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CHAPTER 2: CHEMICAL AND BIOCHEMICAL FOUNDATIONS OF PATHOPHYSIOLOGY

Multiple-Choice Questions

1. Which of the following best describes why atoms have an overall neutral charge?
a. Electrons orbit on the outside of the atom
@ Incorrect answer. Although it is true that electrons orbit outside the nucleus, this is not the reason why atoms have an overall neutral charge.
*b. The number of protons equals the number of electrons
@ Correct answer. There are an equal number of protons, which have a positive charge, and electrons, which have a negative charge. The positive and negative charges balance one another out for an overall neutral charge.
c. There are more neutrons than protons.
@ Incorrect answer. There are the same number of neutrons as protons. Additionally, neutrons have a neutral charge.
d. There are four electrons in the outer shell.
@ Incorrect answer. Some elements have four electrons in the outer shell, but this is not the reason for the overall neutral charge. The number of electrons will match the number of protons.

2. Why do hydrogen and potassium readily interact with other atoms?
a. They only have electrons in the first shell.
@ Incorrect answer. Hydrogen has one electron, but potassium has 19 electrons. Therefore potassium has two electrons in the first shell, eight in the second and third shells, and one in the fourth shell. Hydrogen has one electron in the first shell.
b. They have electrons in all shells.
@ Incorrect answer. Hydrogen has one electron in the first shell. Potassium has two electrons in the first shell, eight in the second and third shells, and one in the fourth shell.
c. They both have four electrons in the outer shell.
@ Incorrect answer. Both hydrogen and potassium have one electron in their outer shells.
*d. They both have one electron in the outer shell.
@ Correct answer. Both hydrogen and potassium have one electron in their outer shells meaning they can readily interact with other atoms.

3. How many electrons does carbon use to interact with other atoms?
*a. 4
@ Correct answer. Carbon has four electrons in its outer shell. Only the electrons in the outer shell, or valence electrons, are used to interact with other electrons.
b. 6
@ Incorrect answer. While carbon has a total of six electrons, only the electrons in the outer shell are used to interact with other electrons. Two of carbon's six electrons are in the first shell.
c. 1
@ Incorrect answer. Carbon has four valence electrons.
d. 2
@ Incorrect answer. While carbon has two electrons in the first shell, it also has four valence electrons that are used to interact with other elements.

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4. Which of the following is true regarding the role of bicarbonate in maintaining homeostasis?
a. Bicarbonate dissociates from hydroxide to form a free hydroxide that neutralizes acid.
@ Incorrect answer. The dissociation of sodium from a hydroxide ion creates a free hydroxide that neutralizes acid.
b. Bicarbonate releases protons when diluted with water, which neutralizes acids.
@ Incorrect answer. Acids release protons when placed in water, but bicarbonate is a base.
c. Bicarbonate is partially ionized in water and is considered to be a weak base.
@ Incorrect answer. Acids are ionized in water, not bases like bicarbonate. Both carbonic acid and phosphoric acid are partly ionized in water, and are considered weak acids.
*d. Bicarbonate functions as a buffer to neutralize acids.
@ Correct answer. Bicarbonate is produced in the pancreas for the purpose of neutralizing the acidity in chyme as it moves from the stomach to the small intestine. It also plays a major role in the carbonic acid buffer system.

5. Which of the following occurs when carbonic acid is placed in water?
a. Almost all of the protons are released into the water.
@ Incorrect answer. Carbonic acid is a weak acid. Only in strong acids do most of the protons dissociate into the water.
*b. Some of the protons are released into the water.
@ Correct answer. Carbonic acid is a weak acid, meaning it is only partly ionized in an aqueous solution. Some of the protons are released into the water.
c. Some of the electrons are released into the water.
@ Incorrect answer. When acids are placed in water the protons are released. They are classified based on their tendency to lose protons. Carbonic acid is a weak acid because only a few of its protons are released into the water.
d. Almost all of the neutrons are released into the water.
@ Incorrect answer. Protons are released when acids are placed in water.

