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1) Which functional groups CANNOT form hydrogen bonds with each other?

- a) Hydroxyl and amine groups
- b) Hydroxyl and carboxyl groups
- c) Amine and monosubstituted amide groups
- d) Carboxyl and carbonyl groups
- e) Disubstituted amide and carbonyl groups

2) Immunoglobulin structure has the following feature:

- a) Noncovalent interactions connect the heavy chains to light chains
- b) All immunoglobulin types are found as dimers
- c) Differences in the constant regions make isotypes
- d) The hypervariable regions are present on the tips of the heavy chains but not the light chains
- e) The carbohydrate moiety is linked to the Fc domain of the light chains
- 3) Dialysis is dependent on:
 - a) Protein charge
 - b) Protein-protein interaction
 - c) Protein solubility
 - d) Protein hydrophobicity
 - e) Protein size

4) You have 1 equivalent of H_2SO_4 in 500 mL. What is the molarity of the solution?

- a) 0.25 M
- b) 3 M
- c) 2 M
- d) 1 M
- e) 0.5 M

5) Which type of enzyme does catalyze the conversion of a dipeptide into two separate amino acids?

- a) A dehydrogenase
- b) An oxidoreductase
- c) A decarboxylase
- d) A hydrolase
- e) A lyase

6) The following statement is TRUE regarding hemoglobin:

- a) Each heme molecule can bind to two oxygen molecules
- b) Heme group is attached to the surface of hemoglobin
- c) Hemoglobin has a high affinity to oxygen at peripheral tissues
- d) Proximal histidine is non-covalently bound to the iron of heme
- e) Distal histidine interacts with the bound oxygen
- 7) Amphipathic molecules:
 - a) Are made of both lipids and sugars
 - b) Have hydrophobic and hydrophilic regions
 - c) Have ring structures
 - d) Never dissolve in water
 - e) Are rounded in structure
- 8) CRISPR-Cas9 allows for:
 - a) Gene editing
 - b) Analysis of promoters
 - c) Protein expression
 - d) Protein tagging
 - e) Protein purification

9) Which of the following statements is TRUE regarding modified amino acids & short peptides:

- a) Enkephalins are pentapeptides that regulate smooth muscle contraction
- b) Carnosine is a tripeptide that functions as antioxidant
- c) Both ends of oxytocin and vasopressin are composed of methyl groups
- d) Gramicidin and tyrocidine A are peptides ends linked by disulfide bonds
- e) Aspartame is unsuitable for consumption by phenylketonuria patients

10) One of the following statements is TRUE of enzyme catalysts:

- a) The transition state molecule has a lower free energy when complexed with the enzyme than uncomplexed transition state
- b) The enzyme is generally equally active on D and L isomers of substrates
- c) The enzyme makes reactions less endergonic
- d) The catalytic activity of enzymes is independent of pH
- e) To be effective, the enzyme must be present at the same concentration as their substrates
- 11) The abundant lipid in myelin sheath is:
 - a) Plasmalogen
 - b) Lecithin
 - c) Globoside
 - d) Sphingomyelin
 - e) Cardiolipin

12) Which group of amino acids can exist in the transmembrane domain of an integral membrane protein?

- a) Met, Val, Trp, lle
- b) Thr, Leu, Asn, Lys
- c) Arg, Asp, Ser, Leu
- d) Pro, His, Tyr, Ala
- e) Lys, Gln, Cys, Phe

13) A drug is a weak acid (HA) with a pka of 4. It is absorbed into the blood through the cells lining the stomach and the small intestine. The pH of the stomach contents is about 2, and the pH of the small intestine is about 6. Is more of this drug absorbed into the bloodstream from the stomach or from the small intestine?

