Biochemistry Exercises

By:
E. Pennington

Biochemistry Exercises

By:
E. Pennington

Online:
< http://cnx.org/content/col11386/1.3/ >

C O N N E X I O N S

Rice University, Houston, Texas

Collection structure revised: December 23, 2011
PDF generated: October 29, 2012

Table of Contents

Chapter 1

Water, Electrolytes and Acids-Bases[1]

1. Which of the following statements **IS NOT** a chemical and physiological property of water in the human body?	
A.	Water has dipolar nature as a result of oxygen being an electronegative atom that pushes electron from the two hydrogen atoms in the water molecule.
B.	Water is the universal solvent of life that keeps cells nourished, removes waste and facilitates biochemical reactions necessary to sustain life.
C.	Water maintains the concentration of both the intracellular (ICF) and extracellular (ECF) fluids constant by keeping ions dissolved via hydrated shells.
D.	Water can only move between the intracellular fluid (ICF) and extracellular (ECF) fluids via active transport mechanisms that required energy.
E.	Solubility of organic molecules that contain oxygen and nitrogen atoms is facilitated via hydrogen bonds with water molecules.

Table 1.1

2. Which of the following hormones regulate both the concentration of sodium and potassium in the blood?	
A.	Parathryoid Hormone (PTH)
B.	Calcitriol
	continued on next page

[1]This content is available online at <http://cnx.org/content/m41743/1.2/>.

C.	Natriuretic peptides (ANP, BNP)
D.	Aldosterone
E.	Antidiuretic Hormone (ADH)

Table 1.2

3. Which of the following mechanisms control the movement of **ONLY** water through a semipermeable membrane when water content is high in one side of the membrane?	
A.	Filtration
B.	Osmosis
C.	Active Transport
D.	Diffusion
E.	Dialysis

Table 1.3

4. Which of the following organs facilitates the most water loss from the human body?	
A.	Kidneys
B.	Pancreas
C.	Lungs
D.	Skin
E.	Gastrointestinal (GI) tract

Table 1.4

5. A 19 year old male college student enters a challenge PowerAde drinking competition. He drinks a total of 1.5 liters. PowerAde is a sport drink made up of water, electrolytes and some sugars. Normal plasma concentration is 270 - 300 mOsmoles/L. If his blood plasma concentration is 280 mOsmoles/L after the competition. Which of the following water disorders would this college student be **MOST LIKELY** to suffer from as a result of his excess consumption of PowerAde?	
A.	Isotonic dehydration
B.	Hypotonic dehydration
C.	Isotonic overhydration
D.	Hypertonic overhydration
E.	Hypotonic overhydration

Table 1.5

6. Which of the following ions is the main electrolyte of the intracellular fluid?	
A.	Sodium
B.	Chloride
C.	Proteins
D.	Bicarbonate
E.	Potassium

Table 1.6

7. Which of the following statements **IS INCORRECT** about acid and bases in the human body?	
A.	Balance is maintained when the amount of acid or base produced/absorbed equals the amount of acid or base excreted/expired.
B.	The lungs excrete volatile acids as carbon dioxide (CO2) gas.
C.	The kidneys are responsible for excreting non-volatile acids in urine.
D.	Metabolism produces both volatile and nonvolatile acids.
E.	Intestinal bacterial digestion and absorption of starches produces bicarbonate.

Table 1.7

8. Which of the following is a respiratory compensatory mechanism when arterial blood pH is acidic (pH < 7.35)?	
A.	Faster and deeper breathing
B.	Slow and shallow breathing
C.	Increase excretion of non-volatile acids
D.	Decrease excretion of non-volatile acids
E.	Increase reabsorption of bicarbonate

Table 1.8

9. Which of the following electrolytes is important in the reabsorption of bicarbonate as part of the renal mechanisms?
continued on next page

A.	Potassium
B.	Phosphate
C.	Chloride
D.	Sodium
E.	Calcium

Table 1.9

10. Which of the following is a renal compensatory mechanism when arterial blood pH is basic (pH > 7.45)?	
A.	Increase reabsorption of bicarbonate
B.	Increase excretion of bicarbonate
C.	Increase excretion of nonvolatile acids
D.	Faster and deeper breathing
E.	Slow and shallow breathing

Table 1.10

11. Which of the following statements **IS CORRECT** about base excess?	
A.	Distinguishes metabolic acidosis caused by excess acid anions from metabolic alkalosis as a result of excess chloride ions
B.	Measures acid-base and oxygenation status by measuring pH, PO2, PCO2 & SO2
C.	Calculated from electrolytes results to indicate the type of metabolic acidosis
D.	Results indicate how much acid or base must be added to a blood sample to bring it to normal blood pH
E.	Must be ordered with arterial blood gases when dealing with acid-base disorders

Table 1.11

12. Which of the following acid-base disorders **IS MOSTLY** like to occur when the arterial blood pH > 7.45, [HCO3-] < 24 mEq/L and PCO2 < 40 mm Hg?	
A.	Metabolic acidosis
B.	Metabolic alkalosis
C.	Respiratory acidosis
D.	Respiratory alkalosis

Table 1.12

13. A 75 year old male has problems controlling his diabetes mellitus. He keeps forgetting to measure his blood glucose levels daily and take his medication as prescribed by his physician. Which of the following lab results would be consistent with a diagnosis of ketoacidosis a result of his uncontrolled diabetes? **Note:** Disregard compensatory mechanisms.	
A.	Arterial blood pH < 7.45 and PCO2 > 40 mm Hg
B.	Arterial blood pH < 7.45 and [HCO3-] < 24 mEq/L
C.	Arterial blood pH > 7.45 and [HCO3-] > 24 mEq/L
D.	Arterial blood pH > 7.45 and PCO2 < 40 mm Hg
14. Which of the following buffers found in **BOTH** the extracellular (ECF) and intracellular (ICF) fluids have side groups with positive and negative charges to buffer hydrogen ions formed in the human body?	
A.	Proteins
B.	Hemoglobin
C.	Phosphate Buffer
D.	Carbonic acid-bicarbonate Buffer
E.	Ammonia-Ammonium Buffer

Table 1.13

15. Which of the following buffers regenerate and reabsorbs bicarbonate from gaseous carbon dioxide (CO2) in the urine and blood as part of the renal mechanisms?	
A.	Proteins
B.	Hemoglobin
C.	Phosphate
D.	Bicarbonate-Carbonic acid
E.	Ammonia-Ammonium

Table 1.14

16. Which of the following electrolytes must be excreted for ammonia (NH3) to be formed inside the renal tubular cells as part of the renal mechanisms?	
A.	Sulfates
B.	Bicarbonate
C.	Magnesium
D.	Potassium
	continued on next page

E.	Sodium

Table 1.15

Chapter 2

Acid-Bases, Water and Electrolytes[1]

Match each of the buffers (1-4)with its characteristics as a buffer system to minimize pH changes (A-D) below:

1. Bicarbonate-Carbonic acid
2. Hemoglobin
3. Phosphate
4. Proteins

A. H+ ions react with bicarbonate
B. Charged amino acids bind excess H+ ions
C. H+ ions react with HPO4-2
D. Bind either CO2 and H+ ions

5. Which of the following statements **BEST** describes the concept of acid-base balance (homeostasis)?	
A.	Acid/base produced and absorbed < acid/base excreted and expired
B.	Acid/base produced and absorbed > acid/base excreted and expired
C.	Acid/base produced and absorbed = acid/base excreted and expired
D.	There is not acid/base produced and absorbed in the human body
E.	There is not acid/base excreted and expired in the human body

Table 2.1

6. Which of the following is the **LEAST LIKELY** property of water?	
A.	Water is an ideal solvent since it helps maintain a constant distribution throughout the body.
	continued on next page

[1]This content is available online at <http://cnx.org/content/m41747/1.2/>.

B.	Facilitates the dissociation and movement of molecules between body compartments.
C.	Can serve as a reagent and provides a constant environment for the cells since it dissipates heat.
D.	The polar nature of water facilitates the formation of its partial charges, hydrogen bonds and hydrated shells with other polar molecules.
E.	Water is static in each of the compartments and this does not contributes to the total concentration of electrolytes in any of the compartments.

Table 2.2

7. Which of the following excreted molecules would **MOST LIKELY** make the pH of urine basic?	
A.	Bicarbonate
B.	Carbonic acid
C.	Non-volatile acids
D.	Carbon dioxide
E.	Citrate

Table 2.3

8. When excess amount of water is retained in the body as a result of lack of urination, water has moved from plasma into the interstitial fluid. To which compartment will the water move next to correct this problem?	
A.	Intracellular Fluid
B.	Intravascular Fluid
C.	Interstitial Fluid
D.	Transcellular Fluid
E.	No Compartment

Table 2.4

9. When excess amount of water is excreted in urine, which is the first compartment to replace the water lost in the plasma?	
A.	Intracellular Fluid
B.	Interstitial Fluid
	continued on next page

C.	Transcellular Fluid
D.	Intravascular Fluid
E.	No compartment

Table 2.5

10. Which of the following **MOST LIKELY** excretes volatile acids in the form of carbon dioxide?	
A.	Kidneys
B.	Proteins
C.	Phosphate
D.	Ammonia - Ammonium
E.	Lungs

Table 2.6

11. Which of the following acids is **MOST LIKELY** to be converted into a volatile acid?	
A.	Hydrochloric acid
B.	Carbonic Acid
C.	Sulfuric Acid
D.	Dihydrogen Phosphate
E.	Ammonium Ion

Table 2.7

12. Which of the following is the **LEAST LIKELY** to be a component of extracellular fluid?	
A.	Interstitial fluid
B.	Transcellular fluid
C.	Intravascular fluid
D.	Intracellular fluid
E.	Plasma

Table 2.8

13. Which of the following effects **MOST** likely results from increased alveolar ventilation?	
A.	Higher concentration of carbon dioxide (CO2)
B.	Lower concentration of carbon dioxide
C.	Higher concentration of H+ ions
D.	Decreases pH of the extracellular fluid (ECF)
E.	Higher concentration of carbonic acid (H2CO3)

Table 2.9

14. What is the **MOST LIKELY** result of high levels of potassium inside the tubular cells?	
A.	Potassium is reabsorbed into circulation to keep the pH of body fluids constant.
B.	Cells utilize potassium for fuel and prevent acid formation.
C.	Reabsorption of hydrogen ions into circulation increases the acidity of body fluids.
D.	Excreting potassium ions increases the acidity of urine and decreases the acidity of body fluids.
E.	Potassium remains inside the tubular cells in order to excrete hydrogen ions.

Table 2.10

15. Which of the following buffers **MOST LIKELY** excretes non-volatile acids as NaH2PO4?	
A.	Bicarbonate - Carbonic Acid
B.	Ammonia- Ammonium
C.	Phosphate
D.	Citrate
E.	Urate

Table 2.11

Chapter 3

Water, electrolytes, acid-bases & carbohydrates[1]

1. Which of the following groups in a plasma protein can neutralize hydrogen ions at a blood pH of 7.35 to 7.45?	
A.	Peptide bonds
B.	Nonpolar amino acids
C.	Polar and uncharged amino acids
D.	Polar and charged amino acids

Table 3.1

2. How would the respiratory centers respond in order to decrease the concentration of hydrogens ions in the extracellular fluid?	
A.	Breathe slower
B.	Breathe faster
C.	Breathe at a normal rate
D.	Hold your breath

Table 3.2

3. Which of the following renal buffers produces bicarbonate from the degradation of glutamine?	
A.	Bicarbonate-Carbonic Acid
B.	Urate
C.	Ammonia-Ammonium
D.	Phosphate
E.	Citrate

Table 3.3

[1] This content is available online at <http://cnx.org/content/m41745/1.1/>.

4. Which of the following lab tests can be used to diagnose **BOTH** electrolytes and acid-base disorders?	
A.	Anion gap
B.	Arterial blood gases
C.	Base excess
D.	Serum electrolytes

Table 3.4

5. Which of the following therapies would be helpful in the treatment of metabolic acid-base disorders?	
A.	Increase ventilation
B.	Decrease ventilation
C.	Fluid and electrolytes
D.	Supplement oxygen

Table 3.5

6. Which of the following laboratory tests indicates a deviation in a patient's blood pH from normal blood pH?	
A.	Base excess
B.	Anion gap
C.	Serum electrolytes
D.	Blood gases

Table 3.6

7. A patient is diagnosed with respiratory acidosis. Which compensatory mechanism will attempt to correct this acid imbalance?	
A.	Lungs increase ventilation
B.	Lungs decrease ventilation
C.	Kidneys excrete bicarbonate ions in urine
D.	Kidneys absorb bicarbonate ions in blood

Table 3.7

8. A 35 year old male with a history of poor diet and frequent alcohol consumption is admitted to the hospital. His lab results showed: **pH = 7. 1** (normal range 7.35 - 7.45); **[HCO3-] = 18 mEq/L** (normal range 20-29 mEq/L) and **PCO2 = 38 mm Hg** (normal range 35 - 45 mm Hg). Which of the following acid-base disorders is consistent with these lab results?
continued on next page

A.	Metabolic acidosis
B.	Metabolic alkalosis
C.	Respiratory acidosis
D.	Respiratory alkalosis

Table 3.8

9. Which of the following electrolyte disorders can occur as a result of excess aldosterone?	
A.	Hyponatremia
B.	Hypochloremia
C.	Hypokalemia
D.	Hypermagnesemia

Table 3.9

10. Which of the following electrolytes is increased in a non-anion gap acidosis?	
A.	Sodium
B.	Potassium
C.	Chloride
D.	Bicarbonate

Table 3.10

11. A 45 year old woman secretes excess parathyroid hormone. Which of the following electrolytes would be affected?	
A.	Sodium
B.	Calcium
C.	Chloride
D.	Potassium

Table 3.11

12. Which of the following disorders is caused by excess production of sorbitol?	
A.	Fructose intolerance
B.	Fructose malabsorption
C.	Diabetic cataracts
D.	Fructosuria

Table 3.12

13. Which of the following enzymes is defective in hereditary fructose intolerance?	
A.	Fructokinase
B.	Triose kinase
C.	Hexokinase
D.	Aldolase

Table 3.13

14. Which of the following hormones regulate GLUT 4 transporters in the brain?	
A.	Aldosterone
B.	Antidiuretic hormone
C.	Parathyroid hormone
D.	Calcitonin
E.	Insulin

Table 3.14

15. Which of the following hormones decreases **BOTH** plasma water volume and blood pressure?	
A.	Antidiuretic hormone
B.	Natriuretic Peptides
C.	Parathyroid Hormone
D.	Calcitonin
E.	Aldosterone

Table 3.15

16. Which age group is susceptible to water intoxication and dehydration as a result of immature kidneys?	
A.	Elderly
B.	Adults
C.	Infants
D.	Adolescents

Table 3.16

17. Which of the following hormones can cause severe dehydration due to diabetes insipidus **AND** water intoxication due to its hyper-secretion in cases of drug abuse?
continued on next page

A.	Antidiuretic Hormone
B.	Aldosterone
C.	Natriuretic peptides
D.	Calcitonin
E.	Parathyroid Hormone

Table 3.17

18. A healthy 23 year old soldier carries out patrol missions in full combat gear in temperatures of over 145 degrees. Which of the following conditions will this soldier most likely develop if he does not ingest adequate amounts of water daily?	
A.	Hypothalamic diabetes insipidus
B.	Nephrogenic diabetes insipidus
C.	Gastroenteritis
D.	Kidney stones
E.	Edema

Table 3.18

19. Which of the following statements describes a common property shared by **BOTH** water and electrolytes?	
A.	Water and electrolytes move freely in the body via electrical impulses.
B.	Hydrogen bonds alter the concentration of electrolytes in the compartments.
C.	Water and electrolytes are vital for some of the chemical reactions in the body.
D.	Hydrostatic and osmotic pressures facilitate the solvation of electrolytes in water.

Table 3.19

20. Which metabolic pathway is directly connected to the degradation of fructose?	
A.	Polyol pathway
B.	Oxidative phosphorylation
C.	Tricarboxylic acid cycle
D.	Glycolysis

Table 3.20

Chapter 4

Digestion fats, proteins and carbohydrates[1]

1. Which of the following byproducts of bacterial digestion can be used for energy by hepatic and intestinal cells?	
A.	Methane gas
B.	Hydrogen gas
C.	Butyric acid
D.	Vitamin K
E.	Vitamin B complex

Table 4.1

2. Which of the following facilitates the hydrolysis of lipids by pancreatic enzymes in the intestines?	
A.	Secretin
B.	Bacteria
C.	Bile salts
D.	Bicarbonate
E.	Hydrochloric acid

Table 4.2

3. Which of the following enzymes digests triglycerides into two fatty acids and 2-monoacylglycerol in the mouth, stomach and intestines?
continued on next page

[1]This content is available online at <http://cnx.org/content/m41744/1.3/>.

