Chapter 03 Testbank

Student: _____

1. In biological systems, energy can be stored as

A. potential energy.

B. kinetic energy.

C. heat.

D. mechanical energy.

E. All of the answers are correct.

2. According to the first and second laws of thermodynamics

A. energy flows spontaneously from systems with high free energy to systems with low free energy in a series of step-by-step transformations.

B. the quantity of energy in the universe is constant but its quality is not.

C. transformation of potential energy in a biological system results in the loss of a small amount of energy.

D. energy can be transformed from one form to another, but can be neither created nor destroyed.

E. energy is lost from systems during energy transformations resulting in increasing entropy in the universe.

3. In biological systems, whenever energy is transformed there is always a (an)

A. increase in the entropy in the system.

B. decrease in the free energy in the system.

C. increase in the potential energy in the system.

D. increase in the entropy in the universe.

E. increase in the free energy in the universe.

4. Biological systems contribute to the increase in entropy in the universe by transforming

A. potential energy into chemical energy.

B. radiant energy into chemical energy.

C. potential energy into kinetic energy.

D. kinetic energy into potential energy.

E. chemical energy into potential energy.

5. Photosynthesis is summarised in the equation CO_2 + H_2O + radiant energy ===> sugars (CH_2O) + O_2 + heat. This is an example of

A. an open system where energy and materials are exchanged with the environment.

B. a closed system with an equilibrium between the environment and the materials.

C. an open system where energy is exchanged with the environment but materials are recycled.

D. an open system where energy is conserved but materials are exchanged with the environment.

E. a closed system where energy and materials are conserved.

6. When a biochemical reaction is at equilibrium

A. the rate of the forward reaction is equal to the rate of the reverse reaction.

B. there is no net change in the ratio of the concentration of reactants to products.

C. the concentration of the reactants is equal to the concentration of the products.

D. the rate of the forward reaction is equal to the rate of the reverse reaction and there is no net change in the ratio of the concentration of reactants to products.

E. the rate of the forward reaction is equal to the rate of the reverse reaction and the concentration of the reactants is equal to the concentration of the products.

7. When a reversible metabolic reaction is in a state of maximum disorder, the system contains its maximum

A. potential energy.

B. entropy.

C. free energy.

D. value for K_{eq}.

E. kinetic energy.

8. Spontaneous biochemical reactions

A. reach equilibrium rapidly.

B. proceed without enzymes.

C. produce products with less free energy than the reactants.

D. occur when an enzyme lowers the activation energy required for the reaction.

E. are initiated without the absorption of activation energy by the reactants.

9. An exergonic reaction

A. requires energy.

B.

has a negative ΔG.

C. is not spontaneous.

D. can be driven by an endergonic reaction.

E. requires heat to proceed.

10. In cells, non-spontaneous endergonic processes can proceed by

A. lowering the equilibrium constant (K_{eq}).

B. reducing the amount of entropy required.

C. changing the concentration of the reactants.

D. linking them to spontaneous energy-yielding processes.

E. linking them to another endergonic reaction.

11. Which statement about activation energy is CORRECT?

A. Lowering the activation energy of a reaction increases the proportion of molecules that have enough energy to react.

B. A catalyst increases the activation energy of the reactant molecules and allows the reaction to proceed more easily.

C. Activation energy is not needed if the reaction is exergonic.

D. Increasing the activation energy of a reaction decreases the amount of the product at equilibrium.

E. Activation energy is the average kinetic energy of the reactant molecules.

12. The complete oxidation of glucose in a cell is represented by the equation

$C_6H_{12}O_6 + 6O_2 \text{ ====> } 6CO_2 + 6H_2O$, DG = –2879 kJ/mol
The value 2879 kJ/mol is the amount of energy
A. converted into ATP.

