December 2021: Kaplan MCAT stumpers put pre-meds to the test

DEC 9, 2021

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If you’re preparing for the Medical College Admission Test (MCAT), you will want to consult the experts. These selections from Kaplan’s MCAT Question of the Day series can help you sharpen your skills as you prepare to begin your potential journey into medical training.

The questions below come from three of the four MCAT sections—biological and biochemical foundations of living systems; chemical and physical foundations of biological systems; and psychological, social, and biological foundations of behavior. A fourth section, critical analysis and reasoning skills (commonly referred to as CARS), is based largely on inference. Medicine can be a career that is both challenging and highly rewarding but figuring out a medical school’s prerequisites and navigating the application process can be a challenge unto itself. For students preparing for medical school, the?AMA pre-med glossary guide?has the answers to frequently asked questions.

Section: Biological and biochemical foundations of living systems

Question: The iron atom in hemoglobin can bind to six different atoms. One of those atoms is a nitrogen atom in histidine, whose side chain:

A. is an aromatic heterocycle.

B. is acidic.

C. is a nonaromatic hydrocarbon.

D. contains a sulfur atom.
The correct answer is A

Kaplan explains why: This question asks about the side chain of histidine. That side chain is an aromatic ring that contains two nitrogen atoms, which matches answer choice B.

Only glutamic acid and aspartic acid fit B, while D applies only to cysteine and methionine. A number of amino acids have non-aromatic hydrocarbon side chains, but histidine isn’t one of them.

Section: Chemical and physical foundations of biological systems

Question: For the following skeletal reaction, what is the coefficient for sulfur dioxide?

\[\text{CuFeS}_2(s) + \text{O}_2(g) \rightarrow \text{Cu}_2\text{S}(s) + \text{Fe}_3\text{O}_4(s) + \text{SO}_2(g)\]

A. 3
The correct answer is D.

Kaplan explains why: When balancing equations, you should start with the element that appears in the least number of species. Copper (Cu) appears the least, so balance that first. We have two coppers on the right and one copper on the left. So, we place a 2 in front of the copper-containing compound on the left. So, we have:

\[ 2\text{CuFeS}_2(\text{s}) + ? \text{O}_2(\text{g}) \rightarrow 1\text{Cu}_2\text{S}(\text{s}) + ? \text{Fe}_3\text{O}_4(\text{s}) + ? \text{SO}_2(\text{g}) \]

Now, let's move on to iron. We are going to have to adjust the coefficients we just found, since the copper-containing species on the left also contains iron. We have three irons on the right and two irons on the left. The least common multiple of 2 and 3 is 6, so replace the 2 in front of the copper iron sulfide with a 6, replace the 1 in front of copper sulfide with a 3, and place a 2 in front of the iron oxide.
Now you have:

$$6 \text{CuFeS}_2 (s) + ? \text{O}_2(g) \rightarrow 3\text{Cu}_2\text{S}(s) + 2\text{Fe}_3\text{O}_4(s) + ? \text{SO}_2 (g)$$

The next step is to balance the number of sulfur atoms on each side of the equation. There are 12 sulfur atoms from the copper iron sulfide, and three are used to make copper sulfide. Therefore, nine must remain for the sulfur dioxide. Check to see that this works for the number of oxygen atoms, and you'll find that the balanced equation is:

$$6\text{CuFeS}_2(s) + 13\text{O}_2(g) \rightarrow 3\text{Cu}_2\text{S(s)} + 2 \text{Fe}_3\text{O}_4 + 9 \text{SO}_2(g)$$

Therefore, the coefficient of sulfur dioxide is 9 and the answer is D.

**Section: Psychological, social and biological foundations of behavior**

**Question:** Which of the following sleeping disorders is associated with loss of muscle tone, and suddenly falling asleep in response to an emotional trigger?

A. Narcolepsy  
B. Insomnia  
C. Sleep apnea  
D. Parasomnias
The correct answer is A.

**Kaplan explains why**: The correct answer is narcolepsy, choice A, which is also associated with cataplexy, a sudden loss of muscle tone and intrusion of REM sleep while awake in response to a stressful trigger. Narcolepsy is also associated with sleep paralysis. Insomnia, choice B, is inability to fall asleep. Sleep apnea, choice C, is another sleep disorder in which breathing stops and starts while asleep, and is associated with fatigue. Parasomnias, choice D, is a category of sleep disorders that includes night terrors and sleepwalking (somnambulism).