Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. According to the first law of thermodynamics,
   a. the energy of a system may increase if there is a corresponding decrease in energy elsewhere in the universe.
   b. the amount of energy in the universe is constant.
   c. chemical reactions do not create or destroy energy.
   d. energy can change from one form to another.
   e. all of these are true.

2. Which of the following statements is false?
   a. The universe has a specific amount of energy.
   b. One form of energy can be converted to other forms of energy.
   c. Whenever energy conversions occur, some energy is converted to less concentrated forms.
   d. Once energy is utilized, it disappears.
   e. There are differences in the quality of energy.

3. Which of the following is an application of the first law of thermodynamics?
   a. The level of entropy increases as time passes.
   b. Living organisms represent an exception to the laws of energy.
   c. The quantity of energy does not increase or decrease in the universe.
   d. Fungi and plants do not make their own energy but derive it from somewhere else.
   e. The amount of energy found in the compounds on one side of an equation is equal to that on the other side.

4. The activation energy of a reaction refers to the minimum amount of energy
   a. released by the reaction.
   b. in the reactants.
   c. in the products.
   d. necessary to cause a reaction to proceed on its own.
   e. difference between the energy of the reactants and the energy of the products.

5. CO₂ and H₂O will not form glucose on their own because
   a. CO₂ does not contain sufficient energy.
   b. H₂O does not contain sufficient energy.
   c. neither CO₂ nor H₂O contain sufficient energy.
   d. the concentration of CO₂ is too low in the atmosphere.
   e. the bonds of CO₂ and H₂O are too stable to be broken without an input of energy.
6. Endergonic reactions
   a. result in products with less energy than the reactants.
   b. require a net input of energy.
   c. occur in the breakdown of glucose.
   d. are used by cells to provide energy for biological reactions.
   e. break down large molecules into smaller molecules.

7. Which of the following statements about exergonic reactions is false?
   a. They release energy.
   b. Glucose metabolism is an example.
   c. Their products have more energy than the reactants.
   d. Some energy is converted to less biologically useful forms.
   e. Bonds are broken.

8. Which of the following statements is false?
   a. Enzymes catalyze reversible reactions in either direction.
   b. Enzymes are highly specific.
   c. Most enzymes are carbohydrate molecules.
   d. Enzymes do not allow some reactions to occur that would never occur without them.
   e. Enzymes may be temporarily modified during their involvement with the substrate.

9. Allosteric enzymes
   a. have regions that bind with inhibitor or activator molecules.
   b. are associated with important energy-carrying nucleotides.
   c. are not affected by temperature or pH.
   d. have two active sites.
   e. have all of these.

10. In some cases, inhibitors or activators of enzyme-catalyzed reactions act by
    a. binding to the substrates.
    b. affecting the supply of ATP.
    c. reversibly binding to an enzyme's allosteric site.
    d. reducing or increasing the concentration of enzymes.
    e. binding to the products.

11. A "high-energy bond" in ATP
    a. absorbs a large amount of free energy when the phosphate group is attached during hydrolysis.
    b. is formed when ATP is hydrolyzed to ADP and one phosphate group.
    c. is similar to the bonds in glucose molecules; that is why glucose can be used as a source of metabolic energy.
    d. contributes to the “energy in” part of an endergonic reaction.
    e. is/does all of these.
12. Which statement is NOT true?
   a. Membranes are often perforated by proteins that extend through both sides of the membrane.
   b. Some membranes have proteins with channels that allow for the passage of hydrophilic substances.
   c. Hydrophilic substances have an easier time passing through the lipid bilayer than do hydrophobic substances.
   d. The current concept of a membrane is best summarized by the fluid mosaic model.
   e. All of these statements are NOT true.

13. The rate of diffusion through a selectively permeable membrane will be lowest when which of the following is(are) true?
   I. Concentration gradients are steep.
   II. Temperatures are low.
   III. Solutes are small molecules.
   a. I only
   b. II only
   c. I and III
   d. II and III
   e. I, II, and III

14. Which of the following is NOT a form of passive transport?
   a. osmosis
   b. facilitated diffusion
   c. simple diffusion
   d. exocytosis
   e. none of these

15. Which of the following statements is NOT TRUE?
   a. Photons are packages of solar energy.
   b. Each photon consists of a fixed amount of energy.
   c. The least energetic photons travel in longer wavelengths.
   d. Photons with different energy levels are perceived as exhibiting different colors.
   e. Photons of visible light have wavelengths shorter than 350 nanometers.