B. available to convert ADP to ATP.

C. provided to the enzymes involved to lower the activation energy.

D. required to activate the reaction.

E. released as heat.

13. Which statement about enzymes is NOT true?

A. The active site of most enzymes is specific for a range of substrates.

B. Most chemical reactions in a cell require a specific enzyme.

C. The reactants that are altered by enzymes are called substrates.

D. Enzymes reduce the activation energy required for a reaction.

E. Only a small part of the enzyme molecule is involved in the reaction.

14. The rate of an enzyme-catalysed reaction can be influenced by

A. temperature.

B. pH.

C. concentration of the reactants.

D. concentration of the products.

E. All of the answers are correct.

15. The rate of an enzyme-catalysed reaction

A. increases with an increase in enzyme concentration.

B. decreases with an increase in the substrate concentration.

C. increases in the presence of allosteric inhibitors.

D. decreases in the presence of cofactors.

E. increases with a decrease in the amount of product.

16. Allosteric mechanisms regulate enzyme activity by

A. adding a phosphate group to an amino acid in the enzyme.

B. changing the 3-D shape of the enzyme.

C. binding organic molecules to the active site of the enzyme.

D. changing the amino acid composition at the active site.

E. changing the concentration of the enzyme.

17. A cofactor

A. provides energy for enzyme activity by adding phosphate residues to particular amino acids (phosphorylation).

B. competes with the substrate to bind to the active site of an enzyme.

C. controls enzyme activity by regulating expression of the DNA coding for the enzyme.

D. is an additional molecule or ion that enables the enzyme to function.

E. is covalently linked to the active site of an enzyme to increase activity.

18. The binding of a substrate to the active site of an enzyme

A. is irreversible.

B. may produce changes in the shape of the enzyme.

C. is coupled to the hydrolysis of ATP.

D. requires activation energy.

E. is by the formation of covalent bonds.

19.

The enzyme 'thermolysin' has a zinc ion as part of its active site. This ion destabilises chemical bonds in the substrate by attracting electrons and is called

A. an electron carrier.

B. an inhibitor.

C. a coenzyme.

D. a cofactor.

E. a hydrolyase.

20. Each step in the biochemical reaction A > B > C > D is catalysed by a specific enzyme. Product D binds to the enzyme that converts B to C at a specific site that is not part of its active site. The binding of D to the enzyme decreases the activity of the enzyme. In this biochemical reaction, substance D is

A. an enzyme-substrate complex.

B. an allosteric inhibitor.

C. a substrate.

D. an enzyme.

E. a cofactor.

21. Each step in the biochemical reaction A > B > C > D is catalysed by a specific enzyme. Product D binds to the enzyme that converts B to C at a specific site that is not part of its active site. The binding of D to the enzyme decreases the activity of the enzyme. In this biochemical reaction, substance B functions as

A. an enzyme-substrate complex.

B. an allosteric inhibitor.

C. a substrate.

D. an enzyme.

E. a cofactor.

22. An example of catabolism would be

A. assembling cellulose from glucose.

B. the light-independent reactions of photosynthesis.

C. anaerobic respiration.

D. transport across membranes.

E. synthesis of glycogen from glucose.

23. An enzyme catalyses the breakdown of a dipeptide into two amino acids. There is a release of energy. Terms that could be used to describe the reaction are

A. hydrolysis and exergonic.

B. oxidation and exergonic.

C. hydrolysis and endergonic.

D. condensation and exergonic.

E. condensation and endergonic.

24. ATP

A. is the only energy carrier in the cell.

B. drives energetically favourable reactions.

C. gives up its energy in the form of high energy electrons.

D. often transfers energy from degradative to synthetic pathways.

E. supplies energy for the diffusion of compounds across cell membranes.

25.

