1610 Questions: Passage-based and 'discretes' structured like the real exam!

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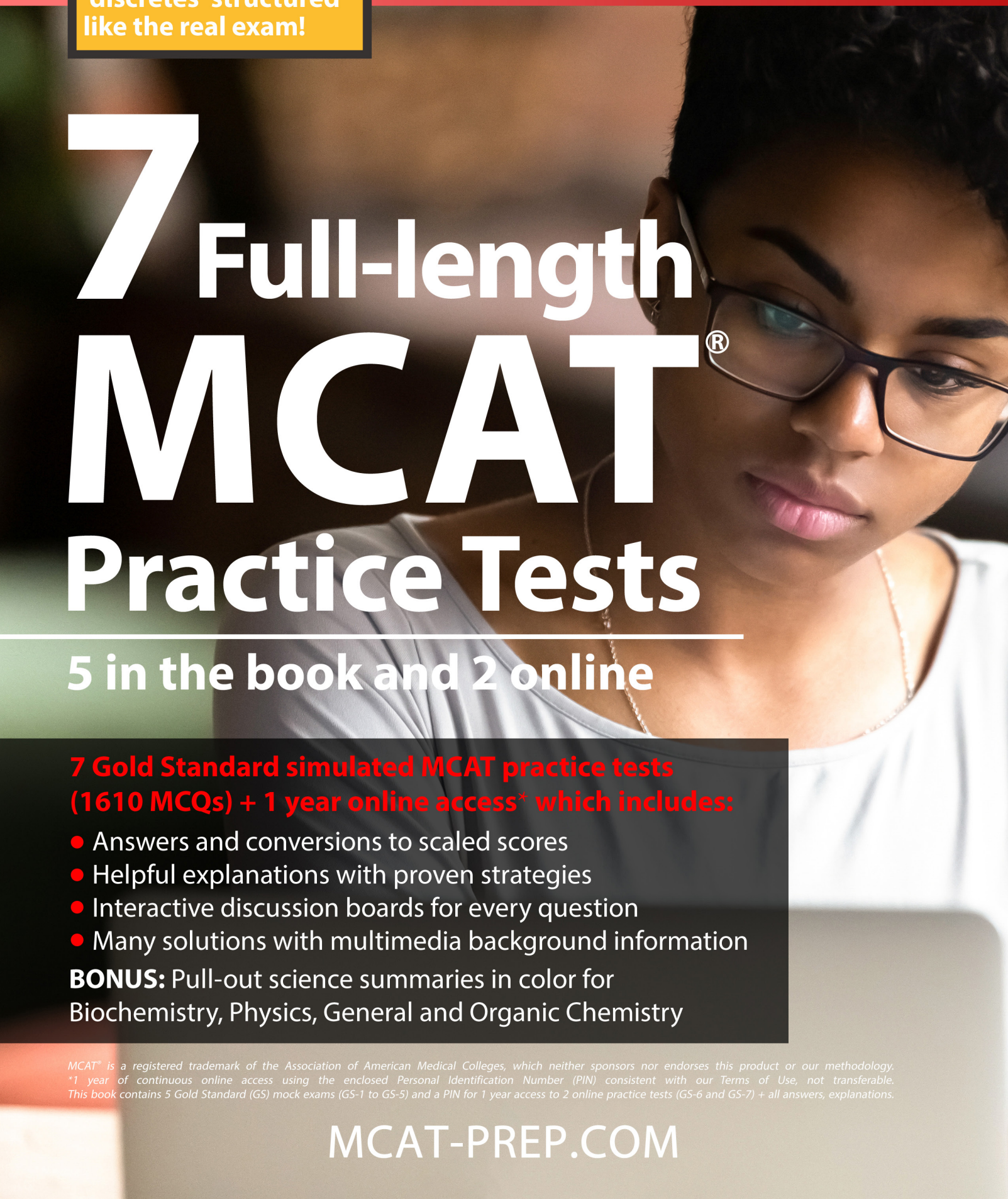

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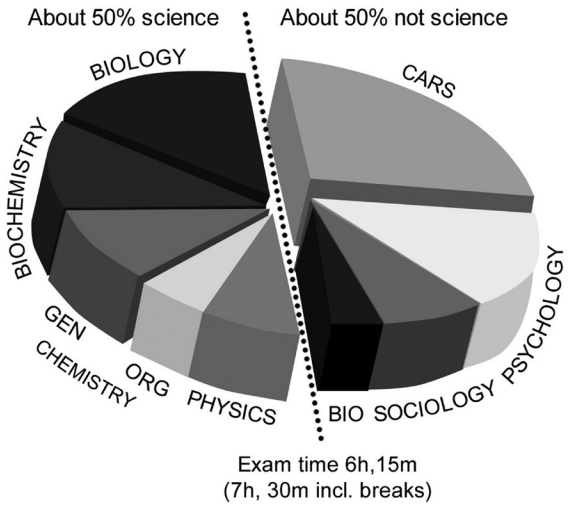
How is the real MCAT scored?

When you take the real MCAT, the AAMC will access your raw scores which are based on the number of correct answers in each section (note: *there is no penalty for wrong answers*). Your raw scores from each of the 4 sections of the MCAT will then be converted to scaled scores which are the only scores that interest medical school admissions committees. You will receive five scores for the MCAT: one for each of the four sections scored from a low of 118 to a high of 132, with a midpoint of 125; and one combined total score which will range from 472 to 528, with a midpoint of 500.

MCAT Scores



Exam time 6h,15m
(7h, 30m incl. breaks)

What is an average, good and high MCAT score?

Average, good and high MCAT scores are relative terms and, as such, are dependent on perspective, the cohort and the medical school to which you intend to apply. There is no pass or fail score for the MCAT, there are only scores that are acceptable for specific, individual medical schools. Consider consulting specific medical schools, or their websites or aamc.org, for past trends.

Please keep in mind that the percentile rank indicates your test performance relative to all the students who sat the same test on the same day. It records the percentage of students whose scores were lower than yours.

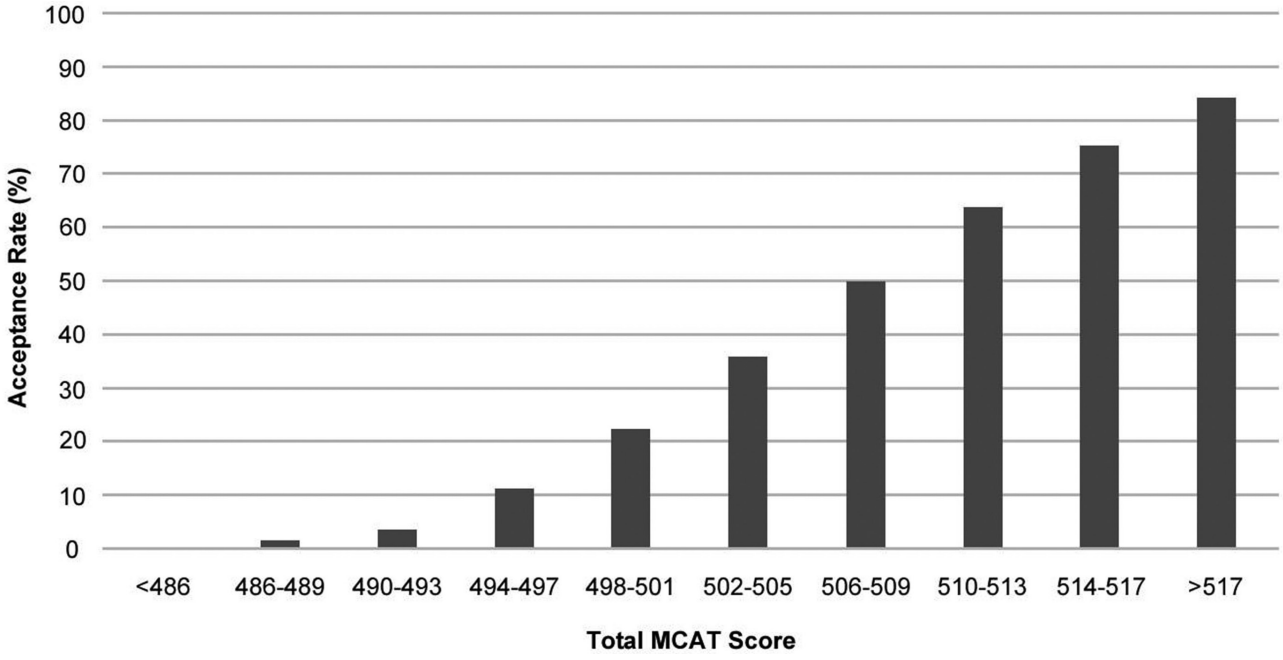
	Average score acceptable to some medical schools	**Average score acceptable to most medical schools**	**Average score acceptable to some Ivy League medical schools**
Qualitatively	average MCAT score	good MCAT score	high MCAT score
Percentile* rank	50th percentile	80th percentile	95th percentile
Sectional MCAT score (max. = 132)	125	128**	130**
Total MCAT score (max. = 528)	501	511**	518**

Note: the expression "average score" does not have the same meaning as cutoff or minimum score. Rather it refers to the simple average of students accepted to medical school (historic and predicted averages). Having an acceptable MCAT score in no way guarantees medical school admissions since acceptance is also contingent on GPA and non-academic factors (i.e. personal statement and/or autobiographical material, letters of reference, and the medical school interview).

