

January 2022: Kaplan MCAT stumpers put pre-meds to the test

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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 rate of a reaction catalyzed by enzyme A, which has a K_m value of $4 \times 10^{-5} M$ and V_{max} of 30 mmol/min, is 15 mmol/min. Which of the following would most likely be the substrate concentration?

- A. $2 \times 10^{-5} M$
- B. $4 \times 10^{-5} M$
- C. $8 \times 10^{-5} M$

D. $1.6 \times 10^{24} M$

The correct answer is B.

Kaplan explains why: In the reaction catalyzed by enzyme A, the rate of the reaction (15 mmol/min) is half of V_{\max} (30 mmol/min). When the reaction rate is exactly half the maximum rate or V_{\max} , the substrate concentration is equal to the Michaelis constant K_m . Since the K_m value is $4 \times 10^{25} M$, the substrate concentration would also be $4 \times 10^{25} M$. **Choice B** is correct.

Section: Chemical and physical foundations of biological systems

Question: Which of the following statements is true regarding the relative boiling points of *cis*- and *trans*-1,2-dichloroethene?

A. The boiling point of the *cis* isomer is higher because it has a net dipole moment.

- B. The boiling point of the *cis* isomer is higher because it is thermodynamically more stable.
- C. The boiling point of the *trans* isomer is higher because the electrons are more delocalized.
- D. The boiling point of the *trans* isomer is higher because it is more symmetrical.

The correct answer is A.

Kaplan explains why: Since each geometric isomer, *cis* and *trans*, has the same molecular weight, this question is really about intermolecular forces and their effects on boiling point. For the *cis* isomer, the dipole moments of the two C-Cl bonds do not directly oppose one another (as they do in the *trans* configuration).

As such, the *cis* isomer will have a permanent dipole moment, whereas the *trans* counterpart will not (the two bond dipoles are negated due to the symmetry of the *trans* molecule). Knowing this, **choice A** must be the correct answer-the asymmetry of the bond dipoles present in the *cis* isomer leads to a net molecular dipole moment. This molecular dipole allows stronger intermolecular forces to prevail, thereby necessitating a higher boiling point. **Choice A** is the correct answer.

Choice B: Distortion. The boiling point has nothing to do with thermodynamic stability.

Choice C: Distortion. The boiling point of the *trans* isomer is lower than the *cis* isomer due to the cancellation of its dipole moments.

Choice D: Distortion. The boiling point of the *trans* isomer is lower than the *cis* isomer due to the cancellation of its dipole moments.

Section: Psychological, social and biological foundations of behavior

Question: The area of the brain primarily responsible for language comprehension is:

- A. Broca's area.
- B. The organ of Corti.
- C. Wernicke's area.
- D. The occipital lobe

The correct answer is C.

Kaplan explains why: Wernicke's area, located in the temporal lobe, is the region of the brain concerned with the comprehension of language. Thus **choice C** is the correct answer. Broca's area, **choice A** is often associated with Wernicke's area (and language); however, Broca's area is primarily responsible for speech production.

The organ of Corti, **choice B**, is the structure in the cochlea that produces nerve impulses in response to sound vibrations, and so while it does play a part in language comprehension, it is not an "area of the brain." Finally, the occipital lobe, **choice D**, is associated with vision.