The reaction $NAD^+ + P_i$ ====> NADH is likely to be catalysed by

A. a ligase.

B. a transferase.

C. an isomerase.

D. an oxidoreductase.

E. a hydrolyase.

26. The reduction of a compound involves

A. addition of oxygen.

B. gain of electrons.

C. loss of protons.

D. the conversion of Fe^{2+} to Fe^{3+}.

E. removal of hydrogen.

27. The purpose of the cytochromes in electron transport chains is to

A. release energy in small quantities without a large loss to heat.

B. reduce NADH to NAD^+.

C. reduce Fe^{3+} to Fe^{2+}.

D. convert oxygen to water.

E. recycle ADP.

28. An electron transport chain consists of three cytochromes with the following standard redox potentials:

Cytochrome a (Fe^{3+})/Cytochrome a (Fe^{2+}) +290
Cytochrome b (Fe^{3+})/Cytochrome b (Fe^{2+}) +120
Cytochrome c (Fe^{3+})/Cytochrome c (Fe^{2+}) +220
Which cytochrome in the chain is most likely to donate electrons to the final electron acceptor (e.g. O_2)?
A. Cytochrome a (Fe^{3+})

B. Cytochrome a (Fe^{2+})

C. Cytochrome b (Fe^{2+})

D. Cytochrome c (Fe^{3+})

E. Cytochrome b (Fe^{3+})

29. Which of the following is the best energy fuel for a cell?

A. Glucose, because it has the highest proportion of C–O bonds.

B. Protein, because it has energy-rich C–N bonds.

C. Lipids, because they have the highest proportion of C–H bonds.

D. ADP, because it forms ATP.

E. Cytochromes, because they are involved in electron transport.

30. Which of the following statements about enzyme catalysis is CORRECT?

A. The specificity of an enzyme is determined by the amino acids at the active site.

B. All enzymes operate optimally at pH 7.0.

C. During substrate binding to the active site, formation of covalent bonds ensures the correct reaction occurs.

D. Enzymes require a metal ion or a cofactor for activity.

E. All of these answers are correct.

31. The direction of a biological reaction is driven by

A. the concentration of the reactants.

B. the concentration of the products.

C. the energy of the products compared to the energy of the reactants.

D. the free energy released by the reaction.

E. All of these factors affect the direction of a biological reaction.

32. The role of an enzyme in an enzyme-catalysed reaction is to

A. increase the rate at which the substrate is converted to product.

B. increase the activation energy of the reaction.

C. form an enzyme-substrate complex which cannot be converted back to free substrate.

D. convert all the substrate to product.

E. All of these are true about enzyme-catalysed reactions.

33. The specificity of an enzyme is due to

A. the unique amino acid structure of the binding surface at the active site.

B. the fixed shape of the amino acids at the active site.

C. the specific covalent bonding between the substrate and the amino acids at the active site.

D. the ability of amino acids distal from the active site to react with the substrate and correctly align the substrate.

E. All of these answers are correct.

34. Allosteric enzymes are enzymes that

A. exist in at least two different shapes.

B. require cofactors for activity.

C. are easily phosphorylated and inactivated.

D. use coenzymes for activity.

E. contain metal ions.

35. The inorganic non-protein components that participate in enzyme catalysis are known as

A. coenzymes.

B. cofactors.

C. substrates.

D. products.

E. allosteric inhibitors.

36. Reactions which do not proceed spontaneously and require energy are called

A. thermodynamic.

B. allosteric.

C. metabolic.

D. exergonic.

E. endergonic.

37. In the cell, oxidation of fuel molecules involves

A. the removal of electrons in a step-wise process.

B. oxidation of electron carrier molecules.

C. the direct reaction of fuel molecules with oxygen.

D. the addition of electrons in a step-wise process.

E. the compulsory gain or loss of protons in accordance with the gain or loss of electrons.

38. ATP is synthesised using

A. gluconeognesis.

B. an irreversible reaction driven by free electrons.

C. the addition of a phosphate group to AMP.

D. protons donated via the electron transport chain.

E. the energy of electrons removed from fuel molecules.

39. If oxidation can involve the adding of oxygen, removal of hydrogen or removal of electrons, reduction must therefore involve

A. removing oxygen, electrons or hydrogen.

B. adding oxygen, removing electrons or hydrogen.

C. removing oxygen, adding electrons, removing hydrogen.

D. adding oxygen, electrons or hydrogen.

E. removing oxygen, adding electrons or hydrogen.

40. When cells oxidise molecules such as fatty acids or glucose, which molecule generally operates as the electron carrier?

