of many chemical reactions**
- 25. Powerhouse of the cell**
- 26. Protective covering around a plant cell**
- 27. Packaging center of the cell for secreted materials**
- 28. Site of photosynthesis in plant cells**
- 29. Storage for liquids and crystals – Helps plants with turgor pressure**
- 30. Recycling center – has enzymes to digest proteins**

CELL BIOLOGY – SAMPLE 2

STATION C: ORGANELLES/STRUCTURES

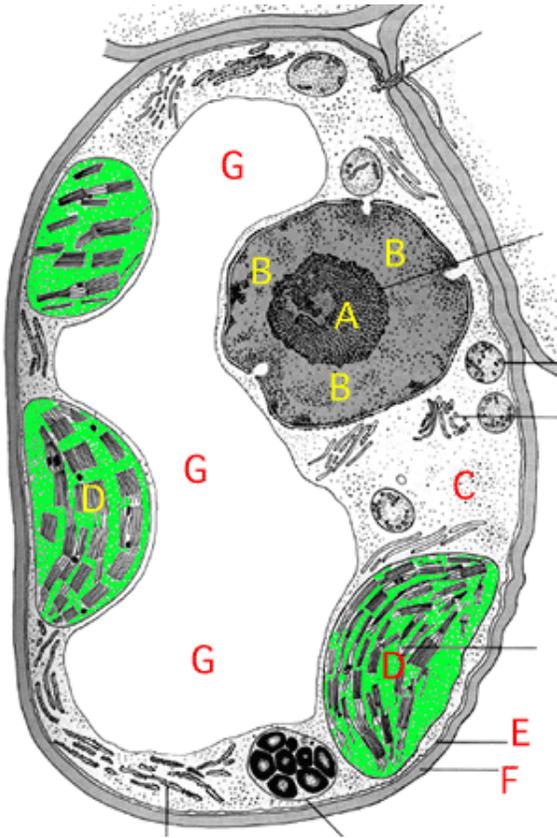


DIAGRAM 1

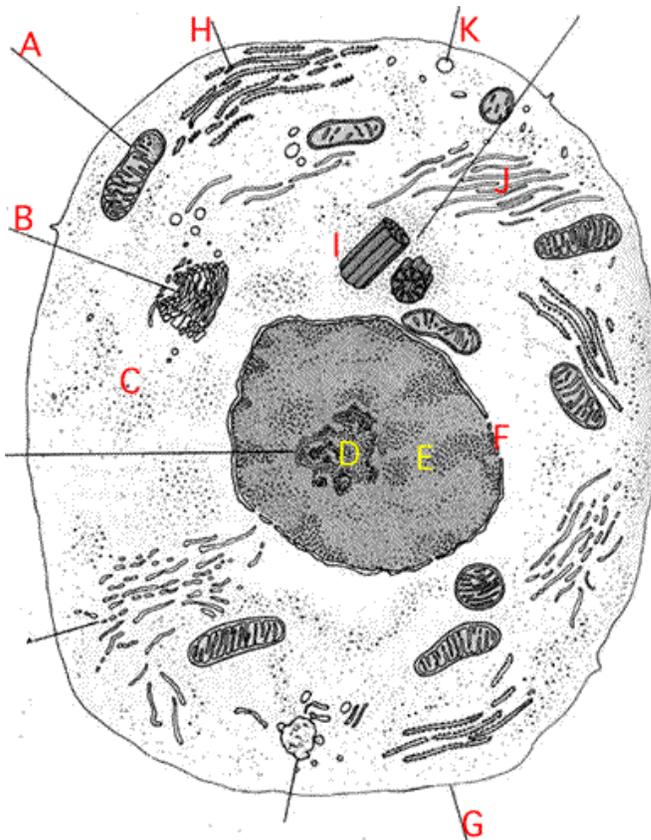


DIAGRAM 2

CELL BIOLOGY – SAMPLE 2

STATION D: MONOMERS AND POLYMERS

Examine the food label for a spaghetti dinner and answer the following questions.

