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Topic Break Down

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QUESTION NO: 1

The primary seat of tubercular infection is generally in the upper part of the lung. The invading organisms settle on the surface here and cause a multiplication of the cells and an inflammatory exudate in a small area. With the continuous growth of the bacilli in the localized region, adjoining areas of the lung become affected, and there is further extension into the immediate vicinity by means of the lymphatics. Small nodules form and then coalesce to create a larger area. The body primarily defends itself with the formation of dense masses of cicatricial tissue, which function to wall off the affected area. This results in unfavorable growth conditions for the bacilli. This mode of defense, combined with the production of substances antagonistic to the toxins produced by the bacilli, is so efficacious that in the great majority of cases no further extension of the process takes place. In certain cases, however, the growth of the bacilli in the focus area is unchecked, then the surrounding tissue is killed and converted into a soft semi-fluid material; further extension then takes place. All parts of the enormous surface of the lungs are connected by a system of air tubes or bronchi, and as a result, the bacilli have favorable opportunity for distribution. This opportunity is facilitated by sudden movements of the air currents in the lung produced by coughing. The body's defense; however, can still keep pace with the attack, and even in an advanced stage, the infection can sometimes be permanently checked; in other cases, the check is temporary, the process of softening continues, and large cavities are produced by the destruction of the tissue. On the inner surface of these cavities there may be a rapid growth of bacilli. From the lungs, the bacilli are carried by the lymphatics to the lymph nodes at the root of the lungs, in which a similar process takes place; this, on the whole, is favorable, because further extension by this route is for a time blocked. The extension across surfaces continues and the abundant sputum, which is formed in the lungs and contains large numbers of bacilli, becomes the vehicle of

transportation. The windpipe and larynx may become infected, as the back parts of each are more closely in contact with the sputum and are the parts most generally infected. A large part of the sputum is swallowed and infection of the intestine takes place with the lesions taking the form of large ulcers. From the intestinal ulcers there is further extension by means of the lymphatics to the large lymph nodes in the back of the abdominal cavity.

It is true that bacilli:

- A. are insensible to outside influence.
- B. attack lymph nodes first.
- C. produce toxins harmful to the body.
- D. do not destroy surrounding tissue.

ANSWER: C**Explanation:**

The passage states that the body tries to defend itself with the production of substances that are antagonistic to "toxins produced by the bacilli."

QUESTION NO: 2

What is 0.25% of $\frac{1}{3}$?

- A. 0.83
- B. 0.083

- C. 0.0083
- D. 0.00083

ANSWER: D

Explanation:

Convert 0.25% to a fraction and multiply it by 1/3:

$$\begin{aligned} 0.25\% &= \frac{25}{1000} \\ &= \frac{1}{400} \times \frac{1}{3} \\ &= \frac{1}{1200} \\ &= 0.00083 \end{aligned}$$

QUESTION NO: 3

In photosynthesis, high-energy electrons in Photosystem II are transferred along an electron transport chain and eventually end up in high-energy molecules used in the Calvin Cycle. Which molecule provides electrons to replace those lost by Photosystem II after light stimulation?

- A. CO₂
- B. FADH₂
- C. NADPH
- D. ATP
- E. H₂O

ANSWER: E

Explanation:

Water and carbon dioxide are the two essential consumable molecules in photosynthesis. First, water is split into oxygen, protons, and electrons, and then carbon dioxide is used in the Calvin cycle to create glucose. The electrons from splitting water are used in photosystem II, the protons are used to create NADPH, and oxygen is a waste product of the splitting of water.

QUESTION NO: 4

Under what conditions do gases exhibit ideal behavior?

- A. Low pressures and low temperatures
- B. Low pressures and high temperatures
- C. High pressures and high temperatures
- D. High pressures and low temperatures

ANSWER: B

Explanation:

At high pressures, gas particles are forced close together; therefore, intermolecular forces between the particles become significant, and the gas deviates from ideality. On the other hand, at low pressures, the gas particles are far apart from each other, so they cannot interact, and intermolecular forces are insignificant. Ideal gas behavior is also observed at high temperatures because the gas particles possess a large amount of kinetic energy – large enough for the particles to overcome their attractive forces towards each other. As the temperature is lowered, the kinetic energy of the particles decreases, so the particles do not have enough energy to break away from each other, and attractive forces become significant.

QUESTION NO: 5

Which of the following is the major way in which nitrogen is assimilated into living things?

- A. Erosion from sediments
- B. Fixation by bacteria
- C. Respiration from the atmosphere
- D. Transpiration
- E. Absorption from soils

ANSWER: B

Explanation:

Plants and animals cannot use inorganic nitrogen. It must be fixed, or reduced to ammonium, in order to enter a living ecosystem.