- a) Small intestine because more drug is in the uncharged form that can cross cell membranes easier
- b) Small intestine because more drug is in the charged form that can cross cell membranes easier
- c) The drug is absorbed equally from stomach and small intestine into the bloodstream
- d) Stomach because more drug is in the neutral form that can cross cell membranes easier
- e) Stomach because more drug is in the charged form that can cross cell membranes easier

14) Ceramide is the basic structure of:

- a) Triglycerides
- b) Phospholipids
- c) Sphingolipids
- d) Plasmalogens
- e) Cholesteryl esters

15) The luciferase assay is used to:

- a) Test for the transcription site of a gene
- b) Test for regulatory sequences of gene expression
- c) Purify a protein
- d) Measure expression of luciferase in flies
- e) Express a tagged protein

16) When performing PCR, the order to temperatures of the steps within a typical cycle is:

- a) 60°C, 72°C, 95°C
- b) 95°C, 60°C, 72°C
- c) 72°C, 95°C, 60°C
- d) 60°C, 95°C, 72°C
- e) 95°C, 72°C, 60°C

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17) You performed an experiment on an enzyme that follows the Michaelis-Menten behavior with a Km value of 0.3 μ M. The velocity of this enzyme at substrate concentration of 60 μ M is approximately:

- a) 50% of Vmax
- b) 99% of Vmax
- c) 33% of Vmax
- d) 0.001 of Vmax
- e) 70% of Vmax

18) The CORRECT statement about myoglobin is:

- a) It is made of beta sheets completely
- b) Its p50 towards oxygen is constant with changing oxygen pressure in muscle tissues
- c) It is an allosteric protein
- d) It has high affinity towards oxygen
- e) Oxygen is released during light exercise

19) When blood pH decreases due to a metabolic problem, the following compensation may occur:

- a) More CO2 is exhaled
- b) More H2CO3 is produced
- c) Less HCO3- is reabsorbed
- d) More HCO3- is reabsorbed
- e) Less CO2 is exhaled

20) This sugar molecule is branched:

- a) Hyaluronic acid
- b) Cellulose
- c) Heparin
- d) Chondroitin sulfate
- e) Amylopectin

21) The following is NOT related to glycolipids:

- a) Cerebrosides
- b) Phosphatidylinositol
- c) Ganglioside
- d) Globosides
- e) Cardiolipin

22) One of the following is NOT true in regard to isozymes:

- a) They may be activated differently
- b) They may catalyze different reactions using the same substrate
- c) They may function in different tissues
- d) They may have different affinities for their substrate
- e) They are produced from different genes

23) Collagen and elastin share the following structural feature:

- a) High concentration of proline residues
- b) High elasticity due to the presence of the hydrophobic segments
- c) The formation of desmosine cross links
- d) Hydroxylation of proline to introduce kinks in their structures
- e) Hydroxylysine that acts as an attachment site for carbohydrate moiety

24) In any form of chromatography, how will a compound that interacts more strongly with the stationary phase elute compared to one that interacts less strongly?

- a) A compound interacting more strongly will elute later
- b) A compound interacting more strongly will elute earlier
- c) None of the answers is true
- d) The weaker the binding, the higher concentration of salt in the buffer being used
- e) The order of the elution has nothing to do with interactions with the stationary phase

25) Activation of protein kinase A involves all of the following EXCEPT:

- a) Dissociation of subunits
- b) Changing the quaternary structure of the whole protein
- c) Binding to its substrate
- d) Binding to cAMP
- e) Binding to a small modifier

26) The chemical bond that links two monosaccharides is known as:

- a) Ester
- b) Saccharidic
- c) Phosphodiester
- d) Phosphoanhydride
- e) Glycosidic

27) Which of the following is an aldo-pentose?

- a) Glucose
- b) Mannose
- c) Galactose
- d) Ribose
- e) Fructose

28) You have purified 100 mg of an enzyme with a molecular weight of 65 KDa, and measured its rate of reaction in 2.5 L and found it to be 5 x 10⁻⁴ M/sec. What is the specific activity of this enzyme?

- a) 8.125 x 10^2 mol/sec.g
- b) 8.125 x 10^5 mol/sec.g
- c) 12.5 x 10^-3 mol/sec.g
- d) 1.25 x 10^-3 mol/sec.g
- e) 8.125 mol/sec.g

20) The community describes describes a the following with raise of estarts	
29) The enzyme pyruvate decarboxylase depends on the following vitamin as a cofactor:	
a) Vitamin B1 (thiamine)	
b) Vitamin B5 (pantothenic acid)	
c) Vitamin b3 (niacin)	
d) Vitamin b2 (flavin)	
e) Biotin	
30) The amino acid that disrupts beta sheet is:	
a) Pro	
b) Lys	
c) Gly	
d) Glu	
e) Trp	
31) A monosaccharide has 3 chiral carbon centers. The number of isomers (including itself)):
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a) 5 b) 8	
c) 16	
d) 12	
e) 3	
32) X-gal is a metabolite used in this assay:	
a) Cell survival	
b) Co-immunoprecipitation	
c) Yeast two-hybrid system	
d) CRISPR-Cas9	
e) Gene cloning	