A.	Colipase
B.	Lipase
C.	Alpha-amylase
D.	Pepsin
E.	Chymotrypsin

Table 4.3

4. Which of the following can safely transport long chain fatty acids in circulation?	
A.	Albumin
B.	Chylomicrons
C.	Bile salts
D.	Bicarbonate
E.	Micelles

Table 4.4

5. Which of the following nutrient pairs can passively diffuse out of the intestinal cells and is transported bound to plasma proteins in circulation?	
A.	Matured chylomicrons and dipeptides
B.	Polar amino acids and fructose
C.	Galactose and small tripeptides
D.	Short fatty acids and nonpolar amino acids
E.	Fructose and nascent chylomicrons

Table 4.5

6. A 35 year old patient has consumed aspirin on a daily basis for his usual headaches as a result of his stressful job. An endoscopy (a flexible probe with a camera on the end) was performed to check the stomach lining. Results showed inflammation and mucous erosion. What enzyme zymogen can be helpful in the diagnosis of suspected gastritis?	
A.	Trypsinogen
B.	Proelastase
C.	Procarboxypeptidase
D.	Chymotrypsinogen
	continued on next page

E.	Pepsinogen

Table 4.6

7. Which of the following pancreatic enzymes is activated by trypsin to help digest phospholipids in the intestines?	
A.	Chymotrypsinogen
B.	Proelastase
C.	Procollagenase
D.	Prophospholipase A2
E.	Procarboxypeptidase

Table 4.7

8. Which of the following can allow fructose in and out of the intestinal cells?	
A.	Sodium-dependent transporters (SGLT1)
B.	Hydrogen-dependent transporter
C.	Glucose transporter 4 (GLUT4)
D.	Glucose transporter 5 (GLUT5)
E.	Passive diffusion

Table 4.8

Chapter 5

Proteins and Nucleic Acids[1]

1. Which of the following is **MOST LIKELY** an example of a paralog?	
A.	Hemoglobin A & Hemoglobin F
B.	Hemoglobin S and Hemoglobin C
C.	Hemoglobin A1 and Hemoglobin A2
D.	Myoglobin & Hemoglobin
E.	Creatine kinase BB and Creatine kinase MM

Table 5.1

2. Which of the following is the **LEAST LIKELY** basic structure of the DNA molecule?	
A.	Purine Bases: Adenine, Guanine
B.	Pyrimidine Bases: Cytosine, Uracil
C.	Pyrimidine Bases: Cytosine, Thymine
D.	Sugar: Deoxyribose
E.	3' to 5' phosphodiester bond between sugars

Table 5.2

3. Which of the following structures is **LEAST LIKELY** a component of the 80S ribosome?	
A.	60S rRNA subunit
B.	40S rRNA subunit
C.	DNA and proteins
D.	rRNA and proteins
E.	Binding sites for tRNA

Table 5.3

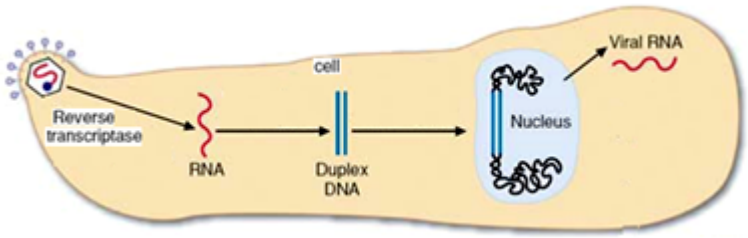
Match the types of RNAs in questions number 4 and 5 with their corresponding structure on the right:

[1] This content is available online at <http://cnx.org/content/m41748/1.2/>.

4. mRNA
5. tRNA

A.	Cloverleaf adapter with 3' adenosine end and an anticodon region.
B.	Double stranded helix with hydrogen bonding between the strands.
C.	Single stranded with 5' - cap end and polyadenosine tails.
D.	Two subunits with secondary structure as a result of extensive base pairing loops.

Table 5.4



6. In the picture below: Which of the following statements is **MOST LIKELY** the cause of these changes in the human chromosomes?

A.	Exchanging DNA segments between two chromosomes.
B.	Moving segments of DNA to another location in the same gene.
C.	Normal synthesis of DNA per genetic code in the human genome of individuals.
D.	Synthesis of ds-cDNA from a viral RNA template for integration into the human genome.
E.	Breaking and exchanging large portions of the chromosomes due to carcinogens and chemicals.

Table 5.5

Chapter 6

Protein and Nucleic Acids II[1]

1. Which of these is **NOT** a biological requirement for maintaining a protein's 3-D structure?

A. It must demonstrate both flexibility and stability.
B. It must have an external surface compatible with its environment.
C. It must be compatible with the structure of its binding sites.
D. It must be degradable.
E. It must resist folding during synthesis.

2. Which of these primary amino acid sequences would **LEAST** likely be a component of an α-helix?

A. thr-pro-gly
B. cys-val-tyr
C. ser-lys-ala
D. phe-phe-phe
E. thr-val-met

3. What immunoglobulin is present in the greatest percentage in the circulation and can cross the placenta to impart immunity to the developing fetus?

A. IgG
B. IgA
C. IgM
D. IgD
E. IgE

4. Which of the following is the main factor that directly regulates glycation of hemoglobin?

A. The enzyme controlling the Amadori reaction
B. The concentration of glucose in blood
C. The specificity of an enzyme cofactor
D. The role of insulin for moving glucose into the red blood cell
E. The concentration of glucagon in blood

5. What statement about an enzyme's active site is **LEAST** correct?

A. The active site is the location of the enzyme-substrate complex.

[1] This content is available online at <http://cnx.org/content/m41759/1.2/>.

B. The primary sequence in an active site has functional groups to facilitate the reaction.
C. Substrate binding to an active site results in a conformation change in the enzyme shape.
D. Substrate active sites are specific for enzyme classes.
E. Enzymes are degraded once the reaction is completed after they leave the active site.

6. What product directly forms when glucokinase catalyzes a reaction with glucose?

A. Glucose 6-phosphate
B. Galactose
C. Branched glucose molecules
D. Pyruvate
E. Lactate

7. Which protein pair is an example of paralog?

A. HbA and HbF
B. CK-BB and CK-MM
C. HbA1 and HbA2
D. Myoglobin and hemoglobin
E. Lactate dehydrogenase and hemoglobin

8. Which of the following structures would LEAST likely be a part of a DNA molecule?

A. Adenine bonded to guanine as purine bases
B. Cytosine bonded to uracil as pyrimidine bases
C. Deoxyribose sugar
D. 3' to 5' phosphodiester bonds between sugar molecules
E. Thymine bonded to cytosine as pyrimidine bases

9. Which of the following is **NOT** a component of the 80S ribosome?	
A.	60S rRNA subunit
B.	40S rRNA subunit
C.	DNA and proteins
D.	rRNA and proteins
E.	Binding sites for tRNA

Table 6.1

For #10-11, match the RNA type to the correct description of the corresponding structure.

10. mRNA
11. tRNA

A. Cloverleaf adapter with 3' adenosine end and an anticodon region
B. Double stranded helix with hydrogen between the strands
C. Single stranded molecule with a 5'-cap and polyadenosine tail
D. Two subunits with secondary structures as a result of extensive base pairing loops

12. Which statements **BEST** explains the process demonstrated in the figure?

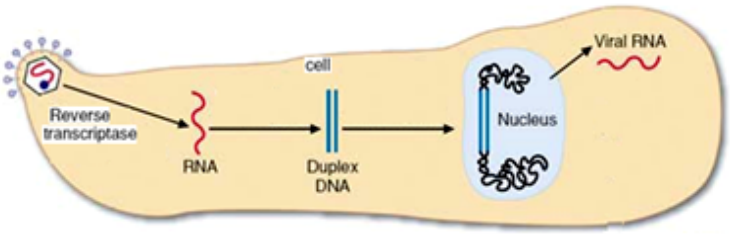


Figure 6.1

A. There are two chromosomes that are exchanging portions of DNA.
B. DNA segments are moving to another location on the same gene.
C. DNA is undergoing normal synthesis per the genetic code.
D. Ds-DNA is being synthesized from a viral RNA template for human genome integration.
E. Large portions of chromosomes are exchanged in the presence of a carcinogen.

Chapter 7

Proteins, Amino Acids, Nucleic Acids, Electron transport chain and Tricarboxylic acid[1]

1. Which of the following interactions is **LEAST LIKELY** to contribute to the overall 3-dimensional structure of a protein and its physiological function?	
A.	Hydrophobic regions
B.	Hydrogen bonding
C.	Conduction of heat
D.	Disulfide bonds
E.	Ionic bonding

Table 7.1

2. Which of the following classifications will **MORE LIKE** describe the dual function of the side groups of an amino acid acting as polar binding site as well as an acid-base buffer?	
A.	Non-polar amino acids
B.	Polar and uncharged amino acids
C.	Polar and charged amino acids
D.	Peptide bonds
E.	L-form isomers

Table 7.2

[1] This content is available online at <http://cnx.org/content/m41746/1.2/>.

3. Which of the following statements is the **MOST ACCURATE** in regards to the DNA molecular structure?	
A.	DNA is a single stranded molecule with secondary and tertiary structures of a common protein.
B.	DNA strands run in the same direction and are parallel to each other in a linear fashion to keep the DNA molecule intact.
C.	The DNA molecule has a double stranded spiral shape with two types of grooves for protein interactions.
D.	The phosphodiester bond formed between the carbon atoms of two adjacent ribose sugars facilitates the overall shape of the DNA molecule.
E.	The overall shape of the DNA molecule is determined by base pairing between two purines (adenine and guanine) or two pyrimidines (cytosine and thymine).

Table 7.3

4. In which region of the tRNA molecule would amino acids **MOST LIKELY** bind?	
A.	Anticodon
B.	Ribothymidine
C.	Dihydrouridine
D.	3' end adenosine
E.	Pseudouridine

Table 7.4

5. Which of the following DNA repair mechanisms **MOST LIKELY** corrects the addition of bulky adducts on the bases of DNA?	
A.	Base Excision
B.	Replication
C.	Mismatch
D.	Nucleotide Excision
E.	Transcription-Coupled

Table 7.5

6. Which of the following processes **BEST** describe the release of an uncharged-tRNA on the P site and the movement of a peptidyl-tRNA from the A site to the P site of the 80S ribosome?	
Replication	A.

continued on next page

Transcription	B.
Initiation	C.
Translocation	D.
Termination	E.

Table 7.6

7. Which of the following statements is the **LEAST ACCURATE** about DNA polymerase delta?	
A.	This enzyme starts adding polynucleotides to the newly synthesized DNA chain after an RNA-DNA primer is formed on both the leading and lagging strands.
B.	This enzyme can synthesize about 200 nucleotides of DNA in the lagging strand before it reaches the RNA primer of the next Okazaki fragment.
C.	This enzyme continuously adds polynucleotides to the newly synthesize DNA in the leading strand.
D.	This enzyme is also considered a 3' to 5' exonuclease that proofreads the newly synthesize DNA to detect and repair DNA changes.
E.	This enzyme has the capabilities of an RNA polymerase and completes DNA synthesis at the end of the chromosomes.

Table 7.7

	8. Which of the following DNA mutations will **MOST LIKELY** produce a defective mRNA with a different reading frame than normal?	
	A.	Point Mutations
	B.	Frameshift
	C.	Missense
	D.	Nonsense
		continued on next page

	E.	Silent

Table 7.8

9. Which of the following codon is **LEAST LIKELY** to terminate protein synthesis?	
A.	UAG
B.	UAA
C.	AUG
D.	UGA

Table 7.9

10. Which of the following structures **MOST LIKELY** makes the 3' end of a newly synthesized mRNA molecule?	
A.	5' cap
B.	Pol (A) tail
C.	Codons for amino acids
D.	Start codon
E.	Stop codon

Table 7.10

11. Which of the following statements is **LEAST LIKELY** to be correct about metabolism in the mitochondria?	
A.	In the mitochondria, cellular respiration involves oxidation of fuels.
B.	The goal of metabolism is to generate energy in the form of ATP.
C.	ATP is use as energy to sustain cellular respiration in the mitochondria as well as other metabolic pathways.
D.	Cellular respiration does not consumed oxygen in order to generate ATP.
	continued on next page

E.	Three pathways, the tricarboxylic acid, electron transport chain and oxidative phosphorylation, work together to generate ATP and heat.

Table 7.11

12. Which of the following components in the electron transport chain **MOST LIKELY** shares the same enzyme with the tricarboxylic acid pathway?	
A.	Complex I: NADH dehydrogenase
B.	Complex II: Succinate dehydrogenase
C.	Cytochrome c
D.	Complex III: cytochromes b-c1
E.	Complex IV: cytochrome c oxidase

Table 7.12

11. Which of the following statements is **LESS ACCURATE** about the electron transport chain?	
A.	Pathway responds very rapidly based on the body's needs and demands for energy (ATP).
B.	Pathway uses an electrochemical gradient of protons to provide the energy necessary for ATP synthesis, transport of ions across the mitochondrial membrane and heat.
C.	This pathway is reversible and electron transfer is not linked to proton pumping into the intermembrane space.
D.	Pathway consists of a series of oxidation-reductions reactions carried out by a series of electron carrier complexes inside the inner membrane of the mitochondria.
E.	The electrons carriers pass electrons to other complexes sequentially while pumping protons into the intermembrane space.

Table 7.13

14. Which of the following pairs of enzymes are **MOST LIKELY** to cause accumulation of acids in the blood as a result of thiamine deficiency?
continued on next page

A.	Malate dehydrogenase and citrate synthase
B.	Succinate dehydrogenase and fumarase
C.	Pyruvate dehydrogenase and alpha-ketoacid dehydrogenase
D.	SuccinylCoA synthase and citrate synthase
E.	Isocitrate dehydrogenase and aconitase

Table 7.14

15. Which of the following classes of molecules is **LESS LIKELY** to feed into the tricarboxylic acid pathway to be oxidized as fuel?	
A.	Amino acids
B.	Carbohydrates
C.	Fatty Acids
D.	Enzymes
E.	Alcohols like ethanol

Table 7.15

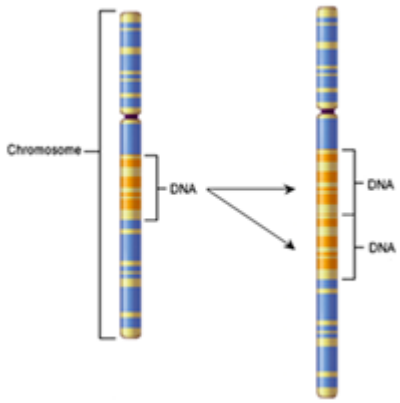
16. Which of the following chemicals is **LESS LIKELY** to cause damage to the central nervous system or cancer by inhibiting alpha-ketoacid dehydrogenase in the tricarboxylic acid pathway?	
A.	Mercury
B.	Arsenate (AsO4-3)
C.	Arsenite (AsO3-3)
D.	NADH

Table 7.16

17. Which of the following statements is **LEAST ACCURATE** about oxidative phosphorylation?	
A.	One full turn of the c subunits of the F0 pore releases a total of twelve protons into the mitochondrial matrix.
B.	Energy from the electrochemical gradient of the electron transport chain and rotation of the asymmetric shaft of the F0 pore alters the shape of binding sites of the F1 headpiece.
	continued on next page

C.	One full term of the binding sites in the F_1 headpiece releases twelve ATP molecules.
D.	The three binding sites in the F1 headpiece facilitates: binding of ADP + Pi, as well as synthesis and release of ATP.
E.	The body increased needs for energy during strenuous exercise ties together oxidative phosphorylation to the electron transport chain and the tricarboxylic acid pathways.

Table 7.17



18. In the picture below: Which of the following DNA mutations is **MOST LIKELY** the cause of these changes in the chromosomes?

	A.
	B.
	C.
	D.
	E.

Table 7.18

19. Which of the following metabolic pathways are **LESS LIKELY** to use an intermediate molecule directly from the tricarboxylic acid pathway for their other own metabolism?	
A.	Amino acids synthesis, nucleotide synthesis and gluconeogenesis

continued on next page

B.	Glycolysis, glycogen synthesis and pentose phosphate pathway
C.	Fatty acids, steroids and neurotransmitter synthesis
D.	Electron transport chain and oxidative phosphorylation
E.	Porphyrin and heme synthesis

Table 7.19

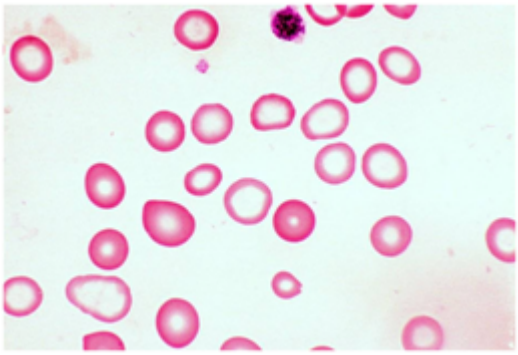
20. In this picture below, abnormal red blood cells are microcytic and hypochromic.  This picture shows the result of a disorder affecting the heme synthesis and the Fe-S centers of the proteins in the electron transport chain. Which of the following disorders is **MOST LIKELY** to cause this appearance on a peripheral blood smear?	
A.	Hypoxia
B.	Cyanide poisoning
C.	Malaria
D.	Iron deficiency
E.	Hemolytic disease of the newborn

Table 7.20

Chapter 8

Carbohydrate[1]

1. Which of the following digestive enzymes can break complex carbohydrates into smaller carbohydrates in both the mouth and intestinal tract?	
A.	Glucoamylase
B.	Dextrinase
C.	Trehalase
D.	Glycosidase
E.	Amylase

Table 8.1

2. Which of the following complex carbohydrates can reduce the absorption of cholesterol inside the intestinal tract?	
A.	Glycogen
B.	Soluble fibers
C.	Insoluble fibers
D.	Amylose
E.	Amylopectin

Table 8.2

3. What is the metabolic function of the intestinal glycosidases?	
A.	Break down smaller carbohydrates into glucose, fructose and galactose.
B.	Cleave hydroxyl groups of dietary complex carbohydrates molecules.
C.	Digest dietary complex carbohydrate in the mouth and the stomach.
D.	Join two simple sugars together to form complex carbohydrate molecules.
E.	Allow passage of simple sugars inside the intestinal cells.