* percentile does not refer to the percent, which relates to the ratio of correct answers to the total number of questions. The percentile rank records the percentage of students whose scores were lower than yours. Percentile ranks are not used as medical school admissions criteria. Only the scaled score matters for medical school admissions.

** This assumes that current percentile rank predictions for the MCAT remain stable.

Medical School Admissions Data Based on MCAT Scores for the 2017-2019 Admissions Cycles, AAMC Data (aggregated; n = 95,797)



The higher rates of admissions with higher MCAT scores is nothing new. However, it is of value to note that a score of 500 has a rate of admissions just over 20% and lesser scores may still result in admissions. Conversely, an exceptional score (above 517) does not guarantee medical school admissions.

The MCAT-prep.com online MCAT Guide has a free medical school admissions calculator to determine your chances of getting into medical school based on your GPA and MCAT score.

Is it really important to try many mock exams?

Although there are some students who believe that 'more MCAT practice is better', perhaps a more realistic expression would be: 'more effective MCAT practice is better'. There is little value to have extra full-length MCAT practice tests if you don't have the time and motivation to use them as full-length practice (which should include a careful review of answers and explanations over 1-2 days per exam).

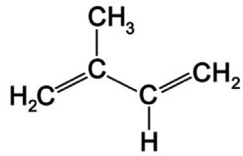
Frankly, re-taking mock exams is not usually an efficient use of time. However, taking brief, efficient notes from your MCAT practice test experience and reviewing all of those notes several times per week builds knowledge, reasoning and confidence moving forward. Choose the number of practice exams according to your needs, budget and schedule.

It's also important to note that no one company provides the perfect practice test experience. Of course, the AAMC - being the official MCAT organization - is best but other than that, there are as many opinions as learning styles. Most students with high, official MCAT scores have used a variety of reputable MCAT practice tests.

Passage 1 (Questions 1–5)

Terpenes are major biosynthetic building blocks. Steroids, for example, are derivatives of the terpene squalene and the terpenoid lanosterol. The difference between terpenes and terpenoids is that terpenes are hydrocarbons, whereas terpenoids contain additional functional groups.

Terpenes are derived biosynthetically from units of isoprene, which has the molecular formula C_5H_8. Isoprene units can be linked together "head to tail" (i.e., from one end of the longest chain to the other end from another molecule) to form linear chains, or they may be arranged to form rings. The isoprene unit is thus one of nature's common building blocks.



Isoprene (methylbuta-1,3-diene, a hemiterpene)

Table 1 Classification of Terpenes

Terpenes	Isoprene units
Monoterpenes	2
Sesquiterpenes	3
Diterpenes	4
Sesterterpenes	5
Triterpenes	6
Carotenoids	8

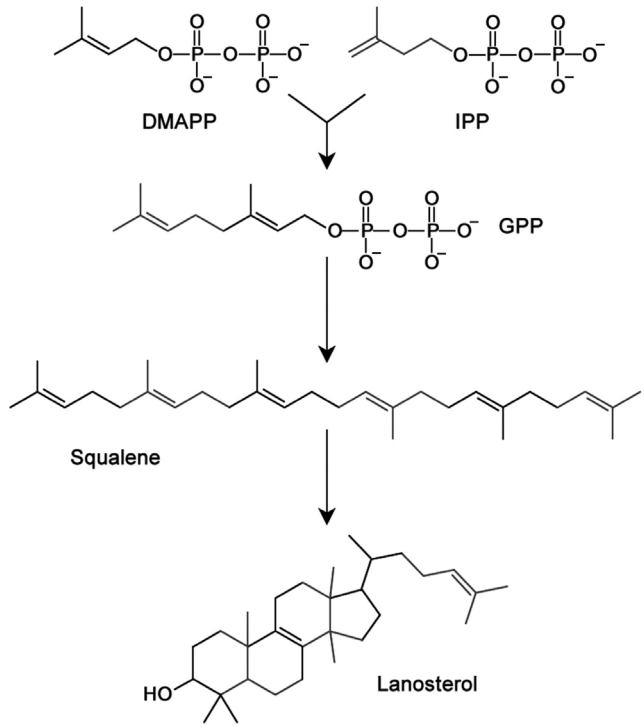
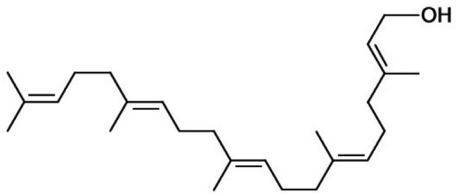


Figure 1 Summary of lanosterol synthesis with intermediates isopentenyl pyrophosphate (IPP), dimethylallyl pyrophosphate (DMAPP), geranyl pyrophosphate (GPP), and squalene shown. Some intermediates are omitted.

Question 1

Consider the structure of geranylfarnesol.

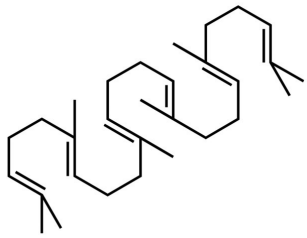


Geranylfarnesol is best classified, based on the number of carbon atoms in its structure, as which of the following?

- **A.** Sesquiterpenoid
- **B.** Diterpenoid
- **C.** Sesterterpenoid
- **D.** Triterpenoid

Question 2

Consider the following image.



The molecule above is best categorized as:

- **A.** a sesterterpene.
- **B.** a steroid.
- **C.** an all *Z* hydrocarbon.
- **D.** squalene.

Question 3

From the pathway illustrated in Figure 1, which of the following could NOT have reasonably occurred?

- **A.** The half reaction: $NADPH + H^+ \rightarrow NADP^+ + 2e^-$
- **B.** Condensation reaction
- **C.** Oxidation
- **D.** All the above could have reasonably occurred.

Question 4

How many different stereoisomers of lanosterol are possible?

- **A.** Fewer than 10
- **B.** Between 10 and 50
- **C.** Between 50 and 100
- **D.** More than 100

Question 5

The pathway in Figure 1 occurs spontaneously:

- **A.** as written.
- **B.** only if coupled with a sufficiently exergonic reaction or series of reactions.
- **C.** only if coupled with a sufficiently endergonic reaction or series of reactions.
- **D.** in conditions that cannot be determined with the information provided.

Passage 2 (Questions 6–9)

The essential stages in the manufacture of H_2SO_3 involve the burning of sulfur or roasting of sulfide ores in air to produce SO_2. This is then mixed with air, purified, and passed over a vanadium catalyst (either VO_3^- or V_2O_5) at 450 degrees Celsius. Thus, the following reaction occurs.

Reaction I

$2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) \qquad \Delta H = -197 \text{ kJ mol}^{-1}$

If the SO_2 is very carefully dissolved in water, sulfurous acid (H_2SO_3) is obtained. The first proton of this acid ionizes as if from a strong acid, while the second ionizes as if from a weak acid.

