

Multiple Choice questions: 2 points each. Please put your answers to this section on the Standardized Bubble Sheet. Feel free to use the question sheet for scratch work. Each question has only one correct answer. You will not be penalized for guessing on this section. Fill in your Answer Sheet carefully. Make sure that the number of the question matches the number whose bubble you're filling in!

- 1) Which of the following statements is true?
 - a) A white ground color will heat faster than a black ground color.
 - b) Aquatic environments typically show greater temperature variations than do terrestrial environments.
 - c) There are a many endothermic animal species in aquatic environments.
 - d) Animals and plants choose microhabitats to use as a way to regulate body temperatures
 - e) Water heats up quickly because of its low capacity to absorb heat without changing temperature.

- 2) Because the body temperature of most insects depends on heat from their environment, these organisms are considered to be _____.
 - a) homeotherms
 - b) endotherms
 - c) poikilotherms
 - d) eurytherms
 - e) thermal neutral zones

- 3) Cowboys and ranchers often wear straw hats in the summer and felt hats in the winter. Which means of heat gain and loss are most affected by this change in headgear?
 - a) Summer -- radiation; winter -- convection
 - b) Summer --conduction; winter -- conduction
 - c) Summer --conduction; winter -- radiation
 - d) Summer -- evaporation; winter -- metabolic
 - e) None -- hats do not affect heat exchange

- 4) Photosynthetic organisms derive their carbon from:
 - a) Carbon monoxide
 - b) Carbon dioxide
 - c) Hydrocarbons
 - d) Methane
 - e) The soil

- 5) Which statement is false?
 - a) The greatest trophic diversity is found in bacteria.
 - b) C₃ photosynthesis is most common in plants from arid environments.
 - c) CAM photosynthesis allows succulent plants in arid environments to keep their stomata closed during the day.
 - d) Plant tissues typically have a high C:N ratio.

- 6) Some Cabbage White butterflies emerge in the spring, and live for many weeks. As spring becomes summer, the environmental temperature gradually increases. During this time, a physiological shift in the optimum temperature for butterfly flight activity occurs. This is best considered to be an example of:
- Optimal foraging
 - Liebig's Law of the Minimum
 - Acclimation
 - Adaptation
 - C3

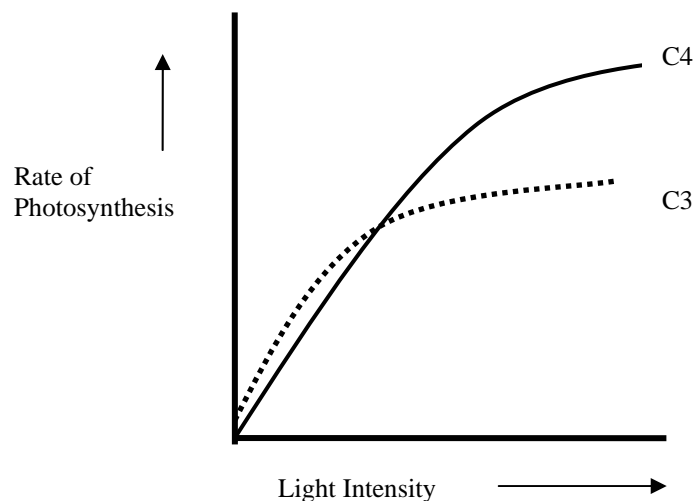
For the following three questions, use the following list. How would each of these attributes or behaviors influence the heat budget of an organism?

- A = increase heat gain
 B = reduce heat gain
 C = increase heat loss
 D = reduce heat loss
 E = no effect on heat loss or gain

- leaves oriented perpendicular to direct sunlight
- a layer of blubber
- sweat production

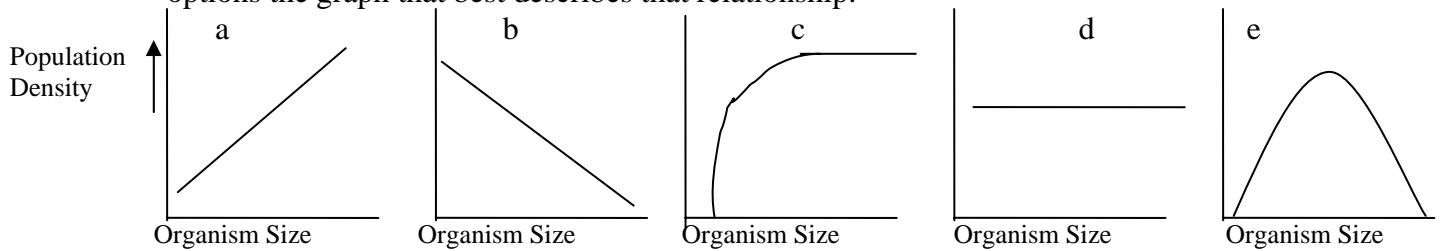
10) Which statement about this graph is most accurate?