6. Which of the following most fully describes how proteins are used to buffer pH?
a. Proteins are used to neutralize excess acids because they have a carboxylic acid group.
@ Incorrect answer. The carboxylic acid group enables proteins to neutralize excess bases.
b. Proteins have an amino group, which is an acid, therefore they can neutralize excess base.
@ Incorrect answer. The amino group is a base, which enables proteins to neutralize excess acids.
c. Proteins are able to neutralize either excess base or excess acid because they have a neutral amino group.
@ Incorrect answer. The amino group is a base, which enables proteins to neutralize excess acids. The carboxylic acid group is an acid, which enables proteins to neutralize excess bases.
*d. Proteins are made up of basic amino groups and acidic carboxylic acid groups, which can be used to neutralize either excess bases or acids.
@ Correct answer. Proteins can neutralize either excess bases or excess acids because they are made up of an amino group (base) and a carboxylic acid group (acid).

7. Which of the following correctly describes the bond between two oxygen atoms?
*a. Two oxygen atoms share a double bond, enabling them both to fulfill the octet rule.
@ Correct answer. One oxygen atom will share two of its electrons with the other atom, forming a double bond and fulfilling the octet rule for both atoms.
b. Two oxygen atoms share bonds with two hydrogen atoms enabling them to fulfill the octet rule.

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@ Incorrect answer. Two oxygen atoms only need to share two electrons with one another in order to form a double bond that fulfills the octet rule.
c. Two oxygen atoms share protons, forming a double bond and fulfilling the octet rule.
@ Incorrect answer. Two oxygen atoms share electrons, not protons, to form a double bond and fulfill the octet rule.
d. Two oxygen atoms share two electrons to form a double bond and eight neutrons to fulfill the octet rule.
@ Incorrect answer. Two oxygen atoms share only two electrons to form a double bond and fulfill the octet rule.

8. Which of the following correctly describes a molecule that is most likely to be polar?
*a. A molecule enriched in hydroxyl groups
@ Correct answer. A molecule that contains O-H or N-H bonds is most likely to be polar.
b. A molecule modified with additional methyl groups
@ Incorrect answer. Methyl groups only contain carbon and hydrogen, making them nonpolar.
c. A molecule with 14 carbons, all bonded to hydrogens
@ Incorrect answer. A molecule containing only carbon and hydrogen is a nonpolar molecule.
d. A molecule of carbon dioxide with linear symmetry
@ Incorrect answer. Carbon dioxide cannot have an electrical dipole, because it is a straight, symmetrical molecule.

9. Electronegativity is the tendency of an element to attract a bonding pair of electrons. Which of the following elements is the most electronegative?
a. Hydrogen
@ Incorrect answer. Electronegativity increases across the periodic table. Hydrogen has one electron, and is more likely to release a valence electron.
b. Carbon
@ Incorrect answer. Carbon has four valence electrons.
c. Potassium
@ Incorrect answer. Potassium has one valence electron and is more likely to release it.
*d. Oxygen
@ Correct answer. Oxygen has six valence electrons and is more likely to attract two more electrons to fulfill the octet rule.

10. Which of the following accurately describes a fact about hydrophobic molecules?
a. Water is nonpolar, so hydrophobic molecules cannot readily dissolve in water.
@ Incorrect answer. Water is polar. Nonpolar molecules are unable to form hydrogen bonds or ionic interactions with polar molecules. Therefore, hydrophobic molecules cannot dissolve in water.
*b. Hydrophobic molecules help determine the three-dimensional structure of proteins.
@ Correct answer. Many proteins contain both hydrophilic and hydrophobic areas. Hydrophobic molecules are attracted to other hydrophobic molecules and this interaction contributes to the three-dimensional structure of the protein.
c. Hydrophobic molecules are unable to dissolve in water because they form hydrogen bonds.
@ Incorrect answer. Hydrophobic molecules are unable to dissolve in water because they cannot form hydrogen bonds or ionic interactions with water.
d. Hydrophobic molecules cannot be transported in aqueous solutions because they do not dissolve.
@ Incorrect answer. Hydrophobic molecules cannot dissolve in aqueous solutions, but they can be transported with special packaging.