Reaction II

$H_2SO_3 + H_2O \rightarrow H_3O^+ + HSO_3^-$

Reaction III

$HSO_3^- + H_2O \leftrightarrow H_3O^+ + SO_3^{2-} \qquad K_a = 5.0 \times 10^{-6}$

The concentration of H_2SO_3 in antiseptic fluid was determined by titration with 0.10 M NaOH (strong base) as shown in Figure 1. Two equivalence points were determined using 30 ml and 60 ml of NaOH, respectively:

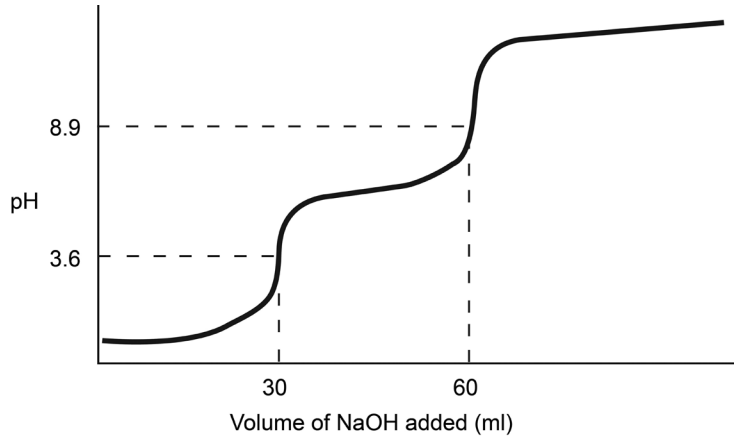


Figure 1

Question 6

What is the oxidation number of sulfur in sulfurous acid?

- ○ **A.** +3
- ○ **B.** +4
- ○ **C.** +5
- ○ **D.** +6

Question 7

What is the percent by mass of oxygen in sulfurous acid?

- ○ **A.** 31.9%
- ○ **B.** 19.7%
- ○ **C.** 39.0%
- ○ **D.** 58.5%

The kinetics of parental BL and its K_i were then investigated by generating a Lineweaver–Burk plot to determine the mode of inhibition (*see* Figure 3).

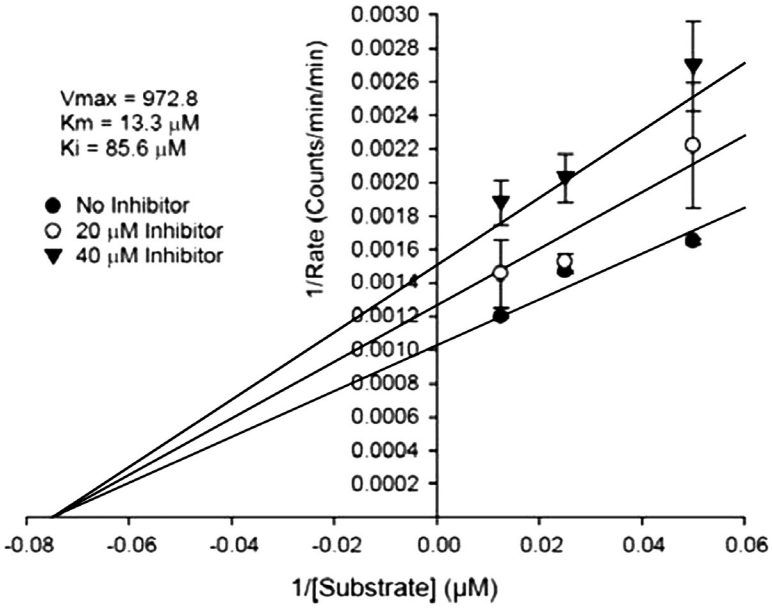


Figure 3 Lineweaver–Burk plot of the kinetics of BL

At the end of the experiment, further analyses were made to determine IC_{50}, the half-maximal inhibitory concentration.

Source: Adapted from nih.gov, PMC2749490.

Question 23

What is the optimal number of β-alanines required to achieve a potent PKA inhibitor?

- **A.** 3
- **B.** 5
- **C.** 7
- **D.** 9

Question 24

What is the method of inhibition of BL?

- **A.** Mixed
- **B.** Competitive
- **C.** Noncompetitive
- **D.** Uncompetitive

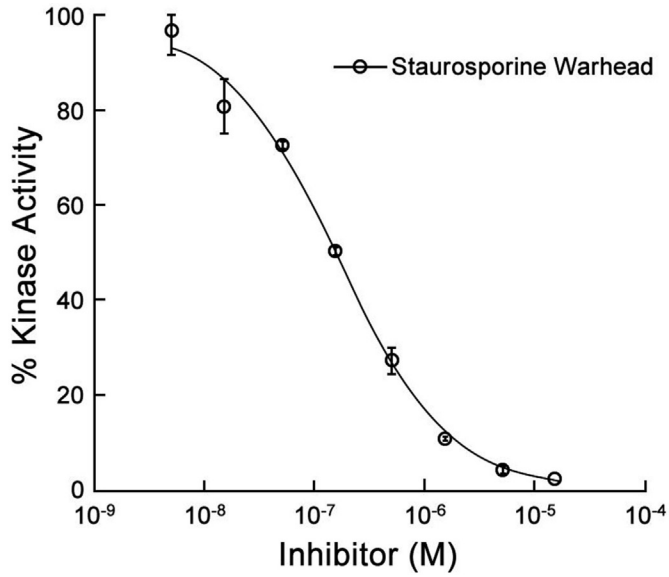
Question 25

BL binds to PKA both inside and outside the enzyme active site and inhibits the ATPase activity. The most important amino acid for the inhibitory activity is R9 (amino acid R at position 9 along the primary structure). Which of the following mutations is most likely to have the greatest effect on the inhibition of the interaction between PKA and BL?

- **A.** R9H
- **B.** R9K
- **C.** R9D
- **D.** R9G

Question 26

BL was modified further to generate a "staurosporine warhead," and the kinetics of the resulting agent were analyzed.

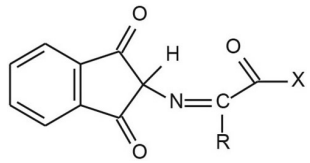


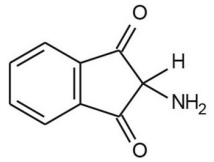
What is the approximate IC_{50} of the new compound?

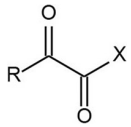
- **A.** 150 nM
- **B.** 150 pM
- **C.** 10 mM
- **D.** 100 μM

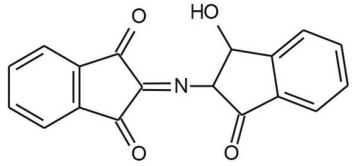
Question 36

Which of the following compounds would be isotopically labeled if $H_2{}^{18}O$ were the only isotype source in the ninhydrin reaction?

○ **A.** 

○ **B.** 

○ **C.** 

○ **D.** 

Question 37

Polypeptides sloughed off in fingerprints react with ninhydrin. Which of the following tetrapeptides would likely be most reactive with ninhydrin?

○ **A.** K-G-K-N
○ **B.** Y-V-V-T
○ **C.** H-D-E-E
○ **D.** C-C-G-C

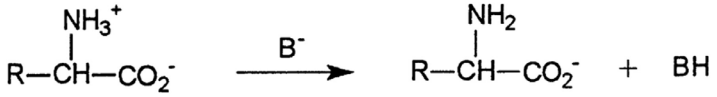
Question 38

A mixture of alanine and benzoyl chloride is treated with dilute aqueous sodium hydroxide to yield compound Q. What functional group would be present in compound Q?

○ **A.** Ester
○ **B.** Aldehyde
○ **C.** Amide
○ **D.** Ether

Question 39

Base treatment of an amino acid usually results in the conversion of the acid to a derivative via the amino-carboxylate salt.



The above procedure:

○ **A.** decreases the rate of electrophilic reaction of the free amino group.
○ **B.** decreases the rate of nucleophilic reaction of the free amino group.
○ **C.** enhances the rate of nucleophilic reaction of the free amino group.
○ **D.** enhances the rate of electrophilic reaction of the free amino group.

Passage 1 (Questions 1–5)

No one was less surprised by the news about St. John's wort than Stephen Barrett, 67, a retired psychiatrist who for nearly 30 years has made it his business to sniff out health-related frauds, fads, myths, and fallacies. Through newsletters, books, and now the World Wide Web, he has become one of America's premier debunkers of what he likes to call quackery. Barrett long ago wrote off St. John's wort as a treatment for severe depression, posting a dispassionate analysis of the evidence for and against it on his website, www.quackwatch.com, alongside similar dismissals of such nostrums as bee pollen, royal jelly, and "stabilized oxygen." His site - filled with useful links, cautionary notes and essays on treatments ranging from aromatherapy to wild-yam cream - is widely cited by doctors and medical writers and draws 100,000 hits a month. It has also made Barrett a lightning rod for herbalists, homeopaths, and assorted true believers, who regularly vilify him as dishonest, incompetent, a bully, and a Nazi.

None of these seems to daunt Barrett, who has been exposing bogus health claims since the late 1970s, when he first surveyed health-related mail-order ads in national magazines and discovered that none of them lived up to their claims. His findings spurred legislation that authorizes the federal government to levy penalties of $25,000 a day on repeat mail-order offenders. His big breakthrough - or, as he calls it, his "first Babe Ruth" - came in 1985, when he went after the hair analysis industry. He sent samples from the heads of two healthy girls to 13 laboratories that claimed they could measure nutritional needs based on a scientific analysis of an individual's hair. The reports were so off base and contradictory that his debunking report was published in the *Journal of the American Medical Association* and picked up by the national press. "It left the hair analysis industry with egg on its face," says Barrett. "Half the labs shut down."

Other Babe Ruth moments followed, none more satisfying to Barrett than the 1998 publication in *JAMA* of a report by Emily Rosa, an 11-year-old Colorado girl who for a school science project devised a simple test of therapeutic touch. It demonstrated that practitioners were unable to detect the "human energy field" on which their technique is based. Hearing of Emily's project, Barrett helped edit a report, got it published, and was rewarded with worldwide press coverage.

Barrett is underwhelmed by today's New Age celebrities. Dr. Andrew Weil, for example, is "very slick but makes glaring errors and hardly ever admits anything is quackery. I call him a 'rubber ducky.'" Deepak Chopra he dismisses as a purveyor of "Ayurvedic mumbo jumbo." (Chopra, for his part, calls Barrett "a self-appointed vigilante for the suppression of curiosity.")

Chiropractors too have felt Barrett's sting. While he sees benefits in chiropractic manipulation, he wonders about "a whole profession based on an idea - subluxations - that isn't true." He especially deplores the fact that some chiropractors claim that their manipulations can treat infectious diseases and prescribe homeopathic remedies, which he considers worthless. Barrett retired from his psychiatric practice in 1993 to devote himself full time to quackbusting. Along the way, he honed his communication skills and now considers himself an investigative journalist taking full advantage of the power of the internet. "Twenty years ago, I had trouble getting my ideas through to the media," he says. "Today, I am the media."

Source: Adapted from L. Jaroff, "The Man Who Loves to Bust Quacks." Copyright 2011 Time.

Passage 1 (Questions 1–4)

Preliminary attempts to characterize a new human protein, XBR, have suggested that it may influence the expression of specific genes, including the gene *pyx*. However, it was initially unclear whether this regulation was mediated via downstream transcription factors or direct interaction.

Experiment 1

An electrophoretic mobility shift assay was used to determine whether XBR directly interacts with *pyx* (Figure 1). Different amounts of XBR were incubated with the DNA promoter region of *pyx* and a middle section of the ampicillin resistance gene as a control. Each DNA fragment was labeled with a radioisotope, was identical in length (250 bp), and contained one promoter, as well as a transcriptional and translational start site.

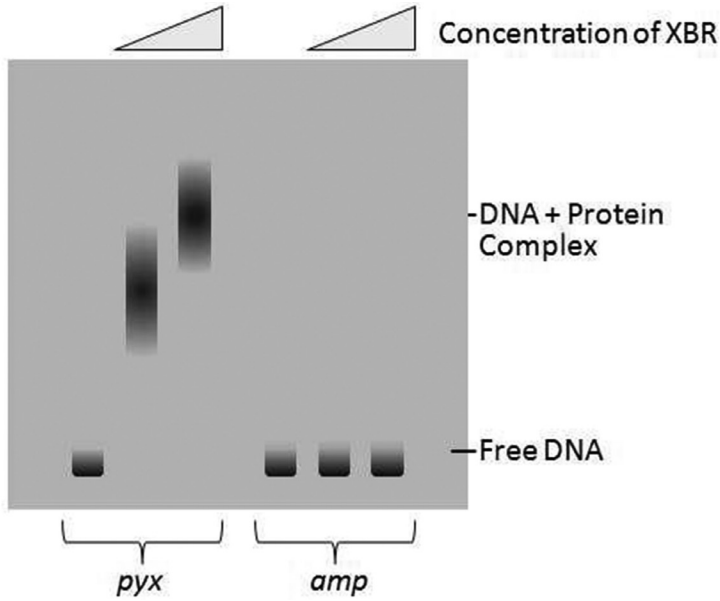


Figure 1 Interaction of XBR with *pyx* promoter and a fragment of the ampicillin resistance gene (*amp*) in an electrophoretic mobility shift assay

Experiment 2

Interaction of XBR with the *pyx* promoter region was studied *in vitro* using a β-galactosidase assay (Figure 2). Two plasmids were created, one that carried the β-galactosidase gene controlled by the *pyx* promoter, and one with the XBR operon connected with a *lacUV5* promoter. The *pyx* promoter plasmid was transformed into *E. coli* cells, both with and without the additional co-transformation of the XBR operon plasmid. Expression of the *lacUV5* promoter is regulated by the *lacI* repressor and can be induced with IPTG. Adding IPTG to the *E. coli* cultures containing the XBR plasmid induced the expression of XBR. To measure β-galactosidase expression, the *E. coli* cultures were given a solution that disrupted the cell membranes, but left the β-galactosidase intact. Samples were then treated with a synthetic color-reporting compound called ONPG, which was cleaved by β-galactosidase to yield a yellow compound. Activity of specific β-galactosidase is given in Miller units, a standardized measurement that quantifies β-galactosidase using ONPG.

Question 14

According to the data presented in Figure 2, which of the following statements is NOT correct?

- ○ **A.** 4R is metabolized faster in human as opposed to rat microsomes.
- ○ **B.** 4R is metabolized faster than midazolam.
- ○ **C.** Midazolam is metabolized faster in human as opposed to rat microsomes.
- ○ **D.** 4R is metabolized completely within 20 minutes.

Question 15

HPLC with a polar stationary phase and a nonpolar mobile phase was used to separate 4R and its metabolites. Based on the data in Figure 3 and Table 1, which of the following statements describes the metabolites most accurately?

- ○ **A.** M1 is the most polar metabolite, and M10 is the least polar.
- ○ **B.** M10 is the most polar metabolite, and M1 is the least polar.
- ○ **C.** The dihydroxylated metabolites are more polar than the monohydroxylated metabolites.
- ○ **D.** There is no interconversion between di- and mono-hydroxylated metabolites.

Question 16

During the metabolism of 4R, cytochrome P450 enzymes metabolize 4R via the following reaction:

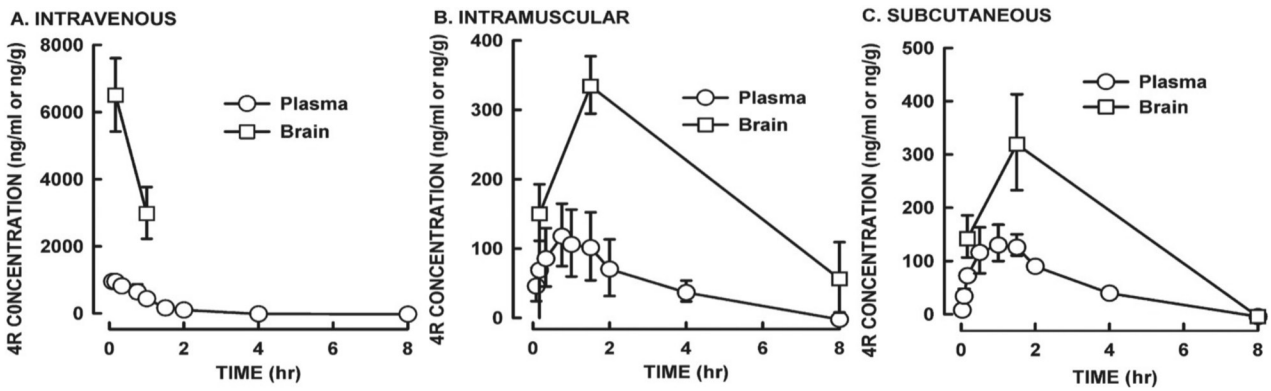
$$RH + O_2 + NADPH + H^+ \rightarrow ROH + H_2O + NADP^+$$

Which of the following chemical conversions occurs in the preceding reaction?

- ○ **A.** NADPH is reduced, and O_2 is reduced.
- ○ **B.** NADPH is oxidized, and O_2 is reduced.
- ○ **C.** NADPH is reduced, and O_2 is oxidized.
- ○ **D.** NADPH is oxidized, and O_2 is oxidized.

