BIOL 1114    EXAM 1 (No Star Form) 11 February 2002

Use a #2 pencil to fill in the information portion of your NCS answer sheet including the appropriate circles (bubbles). Write "No Star Form" – above your name in the margin of your NCS answer sheet. Read all questions and answers carefully before choosing the single BEST response for each question. Feel free to ask the instructor for clarification. Don’t be shy.

1. What is correct regarding natural selection?
   a. It does not allow equal reproduction to all members of the population.
   b. It will not occur without genetic variability in the population.
   c. Animals change themselves consciously but plants lack this capability.
   d. All the above are correct.
   e. Only (a) and (b) are correct.

2. On a hot and windy day around noon the temperature of plant leaves reach a temperature higher than the surrounding air. These leaves may cool down by _________________.
   a. evaporation of water from the leaf surface
   b. convection
   c. radiation
   d. all of the above would allow the leaves to cool down

3. Which of the following will increase the rate of cooling of a leaf?
   a. High ratio of surface area to volume.
   b. Low ratio of surface area to volume.
   c. Thick layer of hair on the surface of the leaf.
   d. No wind.
   e. Full moon light.

4. When seeds start to germinate the first step is absorption of water by osmosis and the seeds swell. Which one or more of the following conditions will not result in seeds swelling when they are soaked in water.
   a. The water contains no salt (distilled water).
   b. The water contains higher concentration of salts than the seeds.
   c. Before the seeds are soaked in distilled water, they are treated with a chemical that destroys the cell membranes and makes them leaky.
   d. Before the seeds are soaked in water that contains the same concentration of salt as the seeds, the seeds are treated with a chemical that destroys the cell membranes and makes them leaky.
   e. (b), (c) and (d) will not result in seed swelling.

5. A bag containing seeds was found in an archeological dig. Whether or not the seeds are alive may be established without actually germinating them by finding if the seeds still conduct cellular respiration. Which of the following findings indicate viable seeds?
   a. They release oxygen.
   b. They release carbon dioxide.
   c. They release both carbon dioxide and oxygen.
   d. They do not release any gas.
   e. The cells contain no mitochondria.

6. The scientist conducting the experiment in the previous question is not confident with the results. It looks that the seeds released a gas but since it is an extremely low amount, he cannot be sure what the gas is. One way to improve the experiment and have higher emission is to _________________.
   a. warm the seeds so that metabolism will increase.
   b. warm the seeds so that metabolism will slow down.
   c. cool the seeds so that metabolism will slow down.
   d. cool the seeds so that metabolism will increase.
   e. treat the seeds with a chemical that makes the mitochondria membrane leaky to protons.
7. What is correct regarding the counter current exchanger in endotherms?
   a. The temperature of the blood coming back to the heart is much lower than the blood temperature leaving the heart.
   b. The temperature of the blood coming back to the heart is slightly lower than the blood temperature leaving the heart.
   c. This is a mechanism to dissipate heat from the body into the atmosphere.
   d. A heat gradient facilitates the heat flow in the exchanger.
   e. Both (b) and (d) are correct.

Use the following graph to answer the next 3 questions.

8. A professor in BIOL 1114 conducted a study in which he plotted student final grades against attendance as depicted on the “scatter plot” graph. The ____ variable is plotted on the ____ axis.
   a. dependent (response or measured), y
   b. independent (manipulated), x
   c. independent (manipulated), y
   d. dependent (response or measured), x
   e. Both (a) and (b) are correct.

9. What hypothesis is supported by the data on the graph?
   a. Poor grades are always the result of poor attendance.
   b. High attendance always results in good grades.
   c. High grades are associated positively with good attendance.
   d. Grades are randomly distributed in this kind of course.
   e. We cannot make any hypotheses in such a population.

10. Which one or more of the following serve as the control group on the graph?
    a. Grades
    b. Attendance
    c. Slope of the line.
    d. Both (a) and (b).
    e. There is no control group in an observational experiment.