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11. Why do some individuals have lactose intolerance?
*a. Some adults are unable to produce lactase.
@ Correct answer. Some adults are unable to produce lactase, the enzyme needed to breakdown lactose.
b. In some adults, the enzyme changes shape.
@ Incorrect answer. Some adults are unable to produce lactase.
c. In some adults, the enzyme lactase is unable to breakdown the milk sugars.
@ Incorrect answer. Some adults lack the ability to produce lactase, which is the enzyme needed to breakdown the milk sugar lactose.
d. In some adults, an inappropriate immune response occurs as a result of exposure to lactose.
@ Incorrect answer. An allergic response is not why some individuals have lactose intolerance. It is a lack of production of lactase, the enzyme needed to breakdown the milk sugar that causes lactose intolerance.

12. How do carbohydrates impact the brain?
a. Carbohydrates decrease brain activity.
@ Incorrect answer. The brain relies on the carbohydrate glucose for most functions.
b. Glycolipids enhance neural activity.
@ Incorrect answer. Glycolipids are lipids with an added carbohydrate. Glycolipids form a sugary membrane coat.
*c. The brain relies on glucose for most functions.
@ Correct answer. The carbohydrate glucose is what the brain relies on for most functions.
d. The brain relies on glycoproteins as its main energy source.
@ Incorrect answer. Glycoproteins are proteins with an added carbohydrate. They are abundant in the plasma membrane.

13. Phospholipids are two fatty acids bound to a glycerol molecule. Which of the following is one reason why phospholipids are able to form cell membranes?
a. Phospholipids are amphipathic, meaning they have two polar ends.
@ Incorrect answer. Phospholipids are amphipathic, but this means they have one polar end and one nonpolar end.
b. Phospholipids have two nonpolar ends, so they can form a barrier against water.
@ Incorrect answer. Phospholipids make good plasma membranes because they have one polar end and one nonpolar end.
c. Phospholipids are not able to spontaneously aggregate, making them more stable as plasma membranes.
@ Incorrect answer. Phospholipids do spontaneously aggregate, making them stable as plasma membranes.
*d. Phospholipids have one polar end and one nonpolar end enabling them to form plasma membranes.
@ Correct answer. Phospholipids are amphipathic, the basis for their major biological role in forming cell membranes.

14. The production of prostaglandins and leukotrienes during inflammation depends on the presence of a specific:
a. Cell membrane carbohydrate
@ Incorrect answer. Prostaglandins and leukotrienes are made from plasma membrane arachidonic acid.
*b. Cell membrane lipid
@ Correct answer. Cell membrane phospholipids are the source of the fatty acid arachidonic acid.
c. Cell membrane protein

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@ Incorrect answer. Prostaglandins and leukotrienes are made from plasma membrane arachidonic acid.
d. Intracellular nucleotide
@ Incorrect answer. Prostaglandins and leukotrienes are made from plasma membrane arachidonic acid.

15. Which of the following is true regarding energy storage in the body?
*a. Triglycerides are the major form of energy storage because hydrocarbon chains release large amounts of energy when they undergo catabolic reactions.
@ Correct answer. Triglycerides, mainly stored in adipose tissue, release large amounts of energy when the hydrocarbon chains undergo catabolic reactions. Therefore, they are the major source of energy in the body.
b. Glycoproteins are the major form of energy storage because they are readily broken down into glucose.
@ Incorrect answer. Triglycerides, not glycoproteins, are the major form of energy storage for the body.
c. Triglycerides are a minor form of energy storage because the hydrogen chains break apart easily.
@ Incorrect answer. Triglycerides are made up of hydrocarbon chains that release large amount of energy when they undergo catabolic reactions.
d. The main storage area for energy is in the mitochondria.
@ Incorrect answer. The main storage area for triglycerides is adipose tissue.

16. The endogenous pathway transports energy packaged in the liver to the tissues for use. Which of the following delivers the triglycerides to the tissues?
a. High-density lipoproteins (HDL)
@ Incorrect answer. HDL transfers apolipoproteins to VLDL and into the circulation.
b. Low-density lipoproteins (LDL)
@ Incorrect answer. LDL is mostly made of cholesterol and functions in delivery of cholesterol to the cells.
c. Intermediate-density lipoproteins (IDL)
@ Incorrect answer. IDL are remnants of VLDL after tissues have removed triglyceride.
*d. Very low-density lipoproteins (VLDL)
@ Correct answer. VLDL are rich with triglycerides, which are delivered to the tissues.

