1. In how many of the following organisms does cellular respiration take place?
- tomato plants     - poison arrow frogs      - grass     - mice       - finches
   a. 1 of these
   b. 2 of these
   c. 3 of these
   d. 4 of these
   e. 5 of these

2. A scientist is interested in testing the effects of exposure to various colors of light on the sleep of college student volunteers. The independent or manipulated variable in any experiment to examine the effect of the color of the light would be
   a. wavelengths of light
   b. length of sleep period in darkness
   c. responsiveness during sleep
   d. number of hours slept
   e. quality of sleep

3. Galapagos penguins have the same general body type as emperor penguins, which live in a colder habitat. Galapagos penguins, smaller than the emperors, are faced with problems staying cool enough on land. You would expect the surface area: volume ratio of Galapagos penguins to be ____ the surface area: volume ratio of emperor penguins. (Stop and Think!)
   a. smaller than
   b. larger than
   c. the same as

4. The energy required for active transport of materials across a membrane is most likely generated by which of the following organelles:
   a. mitochondrion
   b. golgi body
   c. ribosome
   d. nucleus
   e. smooth endoplasmic reticulum

5. Which of the following would be found in only one type of organelle?
   a. ATP synthase (enzyme that produces ATP)
   b. membranes
   c. chlorophyll
   d. electron carriers
   e. proteins

6. Active transport requires energy. Active transport is most likely necessary for material to move across a membrane in which of the following situations:
   a. small ions such as sodium and potassium moving down a concentration gradient
b. water moving down a concentration gradient
c. small ions such as sodium and potassium moving up (against) a concentration gradient
d. sugars moving up a concentration gradient
e. both (c) and (d)

7. The energy used for active ion transport by the sodium/potassium pump is most likely provided by which of the following molecules:
a. NAD+
b. FAD
c. ADP
d. ATP
e. none of these

8. Atropine binds with neurotransmitter (acetylcholine) receptors. It is the antidote for many insecticides. You correctly hypothesize that these insecticides contain:
a. an aerobic respiration electron transport inhibitor
b. an inhibitor for the enzyme acetylcholinesterase that normally removes the neurotransmitter from the synaptic cleft.
c. a compound similar in action to one found in the calabar bean (physostigmine, which causes muscle contractions.)
d. both (a) and (b)
e. both (b) and (c)

9. Which of the following is (are) likely to explain why plants contain neurotoxins?
a. plants deliberately created this toxin to prevent animals from eating the plants
b. plants carrying this toxin were favored by natural selection because they grew more quickly than other plants
c. plants carrying this toxin were favored by natural selection because they had greater membrane potentials
d. plants carrying this toxin are not eaten as readily by herbivores as are those lacking the toxins
e. (a) and (c)

10. If the sodium and potassium channels (gates) on an axon were held closed while the neuron was in a resting state
a. an action potential (nerve signal) would be generated immediately.
b. the inside of the axon would become more positive over time.
c. the inside of the axon would become more negative over time.
d. no action potential (nerve signal) would be generated.
e. the cell would rupture as a gradient formed.

11. Scorpion venom contains a neurotoxin which prevents opening of the axon sodium channels/gates of a neuron that stimulates muscle contraction. Knowing this, you correctly predict the following results if scorpion neurotoxins are present:
a. intense muscle contractions
b. paralysis (no muscle contractions)
c. normal action potential propagated in the presynaptic axon
d. no action potential propagated in the presynaptic axon
e. (b) and (d)

12. One type of food poisoning (botulism) is caused by a bacterium, *Clostridium botulinum*. Botulinum toxin blocks neurotransmitter release into a synapse. Knowing this, you correctly predict the following results if botulinum toxin is present between a stimulatory neuron and the muscle.
a. normal action potential propagated at the presynaptic axon
b. no action potential propagated in the presynaptic axon
c. paralysis
d. intense muscle contractions
e. (a) and (c)

13. When a neuron is at rest,
a. there are more sodium ions on the outside of the axon than inside the axon.
b. all the sodium and potassium ions are inside the axon.
c. gated sodium channels are open.
d. gated potassium channels are open
e. the interior of the cell membrane is relatively more positive than the outside

14. Release of neurotransmitters from the axon into the synapse (synaptic cleft) is an example of:
a. osmosis
b. exocytosis
c. cellular secretion
d. (b) and (c)
e. (a) and (b)