- 31. When the fats are digested, what monomers will be formed?**
- 32. When the carbohydrates are digested, what monomers will be formed?**
- 33. When the proteins are digested, what monomers will be formed?**
- 34. How many of the calories for one serving are from protein?**
- 35. How many of the calories for one serving are from total carbohydrates?**
- 36. What percent of the calories are from total fat?**
- 37. What percent of one serving is from total carbohydrate?**
- 38. How many of the 326 grams per serving are from protein, total fat, or total carbohydrate?**
- 39. What makes up the majority of the rest of the grams per serving that are not protein, fat, or carbohydrate?**
- 40. Why are the vitamins and minerals so important in our food?**

CELL BIOLOGY – SAMPLE 2

STATION D: MONOMERS AND POLYMERS

| Nutritional Facts: | Amount/serving | % DV* |
|----------------------------|---------------------------------|--------------|
| Serving size: 1pkg (326 g) | Total Fat 4 g | 6% |
| Servings per container 1 | saturated fat 1g | 5% |
| Calories 300 | polyunsaturated fat 1g | |
| | monounsaturated fat 1.5 g | |
| | Cholesterol 15 mg | 4% |
| | Sodium 510 mg | 20% |
| | Total Carbohydrates 51 g | 17% |
| | Dietary fiber 5g | 20% |
| | Sugars 9g | |
| | Protein 13g | |

Vitamin A – 15%* Vitamin C – 4%* Calcium – 6%* Iron – 10%*

Ingredients: Cooked spaghetti, tomatoes, water, beef, mushrooms, onions, bleached flour, salt, parmesan cheese, beef flavor, soy sauce, pepper

Calories per gram: Fat 9 Carbohydrates 4 Protein 4

* Percent Daily Values (DV) are based upon a 2000 calorie diet

CELL BIOLOGY – SAMPLE 2

STATION E: MEMBRANES & TRANSPORT

For questions 41-45, use the diagrams showing the 2% sucrose dialysis tubing being added to the three solutions in the beaker.

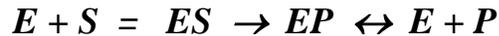
- 41. Is sucrose able to move through the dialysis tubing?**
- 42. What is moving in and out of the dialysis tubing?**
- 43. Which beaker solution is isotonic with the solution inside the dialysis tubing?**
- 44. Which beaker solution is hypertonic with the solution inside the dialysis tubing?**
- 45. Which beaker solution is hypotonic with the solution inside the dialysis tubing?**

For questions 46-50, use the diagrams of the plants and plant cells A-C. Assume that the plant has been watered in diagram A with tap water.

- 46. What type of pressure is being applied to the inside of the cell wall in figure A?**
- 47. What is causing the inside of the cell to change in figure's B and C?**
- 48. What is the term for the process displayed in Figure C?**
- 49. What would happen in figure A if the plant was watered with distilled water?**
- 50. What would happen in figure A if the plant was accidentally watered with a solution of salt water?**

CELL BIOLOGY – SAMPLE 2

STATION F: ENZYMES AND ACTIVATION ENERGY

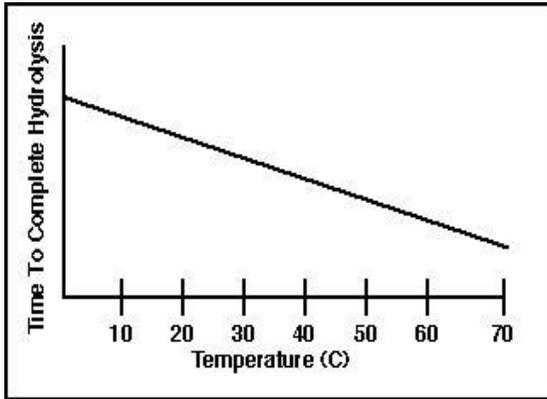


Where E, S, and P are enzyme, substrate, and product respectively

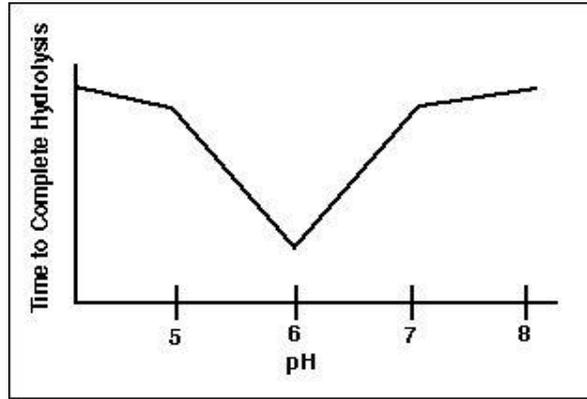
51. How does an enzyme affect the amount of activation energy needed to start a reaction?
52. What does the ES represent in the above equation?
53. Why is the E on both sides of the equation?
54. Examine the graphs provided. What factors affect the rate of reactions involving enzymes?
55. Graph E is the effect of temperature on the operation of an enzyme. At what temperature does this enzyme work the fastest?
56. If the temperature were raised above boiling, the enzyme would be denatured. What happens when an enzyme is denatured?
57. Graphs B and F show the effect of pH on two different enzymes. At what pH does the enzyme in B work most effectively? What pH was most effective for the enzyme in F?
58. Graphs A – D were based on reactions using amylase. What would be the substrate if amylase is the enzyme?
59. What type of indicator could be used to test for the presence of the substrate that amylase will catalyze? What color will the indicator turn if the substrate is present?
60. Based upon your knowledge of enzymes, why does adding lemon juice to a freshly peeled apple prevent it from turning brown?