- P_{max} is larger for the C3 plant than for the C4 plant
- I_{sat} is larger for the C3 plant than for the C4 plant
- The C3 plant would perform better under low light than would the C4 plant
- More than one of the above
- None of the above



- 11) Plants in environments where soil nutrients are abundant compared to their needs (but light is limiting) are likely to:
- Invest more energy in the growth of stems and leaves and less in roots
 - Invest less energy in the growth of stems and leaves and more in roots
 - Invest more energy in the growth of stems and leaves and more in roots
 - Invest less energy in the growth of stems and leaves and less in roots
 - None of the above

- 12) Your book had a section explaining how population density and organism size (e.g., body mass) are generally related with each other. Choose from among the following options the graph that best describes that relationship.



- 13) Plants must open their stomata to get CO₂, but this also allows water to leave. In hot, dry environments where water is limiting, this loss of water can reduce plant growth rates. However, your book points out that some plants have evolved special means to reduce water loss. Which of the following features of plants was presented in the book as a way for plants to face this challenge?

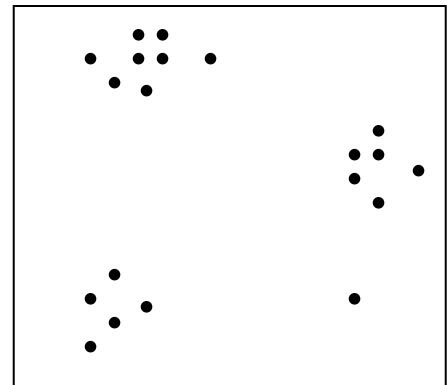
- C-5 photosynthesis
- Carbon fixation and the light-dependent reactions of photosynthesis occur in separate cells.
- Carbon fixation takes place in the daytime, while the light dependent reactions occur at night
- Carbon fixation and the light dependent reactions of photosynthesis occur at the same time in the same cells
- More than one of the above

- 14) Which of the following may not contribute to an organism's niche?

- Average hours above freezing/year
- Prey size
- Time of day used for foraging
- Seasonal rainfall pattern
- All of the above may contribute to the niche

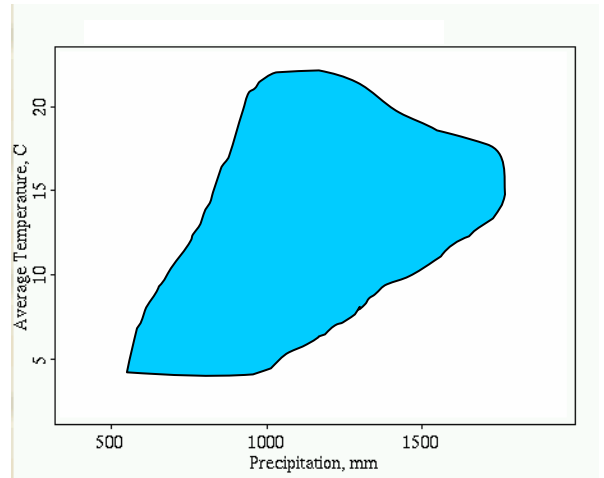
- 15) Which of the following best describes the pattern of dispersion in this map (in the map, each dot represents one deer, and the whole field of view represents a 100m x 100m patch of the Cuyahoga Valley).

- Clumped
- Regular
- Random
- Photosynthetic
- None of the above

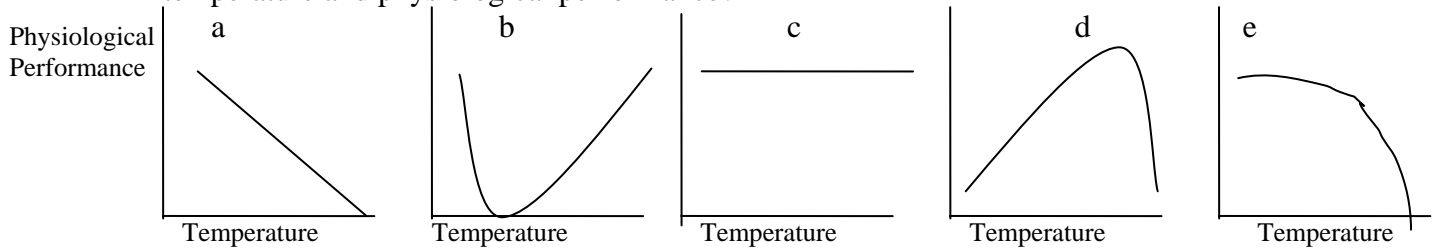


16) In this graph the darkened region indicates the range of conditions that Meadow Voles (*Microtus pennsylvanicus*) can tolerate. Which of the following is MOST correct?

