

Maxmark Questions Chapter 2: The chemistry of life

Question 1: Within a cell, the chemical and energy transformations are known as:

- A: entropy
- B: thermodynamics
- C: photosynthesis
- D: respiration
- E: metabolism

Question 2: The energy that is stored in the bonds between the atoms in molecules is referred to as:

- A: kinetic energy
- B: potential energy
- C: metabolic energy
- D: entropy
- E: none of the above

Question 3: The first law of thermodynamics states:

- A: that energy in the universe is increasing
- B: that energy in the universe is decreasing
- C: that energy can be neither created nor destroyed
- D: the entropy of the universe is decreasing
- E: the entropy of the universe cannot be created or destroyed

Question 4: A significant proportion of energy is lost in all biological reactions as:

- A: light photons
- B: heat
- C: potential energy
- D: carbon dioxide
- E: electromagnetic radiation

Question 5: The degree of disorder of a system is known as

- A: potential energy
- B: kinetic energy
- C: equilibrium constant
- D: chemical potential
- E: entropy

Question 6: When a chemical reaction is said to be at equilibrium:

- A: there is no net change in the concentration of reactants or products
- B: the reaction is reversible
- C: potential energy is zero
- D: reactants form to produce products, producing kinetic energy
- E: all of the above

Question 7: If the reactants and products of a chemical reaction contain the same chemical energy per molecule, the equilibrium constant (K_{eq}) is equal to:

- A: 0
- B: 1
- C: INFINITY
- D: less than 1
- E: greater than 1

Question 8: The change in free energy of a system (ΔG) is dependent on changes in:

- A: the internal energy of the reactants or their heat content (ΔH)
- B: the entropy or degree of disorder of the reactants (ΔS)
- C: the temperature of the reaction
- D: A and B

E: A, B and C

Question 9: When the chemical potential ΔG of a reaction is negative, the reaction is:

- A: at equilibrium
- B: exergonic
- C: endergonic
- D: consuming energy
- E: non-spontaneous

Question 10: The rate at which a chemical reaction proceeds is dependent upon:

- A: the concentration of reactants
- B: the concentration of products
- C: the activation energy of molecules
- D: the kinetic energy of reacting molecules
- E: all of the above

Question 11: The activation energy of a reaction can be lowered by:

- A: decreasing temperature
- B: reaching equilibrium
- C: catalysis
- D: increasing the concentration of the products of the reaction
- E: all of the above

Question 12: The catalysts of biological reactions are known as:

- A: substrates
- B: peptides
- C: products
- D: reactants
- E: enzymes

Question 13: The region of an enzyme into which the substrate molecule fits is known as:

- A: the tertiary structure
- B: the enzyme complex
- C: the active site
- D: the hydrophilic region
- E: the catalytic complex

Question 14: The specificity of the binding of the enzyme to its substrate is determined by:

- A: hydrophilic interactions between the two molecules
- B: hydrophobic interactions between the two molecules
- C: its activation energy
- D: the quaternary structure of proteins and substrate
- E: the arrangement of the exposed R-groups of amino acids lining the active site

Question 15: The binding of substrates to the active site of an enzyme is achieved by:

- A: ionic interactions
- B: hydrogen bonds
- C: van der Waals forces
- D: A and B
- E: A, B and C

Question 16: In enzymes, the transition state refers to:

- A: when substrate molecules are bound to the active site and are strained and distorted

- B: when substrate molecules have been cleaved, bonds are broken but the substrate is still attached to the active site
- C: the enzyme configuration prior to binding of a substrate
- D: the enzyme configuration and tertiary structure after binding of a substrate
- E: when the catalytic action of the enzyme has been completed

Question 17: According to Koshland and Pauling's models of enzyme action, enzymes change their structure when a substrate is bound and this is termed:

- A: the transition state
- B: the stabilisation state
- C: induced fit
- D: the quaternary state
- E: stereospecificity

Question 18: The binding of substrates to an enzyme:

- A: increases the entropy of the system
- B: lowers the entropy of the system
- C: means the entropy does not change, and activation energy increases
- D: causes an increase in activation energy and entropy of the system
- E: decreases the catalytic action of the enzyme

Question 19: The rate of an enzyme reaction can be increased by:

- A: increasing the concentration of substrates
- B: increasing the concentration of enzymes
- C: increasing the concentration of the products
- D: A and B
- E: A, B and C

Question 20: Which of the following statements about enzymes is false?

