1. The atomic # for Fe (iron) is 26. How many protons in Fe\(^{2+}\)?
   (A) 22 (B) 24 (C) 26 (D) 28 (E) 30

2. Two molecules that are isomers:
   (A) must contain the same functional groups
   (B) often differ in the number of unsaturated bonds they possess
   (C) have the same molecular formulas
   (D) often have different masses

3. The maximum number of electrons which may occupy any given energy level in an atom is:
   (A) the Group number
   (B) the valence of that atom
   (C) \(n^2\)
   (D) 2n
   (E) the octet rule

4. In which of the following kinds of organic compounds does a carbon atom bond ONLY to hydrogen and other carbon atoms?
   (A) carbohydrates
   (B) fatty acids
   (C) lipids
   (D) nucleic acids
   (E) hydrocarbons

5. Glycogen is best defined as a:
   (A) storage form of lipids
   (B) storage form of glycerol
   (C) polymer of lactose
   (D) polymer of glucose
   (E) storage form of proteins

6. Most biologically important atoms attempt to possess _____ electrons in their outermost energy level.
   (A) \(n^2\) (B) 2 (C) 10 (D) 4 (E) 8

7. The number of valence electrons in an atom with atomic number 13 is:
   (A) 1 (B) 3 (C) 5 (D) 8 (E) 13

8. Which molecule does NOT have a polar covalent bond?
   (A) \(\text{H}_2\text{O}\) (B) \(\text{H-Br}\) (C) \(\text{H-H}\) (D) \(\text{H-F}\) (E) \(\text{H-I}\)

9. What chemical family does \(\text{H}_2\text{C=C=CH}_2\) belong to?
   (A) alkane
   (B) alkene
   (C) alkyne
   (D) ether
   (E) ester

10. In the induced-fit model of enzyme action, a _______ must bind to the enzyme's_______ for the enzyme to perform its function.
    (A) catalyst; activation energy
    (B) product; active site
    (C) substrate; active site
    (D) product; catalytic site
    (E) water molecule; allosteric site

11. Which one of the following applies to a basic solution?
    (A) high \(\text{OH}^-\)
    (B) low \(\text{OH}^-\)
    (C) high \(\text{H}^+\)
    (D) \(\text{H}^+ = \text{OH}^-\)
    (E) both B and C are correct

12. Which one of the four classes of biologically important molecules does CELLULOSE belong to?
    (A) carbohydrates
    (B) nucleic acids
    (C) proteins
    (D) lipids

13. Amino acids are joined during a(n) __________ reaction and a(n) __________ bond/linkage is formed.
    (A) hydrolysis; peptide
    (B) neutralization; ether
    (C) condensation; amide
    (D) oxidation; ester

14. With respect to proteins, the primary structure refers to the:
    (A) helix or pleated sheet pattern of a polypeptide
    (B) complex 3-dimensional folding pattern of a polypeptide
    (C) interaction of more than one polypeptide chain
    (D) ordered sequence of amino acids in a polypeptide
15. With respect to proteins, the **quaternary structure** refers to the:  
(A) helix or pleated sheet pattern of a polypeptide  
(B) complex 3-dimensional folding pattern of a polypeptide  
(C) interaction of more than one polypeptide chain  
(D) ordered sequence of amino acids in a polypeptide

16. Complete the equation: glucose + fructose ——— ?  
(A) maltose  
(B) sucrose  
(C) cellulose

17. Which molecule would provide the most glucose upon hydrolysis?  
(A) polypeptide  
(B) starch  
(C) amino acid

18. An athlete is tested at an Olympic event and STEROIDS are found in the bloodstream. Which class of biologically important molecules are **steroids** related to?  
(A) carbohydrates  
(B) proteins  
(C) lipids

19. The **independent** variable in a scientific experiment is the:  
(A) condition or event manipulated by the investigator  
(B) condition or event that may change due to the other variable  
(C) condition which the investigator attempts to keep the same  
(D) same as the dependent variable

20. Glucose + galactose produces:  
(A) lactose  
(B) cellulose  
(C) maltose

21. If the H from the OH group in CH$_3$-OH is removed and replaced with a M ETHYL group, what family will the molecule then belong to?  
(A) ether  
(B) aldehyde  
(C) carboxylic acid

22. Which of the following is **CORRECT** for an exergonic reaction?  
(A) more activation energy is needed than for an endergonic reaction  
(B) less activation energy is needed than for an endergonic reaction  
(C) products have more energy than reactants  
(D) products have less energy than reactants  
(E) both B and C are correct

23. **Hydrolysis** is best described as the:  
(A) heating of a compound in order to drive off excess water and concentrate its volume  
(B) breaking of a long-chain compound into subunits by adding water  
(C) linking of two or more molecules by the removal of one or more water molecules  
(D) constant removal of hydrogen atoms from the surface of a carbohydrate

24. Unlike triglycerides, **phospholipid** molecules:  
(A) have 1 lipid tail  
(B) have 2 lipid tails  
(C) have 3 lipid tails  
(D) have 4 lipid tails  
(E) have NO lipid tails

25. Which one of the following would convert a **liquid** fat to a **solid** fat:  
(A) add heat  
(B) add hydrogen (hydrogenation)  
(C) add carbon  
(D) unsaturate it  
(E) add "kinks" in tails
26. **Enzymes**:
   (A) increase the rate of a chemical reaction  
   (B) are consumed in chemical reactions  
   (C) raise activation energy  
   (D) are always stored in active form  
   (E) all of the above

27. The following **chemical reaction** occurs during a process called "glycolysis":

   glucose + ATP  \( \rightarrow \)  glucose-6-phosphate + ADP

   In this reaction, the substrate is _____________ and the enzyme is _______________.
   (A) ATP; ADP  
   (B) ADP; glucose-6-phosphate  
   (C) glucose-6-phosphate; kinase  
   (D) kinase; glucose  
   (E) glucose; kinase

28. The exoskeleton of many insects is made of **chitin** which is a modified form of:
   (A) carbohydrate  
   (B) protein  
   (C) lipid  
   (D) nucleic acid

29. Electrons are shared **unequally** in a(n) ________ bond.
   (A) non polar covalent  
   (B) hydrogen  
   (C) ionic  
   (D) polar covalent  
   (E) both A and B

30. Myoglobin is an oxygen-carrying molecule in muscle. It consists of just one polypeptide chain. Myoglobin **lacks**:
   (A) primary structure  
   (B) secondary structure  
   (C) tertiary structure  
   (D) quaternary structure

( ANSWERS ON NEXT PAGE )
Answers for EVEN question numbers are given below. Students discuss all ODD questions.

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