15. Active transport by membrane proteins,
a. requires cellular energy
b. allows cells to regulate internal conditions
c. allows cells to set up gradients for membrane potentials
d. all of the above (a, b, and c)
e. none of the above

16. Thyroxine is a protein hormone present in many animals, including humans, frogs, and fish. Which of the following cell structures would you expect to find abundantly in a cell designed to secrete thyroxine?
a. golgi bodies
b. ribosomes
c. rough endoplasmic reticulum
d. all of the above (a, b, and c)
e. none of the above

17. The process of evolution by natural selection requires how many of the following to be true?
Within a population, the number of births is equal to the number of deaths.
All members of the population must be genetically identical
Members of different species must be geographically isolated from each other.
There must be variation among the members of the population and this variation is heritable.

18. Which of the following has had the greatest impact on the biological history of the Galapagos Islands?
   a. volcanic origin
   b. exposure to tidal waves
e. use as nuclear test sites
c. extreme age (about 100 million years)

19. Which of the following are dispersal mechanisms by which organisms reach oceanic islands?
   a. wind
   b. ocean currents
c. brought by other organisms
d. record of glaciation
e. all of these (a, b, c, and d)

20. The Galapagos marine iguana is adapted to feed in the ocean. This organism cannot live exclusively in the ocean because
   a. it gets too cold and must return to land to warm up.
b. it has to breathe air.
c. it needs to escape from its predator, the Galapagos penguin.
d. its surface area to volume ratio is zero.

21. You have seen data in lecture (Grant research team) and lab (by simulation) showing that mortality (death rate) in the Galapagos finches varies from year to year. What is the main factor responsible for this variation?
   a. Availability of suitable mates
   b. Availability of nesting sites
c. Availability of sufficient food
d. Predation by snakes

22. When you were stranded on an island with only a few items in your suitcase, even human ingenuity may not have been enough to ensure your survival. This harsh reality illustrates the evolutionary principle that________________.
   a. the most creative individuals were sure to survive
   b. one’s available resources/adaptations limit response to a new situation
c. anticipation of future circumstances can allow organisms to prepare for survival
d. all of the above (a, b, and c)
23. The Grants have found that drought conditions usually favor the larger finch species over the smaller because_________.
   a. they have stronger, deeper beaks and are capable of cracking tough seeds
   b. they have a larger surface area to volume ratio and can conserve energy
   c. they can store food in their territories and keep it away from other finches
   d. the smaller finch species live longer

24. Once upon a time, on the island of Mauritius, there were Calvaria trees that depended on the dodo bird to disperse its fruit and to digest the hard outer layer of it’s fruit allowing it to germinate. The dodo bird ate only the fruits of this tree. When the dodos died out, the trees also became extinct. This interdependence of two organisms is termed:
   a) parasitism  b) competition  c) coevolution  d) adaptive radiation  e) colonization

25. In your journey at sea you discover a set of islands that are inhabited by grey and brown monkeys. Which of the following observations might provide the best evidence that more than one species of monkey is found on the islands?
   a. the brown monkeys prefer to eat bananas and the grey monkeys prefer mangos
   b. both monkeys spend most of their time in the trees
   c. the female brown monkeys breed in the spring and the female grey monkeys breed in the fall.
   d. the leopards of these islands usually kill the brown monkeys but not the grey monkeys
   e. the brown monkeys tend to play with other brown monkeys and the grey monkeys tend to play with other grey monkeys.

26. Hawaiian honeycreepers are almost as famous an example of adaptive radiation as the Galapagos finches. Knowing this, you would correctly hypothesize that
   a) they have a common ancestor
   b) they all occupy the same niche (eat the same food, live in the same trees etc.)
   c) they all arrived in Hawaii at about the same time
   d) they displaced the native Hawaiian species and caused mass destruction of crops
   e) they all have bills of the same size and shape.

27. Assuming that anatomical or morphological variation has a genetic basis, it is safe to say that the more morphological variation (different appearance) in a population, the greater its genetic variation. How would you compare a founding (colonizing) population to the population from which it came?
   a. The founder population would have the greater genetic variation.
   b. The founder population would have the smaller genetic variation.
   c. The populations would have equal genetic variation.
   d. The genetic variation in the founder population would increase the farther away from the parent (original) population it is located.
   e. The parent (original) population is smaller.