- a) This is a full description of the niche for *Microtus pennsylvanicus*
- b) The niche of *Microtus pennsylvanicus* changes over time
- c) *Microtus pennsylvanicus* tolerate moisture levels from ~550-1760 mm /year
- d) *Microtus pennsylvanicus* tolerate average annual temperatures from ~5 - 22 C
- e) Temperature tolerance for *Microtus pennsylvanicus* depends on moisture availability, and moisture tolerance depends on temperature



17) Which of the following curves describes the most common relationship between temperature and physiological performance?



Short answer (one-three sentences).

18) 4 points. Choose one of the multiple choice questions that you were unsure of, explain why it was difficult. Explain why you chose your answer, and why you didn't choose the others.

19) 4 points. Choose **one** of the following questions (by circling it), and answer it in the space below (these questions deal with topics discussed in your text):

- a) Why does adding sucrose to mine spoils increase the rate of breakdown of cyanide by bacteria?
- b) How can study of snail populations in Switzerland provide useful information about recent changes in their thermal environment?
- c) What sorts of information would you need in order to estimate population size of elusive animals like whales? Explain briefly (no equation is necessary).

20) 6 points. Squirrels eat acorns. To eat the nutmeat inside, the squirrels must remove the hard outer shell of the acorn. Acorns from different oak trees vary in both shell hardness and energy content. Using ideas from optimal foraging theory, answer the following questions about how to predict which acorns would be most preferred by squirrels.

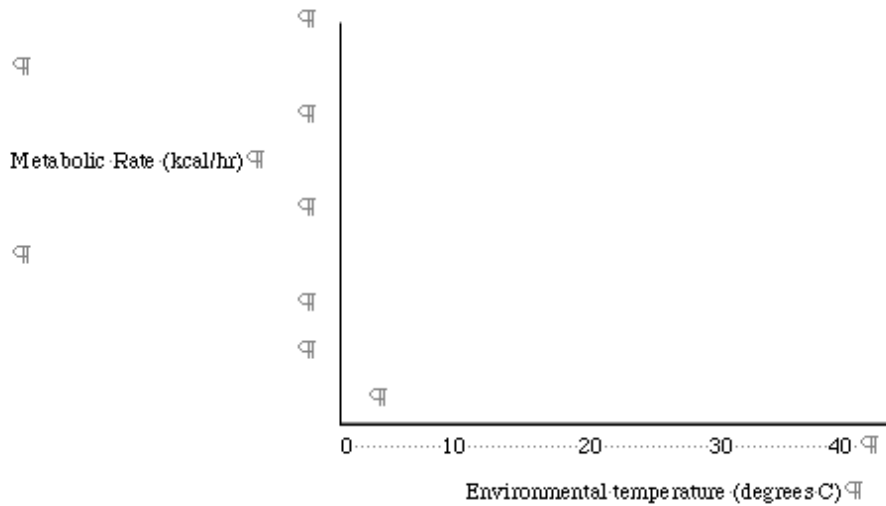
- a) What are two of the pieces of information that would be needed to use the optimal foraging equation in your book?

- b) In general, how might one predict squirrel preferences from this information (no equation is necessary)?

21) 4 points. Name **two** of the attributes of a species that would make us consider it to be rare, based on the discussion in your text and in class.

22) 6 points Use the axes below to draw

- a) With a solid line, how the metabolic rate for a mammal should change as the environmental temperature varies. Label the thermal neutral zone (TNZ).
- b) With a dashed line, draw the metabolic rate that you would expect for a poikilothermic frog.
- c) Explain your answer in a sentence or two



23) 4 points. What advantage does advertising give to noxious prey? How is this related to 'mimicry'?

24) **15 points.** Pre-prepared review sheet question: Remember: your answer should be well-reasoned and well-written -- outline format is not acceptable (though you may outline the answer for your own benefit on the back of another page). Your answer should fit on this page.

Describe an ecological pattern, suggest a hypothesis to explain that pattern, and propose two DIFFERENT ways to test that hypothesis. Discuss the extent to which these two ways of testing the hypothesis differ in realism and control.