GEORGIA STATE MIDDLE SCHOOL SCIENCE OLYMPIAD
LIFE SCIENCE PROCESS SKILLS
GEORGIA STATE UNIVERSITY
APRIL 16, 2005

The test has 10 stations and a total of 56 questions. Print your name and school on the answer sheet. You will have 4.5 minutes per station. Do 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 recorded as incorrect. Be sure to match the questions at a station with the matching numbers on the answer sheet. You will not be able to return to any station.

Station A (Questions 1-5)

1.   How many 1 cc cubes can fit into a box that is a cubic meter in volume?

2.   How many grams are in 3.47 kg?

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 units would be the best to express the mass and volume of a 10 gallon aquarium? (You are to list mass unit first.)

5.   What metric unit would be the best to express the distance traveled by a snail in 1 minute?

Station B (Questions 6-9)

Involve the following information:
Serving size   85 g
Calories/serving   400
Fat   6.0g
Total carbs   43 g
Protein   4 g
Calories per gram   carb 4
Calories per gram   protein 4
Calories per gram   fat   9

6.   What per cent of calories in this food come from carbohydrates?

7.   Suppose the recommended daily amount of protein is 48 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?

Use the following table to answer the question 8.

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

8.   Which food will have the least amount of carbohydrates per 8 0z serving?

9.   Which of the following would be a good source of fiber?
      cheese sandwich
      macaroni and cheese
      salad
      taco

Station C (Questions 10-19)

Identify the dependent variable in each of the following: YOUR ANSWER MUST BE STATED IN THREE WORDS OR LESS. (Question 10 – 13)

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 recorded.

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.

Identify the independent variable in each of the following. YOUR ANSWER MUST BE STATED IN THREE WORDS OR LESS. (Questions 14 – 17)

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 STATED IN THREE 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
1	20	15	25	40
2	87	10	3	0
Total	107	25	28	40

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 per cent of the total number of organisms sampled were organism C?

24. What per cent 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 that is not present in area 1.
   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)
Refer to the following graph to answer questions 26 – 27.
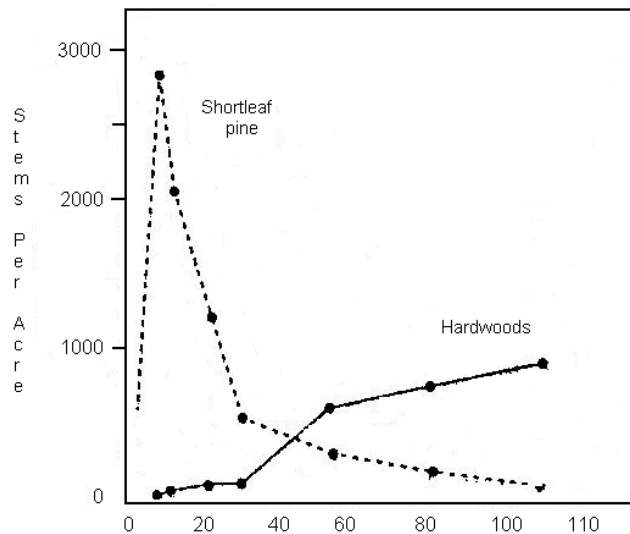
26.   Approximately how many pines were lost per acre between years 10 and 25?

27.   What was the percentage increase in hardwoods between 50 years and 100 years?

28.   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.   Smells of chemicals should be detected by a wafting motion.
        C.   Test tube tongs should be used when handling hot glassware.
        D.   Long hair should be pulled back when working with flames.

29.   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.

Match the temperature with the indicated situation. Some choices may be used more than
once, others not at all. (Questions 30 – 35)

                A.   -150°C to 0°C   C.   35°C to 45°C
   B.   °C to 20°C   D.   >100°

30.   Bath water   33.   Oven for baking bread

31.   Ice cubes taken from a freezer   34.   Mountain stream during January

32.   Normal human body temperature   35.   Typical temp in GA during late January

Station F (Questions 36-38)

36-37 You have three unlabeled solutions, A, B, and C. You know that one is an enzyme solution, another contains the substrate (molecule worked on by enzyme), and the third contains an inhibitor of the enzyme. You know that when the enzyme and substrate interact, a red color is produced. You mix various amounts of the solutions and the results appear in the table below:

Reaction number	Amount of solution A (ml)	Amount of solution B (ml)	Amount of solution C (ml)	color
1	0	0.1	0.1	Red
2	0.1	0	0.1	Colorless
3	0.1	0.1	0	Colorless
4	0.1	0.1	0.1	Med. Pink
5	0.2	0.1	0.1	Light pink
6	0.1	0.2	0.1	Dark pink
7	0.1	0.4	0.2	Red