28. About 2500 years ago, a pair of sneers (a type of rat) washed ashore on an island filled with plant life, but no other seed-eating rodents. The original pair had light gray fur and the male had red whiskers. A recent trip to the island revealed five types of seers: one eats takira seeds,
one eats crisa flowers, one eats crisa stems, one eats worms, and one drinks the sap from the jejuba tree. Seed-eaters breed in June, flower-eaters in July, stem-eaters in April, worm-eaters in May, and sap-drinkers in March. Which of the following would best describe what happened to the sneers?
   a) misadaptation
   b) adaptive radiation
   c) competitive exclusion
   d) coevolution
   e) addition of pest species

29. Which of the following colors of light would provide a red plant the least amount of harvestable energy?
   a. red
   b. green
   c. blue
   d. yellow
   e. orange

30. Which of the following organelles is likely to provide the most ATP as a seed germinates under the ground?
   a. Golgi
   b. chloroplast
   c. mitochondria
   d. endoplasmic reticulum
   e. nucleus

31. Which of the following statements is FALSE about photosynthesis AND cellular respiration?
   a. both use chemiosmosis to form ATP
   b. both occur in plants
   c. both occur in double membrane organelles
   d. both provide or release usable energy for the cell
   e. both produce carbon dioxide

32. Which of the following can be the driving force for the movement of ions across a membrane?
   a. high-energy electrons
   b. ATP
   c. concentration gradients
   d. all of the above (a, b, and c)
   e. (a) and (b) only

33. Canaries appear yellow to us because______________.
   a. they have pigments in their feathers that absorb yellow light
   b. they have pigments in their feathers that reflect yellow light
   c. people have retina cells called cones which have pigments that initiate an action potential when visible light is absorbed.
d. (a) and (c)
e. (b) and (c)

34. The concept of color acting as a warning is best exemplified by____________________.  
   a. toads being brown  
   b. poison arrow frogs being brightly colored  
   c. apples being red  
   d. leaves being green

35. Red algae benefit from their pigmentation (color) because __________________.  
   a. red pigments absorb red light, which is readily available under water below 15m.  
   b. red pigments absorb yellow/green light, which is available under water between 10 and 20 m  
   c. chlorophyll pigments absorb yellow/green light, which is available under water between 10 and 20m  
   d. (a) and (c)  
   e. (a), (b), and (c)

36. The product(s) of light dependent reactions in the chloroplast is/are:  
   a. sugar  
   b. starch  
   c. ATP and NADPH (energy rich molecules)  
   d. water and carbon dioxide  
   e. (Don’t pick this one)

37. The product(s) of light independent reactions in the chloroplast is/are:  
   a. sugar  
   b. ATP and NADPH (energy rich molecules)  
   c. carbon dioxide and water  
   d. oxygen and water  
   e. proteins

38. In the Thylakoid Figure, the thylakoid is normal and functioning properly. Given the H+  
distribution that you see, the following is most likely  
to occur if no further energy was provided

Thylakoid Figure  
   a. Hydrogens will continue to follow the gradient out of the thylakoid space and NADPH would  
be generated for a while  
   b. Hydrogens will continue to follow the gradient into the thylakoid space  
   c. Hydrogens will continue to follow the gradient out of the thylakoid space and ATP would be  
generated for a while.  
   d. Hydrogens will continue to follow the gradient into the thylakoid space and ATP would be  
generated for a while.  
   e. ATP will continue to follow the gradient into the thylakoid space and H+ would be generated  
for a while.
39. To maintain the gradient illustrated in the Thylakoid Figure
   a. ATP must be constantly used up
   b. The thylakoid must be exposed to light
   c. A neurotransmitter must be released regularly
   d. CO2 is regularly released
   e. Electron flow must be stopped.

40. Our diver’s blood does not appear to be its normal color 15 m below the ocean surface because
   a. visible red light is filtered out by the water above her, so red light is not reflected by the blood to stimulate cones in her retina
   b. salt water changes the light reflecting qualities of red blood cells
   c. red light is converted to green light in the water above her, so green light is absorbed by her blood
   d. water pressure at 15 m depth is much greater, causing cones in her retina to malfunction, sending a confusing message to the brain
   e. neuron action potentials do not work well in divers when they are deep in water.