CELL BIOLOGY – SAMPLE 2

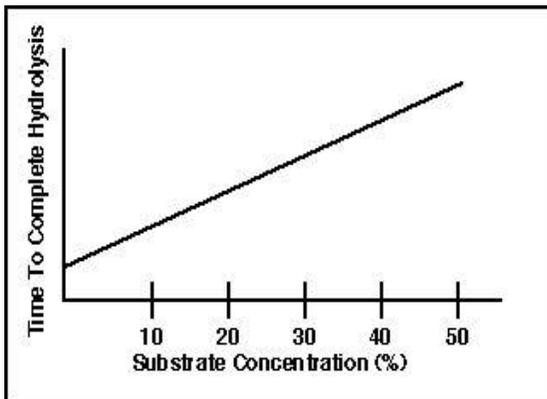
STATION F: ENZYMES AND ACTIVATION ENERGY



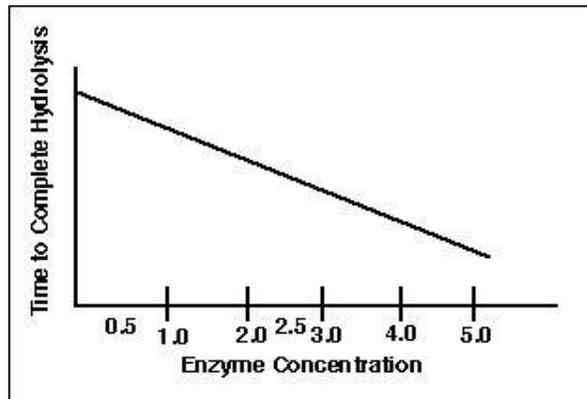
A



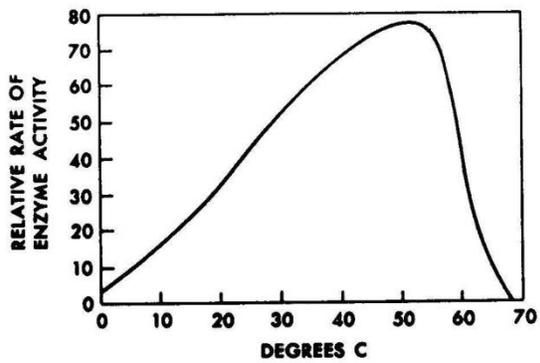
B



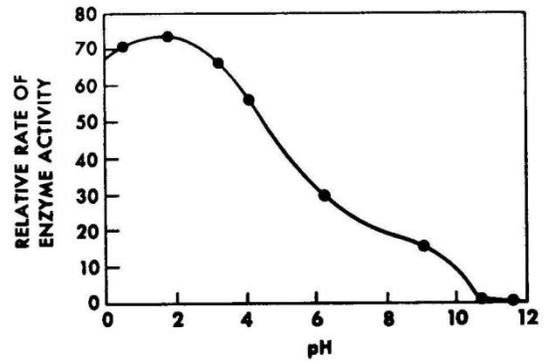
C



D



E



F

CELL BIOLOGY – SAMPLE 2

STATION G: pH and Buffers

The pH paper and the pH probe were used to determine the pH of 5 different solutions. Below are the results.

| | pH paper | pH Probe |
|--------------|----------|----------|
| Solution A - | 3 | 4.4 |
| Solution B - | 8 | 8.4 |
| Solution C - | 5 | 5.3 |
| Solution D - | 3 | 3.3 |
| Solution E | 7 | 7.0 |

Use the data and the pH of common items in answering the questions.

61. Which of the common items might Solution A be?
62. Which of the common items might Solution B be?
63. Which of the common items might Solution C be?
64. Which of the common items might Solution D be?
65. Account for the deviation in the results of solution A between the pH paper and the probe? What is the advantage of using the probe over using the pH paper?
66. Which Solutions (A-E) are basic? List them from strongest to weakest base.
67. Which Solutions (A-E) are acidic? List them from strongest to weakest acid.
68. How many times more hydrogen ions are there in Solution A than in Solution B? Use the results from the probe.
69. How is the body able to keep blood at a pH of about 7.4?
70. If a person is hyperventilating, it will change the pH of the blood because carbonic acid is being removed from the blood? How will this change the pH of the blood?