36.   Which solution, A, B, or C, contains the inhibitor?

37.   Which solution, A, B, or C, contains the enzyme?

38.   The three graphs below represent three different enzymes that are required for growth by a protozoan. What water pH is the best pH for the organism?
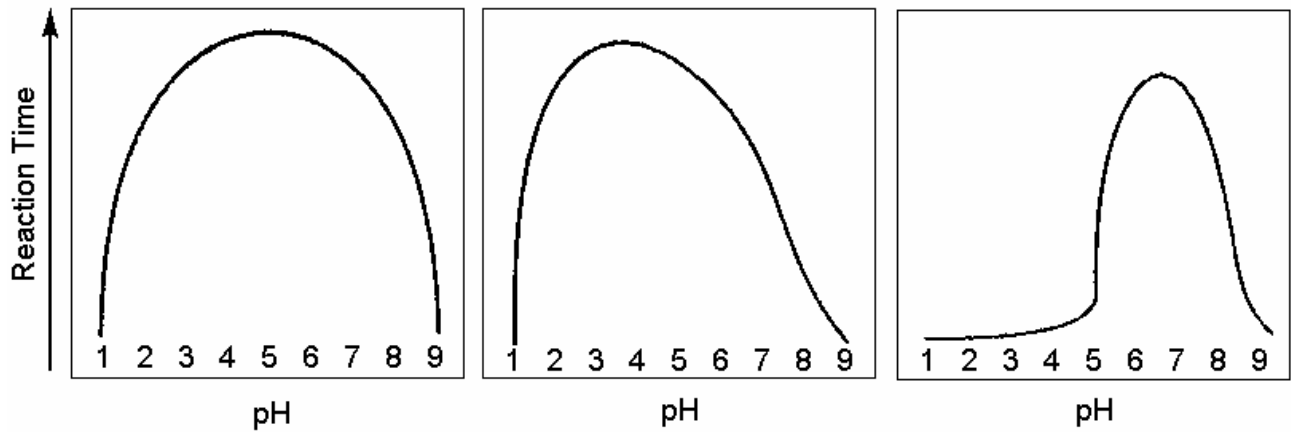
Station G (Questions 39-41)

39. Consider the following cross
    Qq X qq

    If 120 progeny are produced, how many are expected to be qq?

40-41 Tongue rolling is dominant to non-rolling (R vs r). The presence of arches is dominant to flat feet. (A vs a) A couple, each with the genotype RrAa, have 16 children. You may find the chart helpful.

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

40. What fraction of their children will be non-rollers with arches?

41. How many of their children will have arches?

Station H (Questions 42-46)

Students were asked to make a key for identifying animals. The first grouping had to put all animals EXCEPT one into one group. The groups formed by students appear below the animals.

Animals: bird, toad, butterfly, monkey, crab, earthworm.

Group A: all except the earthworm

Group B: all except the crab

Animals: shark, goldfish, jellyfish, penguin, rattlesnake

Group C: shark, goldfish, jellyfish, penguin, but not the rattlesnake

Group D: shark, rattlesnake, goldfish, penguin, but not the jellyfish

Identify the trait used to categorize all the animals except the one for each of the following groups. YOUR ANSWER MUST BE STATED IN THREE WORDS OR LESS.

42.   Group A
43.   Group B
44.   Group C
45.   Group D
46.   In which group, A, B, C, or D, would you put an octopus?

Station I (Questions 47-56)

47- 56. 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 a plant cell.
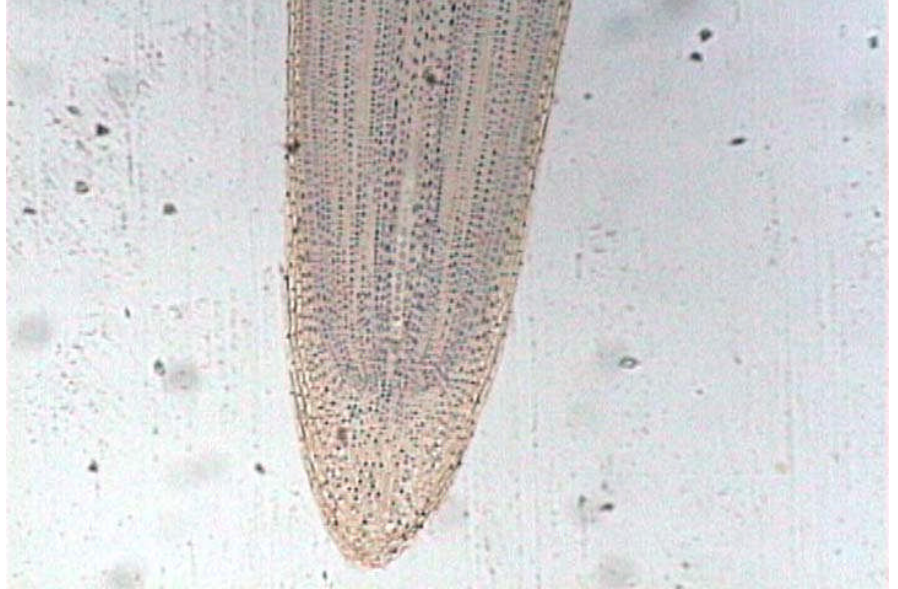C.   These cells carry oxygen to tissues.
D.   No answer given
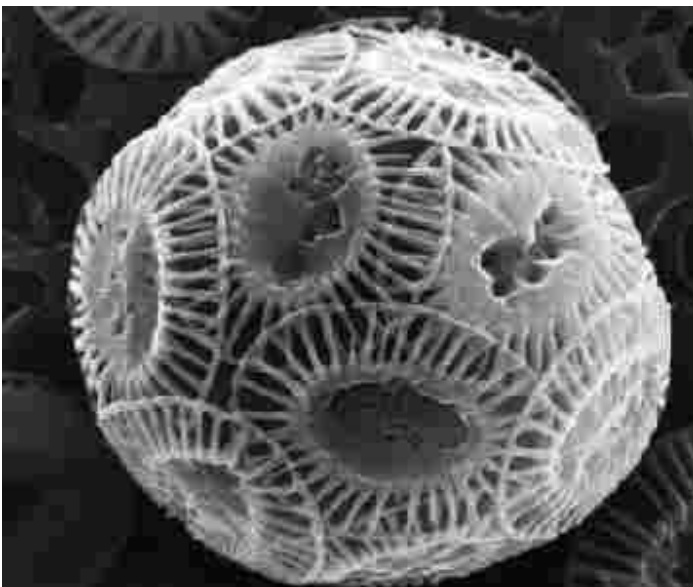
←47

