

Bio Process 2008 Instructions

This event can be run either as stations or purely paper pencil. I have submitted it to be used in a station format.

Obviously, it will need many sheets of paper for desk type situation. If doing stations, in an ideal world, each page should be put in a plastic sleeve and the sleeves taped to the table. At any rate, the questions should be taped down, and students reminded repeatedly not to write on the questions. Probably a good idea to pass out some sheets of scrap paper to each team before the event begins.

The event has 10 stations and a total of 60 questions. Have students print name on a cover sheet provided by you and it's a good idea to have them put this on their answer sheet as well. Make them do this before they get started. Give 4 minutes per station. Remind students not move to the next station until told to do so. **If an answer asks for a letter, use capital letters only. Lower case letters will be counted wrong.** Be sure you check the questions at a station with the correct numbers on the answer sheet. You will not be able to return to any station.

Please contact me if you have any questions. Bill Wellnitz (wwellnit@aug.edu)

Event Provided by Georgia

Station A (Questions 1-5)

1. How many 1 cc cubes can fit into a box that is a cubic meter in volume?
2. Convert 3.473 kg to grams.
3. Express 6738 mm in meters. Your answer should have a decimal in it, and should have the following form: 34.28 m
4. What metric unit would be the best to express the mass of 10 gal of water ? (1 gal water has mass of about 8.2 pounds)
5. What metric unit would be the best to express the distance traveled by a snail in 1 minute?

Station B (Questions 6-9)

Questions 6-7 involve the following information:

Serving size 85 g
Calories/serving 400
Fat 24g
Total carbs 43 g
Protein 3 g
Calories per gram carb 4
“ “ “ protein 4
“ “ “ fat 9

6. What per cent of calories in this food come from carbohydrates?
7. Suppose the recommended daily amount of protein is 18 g. If the above food were the only source of protein in the diet, how much (**in grams**) of this food would have to be eaten?
8. Using the table below, which food will have the **least** amount of carbohydrates per 8 oz serving?

Food	Serving size	Carbs/serving
A	2 oz	8 g
B	4oz	18 g
C	6 oz	20g

9. Which of the following would be a good source of fiber?
 - A. cheese sandwich
 - B. macaroni and cheese
 - C. salad
 - D. taco

Station C (Questions 10-19)

For questions 10-13, identify the **dependent** variable in each of the following statements. **YOUR ANSWER MUST BE 4 WORDS OR LESS**

10. Height of bean plants is recorded daily for two weeks.

11. Guinea pigs are tested at different temperatures for 6 weeks, and per cent weight gain is determined.

12. Light absorption of a pigment is measured for different colors of light.

13. Rate of germination of seeds soaked in different salt solutions is calculated.

For questions 14-17, identify the **independent variable** in each of the following. **YOUR ANSWER MUST BE 4 WORDS OR LESS**

14. The pulse rate after different kinds of exercise is determined.

15. Tumors produced after exposure to different wavelengths of light.

16. Number of animals found at different temperatures.

17. Amount of weight gained on various single food diets.

18. When drawing a graph, which variable is placed on the y-axis?

19. Papers are treated with different chemicals and people are asked if they can taste the chemical. What is an appropriate control for this experiment? **YOUR ANSWER MUST BE 4 WORDS OR LESS**

Station D (Questions 20-25)

A scientist collected samples from two different 2m x 2m areas. The results appear in the table below

Sampling area	Organism A	Organism B	Organism C	Organism D	TOTAL
1	20	15	25	40	100
2	87	10	3	0	100
Total	107	25	28	40	200

20. Which sampling area, 1 or 2, has the greatest diversity?
21. What is the population density per square meter of organism A in sampling area 1?
22. What is the population density per square meter of organism A in sampling area 2?
23. What percent of the total number of organisms sampled is organism C?
24. What percent of the organisms in area 1 is represented by organism B?
25. All of the following explanations could explain the differences between the two sampling areas except:
 - A. Area 2 has a predator of D but area 1 does not have the predator.
 - B. Area 1 has more sources of food than area 2.
 - C. Organism C is able to leave to go to different areas.
 - D. Area 1 has a chemical that interferes with the growth of organism D

Station E (Questions 26-35)