Question 17

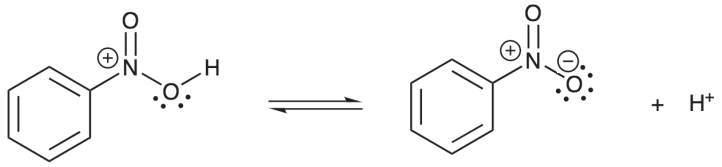
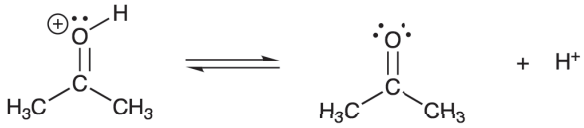
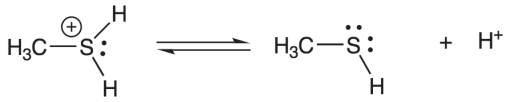
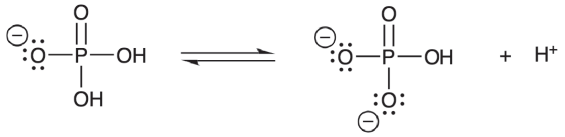
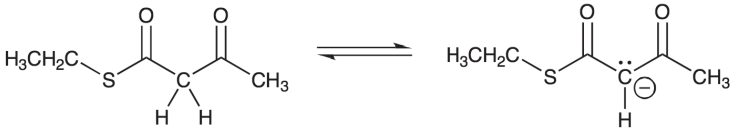
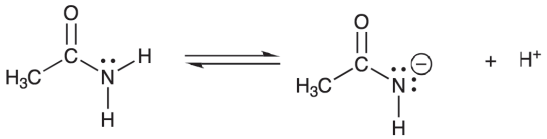
To assess the clinical potential of 4R, rats were injected either intravenously (IV), intramuscularly (IM), or subcutaneously (SC) with 4R, and the plasma and brain distribution was assessed. The C_{max} achieved using IV, IM, and SC administration was 6000–8000 ng/mL, 300–400 ng/mL, and 300–400 ng/mL respectively. Tremors were observed with a C_{max} higher than 5000 ng/mL.



Which should be the first-choice and second-choice delivery routes in patients?

- ○ **A.** IV followed by IM
- ○ **B.** IV followed by SC
- ○ **C.** SC followed by IM
- ○ **D.** IM followed by SC

Table 1 The pKa of Various Functional Groups

		pKa
nitro		-11.3
nitrile		-10.1
ketone		-7.2
thiol		-6.8
phosphoric acid		7.2
β-keto thioester		8.5
amide		15.0
alcohol		15.9

Source: Image of the regulation of gastric acid secretion from the collection of Professor Mitchell L. Schubert, with the acknowledgement of Mary Beatty-Brooks (medical illustrator).

Question 53

In addition to stimulating gastric chief cells, cholinergic activity from the vagus nerve increases acid production by stimulating parietal cells. Yet another action of the cholinergic activity from the vagus, consistent with the information provided, would likely be which of the following?

- ○ **A.** Sensitizing ECL cells to gastrin
- ○ **B.** Sensitizing parietal cells to somatostatin
- ○ **C.** Desensitizing ECL cells to gastrin
- ○ **D.** Desensitizing parietal cells to histamine

Passage 1 (Questions 1–4)

Schizophrenia is one of the most severe and disabling psychiatric diagnoses, affecting about 1% of the American population. It is usually characterized by its cognitive symptomatology (e.g., hallucinations and delusions). Yet deficits in social functioning can also help to diagnose this disorder. This social symptomatology is found in relatives of diagnosed schizophrenics and in people with other psychopathological conditions, namely diagnosed autists and suicide attempters.

Impaired social functioning in diagnosed schizophrenics helps to predict relapses, poor illness course, and unemployment. Assessed areas include deficits in personal hygiene, community functioning, and social cognition. For example, face processing, voice processing, and facial and vocal emotion recognition are aspects of social cognition that have been found to be impaired both in diagnosed schizophrenics and in individuals with schizoid personality traits.

An investigation of the consequences of facial and voice recognition deficits in 20 diagnosed schizophrenics with no comorbidity, and in matched healthy controls adopted the following measures: facial recognition; facial affect recognition; neutral face recognition; vocal affect recognition; pitch perception; and a social functioning scale, assessing the domain of public self (behavior, appearance, and social presentation), independent living, occupational functioning, family relationships, important relationships other than family, community/leisure/recreation, acceptance and adherence to health regimens, communication, and locus of control. Results confirmed the previous findings associating face-related and voice-related deficits with the disorder. Table 1 shows correlations between some of this study's measures.

A study of the neural correlates of social cognition compared data from 146 autism spectrum disorder participants (autism group), 336 schizophrenic participants (schizophrenia group), and 492 healthy control subjects (control group). During functional magnetic resonance imaging (fMRI), participants performed two tasks: facial emotion recognition (FER) and theory of mind (ToM) paradigms. The autism group showed more pronounced medial prefrontal hypoactivation. The hypoactivation of the amygdala was found in both the schizophrenia and autism groups, specifically during FER for the schizophrenia group and during more complex ToM tasks for the autism group. Both groups also showed hypoactivation within the superior temporal sulcus during ToM tasks, though its hypoactivation was higher during FER in the autism group. Finally, somatosensory engagement was higher in the schizophrenia group and lower in the autism group.

Table 1 The Correlation Matrix for the Cognitive Tasks and Specific Domains of Social Functioning

	Face Affect	Vocal Affect	Test of Facial Recognition
Face Affect Recognition			
Vocal Affect Recognition	0.35		
Test of Facial Recognition	0.43*	0.47*	
Communication Dysfunction	−0.59**	−0.1	0.1
Occupational Dysfunction	−0.56**	−0.58**	−0.2
Public Self	−0.46*	−0.1	−0.04

* $p \leq 0.1$ (2-tailed, unadjusted)
** $p \leq 0.05$ (2-tailed, unadjusted)

Sources: Adapted from S.M. Couture, D.L. Penn, and D.L. Roberts, "The Functional Significance of Social Cognition in Schizophrenia: A Review." Copyright 2006 Schizophrenia Bulletin; G. Sugranyes, M. Kyriakopoulos, R. Corrigallet et al., "Autism Spectrum Disorders and Schizophrenia: Meta-analysis of the Neural Correlates of Social Cognition." Copyright 2011 PloS one; C. Hooker and S. Park, "Emotion Processing and Its Relationship to Social Functioning in Schizophrenia Patients." Copyright 2002 Psychiatry Research; K. Szanto, A.Y. Dombrovski, B.J. Sahakian et al. "Social Emotion Recognition, Social Functioning, and Attempted Suicide in Late-life Depression." Copyright 2012 American Journal of Geriatric Psychiatry.

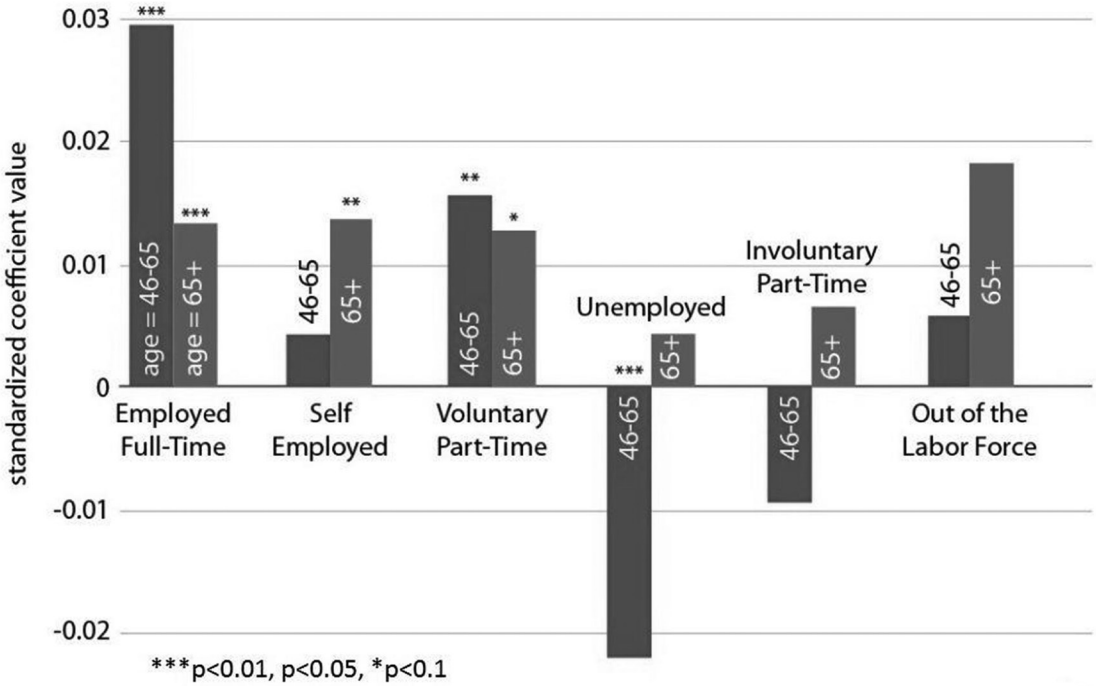


Figure 2 BPL (happiness) of 15- to 46-year-olds (reference group) per late-life work and employment arrangements

Notes: The numbers are based on the fully standardized coefficient estimates from an OLS regression from 2009-2012 using country and year dummies. The dependent variable measures the respondents' assessment of their current life relative to their best possible life on a scale of 0 (worst possible life) to 10 (best possible life). *References/sources au verso.*

Question 18

Which of the following topics would be the most interesting from a macrosociological perspective?