A. ATP

B. NADH

C. DNA

D. RNA

E. FADH

41. Where are cytochromes located?

A. membranes of prokaryotes, mitochondria of eukaryotes.

B. membranes of eukaryotes, mitochondria of prokaryotes.

C. membranes of both prokaryotes and eukaryotes.

D. mitochondria of both prokaryotes and eukaryotes.

E. chloroplasts.

42. The proton motive force produces

A. ATP.

B. NADH.

C. RNA.

D. free electrons.

E. protons.

43. Which of the following does NOT occur as a result of transferring electrons across the electron transport chain?

A. Creation of an electrochemical gradient

B. Formation of glucose

C. Regeneration of ATP from ADP and Pi

D. Pumping of protons across a proton impermeable membrane

E. Release of free energy

44. Oxidative phosphorylation occurs in the

A. nucleus.

B. chloroplasts.

C. cell membrane.

D. cytosol.

E. mitochondria.

45. Which of the following statements about glucose is CORRECT?

A. It is a metastable compound.

B. It has the chemical formula of $C_6H_{11}O_6$.

C. It is not a monomer.

D. It consists of a sucrose and a fructose molecule.

E. In a biological sense, energy is extracted from the C-C, C-H and C-O covalent bonds.

Chapter 03 Testbank Key

1. In biological systems, energy can be stored as

A. potential energy.

B. kinetic energy.

C. heat.

D. mechanical energy.

E. All of the answers are correct.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.1. Define the terms potential energy and kinetic energy.
Section: Chemical reactions and life processes depend on energy

2. According to the first and second laws of thermodynamics

A. energy flows spontaneously from systems with high free energy to systems with low free energy in a series of step-by-step transformations.

B. the quantity of energy in the universe is constant but its quality is not.

C. transformation of potential energy in a biological system results in the loss of a small amount of energy.

D. energy can be transformed from one form to another, but can be neither created nor destroyed.

E. energy is lost from systems during energy transformations resulting in increasing entropy in the universe.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.2. State the first and second laws of thermodynamics.
Section: Chemical reactions and life processes depend on energy

3. In biological systems, whenever energy is transformed there is always a (an)

A. increase in the entropy in the system.

B. decrease in the free energy in the system.

C. increase in the potential energy in the system.

D. increase in the entropy in the universe.

E. increase in the free energy in the universe.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.2. State the first and second laws of thermodynamics.
Section: Chemical reactions and life processes depend on energy

4. Biological systems contribute to the increase in entropy in the universe by transforming

A. potential energy into chemical energy.

B. radiant energy into chemical energy.

C. potential energy into kinetic energy.

D. kinetic energy into potential energy.

E. chemical energy into potential energy.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.1. Define the terms potential energy and kinetic energy.
Section: Chemical reactions and life processes depend on energy

5. Photosynthesis is summarised in the equation CO_2 + H_2O + radiant energy ===> sugars (CH_2O) + O_2 + heat. This is an example of

A. an open system where energy and materials are exchanged with the environment.

B. a closed system with an equilibrium between the environment and the materials.

C. an open system where energy is exchanged with the environment but materials are recycled.

D. an open system where energy is conserved but materials are exchanged with the environment.

E. a closed system where energy and materials are conserved.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.2. State the first and second laws of thermodynamics.
Section: Chemical reactions and life processes depend on energy

6. When a biochemical reaction is at equilibrium

A. the rate of the forward reaction is equal to the rate of the reverse reaction.

B. there is no net change in the ratio of the concentration of reactants to products.

C. the concentration of the reactants is equal to the concentration of the products.

D. the rate of the forward reaction is equal to the rate of the reverse reaction and there is no net change in the ratio of the concentration of reactants to products.