Table 8.3

[1] This content is available online at <http://cnx.org/content/m41754/1.1/>.

4. Which of the following transporters absorb both glucose and galactose inside the renal and intestinal cells?	
A.	GLUT1
B.	GLUT2
C.	SGLT1
D.	GLUT4
E.	GLUT5

Table 8.4

5. A urine test is positive for fructose. Which of the following enzymes is deficient in fructosuria?	
A.	Aldolase B
B.	Phosphoglucomutase
C.	4-Epimerase
D.	Fructokinase
E.	Galactokinase

Table 8.5

6. Which of the following disorders uses a stool acidity test as a diagnostic tool for infants?	
A.	Fructose Intolerance
B.	Fructose Malabsorption
C.	Fructosuria
D.	Classical Galactosemia
E.	Non-classical Galactosemia

Table 8.6

7. A patient's test results show hypoglycemia, liver failure, hyperuricemia and prolonged coagulation times. Which of the following carbohydrate disorders are consistent with these results?	
A.	4-Epimerase Deficiency
B.	Galactokinase Deficiency
C.	Classical Galactosemia
D.	Fructose Intolerance
	continued on next page

E.	Fructose Malabsorption

Table 8.7

8. Which of the following enzyme pairs are the two defective enzymes that share similar symptoms by forming phosphorylated intermediates in galactose metabolism disorders?	
A.	Lactalbumin and glycosyltransferases
B.	Fructokinase and aldose reductase
C.	Galactosyltransferase and phosphoglutamase
D.	Galactokinase and aldolase B
E.	Galactose 1-phosphate uridyltransferase and 4-epimerase

Table 8.8

9. Which of the following statements about galactosemic and diabetic cataracts is **INCORRECT**?	
A.	A newborn screening test helps diagnose the defective enzyme in galactose metabolism.
B.	Galactitol is synthesized via the polyol pathway using excess fructose from blood.
C.	Sorbitol is synthesized via the polyol pathway using excess glucose from blood.
D.	Accumulation of galactitol in the lens of eyes can cause developmental delays in infants.
E.	Diabetic patients develop cataracts due to accumulation of sorbitol in the lens of the eyes.

Table 8.9

10. Which of the following molecules is a byproduct of anaerobic glycolysis in the red blood cells and used for energy by the renal cells?	
A.	Gases
B.	Short fatty acids
C.	Vitamin K
D.	Lactate
E.	Glucose

Table 8.10

11. What is the metabolic function of the two subunits of lactose synthase?	
A.	Lactalbumin synthesizes prolactin and galactosyltransferase synthesizes cortisol.
B.	Lactalbumin synthesizes lactoglobulin and glycosyltransferase synthesizes casein.
C.	Lactalbumin increases the catalytic rate of galactosyltransferase during the synthesis of lactose.
D.	Lactalbumin synthesizes colostrum and galactosyltransferase synthesizes mature milk.
E.	Lactalbumin converts glucose to galactose and galactosyltransferase degrades galactose.

Table 8.11

12. Which of the following enzymes is responsible for the rapid drug clearance of barbiturates?	
A.	Debranching enzyme
B.	Glycogen synthase
C.	Aldose reductase
D.	Lactose synthase
E.	UDP-glucuronyltransferase

Table 8.12

13. Which of the following subclasses of glycolipids are responsible for the ABO groups in the membranes of the red blood cells?	
A.	Galactocerebrosides
B.	Glucocerebrosides
C.	Sulfatides
D.	Gangliosides
E.	Globosides

Table 8.13

14. Which of the following amino acids is the residue for the formation of N-glycosidic bonds in glycoproteins?	
A.	Asparagine
B.	Aspartate
C.	Serine
D.	Threonine
E.	Hydroxylysine

Table 8.14

15. Why are glycosylated proteins clinically important for diabetic patients only?	
A.	They form surface receptors for connection and neural communication between cells.
	continued on next page

B.	They are important components of the coagulation cascade and in diagnosing coagulation disorders.
C.	They provide lubrication for cell surfaces and protection against pathogenic bacteria.
D.	They cause thickening of blood vessels impairing delivery of nutrients and gas exchange in the cells.
E.	They can function either as hormones or enzymes for metabolic and reproductive function.

Table 8.15

16. Which of the following hormones regulate glycogenesis?	
A.	Insulin
B.	Glucagon
C.	Epinephrine
D.	Cortisol
E.	Secretin

Table 8.16

17. A patient suffers from cramps and fatigue every time he exercises. Which of the following defective enzymes can affect the breakdown of glycogen in the muscles?	
A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Glycogen synthase
D.	Branching enzyme
E.	Glucose-6-phosphatase

Table 8.17

18. Which of the following hormones facilitates the breakdown of glycogen in muscle?	
A.	Insulin
B.	Glucagon
C.	Cortisol
D.	Epinephrine
E.	Norepinephrine

Table 8.18

19. Which of the following statements about glycogenolysis in the liver is **INCORRECT**?	
A.	Cortisol stimulates gluconeogenesis and suppresses the translocation of GLUT4.
B.	Epinephrine binding to both alpha and beta receptors stimulates glycogenolysis.
C.	Epinephrine binding to beta receptors also enhances the effects of glucagon.
D.	Epinephrine binding to alpha receptors also stimulates gluconeogenesis.
E.	Glucagon stimulates glycogenolysis via inositol-phospholipid signaling pathway.

Table 8.19

20. Which of the following is a compensatory mechanism in the brain to help increase the uptake of sugar to the neurons?	
A.	Arrangement of neurofibrillary tangles in helices and filaments
B.	Increased phosphorylation of *tau*
C.	Decreased glycosylation of proteins
D.	Increased GLUT2 transporters in astrocytes
E.	Decreased GLUT1 and GLUT3 transporters

Table 8.20

21. Which of the following glucose transporters is regulated by HIF-1 in the brain?	
A.	GLUT2
B.	GLUT3
C.	GLUT4
D.	GLUT7
E.	GLUT8

Table 8.21

22. Which of the following glucose transporters is the insulin-sensitive transporter found in muscle and fat cells?	
A.	GLUT1
B.	GLUT2
C.	GLUT3

continued on next page

D.	GLUT4
E.	GLUT5

Table 8.22

Chapter 9

Carbohydrate II[1]

1. Which of the following complex carbohydrates can reduce the absorption of cholesterol inside the intestinal tract?	
A.	Glycogen
B.	Soluble fibers
C.	Insoluble fibers
D.	Amylose
E.	Amylopectin

Table 9.1

2. What is the metabolic function of the intestinal glycosidases?	
A.	Breaks down smaller carbohydrates into glucose, fructose and galactose.
B.	Cleaves hydroxyl groups of dietary complex carbohydrates molecules.
C.	Digests dietary complex carbohydrate in the mouth and the stomach.
D.	Joins two simple sugars together to form complex carbohydrate molecules.
E.	Allows passage of simple sugars inside the intestinal cells.

Table 9.2

3. A patient's laboratory test is positive for fructose in urine only. All blood test results are normal. Which of the following enzymes is deficient in this patient?	
A.	Aldolase B
B.	Phosphoglucomutase
	continued on next page

[1]This content is available online at <http://cnx.org/content/m41757/1.1/>.

C.	4-Epimerase
D.	Fructokinase
E.	Galactokinase

Table 9.3

4. A 9 month old male suffers from abdominal pain and bloating with frequent diarrhea after being fed solid foods. A stool acidity test is ordered. Which of the following carbohydrate disorders uses a stool acidity test as a diagnostic tool for infants?	
A.	Fructose Intolerance
B.	Fructose Malabsorption
C.	Fructosuria
D.	Classical Galactosemia
E.	Non-classical Galactosemia

Table 9.4

5. A patient's test results show hypoglycemia, liver failure, hyperuricemia, prolonged coagulation times and a positive urine test for fructose. Which of the following carbohydrate disorders is consistent with these lab results?	
A.	Fructosuria
B.	Galactokinase Deficiency
C.	Classical Galactosemia
D.	Fructose Intolerance
E.	Fructose Malabsorption

Table 9.5

6. Which of the following defective enzymes impairs carbohydrate metabolism by forming phosphorylated intermediates that can cause mental retardation or severe liver damage if left untreated?	
A.	Lactalbumin and glycosyltransferases
B.	Fructokinase and aldose reductase
C.	Galactosyltransferase and phosphoglutamase
D.	Galactokinase and aldolase B
E.	Galactose 1-phosphate uridyltransferase and 4-epimerase

Table 9.6

7. What is the metabolic function of the two subunits of lactose synthase?	
A.	Lactalbumin synthesizes prolactin and galactosyltransferase synthesizes cortisol.
B.	Lactalbumin synthesizes lactoglobulin and glycosyltransferase synthesizes casein.
C.	Lactalbumin increases the catalytic rate of galactosyltransferase and galactosyltransferase synthesizes lactose.
D.	Lactalbumin synthesizes colostrum and galactosyltransferase synthesizes mature milk.
E.	Lactalbumin converts glucose to galactose and galactosyltransferase degrades galactose.

Table 9.7

8. Which of the following enzymes is responsible for the rapid drug clearance of barbiturates?	
A.	Debranching enzyme
B.	Glycogen synthase
C.	Aldose reductase
D.	Lactose synthase
E.	UDP-glucuronyltransferase

Table 9.8

9. Which of the following hormones exerts its effects on glycogen synthesis?	
A.	Insulin
B.	Glucagon
C.	Epinephrine
D.	Cortisol
E.	Secretin

Table 9.9

10. A patient suffers from cramps and fatigue every time he exercises. He is diagnosed with McArdle's disease. Which of the following defective enzymes prevents the breakdown of glycogen on this patient?
continued on next page

A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Glycogen synthase
D.	Branching enzyme
E.	Glucose-6-phosphatase

Table 9.10

11. Which of the following hormones facilitates the breakdown of glycogen in muscle?	
A.	Insulin
B.	Glucagon
C.	Cortisol
D.	Epinephrine
E.	Norepinephrine

Table 9.11

12. Which of the following statements directly explains the effects of hormones in the liver during fasting?	
A.	Cortisol stimulates insulin secretion in order to suppress the translocation of GLUT4.
B.	Epinephrine binding to both alpha and beta receptors activates glycogen phosphorylase.
C.	Epinephrine binding to beta receptors stimulates both glycogen and protein synthesis.
D.	Epinephrine binding to alpha receptors helps inactivates glycogen [hosphorylase.
E.	Glucagon stimulates glycogenolysis via inositol-phospholipid signaling pathway.

Table 9.12

13. Which of the following is a normal compensatory mechanism that helps increase the neuronal uptake of glucose n cases of Alzheimer disease?	
A.	Arrangement of neurofibrillary tangles in helices and filaments

continued on next page

B.	Increased phosphorylation of *tau*
C.	Decreased glycosylation reactions of proteins
D.	Increased GLUT2 transporters in astrocytes
E.	Decreased GLUT1 and GLUT3 transporters

Table 9.13

14. Which type of glucose transporters are synthesized under the control of hypoxia inducing factor-1 inside the neurons?	
A.	GLUT2 and GLUT4
B.	GLUT1 and GLUT3
C.	GLUT5 and GLUT8
D.	GLUT2 and GLUT7
E.	GLUT5 and GLUT7

Table 9.14

15. Which of the following glucose transporters can facilitate the release of glucose, galactose and fructose from the intestinal cells into the hepatic portal vein?	
A.	GLUT1
B.	GLUT2
C.	GLUT3
D.	GLUT4
E.	GLUT5

Table 9.15

16. Patients can develop cataracts from the build-up of sugar alcohols inside the lens of the eyes. Which of the following enzymes has the capability to synthesize sugar alcohols from either excess glucose or galactose?	
A.	Fructokinase
B.	Galactokinase
C.	Aldose reductase
D.	Phosphoglucomutase
	continued on next page

E.	Glucose-6-phosphatase

Table 9.16

17. Which of the following hormones stimulates the synthesis of α-lactalbumin?	
A.	Prolactin and cortisol
B.	Glucagon and epinephrine
C.	Estrogen and progesterone
D.	Testosterone and aldosterone
E.	Thyroid and human placental lactogen

Table 9.17

18. Which of the following classes of molecules make the composition of human breast milk unique from commercially based formulas?	
A.	Proteins
B.	Fats
C.	Vitamins
D.	Carbohydrates
E.	Immunoglobulins

Table 9.18

19. Which of the following statements about the anticancer properties of glucuronides is **INCORRECT**?	
A.	Inhibit beta-glucuronidase to prevent the release of carcinogens in the body.
B.	Decrease the therapeutic effect of anticancer drugs administered to patients.
C.	Increase the rate of glucuronidation reactions to clean toxic molecules faster.
D.	Suppress cell proliferation, staging and metastasis by inducing cell apoptosis.
E.	Effective in treating lung, skin, liver, breast, colon, bladder and prostate cancers.

Table 9.19

20. A 6 year old boy's lab results show: hypoglycemia, jaundice, hemorrhage, hepatomegaly, and hyperuricemia. He is diagnosed with fructose intolerance. Which of the following hepatic enzymes is defective in this patient?	
A.	Galactokinase
B.	Triose Kinase
C.	Hexokinase
D.	Aldolase B
E.	Fructokinase

Table 9.20

21. A 6 month old female is failing to thrive. Lab results show: hypoglycemia and hyperketonemia. She is diagnosed with Lewis' Disease. Which hepatic enzyme is defective in this patient?	
A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Branching enzyme
D.	Glycogen synthase
E.	Glucose-6-phosphatase

Table 9.21

22. Andersen's and Cori's Disease are two glycogen disorders that produces hypoglycemia and altered branches of glycogen in both the fed and fasting states, respectively. In which of the following tissues can these disorders be the main cause for hypoglycemia?	
A.	Muscle
B.	Liver
C.	Intestines
D.	Kidneys
E.	Heart

Table 9.22

23. Which of the following shows the health benefits of insoluble fibers?	
A.	Form a gel that can be degraded by normal flora into gases
B.	Slows the absorption of glucose; thus, regulating blood sugar levels
C.	Prevents heart disease by reducing total and LDL cholesterol levels
D.	Draws water inside the intestines softening the stool for regularity
E.	Fiber fermentation produces short fatty acids for energy

Table 9.23

24. Which of the following mechanisms **IS NOT** part of the process of glycogen degradation in the muscle cells?	
A.	Influx of calcium ions from nerve impulses
B.	High levels of AMP from muscle contraction
C.	Epinephrine binding to muscle cells beta receptors
D.	Glucagon cAMP signal transduction cascade
E.	Activation of glycogen phosphorylase

Table 9.24

25. A 7 days old full-term male is losing weight. He vomits and has diarrhea everytime he ingests breast milk. Current lab results show: impaired liver function, hypergalactosemia, hyperchloremic metabolic acidosis, hyperaminoaciduria and high urinary galactitol levels. Which of the following defective enzymes would be consistent with this patient lab results?	
A.	Aldolase B
B.	Galactokinase
C.	Aldose reductase
D.	UDP-glucuronyltransferase
E.	Galactose-1-phosphate uridyltransferase

Table 9.25

Chapter 10

Carbohyhdrates III[1]

1. Which of the following enzymes digests starches and glycogen into small fragments in the mouth and intestines?	
A.	Alpha-amylase
B.	Trehalase
C.	Beta-glycosidase
D.	Beta-glucoamylase
E.	Sucrase-isomaltase

Table 10.1

2. Which of the following cells supplies the neurons with lactate to maintain ATP levels in both the fed and fasting states?	
A.	Enterocytes
B.	Astrocytes
C.	Sertoli Cells
D.	Hepatocytes

Table 10.2

3. Which of the following conditions is a genetic disorder that slows the rate of synthesis of bilirubin diglucuronide inside the liver cells?	
A.	Hepatitis A or B
B.	Cirrhosis of the liver
	continued on next page

[1]This content is available online at <http://cnx.org/content/m41758/1.1/>.

C.	Hepatic carcinoma
D.	Gilbert's Syndrome

Table 10.3

4. von Gierke's Disease is a severe disorder that causes hypoglycemia, lactic acidemia and hyperlipidemia in the fasting state. The defective enzyme is glucose-6-phosphate dehydrogenase. Which hepatic metabolic pathway **IS NOT** affected by this defective enzyme?	
A.	Glycogenesis
B.	Glycogenolysis
C.	Gluconeogenesis
D.	Fructose degradation

Table 10.4

5. Which of the following is a potential concern with feeding breast milk for the first six months of life?	
A.	Producing more than five wet diapers daily
B.	Immunoglobulins provide immunity and help prevent food allergies
C.	Lack of iron will affect brain development
D.	Hormones, proteins, fats, minerals and vitamins are essential for growth

Table 10.5

6. Which of the following statements makes insulin regulation unique in the fed state?	
A.	Stimulates the synthesis of enzymes for glycolysis in both muscle and liver cells.
B.	Activates both glycolysis and glycogenesis in liver and muscle cells.
C.	Inhibits the enzymes of glycogenolysis in muscle and liver cells.
D.	Opens only transmembrane GLUT4 transporters in muscle cells.

Table 10.6

7. Which of the following carbohydrate disorders **WILL NOT** impair liver function?	
A.	Fructose Intolerance
B.	Fructosuria
C.	UDP-galactose-4-epimerase
D.	Galactose-1-phosphate uridyltransferase

Table 10.7

8. A patient is diagnosed with Hers' Disease. Which of the following is the defective enzyme in this disorder?	
A.	Muscle glucose-6-phosphatase
B.	Muscle glycogen phosphorylase
C.	Hepatic glycogen phosphoprylase
D.	Hepatic glycogen debranching enzyme

Table 10.8

9. Andersen's and Cori's Disease are two glycogen disorders that produces hypoglycemia and altered branches of glycogen in the both the fed and fasting states respectively. In which of the following tissues can these disorders be the cause of hypoglycemia?	
A.	Muscle
B.	Liver
C.	Intestines
D.	Kidneys

Table 10.9

10. Which of the following is a possible treatment for gallstones?	
A.	Phototherapy
B.	Corticosteroids
C.	Cholecystectomy
D.	Iron supplements
E.	Intravenous immunoglobulin

Table 10.10

11. Which of the following is a defective hepatic enzyme that can affect metabolic pathways in both the fed (glycolysis) and fasting states (gluconeogenesis)?	
A.	Hexokinase
B.	Aldolase A
C.	Aldolase B
D.	Triose kinase

Table 10.11

12. Which of the following hormone pairs stimulates the synthesis of each of the subunits of lactose synthase?	
A.	Prolactin and cortisol
B.	Thyroxine and triidothyronine
C.	Aldosterone and progesterone
D.	Estrogen and human placental lactogen

Table 10.12

13. Which of the following shows a potential risk of using glucuronides as therapeutic agents?	
A.	Synergistic effect with some cancer drugs
B.	Higer rate of drug clearance in urine
C.	Antiproliferative effects on carcinogenic cells
D.	Increased removal of toxins/carcinogens via glucuronidation reactions
E.	Preventing the reversal of glucuronidation reactions via inhibition of beta-glucuronidase

Table 10.13

14. A week old premature male has developed physiological jaundice. He is receiving phototherapy and being carefully monitored. The current lab results show:**Plasma Bilirubin (BC):** 0 umol/L (Normal: < 8 umol/L)**Plasma Total Bilirubin (TBIL):** 332 umol/L (Normal: 85 - 200 umol/L)**Unconjugated Bilirubin (BU):** 332 umol/L (Normal: < 10 umol/L)**Urine bilirubin:** Negative**Urine urobilinogen:** 0 mg/dL (Normal: 0.2 - 1 mg/dL)**Fecal urobilinogen:** NegativeWhich of the following will be another treatment to prevent permanent neurological damage in this patient?	
A.	Fiber-optic blankets
B.	Exchange transfusion
C.	Intravenous immuneglobulin
D.	Corticosteroids

Table 10.14

15. Which of the following enzymes is responsible for the synthesis of sugar alcohols involved in the development of cataracts?	
A.	Galactokinase
B.	Aldolase B
C.	Fructokinase
	continued on next page

D.	Phosphorylase
E.	Aldol reductase

Table 10.15

16. Which of the following shows the health benefits of insoluble fibers?	
A.	Form a gel that can be degraded by normal flora into gases
B.	Slows the absorption of glucose; thus, regulating blood sugar levels
C.	Prevents heart disease by reducing total and LDL cholesterol levels
D.	Draws water inside the intestines softening the stool for regularity
E.	Fiber fermentation produces short fatty acids for energy

Table 10.16

17. A 7 days old full-term male is losing weight. He vomits and has diarrhea everytime he ingests breast milk. Current lab results show: impaired liver function, hypergalactosemia, hyperchloremic metabolic acidosis, hyperaminoaciduria and high urinary galactitol levels. Which of the following are the two possible defective hepatic enzymes consistent with these lab results in this patient?	
A.	Aldolase B and fructokinase
B.	Galactokinase and aldose reductase
C.	Phosphoglucomutase and glucose-6-phosphatase
D.	Galactose-1-phosphate uridyltransferase and UDP-galactose-4-epimerase

Table 10.17

18. Which of the following molecules may turn the urine dark in cases of intra-hepatic and post-hepatic jaundice?

continued on next page

A.	Urobilin
B.	Biliverdin
C.	Conjugated bilirubin
D.	Unconjugated bilirubin

Table 10.18

19. Which of the following enzyme levels would be affected in hepatic disease?	
A.	Alpha-amylase
B.	Alkaline phosphatase
C.	Aspartate aminotransferase
D.	Gamma-glutamyltransferase

Table 10.19

20. Which of the following uses the same signal cascade mechanism to help regulate glycogenolysis in both the liver and muscle cells during the fasting state?	
A.	Epinephrine bound to an alpha cell receptor
B.	Epinephrine bound to a beta cell receptor
C.	Cortisol bound to its own cell receptor
D.	Glucagon bound to its own cell receptor

Table 10.20

21. A 9 month old male suffers from abdominal pain and bloating with frequent diarrhea after being fed solid foods. A stool acidity test is positive for fructose. Which of the following glucose transporters is defective in this patient?	
A.	Muscle GLUT4
B.	Hepatic GLUT2
C.	Hepatic GLUT5
D.	Intestinal SGLT1
E.	Intestinal GLUT5

Table 10.21

22. Which of the following statements makes muscle regulation unique in the fasting state?	
A.	Glucagon does not exert any regulatory effects in muscle in the fasting state.
B.	Calcium complexes stimulate glycogenolysis and inhibits glycogenesis.
C.	A cAMP mediated signal cascade stimulates glycogenolysis and inhibits glycogenesis.
D.	High AMP levels from muscle contraction stimulate both glycogenolysis and glycolysis.

Table 10.22

23. Which of the following disorders affects the degradation of glycogen in muscle cells?	
A.	Lewis' Disease
B.	Cori's Disease
C.	Hers' Disease
D.	Andersen's Disease
E.	McArdle's Disease

Table 10.23

24. A 6 month old female is failing to thrive. Lab results show: hypoglycemia and hyperketonemia. She is diagnosed with Lewis' Disease. Which of the following is the defective enzyme in this disorder?	
A.	Muscle glycogen synthase
B.	Muscle glycogen phosphorylase
C.	Hepatic glycogen phosphorylase
D.	Hepatic glycogen synthase

Table 10.24

25. A 25 year old Hispanic female suffers from fatigue, sporadic episodes of pain in the extremities, fever, jaundice and recurrent infections. Lab results show:**Serum iron:** 38 mcg/dL (Normal: 60 -170 mcg/dL)**Plasma Conjugate Bilirubin (BC):** 0 umol/L (Normal: < 8 umol/L)**Plasma Total Bilirubin (TBIL):** 85 umol/L (Normal: < 18 umol/L)**Plasma Unconjugated Bilirubin (BU):** 85 umol/L (Normal: < 10 umol/L)**AST:** 25 U/L (Normal: 5 - 45 U/L)**ALP:** 145 U/L (Normal: 50 - 260 U/L)**Urine bilirubin:** Negative**Urine urobilinogen:** 4 mg/dL (Normal: 0.2 - 1 mg/dL)**Fecal urobilinogen:** 386 mg/24 hours (Normal: 50 to 300 mg/24 hours)Blood smear: Image not finished Which of the following causes is consistent with these lab results?
continued on next page

A.	Sickle cell anemia
B.	Hepatitis
C.	Cholangitis
D.	Cirrhotic liver

Table 10.25

Chapter 11

Carbohydrates IV[1]

1. A 21-year old male joins the military. He is required to do exercise during basic training. He experiences pain, cramps and fatigue after 20 minutes of strenuous physical activity and his urine turns burgundy-colored. Lab results showed after exercise: high serum creatine levels and myoglobinuria. An ischemic forearm exercise test showed: low lactate and high ammonia levels in blood. A muscle biopsy reveals:

Glycogen 1.85 mmol/min/g (**Normal values:** 0.1 - 1.5 mmol/min/g)
Phosphorylase A 0.09 mmol/min/g (**Normal values:** 12 mmol/min/g)
What condition is this patient suffering from?

A. McArdles' disease type V
B. Andersons' disease type IV
C. von Gierke's disease type I
D. Hers' disease type VI
E. Cori's disease type III

2. Which of the following hepatic enzymes connects glycogenolysis to the last step of gluconeogenesis?

A. Glycogenin
B. Branching enzyme
C. Phosphoglucomutase
D. Glucose-6-phosphatase
E. Glycogen phosphorylase

3. Which of the following proteins is directly involved in glycogenolysis in the liver and muscle cells?

A. Glycogenin
B. Phosphoglucomutase
C. Branching enzyme
D. Glycogen synthase
E. Insulin

4. Which of the following statements about fibers is **INCORRECT**?

A. Soluble fibers are fermented by normal intestinal bacteria.
B. Soluble fibers slow the absorption of glucose into circulation.
C. Soluble fibers can prevent heart disease by reducing cholesterol in circulation.
D. Insoluble fibers increase the regularity of bowel movements and prevent constipation.

[1] This content is available online at <http://cnx.org/content/m42114/1.1/>.

E. The products of insoluble fibers are gases, short fatty acids, lactate and vitamin K.

5. What is the main purpose of glucuronidation reactions?

A. Stimulate abnormal cell proliferation in the tissues.
B. Activate other enzymes to release non-polar molecules.
C. Get rid of drugs faster from the body without a therapeutic effect.
D. Add two glucose molecules to non-polar molecules to make them polar.
E. Clear insoluble molecules by excreting them via the urine and feces.

6. Which of the following enzymes is responsible for the development of cataracts in galactosemic patients?

A. Galactose-1-phosphate uridyltransferase
B. UDP-galactose-4-epimerase
C. Sorbitol dehydrogenase
D. Galactokinase
E. Aldose reductase

7. Which of the following enzymes actively breaks down complex carbohydrates in **both** the mouth and the lumen of the intestines?

A. α-amylase
B. Sucrase
C. Isomaltase
D. ß-glucoamylase
E. ß-glycosidase

8. Which of the following is the best screening test to detect GLUT1 mutations?

A. CSF glucose levels
B. Serum glucose levels
C. SLC2A1 genetic testing
D. CSF per Blood glucose ratios
E. F 18 positron emission tomography

9. Which of the following proteins is found in high concentration in colostrum?

A. α-lactalbumin
B. Immunoglobulin A
C. Lysozyme
D. Insulin
E. Casein

10. A 7-month old baby is being introduced to solid foods. Mother notices her baby gets fussy, and suffers from chronic bloating and diarrhea every time he eats bananas, apples or pears. A stool reducing substances test is positive. Which of the following proteins might be defective in this patient?

A. Sucrase
B. α-amylase
C. ß-glucoamylase
D. GLUT5
E. ß-glycosidase

11. Which of the following enzymes can **only** break disaccharides inside the lumen of the intestines?

A. Sucrase
B. Isomaltase
C. ß-glucoamylase
D. α-amylase

12. Which of the following enzymes adds glucuronate molecules to non-polar molecules?

A. ß-glucuronidase
B. α–lactalbumin
C. Glucose-6-phosphatase
D. Galactosyltransferase
E. UDP-glucuronyltransferase

13. What is the main purpose of the polyol pathway?

A. Stimulates the release of insulin during the fed state.
B. Converts excess glucose into glycogen in the liver and muscle.
C. Converts excess glucose into fructose for fast energy in all the cells.
D. Converts excess glucose into triglycerides in the liver and adipose cells.
E. Stimulates the release of glucagon, epinephrine and cortisol in the fasting state.

14. Which of the following molecules can be an alternate source of energy in cases of GLUT1 deficiencies?

A. Glucose
B. Fructose
C. Galactose
D. Proteins
E. Ketone Bodies

15. Which of the following statements shows the importance of detecting and treating GLUT1 deficiencies in patients with or without epileptic seizures?

A. Preventing mental impairments if it is detected and treated very early.
B. Controlling seizures by supplying glucose via monocarboxylic acid transporters.
C. Supplying other energy molecules that can pass through GLUT1 transporters.
D. Inducing a permanent fed state in the entire body in which insulin levels are high.
E. Recognizing variations in de novo mutations as the only mode of inheritance.

16. Which of the following enzymes can perform lactogenesis in the mammary glands and glycoprotein synthesis in all the body's cells?

A. ß-glucuronidase
B. α-lactalbumin
C. Glucose-6-phosphatase
D. Galactosyltransferase
E. UDP-glucuronyltransferase

17. A 1-month old male is failing to thrive. Lab results showed hypoglycemia accompanied by ketosis during fasting and low blood levels of lactate and alanine. Although feeding relieves the symptoms, it results in post-prandial hyperglycemia and hyperlacticacidemia. A liver biopsy revealed decreased glycogen stores in the liver. There is not enlargement of the liver as a result of storage of excessive or abnormal glycogen.

Which of the following enzymes is responsible for the lack of enlongated terminal ends (A-chains) in the stored glycogen of this patient?

A. Glycogenin

B. Branching enzyme
C. Debranching enzyme
D. Glycogen synthase
E. Glycogen phosphorylase

18. Which of the following is a benign disorder that can have normal blood lab values?

A. Fructosuria
B. Fructose Intolerance
C. Classical galactosemia
D. UDP-galactose-4-epimerase

19. Which of the following hepatic metabolic pathways **WOULD NOT** be affected by a deficient aldolase B?

A. Glycolysis
B. Glycogenesis
C. Glycogenolysis
D. Gluconeogenesis
E. Fructose metabolism

20. Which of the following hormones controls the synthesis and activity of glycogen synthase during the fed state?

A. Renin
B. Cortisol
C. Insulin
D. Glucagon
E. Epinephrine

21. Which of the following hormones stimulates the synthesis of the enzymes for lactogenesis?

A. Aldosterone
B. Epinephrine
C. Prolactin
D. Insulin
E. Glucagon

22. Which of the following protein transporters has the capability to allow glucose, galactose and fructose into the hepatic portal vein circulation?

A. GLUT1
B. GLUT2
C. GLUT3
D. GLUT4
E. GLUT5

Questions 23 to 25 will use the same clinical information to be answered.

23. A newborn is initially breastfed. He develops the following symptoms when he feeds: vomiting, diarrhea, convulsions, irritability, lethargy and refuses to ingest breast milk. He begins to lose weight.

Which of the following conditions should be ruled out in this patient?

- Fructose intolerance
- Classical galactosemia

- Fructose malabsorption
- UDP-galactose-4-epimerase deficiency

24. Blood lab tests of this newborn (Question 23 above) showed: hypoglycemia, aminoaciduria, hepatomegaly and impaired liver function. A screen for reducing substances in the urine was positive. Carbohydrate chromatography showed high levels of galactose and galactitol in urine.

Which of the following enzymes is defective in this infant?

A. Aldolase B
B. Fructokinase
C. Galactokinase
D. Galactosyltransferase
E. Galactose-1-phosphate uridyltransferase

25. Which of the following milk products can be used to feed this newborn patient? (Patient in questions 23 & 24 above)

A. Colostrum
B. Cow's milk
C. Goat's milk
D. Soy formula
E. Mother's breast milk

Chapter 12

Carbohydrate and Nitrogen[1]

1. Which of the following statements is **INCORRECT** about the glucose transporters in the brain?	
A.	Regions of the brain with higher need for glucose have high densities of glucose transporters to facilitate this uptake.
B.	Two types of GLUT1 exist in the cerebral cortex, neurons, astrocytes, microglia and oligodendrocytes.
C.	GLUT3 is primarily found in astrocytes, oligodendrocytes and microglia cells in the brain.
D.	GLUT5 is a multifunction transporter predominantly found in the microglial cells.
E.	There are other types of transporters in the brain such GLUT2, GLUT4 and GLUT7.

Table 12.1

2. Which of the following byproducts of hemoglobin degradation feeds directly into the amino acid pool?	
A.	Heme
B.	Iron
C.	Bilirubin
D.	α and β chains
E.	Biliverdin

Table 12.2

[1]This content is available online at <http://cnx.org/content/m41751/1.1/>.

3. Which of the following statements about how the liver support blood glucose levels is **INCORRECT**?	
A.	Glucagon levels rise during fasting, increasing the cAMP levels to activate glycogen phosphorylase to release glucose from glycogen degradation.
B.	Glucagon levels decrease in the fed state, decreasing the cAMP levels to stop glycogen degradation by inactivating glycogen phosphorylase.
C.	Insulin levels rise during fasting, increasing the cAMP levels to activate glycogen synthase for glycogen synthesis.
D.	Insulin and glucose levels rise during the fed state increasing the uptake of glucose via glucose transporters and stimulating glycogen synthesis
E.	Epinephrine binds alpha and beta receptors to stimulate glycogen degradation during periods of exercise, stress and hypoglycemia.