11. Some “fat burners” (diet formulas often considered dangerous by the Food & Drug Administration) consist of drugs that allow electron transport to occur during aerobic respiration without ATP synthesis. Which one of the following is a correct hypothesis for how this drug works?
    a. Inhibition of NADH production.
    b. Inhibition of water formation from oxygen.
    c. Inhibition of proton \([H^+]\) gradient formation across inner mitochondrial membrane.
    d. Inhibition of electron transport within the inner mitochondrial membrane.
12. Which one of the following processes is **not** associated with a cell’s mitochondrion?
   a. Glycolysis
   b. Krebs cycle
   c. Chemiosmosis
   d. Electron transport
   e. Proton \([H^+]\) pumping

13. The remarkable desert kangaroo rat never drinks water and receives only 10% of its water requirement from a seed diet. What is the direct source of the rest of the kangaroo rat's water?
   a. Atmospheric condensation
   b. Photosynthesis
   c. Electron transport
   d. Krebs cycle
   e. Diet soda

14. Venous blood carries back to the heart and lungs dissolved carbon dioxide (\(CO_2\)) gas produced during_______.
   a. Glycolysis
   b. The Krebs Cycle
   c. Chemiosmosis
   d. Photosynthesis
   e. Combustion

15. Dr. Hamilton's cat, Mulan, characteristically seeks out a fireplace on a winter's evening. The closer the cat gets to the fire, the more she stretches her body. This does which of the following for the cat?
   a. Increases her exposed surface area to volume ratio.
   b. Decreases her exposed surface area to volume ratio.
   c. Allows her to have more heat exchange with her environment.
   d. Both (a) & (c) are correct.
   e. Both (b) & (c) are correct.

16. The polar bear has a much larger body than its American "cousin", the black bear. Polar bears are therefore better adapted to the Arctic tundra because of their_______.
   a. Increased surface area to volume ratio.
   b. Decreased surface area to volume ratio.
   c. Sharp claws and teeth.
   d. Both (b) & (c)

17. Microbiologists usually culture pathogenic bacteria optimally at 37\(^\circ\) C instead of at room temperature (25\(^\circ\) C). Which one or more of the following explains this?
   a. Metabolic processes occur more rapidly at 37\(^\circ\) C.
   b. ATP is better synthesized at 37\(^\circ\) C.
   c. Enzymes work better at 37\(^\circ\) C.
   d. Bacterial reproduction (division) is more rapid at 37\(^\circ\) C.
   e. All of the above are correct explanations.

18. Three students are having an argument about what "Theory" means. Which of the following statements would be a valid argument or description on the part of a student?
   a. Student 1: It is nothing more than a guess.
   b. Student 2: It is a guess, but it involves many scientists.
   c. Student 3: Once a theory is proven, it is never changed.
   d. Student 1: Right, once a theory is proven, it is never tested again.
   e. Student 2: No, it is an explanation supported by lots of evidence, but it can always turn out to be wrong.
Use the following information to answer the next 3 questions.
A scientist is interested in testing whether emissions from cell phones are responsible for brain damage and low exam grades in Junior High school students. He proposes the following experiment to the National Institute of Mental Health (NIMH). “I will select 100 students. I will perform an MRI (brain scan) on each student at the beginning of the 5th grade. At the end of the 7th grade I will perform another MRI on each student, issue all the students cell phones, and call them 3 times per day for two years. At the end of the 9th grade I will perform a final MRI on each student. I will then compare the MRIs.” The proposal was immediately rejected, and the scientist told not to apply again.

19. Which of the following reasons would account for this unequivocal, irreversible rejection?
   a. The scientist did not properly use the students as their own controls.
   b. Such an experiment is unethical. The hypothesis should be tested by an observational (correlational) experiment.
   c. Children don’t use cell phones.
   d. The scientist should have tested fewer students.
   e. There was no control in the experiment.

20. In the experiment on cell phone effects, which of the following would be the dependent (response) variable?
   b. Students’ age.
   c. Students’ income.
   d. Differences in MRI patterns.
   e. Choice of wireless provider.

21. However wrong the experimental design, why did the scientist choose to measure each student repeatedly?
   a. To make the experiment longer.
   b. To make the experiment more costly.
   c. To account for the sex of the students.
   d. To account for individual difference in students.
   e. To get more samples.

