

08 CELL BIOLOGY SAMPLE TOURNAMENT

by Karen L. Lancour

Station A:

Use the experimental setup with cells in beakers of solutions. Each beaker contains either distilled water, 7%NaCl or 12%NaCl.

1. What process is being studied in this experiment?
2. In which beaker(s) is the solution outside the cell made up of distilled water?
3. In which beaker(s) is the solution inside the cell hypotonic?
4. In which beaker(s) are the cells experiencing plasmolysis?
5. In which beaker(s) are the cells demonstrating an increase in turgor pressure?

Station B:

Examine the data on the cell cycle of normal and cancerous cells.

6. In which phase does a cell spend most of it's life?
7. In which phase does a cell spend the smallest amount of time?
(Give the name from the data table and the letter from the diagrams.)
8. How many minutes does it take a normal cell to complete the cell cycle?
9. How many minutes does it take a cancerous cell to complete the cell cycle?
10. During which phase is the time most greatly reduced in the cancerous cells? Why is it so greatly reduced?

TIME FOR MITOSIS OF NORMAL AND CANCEROUS CELLS

| | NORMAL CELL IN MIN. | CANCEROUS CELLS IN MINUTES |
|-------------------|----------------------------|-----------------------------------|
| INTERPHASE | 540 | 380 |
| PROPHASE | 60 | 45 |
| METAPHASE | 11 | 10 |
| ANAPHASE | 3 | 3 |
| TELOPHASE | 11 | 10 |

CONDUCTED BY THE CANCER RESEARCH CENTER

Station C:

Examine the diagrams of the microscopes and the photos taken using these microscopes.

11. Give the letter of the diagram which illustrates the operation of a light microscope.
12. Give the letter of the diagram which illustrates the operation of a scanning electron microscope.
13. Give the letter of the diagram which illustrates the operation of a transmission electron microscope.
14. Which microscope can examine a living organism. Give the letter of the diagram and name of the microscope.
15. This photo was taken using which of these kinds of microscopes. Give the letter of the diagram and the name of the microscope.

Station D:

Examine the graphs regarding enzymes and chemical reactions.

16. Give the letter of the graph that would illustrate the type of chemical reaction involved in photosynthesis? (C or D)
Justify your answer.
17. Give the letter of the graph that would illustrate the type of chemical reaction involved in respiration? (C or D)
Justify your answer.
18. What is the optimal pH for pepsin?
19. What is the Human optimal temperature?
20. What is wrong with the graphs concerning pH and temperature affecting the rate of reactions?

Station E:

The nitrogen base sequence along the coding strand of DNA is
GAATTCATGCC

21. What will be the sequence of codons along the mRNA produced by this coding strand of DNA?
22. What will be the sequence of anticodons on the tRNA that will attach to this mRNA?
23. What are the stop codons for M-RNA?
24. How many amino acids will be produced from the codons on the M-RNA? What will be the first one?
25. If a mutation occurred in that DNA coding strand changing **GAA** to **CAA**, what would be the new M-RNA codon and it's amino acid?

Station F:

Examine the **items** and use the **indicator key** to answer the questions.

ITEMS INCLUDE THE FOLLOWING: CORN SYRUP, EGG WHITE, BUTTER, CRACKERS, AND A SOLUTION OF WATER THAT A GAS WAS BUBBLED INTO WITH A STRAY.

26. Which indicator(s) should be used to test for the main ingredient in the **Corn Syrup**?
27. Which indicator(s) should be used to test for the main ingredient in the **Egg White**?
28. Which indicator(s) should be used to test for the main ingredient in the **Butter**?
29. Which indicator(s) should be used to test for the main ingredient in the **Crackers**?
30. Which indicator(s) should be used to test for the **carbon dioxide** bubbled into water.

CHEMICAL ANALYSIS - INDICATOR KEY

- A. BIURET REAGENT TEST
- B. BENEDICT'S SOLUTION
- C. NITRIC ACID TEST
- D. IODINE
- E. BROWN PAPER BAG TEST
- F. GLUCOSE TEST STRIPS
- G. pH PAPER
- H. NINHYDRIN TEST
- I. BROMTHYMOL BLUE

Station G:

Use the data concerning the parental case and answer the following questions.

31. What is the blood type of the child? What is its genotype?
32. What is the blood type of the mother? What is her genotype?
33. What are the blood types of the possible fathers ?
34. Based upon the blood types, which of the possible fathers **could be** the biological father of the child?
35. Based upon all of the evidence, which of the possible fathers is **most likely** the father of the child?

Station H:

Any cell that is carrying on photosynthesis is also carrying on respiration. On the average, if a plant is to grow, the photosynthesis rate must exceed the rate of respiration by a factor of at least three.

Examine the graph provided and answer the questions.

36. At what temperature is the compensation point reached in this experiment?
37. At what temperature would you expect the growth to be most rapid? Why?
38. Where in the plant cell would photosynthesis occur and at what temperature does it reach it's peak rate for this plant?
39. Where in the plant cell would respiration occur and at what temperature does it reach it's peak rate for this plant?
40. Certain foods such as apples are frequently stored under refrigeration in a carbon dioxide rich atmosphere. How would this help to keep the fruit fresh?

Station I:

Examine the diagram of agar cubes. Assume each cube represents the shape of a particular cell.

41. What is the surface area of the 1.0 mm cube?
42. What is the volume of the 1.0 mm cube?
43. Which cell would have the greatest surface area to volume ratio?
44. Which cell would probably have the slowest metabolic rate? Why?
45. How might the shape of these cells be changed to allow for greater size while maintaining a great surface area to volume ratio? **Draw the cell shapes.**

Station J:

Use the key of scientific processes to identify the correct procedure to accomplish each of the following tasks.

46. Separate a homogenous mixture of cell organelles.
47. Produce a micrograph of a mitochondrion.
48. Examine a print of a person's chromosomes to determine if the chromosome number and size is correct.
49. Separating fragments of DNA by size of fragments.
50. Breaking up cells so the components can be separated.

Key:

- A. gel electrophoresis
- B. electron microscopy
- C. light microscopy
- D. centrifugation
- E. pH measurement
- F. spectrophotometry
- G. karyotyping
- H. fragmentation

**SAMPLE TOURNAMENT
CELL BIOLOGY**

SCHOOL NUMBER _____
SCHOOL _____
STATE _____

STUDENT NAMES: (PLEASE PRINT)

1. _____
2. _____

RAW SCORE _____
RANK _____
POINTS _____

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

STATION A:

1. _____
2. _____
3. _____
4. _____
5. _____

STATION F:

26. _____
27. _____
28. _____
29. _____
30. _____

STATION B:

6. _____
7. _____
8. _____
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10. _____

STATION G:

31. _____
32. _____
33. _____
34. _____
35. _____

STATION C:

11. _____
12. _____
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14. _____
15. _____

STATION H:

36. _____
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40. _____

STATION D:

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STATION I:

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45. _____

STATION E:

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24. _____
25. _____

STATION J:

46. _____
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48. _____
49. _____
50. _____