For questions 26-28, refer to the following TABLE

YEAR	NUMBER OF PINES PER ACRE	NUMBER OF HARDWOODS PER ACRE
1905	300	37
1910	300	38
1915	273	50
1920	221	78
1925	198	103
1930	152	114

26. How many pines were lost per acre between years 1910 and 1925?
27. What was the percentage increase in hardwoods between 1920 and 1930?
28. All of the following statements could explain the increase in hardwood trees **except**
- A. Pine beetles arrived in the forest in 1913.
 - B. Ecological succession is occurring.
 - C. C. In 1916 the squirrel population exploded, and the squirrels ate all of the acorns.
 - D. The production of newspapers tripled in 1921.
29. Which of the following safety rules is misstated?
- A. When working with chemicals, wearing safety goggles should be done only if the chemicals are not known.
 - B. Closed-toed shoes should be worn in the lab.
 - C. Test tube tongs should be used when handling hot glassware.
 - D. Long hair should be pulled back when working with flames.
30. A person in a tent in the tropical rain forest sees that the thermometer reads 31° . This thermometer is calibrated in which scale?
- A. Degrees Celsius (centigrade)
 - B. Degrees Fahrenheit
 - C. Either scale is possible
 - D. Unable to determine from the information given.

For Questions 31-35, match the temperature with the indicated situation. Some choices may be used more than once, others not at all.

A. -15°C to 0°C ; B. 0°C to 20°C ; C. 35°C to 40°C ; D. $>100^{\circ}\text{C}$

- 31. ice cubes taken from a freezer
- 32. normal human body temperature
- 33. oven for baking bread
- 34. mountain stream in January
- 35. typical temperature in Georgia in late January

Station F (Questions 36-39)

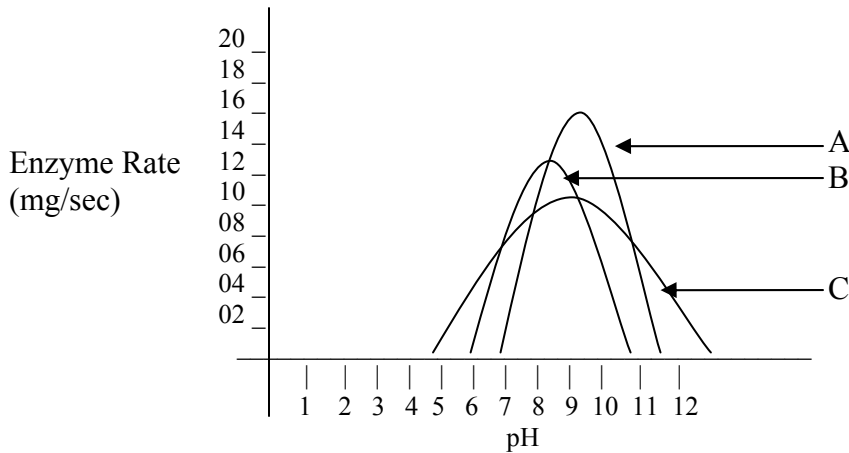
36. Will the cells of a carrot contain chloroplasts?

- A. Yes. A carrot is a plant, and plants carry out photosynthesis.
- B. Yes, but the orange pigments in the carrot will make it difficult to see the chloroplasts.
- C. No, a carrot will not be exposed to light while it is maturing.
- D. No. Photosynthesis occurs only in the spring, and carrots are harvested in the fall.

37. Which of the following statements best describes a single-celled organism that is found to contain cilia?

- A. It probably lives on the skin.
- B. It probably lives in water
- C. It probably can capture its food by grabbing it with the cilia
- D. It probably uses the cilia to hook to other cells with cilia.

38. The three graphs below represent three different enzymes, A, B, C, that are required for growth by a protozoan. What water pH is the best pH for the organism?



39. What is the approximate rate of enzyme C at pH 6? Be sure to use proper units.

Station G (Questions 40-42)

40. Consider the following cross: $Qq \times qq$. If 120 progeny are produced, how many are expected to be qq ?

Use the genotype table below to answer questions 41-42. Tongue rolling is dominant to non-rolling (R vs r). Arched is dominant to flat feet. (A vs a) A couple, each with the genotype $RrAa$, mate and have children.

