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**MCAT[®] Physics and Math
Review
2023–2024**

ONLINE + BOOK

Edited by Alexander Stone Macnow, MD

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Getting Started Checklist

Getting Started Checklist

Register for your free online assets—including full-length tests, Science Review Videos, and additional practice materials—at www.kaptest.com/moreonline.

Create a study calendar that ensures you complete content review and sufficient practice by Test Day!

As you finish a chapter and the online practice for that chapter, check it off on the table of contents.

Register to take the MCAT at www.aamc.org/mcat.

Set aside time during your prep to make sure the rest of your application—personal statement, recommendations, and other materials—is ready to go!

Take a moment to admire your completed checklist, then get back to the business of prepping for this exam!

Preface

And now it starts: your long, yet fruitful journey toward wearing a white coat. Proudly wearing that white coat, though, is hopefully only part of your motivation. You are reading this book because you want to be a healer.

If you're serious about going to medical school, then you are likely already familiar with the importance of the MCAT in medical school admissions. While the holistic review process puts additional weight on your experiences, extracurricular activities, and personal attributes, the fact remains: along with your GPA, your MCAT score remains one of the two most important components of your application portfolio—at least early in the admissions process. Each additional point you score on the MCAT pushes you in front of thousands of other students and makes you an even more attractive applicant. But the MCAT is not simply an obstacle to overcome; it is an opportunity to show schools that you will be a strong student and a future leader in medicine.

We at Kaplan take our jobs very seriously and aim to help students see success not only on the MCAT, but as future physicians. We work with our learning science experts to ensure that we're using the most up-to-date teaching techniques in our resources. Multiple members of our team hold advanced degrees in medicine or associated biomedical sciences, and are committed to the highest level of medical education. Kaplan has been working with the MCAT for over 50 years and our commitment to premed students is unflagging; in fact, Stanley Kaplan created this company when he

had difficulty being accepted to medical school due to unfair quota systems that existed at the time.

We stand now at the beginning of a new era in medical education. As citizens of this 21st-century world of healthcare, we are charged with creating a patient-oriented, culturally competent, cost-conscious, universally available, technically advanced, and research-focused healthcare system, run by compassionate providers. Suffice it to say, this is no easy task. Problem-based learning, integrated curricula, and classes in interpersonal skills are some of the responses to this demand for an excellent workforce—a workforce of which you'll soon be a part.

We're thrilled that you've chosen us to help you on this journey. Please reach out to us to share your challenges, concerns, and successes. Together, we will shape the future of medicine in the United States and abroad; we look forward to helping you become the doctor you deserve to be.

Good luck!

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About *Scientific American*

As the world's premier science and technology magazine, and the oldest continuously published magazine in the United States, *Scientific American* is committed to bringing the most important developments in modern science, medicine, and technology to our worldwide audience in an understandable, credible, and provocative format.

Founded in 1845 and on the “cutting edge” ever since, *Scientific American* boasts over 175 Nobel laureate authors including Albert Einstein, Marie Curie, Francis Crick, Christiane Nüsslein-Volhard, Stanley Prusiner, and Richard Axel. *Scientific American* is a forum where scientific theories and discoveries are explained to a broader audience.

Scientific American published its first international edition in 1890, and in 1979 was the first North American magazine published in the People's Republic of China. Today, *Scientific American* is published in 14 additional language editions. *Scientific American* is also a leading online destination (www.ScientificAmerican.com), providing the latest science news and exclusive features to millions of visitors each month.

The knowledge that fills our pages has the power to spark new ideas, paradigms, and visions for the future. As science races forward, *Scientific*

American continues to cover the promising strides, inevitable setbacks and challenges, and new medical discoveries as they unfold.

About the MCAT

Anatomy of the MCAT

Here is a general overview of the structure of Test Day:

Section	Number of Questions	Time Allotted
Test-Day Certification		4 minutes
Tutorial (optional)		10 minutes
Chemical and Physical Foundations of Biological Systems	59	95 minutes
Break (optional)		10 minutes
Critical Analysis and Reasoning Skills (CARS)	53	90 minutes
Lunch Break (optional)		30 minutes
Biological and Biochemical Foundations of Living Systems	59	95 minutes
Break (optional)		10 minutes
Psychological, Social, and Biological Foundations of Behavior	59	95 minutes
Void Question		3 minutes
Satisfaction Survey (optional)		5 minutes

The structure of the four sections of the MCAT is shown below.

Chemical and Physical Foundations of Biological Systems	
Time	95 minutes
Format	<ul style="list-style-type: none">• 59 questions• 10 passages• 44 questions are passage-based, and 15 are discrete (stand-alone) questions.• Score between 118 and 132
What It Tests	<ul style="list-style-type: none">• Biochemistry: 25%• Biology: 5%• General Chemistry: 30%• Organic Chemistry: 15%• Physics: 25%
Critical Analysis and Reasoning Skills (CARS)	
Time	90 minutes
Format	<ul style="list-style-type: none">• 53 questions• 9 passages• All questions are passage-based. There are no discrete (stand-alone) questions.• Score between 118 and 132
What It Tests	Disciplines: <ul style="list-style-type: none">• Humanities: 50%• Social Sciences: 50% Skills: <ul style="list-style-type: none">• <i>Foundations of Comprehension</i>: 30%• <i>Reasoning Within the Text</i>: 30%• <i>Reasoning Beyond the Text</i>: 40%
Biological and Biochemical Foundations of Living Systems	
Time	95 minutes
Format	<ul style="list-style-type: none">• 59 questions• 10 passages• 44 questions are passage-based, and 15 are discrete (stand-alone) questions.• Score between 118 and 132

