1. Enzymes are biological catalysts that:

(a) Increase the rate of a reaction without being consumed

(b) Decrease the rate of a reaction

(c) Initiate new chemical reactions

(d) Are used up in the reaction they catalyze

2. Most enzymes are:

(a) Lipids

(b) Carbohydrates

(c) Proteins (with some exceptions like ribozymes)

(d) Nucleic acids

3. Enzymes are highly specific and act on a specific molecule called the:

(a) Effector

(b) Inhibitor

(c) Substrate

(d) Cofactor

4. Enzymes can be denatured by factors such as:

(a) Extreme temperatures

(b) Extreme pH

(c) Heavy metals

(d) All of the above

5. Competitive inhibitors bind to the:

(a) Active site of the enzyme

(b) Allosteric site of the enzyme

(c) Substrate binding site

(d) Both (a) and (c)

6. Enzyme names often end with the suffix "-ase" and indicate the:

(a) Source of the enzyme

(b) Type of reaction catalyzed

(c) Function of the enzyme

(d) Substrate of the enzyme

7. The International Union of Biochemistry and Molecular Biology (IUB) classifies enzymes based on the type of reaction they catalyze. Which class includes enzymes that transfer functional groups between molecules?

(a) Oxidoreductases

(b) Transferases

(c) Hydrolases

(d) Lyases

8. Each enzyme in the IUB classification system is assigned a unique Enzyme Commission (EC) number. This number consists of:

(a) A single digit

(b) Two digits separated by a period

(c) Four digits separated by periods

(d) A letter and a number

9. Hexokinase (EC 2.7.1.1) belongs to subclass 7 of class 2 in the IUB classification. What type of reaction does it catalyze?

(a) Oxidation-reduction

(b) Transfer of a phosphoryl group

(c) Hydrolysis of a bond

(d) Cleavage of C-C, C-O, or C-N bonds

10. Enzymes with similar EC numbers are likely to have similar:

(a) Substrate specificities

(b) Reaction mechanisms

(c) Both (a) and (b)

(d) Neither (a) nor (b)

11. The Michaelis constant (Km) represents the substrate concentration at which the reaction rate reaches:

(a) 0%

(b) 50%

(c) 100%

(d) It depends on the specific enzyme

12. A higher Km value indicates:

(a) Lower affinity of the enzyme for the substrate

(b) Higher affinity of the enzyme for the substrate

(c) Slower rate of the reaction

(d) All of the above

13. The Michaelis-Menten equation relates the reaction rate (v) to the substrate concentration ([S]). The Lineweaver-Burke plot is a graphical representation of this equation and allows for the determination of:

(a) Km and Vmax (maximum reaction velocity)

(b) Km only

(c) Vmax only

(d) Neither Km nor Vmax

14. In a Lineweaver-Burke plot, the y-intercept is equal to:

(a) 1/Vmax

(b) Km

(c) Vmax

(d) -Km

15. A competitive inhibitor will:

(a) Increase the Km value on a Lineweaver-Burke plot

(b) Decrease the Km value on a Lineweaver-Burke plot

(c) Have no effect on the Km value on a Lineweaver-Burke plot

(d) It depends on the specific inhibitor

16. Enzyme inhibitors are molecules that decrease the activity of an enzyme. They can be classified into two main types. Competitive inhibitors bind to the:

(a) Active site of the enzyme

(b) Allosteric site of the enzyme

(c) Neither, they bind a different site entirely

(d) Substrate binding site, but not the active site

17. Non-competitive inhibitors bind to a site other than the active site, but still cause inhibition. An example of a non-competitive inhibitor is:

(a) Malonate, which competes with succinate in the citric acid cycle

(b) Allopurinol, which inhibits xanthine oxidase in gout treatment

(c) Aspirin, which inhibits cyclooxygenase and reduces inflammation

(d) Penicillin, which inhibits bacterial cell wall synthesis

18. Irreversible inhibitors covalently modify the enzyme, permanently inactivating it. An example of an irreversible inhibitor is:

(a) Methotrexate, which inhibits folate synthesis in cancer treatment

(b) Diuretics, which increase urine output by inhibiting water reabsorption

(c) Statins, which lower cholesterol by inhibiting HMG-CoA reductase

(d) Acarbose, which delays carbohydrate breakdown by inhibiting intestinal glucosidase

19. Enzyme induction is a regulatory mechanism where the synthesis of an enzyme is increased in response to the presence of its substrate. This is commonly seen in the regulation of:

(a) Digestive enzymes

(b) Detoxification enzymes

(c) Both (a) and (b)

(d) Neither (a) nor (b)

20. Enzyme repression is the opposite of induction, where the synthesis of an enzyme is decreased in response to high levels of its product. This helps to maintain:

(a) Cellular homeostasis

(b) Substrate availability

(c) Energy balance

(d) All of the above

21. Feedback inhibition is a specific type of enzyme repression where the end product of a metabolic pathway inhibits an earlier enzyme in the pathway. This provides a mechanism for:

(a) Coordinated regulation of metabolic pathways

(b) Prevention of substrate depletion

(c) Product formation only when needed

(d) All of the above

22. Allosteric enzymes are enzymes that have one or more regulatory sites distinct from the active site. These regulatory sites can bind to:

(a) Allosteric activators, increasing enzyme activity

(b) Allosteric inhibitors, decreasing enzyme activity

(c) Both (a) and (b)

(d) Neither (a) nor (b)

23. Binding of an allosteric activator to an allosteric enzyme can induce a conformational change that:

(a) Increases the affinity of the enzyme for its substrate

(b) Decreases the affinity of the enzyme for its substrate

(c) Increases the Vmax of the enzyme

(d) All of the above

24. An example of an allosteric enzyme is phosphofructokinase (PFK-1), a key regulatory enzyme in glycolysis. Citrate, a product of a later step in the pathway, acts as an allosteric:

(a) Activator, indicating high ATP levels and slowing glycolysis

(b) Inhibitor, indicating high ATP levels and slowing glycolysis

(c) Activator, indicating low ATP levels and stimulating glycolysis

(d) Inhibitor, indicating low ATP levels and stimulating glycolysis

25. The regulatory properties of allosteric enzymes allow for a more:

(a) Flexible and responsive metabolic control

(b) Simple and linear reaction rate

(c) Increased enzyme production

(d) Decreased substrate availability

26. Enzyme replacement therapy is a treatment approach used for some genetic disorders caused by:

(a) Deficiencies in specific enzymes

(b) Mutations in enzyme structure leading to reduced activity

(c) Both (a) and (b)

(d) Excessive enzyme activity

27. Thrombolytic drugs like streptokinase are enzymes used to dissolve blood clots by:

(a) Degrading fibrin, a major component of clots

(b) Inhibiting platelet aggregation

(c) Reducing blood viscosity

(d) All of the above

28. Digestive enzymes like lactase can be used as dietary supplements to help individuals with:

(a) Lactose intolerance

(b) Celiac disease

(c) Crohn's disease

(d) Ulcerative colitis

29. Measuring the activity of certain enzymes in the blood can be used to diagnose diseases like:

(a) Liver damage (elevated ALT and AST)

(b) Myocardial infarction (elevated cardiac troponin)

(c) Prostate cancer (elevated PSA)

(d) All of the above

30. Isoenzymes are enzymes with slight variations in structure that can be found in different tissues. Measuring specific isoenzymes can help pinpoint the:

(a) Overall level of enzyme activity

(b) Tissue origin of a disease process

(c) Specific genetic mutation causing an enzyme deficiency

(d) Effectiveness of enzyme replacement therapy

31. Creatine kinase (CK) has multiple isoenzymes. CK-MB, primarily found in heart muscle, is elevated in the blood following a heart attack. This is an example of using isoenzymes for:

(a) Diagnosis of tissue-specific damage

(b) Monitoring enzyme replacement therapy

(c) Studying enzyme structure-function relationships

(d) Identifying genetic polymorphisms

32. Coenzymes are small organic molecules that function as:

(a) Catalytic components of enzymes

(b) Regulatory molecules for enzyme activity

(c) Building blocks for macromolecules

(d) Energy carriers in cellular metabolism

33. Coenzymes often participate in reactions by accepting or donating:

(a) Functional groups like phosphates or methyl groups

(b) Electrons

(c) Both (a) and (b)

(d) Neither (a) nor (b)

34. Nicotinamide adenine dinucleotide (NAD+) is a coenzyme involved in numerous oxidation-reduction reactions. The reduced form of NAD+ is:

(a) NADH

(b) NADP+

(c) NADPH

(d) FAD

35. Flavin adenine dinucleotide (FAD) is another important coenzyme that functions as an electron carrier in cellular respiration. The reduced form of FAD is:

(a) NADH

(b) NADP+

(c) NADPH

(d) FADH2

36. Coenzyme A (CoA) is a crucial coenzyme involved in:

(a) Fatty acid metabolism

(b) Amino acid metabolism

(c) Carbohydrate metabolism

(d) All of the above

37. Biotin is a B vitamin that acts as a coenzyme for enzymes involved in:

(a) Gluconeogenesis and fatty acid synthesis

(b) Transamination reactions of amino acid metabolism

(c) Decarboxylation reactions

(d) Activation of fatty acids for metabolism

38. Thiamine pyrophosphate (TPP) is a coenzyme essential for the activity of enzymes in the:

(a) Citric acid cycle

(b) Pentose phosphate pathway

(c) Electron transport chain

(d) Urea cycle

39. A deficiency in vitamin B6 (pyridoxine) can lead to symptoms like:

(a) Peripheral neuropathy

(b) Dermatitis

(c) Anemia

(d) All of the above

40. Coenzyme deficiencies can disrupt various metabolic pathways, leading to a range of diseases. Understanding coenzyme function is crucial for:

(a) Development of targeted therapies for metabolic disorders

(b) Design of personalized nutrition plans

(c) Both (a) and (b)

(d) Neither (a) nor (b)