22. A rancher is interested in reducing the amount of food he must feed his cattle in order for them to reach market weight. Which of the following methods would most likely help him do this?
   a. Increasing the temperature in the feedlot above the cattle’s thermal neutral zone.
   b. Decreasing the temperature in the feedlot below the cattle’s thermal neutral zone.
   c. Regulate the temperature in the feedlot to maintain the cattle’s thermal neutral zone.
   d. The feedlot temperature would not effect food consumption.
   e. The choice depends on the temperature outside the feedlot.

23. The rancher decides to house his cattle in an insulated structure. Which of the following effects would you correctly hypothesize that would have?
   a. Reduce the heat loss from the cattle due to radiation
   b. Increase the heat gain by the cattle due to solar radiation.
   c. Increase the heat loss from the cattle due to convection
   d. Reduce the heat gain by the cattle due to evaporation
   e. The effect on the mice is the same as on the cattle.

24. The mice in the feedlot are also affected by the rancher’s actions in the previous question. Which of the following would you predict about this effect on mice in the winter?
   a. The effect on the mice is much greater than on the cattle because the mice have a much higher surface to volume ratio.
   b. The effect on the mice is much greater than on the cattle because the cattle have a much higher surface to volume ratio.
   c. The effect on the mice is much lower than on the cattle because the cattle have a much higher surface to volume ratio.
   d. The effect on the mice is much lower than on the cattle because the cattle have a much lower surface to volume ratio.
   e. The effect on the mice is the same as on the cattle.
25. The rancher’s son has a pet iguana (like the one on display outside the LRC). To reduce the iguana’s food consumption, the boy just needs to
   a. Feed him more.
   b. Reduce the temperature in the iguana’s terrarium.
   c. Increase the temperature in the iguana’s terrarium.
   d. Keep the temperature constant in the iguana’s terrarium.
   e. Chase the iguana around the feedlot.

26. When the iguana’s O\textsubscript{2} consumption increases, you would correctly hypothesize that
   a. Its CO\textsubscript{2} consumption would also increase.
   b. Its consumption of glucose would also increase.
   c. Its mitochondria would be performing fewer chemical reactions per second.
   d. The air temperature around the iguana would decrease.
   e. Its metabolic rate would be decreasing.

27. Although we consider Burmese pythons, which can be 91 kg (200 lb), to be ectotherms, they wrap themselves around their eggs and vibrate their muscles. Which of the following statements is a hypothesis that is consistent with that observation?
   a. They are probably cooling their eggs by conduction.
   b. Their bodies can probably serve as insulators because they are large.
   c. They are probably shivering to lower their metabolic rates.
   d. They are reciting bedtime stories to their unhatched young.
   e. They are cooling their eggs by evaporation.

28. If you were to examine the muscle cells that were responsible for the rapid vibrations, you would correctly predict that the number of mitochondria in those cells would probably be _______ than in cells that were less metabolically active.
   a. much more
   b. much fewer
   c. about the same

29. In those same active muscle cells, you would expect the rate of glycolysis to be ____ when they are vibrating than when they are not.
   a. much higher
   b. much lower
   c. about the same

30. If a chemical is injected into the muscle cells that prevents electrons from binding with O\textsubscript{2} at the end of the electron transport chain, which of the following would you correctly predict as the result?
   a. Water production in mitochondria would increase.
   b. ATP production in mitochondria would be unaffected.
   c. There would be a continuous build up of the hydrogens in the mitochondrial intermembrane space.
   d. Electron transport would stop.
   e. NADH production would increase.

31. As stated in class, the scientific method is a systematic process that allows you to investigate natural phenomena. In which one or more of the following examples could you apply the scientific method?
   a. Determining the role of calcium in preventing osteoporosis.
   b. Determining which type of fertilizer produces the best tomatoes in your home garden.
   c. Determining why your car will not start.
   d. Determining why a certain species of fish found in two different streams in the rainforest is more brightly colored in one stream than the other.
   e. You could apply the scientific method in all of the examples above.
In a project involving a population of sandpipers (a shore bird) the following data were generated from an experiment designed to investigate the effect of clutch size (number of eggs laid) on the number of young that successfully hatch and survive to adulthood.

<table>
<thead>
<tr>
<th>Clutch size</th>
<th>Number of survivors</th>
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<td>1</td>
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32. Which one of the following graphs correctly display the data?

a. [Graph A]
   b. [Graph B]
   c. [Graph C]
   d. [Graph D]

33. How many of the following would you correctly predict after moving the specified organism from 10°C chamber?
   __ The metabolic rate of an insect would decrease significantly if placed in a 25°C chamber.
   __ The metabolic rate of a bird would decrease significantly if placed in a 5°C chamber.
   __ The internal temperature of a snake would increase significantly if placed in a 25°C chamber.
   __ The internal temperature of a cat would increase significantly if placed in a 25°C chamber.
   __ The rate of carbon dioxide production by a hamster in a 5°C chamber will decrease significantly.

   a. 1  b. 2  c. 3  d. 4  e. 5
34. If you place an endotherm that has a thermal neutral zone of 28°C to 39°C in a metabolic chamber which is kept constant at 20°C, which one or more of the following would you correctly predict to occur?
   a. The animal's internal body temperature would decrease to 20°C.
   b. The animal's rate of oxygen consumption would decrease.
   c. The animal's rate of carbon dioxide production would increase.
   d. All of the above would occur.

35. Which one or more of the following involve a gradient to function?
   a. Formation of ATP in the mitochondria.
   b. Production of concentrated urine in the nephron tubules.
   c. Warming of a lizard on a rock.
   d. (a), (b) and (c) all involve gradients.

36. A group of BIOL 1114 students were able to measure various metabolic functions of a white mouse before and immediately after they let it run on an exercise wheel for 10 minutes. You would correctly predict that the mouse would _______________ than before it ran on the exercise wheel.
   a. move protons (H+) across the inner mitochondrial membrane faster
   b. move protons (H+) across the inner mitochondrial membrane slower
   c. show a decreased rate of CO2 production
   d. pump more glucose out of the mitochondria
   e. pump more oxygen out of the mitochondria

37. Which one or more of the following would you correctly predict in animal cells that were treated with a chemical that prevented the formation of the proton (H+) gradient across the inner mitochondrial membrane?
   a. An increase in cell activity.
   b. An increase in the number of mitochondria in the cell.
   c. An increase in ATP production by the mitochondria.
   d. A decrease in ATP production by the mitochondria.
   e. Both (a) and (d) would occur.

38. During a metabolic experiment you notice that the rate of CO2 production by the experimental animal has decreased over the course of the experiment. This would be an indication that
   a. The rate of glycolysis in the animal's cells had increased.
   b. The rate of the Krebs cycle in the animal's cells had increased.
   c. The rate of the Krebs cycle in the animal's cells had decreased.
   d. The rate of oxygen consumption by the animal's cells has increased.

39. In lab you conducted metabolic rate experiments with cute little white mice and those charming cockroaches. Based on those experiments and what you have learned in lecture, which one of the following statements is correct for an experiment involving the cockroaches?
   a. As ambient temperature increases the rate of CO2 production decreases and oxygen consumption increases.
   b. As ambient temperature decreases the rate of CO2 production decreases and oxygen consumption increases.
   c. As ambient temperature increases the rate of CO2 production increases and oxygen consumption increases.
   d. As ambient temperature decreases the rate of CO2 production increases and oxygen consumption decreases.
40. If you were conducting metabolic experiments with **white mice**, which one or more of the following would you correctly predict if the experimental ambient temperature was **outside the mouse's thermal neutral zone**?

a. As ambient temperature increases the rate of CO\(_2\) production decreases and oxygen consumption increases.

b. As ambient temperature decreases the rate of CO\(_2\) production decreases and oxygen consumption increases.

c. As ambient temperature increases the rate of CO\(_2\) production increases and oxygen consumption increases.

d. As ambient temperature decreases the rate of CO\(_2\) production increases and oxygen consumption increases.

e. Both (c) and (d) would be correct if the experimental ambient temperature was outside the mouse’s thermal neutral zone.