MCAT-TEST Q&As

Medical College Admission Test: Verbal Reasoning, Biological Sciences, Physical Sciences, Writing Sample

Pass MCAT MCAT-TEST Exam with 100% Guarantee

Free Download Real Questions & Answers **PDF** and **VCE** file from:

https://www.geekcert.com/mcat-test.html

100% Passing Guarantee
100% Money Back Assurance

Following Questions and Answers are all new published by MCAT Official Exam Center

- **Instant Download** After Purchase
- **100% Money Back** Guarantee
- **365 Days** Free Update
- **800,000+** Satisfied Customers

QUESTION 1

Many nutrients required by plants exist in soil as basic cations:

$Mg^{2+}, Mn^{2}, and\ Ca^{2}.$

A soil\\'s cation-exchange capacity is a measure of its ability to adsorb these basic cations as well as exchangeable hydrogen and aluminum ions. The cation-exchange capacity of soil is derived from two sources: small clay particles called micelles consisting of alternating layers of alumina and silica crystals, and organic colloids.

$A1^{3+}$

Replacement of + and + by other cations of lower valence creates a net negative charge within the inner layers of the micelles. This is called the soil\\'s permanent charge. For example, replacement of an atom of aluminum by calcium within a section where the net charge was previously zero, as shown below, produces a net charge of ?, to which other cations can become adsorbed.

$\boxed{O^{2-}A1^{3+}OH^{-}} \rightarrow \boxed{O^{2-}CA^{2+}OH^{-}}$

Figure 1

A pH-dependent charge develops when hydrogen dissociates from hydroxyl moieties on the outer surfaces of the clay micelles. This leaves negatively-charged oxygen atoms to which basic cations may adsorb. Likewise, a large pH-

dependent charge develops when hydrogen dissociates from carboxylic acids and phenols in organic matter.

In most clays, permanent charges brought about by substitution account for anywhere from half to nearly all of the total cation-exchange capacity. Soils very high in organic matter contain primarily pH-dependent charges. In a research study,

three samples of soil were leached with a 1 N solution of neutral KCl, and the displaced A13+ and basic cations measured. The sample was then leached again with a buffered solution of BaCl2 and triethanolamine at pH 8.2, and the

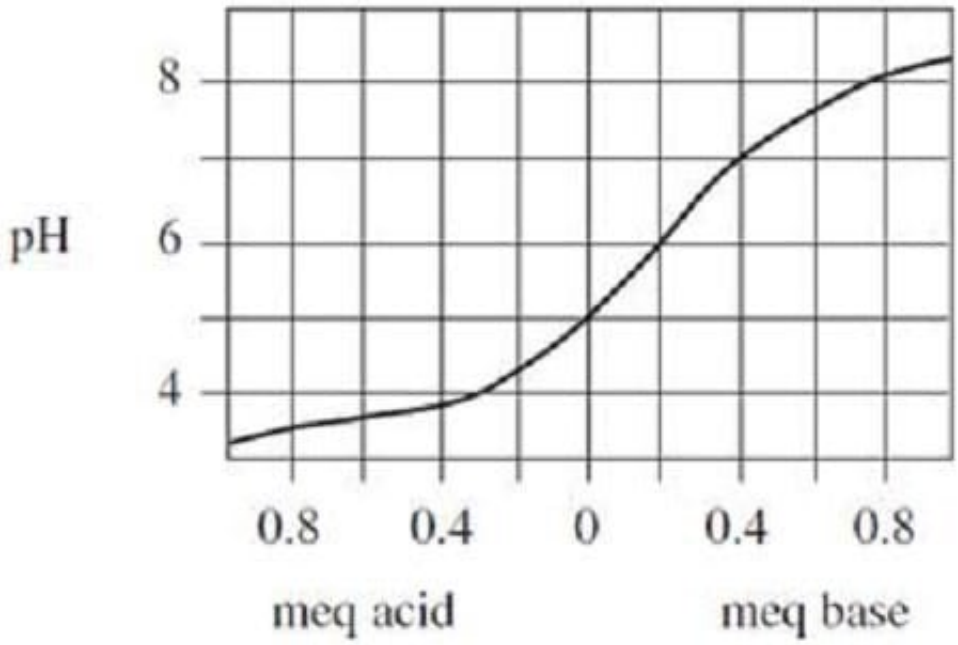
displaced H+ measured. Table 1 gives results for three soils tested by this method.

Table 1

	(meq/100 g)				Total Cation Exchange Capacity
	pH	Al^{3+}	Basic Cations	H^+	
Sample I	4.5	11.7	1.9	34.0	47.6
Sample II	5.3	1.6	16.3	19.5	37.4
Sample III	6.0	0.5	9.8	7.8	18.1

Due to the buffering effect of the soil\\'s cation exchange capacity, just measuring the soil solution\\'s pH will not indicate how much base is needed to change the soil pH. In another experiment, measured amounts of acid and base were added to 10-gram samples of well-mixed soil that had been collected from various locations in a field. The volumes of the samples were equalized by adding water. The results were recorded in Figure 2.

Figure 2.



The amount of soil on a particular one-acre field down to a depth of one furrow slice weighs 9 ?105 kilograms. Based on Figure 2, how many kilograms of CaCO3 would have to be added to this field to raise the pH from 5 to 6?

A. 900 kg
B. 1800 kg
C. 9×10^5 kg
D. 1.8 × 106 kg

A. Option A

B. Option B

C. Option C

D. Option D

Correct Answer: A

Beginning at pH 5, the graph tells you how much of a change in pH is produced by adding a given number of milliequivalents of acid or base to 10 grams of soil. You can see by examining the graph that 0.2 milliequivalents of base would raise the pH of the sample from 5 to 6. Since one equivalent equals a thousand milliequivalents, and one kilogram equals a thousand grams, you can convert this ratio from 0.2 milliequivalents per 10 grams, to 0.2 equivalents per 10 kilograms, or

0.02 equivalents per one kilogram. Since one mole of carbonate can take up two moles of hydrogen ions, a mole of calcium carbonate acts as two equivalents of base. Remember that as the concentration of hydrogen ions goes down, the pH of the solution goes up. The molecular weight of calcium carbonate is 100, so 100 grams of calcium carbonate will provide 2 equivalents of base. We have determined that you need 0.02 equivalents of calcium per kg of soil. Since 2 equivalents are provided by 100 grams of calcium carbonate, 0.02 equivalents are provided by 1 gram. So you need 1 gram of calcium carbonate for each kilogram of soil in the acre furrow slice. This comes to 9 105 grams of calcium carbonate, or 900 kilograms, choice A.

QUESTION 2

Which of the following functional groups are NOT found on the side chains of any of the naturally occurring amino acids?

A. Hydroxyl

B. Methyl

C. Carboxylic acid

D. Aldehyde

Correct Answer: D

Aldehydes do not occur in the 20 amino acids found in naturally occurring proteins. Choice A is incorrect because the hydroxyl group is found on serine and threonine. Choice B is incorrect because the methyl group is found on alanine and a

number of other nonpolar amino acids.

Choice C is incorrect because the carboxylic acid functionality is found on the side chain of aspartic acid and glutamic acid.

QUESTION 3

Muzak, the intentionally unobtrusive music that most people associate with elevators and dentists\\' waiting rooms, represents the paradoxical success story of a product designed to be ignored. Although few people admit to enjoying its blandly melodic sounds, Muzak reaches over 100 million listeners in 14 countries and has played in the White House, the Apollo lunar spacecraft, and countless supermarkets, offices, and factories. This odd combination of criticism and widespread acceptance is not surprising, however, when one considers that Muzak is not created for the enjoyment of its listeners: rather, its purpose is to modify physiological and psychological aspects of an environment.

In the workplace, Muzak is credited with increasing both productivity and profitability. Research into the relationship between music and productivity can be traced to the earliest days of the Muzak Corporation. Developed by a military officer in 1922 as a way of transmitting music through electrical wires, Muzak blossomed in the 1930\\'s following a study which reported that people work harder when they listen to certain kinds of music. Impressed by these findings, the BBC began to broadcast music in English munitions factories during World War II in an effort to combat fatigue. When workers assembling weapons increased their output by 6 percent, the U.S. War Production Board contracted the Muzak Corporation to provide uplifting music to American factories. Today, the corporation broadcasts its "Environmental Music" to countless businesses and institutions throughout the world. And while most people claim to dislike Muzak\\'s discreet cadences, it seems to positively influence both productivity and job satisfaction.