16. Which of the following statements about the electromagnetic spectrum is true?
   a. Infrared energy is sufficient to produce ionization.
   b. Infrared radiation has more energy than red radiation.
   c. Visible light has more energy than ultraviolet radiation.
   d. Chlorophyll absorbs some visible wavelengths, but not all.
   e. Chloroplasts absorb all wavelengths of visible light equally.
17. Which of the following choices is NOT TRUE?
   a. Carotenoids use yellow and red light to assist in photosynthesis.
   b. Carotenoids are accessory pigments that capture certain energy from light and transfer it to chlorophyll a.
   c. The presence of carotenoids in a leaf is masked by the presence of chlorophyll throughout the growing season.
   d. Carotenoids absorb blue and violet wavelengths and reflect red, orange, and yellow.
   e. Both carotenoids and anthocyanins reflect red wavelengths.

18. Which of the following statements describes an electron transfer chain?
   a. It generates energy from carbohydrates.
   b. Cells use it to dispose of excess electrons.
   c. It utilizes ATP to synthesize nutrients.
   d. It transfers energy, stepwise, from one compound to another.
   e. It requires activation by oxygen.

19. A high concentration of H⁺ in the thylakoid compartment provides potential energy for the ______ by______.
   a. breakdown of water; oxidation
   b. production of ATP; ATP synthesis
   c. reduction of NADP⁺; an electron transfer chain
   d. production of sugars; the light-independent reactions
   e. production of O₂; photolysis

20. The proteins associated with the light-dependent reactions of photosynthesis are located
   a. on the outer membranes of the chloroplast.
   b. in the stroma.
   c. on the thylakoid membrane.
   d. throughout the cytoplasm of plant cells.
   e. in the thylakoid compartment.

21. Which of the following is formed last in the transfer of solar energy?
   a. H⁺
   b. excited electrons
   c. ATP
   d. O₂
   e. NADPH

22. The light-independent reactions of photosynthesis
   a. fix carbon dioxide.
   b. release oxygen.
   c. cannot occur in light.
   d. generate ATP.
   e. do all of these.
23. Aerobic respiration
   a. evolved and enabled living organisms to utilize energy stored in glucose.
   b. occurs only in animal cells because plants carry on photosynthesis.
   c. utilizes fat as its primary energy source.
   d. occurs at the same rate throughout all cells of the body.
   e. is the only cellular mechanism that yields ATP.

24. For glycolysis to begin,
   a. glucose must enter the mitochondria.
   b. there must be an input of energy from ATP.
   c. oxygen must be available.
   d. some hydrogen acceptors must be available.
   e. none of these needs to occur.

25. In the breakdown of glucose, a phosphorylated six-carbon compound is split into two three-carbon compounds, which are named
   a. PGAL.
   b. pyruvate.
   c. acetyl-CoA.
   d. lactate.
   e. acetaldehyde.

26. Substrate-level phosphorylation
   a. occurs during glycolysis.
   b. requires the presence of oxygen.
   c. is a precursor for the phosphorylation of glucose.
   d. is the source for the majority of the ATP produced in aerobic respiration.
   e. all of these are true.

27. Which of the following yields carbon dioxide during the breakdown of glucose in aerobic respiration?
   a. phosphoglycerate
   b. pyruvate
   c. oxaloacetate
   d. PGAL
   e. fructose bisphosphate

28. During the Krebs cycle,
   a. substrate-level phosphorylation occurs.
   b. oxaloacetate is regenerated.
   c. electrons and H+ are transferred to coenzymes NAD+ and FAD.
   d. molecules of carbon dioxide are formed.
   e. all of these occur.
29. During which phase of aerobic respiration is FADH₂ produced?
   a. glycolysis
   b. ethanol production
   c. acetyl-CoA formation
   d. the Krebs cycle
   e. glycolysis and the Krebs Cycle

30. The yield from each pyruvate in the second stage of aerobic respiration includes
   a. 4 NADH.
   b. 1 FADH₂.
   c. 1 ATP.
   d. 3 CO₂.
   e. all of these.

31. The electron transfer chain is located
   a. on the inner membrane of the mitochondria.
   b. on the inner membrane of the chloroplasts.
   c. in the fluid part of the chloroplast.
   d. throughout the cytoplasm of the cell.
   e. on the plasma membrane of eukaryotes.

32. Because of its location in the electron transfer chain, delivery of electrons to each NADH results in ____ ATPs.
   a. 4
   b. 2
   c. 3
   d. 32
   e. 0

33. If fermentation pathways follow glycolysis,
   a. CO₂ will be one of the products as pyruvate is converted to lactate.
   b. the two NADH molecules produced during glycolysis will (depending on the organism) be used to reduce pyruvate to either lactate or ethanol and CO₂.
   c. ATP will be required to convert pyruvate to either lactate or ethanol and CO₂.
   d. oxidative phosphorylation occurs either on the plasma membrane or on derivatives of the plasma membrane.
   e. none of these will occur.

34. In the conversion of pyruvate to ethanol, which of the following is(are) produced?
   a. acetaldehyde
   b. carbon dioxide
   c. NADH
   d. acetaldehyde and carbon dioxide only
   e. acetaldehyde, carbon dioxide, and NADH
35. If you were searching for anaerobic bacteria, you would NOT look for them in
a. the guts of farm animals.
b. swamps.
c. shallow, running water.
d. sediments of lakes and oceans.

36. Which statement is true?
   a. High concentrations of ATP inhibit the formation of more ATP.
   b. The ATP concentration in cells actually decreases at first when cells need
      large supplies of energy.
   c. The activity of many different enzymes influences the supply of ATP in
      cells.
   d. Cells constantly adjust their metabolic reactions to provide energy whenever
      it is needed.
   e. All of these are true.

37. If a mixture of bacteriophages, some labeled with radioactive sulfur and others labeled with
   radioactive phosphorus, is placed in a bacterial culture, the bacteria will eventually contain
a. radioactive sulfur.
b. radioactive phosphorus.
c. both radioactive sulfur and phosphorus.
d. neither radioactive sulfur nor radioactive phosphorus.
e. complete viruses with radioactive sulfur coats.

38. DNA and RNA are alike in
   a. the pentose sugar.
b. all the nitrogenous bases used to assemble the genetic code.
c. the number of strands.
d. their function in genetics.
e. none of these.

39. If the DNA nucleotides read ATG–CGT–GAC, the amino acid sequence of the resulting
   polypeptide would be
a. tyrosine – alanine – leucine.
b. methionine – arginine – asparagines.
c. histidine – glycine – praline.
d. serine – lysine – glycine.
e. all of these.

40. The wobble effect pertains to the matching of
   a. codons with anticodons.
b. codons with exons.
c. exons with introns.
d. template DNA with messenger RNA.
e. messenger RNA with ribosomal RNA.
41. Which of the following statements is true?
   a. Gene mutations occur independently of each other.
   b. Gene mutations are relatively rare.
   c. Ionizing radiation causes chromosomal damage and free radical formation.
   d. Mutations are random; that is, it is impossible to predict exactly when a specific gene will mutate, but an expected frequency can be assigned.
   e. All of these are true.

42. Which event may occur in all viruses, prokaryotes, and eukaryotes?
   a. duplication
   b. aneuploidy
   c. translocation
   d. mutation
   e. none of these

43. The difference between normal and sickle-cell hemoglobin is based upon
   a. the number of amino acids in the molecule.
   b. the substitution of one amino acid for another.
   c. the number and orientation of the amino acid chains attached to the heme portion of the molecule.
   d. the number of oxygen molecules that can be carried.
   e. the type of bone marrow that produces it.
MULTIPLE CHOICE

1. ANS: E       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension
   TOP: ENERGY IN THE WORLD OF LIFE

2. ANS: D       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
   TOP: ENERGY IN THE WORLD OF LIFE

3. ANS: C       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Application
   TOP: ENERGY IN THE WORLD OF LIFE

4. ANS: D       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Knowledge
   TOP: ENERGY IN THE MOLECULES OF LIFE

5. ANS: E       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
   TOP: ENERGY IN THE MOLECULES OF LIFE

6. ANS: B       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Comprehension
   TOP: ENERGY IN THE MOLECULES OF LIFE

7. ANS: C       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
   TOP: ENERGY IN THE MOLECULES OF LIFE

8. ANS: C       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
   TOP: HOW ENZYMES WORK

9. ANS: A       PTS: 1       DIF: Difficult
   OBJ: Bloom's Taxonomy: Knowledge
   TOP: METABOLISM --ORGANIZED, ENZYME-MEDIATED REACTIONS

10. ANS: C      PTS: 1       DIF: Difficult
    OBJ: Bloom's Taxonomy: Comprehension
TOP: METABOLISM -- ORGANIZED, ENZYME-MEDIATED REACTIONS

11. ANS: D  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension  
   TOP: COFACTORS IN METABOLIC PATHWAYS

12. ANS: C  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis  
   TOP: A CLOSER LOOK AT CELL MEMBRANES

13. ANS: B  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Evaluation  
   TOP: DIFFUSION AND MEMBRANES

14. ANS: D  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis  
   TOP: MEMBRANE TRAFFICKING

15. ANS: E  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis  
   TOP: SUNLIGHT AS AN ENERGY SOURCE

16. ANS: D  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis  
   TOP: SUNLIGHT AS AN ENERGY SOURCE

17. ANS: A  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis  
   TOP: SUNLIGHT AS AN ENERGY SOURCE

18. ANS: D  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Knowledge  
   TOP: LIGHT-DEPENDENT REACTIONS

19. ANS: B  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Synthesis  
   TOP: LIGHT-DEPENDENT REACTIONS

20. ANS: C  PTS: 1  DIF: Difficult  
   OBJ: Bloom's Taxonomy: Comprehension  
   TOP: ENERGY FLOW IN PHOTOSYNTHESIS

21. ANS: E  PTS: 1  DIF: Difficult
OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Synthesis
TOP: ENERGY FLOW IN PHOTOSYNTHESIS

22. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: LIGHT-INDEPENDENT REACTIONS

23. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: OVERVIEW OF CARBOHYDRATE BREAKDOWN PATHWAYS

24. ANS: B  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: GLYCOLYSIS--GLUCOSE BREAKDOWN STARTS

25. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Comprehension
TOP: GLYCOLYSIS--GLUCOSE BREAKDOWN STARTS

26. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: GLYCOLYSIS--GLUCOSE BREAKDOWN STARTS

27. ANS: B  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Evaluation
TOP: SECOND STAGE OF AEROBIC RESPIRATION

28. ANS: E  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: SECOND STAGE OF AEROBIC RESPIRATION

29. ANS: D  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Evaluation
TOP: SECOND STAGE OF AEROBIC RESPIRATION

30. ANS: E  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Application
TOP: SECOND STAGE OF AEROBIC RESPIRATION

31. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
TOP: AEROBIC RESPIRATION'S BIG ENERGY PAYOFF
32. ANS: C  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Application
    TOP: AEROBIC RESPIRATION'S BIG ENERGY PAYOFF

33. ANS: B  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Evaluation
    TOP: FERMENTATION

34. ANS: D  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
    TOP: FERMENTATION

35. ANS: C  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
    TOP: FERMENTATION

36. ANS: E  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
    TOP: MIGHTY MITOCHONDRIA (revised)

37. ANS: B  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Application
    TOP: THE DISCOVERY OF DNA'S FUNCTION

38. ANS: E  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Analysis
    TOP: TRANSCRIPTION: DNA TO RNA

    TOP: RNA AND THE GENETIC CODE

40. ANS: A  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
    TOP: RNA AND THE GENETIC CODE

41. ANS: E  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Comprehension | Bloom's Taxonomy: Analysis
    TOP: MUTATED GENES AND THEIR PROTEIN PRODUCTS

42. ANS: D  PTS: 1  DIF: Difficult  OBJ: Bloom's Taxonomy: Knowledge
    TOP: MUTATED GENES AND THEIR PROTEIN PRODUCTS
43. ANS: B   PTS: 1   DIF: Difficult   OBJ: Bloom's Taxonomy: Analysis   TOP: MUTATED GENES AND THEIR PROTEIN PRODUCTS