- ○ **A.** The psychological distress caused by the Great Recession to unemployed parents
- ○ **B.** The cross-cultural worldwide impact of the Great Recession on family structures
- ○ **C.** The social impact of the Great Recession on American men's practices
- ○ **D.** The worldwide impact of the Great Recession on the functioning of the banking industry

Question 19

A longitudinal study followed the workers of a plant until it closed. The study began as soon as the news of the impending closure was announced and finished one year after the closure. Which of the following would affect the least the validity and reliability of the study?

- ○ **A.** Generalizability
- ○ **B.** Selection bias
- ○ **C.** Endowment effect
- ○ **D.** Attrition bias

Question 20

Figure 1 and Figure 2 put together illustrate how:

- ○ **A.** the fact that we are "one of a million" unemployed people does not make the situation any better. However, being employed is associated with higher levels of happiness and well-being.
- ○ **B.** the majority of unemployed people are discontented with their lives. Most do not start to feel better about unemployment in the long run or show great signs of improvement in well-being.
- ○ **C.** everyone reacts badly to unemployment. However, there are great and statistically significant national disparities in the way people react to unemployment.
- ○ **D.** people are generally happy when employed. There is only a decline in well-being after they lose their jobs.

CANDIDATE'S NAME _____

TOTAL SCORE (conversions at MCAT-prep.com) _____ / 528

GS-1
Mock Exam 1 of 7
Solutions at MCAT-prep.com

Section I:
Chemical and Physical Foundations of Biological Systems

	A	B	C	D		A	B	C	D		A	B	C	D
1	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26	Ⓐ	Ⓑ	Ⓒ	Ⓓ	51	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27	Ⓐ	Ⓑ	Ⓒ	Ⓓ	52	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28	Ⓐ	Ⓑ	Ⓒ	Ⓓ	53	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29	Ⓐ	Ⓑ	Ⓒ	Ⓓ	54	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30	Ⓐ	Ⓑ	Ⓒ	Ⓓ	55	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	Ⓒ	Ⓓ	31	Ⓐ	Ⓑ	Ⓒ	Ⓓ	56	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7	Ⓐ	Ⓑ	Ⓒ	Ⓓ	32	Ⓐ	Ⓑ	Ⓒ	Ⓓ	57	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8	Ⓐ	Ⓑ	Ⓒ	Ⓓ	33	Ⓐ	Ⓑ	Ⓒ	Ⓓ	58	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9	Ⓐ	Ⓑ	Ⓒ	Ⓓ	34	Ⓐ	Ⓑ	Ⓒ	Ⓓ	59	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10	Ⓐ	Ⓑ	Ⓒ	Ⓓ	35	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
11	Ⓐ	Ⓑ	Ⓒ	Ⓓ	36	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
12	Ⓐ	Ⓑ	Ⓒ	Ⓓ	37	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
13	Ⓐ	Ⓑ	Ⓒ	Ⓓ	38	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
14	Ⓐ	Ⓑ	Ⓒ	Ⓓ	39	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
15	Ⓐ	Ⓑ	Ⓒ	Ⓓ	40	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
16	Ⓐ	Ⓑ	Ⓒ	Ⓓ	41	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
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18	Ⓐ	Ⓑ	Ⓒ	Ⓓ	43	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
19	Ⓐ	Ⓑ	Ⓒ	Ⓓ	44	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
20	Ⓐ	Ⓑ	Ⓒ	Ⓓ	45	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
21	Ⓐ	Ⓑ	Ⓒ	Ⓓ	46	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
22	Ⓐ	Ⓑ	Ⓒ	Ⓓ	47	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
23	Ⓐ	Ⓑ	Ⓒ	Ⓓ	48	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
24	Ⓐ	Ⓑ	Ⓒ	Ⓓ	49	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
25	Ⓐ	Ⓑ	Ⓒ	Ⓓ	50	Ⓐ	Ⓑ	Ⓒ	Ⓓ					

Raw Score
/ 59

Scaled Score
/ 132

Section II:
Critical Analysis and Reasoning Skills (CARS)

	A	B	C	D		A	B	C	D		A	B	C	D
1	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26	Ⓐ	Ⓑ	Ⓒ	Ⓓ	51	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27	Ⓐ	Ⓑ	Ⓒ	Ⓓ	52	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28	Ⓐ	Ⓑ	Ⓒ	Ⓓ	53	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
5	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
6	Ⓐ	Ⓑ	Ⓒ	Ⓓ	31	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
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12	Ⓐ	Ⓑ	Ⓒ	Ⓓ	37	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
13	Ⓐ	Ⓑ	Ⓒ	Ⓓ	38	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
14	Ⓐ	Ⓑ	Ⓒ	Ⓓ	39	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
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25	Ⓐ	Ⓑ	Ⓒ	Ⓓ	50	Ⓐ	Ⓑ	Ⓒ	Ⓓ					

Raw Score
/ 53

Scaled Score
/ 132

Section III:
Biological and Biochemical Foundations of Living Systems

	A	B	C	D		A	B	C	D		A	B	C	D
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3	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28	Ⓐ	Ⓑ	Ⓒ	Ⓓ	53	Ⓐ	Ⓑ	Ⓒ	Ⓓ
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5	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30	Ⓐ	Ⓑ	Ⓒ	Ⓓ	55	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	Ⓒ	Ⓓ	31	Ⓐ	Ⓑ	Ⓒ	Ⓓ	56	Ⓐ	Ⓑ	Ⓒ	Ⓓ
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24	Ⓐ	Ⓑ	Ⓒ	Ⓓ	49	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
25	Ⓐ	Ⓑ	Ⓒ	Ⓓ	50	Ⓐ	Ⓑ	Ⓒ	Ⓓ					

Raw Score
/ 59

Scaled Score
/ 132

Section IV:
Psychological, Social, and Biological Foundations of Behavior

	A	B	C	D		A	B	C	D		A	B	C	D
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20	Ⓐ	Ⓑ	Ⓒ	Ⓓ	45	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
21	Ⓐ	Ⓑ	Ⓒ	Ⓓ	46	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
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23	Ⓐ	Ⓑ	Ⓒ	Ⓓ	48	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
24	Ⓐ	Ⓑ	Ⓒ	Ⓓ	49	Ⓐ	Ⓑ	Ⓒ	Ⓓ					
25	Ⓐ	Ⓑ	Ⓒ	Ⓓ	50	Ⓐ	Ⓑ	Ⓒ	Ⓓ					

Raw Score
/ 59

Scaled Score
/ 132

Note: Summaries are only useful post-content review.

Gold Standard MCAT Physics Equations - Memorize

Translational motion	$x = x_o + v_o t + 1/2at^2$ | $(V_f)^2 = (V_o)^2 + 2ax$	$V_f = V_o + at$
Frictional force	$f_{max} = \mu N$	$\mu_k < \mu_s$ always
Uniform circular motion*	$F_c = ma_c = mv^2/r$	$a_c = v^2/r$
Momentum, Impulse*	$I = F \Delta t = \Delta M$	$M = mv$
Work, Power	$W = F d \cos\theta$	$P = \Delta W/\Delta t$
Energy (conservation)	$E_T = E_k + E_p$	$E = mc^2$
Spring Force, Work	$F = -kx$	$W = kx^2/2$
Continuity (fluids)	$A v = const.$	$\rho Av = const.$
Current and Resistance	$I = Q/t$	$R = \rho l/A$
Resistors (series, par.)	$R_{eq} = R_1 + R_2 \ldots$ | $1/R_{eq} = 1/R_1 + 1/R_2$	R = 1 / conductance
Capacitors in Ser. and Par.	$1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 \ldots$	$C_{eq} = C_1 + C_2 \ldots$
Sound	$dB = 10 \log_{10} (I/I_0)$	beats = Δf
Kirchoff's Laws	$\Sigma i = 0$ at a junction	$\Sigma \Delta V = 0$ in a loop
Thermodynamics	$Q = mc \Delta T$ (*resembles* MCAT !)	$Q = mL$
Torque forces	$L_1 = F_1 \times r_1$ (CCW + ve)	$L_2 = F_2 \times r_2$ (CW - ve)
Torque force at EQ	$\Sigma F_x = 0$ and $\Sigma F_y = 0$	$\Sigma L = 0$
Refraction	$(\sin\theta_1)/(\sin\theta_2) = v_1/v_2 = n_2/n_1 = \lambda_1/\lambda_2$	$n = c/v$

*Not technically in the new MCAT Physics syllabus but since these are simple concepts that have been the source of traditional MCAT questions, we do not believe that they should be discarded from your preparation.