Researchers speculate that listening to Muzak and other soft music improves morale and reduces stress by modifying our physiology. Physiological changes such as lowered heart rate and decreased blood pressure have been documented in hospital studies testing the effect of calming music on cardiac patients. In addition, certain kinds of music seem to effect one\\'s sense of emotional, as well as physical, well being. It is just this sort of satisfaction which is thought to result in increased performance in the workplace. In a study of people performing repetitive clerical tasks, those who listened to music performed more accurately and quickly than those who worked in silence; those who listened to Muzak did better still. Moreover, while Muzak was conceived as a tool for productivity, it also seems to influence a business\\' profitability. In an experiment in which supermarket shoppers shopped to the mellow sounds of Muzak, sales were increased by as much as 12 percent. What makes Muzak unique is a formula by which familiar tunes are modified and programmed. Careful instrumentation adds to an overall sound that is neither monotonous nor rousing. But it is the precisely timed programming that separates Muzak from other "easy listening" formats. At the core of the programming is the concept of the "Stimulus Progression". Muzak programs are divided into quarter-hour groupings of songs, and are specifically planned for the time of day at which they will be heard. Each composition is assigned a mood rating between 1 and 6 called a stimulus value; a song with a rating of 2, for example, is slower and less invigorating than one with a value of 5. Approximately six compositions with ascending stimulus values play during any given quarter hour; each 15-minute segment ends in silence. Each segment of a 24-hour program is carefully planned. Segments that are considered more stimulating air at 11 a.m. and 3 p.m. (the times when workers typically tire), while more soothing segments play just after lunchtime and towards the end of the day, when workers are likely to be restless.

From the point of view of management, then, Muzak is a useful tool in the effort to maximize both productivity and profits. However, some people object to its presence, labeling it as a type of unregulated air pollution. Still others see it as an Orwellian nightmare, a manipulation of the subconscious. But Muzak\\'s effectiveness seems to lie in the fact that most people never really listen to it. While it may be true that no one actually likes this carefully crafted aural atmosphere, many simply ignore it, allowing its forgettable sounds to soften the contours of the day.

According to the passage, Muzak differs from other "easy listening" formats in that Muzak:

I. produces measurable health benefits.

II. improves workers\\' job performances.

III.

is programmed in order to effect behavioral changes.

A.

I only

B.

II only

C.

III only

D.

II and III only.

Correct Answer: C

This asks how Muzak differs from other easy listening formats. The first sentence of the third paragraph states that listening to Muzak and other soft music may produce health benefits. Since the passage states that soft music in general, and not Muzak in particular, seems to positively influence health, option I is not a distinction between Muzak and other "easy listening" formats. In that same paragraph the author claims that people who listened to Muzak and those who listened to other forms of music performed better in their jobs than those who worked in silence. Therefore, option II is also not distinctive of Muzak. However, the fourth paragraph describes how Muzak, unlike other easy listening formats, is carefully programmed to effect behavioral changes. Since III is the only option which describes how Muzak is different from other easy listening formats, the answer is choice (C), III only.

QUESTION 4

An example of discontinuous variation is reflected by:

A. height.

B. intelligence.

C. blood group.

D. weight.

Correct Answer: C

QUESTION 5

Noncompetitive inhibition differs from uncompetitive inhibition in that a noncompetitive inhibitor binds to an allosteric site on the enzyme and prevents it from catalyzing a reaction, whereas uncompetitive inhibitors bind to the enzyme-substrate complex and prevent catalysis. Increasing the substrate concentration would have which of the following effects?

A. Increasing impact of uncompetitive inhibitor and decreasing concentration of noncompetitive inhibitor

B. Decreasing impact of uncompetitive inhibitor and increasing impact of noncompetitive inhibitor.

C. Increasing impact of uncompetitive inhibitor

D. No effect

Correct Answer: C

As substrate concentration increases, there will be more binding between the substrate and the enzyme. More enzyme-substrate complex in solution means more opportunity for an uncompetitive inhibitor to bind. Thus, as substrate concentration increases, the impact of an uncompetitive inhibitor would be expected to increase.

A: The concentration of a noncompetitive inhibitor isn\\'t changed by changing the substrate concentration. B, D: As discussed above, the impact of an uncompetitive inhibitor would be increased.