Table 12.3

4. Which of the following metabolites in the degradation of glycine causes precipitates (renal stones) with excess calcium ions in the kidneys?	
A.	Serine
B.	Glycine
C.	Oxalate
D.	Ammonia
E.	Glyoxylate

Table 12.4

5. Which of the following is **NOT** a byproduct of the bacterial digestion of undigested fibers?	
A.	Lactate
B.	Acetic Acid
C.	Hydrogen gas
D.	Sulfuric acid
E.	Methane gas

Table 12.5

6. Which of the following statements is **INCORRECT** about the electron transport chain and oxidative phosphorylation?	
A.	The chemical structure of the electron carriers facilitates electron transfer down the Fe-S centers and proton pumping out of the matrix.
B.	The electrochemical gradient outside the matrix provides energy for ATP synthesis, transport of molecules/ions across cell membranes and heat.
C.	This is a series of REDOX reactions with O2 acting as an electron donor, NADH and FADH2 as the electron acceptors, and 5 mol of ATP as the only products.
D.	One complete turn of the F0F1 ATPase synthase would release 12 protons and three ATP molecules into the matrix of the mitochondria.
E.	A proton back pressure maintains the rate of proton pumping and oxygen consumption and this regulation also affects the rate of ATP synthesis.

Table 12.6

7. Which of the following **IS NOT** a metabolic function of NADPH from the pentose phosphate pathway?	
A.	Detoxification and superoxide synthesis
B.	Fatty acid synthesis and chain elongation
C.	Neurotransmitter and cholesterol synthesis
D.	Deoxynucleotide synthesis for DNA
E.	Glucose synthesis and degradation

Table 12.7

8. Which of the following amino acids, produced from intermediates of tricarboxylic acid, is used for the synthesis of both purine bases for nucleic acids and neurotransmitters?	
A.	Glycine
B.	Glutamate
C.	Aspartate
D.	Arginine

continued on next page

E.	Alanine
9. Which of the following molecules is a byproduct of hemoglobin degradation that can be excreted as glucuronides via the intestines or the kidneys?	
A.	Iron
B.	Amino acids
C.	Bilirubin
D.	Alpha chains
E.	Beta chains

Table 12.8

10. Which of the following organs is the main site for the urea cycle?	
A.	Lungs
B.	Kidneys
C.	Liver
D.	Intestines
E.	Brain

Table 12.9

Chapter 13

Carbohydrate and Nitrogen II[1]

1. Which of the following statements about glucose transporters is **TRUE**?	
A.	The transporter for red blood cells is an insulin-sensitive transporter.
B.	The transporter in spermatozoa function to transport fructose.
C.	The transporter for muscle is a glucose sensor transporter.
D.	The transporter for adipose tissue is a low affinity transporter.
E.	The transporter for the liver is a high affinity transporter.

Table 13.1

2. Which of the following statements **BEST** states the clinical significance of glucose transporters in the brain?	
A.	The passage of glucose across the endothelial cells of the blood brain barrier is fast, thus maintaining a balance of supply and demand, especially during systemic hypoglycemia and seizures.
B.	An ideal glucose level for normal neuronal function is 18-54 mg/dL and this prevents symptoms of light-headedness, dizziness or coma.
C.	The levels of GLUT1 and GLUT3 remain constant from birth to adulthood and this facilitates neuronal maturation and synaptic activity in the brain.
D.	Patients with Alzheimer's disease show reduced levels of GLUT1 and GLUT3 in regions that show deficits in cerebral glucose utilization.
	continued on next page

[1]This content is available online at <http://cnx.org/content/m41752/1.1/>.

E.	Studies of glucose transporters in the brain do not offer any useful information for diseases like diabetes, hypoxia/ischemia, epilepsy and neurodegenerative disorders.

Table 13.2

3. Which of the following statements about muscle protein degradation is **INCORRECT**?	
A.	An ubiquitin-proteasome complex targets proteins that contains rich region of proline, glutamate, serine and threonine (PEST).
B.	An active proteasome complex breaks down muscle proteins via a PA700 CAP with a PA28 subunit or a PA 28 subunit by itself.
C.	Lysosomes contain cathepsins enzymes which break down muscle proteins and release amino acids into circulation.
D.	Phagocytosis facilitates the intake and break down of muscle proteins in the inside of the lysosomes.
E.	Calpains are cytosolic calcium regulated enzymes capable of breaking muscle proteins into amino acids.

Table 13.3

4. Which of the following **CANNOT** be broken down into amino acids by any of the enzymes that degrade proteins in the body?	
A.	Muscle
B.	Plant Fiber
C.	Hemoglobin
D.	Digestive enzymes
E.	Sloughed off cells of the intestines

Table 13.4

5. Which of the following statements about GLUT4 is **INCORRECT**?	
A.	GLUT4 is a glucose transporter predominantly found in adipose tissue and heart and skeletal muscle.
	continued on next page

B.	GLUT4 allows entrance of fructose inside the cells and expressed in cells with barrier functions.
C.	Binding of insulin to a cell receptor activates the GLUT4 transporter to allow glucose inside the cells.
D.	Insulin helps regulates the synthesis and activation of glycogen synthase for glycogen storage.
E.	GLUT4 is inactive as an intracellular vesicle during periods of fasting and activated during the feeding state by insulin.

Table 13.5

6. Which of the following is **NOT** a common problem associated with excessive secretion of insulin?	
A.	Hypoglycemia
B.	Depleted storage of glycogen
C.	High storage of glycogen
D.	Stimulation of synthesis of glycogen
E.	Inhibition of glycogen degradation

Table 13.6

7. Which of the following statements about the fate of amino acids during fasting conditions is **INCORRECT**?	
A.	In the fasting state, amino acids from the digestion of dietary proteins travel to the liver for the synthesis of proteins.
B.	In the intestines and lymphocytes, glutamine is converted to alanine and travels via circulation to the liver.
C.	Amino acids from muscle protein are converted to alanine and glutamine and these are the main forms of transport in the blood.
D.	The carbons of alanine are converted to glucose, CO2 and ketones bodies and the nitrogen is converted to urea in the liver.

continued on next page

E.	In the kidneys, glutamine releases ammonia for the formation of salts with metabolic acids in the renal tubules.

Table 13.7

8. Which of the following intestinal enzymes is responsible for the activation of other intestinal zymogens under basic conditions?	
A.	Pepsin
B.	Enteropeptidase
C.	Trypsin
D.	Chymotrypsin
E.	Aminopeptidase

Table 13.8

9. Which of the following statements is **MOST ACCURATE** about the catalytic function of chymotrypsin and carboxypeptidase A in the digestion of proteins in the small intestine?	
A.	Cleaves peptide bonds with Arg and Lys side groups amino acids
B.	Cleaves peptide bond in elastin and small side groups amino acids
C.	Cleaves peptide bonds with hydrophobic side groups amino acids
D.	Cleaves peptide bonds with basic side group amino acids
E.	Cleave peptide bonds one amino acid at a time at the N-terminus ends of proteins

Table 13.9

10. Which of the following protein complexes works simultaneously in both the tricarboxylic acid and the electron transport chain during ATP synthesis?	
A.	Complex I
B.	Complex II
C.	CoQ
	continued on next page

D.	Complex III
E.	Complex IV

Table 13.10

11. Which of the following statements is **INCORRECT** about oxidation-reductions reactions in the electron transport chain?	
A.	Initial reduction reactions involve accepting electrons from electrons donors of the tricarboxylic acid pathway.
B.	The consumption of oxygen is a reduction reaction in which O2 accepts 4 electrons from complex IV and 4 protons from the proton wires.
C.	Oxidation-reductions reactions happen sequentially by proteins accepting and donating electrons in the electron transport chain.
D.	Oxidation-reduction reactions from electron transfer provide the energy necessary to pump protons out of the matrix.
E.	Oxidation-reduction reactions are bidirectional making the electron transport chain reversible when ATP needs decreases.

Table 13.11

12. Which of the following statements **MOST LIKELY** shows the effects of decreased oxygen and cyanide poisoning?	
A.	Depletes iron stores in the bone marrow by impairing hemoglobin synthesis and causing severe iron lost in the tissues.
B.	Maintains the amount of ATP nearly constant for metabolic needs of the tissues except for muscle.
C.	Restores the electrochemical gradient to increase proton pumping and electrons to meet the high demands for ATP.
D.	Causes cellular damage by directly affecting electron flow and proton pumping in the electron transport chain and ATP synthesis.
	continued on next page

E.	Gets incorporated into maternal mitochondrial DNA and is passed 100% of the time to the offspring.

Table 13.12

13. Which of the following statements is **MOST ACCURATE** about resting muscle?	
A.	High demands for ATP depletes the protons in the electrochemical gradient stimulating both the rate of ATP synthesis and the electron transport chain.
B.	The buildup of electron carriers inhibits the enzymes of the tricarboxylic acid facilitating the export of intermediates of this pathway to other metabolic pathways.
C.	Need for ATP is linked to increase concentrations of both adenosine diphosphate and pyrophosphate and the influx of protons into the matrix.
D.	The amount remains nearly constant for all muscles in the body regardless whether muscle is contracting or resting.
E.	O2 consumption speeds up electron flow, thus increasing the electron carriers from the tricarboxylic acid to supply more electrons for the electron transport chain.

Table 13.13

14. Which of the following pathways is responsible for the formation of cataracts as a result of high levels of galactose and glucose in blood and urine?	
A.	Glycolysis
B.	Tricarboxylic acid
C.	Polyol Pathway
D.	Pentose Phosphate
E.	Beta Oxidation

Table 13.14

15. Which of the following statements **MOST LIKELY** states the difference between classical and non-classical galactosemia?
continued on next page

A.	Increased levels of galactose in urine.
B.	Increased levels of galactose in blood.
C.	Accumulation of galactose-1-phosphate in the tissues.
D.	Formation of cataracts on the lenses of eyes via polyol pathway.
E.	Aldose reductase converts blood galactose into galactitol.

Table 13.15

16. Which of the following amino acids, produced from intermediates of glycolysis, is used for the synthesis of both purine bases for nucleic acids and porphyrin for the hemoglobin molecule?	
A.	Glutamine
B.	Glycine
C.	Aspartate
D.	Asparagine
E.	Alanine

Table 13.16

17. Which of the following statements about lactose synthesis is **INCORRECT**?	
A.	One important site for lactose synthesis is the mammary gland right after childbirth under the influence of prolactin.
B.	Lactose synthase is made up of two catalytic sites for the synthesis of lactose or glycoproteins based on hormonal stimuli.
C.	Galactosyltransferase adds a galactose to a glucose molecule via β-1, 4 glycosidic bonds.
D.	α-lactalbumin synthesizes glycoproteins when no prolactin is released and galactosyltransferase is inactive.
E.	Alpha-lactalbumin increases the production of lactose in order to meet the dietary needs of a lactating infant every two hours.

Table 13.17

18. Which of the following statements about the urea cycle is **INACCURATE**?	
A.	The main carriers of nitrogen to the liver to enter the urea cycle are the amino acids alanine and glutamine.
B.	The rate of ammonia (NH4+) formation speeds up the rate of the urea production to be sent to the kidneys for excretion.
C.	A diet rich in high proteins with periods of prolong fasting in between meals stimulates the synthesis of all the enzymes of the urea cycle.
D.	Increased synthesis of arginine facilitates the regeneration of ornithine and activates carbamoylphosphate synthetase I (CPSI).
E.	Ornithine is an amino acid with an mRNA codon that is degraded into urea in the last step of the urea cycle.

Table 13.18

19. Which of the following molecules **DOES NOT**accumulate in bloodas a result of a defect in any of the enzymes of the urea cycle?	
A.	Any of the intermediates of the urea cycle
B.	Ammonia in the form of NH4+
C.	Glutamine and alanine
D.	All the intermediates of glycolysis

Table 13.19

20. Which of the following statements about jaundice is **INCORRECT**?	
A.	Neonatal jaundice is caused by the breakdown of fetal hemoglobin and an immature bilirubin conjugation system in the liver.
B.	Unconjugated bilirubin is insoluble in plasma and accumulates in hydrophobic regions of the eyes and the skin.
C.	Laboratory tests measure the levels of bilirubin in blood as indirect bilirubin, direct bilirubin and total bilirubin.

continued on next page

D.	Yellow tinge of the skin and sclera of the eyes is seen when bilirubin blood levels are below 1 mg/dL.
E.	In adults, it is caused by liver failure to transport, store or conjugate bilirubin, thus accumulating bilirubin in blood.

Table 13.20

Chapter 14

Nitrogen II[1]

1. Which of the following statements about the biochemical function of intracellular proteases is **INCORRECT**?	
A.	Remove old or misfolded proteins quickly.
B.	Regulate protein activity inside the cells.
C.	Must all work at acidic body pH.
D.	Provide protection against foreign proteins and peptides.
E.	Degrade proteins to sustain nutritional needs in the human body.

Table 14.1

2. Which of these is a possible treatment for cystinuria?	
A.	Eating a high protein diet with nicotinamide supplements
B.	Eating a low protein diet with arginine therapy
C.	Undergoing gene therapy and taking amino acid conjugation drugs
D.	Drinking at least 6-8 glasses per day of fluids, particularly water
E.	Taking proteasome inhibitors with plenty of fruit juices, soft drinks and coffee

Table 14.2

3. A 45-year old sedentary male wants to lose 40 pounds. He decides to try a high protein, low carbohydrate diet. What is the potential risk of consuming too much protein without any physical activity?
continued on next page

[1]This content is available online at <http://cnx.org/content/m42112/1.1/>.

A.	Essential amino acids will be missing from his diet.
B.	Develop kidney stones from cystine crystals in urine.
C.	Pancreatitis as a result of accidental trypsin activation.
D.	Damage to lung tissue from activation of elastase.
E.	He will produce excess lipids and glycogen.

Table 14.3

4. Which of the following molecules destroys the cell membranes of the hepatic cells causing hyperammonemia?	
A.	Carbamoyl Phosphate synthetase I
B.	Excess radicals from alcohol consumption
C.	Ornithine transcarbamoylase
D.	Argininosuccinate synthetase
E.	Argininosuccinate lyase

Table 14.4

5. Which of the following digestive enzyme pairs can activate their own zymogens and break proteins into small polypeptides?	
A.	Trypsin and pepsin
B.	Aminopeptidase and elastase
C.	Collagenase and chymotrypsin
D.	Carboxypeptidase and dipeptidase
E.	Enterokinase and tripeptidase

Table 14.5

6. Which of the following shows the effects of amino acid deficiencies in relation to the carbohydrate metabolic pathways?	
A.	Increases the storage of glycogen in both liver and muscle.
B.	Degradation of excess amino acids via the urea cycle.
	continued on next page

C.	Stimulates the synthesis of triacylglycerides and VLDL in the liver.
D.	Causes fatigue or exhaustion as a result of decrease levels of ATP.
E.	Increases protein synthesis inside the peripheral tissue cells.

Table 14.6

7. Which of the following proteins would be exempt from protein turnover?	
A.	Proteins with ubiquitin tails
B.	Proteins with oxidized amino acids
C.	Proteins with PEST sequences
D.	Proteins with specific amino end groups
E.	Proteins in the lenses of the eyes

Table 14.7

8. A 4-month old female goes to her well baby check. Physical examination and measurements show a 93% increase in the growth and development scale. In which nitrogen state is this patient right now?	
A.	Negative
B.	Positive
C.	Balanced
D.	Intrinsic
E.	Extrinsic

Table 14.8

9. Which of the following digestive enzyme pairs can break peptides that are 2-3 amino acids long?	
A.	Enterokinase and chymotrypsin
B.	Elastase and collagenase
C.	Carboxypeptidase A and B
D.	Dipeptidase and tripeptidase
E.	Aminopeptidase and Trypsin

Table 14.9

10. A 2-year old male has a red, scaly rash that gets worse when the patient is exposed to sunlight. He has short stature, muscle weakness, uncoordinated movements, tremors and involuntary eye movements. He is malnourished and failing to thrive. Blood test results show very low levels of niacin (vitamin B3) and tryptophan. Urine has high levels of amino acids. Stool indoles and urinary indican were elevated after an oral tryptophan loading test was administered. Which of the following disorders is consistent with these lab results?	
A.	Atrophic gastritis
B.	Emphysema
C.	Pancreatitis
D.	Cystinuria
E.	Hartnup disease

Table 14.10

11. Which enzyme produces ammonium ions for the urea cycle?	
A.	Oxidase
B.	Transaminase
C.	Aminotransferase
D.	Lactate dehydrogenase
E.	Glutamate dehydrogenase

Table 14.11

Match the term on the left with its biochemical function:

A.	Process breaks down protein in the lysosomes as result of nutritional imbalances
B.	Process breaks down organelles and proteins into single amino acids
C.	Recognizes proteins with ubiquitin tails and feeds them into the 20S proteasome
D.	Facilitates the entrance of non-ubiquitinidated proteins inside the 20S proteasome
E.	Shreds any size proteins into small peptides

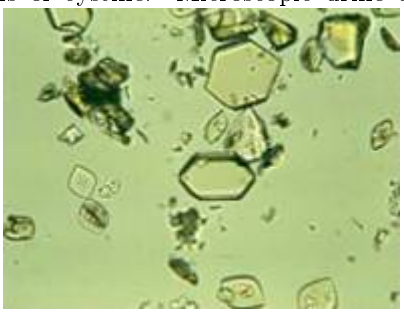
Table 14.12

12. ____20S Proteasome
13. ____Macroautophagy
14. ____Chaperone-Mediated autophagy
15. ____19S regulatory cap
16. ____11S regulatory cap

Table 14.13

17. Which of the following statements explains the concept of high protein, low carbohydrate diets?	
A.	Increased in insulin levels induce both glycolysis and glycogenesis.
B.	Increased in glucagon levels stimulate lipolysis and b-oxidation of fats.
C.	Increased in cortisol levels activate glycogenolysis in muscle.
D.	Decreased in epinephrine levels enhance the rate of gluconeogenesis.
E.	Decreased in insulin levels open GLUT4 transporters in muscle.