CELL BIOLOGY – SAMPLE 2

pH of Common Items

| pH | Common Items |
|-----------|----------------------|
| 1.0 | battery acid |
| 2.0 | lemon juice |
| 2.2 | vinegar |
| 3.0 | apples |
| 3.5 | soft drink |
| 4.0 | wine |
| 4.5 | tomatoes |
| 5.6 | unpolluted rainwater |
| 6.6 | milk |
| 7.0 | pure water |
| 7.4 | human blood |
| 8.3 | baking soda solution |
| 8.4 | sea water |
| 10.5 | milk of magnesia |
| 11.0 | household ammonia |
| 12.4 | lime |
| 13.0 | lye |

CELL BIOLOGY – SAMPLE 2

STATION H: PHOTOSYNTHESIS AND RESPIRATION

Examine the Coleus leaves provided.

71. Why were these leaves boiled?
72. The iodine is used to test for the presence of what substance?
73. What cell process occurred in the edges of this leaf to produce the product indicated by the iodine? (Photosynthesis, Respiration, Both)
74. Which processes do Coleus leaves perform? (Photosynthesis, Respiration, Both)
75. Which of the following is the correct equation for photosynthesis?
 - a. $\text{CO}_2 + \text{H}_2\text{O} + \text{Light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
 - b. $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Light}$
 - c. $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light}$
 - d. $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

For questions 76-80, indicate whether the statement is true or false.

76. In cellular respiration, most of the ATP is made in the electron transport system.
77. Plants do not use the Krebs cycle.
78. Glycolysis occurs in the mitochondria.
79. Carbon dioxide is used in the light independent reactions.
80. Glucose must be phosphorylated before it can be broken down.

CELL BIOLOGY – SAMPLE 2

STATION H: PHOTOSYNTHESIS AND RESPIRATION



On the far left is the original Coleus leaf. The middle pictures are at various stages after being boiled and the final leaf, on the far right, has been covered with Iodine.

CELL BIOLOGY – SAMPLE 2

STATION I: CELL CYCLE

Use the Cell Cycle Diagram in answering the questions 81-85.

- 81. Which phases make up the Interphase portion of the cell cycle?**
- 82. Name the four mitotic phases in the correct order.**
- 83. What happens during the S phase?**
- 84. What happens during the G₁ phase?**
- 85. What happens during the G₂ phase?**

Examine the cell models and use the letter on the model to answer questions 86-89.

- 86. Which of the models represent activities during prophase?**
- 87. Which of the models represent activities during metaphase?**
- 88. Which of the models represent activities during anaphase?**
- 89. Which models represents activities during telophase?**

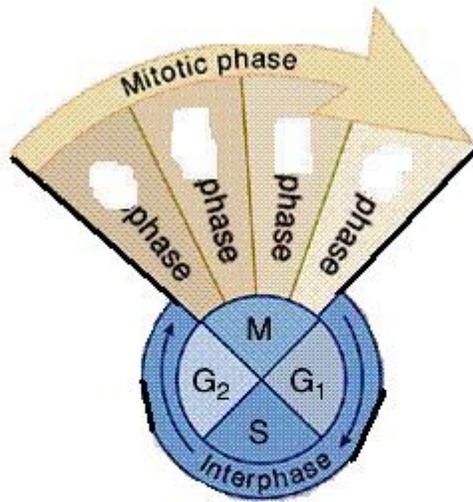
Examine the Cell Cycle Control System diagram.

- 90. There are three check-points for the control the cell cycle. What is “checked” at each of these points?**

