**Question bank**

**Chapter 1**

Review Questions:

a- Give the function of:

1- Mitochondria

2- Golgi apparatus

3- Endoplasmic Reticulum

4- Lysosomes

5- Peroxisomes

6- Nucleus

7- Cell membrane

b- Define:

Biochemistry, Mitochondria, Golgi apparatus, Endoplasmic Reticulum prokaryotes, eukaryotes., Lysosomes, Peroxisomes, Nucleus, Cell membrane, The cell, prokaryotes, eukaryotes.

c- What is the difference between:

1- prokaryotes, eukaryotes.

2- Smooth Endoplasmic Reticulum and rough Endoplasmic Reticulum

d- What are the components of:

Cell, Cell membrane, Biomolecules, organic compounds in the cell

e- Write five branches of biochemistry.

f- Write three applications of biochemistry

g- What are the elemental compositions for biomolecules in the cell

**Chapter 2**

**How many asymmetric C atoms are there in a 6-carbon aldose?**

How many asymmetric C atoms are there in a 6-carbon ketose?

How many chiral C atoms does glucose have?   
At how many of those chiral C atoms does the configuration of D-glucose differ from that of L-glucose?

Which anomer of D-glucose is more stable and thus would predominate?

Which of these 3 disaccharides is/are reducing sugars?

What enzyme catalyzes interconversion of glyceraldehyde-3-P and dihydroxyacetone-P? What kind of reaction is that?)

 As noted [above](http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/carbhyd.htm#carb1), sugars may be classified as **reducing** or **non-reducing** based on their reactivity with [Tollens', Benedict's or Fehling's reagents](http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/aldket1.htm#rx4). If a sugar is oxidized by these reagents it is called **reducing**, since the oxidant (Ag(+) or Cu(+2)) is reduced in the reaction, as evidenced by formation of a silver mirror or precipitation of cuprous oxide. The Tollens' test is commonly used to detect aldehyde functions; and because of the facile [interconversion of ketoses and aldoses](http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/carbhyd.htm#carb3) under the basic conditions of this test, ketoses such as fructose also react and are classified as reducing sugars.

Write the cyclic form of α-D-galactose:

Write the products of the oxidation and reduction of D-mannose.

Indicate whether each is the D or L isomer

How many stereoisomers are possible for

a. 2-ketoheptose

b. an aldoheptose

Reduction of an aldose forms an alditol

 Reduction of a ketose, however, form two alditols.

 Which monosaccharides can form the following osazone?

1. You may be asked to describe one or more of the following, providing requested diagrams (to be selected by the instructor). Where two items are listed, explain the difference between these.

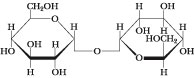
* D versus L sugars (draw an example of D & L isomers of a sugar)
* aldose versus ketose (draw an example of each)
*  and  anomers of D-glucose (draw Haworth projection structures of both)
* glucose versus acetylglucosamine (draw Haworth projection structures of both)
* glycosidic bond (draw an example of substrates and products of a reaction to form a glycosidic bond)

2. Describe and compare the structures of **cellulose** and **amylopectin**. Include a diagram showing enough of the structure to depict the different glycosidic linkages between glucose monomers in each polymer. What is the general function of each of these polymers? How are their polymeric structures suited to their cellular functions? How does glycogen structure differ from amylopectin? How is this important to the role of glycogen.

Draw Haworth structures for the two possible isomers of d-altrose ([Figure 7.2](http://web.virginia.edu/Heidi/chapter7/chp7.htm#7_2)) and d-psicose ([Figure 7.3](http://web.virginia.edu/Heidi/chapter7/chp7.htm#7_3)).

2. Give the systematic name for stachyose

3. Trehalose, a disaccharide produced in fungi, has the following structure:



a. What is the systematic name for this disaccharide?

b. Is trehalose a reducing sugar? Explain.

4. Draw a Fischer projection structure for l-sorbose (d-sorbose is shown in Figure 7.3).

5. α-d-Glucose has a specific rotation, [α]d20, of +112.2°, whereas β-d-glucose has a specific rotation of +18.7°. What is the composition of a mixture of α-d- and β-d-glucose, which has a specific rotation of 83.0°?

6. A 0.2-g sample of amylopectin was analyzed to determine the fraction of the total glucose residues that are branch points in the structure. The sample was exhaustively methylated and then digested, yielding 50 μmol of 2,3-dimethylglucose and 0.4 μmol of 1, 2, 3, 6-tetramethylglucose.

a. What fraction of the total residues are branch points?

b. How many reducing ends does this amylopectin have?