E. the rate of the forward reaction is equal to the rate of the reverse reaction and the concentration of the reactants is equal to the concentration of the products.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.3. Explain the equilibrium process and how enzyme action affects equilibrium.
Section: The equilibrium state of a reaction determines its available energy

7. When a reversible metabolic reaction is in a state of maximum disorder, the system contains its maximum

A. potential energy.

B. entropy.

C. free energy.

D. value for K_{eq}.

E. kinetic energy.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.2. State the first and second laws of thermodynamics.
Section: Chemical reactions and life processes depend on energy

8. Spontaneous biochemical reactions

A. reach equilibrium rapidly.

B. proceed without enzymes.

C. produce products with less free energy than the reactants.

D. occur when an enzyme lowers the activation energy required for the reaction.

E. are initiated without the absorption of activation energy by the reactants.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.4. Describe the role of free energy (ΔG) as an indicator of ultimate equilibrium position.
Section: The equilibrium state of a reaction determines its available energy

9. An exergonic reaction

A. requires energy.

B.

has a negative ΔG.

C. is not spontaneous.

D. can be driven by an endergonic reaction.

E. requires heat to proceed.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.4. Describe the role of free energy (ΔG) as an indicator of ultimate equilibrium position.
Section: The equilibrium state of a reaction determines its available energy

10. In cells, non-spontaneous endergonic processes can proceed by

A. lowering the equilibrium constant (K_{eq}).

B. reducing the amount of entropy required.

C. changing the concentration of the reactants.

D. linking them to spontaneous energy-yielding processes.

E. linking them to another endergonic reaction.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.4. Describe the role of free energy (ΔG) as an indicator of ultimate equilibrium position.
Section: The equilibrium state of a reaction determines its available energy

11. Which statement about activation energy is CORRECT?

A. Lowering the activation energy of a reaction increases the proportion of molecules that have enough energy to react.

B. A catalyst increases the activation energy of the reactant molecules and allows the reaction to proceed more easily.

C. Activation energy is not needed if the reaction is exergonic.

D. Increasing the activation energy of a reaction decreases the amount of the product at equilibrium.

E. Activation energy is the average kinetic energy of the reactant molecules.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.4. Describe the role of free energy (ΔG) as an indicator of ultimate equilibrium position.
Section: The equilibrium state of a reaction determines its available energy

12. The complete oxidation of glucose in a cell is represented by the equation

$C_6H_{12}O_6 + 6O_2 ====> 6CO_2 + 6H_2O$, DG = –2879 kJ/mol
The value 2879 kJ/mol is the amount of energy
A. converted into ATP.

B. available to convert ADP to ATP.

C. provided to the enzymes involved to lower the activation energy.

D. required to activate the reaction.

E. released as heat.

Bloom's: Knowledge
Difficulty: Hard
Learning Objective: 3.7. Describe the function of ATP, cofactors and coenzymes and explain their role in biological reactions.
Section: Chemical reactions drive events in cells

13. Which statement about enzymes is NOT true?

A. The active site of most enzymes is specific for a range of substrates.

B. Most chemical reactions in a cell require a specific enzyme.

C. The reactants that are altered by enzymes are called substrates.

D. Enzymes reduce the activation energy required for a reaction.

E. Only a small part of the enzyme molecule is involved in the reaction.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.5. Define an enzyme and explain the model of enzyme action, i.e. the lock and key model.
Section: Enzymes are biological catalysts

14. The rate of an enzyme-catalysed reaction can be influenced by

A. temperature.

B. pH.

C. concentration of the reactants.

D. concentration of the products.

E. All of the answers are correct.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.6. List factors that influence enzyme activity.
Section: Enzymes are biological catalysts

15. The rate of an enzyme-catalysed reaction

A. increases with an increase in enzyme concentration.

B. decreases with an increase in the substrate concentration.

C. increases in the presence of allosteric inhibitors.

D. decreases in the presence of cofactors.

E. increases with a decrease in the amount of product.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.6. List factors that influence enzyme activity.
Section: Enzymes are biological catalysts

