1. A scientist is interested in the effect of age on rate of digestion in male mice. The control group
a) would be fed a different diet.
b) would be all female.
c) would be all juveniles.
d) doesn’t exist, this would have to be a correlational/observational/descriptive study.
e) should be fed a placebo.

2. A scientist is interested in measuring the effect of a new drug on cell growth. The independent
or manipulated variable in any experiment to examine the effect of the drug would be
a) the number of cells.
b) the size of the cells.
c) the level or concentration of drug.
d) a placebo of distilled water.
e) the length of time required for change to occur.

3. A scientist says she has proven her theory. She
a) might be correct.
b) must have performed many experiments.
c) probably did not properly use controls.
d) does not understand that this can never happen.
e) is combining data from many experimenters world wide.

4. After designing an experiment to test a hypothesis, an experimenter should generate predictions
a) to admit his/her biases.
b) that illustrate possible results that provide supporting or contradictory evidence for each
hypothesis.
c) that indicate the level of preparedness of each experimenter.
d) that reflect the limits of the experimental designs offered.
e) that exhaust all possible outcomes and provide a complete set of potential data for the
experimenter to use.

5. To analyze data, an experimenter might use a graph. On the graph, the x-axis (horizontal) would
a) provide the scale for the control variable(s).
b) provide the scale for the manipulated or independent variable.
c) provide the scale for the measured variables.
d) indicate the values to which the data should be compared.

6. A good hypothesis must
a) be testable.
b) be falsifiable.
c) explain some event or phenomenon.
d) lead to specific predictions.
e) all of the above.

7. How many of the following would you predict after moving the organism from 25°C?
--- The metabolic rate of an insect would decrease significantly if placed on ice.
--- The metabolic rate of a sparrow would increase significantly if placed on ice.
--- The internal temperature of a snake would increase significantly if placed on ice.
--- The internal temperature of a cat will increase significantly if placed in a 40°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

8. A lizard is positioning itself on a hot summer day so that it casts the smallest possible shadow. You would hypothesize that it is
a) cooling itself by convection.
b) warming itself by radiation.
c) cooling itself by avoiding radiation.
d) cooling itself by evaporation.
e) doing the macarena

9. Because of the permafrost in the arctic tundra,
a) standing water (pools, bogs) are common in the warmer months.
b) trees are scarce because water is always available.
c) trees are plentiful because their roots are held firm.
d) musk oxen burrow in winter.
e) water passes through the soil rapidly and is lost forever.

10. Total annual precipitation is
a) low in the desert and high in the tundra.
b) low in the desert and low in the tundra.
c) high in the desert and high in the tundra.
d) high in the desert and low in the tundra.
e) not predictable in the desert or the tundra.

11. Organisms regulate their body temperatures so that
a) chemical reactions will be slow.
b) proteins are protected from destruction by heat.
c) there is sufficient energy for chemical reactions to occur.
d) (b) and (c)
e) (a) and (b) and (c)
12. Which of the following represents a properly working counter current exchanger in an endotherm?

![Diagram of a counter current exchanger]

13. Initially when placed in the cold, a healthy wolf will
   a) pump lots of blood to its ears to lose heat.
   b) restrict blood flow to its brain.
   c) reduce its core (central body) temperature .
   d) howl incessantly at the moon.
   e) conserve heat to the core by reducing blood flow to its feet and ears.

![Graph of metabolic rate vs. environmental temperature]
14. Based on the graph above, you would predict that this animal might be shivering or performing some other energy consuming activity once the environmental temperature drops below ____ oC
   a) 10
   b) 20
   c) 30
   d) 40
   e) 50

15. If an organism has a high surface-to-volume ratio, it will ___________ than it would if it had a low surface-to-volume ratio.
   a) lose heat faster to the environment and gain heat faster from the environment
   b) lose heat slower to the environment and gain heat faster from the environment
   c) lose heat slower to the environment and gain heat slower from the environment

16. Being an observant scientist, you notice that very few insects ever eat the leaves of Chrysanthemum plants in your home garden, while insects cause significant damage to all of the other plants (you haven't used any insecticides). However, you also notice bees feeding on the nectar of Chrysanthemums and thereby pollinating the flowers (necessary for making seeds = new plants). Which of the following does NOT seem like a possible explanation of your observations or a reasonable prediction of what may happen in the distant future?
   a) Natural selection will favor Chrysanthemums that make a chemical in nectar to poison bees.
   b) Insects don't like the taste of leaves of Chrysanthemums.
   c) Chrysanthemums make a distasteful or toxic chemical in leaves but not in the nectar.
   d) Bees are resistant to whatever defense mechanism the Chrysanthemums have.
   e) Eventually one or more insects may evolve resistance to the Chrysanthemum's defense.