Gold Standard MCAT Physics Equations - Memorize As Pairs

$F = ma$	$F = qE$	Similar Form
$F = K_G (m_1 m_2 / r^2)$	$F = k (q_1 q_2 / r^2)$	
$V = IR$	$P = IV$	Paired Use
$v_{av} = \Delta d / \Delta t$	$a_{av} = \Delta v / \Delta t$	(avg vel, acc)
$v = \lambda f$	$E = hf$	(f = 1/T)
$E_k = 1/2\ mv^2$	$E_p = mgh$	(kin, pot E)
$P = F/A$	$\Delta P = \rho g \Delta h$	(pressure P)
SG = ρ substance / ρ water	$\rho = 1\ g/cm^3 = 10^3\ kg/m^3$	(Spec Grav)
ρ = mass / volume	$F_b = V\rho g = mg$	(buoyant F)
$1/i + 1/o = 1/f = 2/r$ = Power	M = magnification = - i/o	Optics
$\Delta G = \Delta H - T\Delta S$	Gibbs Free Energy	$\Delta G° = -RT \ln K_{eq}$

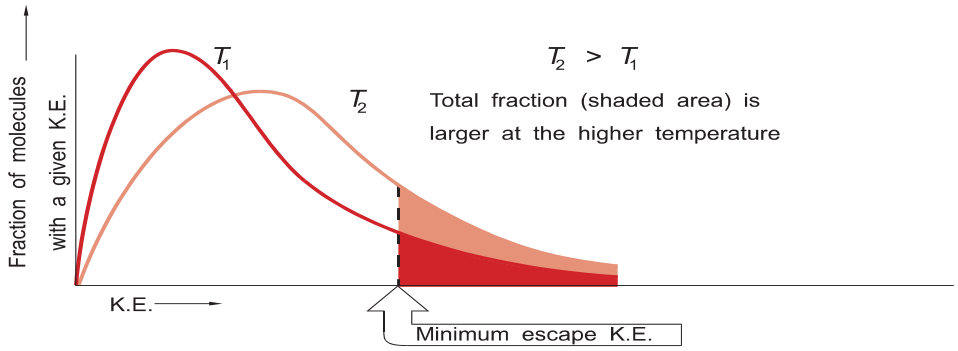
Gold Standard MCAT Physics Equations - Know How to Use - Do Not Memorize

$P + \rho gh + 1/2\ \rho v_2 = constant$	Bernouilli's Equation	Fluids in Motion
$f_0 = f_s (V \pm V_0)/(V \pm V_s)$	Doppler Effect: when d is decreasing use + V_0 and - V_s	
$V = Ed$ for a parallel plate capacitor	d = the distance between the plates	
$dF = dq\ v(B \sin\alpha) = I\ dl(B \sin\alpha)$	Laplace's Law	RH rule
Potential Energy (PE) = $W = 1/2\ QV$	Work in Electricity	$W = 1/2\ CV^2$

Gold Standard MCAT General Chemistry Review: Phases & Phase Equilibria

- Standard Temperature and Pressure, Standard Molar Volume
  - 0 °C (273.15 K) and 1.00 atm (101.33 kPa = 760 mmHg = 760 torr); these conditions are known as the standard temperature and pressure (STP). {Note: the SI unit of pressure is the pascal (Pa).}
  - The volume occupied by one mole of any gas at STP is referred to as the standard molar volume and is equal to 22.4 L.

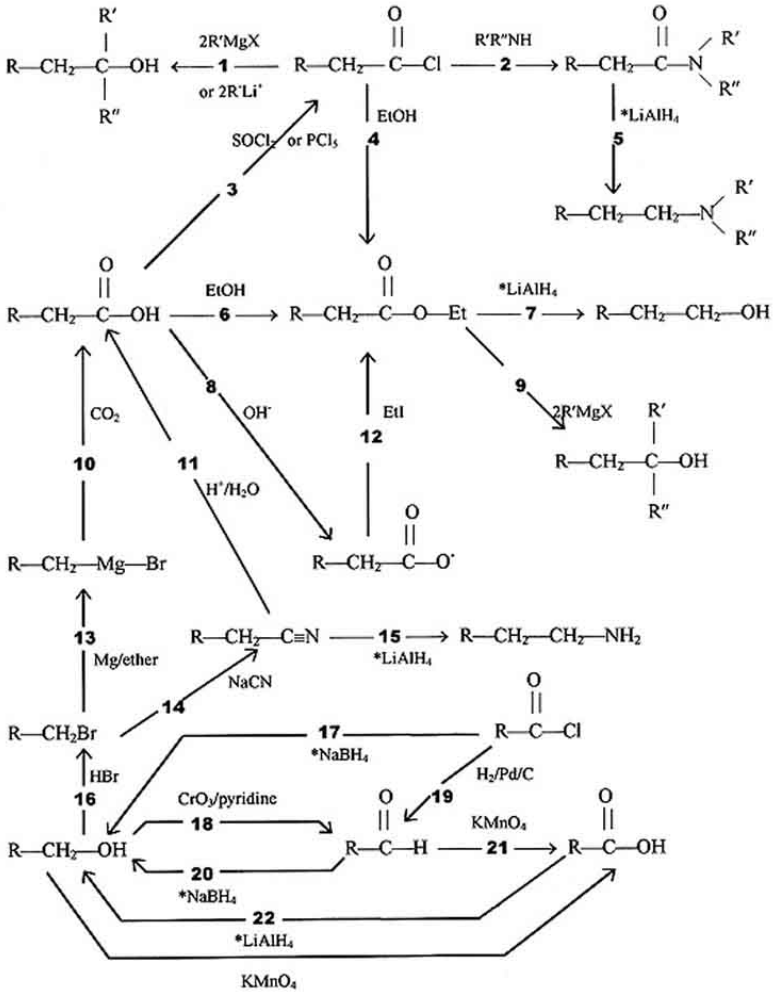
- Kinetic Molecular Theory of Gases (A Model for Gases)
  - The average kinetic energy of the particles (KE = 1/2 mv^2) increases in direct proportion to the temperature of the gas (KE = 3/2 kT) when the temperature is measured on an absolute scale (i.e. the Kelvin scale) and k is a constant (the Boltzmann constant).



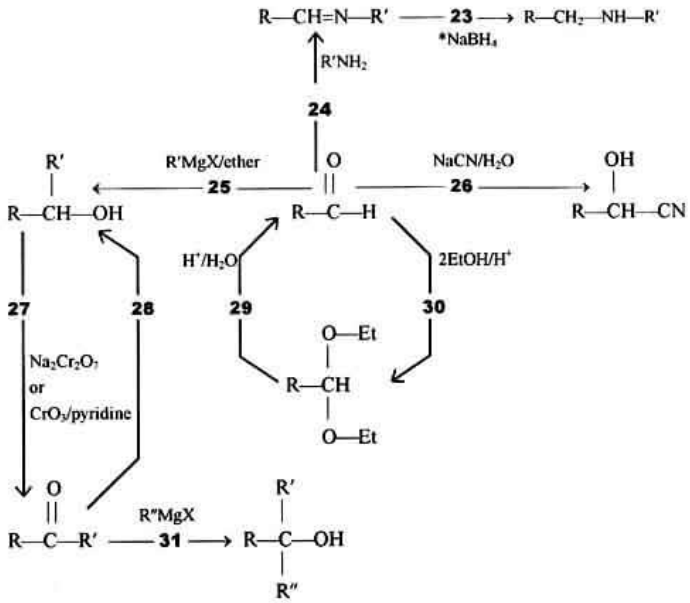
The Maxwell Distribution Plot

Graham's Law (Diffusion and Effusion of Gases) $\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}}$	Combined Gas Law $\frac{P_1V_1}{T_1} = k = \frac{P_2V_2}{T_2}$ (at constant mass)
Charles' Law $V = \text{Constant} \times T$ or $V_1/V_2 = T_1/T_2$ or $V_1/T_1 = V_2/T_2$	Ideal Gas Law $PV = nRT$ since m/V is the density (d) of the gas: $P = \frac{d\text{RT}}{M}$
Boyle's Law $V = \text{Constant} \times 1/P$ or $P_1V_1 = P_2V_2$	Partial Pressure and Dalton's Law $P_T = P_1 + P_2 + \ldots + P_i$ Of course, the sum of all mole fractions in a mixture must equal one: $\Sigma X_1 = 1$
Avogadro's Law $V/n = \text{Constant}$ or $V_1/n_1 = V_2/n_2$	The partial pressure (P_i) of a component of a gas mixture is equal to: $P_i = X_iP_T$

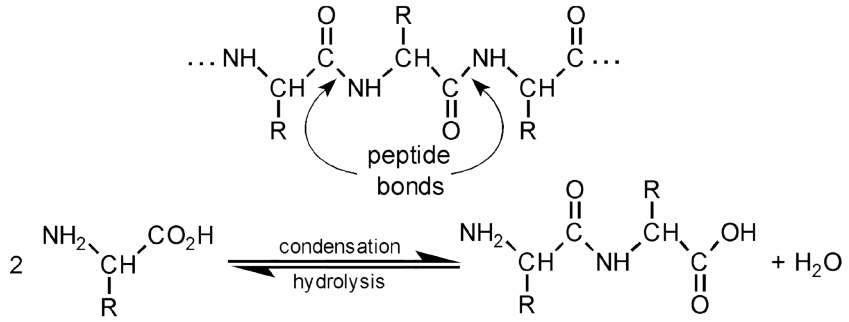
Gold Standard MCAT Organic Chemistry Mechanisms: Summary I



Gold Standard MCAT Organic Chemistry Mechanisms: Summary II



R = alkyl Et = ethyl X = halide $R^- MgX^+$ = Grignard reagent $R^- Li^+$ = alkyl lithium



Helpful Mnemonics for One-Letter Amino Acid Abbreviations:

Alanine, aRginine, asparagiNe, asparDic acid [aspartic acid], Cysteine, Qutamine [glutamine], glutamEc acid [glutamic acid], Glycine, Histidine, Isoleucine, Leucine, Kysine [lysine], Methionine, Fenylalanine [phenylalanine], Proline, Serine, Threonine, tWyptophan [tryptophan], tYrosine, Valine

Nonpolar Amino Acids = G A P V W L I M F or Gap V.W. Lymph

(lymph is important in fatty acid transport . . . think fatty acid tails are nonpolar)

Polar Uncharged Amino Acids = S T Y C N Q or Stick Nick

(stick like a "pole" . . . think polar)

Electric Amino Acids = D E H K R or Dee Hicker

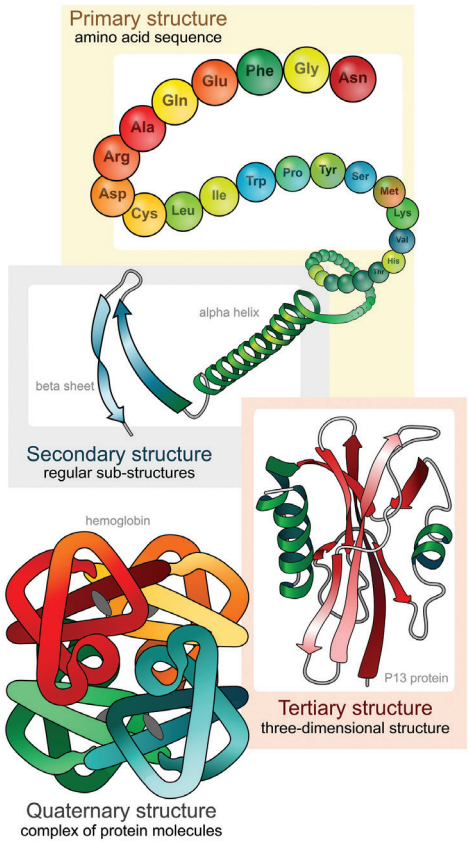
(dee hicker like deelectric . . . think electric)

To be more precise, for the Polar Charged Amino Acids:

Dee Negative, Hicker Positive, D(-) E(-) H(+) K(+) R(+)

General Principles of Proteins

- Primary structure
  - Sequence of amino acids encoded by DNA and linked to each other through covalent bonds (including disulfide bonds)
- Secondary structure
  - Orderly inter- or intramolecular hydrogen bonding of the protein chain
  - Usually organized in a stable α-helix or a β-pleated sheet
- Tertiary structure
  - Further folding of the protein molecule onto itself
  - 3D shape (spatial organization) of an entire protein molecule
- Quaternary structure
  - 2 or more protein chains bonded together by noncovalent bonds



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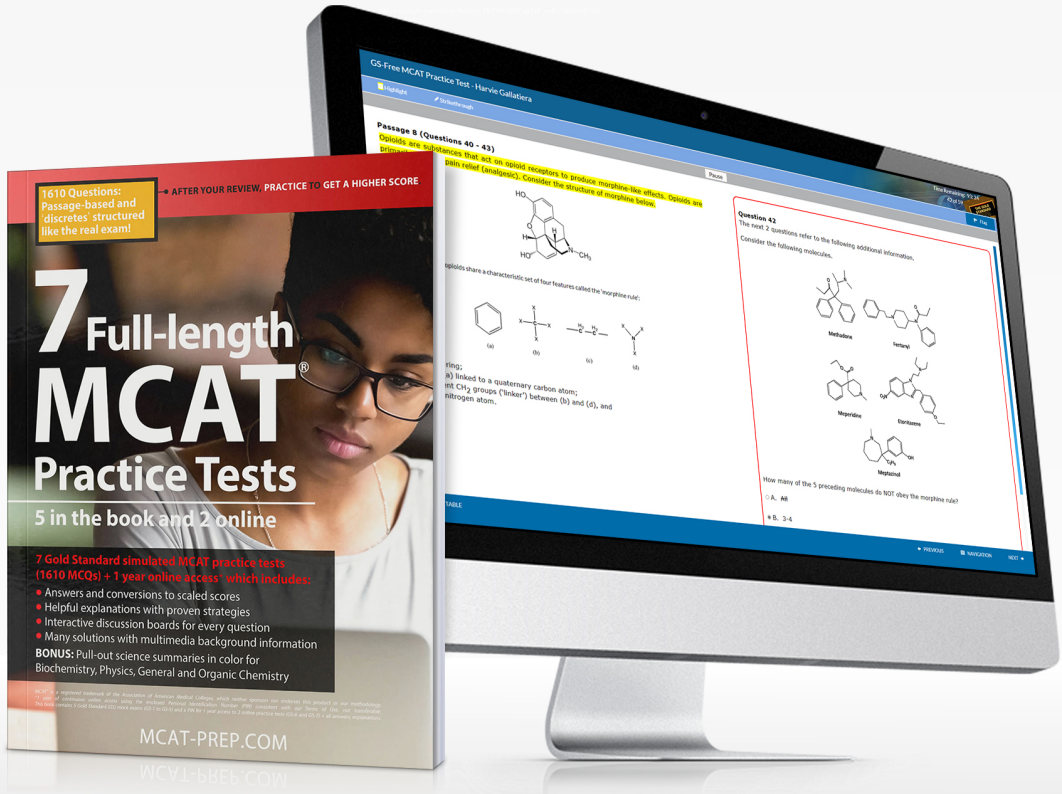
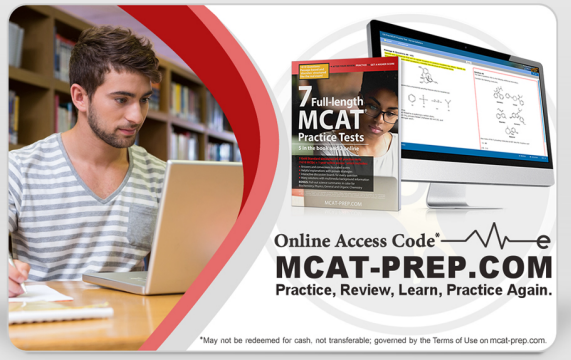


To paraphrase Lombardi, *perfection may not be attainable, but let's chase it and achieve excellence!*



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