QUESTION NO: 6

An electron pair donor is best classified as a:

- A. strong acid
- B. Bronsted-Lowry acid

- C. Lewis acid
- D. Lewis base

ANSWER: D

Explanation:

By definition, a Lewis base is an electron pair donor. A Lewis acid, on the other hand, is an electron pair acceptor.

QUESTION NO: 7

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

ANSWER: C

Explanation:

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).

QUESTION NO: 8

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 pneumonia 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.

Which of the following is NOT true about mycoplasma infection?

- A. It can be contracted without an identifiable risk factor.
- B. It has an incubation period of over three weeks.
- C. It can be diagnosed without laboratory testing.
- D. It can cause nausea, vomiting, or diarrhea in children.

ANSWER: C

Explanation:

The final paragraph of the passage states that mycoplasma infection CANNOT be diagnosed without laboratory testing, "This infection cannot be diagnosed based on symptoms alone; laboratory testing is essential."

QUESTION NO: 9

Nitrogen fixing bacteria on root nodules of Leguminous plants are known as:

- A. Azobacteria
- B. Nanobacteria
- C. Rhizobium bacteria
- D. Mycobacteria

ANSWER: C

Explanation:

Nitrogen fixing bacteria on root nodules of Leguminous plants are known as Rhizobium. They fix the atmospheric nitrogen and convert it into ammonia. The nitrogen fixing bacteria are also known as nitrifying bacteria.

Azobacteria are present in the soil. They convert atmospheric nitrogen into nitrates and nitrites. In this way, they increase the fertility of the soil. These ammonium nitrates and nitrites are then absorbed by plants to obtain nitrogen.

QUESTION NO: 10

Solve for y in the following equation if $x = -3$ $y = x + 5$

- A. $y = -2$
- B. $y = 2$
- C. $y = 3$
- D. $y = 8$

ANSWER: B

Explanation:

$y = x + 5$, and you were told that $x = -3$. Fill in the missing information for x, then solve: $y = (-3) + 5y = 2$

QUESTION NO: 11

$$p = -3x + 5y \quad q = x + 2y$$

What is the value of $p - 2q$?

- A. $5x + y$
- B. $-5x + y$
- C. $-y + 5x$
- D. $5 + y$

ANSWER: B

Explanation:

Substitute the values of p and q into the expression:

$$(-3x + 5y) - 2(x + 2y)$$

Distribute and combine like terms to simplify:

$$= -3x + 5y - 2x - 4y = -5x + y$$

QUESTION NO: 12

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 passage as a whole can best be described as a:

- A. Narrative
- B. Persuasive essay
- C. Expository essay
- D. Scientific article

ANSWER: C

Explanation:

An expository essay is also known as an informative essay. Expository essays provide clear and concise descriptions of a particular topic. In this case, the essay is an exposition on sickle cell disease and its variants. The passage lacks the formality of a scientific article, does not tell a story, and is not attempting to persuade opinion on an issue.

QUESTION NO: 13

Which is not a function of immunoglobins?

- A. coagulation
- B. assist in phagocytosis
- C. attack pathogens
- D. labeling of pathogens

ANSWER: C

Explanation:

Antibodies or immunoglobins perform all of the functions except for directly attacking pathogens. Leukocytes, or white blood cells, are responsible for attacking pathogens.

QUESTION NO: 14

What is the oxidation state of each nickel on the reactant side of the following reaction? $2 \text{NiO}(\text{OH}) + \text{Cd} + 2 \text{H}_2\text{O} \rightarrow 2 \text{Ni}(\text{OH})_2 + \text{Cd}(\text{OH})_2$

- A. -2
- B. -1
- C. +1
- D. +3

ANSWER: D**Explanation:**

Oxidation numbers provide a way to keep track of the movement of electrons in a reaction. Several rules govern how oxidation numbers are calculated, but in this situation, it's only important to recognize the oxidation numbers of the common components attached to nickel [Ni] on the reactant side and to remember that the sum of the internal oxidation numbers of a molecule equals that molecule's net charge. In this case, nickel oxide [NiO(OH)] is neutral, so the sum of its internal oxidation numbers must be 0. Hydroxide [OH⁻] always has an oxidation number of -1, and oxygen [O] almost always has an oxidation number of -2. To make these charges cancel out to equal 0, the oxidation number of nickel [Ni] must be +3: $3 - 1 - 2 = 0$.

QUESTION NO: 15

255 feet of fencing is needed to enclose a rectangular-shaped back yard. If the yard is 32 feet wide, what is the length?

- A. 121 ft
- B. 36.56 ft
- C. 95.5 ft
- D. 0.521 ft

ANSWER: C**Explanation:**

The perimeter of a rectangle can be calculated by using the following equation:

$P = 2L + 2W$, where P = perimeter, L = length, W = width

$P = 2L + 2W$

$$255 = 2L + 2 \times 32$$

$$255 - 64 = 2L$$

$$191 = 2L$$

$$L = 95.5 \text{ ft}$$