USMLE-STEP-1 Q&As

United States Medical Licensing Step 1

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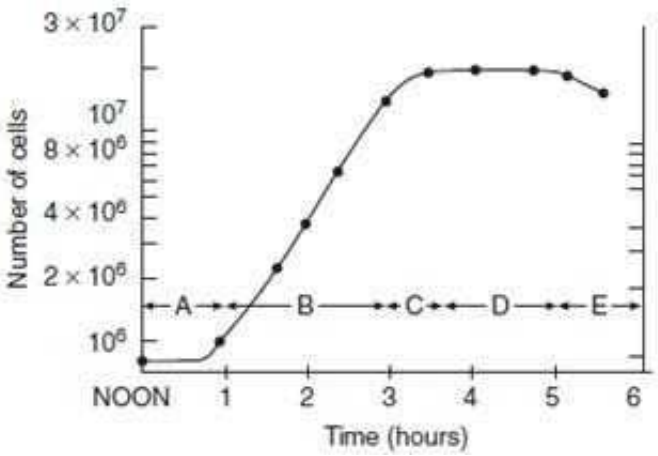
QUESTION 1

After isolating a pathogen from a patient, you monitor its growth in rich medium. According to below figure the rate of growth of the bacterial culture for which it was obtained reaches its maximum rate of growth between which of the following time periods?



A. noon and 1:00 p.m.

B. 2:00 p.m. and 3:00 p.m.

C. 3:00 p.m. and 4:00 p.m.

D. 3:00 p.m. and 5:00 p.m.

E. 4:00 p.m. and 5:00 p.m.

Correct Answer: B

Section: Microbiology/Immunology By definition, the rate of growth of bacteria represents the change in the bacterial cell numbers over the change in time. From the choices given, the maximum rate of growth occurs between 2 p.m. and 3 p.m., where within 1 hour the number of bacteria has increased approximately threefold. Between noon and 1 p.m., 34 p.m., and 35 p.m., there is no increase in the number of cells and the rate of growth is zero.

$$\frac{2 \times 10^7 - 2 \times 10^7}{5 - 4} = 0$$

QUESTION 2

The parents of a 1-year-old boy are alarmed at the increasing frequency of their child biting his lips and finger tips. In addition, on several occasions they have noticed what appear to be particles of "orange sand" in their son\\'s diapers. They report to their pediatrician that they believe their child is delayed in acquiring motor skills such as holding up his head and sitting unaided. Clinical tests performed on serum and urine indicate a threefold increase in serum uric acid and a tenfold elevation in the urinary ratio of uric acid to creatinine. These findings are suggestive of which of the following disorders?

A. adenosine deaminase deficiency

B. adenylosuccinate lyase deficiency

C. Lesch-Nyhan disease

D. purine nucleotide phosphorylase deficiency

E. orotic aciduria

Correct Answer: C

Section: Biochemistry Deficiencies in the purine nucleotide salvage enzyme, HGPRT, cause three overlapping clinical syndromes. The most severe deficiency (patients having less than 1.5% residual enzyme activity) results in debilitating neurologic disability, overproduciton of uric acid, and behavioral abnormalities that include impulsive and self-injurious activities such as biting finger tips and lips. This severe form of HGPRT deficiency is referred to as Lesch-Nyhan disease. The overproduction of uric acid leads to symptoms of gout and the appearance of "orange sand" in the urine. Deficiencies in ADA (choice A), another purine nucleotide salvage enzyme, are the cause of severe-combined immunodeficiency syndrome, SCID. SCID is characterized by a lack of both cell-mediated and humoral immunity. ADSL (choice B) is an enzyme in the pathway of de novo purine nucleotide synthesis. It is also an important component of the purine nucleotide cycle (see below figure). Deficiencies in ADSLcause psychomotor retardation, epileptic seizures, growth retardation, and muscle wasting. Deficiencies in PNP (choice D) result in a form of immunodeficiency characterized by defective cell-mediated responses. Afflicted individuals may also have normal, hyperactive, or reduced humoral immunity. Orotic aciduria is caused by deficiencies in the de novo pathway of pyrimidine nucleotide synthesis. Adeficiency in either of the last two enzymes in the pathway, orotate phosphoribosyltransferase or OMP decarboxylase, leads to orotic aciduria.

QUESTION 3

A 32-year-old man presents with diarrhea and symptoms of peptic ulcer disease. Endoscopy reveals two ulcers, one in the first portion of the duodenum and one in the midduodenum. However, they do not respond to the usual peptic ulcer treatment programs. The most likely explanation for the findings in this patient is which of the following?

A. antibodies to intrinsic factor

B. ectopic hypersecretion of gastrin

C. gastric mucosal atrophy

D. pressure ulceration from bezoars

E. vascular abnormality

Correct Answer: B

Section: Pathology and Path physiology Peptic ulcerations seen in ZollingerEllison syndrome are due to ectopic hypersecretion of gastrin. An islet cell tumor of the pancreas is the most frequent ectopic site. Antibodies to intrinsic factor (choice A) are seen with pernicious anemia and usually cause gastric mucosal atrophy and metaplasia. Gastric mucosal hypertrophy, not atrophy (choice C), is the expected result with an increased secretion of gastrin as is seen with ZollingerEllison syndrome. Pressure ulceration from bezoars (choice D) and vascular abnormalities (choice E) are not the etiology of the peptic ulcerations seen with Zollinger Ellison syndrome.

QUESTION 4

Which of the following statements concerning muscle spindles is correct?

A. Activation of type Ia sensory fibers from a given spindle leads to inhibition of the muscle in which that spindle is located.

B. Alpha motoneurons synapse directly with intrafusal muscle fibers.

C. Each intrafusal fiber is innervated by two different gamma motoneurons.

D. Only one type of intrafusal muscle fiber (cell) is present in most muscle spindles.

E. Type Ia sensory fibers from a spindle form direct synaptic contact with alpha motoneurons in the spinal cord.

Correct Answer: E

Section: Anatomy The type Ia sensory fibers from a spindle form direct excitatory synapses with alpha motoneurons. Activation of type Ia sensory fibers (choice A) leads to excitation of the muscle in which that spindle is located. Alpha motoneurons (choice B) synapse with extrafusal muscle fibers, whereas gamma motoneurons synapse with intrafusal muscle fibers. Each intrafusal muscle fiber (choice C) is innervated by only one gamma motoneuron. Each muscle spindle contains a mixture of both nuclear bag and nuclear chain intrafusal fibers, not just one type as indicated in choice D.

QUESTION 5

What would be the appearance of invasives C. albicans in a Gram-stained abnormal vaginal smear?

A. arthrospores-alternating filled and empty

B. branching mycelia

C. budding yeast cells and hyphae

D. endosporulating spherules

E. single yeast cells

Correct Answer: C

Section: Microbiology/Immunology Candida species are considered to be opportunistic microorganisms. They are normal or usual members of the skin, mucus membranes, and the GI tract. The risk of endogenous opportunistic infection is ever-present. In culture or tissue, candida species grow as oval, budding yeast cells (36 m) which stain blue in the Gram-stain procedure. They also form pseudohyphae when the buds grow, but fail to detach. C. albicans is dimorphic, being also able to produce true hyphae. Diagnostically, C. albicans will begin to form true hyphae (germ tubes) in serum at 37°C in the la boratory. With these characteristics in mind, choice C is correct. Alternating filled and empty arthrospores (choice A) is characteristic of coccidioides. Branching mycelia (choice B) is a general characteristic seen in any mold colony on agar and is not specific for candida. Endosporulating spherules (choice D) are also seen in tissue with coccidioides. Single yeast cells (choice E) may be occasionally seen with candida, but most candida spores will be associated with buds and pseudohyphae.