16. Allosteric mechanisms regulate enzyme activity by

A. adding a phosphate group to an amino acid in the enzyme.

B. changing the 3-D shape of the enzyme.

C. binding organic molecules to the active site of the enzyme.

D. changing the amino acid composition at the active site.

E. changing the concentration of the enzyme.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.6. List factors that influence enzyme activity.
Section: Enzymes are biological catalysts

17. A cofactor

A. provides energy for enzyme activity by adding phosphate residues to particular amino acids (phosphorylation).

B. competes with the substrate to bind to the active site of an enzyme.

C. controls enzyme activity by regulating expression of the DNA coding for the enzyme.

D. is an additional molecule or ion that enables the enzyme to function.

E. is covalently linked to the active site of an enzyme to increase activity.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.7. Describe the function of ATP, cofactors and coenzymes and explain their role in biological reactions.
Section: Enzymes are biological catalysts

18. The binding of a substrate to the active site of an enzyme

A. is irreversible.

B. may produce changes in the shape of the enzyme.

C. is coupled to the hydrolysis of ATP.

D. requires activation energy.

E. is by the formation of covalent bonds.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.5. Define an enzyme and explain the model of enzyme action, i.e. the lock and key model.
Section: Enzymes are biological catalysts

19.

The enzyme 'thermolysin' has a zinc ion as part of its active site. This ion destabilises chemical bonds in the substrate by attracting electrons and is called

A. an electron carrier.

B. an inhibitor.

C. a coenzyme.

D. a cofactor.

E. a hydrolyase.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.7. Describe the function of ATP, cofactors and coenzymes and explain their role in biological reactions.
Section: Enzymes are biological catalysts

20. Each step in the biochemical reaction A > B > C > D is catalysed by a specific enzyme. Product D binds to the enzyme that converts B to C at a specific site that is not part of its active site. The binding of D to the enzyme decreases the activity of the enzyme. In this biochemical reaction, substance D is

A. an enzyme-substrate complex.

B. an allosteric inhibitor.

C. a substrate.

D. an enzyme.

E. a cofactor.

Bloom's: Comprehension
Difficulty: Medium
Learning Objective: 3.6. List factors that influence enzyme activity.
Section: Enzymes are biological catalysts

21. Each step in the biochemical reaction A > B > C > D is catalysed by a specific enzyme. Product D binds to the enzyme that converts B to C at a specific site that is not part of its active site. The binding of D to the enzyme decreases the activity of the enzyme. In this biochemical reaction, substance B functions as

A. an enzyme-substrate complex.

B. an allosteric inhibitor.

C. a substrate.

D. an enzyme.

E. a cofactor.

Bloom's: Comprehension
Difficulty: Medium
Learning Objective: 3.5. Define an enzyme and explain the model of enzyme action, i.e. the lock and key model.
Section: Enzymes are biological catalysts

22. An example of catabolism would be

A. assembling cellulose from glucose.

B. the light-independent reactions of photosynthesis.

C. anaerobic respiration.

D. transport across membranes.

E. synthesis of glycogen from glucose.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.8. Name and describe the six major classes of enzymes given in the chapter.
Section: Chemical reactions drive events in cells

23. An enzyme catalyses the breakdown of a dipeptide into two amino acids. There is a release of energy. Terms that could be used to describe the reaction are

A. hydrolysis and exergonic.

B. oxidation and exergonic.

C. hydrolysis and endergonic.

D. condensation and exergonic.

E. condensation and endergonic.

Bloom's: Knowledge
Difficulty: Hard
Learning Objective: 3.8. Name and describe the six major classes of enzymes given in the chapter.
Section: Chemical reactions drive events in cells

24. ATP

A. is the only energy carrier in the cell.

B. drives energetically favourable reactions.

C. gives up its energy in the form of high energy electrons.

D. often transfers energy from degradative to synthetic pathways.

E. supplies energy for the diffusion of compounds across cell membranes.

Bloom's: Knowledge
Difficulty: Hard
Learning Objective: 3.8. Name and describe the six major classes of enzymes given in the chapter.
Section: Chemical reactions drive events in cells

25.

