

1. A buffer contains 0.010 mol of lactic acid ($pK_a = 3.86$) and 0.050 mol of sodium lactate per liter. Calculate the pH of the buffer.
(A) pH 5.8 (B) pH 7.2 (C) pH 3.4 (D) pH 4.6
2. Which of the following is **not** a noncovalent interaction?
(A) Electrostatic interaction (B) Hydrophobic interaction (C) Disulfide bond
(D) Hydrogen bond
3. Which of the following peptides exhibits the highest UV absorbance at the wavelength of 280 nm? (A) Thr-Lys-Met (B) Tyr-Trp-Arg (C) His-Gly-Pro (D) Asp-Ala-Glu
4. Which of the following reagents cleaves at the C-terminus of a Tyr or Phe residue in a protein?
(A) Chymotrypsin (B) Trypsin (C) Cyanogen bromide (D) Pepsin
5. In a mixture of the five proteins listed below, which should elute first in size-exclusion? (gel filtration) chromatography?
(A) immunoglobulin G $M_r = 145,000$
(B) ribonuclease A $M_r = 13,700$
(C) RNA polymerase $M_r = 450,000$
(D) serum albumin $M_r = 68,500$
6. Regions in proteins that show specific patterns of folding or function are called:
(A) Domains (B) Peptides (C) Sites (D) Subunits
7. Which of the following is **not** commonly used to assist protein folding?
(A) Heat shock protein (B) Disulfide isomerase (C) Chaperone (D) Ubiquitin
8. In the binding of oxygen to myoglobin and hemoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:
(A) both are linear with a negative slope
(B) both are linear with a positive slope
(C) hyperbolic for myoglobin; sigmoidal for hemoglobin
(D) sigmoidal for myoglobin ; hyperbolic for hemoglobin
9. Which of the following is **not** correct concerning cooperative binding of a ligand to a protein?
(A) It is usually a form of allosteric interaction.
(B) It rarely occurs in enzymes.
(C) It results in a sigmoidal binding curve.
(D) It is usually associated with proteins with multiple subunits.
10. In the Lineweaver-Burk plot for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the (A) V_{max} . (B) intercept on the $1/V$ axis.

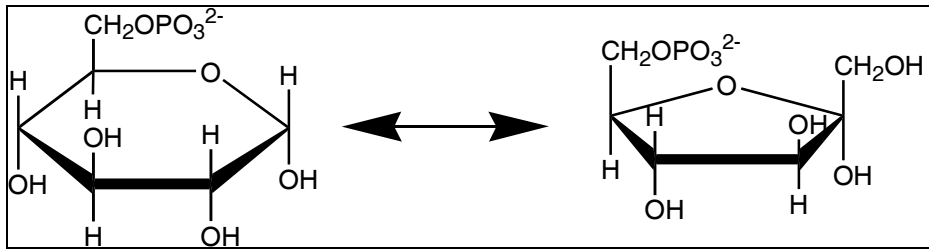
(C) intercept on the $1/[S]$ axis. (D) curvature of the plot.

