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QUESTION 1

You are the primary care physician for a young female college student. She has been engaged over the past 3 months in a vigorous aerobic exercise training regime that includes a significant amount of running in a hot environment. You measure her hematocrit as part of a general physical examination. Her hematocrit could well be abnormal even though she is not anemic. Which of the following choices best fits this profile?

	Total circulating erythrocyte mass	Total plasma volume	Hematocrit
(A)	Decreased	Decreased	Decreased
(B)	Increased	Decreased	Decreased
(C)	Increased	Decreased	Increased
(D)	Unchanged	Decreased	Decreased
(E)	Unchanged	Increased	Decreased

- A. Option A
- B. Option B
- C. Option C
- D. Option D
- E. Option E

Correct Answer: E

Section: Physiology The central points of this question concern the definitions of hematocrit and anemia. Hematocrit is the proportion of blood that is packed cells. The hematocrit reading will be decreased by anything that lowers the number of cells, as well as by anything that increases the volume of plasma. Anemia refers to a condition in which the total circulating erythrocyte mass has decreased. In this student, a long-term regime of exercise in a warm environment has chronically increased her plasma volume, hence her hematocrit is low. However, since her total red blood cell mass is normal, there is no anemia. Choice E is correct. It is common to see a chronic increase in plasma volume develop in response to long-term exercise in a warm environment. Exercising in a warm environment places demands on the circulatory system, which must perfuse working muscles as well as skin capillary beds (to facilitate heat loss). In addition, volume is lost to sweating. Increased plasma volume helps the body meet these demands. In choice A, hematocrit could be low if erythrocyte mass decreased more than blood volume. However, this profile does not fit the question because this individual would be anemic, since erythrocyte mass is low. Choice B could not be correct since decreased plasma volume and increased red cell mass cause increased hematocrit. In choice C, the patient would not be anemic and hematocrit would be increased. However, this is not the best response since, as described above, in an individual exercising in a warm environment the hematocrit is often decreased and plasma volume is usually increased. In choice D, hematocrit would have to be increased.

QUESTION 2

A failure of the truncus conus septum to follow a spiral course results in which of the following conditions?

- A. common atrium
- B. persistent atrioventricular canal

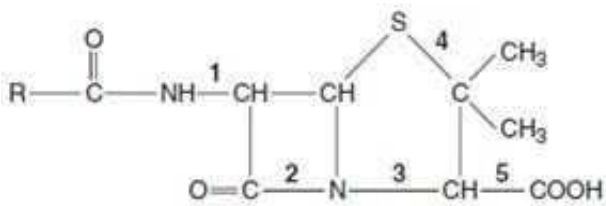
- C. persistent truncus arteriosus
- D. Tetralogy of Fallot
- E. transposition of the great vessels

Correct Answer: E

Section: Anatomy Transposition of the great vessels occurs when the truncocoanal ridges fail to spiral as they divide the outflow tract into two channels. This produces two totally independent circulatory loops with the right ventricle feeding into the aorta and the left ventricle feeding into the pulmonary artery. Common atrium (choice A) results from a complete failure of the septum primum and septum secundum to form. Persistent atrioventricular canal (choice B) results from a failure of the endocardial cushions to fuse and partition the atrioventricular canal into a right and left component. It is accompanied by defects of the atrial and ventricular septa. Persistent truncus arteriosus (choice C) results from a total failure of the truncocoanal ridges to develop and partition the outflow tract of the developing heart. Tetralogy of Fallot (choice D) is a related group of defects with the primary malformation being an unequal division of the outflow tract, resulting in pulmonary stenosis. The other features of tetralogy are an interventricular septal defect, an overriding aorta, and right ventricular hypertrophy. Survival of the infant depends on the maintenance of a patent ductus arteriosus.

QUESTION 3

Two days following surgery to repair a defective valve, a patient developed an acute infection caused by a penicillin-resistant strain of *S. aureus*. below figure shows the penicillin molecule. Which numbered bond in the structure is the site of action of penicillinase?



- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

Correct Answer: B

Section: Microbiology/Immunology An important part of the penicillin molecule is the beta-lactam group. This group is composed of two carbon and two hydrogen atoms at the top of the group. The bottom part of the group contains one carbon, which is linked to one nitrogen atom and one oxygen atom. Penicillinase breaks the bond between the bottom carbon and nitrogen atom, and destroys the antibacterial activity of penicillin, along with that of cephalosporin, which also possesses a beta-lactam group.

QUESTION 4

A premature female infant is born about 24 weeks after fertilization and develops rapid, labored breathing shortly after birth. She is immediately transferred to intensive care where she is diagnosed with hyaline membrane disease (HMD). Which of the following is most likely deficient in the infant?

- A. alveolar ducts
- B. lung surfactant
- C. terminal saccules
- D. type I alveolar cells
- E. type II alveolar cells

Correct Answer: D

Section: Anatomy HMD is also known as respiratory distress syndrome, which is most often caused by the lack of lung surfactant, due to a premature birth. Lung surfactant production begins around 20 weeks after fertilization. But it is present only in small amounts until the last 2 weeks before birth when its amount increases significantly. Alveolar ducts (choice A) branch from the respiratory bronchioles during development. Type I alveolar cells (choice D) or pneumocytes are squamous epithelial cells, which participate in gas exchange. These epithelial cells line the terminal saccules (choice C). Type II alveolar cells (choice E) synthesize surfactant.

QUESTION 5

Which of the following is a normal sexual function?

- A. anorgasmia
- B. dyspareunia
- C. masturbation
- D. pedophilia

Correct Answer: C

Section: Behavioral Science and Biostatistics Masturbation is virtually universal among men and women of all cultures. It is common among married as well as single people. Many sex therapists recommend self-stimulation as an auxiliary treatment technique for a variety of sexual dysfunctions. Choices A, B, and D are sexual dysfunctions.

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