The reaction $NAD^+ + P_i$ ====> NADH is likely to be catalysed by

A. a ligase.

B. a transferase.

C. an isomerase.

D. an oxidoreductase.

E. a hydrolyase.

Bloom's: Comprehension
Difficulty: Medium
Learning Objective: 3.8. Name and describe the six major classes of enzymes given in the chapter.
Section: Chemical reactions drive events in cells

26. The reduction of a compound involves

A. addition of oxygen.

B. gain of electrons.

C. loss of protons.

D. the conversion of Fe^{2+} to Fe^{3+}.

E. removal of hydrogen.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.9. Describe the processes of oxidation and reduction.
Section: Oxidation and reduction reactions

27. The purpose of the cytochromes in electron transport chains is to

A. release energy in small quantities without a large loss to heat.

B. reduce NADH to NAD^+.

C. reduce Fe^{3+} to Fe^{2+}.

D. convert oxygen to water.

E. recycle ADP.

Bloom's: Knowledge
Difficulty: Hard
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Chemical reactions drive events in cells

28. An electron transport chain consists of three cytochromes with the following standard redox potentials:

Cytochrome a (Fe^{3+})/Cytochrome a (Fe^{2+}) +290
Cytochrome b (Fe^{3+})/Cytochrome b (Fe^{2+}) +120
Cytochrome c (Fe^{3+})/Cytochrome c (Fe^{2+}) +220
Which cytochrome in the chain is most likely to donate electrons to the final electron acceptor (e.g. O_2)?
A. Cytochrome a (Fe^{3+})

B. Cytochrome a (Fe^{2+})

C. Cytochrome b (Fe^{2+})

D. Cytochrome c (Fe^{3+})

E. Cytochrome b (Fe^{3+})

Bloom's: Application
Difficulty: Hard
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

29. Which of the following is the best energy fuel for a cell?

A. Glucose, because it has the highest proportion of C–O bonds.

B. Protein, because it has energy-rich C–N bonds.

C. Lipids, because they have the highest proportion of C–H bonds.

D. ADP, because it forms ATP.

E. Cytochromes, because they are involved in electron transport.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.11. Describe the molecules that fuel metabolism.
Section: Oxidation and reduction reactions

30. Which of the following statements about enzyme catalysis is CORRECT?

A. The specificity of an enzyme is determined by the amino acids at the active site.

B. All enzymes operate optimally at pH 7.0.

C. During substrate binding to the active site, formation of covalent bonds ensures the correct reaction occurs.

D. Enzymes require a metal ion or a cofactor for activity.

E. All of these answers are correct.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.6. List factors that influence enzyme activity.
Section: Enzymes are biological catalysts

31. The direction of a biological reaction is driven by

A. the concentration of the reactants.

B. the concentration of the products.

C. the energy of the products compared to the energy of the reactants.

D. the free energy released by the reaction.

E. All of these factors affect the direction of a biological reaction.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.3. Explain the equilibrium process and how enzyme action affects equilibrium.
Section: The equilibrium state of a reaction determines its available energy

32. The role of an enzyme in an enzyme-catalysed reaction is to

A. increase the rate at which the substrate is converted to product.

B. increase the activation energy of the reaction.

C. form an enzyme-substrate complex which cannot be converted back to free substrate.

D. convert all the substrate to product.

E. All of these are true about enzyme-catalysed reactions.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.5. Define an enzyme and explain the model of enzyme action, i.e. the lock and key model.
Section: Enzymes are biological catalysts

33. The specificity of an enzyme is due to

A. the unique amino acid structure of the binding surface at the active site.

B. the fixed shape of the amino acids at the active site.

C. the specific covalent bonding between the substrate and the amino acids at the active site.

D. the ability of amino acids distal from the active site to react with the substrate and correctly align the substrate.

E. All of these answers are correct.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.5. Define an enzyme and explain the model of enzyme action, i.e. the lock and key model.
Section: Enzymes are biological catalysts