Table 14.14

18. A 40-year old woman suffers hematuria and consistent back pain on the left side. A 24-hour urine sample was collected. Urine pH was acidic. Urine was positive for basic amino acids and had high levels of cystine. Microscopic urine examination showed the presence of translucent hexagonal crystals.  Which of the following disorders is consistent with these lab results?

A.	Hartnup disease
B.	Cystinuria
C.	Pancreatitis
D.	Emphysema
E.	Cystic fibrosis

Table 14.15

19. Which of the following high protein food products can be helpful in **both** weight loss and providing essential amino acids to the body?	
A.	Almonds
B.	Cashews
C.	Eggs
D.	Peanuts

continued on next page

E.	Red kidney beans

Table 14.16

A 21 year old 5' 5" tall female weighs 105 lbs. Her body mass index (**BMI**) is 17.5 and percent body fat is 10%. A normal **BMI** for her height and weight is 18.5 - 25. A healthy % body fat is 21% to 33%. She has not had her menstrual period for the past four months. Her complaints are being fatigued, irritable and unable to concentrate. She constantly feels cold even in hot weather. She has a cough and is unable to get better.

Use this clinical case to answer questions 20 to 25.

20. She has an intense fear of becoming fat. She does 2 hours of high intensity exercise and a reduced calorie diet to stay thin. This patient consumes two slices of a Pizza Hut Medium Thin'N Crispy Pizza Cheese daily. Each slice of pizza has 230 calories per slice. A normal female, 18 to 35 years old, who neither leads a sedentary lifestyle, neither is overly active, should consume about 1760 calories daily. She feels a great sense of achievement by keeping herself trim and sees nothing wrong with consuming very small amount of calories in addition to her daily exercise workouts.In which nitrogen state is this patient right now?	
A.	Positive
B.	Negative
C.	Balanced
D.	Intrinsic
E.	Extrinsic

Table 14.17

21. She enjoys drinking daily. Her drinking schedule consists of five to six 12-ounces of beer for happy hour (Monday through Thursday). On the weekends, her alcohol consumption begins after 10 PM and continues until 2 AM. Her favorite drinks are: beers, malt liquor, vodka and tequila shots. She drinks in excess until she is in a drunken stupor or passes out.Which hepatic system will process the excess ethanol molecules in this patient?	
A.	Alcohol dehydrogenase
B.	Lactate dehydrogenase
C.	Malate dehydrogenase
D.	Pyruvate decarboxylase
E.	Ubiquitin-proteasome

Table 14.18

22. Which of the following molecules will cause dehydration and loss of electrolytes in this patient?	
A.	VLDL particles
B.	Glycerol
C.	Lactic acid
D.	Ketone Bodies
E.	Acetaldehyde

Table 14.19

23. Which of the following by-products of alcohol metabolism is the main source of fuel for the cells as a result of excess alcohol consumption in this patient?	
A.	NADPH
B.	Ketone bodies
C.	Lactate
D.	Acetate
E.	Acetaldehyde

Table 14.20

24. Which of the following **IS NOT** an effect associated with the metabolism of excess ethanol?	
A.	Hyperlipidemia
B.	Metabolic acidosis
C.	Dehydration
D.	Overhydration
E.	Loss of electrolytes

Table 14.21

25. Which hepatic system synthesis will be induced as a result of daily excess ethanol consumption in this patient?	
A.	Alcohol dehydrogenase
B.	Microsomal ethanol oxidizing
C.	Ubiquitin-Proteasome
D.	Lysosomal Proteases
E.	Glucuronidation

Table 14.22

Chapter 15

Nitrogen III[1]

1. Which of the following enzyme pairs works best at a pH ∼7.0 to breakdown plants starches and glycogen into maltose, maltotriose and limit dextrins?	
A. Lingual & pancreatic lipase B. Lingual & pancreatic alpha-amylase C. Pancreatic lipase & colipase D. Intestinal dipeptidases & pancreatic trypsin	

Table 15.1

2. Which of the following population groups has a greater risk of degrading and excreting more amino acids as a result of being in a negative nitrogen state?
A. Developing children B. Adolescents C. Pregnant women D. Body builders E. Cancer patients

Table 15.2

3. Which of the following would activate the 20S proteasome to begin protein degradation?

A. Eating a meal
B. Overnight fasting
C. Proteasome inhibitors
D. N-acetylglucosamine

4. Which of the following groups of enzymes are active under acidic conditions?

A. Serine proteases and caspases

[1] This content is available online at <http://cnx.org/content/m42113/1.1/>.

B. Calpains and metalloproteinases
C. Aspartate proteases and cathepsins
D. Ubiquitin ligases and conjugating enzymes

5. Which of the following can be activated by viruses?

A. Ubiquitin ligase
B. Ubiquitin activating enzyme
C. Ubiquitin conjugating enzyme
D. Threonine proteases

6. Which of the following processes uses a cytosolic protein complex to move a single target protein inside the lysosomes?

A. Macroautophagy
B. Microautophagy
C. Autophagosome
D. Chaperone-mediated autophagy

7. Which of the following statements makes the "feed forward" regulation of the urea cycle unique?

A. The more amino acids are degraded; the more NH**4**+ ions are formed.
B. The rate of urea cycle increases as more amino acids are broken down.
C. The synthesis of all the urea cycle enzymes increases despite normal levels.
D. NH**4**+ ions are excreted in urine and carbon skeletons of amino acids are used for glucose synthesis.

8. Which of the following treatments can conjugate the amino acid glutamine?

A. Phenylbutyrate
B. Benzoic acid
C. Low-protein diet
D. Arginine therapy
E. Ultrasound shock waves

9. Which of the following would activate the 20S proteasome to begin protein degradation?

A. Eating a meal
B. Overnight fasting
C. Proteasome inhibitors
D. N-acetylglucosamine

10. Which of the following systems can break body's proteins into single amino acids?	
A. A 19S cap with a 20S proteasome. B. A 19S cap, 20S proteasome and 11S cap C. A 20S proteasome with an 11S cap D. Lysosomal proteases	

Table 15.3

11. Which of the following population groups has a greater risk of degrading and excreting more amino acids as a result of being in a negative nitrogen state?
A. Developing children B. Adolescents C. Pregnant women D. Body builders E. Cancer patients

Table 15.4

Chapter 16

Comprehensive[1]

1. Which of the following molecules **CANNOT** be excreted by the kidneys as glucuronides?	
A.	Bile (stercobilin)
B.	Progesterone
C.	Bilirubin diglucuronide
D.	Morphine
E.	Thyroid hormone

Table 16.1

2. Which of the following molecules **DOES NOT**accumulate in bloodas a result of a defect in any of the enzymes of the urea cycle?	
A.	Any of the intermediates of the urea cycle
B.	Ammonia in the form of NH4+
C.	Glutamine and alanine
D.	All the intermediates of glycolysis
3. Which of the following hormones regulates the excretion of both water and sodium counteracting the effects of other water homeostasis hormones?	
A.	Aldosterone
B.	Antidiuretic hormone
C.	Cortisol
D.	Estrogen
	continued on next page

[1]This content is available online at <http://cnx.org/content/m42105/1.1/>.

E.	Natriuretic peptides

Table 16.2

4. Which of the following digestive enzymes pairs can break peptide bonds at either terminal end of a polypeptide?	
A.	Trypsin & chymotrypsin
B.	Elastase & collagenase
C.	Aminopeptidase and carboxypeptidase
D.	Dipeptidase & tripeptidase
E.	Enterokinase and Phospholipase A

Table 16.3

5. Which of the following enzymes pairs can perform autocatalysis once they are activated?	
A.	Pepsin & trypsin
B.	Aminopeptidase & carboxypeptidase
C.	Elastase & collagenase
D.	Dipeptidase & tripeptidase
E.	Chymotrypsin & Phospholipase A

Table 16.4

6. Which of the following zymogens can help in the screening of gastric disorders?	
A.	Trypsinogen
B.	Pepsinogen
C.	Chymotrypsinogen
D.	Procollagenase
E.	Procarboxypeptidase

Table 16.5

7. Which of the following disorders can affect the release of pancreatic digestive enzymes into the intestinal lumen?	
A.	Hartnup disease
	continued on next page

B.	Cystinuria
C.	Cystic fibrosis
D.	Atrophic gastritis
E.	Duodenal ulcer

Table 16.6

8. Which of the following mechanisms facilitates the absorption and release of hydrophobic amino acids into the body's cells?	
A.	Aquaporins
B.	Autophagosomes
C.	Secondary active transporters
D.	Simple diffusion
E.	Facilitated diffusion

Table 16.7

9. Which of the following statements about the degradation of body's proteins is **INCORRECT**?	
A.	Proteins for degradation are recognized based on the presence of ubiquiting tags, PEST sequences, N-terminal or oxidized residues.
B.	A single ubiquitin isopeptide assigns a regulatory function to a protein but multiple ubiquitin isopeptides targets the protein for degradation.
C.	E1 binds and transfer an ubiqutin molecule to E2 and E3 joins the ubiquitin from E2 to the end terminal end of a target protein.
D.	Lysosomal proteases break down body' proteins into polypeptides; while, proteasome complexes break them into single amino acids.
E.	Binding of N-acetylglucosamine to the active sites of the proteasome inhibits protein degradation and the removal of this molecule facilitates protein degradation.

Table 16.8

10. Which of the following digestive enzymes pairs can break peptide bonds at either terminal end of a polypeptide?
continued on next page

A.	Trypsin & chymotrypsin
B.	Elastase & collagenase
C.	Aminopeptidase and carboxypeptidase
D.	Dipeptidase & tripeptidase
E.	Enterokinase and Phospholipase A

Table 16.9

11. Which of the following enzymes pairs need to be activated via autocatalysis?	
A.	Pepsin & lysosomal proteases
B.	Aminopeptidase & carboxypeptidase
C.	Elastase & collagenase
D.	Dipeptidase & tripeptidase
E.	Chymotrypsin & Phospholipase A

Table 16.10

12. Which of the following zymogens can help in the screening of some gastrointestinal cancers?	
A.	Trypsinogen
B.	Pepsinogen
C.	Chymotrypsinogen
D.	Procollagenase
E.	Procarboxypeptidase

Table 16.11

13. Which of the following disorders will not cause a deficiency of essential amino acids due to either the lack of pancreatic digestive enzymes in the intestinal lumen or defective amino acid transporters?	
A.	Hartnup disease
B.	Cystic fibrosis
C.	Cystinuria
D.	Pancreatitis
14. A patient is diagnosed with emphysema. Which of the following enzymes is responsible for the damage to the lungs?	
continued on next page	

A.	Elastase
B.	Collagenase
C.	Carboxypeptidase
D.	Chymotrypsin
E.	Trypsin

Table 16.12

15. Which of the following systems can break body's proteins into single amino acids?	
A.	A 19S cap with a 20S proteasome.
B.	A 19S cap, 20S proteasome and 11S cap
C.	A 20S proteasome with an 11S cap
D.	Lysosomal proteases

Table 16.13

16. Which of the following defective enzyme pairs can produce altered branching in the glycogen molecule?	
A.	Glycogen synthase and glucose-6-phosphatase
B.	Musle and liver glycogen phosphorylase
C.	Glucorynyl transferase and phosphoglucomutase
D.	Glycogenin and alanine aminotransferase
E.	Branching and debranching enzymes

Table 16.14

17. A patient develops kidney failure and skin rashes. A tissue biopsy reveals accumulation of globotriocylceramide. Which of the following defective enzymes can cause Fabry's disease?	
A.	Acid-beta-glucosidase
B.	Alpha-galactosidase A
C.	Acid ceramidase
D.	Beta-galactosidase-1
E.	Galactocerebrosidase

Table 16.15

18. Which of the following hormones binds beta receptors in both the liver and muscle cells to stimulate glycogenolysis via cAMP signal transduction?	
A.	Glucagon
B.	Epinephrine
C.	Cortisol
D.	Insulin
E.	Aldosterone

Table 16.16

19. Which of the following molecules would be present in high concentrations in the meconium of neonates or premies with jaundice?	
A.	Conjugated bilirubin
B.	Urobilinogen
C.	Stercobilin
D.	Unconjugated bilirubin
E.	Urobilin

Table 16.17

20. Which of the following actions stimulates the release of calcium as part of the signal cascade in the liver to activate glycogenolysis and inhibit glycogenesis?	
A.	Epinephrine binding to beta receptors
B.	Epinephrine binding to alpha receptors
C.	Glucagon binding to liver receptors
D.	Degradation of ATP to AMP
E.	Neural impluses on muscle cells

Table 16.18

21. Which of the following defective enzymes can cause accumulation of both galactose and galactitol?	
A.	UDP-galactose-4-epimerase
B.	Galactokinase
C.	Galactose-1-phosphate uridyltransferase
D.	Galactose-6-phosphatase
E.	Phosphoglucomutase

Table 16.19

22. Which of the following organ or tissues cells can convert glucose to lactate for spermatogenesis?	
A.	Muscle cells
B.	Renal cells
C.	Red blood cells
D.	Sertoli cells
E.	Astrocytes

Table 16.20

23. A patient has mental retardation, enlarged liver and skeletal abnormalities. Tissue biopsy reveals accumulation of GM1 gangliosides in neurons. Which of the following defective enzymes can cause GM1 gangliosidosis?	
A.	Acid-beta-glucosidase
B.	Alpha-galactosidase A
C.	Acid ceramidase
D.	Beta-galactosidase-1
E.	Galactocerebrosidase

Table 16.21

24. A 25 year old female, previously diagnosed with Gilbert's syndrome, has hyperbilirubinemia as a result of eating a very low calorie diet. Which of the following treatments would be effective in dealing with her hyperbilirubinemia?	
A.	Iron supplements
B.	Antiviral drugs
C.	Cholecystectomy
D.	No treatment
E.	Steroid drugs

Table 16.22

25. Which of the following enzymes converts glucose-1-phosphate into glucose-6-phosphate during glycogen degradation?	
A.	Glycogen synthase
B.	Glycogen phosphorylase
C.	Phosphoglucomutase
D.	Branching enzyme
E.	Debranching enzyme

Table 16.23

26. Which of the following hormones is important in both the activation and synthesis of the enzymes involved in glycogenesis inside the liver and muscle cells?	
A.	Glucagon
B.	Epinephrine
C.	Norepinephrine
D.	Vasopressin
E.	Insulin

Table 16.24

27. Which of the following enzymes transfers galactose from UDP-galactose to glucose in the mammary glands?	
A.	Galactosyl transferase
B.	Alpha-lactalbumin
C.	Phosphoglucomutase
D.	Glucose-6-phosphatase
E.	Galactose-1-phosphate uridyltransferase

Table 16.25

28. Which of the following enzymes can increase the risk of developing cancer and its activity can be blocked with glucaric acid?	
A.	Hexaminidase A
B.	Arylsulfatase A
C.	Acid ceramidase
D.	Beta-glucuronidase
E.	Beta-galactosidase-1

Table 16.26

29. Which of the following statements **BEST** describes glycogenesis?	
A.	Glycogenesis is regulated via three hormones: glucagon, epinephrine and cortisol.
B.	The branching enzyme adds 8 -12 glucose molecules to the glycogenin primer.
C.	Glycogen synthase adds glucose molecules via alpha-1, 4-O-glycosidic bonds.
D.	UDP-glucuronate is the precursor molecule for building the structure of glycogen.
E.	Insulin activates the enzymes involved in the release of glucose from glycogen.

Table 16.27

30. A 35-year old man has the following symptoms: extreme weigh loss, an enlarged liver, right upper quadrant pain and tenderness, and a yellow tinge to his skin especially in the sclera of the eyes. Laboratory test results shows: **Urinalysis (dipstick):** Urine Urobilinogen: *8 mg/dL* (Normal Range: 0.2 - 1 mg/dL)Urine Bilirubin: *Present* (Measured as positive or negative for presence in urine)Blood Analysis:Alanine aminotransferase (ALT): *50 U/L* (Normal Range 5 - 40 U/L)Alkaline Phosphatase(ALP): *110 U/L* (Normal Range < 140 U/L)Direct Bilirubin: *0.5 mg/dL* (Normal Range 0.1 - 0.3 mg/dL)Indirect Bilirubin: *1.0 mg/dL* (Normal Range 0.2 - 0.8 mg/dL)Blood IgM Anti-HAV antibodies: *Positive*Blood IgG Anti-HAV antibodies: *Negative*Prolonged Prothrombin time (PT) even with vitamin K administrationWhich of the following liver disorders is consistent with these laboratory results?	
A.	Sickle cell anemia
B.	Hepatitis A
C.	Biliary obstruction
D.	Physiological jaundice
E.	Pathological jaundice

Table 16.28

31. Which of the following statements is a common misconception about diabetes insipidus?	
A.	Central diabetes insipidus is caused by damage to the posterior pituitary.
B.	Disease shows high concentration of glucose in both urine and blood.
C.	Nephrogenic diabetes insipidus is caused by genetic mutations.
D.	Patients can lose up to 16 liters of urine per day causing severe dehydration.
E.	Characteristic symptoms include polydipsia for cold water and polyuria.