17. What is the source of familial forms of hypercholesterolemia?
*a. Mutations in the gene that codes for Apolipoprotein B-100 (Apo B-100).
@ Correct answer. Familial forms of hypercholesterolemia are usually associated with mutations in the gene that codes for Apo B-100.
b. Mutations in the gene that codes for very low-density lipoproteins.
@ Incorrect answer. Mutations in the gene that codes for Apo B-100 is associated with familial forms of hypercholesterolemia.
c. Increased intake of saturated fatty acids.
@ Incorrect answer. Mutations in the gene that codes for Apo B-100 is inherited in a dominant fashion in familial forms of hypercholesterolemia.
d. Environmental factors that cause mutations of the genes that code for triglycerides.
@ Incorrect answer. Familial forms of hypercholesterolemia are usually associated with normal triglyceride levels.

18. Intrachain bonds between protein chains are dependent on the presence of this amino acid:
a. Alanine

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@ Incorrect answer. Alanine has a hydrophobic side chain and cannot make cross-links with other amino acid side chains.
b. Aspartate
@ Incorrect answer. Aspartate has an acidic side chain and cannot make cross-links with other amino acid side chains.
*c. Cysteine
@ Correct answer. Cysteine has a thiol side chain and can form a disulfide bond with another cysteine.
d. Cytosine
@ Incorrect answer. Cytosine is a pyrimidine base, not an amino acid.

19. Which nucleic acid is responsible for transporting information to the ribosomes for protein synthesis?
a. Deoxyribonucleic acid (DNA)
@ Incorrect answer. DNA stores genetic information necessary to produce proteins.
*b. Ribonucleic acid (RNA)
@ Correct answer. RNA transports genetic instructions for production of proteins from the DNA to the ribosomes.
c. Guanosine triphosphate (GTP)
@ Incorrect answer. GTP provides a timing switch for membrane receptors.
d. Cyclic adenosine monophosphate (cAMP)
@ Incorrect answer. cAMP is an intracellular second messenger, turning on a signaling cascade.

20. What is the cause of hypopigmentation in children with PKU (phenylketonuria)?
a. There is too little phenylalanine
@ Incorrect answer. There are high levels of phenylalanine because the enzyme to convert phenylalanine into tyrosine is missing.
b. There is an accumulation of phenylacetate
@ Incorrect answer. Through a secondary metabolic pathway, phenylalanine is converted into phenylacetate, which is then excreted through the urine. Phenylacetate gives urine a mousy odor.
*c. Tyrosine is in short supply
@ Correct answer. Melanin is produced from tyrosine. Tyrosine is reduced in PKU because they are missing the enzyme responsible for converting phenylalanine into tyrosine.
d. There is an accumulation of melanin
@ Incorrect answer. There is too little melanin due to a short supply of tyrosine. Too little melanin leads to hypopigmentation.

21. The difference between chemically reactive and chemically inert elements is determined by:
a. The number of protons in the nucleus
@ Incorrect answer. Protons in an atom's nucleus do not interact with other atoms
b. The number of neutrons in the nucleus
@ Incorrect answer. Neutrons in an atom's nucleus do not interact with other atoms
*c. The presence or absence of electrons that completely fill the outer, valence shell
@ Correct answer. An incompletely filled valence shell allows an atom to react with other atoms
d. The total number of electrons in the atom
@ Incorrect answer. The determining factor in an element's reactivity is the filling of the outermost valence electron shell.

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22. Which of the following correctly describes the process of sodium chloride dissolving in water?
a. The atoms of sodium and chloride remain attached via an ionic bond
@ Incorrect answer. The ions separate when a sodium chloride molecule dissolves in water.
b. The sodium and chloride atoms separate, retaining their initial atomic valence shell electron configuration
@ Incorrect answer. The sodium and chloride atoms become ions, with sodium losing one electron to become a positive ion, and chloride gaining one electron to become a negative ion.
*c. The sodium ion acquires a hydration shell of water molecules, with the oxygens oriented toward the sodium ion; the chloride ion acquires a hydration shell of water molecules, with hydrogens oriented toward the chloride ion
@ Correct answer. The electronegative oxygen within polar water molecules is attracted to sodium's positive charge, the electropositive hydrogens within water molecules are attracted to chloride's negative charge
d. The sodium ion acquires a hydration shell of water molecules, with the hydrogens oriented toward the sodium ion; the chloride ion acquires a hydration shell of water molecules, with oxygens oriented toward the chloride ion
@ Incorrect answer. The electronegative oxygen within polar water molecules is attracted to sodium's positive charge, the electropositive hydrogens within water molecules are attracted to chloride's negative charge

23. Which of the following is not a role of ions in the body?
*a. Formation of hydrophobic membrane barriers
@ Correct answer. Ions are hydrophilic
b. Maintaining acid base balance
@ Incorrect answer. Acids and bases that buffer body fluids are also ions
c. Carrying electrical charges
@ Incorrect answer. Ions are also electrolytes, when in solution they help to carry electrical charges
d. Generation of membrane potentials
@ Incorrect answer. Differential distribution of ions and varying membrane ion permeability help to create membrane potentials

24. The components of the bicarbonate buffer system include which of these molecules?
a. Amino acid lysine
@ Incorrect answer. Amino acids contribute to buffering by proteins
b. Ammonia
@ Incorrect answer. Buffering by ammonia is independent of the bicarbonate buffer system
*c. Carbonic acid
@ Correct answer. Carbonic acid is the central compound of the bicarbonate buffer system, formed when bicarbonate ion is exposed to excess acid
d. Hydrochloric acid
@ Incorrect answer. Hydrochloric acid is a strong acid involved in gastric secretion and digestion

25. Nonpolar biomolecules are distinguished by their abundance of which of the following?
*a. Carbon-hydrogen bonds
@ Correct answer. Carbon-hydrogen bonds are nonpolar covalent bonds
b. Carbon-nitrogen-hydrogen bonds
@ Incorrect answer. The presence of nitrogen bonded to hydrogen in a biomolecule constitutes a polar covalent bond

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c. Carbon-oxygen-hydrogen bonds
@ Incorrect answer. The presence of oxygen bonded to hydrogen in a biomolecule constitutes a polar covalent bond
d. Carbon-oxygen-oxygen-hydrogen bonds
@ Incorrect answer. Carbon bonded to two oxygens, one of which is bonded to a hydrogen, describes a carboxyl group, with polar and charged characteristics

26. Transfer of a phosphate group from ATP to a biomolecule (also known as phosphorylation) involves this type of chemical reaction:
a. Degradation
@ Incorrect answer, it is an exchange reaction, reactants are not being degraded
*b. Exchange
@ Correct answer
c. Hydroxylation
@ Incorrect answer – a phosphate is being transferred, rather than a hydroxyl group
d. Synthesis.
@ Incorrect answer, it is an exchange reaction, reactants are not being built into larger molecules

27. Which category of biomolecules has the greatest hydrophobicity?
a. Amino acids
@ Incorrect answer. Carbohydrates have charged and polar carboxyl and amine groups and are very polar and hydrophilic.
b. Carbohydrates
@ Incorrect answer. Carbohydrates are rich in hydroxyl groups and are very polar and hydrophilic
*c. Lipids
@ Correct answer. Fatty acids, triglycerides, and cholesterol are rich in C-H bonds and are very nonpolar and hydrophobic
d. Nucleotides
@ Incorrect answer. Nucleotides have N-H bonds that increase their polar, hydrophilic qualities

28. What is the major biomolecule group that modifies membrane lipids and proteins, forming glycolipids and glycoproteins used as cell markers?
a. Amino acids
@ Incorrect answer. Amino acids are rarely found as modifying attachments to membrane lipids and proteins
b. Fatty acids.
@ Incorrect answer. Carbohydrates, particularly hexose sugars, are the most common biomolecules that modify membrane lipids and proteins
*c. Hexose sugars
@ Correct answer. Hexose sugars, singly and in chains, are common biomolecules that modify membrane constituents, forming glycolipids and glycoproteins
d. Nucleotides
@ Incorrect answer. Nucleotides are not commonly found on the outer membrane surface attached to lipids and proteins.

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29. What is a common membrane phospholipid that is amphipathic, having two fatty acid tails and a polar head group?
a. Blood group antigens
@ Incorrect answer. Blood group antigens are membrane sphingolipids with attached carbohydrate groups.
b. Cholesterol
@ Incorrect answer. Cholesterol is a steroid-type membrane lipid
*c. Phosphatidylcholine
@ Correct answer. Phosphatidylcholine has two fatty acid tails and the polar head group choline.
d. Triglyceride
@ Incorrect answer. Triglycerides have three fatty acid chains and no polar head group, therefore they are not amphipathic

30. Which of the following is not a prominent component of a lipoprotein particle?
*a. Carbohydrate
@ Correct answer. Lipoproteins consist of a lipid core with a phospholipid and protein coat
b. Cholesterol
@ Incorrect answer. Cholesterol is found in varying degrees in many lipoproteins
c. Triglyceride
@ Incorrect answer. Triglyceride molecules are found in varying degrees in many lipoproteins
d. Phospholipids
@ Incorrect answer. Phospholipids are found in the coat of many lipoproteins

31. Which description best characterizes hydrogen bonding in protein secondary structures like alpha helices and beta pleated sheets?
a. Oxygens and hydrogens attached to polar R groups form intrachain hydrogen bonds
@ Incorrect answer. Intrachain hydrogen bonds form between oxygens and hydrogens of the peptide backbone
b. Oxygens and nitrogens attached to polar R groups form intrachain hydrogen bonds
@ Incorrect answer. Intrachain hydrogen bonds form between oxygens and hydrogens of the peptide backbone
c. Oxygens and hydrogens attached to charged R groups form intrachain hydrogen bonds
@ Incorrect answer. Intrachain hydrogen bonds form between oxygens and hydrogens of the peptide backbone
*d. Oxygens and hydrogens attached to the peptide backbone form intrachain hydrogen bonds
@ Correct answer. Intrachain hydrogen bonds form between oxygens and hydrogens of the peptide backbone

32. Which portion(s) of a folded globular protein are stabilized by hydrophobic attraction between R groups?
*a. The protein core
@ Correct answer. Hydrophobic R groups cluster in the core of globular proteins, minimizing interactions with the aqueous solution of intracellular or extracellular fluid
b. The protein surface
@ Incorrect answer. Hydrophobic R groups are found in the core of folded proteins, while the outer surface is rich in hydrophilic charged and polar R groups
c. Regions of both protein core and surface
@ Incorrect answer. Hydrophobic R groups are found in the core of folded proteins

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d. None of these – folding of globular proteins does not involve R groups
@ Incorrect answer. Hydrophobic amino acid R groups influence protein folding by promoting attraction into the core region

33. Individual amino acids can function as precursor molecules for biological signals. An example of a signaling molecule derived from the amino acid tyrosine is:
a. Cholesterol
@ Incorrect answer. Cholesterol is a lipid and is not derived from an amino acid
b. Glycogen
@ Incorrect answer. Glycogen is a polymer of glucose and is not derived from an amino acid
c. Insulin
@ Incorrect answer. Insulin is a protein hormone made up of many amino acids
*d. Norepinephrine
@ Correct answer, norepinephrine is a neurotransmitter derived from the amino acid tyrosine

34. Which of the following is composed of a single nitrogenous base, phosphate group, and ribose sugar molecule?
a. Nucleoside
@ Incorrect answer. A nucleoside has a nitrogenous base and pentose sugar, but no phosphate group
*b. Nucleotide
@ Correct answer. A nucleotide has a nitrogenous base, a pentose sugar, and one or more phosphate groups
c. Ribonucleic acid (RNA)
@ Incorrect answer. RNA is a polymer of many nucleotides
d. Deoxyribonucleic acid (DNA)
@ Incorrect answer. DNA is a polymer of many nucleotides

35. Which of the following cell functions can not be performed by a nucleotide?
a. Energy storage and use
@ Incorrect answer. ATP is the principal unit of cell energy storage and use
*b. Protein synthesis
@ Correct answer. Proteins are synthesized from amino acids, not nucleotides
c. Formation of nucleic acids
@ Incorrect answer. Nucleic acids are polymers of nucleotides
d. Intracellular second messenger signaling
@ Incorrect answer. Cyclic AMP and cyclic GMP are intracellular second messengers

36. Based on the principle of complementary base pairing, in double-stranded DNA the number of adenine molecules must equal the number of molecules of:
a. Cytosine
@ Incorrect answer. Cytosine forms base pairs with Guanine, not adenine
b. Guanine
@ Incorrect answer. Guanine forms base pairs with cytosine, not adenine
*c. Thymine
@ Correct answer. Thymine forms base pairs with adenine, therefore there must be an equal number of thymine and adenine molecules
d. Uracil

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@ Incorrect answer, uracil is a base in RNA, not DNA

37. A characteristic that distinguishes DNA from RNA molecules is:
a. The presence of a pentose sugar attached to each base
@ Incorrect answer. Both DNA and RNA have pentose sugar molecules, however, DNA has deoxyribose sugars, while RNA has ribose sugars
b. The presence of a phosphate group attached to each nucleotide
@ Incorrect answer. Both DNA and RNA have phosphate groups in their backbones
c. The specific purines in the molecule
@ Incorrect answer. Both DNA and RNA use the same purine bases: adenine and guanine
*d. The specific pyrimidines in the molecule
@ Correct answer. DNA uses cytosine and thymine, while RNA uses cytosine and uracil

38. Which treatment has been the main approach to reduce the pathophysiological consequences of phenylalanine hydroxylase deficiency leading to PKU?
a. Gene therapy administered at birth to replace the phenylalanine hydroxylase enzyme
@ Incorrect answer. Gene therapy is not currently available for this condition
b. In vitro fertilization with preimplantation screening to avoid implanting an embryo with phenylalanine hydroxylase deficiency
@ Incorrect answer. Preimplantation screening for this condition has not been used
c. Management with medications that reduce phenylalanine concentrations
@ Incorrect answer. There are no readily available medications to clear phenylalanine from the body
*d. Nutrition therapy with a low phenylalanine diet to reduce hyperphenylalinemia
@ Correct answer. The mainstay of therapy is to feed a low phenylalanine diet as soon as the enzyme deficiency is identified in a newborn, thus preventing the damaging effects of excess phenylalanine

39. Which of the following molecules is most likely to be hydrophobic and poorly soluble in an aqueous environment?
a. Alanine
@ Incorrect answer. Alanine is an amino acid with polar or charged carboxyl and amine groups that improve its solubility in water
*b. Estrogen
@ Correct answer. Estrogen is a steroid hormone that is based on the lipid cholesterol, therefore it is hydrophobic and poorly soluble in an aqueous environment
c. Glucose
@ Incorrect answer. Glucose molecules are enriched in polar hydroxyl groups, making glucose very hydrophilic
d. Guanosine
@ Incorrect answer. Guanosine has a nitrogenous base bonded to a pentose sugar, with both molecular components contributing to its polar and hydrophilic nature.

40. What components of lipoprotein molecules contribute to their ability to travel freely in the circulation despite their overwhelmingly hydrophobic components?
a. They are rich in cholesterol
@ Incorrect answer. Cholesterol is not water soluble and cannot easily travel in the circulation
b. They are rich in triglyceride
@ Incorrect answer. Triglycerides are not water soluble and cannot easily travel in the circulation

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*c. They are coated with phospholipids and proteins
@ Correct answer. Hydrophobic cholesterol and triglyceride are coated with amphipathic phospholipids and proteins, allowing lipoproteins to travel in the aqueous plasma within the circulation
d. They have varying densities
@ Incorrect answer. Although lipoproteins have different densities, they all have a hydrophobic core that would prevent free travel in the circulation without a coat of phospholipid and protein

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