34. Allosteric enzymes are enzymes that

A. exist in at least two different shapes.

B. require cofactors for activity.

C. are easily phosphorylated and inactivated.

D. use coenzymes for activity.

E. contain metal ions.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.8. Name and describe the six major classes of enzymes given in the chapter.
Section: Enzymes are biological catalysts

35. The inorganic non-protein components that participate in enzyme catalysis are known as

A. coenzymes.

B. cofactors.

C. substrates.

D. products.

E. allosteric inhibitors.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.7. Describe the function of ATP, cofactors and coenzymes and explain their role in biological reactions.
Section: Enzymes are biological catalysts

36. Reactions which do not proceed spontaneously and require energy are called

A. thermodynamic.

B. allosteric.

C. metabolic.

D. exergonic.

E. endergonic.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.3. Explain the equilibrium process and how enzyme action affects equilibrium.
Section: The equilibrium state of a reaction determines its available energy

37. In the cell, oxidation of fuel molecules involves

A. the removal of electrons in a step-wise process.

B. oxidation of electron carrier molecules.

C. the direct reaction of fuel molecules with oxygen.

D. the addition of electrons in a step-wise process.

E. the compulsory gain or loss of protons in accordance with the gain or loss of electrons.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.9. Describe the processes of oxidation and reduction.
Section: Chemical reactions drive events in cells

38. ATP is synthesised using

A. gluconeognesis.

B. an irreversible reaction driven by free electrons.

C. the addition of a phosphate group to AMP.

D. protons donated via the electron transport chain.

E. the energy of electrons removed from fuel molecules.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.7. Describe the function of ATP, cofactors and coenzymes and explain their role in biological reactions.
Section: The equilibrium state of a reaction determines its available energy

39. If oxidation can involve the adding of oxygen, removal of hydrogen or removal of electrons, reduction must therefore involve

A. removing oxygen, electrons or hydrogen.

B. adding oxygen, removing electrons or hydrogen.

C. removing oxygen, adding electrons, removing hydrogen.

D. adding oxygen, electrons or hydrogen.

E. removing oxygen, adding electrons or hydrogen.

Bloom's: Evaluation
Difficulty: Medium
Learning Objective: 3.9. Describe the processes of oxidation and reduction.
Section: Oxidation and reduction reactions

40. When cells oxidise molecules such as fatty acids or glucose, which molecule generally operates as the electron carrier?

A. ATP

B. NADH

C. DNA

D. RNA

E. FADH

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

41. Where are cytochromes located?

A. membranes of prokaryotes, mitochondria of eukaryotes.

B. membranes of eukaryotes, mitochondria of prokaryotes.

C. membranes of both prokaryotes and eukaryotes.

D. mitochondria of both prokaryotes and eukaryotes.

E. chloroplasts.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

42. The proton motive force produces

A. ATP.

B. NADH.

C. RNA.

D. free electrons.

E. protons.

Bloom's: Knowledge
Difficulty: Easy
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

43. Which of the following does NOT occur as a result of transferring electrons across the electron transport chain?

A. Creation of an electrochemical gradient

B. Formation of glucose

C. Regeneration of ATP from ADP and Pi

D. Pumping of protons across a proton impermeable membrane

E. Release of free energy

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

44. Oxidative phosphorylation occurs in the

A. nucleus.

B. chloroplasts.

C. cell membrane.

D. cytosol.

E. mitochondria.

Bloom's: Knowledge
Difficulty: Medium
Learning Objective: 3.10. Describe the role of mediators (or biological electron carriers) in the electron transport chain.
Section: Oxidation and reduction reactions

45. Which of the following statements about glucose is CORRECT?

A. It is a metastable compound.

B. It has the chemical formula of $C_6H_{11}O_6$.

C. It is not a monomer.

D. It consists of a sucrose and a fructose molecule.

E. In a biological sense, energy is extracted from the C-C, C-H and C-O covalent bonds.

Bloom's: Knowledge
Difficulty: Hard
Learning Objective: 3.11. Describe the molecules that fuel metabolism.
Section: Oxidation and reduction reactions

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