Sperm

		AR	Ar	aR	ar
Eggs	AR	AA RR	AARr	AaRR	AaRr
	Ar	AARr	AArr	AaRr	Aarr
	aR	AaRR	AaRr	aaRR	aaRr
	ar	AaRr	Aarr	aaRr	aarr

41. What fraction of their children will be non-rollers with arches? Express answer as a fraction.
42. If they have 8 children, how many of their *children* will have arches?

Station H (Questions 43-47)

Two student groups (A and B) were asked to make a key for identifying the following animals: bird, toad, butterfly, monkey, crab, earthworm. The groups had to put all animals EXCEPT one into a group. The animal groups formed by the students were:

Group A: all except the earthworm

Group B: all except the crab

43. Identify the trait Group A used to categorize the animals except the one. **YOUR ANSWER MUST BE 3 WORDS OR LESS**

44. Identify the trait Group B used to categorize the animals except the one. **YOUR ANSWER MUST BE 3 WORDS OR LESS**

Two other student groups (C and D) were asked to make a key for identifying the following animals: shark, goldfish, jellyfish, whale, rattlesnake. The groups had to put all animals EXCEPT one into a group. The animal groups formed by the students were:

Group C: all except the rattle snake

Group D: all but the jellyfish

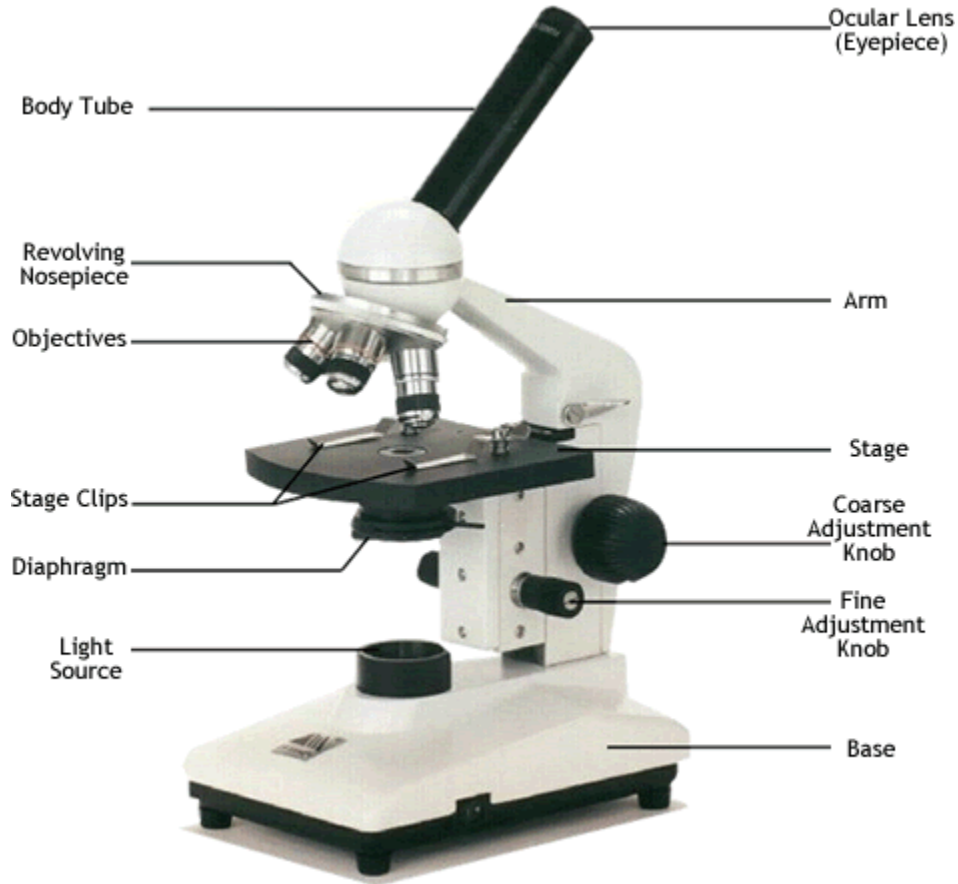
45. Identify the trait Group C used to categorize the animals except the one. **YOUR ANSWER MUST BE 3 WORDS OR LESS**

46. Identify the trait Group D used to categorize the animals except the one. **YOUR ANSWER MUST BE 3 WORDS OR LESS**

47. In which group, A, B, C, or D, would you put an octopus?

Station I (Questions 48-56)

Questions 48-50 at this station pertain to the picture of the microscope below.