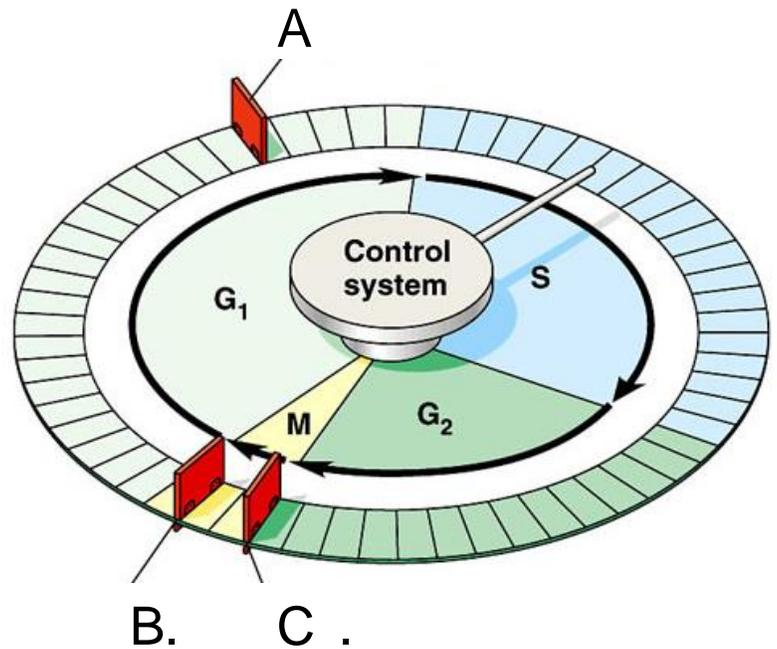
CELL BIOLOGY – SAMPLE 2

STATION I: CELL CYCLE

CELL CYCLE DIAGRAM



CELL CYCLE CONTROL SYSTEM



CELL BIOLOGY – SAMPLE 2

STATION J: CELL TYPES

91-100. On your answer sheet, compare the characteristics of viruses, prokaryotic cells and eukaryotic cells. Feel free to use diagrams to assist you.

CELL BIOLOGY – SAMPLE 2

STUDENT NAMES: (PLEASE PRINT)

1. _____
2. _____

RAW SCORE _____

RANK _____

POINTS _____

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

STATION A: Microscopy

1. 40X to 1000X
2. FJ inverted & reversed
3. ~ 1.6 mm ~ 1600 mm
4. ~ 600-700 mcm
5. ~ 400 mcm
6. 10 cells
7. B it is 3D
8. ~ 400 sq. mcm
9. smaller
10. focus up & thru object

STATION B: Techniques

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

STATION C: Organelles

21. diagram 1 cell wall
22. chloroplast & mitochondria
23. nucleus 1B 2E
24. endoplasmic reticulum 2H
25. mitochondria 2A
26. cell wall 1F
27. Golgi Apparatus 2B
28. chloroplast 1D
29. vacuole 1G
30. lysosome 2K

STATION D: Monomers/Polymers

31. glycerol & fatty acids
32. simple sugars
33. amino acids
34. 52 calories (protein)
35. 204 cal. (total carbs)
36. 1.2% of cal (total fat)
37. 15.6% per serving (total carbs)
38. 68 grams
39. water
40. raw materials for items
cells can't produce

STATION E: Membranes/Transport

41. no
42. water
43. 2% sucrose B
44. 10% sucros C
45. distilled water A
46. tugor pressure
47. cell using or losing water
48. plasmolysis
49. greater tugor pressure
50. less tugor pressure
cell could lose water

STATION F: Enzymes

51. decreases
52. enzyme-substrate complex
53. enzyme is not changed
54. temp, pH, enzyme concentration
55. ~52 degrees Celcius
56. 3D structure is broken
57. 6 2
58. starch
59. iodine brown
60. changes pH so enzyme
can't work

Stations G - J are on the back of the answer sheet.

CELL BIOLOGY – SAMPLE 2

CELL BIOLOGY

STATION G: pH and Buffers

61. wine or tomatoes
62. baking soda or sea water
63. unpolluted rain water
64. apples or soft drink
65. more specific/no color problems
66. B
67. D A C B
68. 10^4
69. buffers
70. more basic-higher pH

STATION I: Cell Cycle

81. G₁ s G₂
82. pro,meta,ana,telo (phases)
83. DNA replicates
84. growth & cell activities
85. growth & prepare for mitosis
86. D
87. A
88. C
89. D
90. cell damage

STATION H: Photosynthesis/Respiration

71. remove chlorophyll
72. starch
73. photosynthesis
74. both
75. d
76. True
- .
77. False
78. False
79. True
80. True

STATION J: Cell types

91. - 100.

Viruses:

- * noncellular infectious agents
- * has DNA or RNA + protein coat
- * can only be replicate after invading a host cell & subverting

the host cell machinery

Prokaryotic

- * single celled - often walled
- * lack membrane bound organelles
- * have cell membrane
- * have ribosomes
- * have DNA & RNA
- * require energy

Eukaryotic:

- * cells with membrane bound organelles
- * may be in colonies
- * nuclear DNA with a membrane
- * have cell membrane
- * have ribosomes
- * have DNA & RNA
- * require energy

**After Station J proceed to
Station A - microscope**

Stations A - F are on the front of the answer sheet.