11. Coenzymes $NAD^+/NADH$ are commonly used as coupling reactions for enzyme activity assay. Which of the following best describes the measurement of NADH production?
(A) $A_{340\text{ nm}}$ increases (B) $A_{340\text{ nm}}$ decreases (C) $A_{595\text{ nm}}$ increases (D) $A_{595\text{ nm}}$ decreases
12. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to: (A) specific lipids. (B) specific oligosaccharides. (C) specific peptides. (D) amphipathic molecules.
13. Which of the following proteins would show up as the band at the bottom of an SDS polyacrylamide gel after electrophoresis?
(A) Ribonuclease A, 14 kDa (B) Myoglobin, 17 kDa (C) DNase I, 31 kDa
(D) Serum albumin, 67 kDa
14. Which of the following bonds or interactions is/are possible contributors to the stability of the tertiary structure of a globular protein?
(A) peptide bonds between a metal ion cofactor and a histidine residue
(B) hydrophobic interactions between histidine and tryptophan R groups
(C) covalent disulfide cross-links between two methionine residues
(D) hydrogen bonds between serine residues and the aqueous surroundings
15. A small molecule (generally under M_r 5000) that can attach to larger molecules in order to elicit an immune response is called?
(A) antigen (B) allergen (C) hapten (D) epitope
16. Which of the following substances is found in RNA molecules but not in DNA molecules?
(A) thymine (B) uracil (C) phosphorus (D) adenine
17. Which kind of experiment procedure is used to probe DNA sequences?
(A) Eastern blotting (B) Northern blotting (C) Southern blotting (D) Western blotting
18. During replication of DNA, a nucleotide base that would bond with cytosine is?
(A) guanine (B) thymine (C) uracil (D) adenine
19. The main purpose of fermentation is to (A) synthesize new glucose molecules (B) regenerate NAD^+ from NADH (C) generate proton gradient for ATP synthesis (D) oxidize glucose to generate NADH
20. Which of the following monosaccharides is not an aldose? (A) ribose (B) glucose (C) mannose (D) fructose
21. In glycogen biosynthesis, the most importance to direct addition unit is (A) glucose-UDP (B) glucose-1-p (C) glucose-6-p (D) glucose
22. In steroid hormone biosynthesis the most important precursor is (A) aldosterone (B) cortisol (C) progesterone (D) testosterone
23. How many NADH are generated in converting 1 mole of glucose to lactate (A) 1 moles (B) 2

- moles (C) 4 moles (D) 38 moles
24. Which of the following organisms has the smallest genome in size (A) *E. coli* (B) *saccharomyces cerevisiae* (C) *homo sapiens* (D) T4 phage
25. Which of the following sub-cellular structures does not exist in mammalian cells (A) golgi complex (B) chloroplasts (C) lysosomes (D) mitochondria
26. Which of the following compound is a specific inhibitor of citric acid cycle (A) AZT (B) chloramphenicol (C) novobiocin (D) cordycepin
27. Which of these lipoproteins can play essential roles in the transport of dietary lipids to tissue (A) chylomicron (B) VLDL (C) HDL (D) LDL
28. Cell membrane mainly consists of (A) polysaccharides and DNA (B) proteins and carbohydrates (C) phospholipids and proteins (D) lipids and carbohydrates
29. Glucose-1-phosphate can be converted to glucose-6-phosphate be a (A) dehydrogenase (B) epimerase (C) isomerase (D) transferse
30. In fatty acid biosynthesis, the most important addition unit is (A) acetyl-ACP (B) acetyl-CoA (C) coenzyme A (D) ketoacyl-ACP
31. The reactions of glycolysis occur in this eukaryotic cell compartment:
- (A) Cytoplasm
 - (B) Mitochondrion
 - (C) Nucleus
 - (D) Both cytoplasm and mitochondria
32. The order of compounds in the conversion of glucose to pyruvic acid is as follows: (PEP = phosphoenolpyruvate)
- (A) Fructose-6-phosphate, fructose-*bis*phosphate, PEP, 1,3-phosphoglyceric acid, 3-phosphoglyceric acid.
 - (B) Fructose-6-phosphate, fructose-*bis*phosphate, 1,3-phosphoglyceric acid, 3-phosphoglyceric acid, PEP.
 - (C) Fructose-6-phosphate, fructose-*bis*phosphate, 3-phosphoglyceric acid, 1,3-phosphoglyceric acid, PEP.
 - (D) Fructose-*bis*phosphate, fructose-6-phosphate, 3-phosphoglyceric acid, 1,3-phosphoglyceric acid, PEP.
33. In humans, pyruvate can be converted to
- (A) acetyl-CoA only
 - (B) lactate only
 - (C) ethanol only
 - (D) acetyl-CoA and lactate
34. What is the net ATP yield from glucose during glycolysis?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

35. Which enzyme could convert the following reaction?

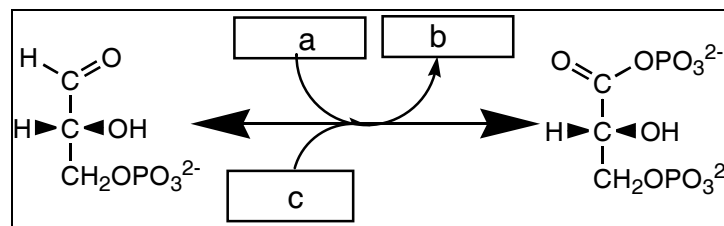


- (A) an epimerase
- (B) an isomerase
- (C) a mutase
- (D) a dehydrogenase

36. Which of the following exercise(s) allosteric control in the reaction of phosphofructokinase?

- (A) ATP
- (B) fructose 2,6-bisphosphate
- (C) All of these answers are correct.
- (D) None of these answers is correct.

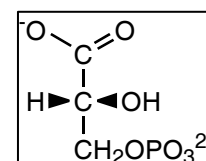
37. Which group of small molecules best fit the boxes associated with the reaction shown?



- | | a | b | c |
|-----|------------------|------------------|------------------|
| (A) | ATP | ADP | H ₂ O |
| (B) | NADH | NAD ⁺ | P _i |
| (C) | NAD ⁺ | NADH | H ₂ O |
| (D) | NAD ⁺ | NADH | P _i |

38. What is the name of the pictured glycolytic intermediate?

- (A) 1-phosphoglycerate
- (B) glyceraldehyde-3-phosphate
- (C) dihydroxyacetone phosphate
- (D) 3-phosphoglycerate



39. During anaerobic metabolism in bacterial, the carbons of glucose end up in this molecule:
- (A) CO₂
 - (B) Ethanol
 - (C) Lactic acid
 - (D) Both CO₂ and ethanol
40. The following enzymes of anaerobic metabolism are all tetrameric, **except**:
- (A) Hexokinase
 - (B) Phosphofructokinase
 - (C) Pyruvate kinase
 - (D) Lactic Dehydrogenase
41. The compound uridine diphosphate glucose (UDPG) plays a role in
- (A) glycogen breakdown
 - (B) glycogen synthesis
 - (C) glycolysis
 - (D) gluconeogenesis
42. When glycogen synthase is phosphorylated
- (A) its activity decreases.
 - (B) its activity increases.
 - (C) its activity is unaffected.
 - (D) That enzyme doesn't get phosphorylated.
43. When glycogen phosphorylase is phosphorylated
- (A) its activity decreases.
 - (B) its activity increases.
 - (C) its activity is unaffected.
 - (D) That enzyme doesn't get phosphorylated.
44. Which enzyme is used in gluconeogenesis, but **NOT** in glycolysis?
- (A) PEP carboxykinase
 - (B) enolase
 - (C) phosphohexose isomerase
 - (D) 3-phosphoglycerate dehydrogenase
45. Phospholipases break down fats by
- (A) adding a phosphate group to them.
 - (B) reducing the double bonds to single bonds.
 - (C) hydrolyzing them.
 - (D) removing acety-CoA units.

46. Where in the cell does β -oxidation occur?
- (A) Cytoplasm.
 - (B) Mitochondrial intermembrane space.
 - (C) Inner mitochondrial membrane.
 - (D) Mitochondrial matrix.
47. Carnitine acyltransferase is located in the mitochondrial
- (A) intermembrane space.
 - (B) outer membrane.
 - (C) inner membrane.
 - (D) matrix.
48. The first three reactions of the β -oxidation cycle of fatty acids produce
- (A) two moles of NADH
 - (B) two moles of FADH₂
 - (C) one mole each of NADH and FADH₂
 - (D) two moles of ATP
49. A key intermediate in the catabolism of fatty acids with uneven numbers of carbon atoms is
- (A) malonyl-CoA
 - (B) propionyl-CoA
 - (C) oxaloacetate
 - (D) phosphoenolpyruvate
50. "Ketone bodies" are formed when
- (A) oxaloacetate is converted to acetoacetyl-CoA.
 - (B) there is a deficiency of acetyl-CoA.
 - (C) there is not enough oxaloacetate to react with available acetyl-CoA.
 - (D) an organism consumes excessive amounts of carbohydrate compared to its lipid intake.