48. Which part would be used to regulate the amount of light?

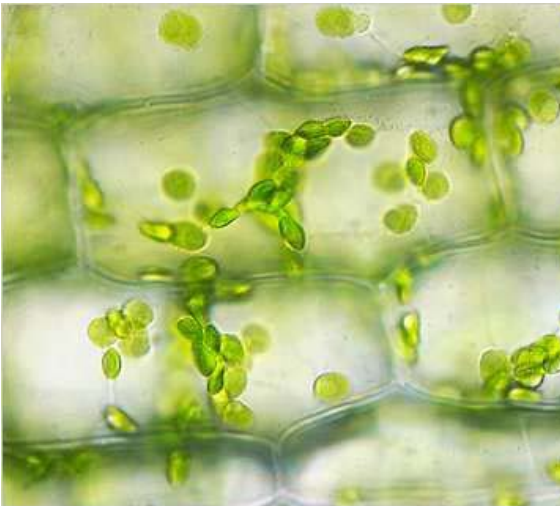
49. Which part is used to change the magnification?

50. Which part is used to provide general focus?

Station I (Continued)

For questions 51-54, match the picture with its correct statement. **USE CAPITAL LETTERS IN YOUR ANSWER.** Some choices will be used more than once, others not at all. Each question will have only one answer.

- A. Could be used to identify cells that are dividing.
- B. Probably plant cells.
- C. These cells carry oxygen to tissues.
- D. No answer given