48↓

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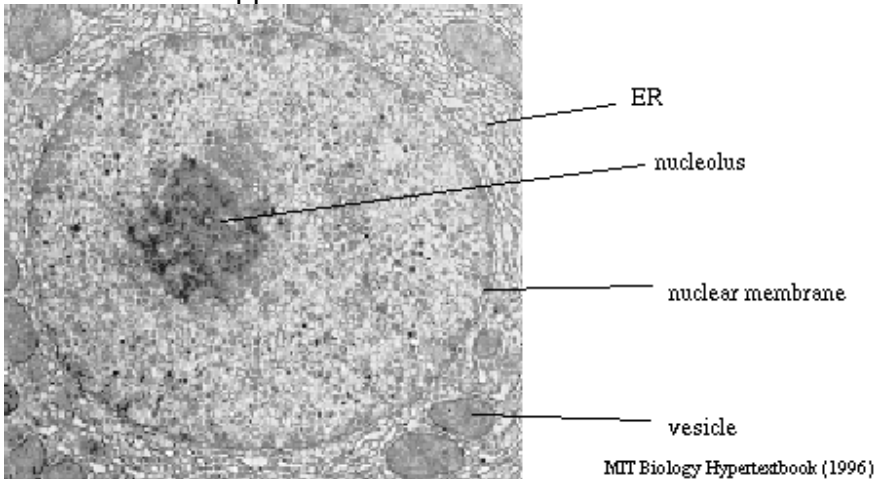
51. What is the approximate diameter of the organism in the picture?

_____
50µ m

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

ER

nucleolus

nuclear membrane

vesicle

MIT Biology Hypertextbook (1996)

‾‾‾‾
 1μ m

Station J (Questions 57-60)

53.   In the following experiment, bacteria were grown in the presence of several antibio-
       dics. Antibiotics work by inhibiting bacterial growth. What is the diameter of zone of
       inhibition for the most effective antibiotic shown here?

bacterial growth   antibiotic discs
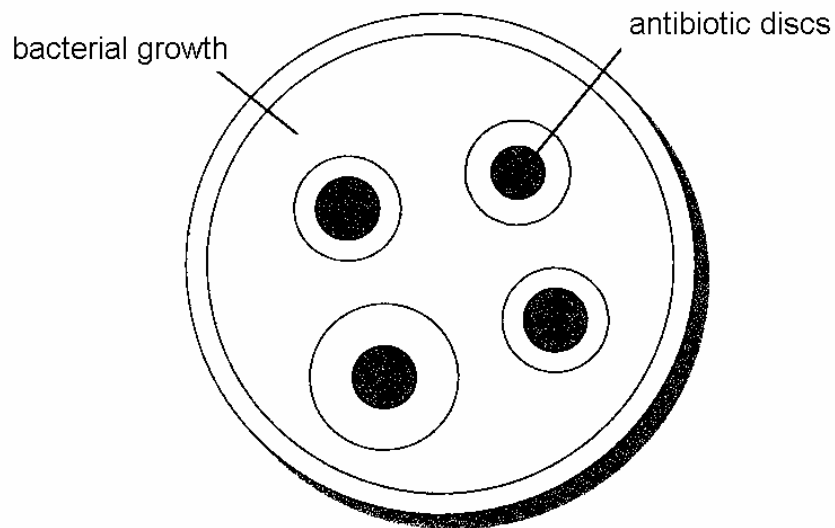
54   Picture of cells, each with the following dimension 0.01μ m x 0.01μ m x 0.2μ m. What
       is volume of cytoplasm?

55.   A sample contained 3.2 x106/mm^3 red blood cells and 1.75 x106/mm^3 white blood
       ells. What percentage of cells were white blood cells?

56.   In humans the small intestine is about 25 feet long. There are 2.5 cm/inch. How long in
       cm is the small intestine?