33) Yeast cells are used instead of bacteria to express human proteins because:

- a) They accept unique plasmids
- b) They can be selected better
- c) They can fold human proteins properly
- d) They are easier to manipulate
- e) They grow faster

34) The non-covalent interactions that reduce the unfavorable interactions between hydrophilic and hydrophobic molecules are:

- a) Hydrogen bonds
- b) Disulfide bridges
- c) Hydrophobic interactions
- d) Van der Waals forces
- e) Electrostatic interactions

35) One of the following factors does NOT affect the effect of diffusion in enzymatic reactions:

- a) Dephosphorylation
- b) Compartmentalization
- c) Formation of enzyme complex
- d) Temperature
- e) Membrane binding of enzyme and substrate

36) An albumin has 16 histidine residues whereas hemoglobin has 38 histidine residues. The difference between their buffering action is:

- a) Albumin has a larger buffering range
- b) Hemoglobin has a larger buffering range
- c) Albumin has a larger buffering capacity
- d) Hemoglobin has a larger buffering capacity
- e) Both have the same buffering range and capacity

37) Denaturation DOES NOT disrupt:

- a) Primary structure
- b) Secondary structure
- c) Tertiary structure
- d) Quaternary structure
- e) Protein function

38) Many drugs like the antibiotics streptomycin and erythromycin are derived from:

- a) Proteoglycans
- b) Oligosaccharides
- c) Glycosaminoglycans
- d) Amino acids
- e) Sphingolipids

39) Treatment of the pentapeptide with cyanogen bromide generated two fragments, a tripeptide that is positively charged at pH 7 and a dipeptide that is negatively charged at pH 7. Based on this, one of the following is a valid prediction of the peptide:

- a) Lys-Phe-Met-Asp-Val
- b) Phe-Lys-Val-Met-Asp
- c) Phe-Pro-Met-Val-Asp
- d) Lys-Asp-Met-Phe-Val
- e) Val-Met-Asp-Phe-Lys

40) Where would an acidic amino acid have its zwitterionic form in the titration curve?

- a) After the completion of the first step of titration
- b) At the inflection point of the second step of titration
- c) At the inflection point of the first step if titration
- d) After the completion of the third step of titration
- e) After the completion of the second step of titration

41) RNA-seq DOES NOT allow for:

- a) Identification of mutations
- b) Comparative gene expression
- c) Confirming protein expression
- d) Measurement of gene expression
- e) Identification of novel expressed genes

42) One of the following enzymes is most specific for liver disease:

- a) AST
- b) LDH1/LDH2
- c) ALT
- d) LDH
- e) CPK

43) Which group of amino acids is likely to be found in the catalytic active site of an enzyme?

- a) Alanine, valine, threonine
- b) Tyrosine, threonine, leucine
- c) Leucine, lysine, alanine
- d) Serine, histidine, aspartate
- e) Cysteine, isoleucine, phenylalanine

44) Arginine amino acid can be used to synthesize:

- a) Nitric oxide
- b) Epinephrine
- c) Glutathione
- d) Serotonin
- e) GABA

45) Allopurinol, a drug used to reduce level of uric acid in blood, is an analogue of the substrate of the enzyme xanthine oxidase (X.O). The drug undergoes partial reactions & remains tightly bound to the enzyme. This mechanism of action is called:

- a) Feedback inhibition
- b) Allosteric inhibition
- c) Suicide inhibition
- d) Decreasing subunit cooperative
- e) Non-competitive inhibition

46) Which of the following statements does best describe an allosteric binding site?

- a) It is a binding site that can accept a wide variety of differently shaped molecules
- b) It is a binding site containing amino acids with aliphatic side chains
- c) It is a binding site, that is separate from the active site, and affects the activity of an enzyme when it is occupied by a ligand
- d) It is an active site with two sub-sites; binding and catalytic
- e) It is a description of an active site that has undergone an induced fit