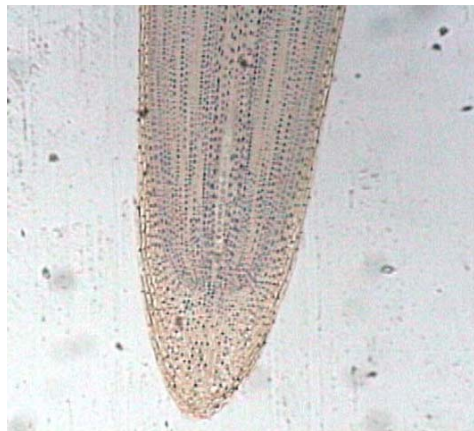
Question 51



Question 52



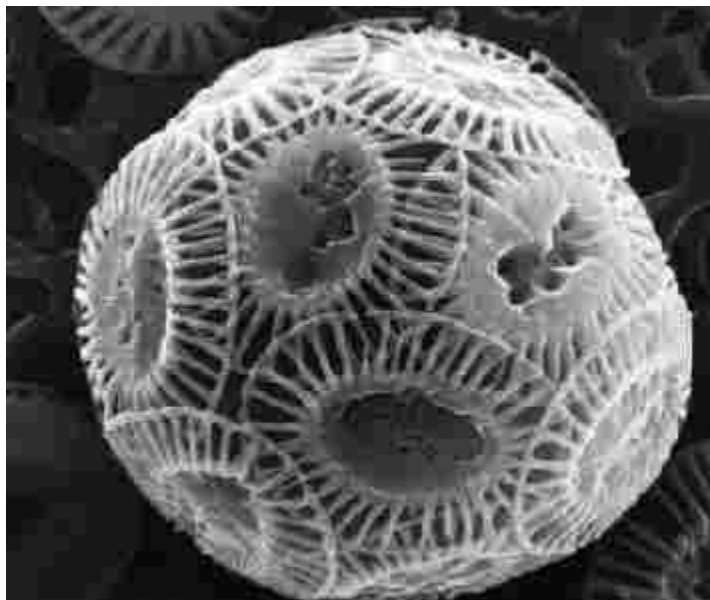
Question 53



Question 54

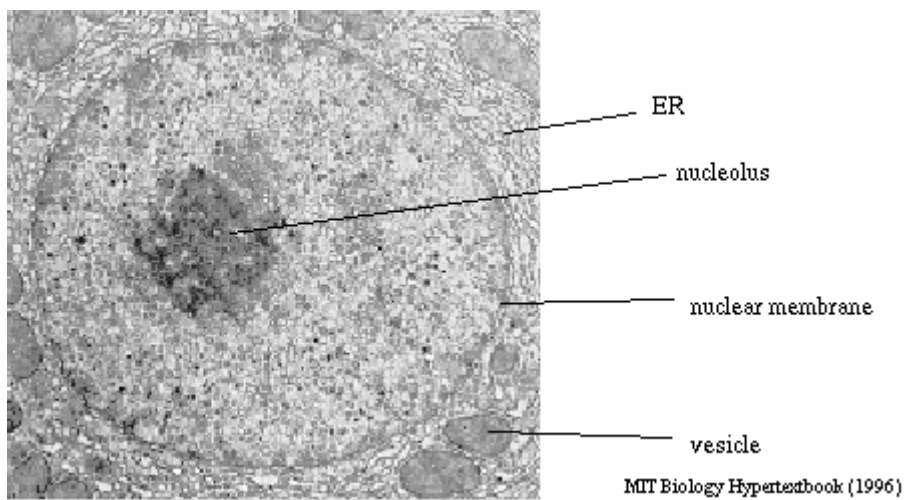
Station I (Continued)

55. What is the approximate diameter of the organism in the picture?



50 μ m

56. What is the approximate diameter of the *nucleus* of the cell in the picture below?



1 μ m

Station J (Questions 57-60)

57. An almost rectangular cell has the following dimensions: 0.01mm x 0.01mm x 2mm. What is volume of cytoplasm? Use proper units.
58. A sample contained $3.2 \times 10^6/\text{cm}^3$ red blood cells and $1.6 \times 10^6/\text{cm}^3$ white blood cells. What percentage of cells were white blood cells?
59. In humans the small intestine is about 25 feet long. There are 2.5 cm/inch. How long in cm is the small intestine?
60. A scientist studies the number of organisms in a circular area with a diameter of 200 m.. What is the approximate area of the field? Use $\pi=3.14$ for your calculations. Be sure to use proper units.

School _____

Names _____

1 _____

2. _____

3. _____

4 _____

5. _____

6. _____

7. _____

8 _____

9. _____

10. _____

11 _____

12. _____

13 _____

14 _____

15 _____

16 _____

17 _____

18 _____

19 _____

20 _____

21 _____

22 _____

23 _____

24 _____

25 _____

26 _____

27 _____

28 _____

29 _____

30 _____

31 _____

32 _____

33 _____

34 _____

35 _____

36 _____

37 _____

38 _____

39 _____

40 _____

41 _____

42 _____

43 _____

44 _____

45 _____

46 _____

47 _____

48 _____

49 _____

50 _____

51 _____

52 _____

53 _____

54 _____

55 _____

56 _____

57 _____

58 _____

59 _____

60 _____

Bio Process Lab Answer Key
DO NOT COPY WITH EVENT!!

- | | |
|--|--|
| 1 cm or mm | 31. A |
| 2. 3473 G | 32. C |
| 3. 6.738 m | 33. D |
| 4 Kg, | 34. B |
| 5. mm or cm | 35. B |
| 6. 43% | 36. C |
| 7. 510 g (3g/85g =18g/x)) | 37 B |
| 8 B | 38 pH 8.5-9.5 |
| 9. C | 39 4-5 mg/sec |
| 10. height (of plant) | 40 60 |
| 11 per cent weight gain | 41 3/16 |
| 12. light absorbed | 42 6 |
| 13. germination rate | 43 THINGS WITH LEGS |
| 14. kind of exercise | 44 LAND ANIMALS |
| 15. wavelength (of light) | 45 AQUATIC ANIMALS |
| 16. temperature | 46 VETEBRATES (BACKBONES) |
| 17. type of food | 47 C |
| 18. dependent | 48. diaphragm |
| 19. paper with no chemical | 49 REVOLVING NOSE PIECE (NOT OBJECTIVE) |
| 20. A | 50. coarse adjustment knob |
| 21. 5 organisms/m ² (20 org/4m ²) | 51 B |
| 22 org/m ² NOT 3.75 | 52 C |
| 23. 14% (28/200) | 53 D |
| 24 15% | 54 A (B OK) |
| 25. D | 55. 125-150 μ m |
| 26 102 pines | 56 about 5 μ m (4.5 to 5 ok) |
| 27. 46% (WITH NO DECIMALS!!) | 57. 2 x 10 ⁻⁴ mm ³ |
| 28. C | 58 33% |
| 29. A | 59 750 cm |
| 30. A | 60. 314 m ² |