**Chapter 4**

Distinguish between proteins, peptides, and polypeptides.  
2. Indicate which of the following amino acids are polar, nonpolar, acidic, or basic:  
a. glycine  
b. tyrosine  
c. glutamic acid  
d. histidine  
e. proline  
f. lysine  
g. cysteine  
h. asparagine  
i. valine  
j. leucine  
3. Arginine has the following pKa values:  
pK1=2.17, pK2=9.04, pKR=12.48  
What is the structure and net charge of arginine at the following pH values? 1, 4, 7, 10, 12  
a. What species are present at each plateau?  
b. Using the titration curve, determine the p*K*a of each ionization of histidine.  
c. What is the isoelectric point of histidine?  
5. Consider the following molecule:  
a. Name it.  
b. Using the three-letter symbols for the amino acids, how  
would this molecule be represented?  
6. Rotation about the peptide bond in glycylglycine is hindered.  
Draw the resonance forms of the peptide bond and explain  
why.  
7. List six functions of proteins in the body.  
8. Differentiate the terms in each pair below:  
a. globular and fibrous proteins  
b. simple and conjugated proteins  
c. apoprotein and holoprotein  
9. Define the following terms:  
a. *a*-carbon  
b. isoelectric point  
c. peptide bond  
d. hydrophobic amino acid  
10. Indicate the level(s) of protein structure to which each of the  
following contributes:  
a. amino acid sequence  
b. *b*-pleated sheet  
c. hydrogen bond  
d. disulfide bond  
11. What type of secondary structure would the following amino  
acid sequence be *most* likely to have?  
a. polyproline  
b. polyglycine  
c. AlaJValJAlaJValJAlaJValJ  
d. GlyJSerJGlyJAlaJGlyJAla  
12. List three factors that do not foster *a*-helix formation.  
13. Denaturation is the loss of protein function from structural  
change or chemical reaction. At what level of protein structure or through what chemical reaction does each of the following denaturation agents act?  
a. heat  
b. strong acid  
c. saturated salt solution  
d. organic solvents (e.g., alcohol or chloroform)  
14. A polypeptide has a high pI value. Suggest which amino acids  
might comprise it.  
15. Outline the steps to isolate typical protein. What is achieved  
at each step?  
16. Outline the steps to purify a protein. What criteria are used to  
evaluate purity?  
17. List the types of chromatography used to purify proteins.  
Describe how each separation method works.  
18. In sequencing a protein using carboxypeptidase, the protein  
is first broken down into smaller fragments, which are then separated from one another. Each fragment is then individually  
sequenced. If this initial fragmentation were not carried out,  
amino acid residues would build up in the reaction medium.  
How would these residues inhibit sequencing?  
19. In an amino acid analysis, a large protein is broken down into  
overlapping fragments by using specific enzymes. Why must  
the sequences be overlapping?  
20. Hydrolysis of *b*-endorphin (a peptide containing 31 amino acid  
residues) produces the following amino acids:  
Tyr (1), Gly (3), Phe (2), Met, Thr (3), Ser (2), Lys (5), Gln  
(2), Pro, Leu (2), Val (2), Asn (2), Ala (2), Ile, His, and Glu  
Treatment with carboxypeptidase liberates Gln. Treatment with  
DNFB liberates DNP-Tyr. Treatment with trypsin produces the  
following peptides:  
Lys, GlyJGln, AsnJAlaJIleJValJLys,  
TyrJGlyJGlyJPheJMetJThrJSerJGluJLys,

AsnJAlaJHisJLys, SerJGlnJThrJProJLeuJ  
ValJThrJLeuJPheJLys  
Treatment with chymotrypsin produces the following peptides:  
LysJAsnJAlaJIleJValJLysJAsnJAlaJ  
HisJLysJLysJGlyJGln  
TyrJGlyJGlyJPhe  
MetJThrJSerJGluJLysJSerJGlnJThrJProJ  
LeuJValJThrJLeuJPhe  
What is the primary sequence of *b*-endorphin?  
21. Consider the following tripeptide:  
GlyJAlaJVal

1. What is the approximate isoelectric point?  
   b. In which direction will the tripeptide move when placed in  
   an electric field at the following pH values? 1, 5, 10, 12  
   22. The following is the amino acid sequence of bradykinin, a peptide released by certain organisms in response to wasp stings:  
   ArgJProJProJGlyJPheJSerJProJPheJArg  
   What amino acids or peptides are produced when bradykinin  
   is treated with each of the following reagents?  
   a. carboxypeptidase  
   b. chymotrypsin  
   c. trypsin  
   d. DNFB

Define each term and give an example.

(a) acid (b) L-amino acid (c) essential amino acid (d) dipolar ion

(e) isoelectric point (f) Strecker synthesis (g) electrophoresis (h) transamination

(i) peptide bond (j) hydrogenolysis (k) enzymatic resolution (l) zwitterion

(m) peptide (n) protein (o) primary structure (p) secondary structure

(q) tertiary structure (r) quaternary structure (s) pleated sheet (t) helix

(u) conjugated protein (v) protein denaturation (w) disulfide bridge (x) Edman degradation

(y) prosthetic group (z) solid-phase peptide synthesis (aa) oligopeptide (bb) prion protein

24-33 Draw the complete structure of the following peptide.

Ser-Gln-Met # NH2