17. Which statement best describes toxic plants and herbivores that eat them, assuming that plant toxins are an important factor in the coevolution of these organisms.
   a) Mutant plants that make herbivore-deterring chemicals always leave more offspring.
   b) Individual herbivores resistant to existing plant toxins are likely to become more common.
   c) Plants knowingly make chemicals to kill herbivores and herbivores knowingly become resistant.
   d) Plants absorb and "learn" how to make the toxic chemicals that humans spray on them.
   e) Any plant species that doesn't make herbivore-deterring chemicals is doomed to extinction.

18. The main function of aerobic respiration is to ________________.
   a) make sugars
   b) make proteins
   c) obtain energy
   d) get oxygen
   e) make carbon dioxide
19. Aerobic respiration requires all of the following EXCEPT _____________.
   a) membranes
   b) H+
   c) oxygen
   d) enzymes
   e) light

20. Fish exposed to rotenone gasp at the water's surface, although there is plenty of oxygen in the water. Based on what you know about how rotenone works, you can explain this by the fact that rotenone...
   a) clogs the gills, thus interferes with ability of fish to "breathe" normally.
   b) makes cell membranes impermeable to oxygen.
   c) comes from a plant, so fish swim to the surface to get away from water plants.
   d) reduces ATP synthesis.
   e) inhibits an enzyme involved in glycolysis.

21. Given what you already know about cells, what is a reasonable explanation for why plants that make respiratory inhibitors don't poison themselves?
   a) Plants cells only do photosynthesis, not respiration.
   b) The poison is made and stored so that it does not enter the mitochondrion.
   c) Plants don't have enzymes or mitochondria.
   d) In plants, oxygen is not involved in respiration.

22. Suppose you exposed mitochondria to a chemical that made the membranes "leaky" to ions like H+. How is it likely to affect cellular respiration?
   a) Glycolysis and the Krebs cycle would be directly inhibited.
   b) Electron transport would stop, but ATP synthesis would continue.
   c) Little ATP would be made.
   d) No carbon dioxide would be made.
   e) It would not affect cellular respiration.

23. ATP is important because it is _________________.
   a) the genetic material allowing reproduction
   b) the source of oxygen used in respiration
   c) stored energy available for many purposes
   d) the starting compound for cellular respiration
   e) the enzyme that makes respiration occur

24. Enzymes are _________________.
   a) products of respiration
   b) proteins
c) membranes
d) substrates for respiration
e) energy

25. Over a "normal" temperature range for any given organism, enzyme activity rate usually ________ with increasing temperature.
a) increases  
b) decreases  
c) doesn't change  
d) is unpredictable

26. The energy needed to attach P to ADP during chemiosmosis/electron transport/respiratory chain is provided by
a) release of oxygen
b) conversion of NADH to FADH2 within the mitochondrial membrane
c) manufacture of enzymes
d) movement of hydrogen ions down a gradient
e) ATP

27. If the inner membrane of normal-sized mitochondria was not highly folded, then the amount of respiration possible for each mitochondria would
a) increase  
b) decrease  
c) stay the same

28. If oxygen is carried to all tissues by the movement of blood, then aerobic respiration in the extremities of an arctic wolf will likely __________ in cold weather.
a) decrease  
b) increase  
c) not change

29. The compound __________ is likely used by plants as a chemical deterrent to herbivory while __________ is a substrate (reactant) in respiration.
a) glucose --nicotine  
b) glucose --caffeine  
c) nicotine --glucose  
d) caffeine --nicotine

30. Which of the following animals has the smallest surface to volume ratio?
a) (Kangaroo rat)
b) (Jackrabbit)
c) (Musk ox)
d) (Fennec, a fox)