Table 16.29

Chapter 17

Comprehensive II[1]

1. Which of the following complex carbohydrates can reduce the absorption of cholesterol inside the intestinal tract?	
A.	Glycogen
B.	Soluble fibers
C.	α-dextrins
D.	Amylose
E.	Amylopectin

Table 17.1

2. What is the metabolic function of the intestinal cell membrane glycosidases?	
A.	Breaks down smaller carbohydrates into glucose, fructose and galactose.
B.	Cleaves hydroxyl groups of dietary complex carbohydrates molecules.
C.	Digests dietary complex carbohydrate in the mouth and the stomach.
D.	Joins two simple sugars together to form complex carbohydrate molecules.
3. A patient's laboratory test is positive for fructose in urine only. All other blood test results are normal. There are no metabolic problems with this patient. Which of the following enzymes is deficient in this patient?	
	continued on next page

[1]This content is available online at <http://cnx.org/content/m42106/1.1/>.

A.	Aldolase B
B.	Phosphoglucomutase
C.	4-Epimerase
D.	Fructokinase
4. A patient's test results show hypoglycemia, liver failure, prolonged bleeding times and a positive urine test for fructose. Which of the following carbohydrate disorders is consistent with these lab results?	
A.	Fructosuria
B.	Galactokinase Deficiency
C.	Classical Galactosemia
D.	Fructose Intolerance
5. What is the metabolic function of the two subunits of lactose synthase?	
A.	Lactalbumin synthesizes prolactin and galactosyltransferase synthesizes cortisol.
B.	Lactalbumin synthesizes lactoglobulin and glycosyltransferase synthesizes casein.
C.	Lactalbumin increases the catalytic rate of galactosyltransferase and galactosyltransferase synthesizes lactose.
D.	Lactalbumin synthesizes colostrum and galactosyltransferase synthesizes mature milk.
E.	Lactalbumin converts glucose to galactose and galactosyltransferase degrades galactose.

Table 17.2

6. Which of the following enzymes is responsible for the rapid drug clearance of some barbiturates in the liver?	
A.	Debranching enzyme
B.	Glycogen synthase
C.	Aldose reductase
D.	Lactose synthase
E.	UDP-glucuronyltransferase

Table 17.3

7. Which of the following statements directly explains the effects of hormones in the **LIVER** during fasting?
continued on next page

A.	Cortisol stimulates insulin secretion in order to suppress the translocation of GLUT4.
B.	Epinephrine binding to both alpha and beta receptors activates glycogen phosphorylase.
C.	Epinephrine binding to beta receptors stimulates both glycogen and protein synthesis.
D.	Epinephrine binding to alpha receptors helps inactivate glycogen phosphorylase.
E.	Glucagon stimulates glycogenolysis via inositol-phospholipid signaling pathway.

Table 17.4

8. Which of the following glucose transporters can facilitate the release of glucose, galactose and fructose from the intestinal cells into the hepatic portal vein?	
A.	GLUT1
B.	GLUT2
C.	GLUT3
D.	GLUT4
9. Patients can develop cataracts from the build-up of sugar alcohols inside the lens of the eyes. Which of the following enzymes has the capability to synthesize sugar alcohols from either excess glucose or galactose?	
A.	Fructokinase
B.	Galactokinase
C.	Aldose reductase
D.	Phosphoglucomutase
E.	Glucose-6-phosphatase

Table 17.5

10. Which of the following hormones stimulates the synthesis of α-lactalbumin?	
A.	Prolactin and cortisol
B.	Glucagon and epinephrine
C.	Estrogen and progesterone
D.	Testosterone and aldosterone
E.	Thyroid and human placental lactogen

Table 17.6

11. A 6 year old boy's exam and lab results show: hypoglycemia, jaundice, hemorrhage, hepatomegaly, and hyperuricemia. He is diagnosed with fructose intolerance. Which of the following hepatic enzymes is defective in this patient?	
A.	Galactokinase
B.	Triose Kinase
C.	Hexokinase
D.	Aldolase B
E.	Fructokinase
12. A 6 month old female is failing to thrive. Lab results show: hypoglycemia and hyperketonemia. She is diagnosed with Lewis' Disease. Which hepatic enzyme is defective in this patient?	
A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Branching enzyme
D.	Glycogen synthase
E.	Glucose-6-phosphatase
13. Andersen's and Cori's Disease are two glycogen disorders that produces hypoglycemia and altered branches of glycogen in both the fed and fasting states, respectively. In which of the following tissues can these disorders be the main cause for hypoglycemia?	
A.	Muscle
B.	Liver
C.	Intestines
D.	Kidneys
E.	Heart
14. A 7 day old full-term male is losing weight. He vomits and has diarrhea every time he ingests breast milk. Current lab results show: impaired liver function, hypergalactosemia, hyperchloremic metabolic acidosis, hyperaminoaciduria and high urinary galactitol levels. Which of the following defective enzymes would be consistent with this patient lab results?	
	continued on next page

A.	Aldolase B
B.	Galactokinase
C.	Aldose reductase
D.	UDP-glucuronyltransferase
E.	Galactose-1-phosphate uridyltransferase

Table 17.7

15. Which of the following digestive enzymes pairs can break peptide bonds at either the C-terminal or N-terminal end of a polypeptide?	
A.	Trypsin & chymotrypsin
B.	Elastase & collagenase
C.	Aminopeptidase and carboxypeptidase
D.	Dipeptidase & tripeptidase
E.	Enterokinase and Phospholipase A

Table 17.8

16. Which of the following disorders **WILL NOT** cause a deficiency of essential amino acids due to either the lack of pancreatic digestive enzymes in the intestinal lumen or defective amino acid transporters?	
A.	Hartnup disease
B.	Cystic fibrosis
C.	Cystinuria
D.	Pancreatitis
17. A patient is diagnosed with emphysema. Which of the following enzymes is responsible for the damage to the lungs?	
A.	Elastase
B.	Collagenase
C.	Carboxypeptidase
D.	Chymotrypsin
E.	Trypsin

Table 17.9

Chapter 18

Comprehensive III[1]

1. For what purpose will the kidneys excrete base as bicarbonate ions (HCO3-)?	
A.	Reduce H+ ions concentration in the extracellular fluid (ECF)
B.	Raise H+ ions concentration in the extracellular fluid (ECF)
C.	Increase H+ ions excretion
D.	Reabsorb more bicarbonate ions (HCO3-)
E.	Generate new bicarbonate ions (HCO3-)

Table 18.1

Match the amino acid mutation on the beta globin with the corresponding hemoglobinopathy:

2. _ _ _ _ Valine replaces glutamic acid	
3. _ _ _ _ Lysine replaces glutamic acid	
4. _ _ _ _ Valine replaces glutamic acid on one chain while lysine replaces glutamic acid on the other chain	

Table 18.2

A.	Hb C
B.	Hb S
C.	Hb SC

Table 18.3

5. Which of the following statements is the **LEAST ACCURATE** about DNA polymerase delta?
continued on next page

[1] This content is available online at <http://cnx.org/content/m42109/1.1/>.

A.	This enzyme starts adding polynucleotides to the newly synthesized DNA chain after an RNA-DNA primer is formed on both the leading and lagging strands.
B.	This enzyme can synthesize about 200 nucleotides of DNA in the lagging strand before it reaches the RNA primer of the next Okazaki fragment.
C.	This enzymes continuously add polynucleotides to the newly synthesize DNA in the leading strand.
D.	This enzyme is also considered a 3' to 5' exonuclease that proofreads the newly synthesize DNA to detect and repair DNA changes.
E.	This enzyme has the capabilities of an RNA polymerase and completes DNA synthesis at the end of the chromosomes.

Table 18.4

6. In which DNA strand are Okazaki fragments **MOST LIKELY** to be found during DNA replication?	
A.	Leading
B.	Lagging
C.	Major groove
D.	Minor groove
E.	RNA primer

Table 18.5

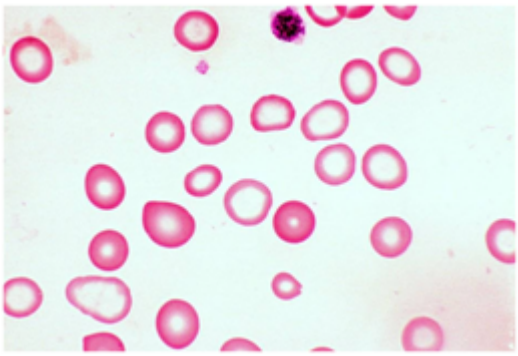
7. In the picture below, abnormal red blood cells are microcytic and hypochromic.  This picture shows the result of a disorder affecting the heme synthesis and the Fe-S centers of the proteins in the electron transport chain. Which of the following disorders is **MOST LIKELY** to cause this appearance on a peripheral blood smear?	
A.	Hypoxia
B.	Cyanide poisoning
C.	Malaria
D.	Iron deficiency
E.	Hemolytic disease of the newborn

Table 18.6

8. Which of the following statements about oxidative phosphorylation is **FALSE**?	
A.	One full turn of the c subunits of the F0 pore releases a total of twelve protons into the mitochondrial matrix.
B.	Energy from the electrochemical gradient of the electron transport chain and rotation of the asymmetric shaft of the F0 pore alters the shape of binding sites of the F1 headpiece.
C.	One full term of the binding sites in the F_1 headpiece releases twelve ATP molecules.
D.	The three binding sites in the F1 headpiece facilitates: binding of ADP + Pi, as well as synthesis and release of ATP.
	continued on next page

E.	The body's increased needs for energy during strenuous exercise ties together oxidative phosphorylation to the electron transport chain and the tricarboxylic acid pathways.

Table 18.7

9. Which of the following statements is **LEAST CORRECT** about the process of elongation during protein synthesis?	
A.	When the P site in the 60S subunit is bound, an aminoacyl-tRNA must have a complimentary and antiparallel anticodon to the next mRNA codon in order to bind the A site in the 60S subunit.
B.	Peptidyltransferase joins the amino acids attached to tRNAs in both the P and A sites of the 60S subunit.
C.	The aminoacyl-tRNA on A site contains the growing polpeptide chain and moves to the P site when the uncharged tRNA on the P site is released.
D.	The process of forming aminoacyl-tRNA complexes, peptide bonds and translocation of the growing protein chain is repeated numerous times until a stop codon is reached.
E.	The growing polypeptide chains forms only primary and secondary structures once outside the tunnel of the 80S ribosome.

Table 18.8

10. Which of the following molecules is **MOST LIKELY** to base pair with Uracil in RNA secondary or tertiary structures?	
A.	Adenosine
B.	Guanine
C.	Cytosine
D.	Thymine
E.	Uracil

Table 18.9

11. Which of the following chemicals is **LESS LIKELY** to cause damage to the central nervous system or cancer by inhibiting alpha-ketoacid dehydrogenase in the tricarboxylic acid pathway?
continued on next page

A.	Mercury
B.	Arsenate (AsO4-3)
C.	Arsenite (AsO3-3)
D.	NADH

Table 18.10

12. Which of the following statements about the urea cycle is **INACCURATE**?	
A.	The rate of the urea cycle increases as amino acids are degraded.
B.	The first source of the nitrogen for the cycle is in the form of NH4+.
C.	Aspartate provides the second source of nitrogen for the cycle as NH2.
D.	Brain and muscle tissue provides nitrogen in the form of glutamine.
E.	Bacteria produce NH4+, which travels to the liver via the hepatic portal vein.

Table 18.11

Chapter 19

Comprehensive IV[1]

1. Which patient group will degrade and excrete more amino acids than normal?	
A.	A developing child
B.	Adolescents
C.	Pregnant women
D.	Body Builders
E.	A burned patient

Table 19.1

2. Which of the following conditions is associated with cirrhosis of the liver?	
A.	Renal calculi
B.	Hyperammonemia
C.	Hartnup Disease
D.	Cystinuria

Table 19.2

3. Which of the following types of jaundice can be attributed to the side effects of toxic of drugs?	
A.	Post-Hepatic
B.	Pre-hepatic
C.	Intrahepatic
D.	Neonatal

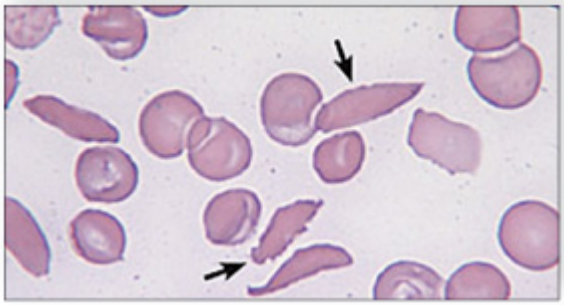
Table 19.3

[1] This content is available online at <http://cnx.org/content/m42110/1.1/>.

4. Which clinical parameters are characteristic of hepatic obstruction?	
A.	Elevated serum amylase and alkaline phosphatase (ALP)
B.	Elevated serum aspartate aminotransferase (AST) and conjugated bilirubin
C.	Elevated serum alanine aminotransferase (ALT) and normal clotting time (PT)
D.	Extended clotting time (PT) and increased serum unconjugated bilirubin

Table 19.4

5. A 25 year old Hispanic female suffers from fatigue, sporadic episodes of pain on the extremities, fever, jaundice and recurrent infections. Lab results show:Serum iron: 38 mcg/dL (Normal: 60 -170 mcg/dL)Plasma Bilirubin (BC): 0 umol/L (Normal: < 8 umol/L)Plasma Total Bilirubin (TBIL): 85 U/L (Normal: < 18 umol/L)AST: 25 U/L (Normal: 5 - 45 U/L)ALP: 145 U/L (Normal: 50 - 260 U/L)Urine bilirubin: NegativeUrine urobilinogen: 8 mg/dL (Normal: 0.2 - 1 mg/dL)Fecal urobilinogen: 456 mg/24 hours (Normal: 50 to 300 mg/24 hours)Blood smear:



Which of the following types of jaundice disorders is consistent with these lab results?

continued on next page

A.	Neonatal
B.	Intrahepatic
C.	Pre-hepatic
D.	Post-hepatic

Table 19.5

6. Which of the following disorders may be passed to liver transplant recipients and does not require any medical treatment?	
A.	Cirrhosis
B.	Gallstones
C.	Hepatitis
D.	Gilbert's syndrome

Table 19.6

7. A 9 month old male shows rapid symptoms of mental retardation and blindness. This is the result of accumulation of both globosides and GM2 gangliosides in neural tissues. Which of the following deficient enymes is responsible for the incomplete breakdown of these glycoproteins and glycolipids in Sandhoff disease?	
A.	Neuraminidase
B.	Galactosidase A
C.	Hexosaminidases A and B
D.	Glucocerebrosidase
E.	Galactocerebrosidase

Table 19.7

8. Accumulation of ceramides in the tissues causes enlargement of the liver and spleen with painful swollen joints. Which of the following glycolipid disorders is caused by a defective acid ceramidase?	
A.	Tay-Sachs AB variant
B.	Fabry disease
C.	Krabbe disease
D.	Farber lipogranulomatosis
E.	Neimann-Pick diseases

Table 19.8

9. Which of the following hormone pairs are responsible for the excretion of both sodium and water in urine?	
A.	Aldosterone and antidiuretic hormone
B.	Nautriuretic peptides and progesterone
C.	Parathyroid hormone and calcitonin
D.	Estrogen and cortisol

Table 19.9

10. Which patient group is more susceptible to the effects of water intoxication?	
A.	Infants
B.	Adolescents
C.	Adults
D.	Elderly

Table 19.10

11. Which of the following hormones **DOES NOT** contribute to water homeostasis in the human body?	
A.	Aldosterone
B.	Antidiuretic hormone
C.	Cortisol
D.	Natriuretic peptides
E.	Parathyroid hormone

Table 19.11

12. Which of the following statements about diabetes insipidus **IS NOT** true?	
A.	Central diabetes insipidus is caused by damage to the posterior pituitary.
B.	Lab results show high glucose levels in both urine and blood.
C.	Nephrogenic diabetes insipidus is caused by genetic mutations.
D.	Losing up to 16 liters of urine per day causes severe dehydration.
E.	Characteristics symptoms include polydipsia and polyuria.

