

Correct Answers Shown in **Red**

I. True or False (#1 to 5)?

1. T **F** In the tripeptide Arg-Pro-Tyr, the C-terminal residue is Arg.
2. **T** F Open systems, such as living creatures, are not at equilibrium.
3. **T** F Hydrophilic substances such as ions and polar molecules dissolve readily in water.
4. **T** F Buffered solutions resist changes in pH within about one pH unit of the pK of the buffering species.
5. **T** F Amino acids may be covalently modified after they have been incorporated into a polypeptide.

II. Calculations

[A: #6 -8]. The molecular weight of the antibiotic ampicillin is 349 g/mole. Calculate how much ampicillin you would need to make **10 ml of a 1000x solution (1000-fold concentrated)** for each of the following:

6. 50 µg/ml ampicillin.

- | | |
|-----------------------------|--------------------|
| A. 100 mg ampicillin | B. 10 g ampicillin |
| C. 500 mg ampicillin | D. 50 g ampicillin |
| E. 5 g ampicillin | |

7. 1 mM ampicillin.

- | | |
|-----------------------|-----------------------------|
| A. 34.9 mg ampicillin | B. 3.49 g ampicillin |
| C. 34.9 g ampicillin | D. 17.5 g ampicillin |
| E. 1.75 g ampicillin | |

8. Calculate how much of the solid reagents (chemical) you would add to make **500 ml of 10x TBE** buffer solution.

10x TBE (0.9 M Tris, 0.9 M Boric acid, 20 mM EDTA)

Tris (MW = 121 g/mole)
Boric acid (MW = 61.8 g/mole)
EDTA (MW = 292 g/mole)

- | |
|---|
| A. 108 g Tris, 55.6 g Boric acid, 5.84 g EDTA |
| B. 54.4 g Tris, 27.8 g Boric acid, 2.92 g EDTA |
| C. 108 g Tris, 27.8 g Boric acid, 2.92 g EDTA |
| D. 54.4 g Tris, 55.6 g Boric acid, 5.84 g EDTA |

E. 121 g Tris, 61.8 g Boric acid, 292 g EDTA

III. Other multiple-choice questions

9. The theory of evolution includes the following principles:

- A. evolution is not directed toward a specific goal.
- B. evolution is ongoing, and is constrained by its past.
- C. evolution requires some “sloppiness” for adaptation to changes.
- D. A and B
- E. A, B, and C

10. Calculate ΔG° for the reaction $A + B \leftrightarrow C + D$ at 25°C when the equilibrium conditions are $[A] = 10 \text{ mM}$, $[B] = 15 \text{ mM}$, $[C] = 10 \text{ mM}$, $[D] = 10 \text{ mM}$ (Gas constant: $8.31 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$).

- A. 1004 J/mol
- B. 10 kJ/mol
- C. 5 kJ/mol
- D. 1 J/mol
- E. insufficient data to determine answer

11. A reaction with $\Delta H = 23 \text{ kJ/mol}$ and $\Delta S = 22 \text{ J/K}\cdot\text{mol}$, at 2°C , is:

- A. spontaneous
- B. nonspontaneous
- C. at equilibrium
- D. impossible to determine reactivity
- E. none of the above

12. If gas molecules in an enclosed space are allowed to enter a second chamber, the resulting distribution of gas molecules represents and increase in

- A. enthalpy
- B. entropy
- C. force
- D. A and C
- E. A, B, and C

13. Amphiphilic molecules:

- A. have both oxidizing and reducing groups.
- B. are micelles.
- C. have chromophores in two different wavelength regions.
- D. have both acidic and basic groups.
- E. have both hydrophilic and hydrophobic groups.

14. Which of the following amino acids has a sulfur atom in its side chain?

- A. Asn
- B. Ser
- C. Phe
- D. Cys
- E. Thr

15. At pH 7, arginine (pKs are α -carboxylate 1.82, α -amino 8.99, guanidino 12.48) would be charged as follows:

- A. 0 α -carboxylate, 0 α -amino, +1 guanidino, +1 net charge
- B. +1 α -carboxylate, 0 α -amino, -1 guanidino, 0 net charge
- C. +1 α -carboxylate, -1 α -amino, -1 guanidino, -1 net charge
- D. -1 α -carboxylate, +1 α -amino, +1 guanidino, +1 net charge
- E. -1 α -carboxylate, 0 α -amino, +1 guanidino, 0 net charge

16. Which of the following amino acids would you expect to find in the interior of a protein's tertiary structure?

- A. Phe
- B. Thr
- C. Asn
- D. Lys
- E. All of the above

17. What is the pH of 0.001 M solution of NaOH?

- A. 2
- B. 10
- C. 11
- D. 12
- E. 13

18. In two homologous proteins, which residue is most likely to replace a Asp residue as a conservative substitution?

- A. Ala
- B. Gln
- C. Asn
- D. Arg
- E. Glu

19. You must cleave the following peptide into smaller fragments. Which of the proteases would be likely to yield the most fragments? (Refer to the table below)

NLTQGRCKPENTFVHSPEVPVQPVC

- A. Trypsin
- B. Chymotrypsin
- C. Elastase
- D. Endopeptidase V8
- E. Pepsin

Table 5-3 Specificities of Various Endopeptidases

Enzyme	Source	Specificity	Comments
Trypsin	Bovine pancreas	R_{n-1} = positively charged residues: Arg, Lys; $R_n \neq$ Pro	Highly specific
Chymotrypsin	Bovine pancreas	R_{n-1} = bulky hydrophobic residues: Phe, Trp, Tyr; $R_n \neq$ Pro	Cleaves more slowly for R_{n-1} = Asn, His, Met, Leu
Elastase	Bovine pancreas	R_{n-1} = small neutral residues: Ala, Gly, Ser, Val; $R_n \neq$ Pro	
Thermolysin	<i>Bacillus thermoproteolyticus</i>	R_n = Ile, Met, Phe, Trp, Tyr, Val; $R_{n-1} \neq$ Pro	Occasionally cleaves at R_n = Ala, Asp, His, Thr; heat stable
Pepsin	Bovine gastric mucosa	R_n = Leu, Phe, Trp, Tyr; $R_{n-1} \neq$ Pro	Also others; quite nonspecific; pH optimum = 2
Endopeptidase V8	<i>Staphylococcus aureus</i>	R_{n-1} = Glu	

Table 5-3 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons