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**QUESTION 1**

Sickle cell disease (SCD) affects millions of individuals worldwide, and the Sickle Cell Disease Association of America estimates that 70,000 to 100,000 individuals have SCD and 3 million individuals have the sickle cell trait. While SCD is known to primarily affect individuals of African American descent, individuals from South America, the Caribbean, Central America, the Middle East, and the Mediterranean can also have SCD or the SCD trait. SCD is estimated to affect 1 in 500 African American infants, and 1 in 12 African Americans are estimated to have the sickle cell trait. SCD is characterized by episodes of acute and chronic pain. By increasing awareness about SCD and promoting patient education, health care professionals can help patients and their families cope with SCD and better manage the associated pain. Recurring episodes of acute and/or severe pain are hallmarks of SCD. SCD pain can often be debilitating, and episodes of pain vary from patient to patient in both frequency and intensity. SCD pain can be classified as acute, chronic, or mixed. At some point, most SCD patients experience episodes of pain often referred to as vaso-occlusive crisis (sickle cell crisis), the duration of which may range from hours to days. Some patients seldom have a sickle cell crisis, while others may experience crises several times a year. Some episodes may be so severe that hospitalization is warranted to manage the pain. An acute pain event is the most common type of pain, and the onset is typically abrupt. It is often the result of an ischemic tissue injury, which is due to the occlusion of microvascular beds by sickled erythrocytes during an acute crisis. Acute pain episodes can also be triggered by factors including extreme temperature changes, changes in altitude, physical and emotional stress, illnesses, infections, dehydration, cold climates, menstruation, and fatigue. Chronic pain is pain that lasts for 3 to 6 months or longer. Chronic pain often results from the destruction of bones, joints, and visceral organs due to recurrent crises. Sources of chronic sickle cell pain include aseptic necrosis, leg ulcerations, and osteomyelitis. Unfortunately, acute and chronic pain associated with SCD are commonly undertreated or inappropriately managed due to patient fear of potential addiction and adverse effects. Many studies report that some health care professionals are also concerned about the potential for addiction. When appropriate, pharmacologic management of SCD pain may involve the use of 3 major pharmacologic classes: nonopioids, opioids, and adjuvants.

The word "hallmarks" in paragraph 2 most likely means?

- A. labels
- B. signals
- C. features
- D. badges

Correct Answer: C

As stated earlier, when answering questions referring to a specific line or word, it is imperative to first get the full context within which the word is used. In this case, it is the "recurring episodes of acute and severe pain" that are the hallmarks of SCD. These can be thought of as characteristics, markers, or attributes of SCD. Consequently, in context, "features" is the best synonym for hallmarks.

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**QUESTION 2**

Coughs that linger after a cold or sinus problem cause constant disruption in the home, school, and workplace. Often, these dry, nonproductive coughs become increasingly troublesome although other symptoms (fever, congestion, and fatigue) resolved days or weeks ago. This stubborn cough persists for weeks, and plagues its victim and the victim's family night and day. The diagnosis might be a common, but overlooked cause of lingering cough: atypical pneumonia caused by mycoplasma. Mycoplasma (pleomorphic bacteria that lack a cell wall) are the smallest and simplest self-replicating organisms known to humans. They probably evolved from gram-positive, walled eubacteria by degenerative evolution. Smaller than amoebas, these 0.1-micrometer organisms grow and reproduce slowly and require no oxygen or host cell. They also change shapes asymmetrically, appearing as long, thin filaments, tiny spheres, or branches.

Scientists have identified more than 100 mycoplasma species. Fifteen species are known to live in humans, most as normal symbiotic flora. *Mycoplasma pneumoniae*, previously called "walking pneumonia," is pathogenic in humans. *Mycoplasma pneumoniae* glides freely and uses its specialized filamentous tips to burrow between cilia within the respiratory epithelium, causing the respiratory epithelial cells to slough. It also produces hydrogen peroxide, which causes initial cell disruption in the respiratory tract and damages erythrocyte membranes. Researchers have determined that more than 40% of infants younger than 1 year old have had a mycoplasma infection. By age 5, approximately 65% of children have been infected. Nearly all adults have been infected at least once, often repeatedly. *Mycoplasma pneumoniae* usually affects people younger than 40 years of age. The highest incidence is found in the 5- to 9-year age group. The risk of contracting mycoplasma pneumonia is greatest for people who live or work in crowded areas, such as daycare facilities, schools, homeless shelters, long-term care units, and military and prison environments. However, many people who develop mycoplasma infections have no identifiable risk factor. Most mycoplasma infections cause mild to moderate clinical symptoms, but the infection incubates over 3 weeks and can last weeks without treatment. This infection cannot be diagnosed based on symptoms alone; laboratory testing is essential. Infection can also cause ear infections, sinus infections, bronchitis, croup, severe sore throats, infectious asthma, and 1 type of the common cold. When mycoplasma infects children, about 25% of them develop nausea, vomiting, or diarrhea.

A diagnosis of mycoplasma may be suspected in cases in which:

- A. fever, congestion, and fatigue were never present
- B. fever, congestion, and fatigue were present initially, but then went away
- C. fever, congestion, and fatigue remain constant during the cough
- D. fever, congestion, and fatigue go away with the cough

Correct Answer: B

The passage states, "Often, these dry, nonproductive coughs become increasingly troublesome although other symptoms ?fever, congestion, and fatigue ?resolved days or weeks ago." A lingering cough after the resolution of the other symptoms is a key marker in suspecting mycoplasma.

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### QUESTION 3

Since 1997, the American Heart Association (AHA) has attempted to increase awareness about cardiovascular disease (CVD) among women. Fortunately, great progress has been made to educate individuals about CVD and its consequences. According to the AHA's 2011 Guidelines for Prevention of Cardiovascular Disease in Women, the misconception that CVD is a "man's disease" has been somewhat disproved, as awareness among the general public increased from 30% in 1997 to 54% in 2009. Unfortunately, CVD continues to be the leading cause of death in the United States for both men and women. Since 1984, the number of deaths related to CVD in women exceeded those in men. In the United States, CVD death rates among women aged 35 to 54 years appear to be increasing by 1% annually, which is most likely attributable to the escalating obesity epidemic. According to the AHA, even though CVD is the number 1 cause of death among women, only 13% of women perceive CVD as a health threat. CVD is responsible for more deaths among women than the next 3 leading causes of death combined, including all forms of cancer. Due to the ongoing prevalence of CVD, increasing awareness and understanding of CVD, especially among the female population, is still a top priority for many health care professionals. As one of the most accessible health care professionals, pharmacists are in a pivotal position to educate and inform their patients of the risks associated with CVD, possible drug therapies, and preventive measures. The AHA has set a goal for 2020 to improve cardiovascular health in all Americans by 20%, while reducing deaths from CVD and stroke by 20%. According to the American Heart Association, in the United States a woman dies of some form of CVD every minute and more than 1 in 3 females have some form of CVD. Studies have demonstrated that gender differences may play an important role in the diagnosis, treatment, and prevention of CVD. Unfortunately, many women may not always recognize the warning signs and symptoms of a heart attack because they sometimes appear more subtle when compared with those typically experienced by men. Results from a study of 515 women who had heart attacks report that 43% did not experience any type of chest pain or pressure during the heart attack. Although the classic symptoms include chest pain, tingling in the

left arm, sweating, and shortness of breath, women may also experience some "atypical" symptoms, such as extreme fatigue, nausea, dizziness, indigestion, vomiting, and pain in the neck or back. By learning and recognizing the warning signs, women can take a proactive approach to their cardiovascular health and get treatment earlier to prevent further complications.

In context, the word "pivotal" in paragraph 3 most nearly means

- A. determining
- B. crucial
- C. important
- D. central

Correct Answer: D

The author describes pharmacists as being in a pivotal position to educate and inform patients of the risks associated with CVD due to their accessibility. While pharmacists are certainly important in transmitting this information, because of their accessibility, they are crucial, or central, to raising awareness of CVD.

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#### QUESTION 4

All of the following molecules are soluble in water except:

- A. Polysaccharides
- B. Triglycerides
- C. Hydroxyl groups
- D. Polypeptides
- E. Carboxylic acids

Correct Answer: B

Triglycerides are hydrophobic. They consist of three fatty acids joined to a glycerol molecule, and because of their long hydrocarbon chains, they are not soluble in water.

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#### QUESTION 5

Which of the following is found in the plasma membrane of a cell?

- A. phospholipid
- B. glycoprotein
- C. cholesterol
- D. all of the above

Correct Answer: D

The plasma membrane of a cell is composed of a phospholipid bilayer, a double layer of lipids combined with phosphate groups. The hydrophilic nature of the phosphate heads and the hydrophobic nature of the lipids create a double-sided membrane with phosphates on both sides and lipids trapped between. Cholesterol and glycoprotein molecules are embedded inside the phospholipid bilayers.

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**QUESTION 6**

The T-tubules transmit an action potential, causing the opening of \_\_\_\_ channels in the \_\_\_\_.

- A. Na<sup>+</sup>, Sarcoplasm
- B. Ca<sup>2+</sup>, Sarcoplasmic Reticulum
- C. Na<sup>+</sup>, Sarcoplasmic Reticulum
- D. Ca<sup>2+</sup>, Sarcoplasm

Correct Answer: B

The T-tubules conduct action potentials that cause channels to open on the surface of the sarcoplasmic reticulum. The opening of these channels results in a release of Ca<sup>2+</sup> into the sarcoplasm of the muscle fiber.

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**QUESTION 7**

Auxin stimulates stem elongation and is involved in the process of phototropism. If plants bend toward a light source, in which region of the plant is auxin most likely to be found?

- A. The shaded side of a stem
- B. The top of a shoot
- C. The bottom of a shoot
- D. The sunny side of a stem
- E. The top side of leaves

Correct Answer: A

Auxin is found in higher concentrations on the shaded side than the sunny side of a stem. More elongation on the shaded side causes the stem to bend toward the light.

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**QUESTION 8**

On a bad day, have you ever been irritable? Have you ever used a harsh tone or even been verbally disrespectful to your parents or teachers? Everyone has a short temper from time to time, but current statistics indicate that between 16% and 20% of a school population suffer from a psychological condition known as Oppositional Defiance Disorder, or ODD.

ODD symptoms include difficulty complying with adult requests, excessive arguments with adults, temper tantrums, difficulty accepting responsibility for actions, low frustration tolerance, and behaviors intended to annoy or upset adults.

Parents of children with ODD can often feel as though their whole relationship is based on conflict after conflict.

Unfortunately, ODD can be caused by a number of factors. Some students affected by ODD suffer abuse, neglect, and severe or unpredictable discipline at home. Others have parents with mood disorders or have experienced family violence. Various types of therapy are helpful in treating ODD, and some drugs can treat particular symptoms. However, no single cure exists.

The best advice from professionals is directed toward parents. Therapists encourage parents to avoid situations that usually end in power struggles, to try not to feed into oppositional behavior by reacting emotionally, to praise positive behaviors, and to discourage negative behaviors with timeouts instead of harsh discipline. Which of the following statements can be inferred from paragraph 4?

- A. Parents of children with ODD are bad parents.
- B. ODD is not a real psychological disorder.
- C. Medication can worsen ODD.
- D. Reacting emotionally to defiant behavior might worsen the behavior.

Correct Answer: D

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#### QUESTION 9

Which of the following is found to be different in isotopes of the same chemical element?

- A. Protons
- B. Neutrons
- C. Electrons
- D. Atomic number

Correct Answer: B

Isotopes are defined as forms of the same chemical element that differ only by the number of neutrons in their nucleus. Most elements have more than one naturally occurring isotope. The atomic number "Z" is the same in such elements, however their atomic mass "A" is different due to differ numbers of neutrons in the nucleus of the atom.

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#### QUESTION 10

Which of the following lists the correct taxonomic order from most inclusive to least inclusive?

- A. Kingdom, Order, Class, Species
- B. Order, Family, Genus, Phylum
- C. Order, Family, Genus, Species
- D. Phylum, Order, Species, Genus

Correct Answer: C

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Kingdom, Phylum, Class, Order, Family, Genus, Species. The mnemonic, "King Philip Came Over For Great Spaghetti," is very useful for remembering the taxonomic order from most inclusive to least inclusive.

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**QUESTION 11**

Lex's mom buys 3 of each kind of cookie for a picnic. If the store gives a 10% discount for purchase of a dozen cookies, how much did she spend?

- A. \$22.60
- B. \$21.60
- C. \$23.00
- D. \$24.00

Correct Answer: B

$\$6 + \$4.50 + \$7.50 + \$6 = \$24$ . 10% of  $\$24 = \$2.40$ .  $\$24 - \$2.40 = \$21.60$ .

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**QUESTION 12**

A population of pea plants has 25% dwarf plants and 75% tall plants. The tall allele, T, is dominant to dwarf (t). What percentage of tall plants is heterozygous?

- A. 0.75
- B. 0.67
- C. 0.5
- D. 0.25
- E. 0.16

Correct Answer: C

According to Hardy-Weinberg equilibrium,  $p + q = 1$  and  $p^2 + 2pq + q^2 = 1$ . In this scenario,  $q^2 = 0.25$ , so  $q = 0.5$ .  $p$  must also be 0.5.

$2pq$  is equal to  $2 \cdot 0.5 \cdot 0.5$  or 0.5.

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**QUESTION 13**

Which of the following is NOT the result of a viral infection?

- A. genital warts
- B. Syphilis
- C. AIDS

D. the common cold

Correct Answer: B

Genital warts are caused by the Human papillomavirus. AIDS is a consequence of the Human Immunodeficiency Virus. The common cold is also a viral infectious disease. Syphilis, however, is the result of a bacterial infection.

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## QUESTION 14

In which of the following stages of embryo development are the three primary germ layers first present?

A. Blastula

B. Zygote

C. Gastrula

D. Coelomate

E. Morula

Correct Answer: C

The gastrula is formed from the blastocyst, which contains a bilayered embryonic disc. One layer of this disc's inner cell mass further subdivides into the epiblast and the hypoblast, resulting in the three primary germ layers (endoderm, mesoderm, ectoderm).

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## QUESTION 15

The synaptonemal complex is present in which of the following phases of the cell cycle?

A. Telophase of meiosis I

B. Metaphase of meiosis II

C. Metaphase of meiosis I

D. Metaphase of mitosis

E. Telophase of meiosis II

Correct Answer: A

The synaptonemal complex is the point of contact between homologous chromatids. It is formed when nonsister chromatids exchange genetic material through crossing over. Once meiosis I has completed, crossovers have resolved and the synaptonemal complex no longer exists. Rather, sister chromatids are held together at their centromeres prior to separation in anaphase II.