Table 19.12

13. Which of the following scenarios can cause water intoxication in healthy individuals?	
A.	Regular consumption of coffee only by the elderly
B.	Drinking constantly cold water due to diabetes insipidus
C.	Binge drinking of alcohol for 4 hours at a frat party
D.	Excess ingestion of water as a result of Ecstasy (MDMA)
E.	Drinking sport drinks after excessive heat conditions

Table 19.13

14. Which chemical buffer **IS NOT** found in plasma?	
A.	Hemoglobin
B.	Proteins
C.	Phosphate
D.	Bicarbonate-Carbonic acid

Table 19.14

15. Which buffer system has the capability to excrete acids via the lungs or kidneys in exchange for specific electrolytes?	
A.	Hemoglobin
B.	Physiological
C.	Plasma proteins
D.	Phosphate

Table 19.15

16. Which buffer system is tightly linked to the degradation of glutamine inside the renal cells?	
A.	Phosphate
B.	Albumin
C.	Ammonia - Ammonium
D.	Bicarbonate - Carbonic acid

Table 19.16

17. Which is a characteristic symptom of an acidotic state?	
A.	Convulsions
B.	Muscle tetany
C.	Respiratory arrest
D.	Depression of the nervous system
E.	Excitability of the nervous system

Table 19.17

18. A 35 year old male is admitted to the hospital with the chief complaint of shortness of breath, which has had become progressively worse during the last 4 - 5 days. He also has had diarrhea for one week. He has had cough productive yellow, blood-tinged sputum, night sweats and urges urinary incontinence for 3 days. Laboratory test values upon admission included the following concentrations: serum sodium, 144 mEq/L (reference range, 135 -145 mEq/L); serum potassium, 4.5 mEq/L (reference range, 3.5 - 5.0 mEq/L); serum chloride, 117.5 mEq/L (reference range, 98 -110 mEq/L); and serum bicarbonate, 15 mEq/L (reference range, 22 - 30 mEq/L). Arterial blood gases were: pH 7.25 (reference range, 7.35 - 7.45); PCO2= 31 mm Hg (reference range, 35 - 45 mm Hg); PO2 = 62 mm Hg (reference range, 75 - 100 mm Hg); and HCO3- = 13 mEq/L (reference range, 22 - 30 mEq/L). Which of the following acid-base disorders is consistent with these lab results?	
A.	Metabolic acidosis
B.	Respiratory acidosis
C.	Metabolic alkalosis
D.	Metabolic acidosis

Table 19.18

19. What would be an effective treatment for cases of respiratory acidosis?	
A.	Decrease ventilation
B.	Increase ventilation
C.	Bicarbonate infusion
D.	Saline IV solution

Table 19.19

Chapter 20

Comprehensive V[1]

1. Which of the following digestive enzymes pairs can break peptide bonds at either terminal end of a polypeptide?	
A.	Trypsin & chymotrypsin
B.	Elastase & collagenase
C.	Aminopeptidase and carboxypeptidase
D.	Dipeptidase & tripeptidase
E.	Enterokinase and Phospholipase A

Table 20.1

2. Which of the following enzymes pairs can perform autocatalysis once they are activated?	
A.	Pepsin & trypsin
B.	Aminopeptidase & carboxypeptidase
C.	Elastase & collagenase
D.	Dipeptidase & tripeptidase
E.	Chymotrypsin & Phospholipase A

Table 20.2

3. Which of the following zymogens can help in the screening of gastric disorders?	
A.	Trypsinogen
B.	Pepsinogen
C.	Chymotrypsinogen
D.	Procollagenase
E.	Procarboxypeptidase

Table 20.3

[1] This content is available online at <http://cnx.org/content/m42111/1.1/>.

4. Which of the following disorders can affect the release of pancreatic digestive enzymes into the intestinal lumen?	
A.	Hartnup disease
B.	Cystinuria
C.	Cystic fibrosis
D.	Atrophic gastritis
E.	Duodenal ulcer

Table 20.4

5. Which of the following mechanisms facilitates the absorption and release of hydrophobic amino acids into the body's cells?	
A.	Aquaporins
B.	Autophagosomes
C.	Secondary active transporters
D.	Simple diffusion
E.	Facilitated diffusion

Table 20.5

6. Which of the following statements about the degradation of body's proteins is **INCORRECT**?	
A.	Proteins for degradation are recognized based on the presence of ubiquiting tags, PEST sequences, N-terminal or oxidized residues.
B.	A single ubiquitin isopeptide assigns a regulatory function to a protein but multiple ubiquitin isopeptides targets the protein for degradation.
C.	E1 binds and transfer an ubiqutin molecule to E2 and E3 joins the ubiquitin from E2 to the end terminal end of a target protein.
D.	Lysosomal proteases break down body' proteins into polypeptides; while, proteasome complexes break them into single amino acids.
E.	Binding of N-acetylglucosamine to the active sites of the proteasome inhibits protein degradation and the removal of this molecule facilitates protein degradation.

Table 20.6

7. Which of the following enzyme pairs works best at a pH ∼7.0 to breakdown plants starches and glycogen into maltose, maltotriose and limit dextrins?	
A. Lingual & pancreatic lipase B. Lingual & pancreatic α-amylase C. Pancreatic lipase & colipase D. Intestinal dipeptidases & pancreatic trypsin	

Table 20.7

8. Which of the following complex carbohydrates can reduce the absorption of cholesterol inside the intestinal tract?	
A.	Glycogen
B.	Soluble fibers
C.	Insoluble fibers
D.	Amylose
E.	Amylopectin

Table 20.8

9. What is the metabolic function of the intestinal glycosidases?	
A.	Breaks down smaller carbohydrates into glucose, fructose and galactose.
B.	Cleaves hydroxyl groups of dietary complex carbohydrates molecules.
C.	Digests dietary complex carbohydrate in the mouth and the stomach.
D.	Joins two simple sugars together to form complex carbohydrate molecules.
E.	Allows passage of simple sugars inside the intestinal cells.

Table 20.9

10. A patient's laboratory test is positive for fructose in urine only. All blood test results are normal. Which of the following enzymes is deficient in this patient?	
A.	Aldolase B
B.	Phosphoglucomutase
C.	4-Epimerase
D.	Fructokinase
	continued on next page

E.	Galactokinase

Table 20.10

11. A 9 month old male suffers from abdominal pain and bloating with frequent diarrhea after being fed solid foods. A stool acidity test is ordered. Which of the following carbohydrate disorders uses a stool acidity test as a diagnostic tool for infants?	
A.	Fructose Intolerance
B.	Fructose Malabsorption
C.	Fructosuria
D.	Classical Galactosemia
E.	Non-classical Galactosemia

Table 20.11

12. A patient's test results show hypoglycemia, liver failure, hyperuricemia, prolonged coagulation times and a positive urine test for fructose. Which of the following carbohydrate disorders is consistent with these lab results?	
A.	Fructosuria
B.	Galactokinase Deficiency
C.	Classical Galactosemia
D.	Fructose Intolerance
E.	Fructose Malabsorption

Table 20.12

13. Which of the following defective enzymes impairs carbohydrate metabolism by forming phosphorylated intermediates that can cause mental retardation or severe liver damage if left untreated?	
A.	Lactalbumin and glycosyltransferases
B.	Fructokinase and aldose reductase
C.	Galactosyltransferase and phosphoglutamase
D.	Galactokinase and aldolase B
E.	Galactose 1-phosphate uridyltransferase and 4-epimerase

Table 20.13

14. What is the metabolic function of the two subunits of lactose synthase?	
A.	Lactalbumin synthesizes prolactin and galactosyltransferase synthesizes cortisol.
B.	Lactalbumin synthesizes lactoglobulin and glycosyltransferase synthesizes casein.
C.	Lactalbumin increases the catalytic rate of galactosyltransferase and galactosyltransferase synthesizes lactose.
D.	Lactalbumin synthesizes colostrum and galactosyltransferase synthesizes mature milk.
E.	Lactalbumin converts glucose to galactose and galactosyltransferase degrades galactose.

Table 20.14

15. Which of the following enzymes is responsible for the rapid drug clearance of barbiturates?	
A.	Debranching enzyme
B.	Glycogen synthase
C.	Aldose reductase
D.	Lactose synthase
E.	UDP-glucuronyltransferase

Table 20.15

16. Which of the following hormones exerts its effects on glycogen synthesis?	
A.	Insulin
B.	Glucagon
C.	Epinephrine
D.	Cortisol
E.	Secretin

Table 20.16

17. A patient suffers from cramps and fatigue every time he exercises. He is diagnosed with McArdle's disease. Which of the following defective enzymes prevents the breakdown of glycogen on this patient?
continued on next page

A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Glycogen synthase
D.	Branching enzyme
E.	Glucose-6-phosphatase

Table 20.17

18. Which of the following hormones facilitates the breakdown of glycogen in muscle?	
A.	Insulin
B.	Glucagon
C.	Cortisol
D.	Epinephrine
E.	Norepinephrine

Table 20.18

19. Which of the following statements directly explains the effects of hormones in the liver during fasting?	
A.	Cortisol stimulates insulin secretion in order to suppress the translocation of GLUT4.
B.	Epinephrine binding to both alpha and beta receptors activates glycogen phosphorylase.
C.	Epinephrine binding to beta receptors stimulates both glycogen and protein synthesis.
D.	Epinephrine binding to alpha receptors helps inactivates glycogen [hosphorylase.
E.	Glucagon stimulates glycogenolysis via inositol-phospholipid signaling pathway.

Table 20.19

20. Which of the following is a normal compensatory mechanism that helps increase the neuronal uptake of glucose n cases of Alzheimer disease?	
A.	Arrangement of neurofibrillary tangles in helices and filaments
B.	Increased phosphorylation of *tau*
C.	Decreased glycosylation reactions of proteins
D.	Increased GLUT2 transporters in astrocytes
E.	Decreased GLUT1 and GLUT3 transporters

Table 20.20

21. Which type of glucose transporters are synthesized under the control of hypoxia inducing factor-1 inside the neurons?	
A.	GLUT2 and GLUT4
B.	GLUT1 and GLUT3
C.	GLUT5 and GLUT8
D.	GLUT2 and GLUT7
E.	GLUT5 and GLUT7

Table 20.21

22. Which of the following glucose transporters can facilitate the release of glucose, galactose and fructose from the intestinal cells into the hepatic portal vein?	
A.	GLUT1
B.	GLUT2
C.	GLUT3
D.	GLUT4
E.	GLUT5

Table 20.22

23. Patients can develop cataracts from the build-up of sugar alcohols inside the lens of the eyes. Which of the following enzymes has the capability to synthesize sugar alcohols from either excess glucose or galactose?	
A.	Fructokinase
B.	Galactokinase
C.	Aldose reductase
D.	Phosphoglucomutase
E.	Glucose-6-phosphatase

Table 20.23

24. Which of the following hormones stimulates the synthesis of alpha-lactalbumin?	
A.	Prolactin and cortisol
B.	Glucagon and epinephrine
C.	Estrogen and progesterone
D.	Testosterone and aldosterone
E.	Thyroid and human placental lactogen

Table 20.24

25. Which of the following classes of molecules make the composition of human breast milk unique from commercially based formulas?	
A.	Proteins
B.	Fats
C.	Vitamins
D.	Carbohydrates
E.	Immunoglobulins

Table 20.25

26. Which of the following statements about the anticancer properties of glucuronides is **INCORRECT**?	
A.	Inhibit beta-glucuronidase to prevent the release of carcinogens in the body.
B.	Decrease the therapeutic effect of anticancer drugs administered to patients.
C.	Increase the rate of glucuronidation reactions to clean toxic molecules faster.
D.	Suppress cell proliferation, staging and metastasis by inducing cell apoptosis.
E.	Effective in treating lung, skin, liver, breast, colon, bladder and prostate cancers.

Table 20.26

27. A 6 year old boy's lab results show: hypoglycemia, jaundice, hemorrhage, hepatomegaly, and hyperuricemia. He is diagnosed with fructose intolerance. Which of the following hepatic enzymes is defective in this patient?	
A.	Galactokinase
B.	Triose Kinase
C.	Hexokinase
D.	Aldolase B
E.	Fructokinase

Table 20.27

30. A 6 month old female is failing to thrive. Lab results show: hypoglycemia and hyperketonemia. She is diagnosed with Lewis' Disease. Which hepatic enzyme is defective in this patient?	
A.	Debranching enzyme
B.	Glycogen phosphorylase
C.	Branching enzyme
D.	Glycogen synthase
E.	Glucose-6-phosphatase

Table 20.28

31. Andersen's and Cori's Disease are two glycogen disorders that produces hypoglycemia and altered branches of glycogen in both the fed and fasting states, respectively. In which of the following tissues can these disorders be the main cause for hypoglycemia?	
A.	Muscle
B.	Liver
C.	Intestines
D.	Kidneys
E.	Heart

Table 20.29

32. Which of the following shows the health benefits of insoluble fibers?	
A.	Form a gel that can be degraded by normal flora into gases
B.	Slows the absorption of glucose; thus, regulating blood sugar levels
C.	Prevents heart disease by reducing total and LDL cholesterol levels
D.	Draws water inside the intestines softening the stool for regularity
E.	Fiber fermentation produces short fatty acids for energy

Table 20.30

33. Which of the following mechanisms **IS NOT** part of the process of glycogen degradation in the muscle cells?	
A.	Influx of calcium ions from nerve impulses
B.	High levels of AMP from muscle contraction
C.	Epinephrine binding to muscle cells beta receptors
D.	Glucagon cAMP signal transduction cascade
E.	Activation of glycogen phosphorylase

Table 20.31

34. A 7 days old full-term male is losing weight. He vomits and has diarrhea everytime he ingests breast milk. Current lab results show: impaired liver function, hypergalactosemia, hyperchloremic metabolic acidosis, hyperaminoaciduria and high urinary galactitol levels. Which of the following defective enzymes would be consistent with this patient lab results?	
A.	Aldolase B
B.	Galactokinase
C.	Aldose reductase
D.	UDP-glucuronyltransferase
E.	Galactose-1-phosphate uridyltransferase

Table 20.32

Index of Keywords and Terms

Keywords are listed by the section with that keyword (page numbers are in parentheses). Keywords do not necessarily appear in the text of the page. They are merely associated with that section. *Ex.* apples, § 1.1 (1) **Terms** are referenced by the page they appear on. *Ex.* apples, 1

Attributions

Collection: *Biochemistry Exercises*
Edited by: E. Pennington
URL: http://cnx.org/content/col11386/1.3/
License: http://creativecommons.org/licenses/by/3.0/

Module: "Water, Electrolytes and Acids-Bases"
By: E. Pennington
URL: http://cnx.org/content/m41743/1.2/
Pages: 1-6
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Acid-Bases, Water and Electrolytes"
By: E. Pennington
URL: http://cnx.org/content/m41747/1.2/
Pages: 7-10
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Water, electrolytes, acid-bases & carbohydrates"
By: E. Pennington
URL: http://cnx.org/content/m41745/1.1/
Pages: 11-15
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Digestion fats, proteins and carbohydrates"
By: E. Pennington
URL: http://cnx.org/content/m41744/1.3/
Pages: 17-19
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Proteins and Nucleic Acids"
By: E. Pennington
URL: http://cnx.org/content/m41748/1.2/
Pages: 21-22
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Protein and Nucleic Acids II"
By: E. Pennington
URL: http://cnx.org/content/m41759/1.2/
Pages: 23-25
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Proteins, Amino Acids, Nucleic Acids, Electron transport chain and Tricarboxylic acid"
By: E. Pennington
URL: http://cnx.org/content/m41746/1.2/
Pages: 27-35
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohydrate"
By: E. Pennington
URL: http://cnx.org/content/m41754/1.1/
Pages: 37-43
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohydrate II"
By: E. Pennington
URL: http://cnx.org/content/m41757/1.1/
Pages: 45-52
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohyhdrates III"
By: E. Pennington
URL: http://cnx.org/content/m41758/1.1/
Pages: 53-60
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohydrates IV"
By: E. Pennington
URL: http://cnx.org/content/m42114/1.1/
Pages: 61-65
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohydrate and Nitrogen"
By: E. Pennington
URL: http://cnx.org/content/m41751/1.1/
Pages: 67-70
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Carbohydrate and Nitrogen II"
By: E. Pennington
URL: http://cnx.org/content/m41752/1.1/
Pages: 71-79
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Nitrogen II"
By: E. Pennington
URL: http://cnx.org/content/m42112/1.1/
Pages: 81-87
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Nitrogen III"
By: E. Pennington
URL: http://cnx.org/content/m42113/1.1/
Pages: 89-91
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Comprehensive"
By: E. Pennington
URL: http://cnx.org/content/m42105/1.1/
Pages: 93-101
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Comprehensive II"
By: E. Pennington
URL: http://cnx.org/content/m42106/1.1/
Pages: 103-107
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Comprehensive III"
By: E. Pennington
URL: http://cnx.org/content/m42109/1.1/
Pages: 109-113
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Comprehensive IV"
By: E. Pennington
URL: http://cnx.org/content/m42110/1.1/
Pages: 115-120
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Module: "Comprehensive V"
By: E. Pennington
URL: http://cnx.org/content/m42111/1.1/
Pages: 121-129
Copyright: E. Pennington
License: http://creativecommons.org/licenses/by/3.0/

Biochemistry Exercises
These are exercise test questions to help build your knowledge of Biochemistry. This will help expand your knowledge on the topics to maximize learning at a deeper level, build confidence and help you succeed in the course.

About Connexions
Since 1999, Connexions has been pioneering a global system where anyone can create course materials and make them fully accessible and easily reusable free of charge. We are a Web-based authoring, teaching and learning environment open to anyone interested in education, including students, teachers, professors and lifelong learners. We connect ideas and facilitate educational communities.

Connexions's modular, interactive courses are in use worldwide by universities, community colleges, K-12 schools, distance learners, and lifelong learners. Connexions materials are in many languages, including English, Spanish, Chinese, Japanese, Italian, Vietnamese, French, Portuguese, and Thai. Connexions is part of an exciting new information distribution system that allows for **Print on Demand Books**. Connexions has partnered with innovative on-demand publisher QOOP to accelerate the delivery of printed course materials and textbooks into classrooms worldwide at lower prices than traditional academic publishers.