- A: All enzymes work at an optimum pH of between 6.5-7.5
- B: Enzyme action is affected by temperature
- C: Enzymes are catalysts
- D: Enzymes have a high specificity for a particular substrate
- E: Enzymes speed up reaction rates

Question 21: An enzyme that has lost its characteristic three-dimensional structure is said to be:

- A: heat modified
- B: denatured
- C: allosteric
- D: stabilised
- E: induced

Question 22: Molecules, which are required by enzymes to perform their catalytic function, are called:

- A: isozymes
- B: abzymes
- C: effectors
- D: activators
- E: cofactors

Question 23: When a cofactor, used by enzymes to perform their catalytic function, is a non-protein, complex organic molecule, it is known as an:

- A: isozyme
- B: abzyme
- C: coenzyme
- D: activator
- E: allosteric isozyme

Question 24: Phosphorylation of enzymes can result in:

- A: an increase or decrease in the enzyme's activity
- B: the creation of energy
- C: denaturation
- D: competition between enzymes
- E: all of the above

Question 25: The binding of organic molecules at specific sites on the enzyme surface, other than the active site, which decreases an enzyme's reaction rate is:

- A: covalent modification
- B: concerted activation
- C: allosteric inhibition
- D: activation inhibition
- E: exvector inhibition

Question 26: For many cellular reactions, the energy released from fuel molecules is:

- A: glucose
- B: ATP
- C: glycogen
- D: oxygen
- E: lactic acid

Question 27: Hydrolysis of ATP forms:

- A: inorganic phosphate and water
- B: CO₂ and water
- C: adenosine diphosphate and inorganic phosphate
- D: adenosine diphosphate and water
- E: adenosine diphosphate and CO₂

Question 28: Which of the following is not true? ATP is:

- A: an energy rich compound
- B: cleaved to form ADP and inorganic phosphate in a reaction that requires energy
- C: an intermediate between degradative and synthetic pathways
- D: the only energy rich compound used in biological reactions
- E: all of the above are true

Question 29: A key high-energy phosphate molecule found in vertebrate striated muscle that has a higher energy of hydrolysis than ATP is:

- A: glucose 1-phosphate
- B: fructose 1-phosphate
- C: AMP
- D : phosphocreatine
- E: ADP

Question 30: Transferases and ligases are involved in:

- A: allosteric modification
- B: electron transport pathway
- C: oxidation
- D: inhibition
- E: biosynthesis of cellular constituents

Question 31: In a hydrolysis reaction:

- A: a water molecule is used
- B: complex molecules are broken down into simple ones
- C: oxidation phosphorylation occurs
- D: A and B
- E: A, B and C

Question 32: Synthetic reactions, or the building of molecules, is called:

- A: catabolism
- B: anabolism
- D: oxidation
- D: reduction
- E: oxidation-reduction reactions

Question 33: When an atom or molecule loses one or more electrons it is said to be:

- A: catabolised
- B: reduced
- C: oxidised
- D: hydrolysed
- E: hydrogenated

Question 34: Fuel molecules release energy through the direct oxidation of:

- A: a C-H bond
- B: a C-C bond
- C: a C-N bond
- D: a C=O bond
- E: a C-S bond

Question 35: The tendency to donate or accept electrons is measured in terms of the:

- A: aerobic potential
- B: anaerobic potential
- C: phosphorylating potential
- D: redox potential
- E: organic potential

Question 36: Which of the following compounds participate in oxidation reactions?

- A: NAD⁺
- B: FMN
- C: Cytochrome *c*
- D: Cytochrome *a*
- E: all of the above

Question 37: What metal atom is bound into the structure of cytochromes?

- A: Copper
- B: Iron
- C: Zinc
- D: Magnesium
- E: All of the above, depending on whether it is cytochrome *a*, *b*, *c* or *d*

Question 38: Cytochromes *a*, *c* and *b*:

- A: are found in the electron transport chain
- B: have different redox potentials
- C: occur in different orders which allow a unidirectional electron flow along a chain
- D: A and B
- E: A, B and C

Question 39: Which of the following can be used as fuel molecules by cells:

- A: carbohydrates
- B: lipids
- C: proteins
- D: A and B
- E: A, B and C

Question 40: Gram for gram, which of the following has the greatest store of energy?

A: Water

B: Lipids

C: Protein

D: Carbohydrates

E: Carbon dioxide