Chemical and Physical Foundations of Biological Systems

What It Tests

- Biochemistry: 25%
- Biology: 65%
- General Chemistry: 5%
- Organic Chemistry: 5%

Psychological, Social, and Biological Foundations of Behavior

Time

95 minutes

Format

- 59 questions
- 10 passages
- 44 questions are passage-based, and 15 are discrete (stand-alone) questions.
- Score between 118 and 132

What It Tests

- Biology: 5%
- Psychology: 65%
- Sociology: 30%

Total

Testing Time

375 minutes (6 hours, 15 minutes)

Total Seat Time

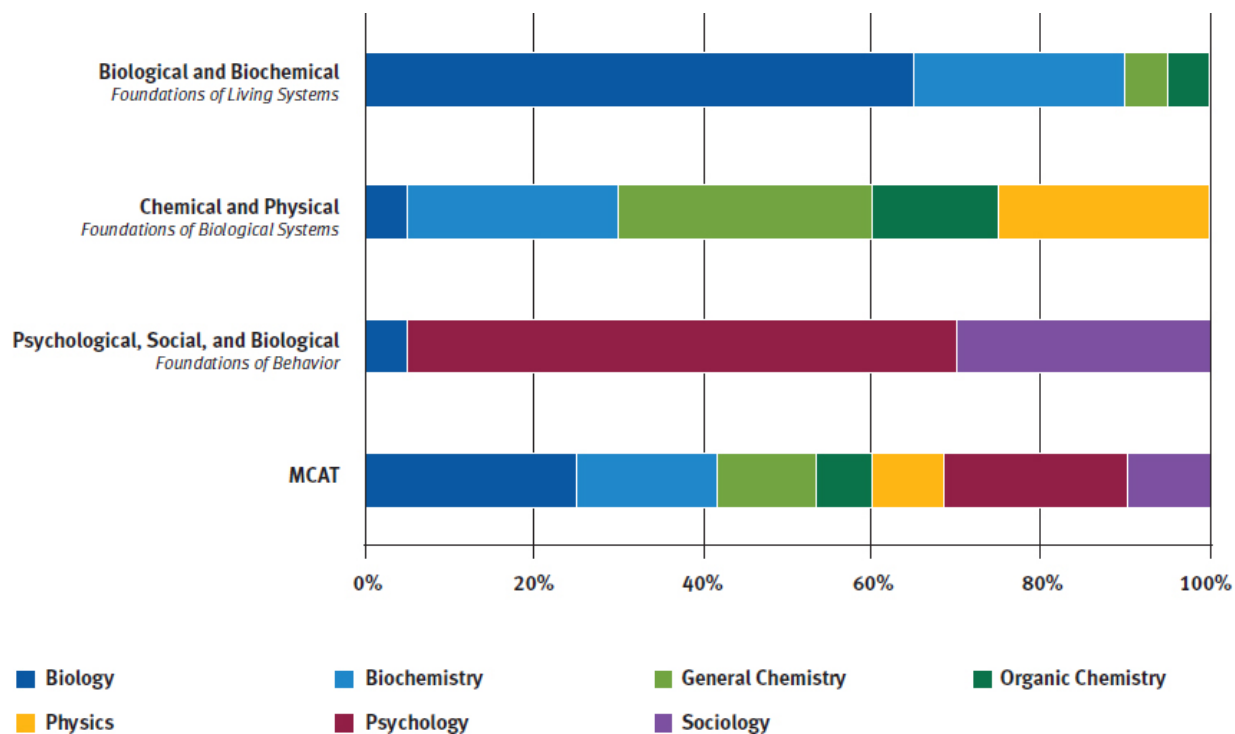
447 minutes (7 hours, 27 minutes)

Questions

230

Score

472 to 528



Scientific Inquiry and Reasoning Skills (SIRS)

The AAMC has defined four *Scientific Inquiry and Reasoning Skills (SIRS)* that will be tested in the three science sections of the MCAT:

- . *Knowledge of Scientific Concepts and Principles* (35% of questions)
- . *Scientific Reasoning and Problem-Solving* (45% of questions)
- . *Reasoning About the Design and Execution of Research* (10% of questions)
- . *Data-Based and Statistical Reasoning* (10% of questions)

Let's see how each one breaks down into more specific Test Day behaviors. Note that the bullet points of specific objectives for each of the SIRS are taken directly from the *Official Guide to the MCAT Exam*; the descriptions of what these behaviors mean and sample question stems, however, are written by Kaplan.

Skill 1: Knowledge of Scientific Concepts and Principles

This is probably the least surprising of the four SIRS; the testing of science knowledge is, after all, one of the signature qualities of the MCAT. Skill 1 questions will require you to do the following:

Recognize correct scientific principles

Identify the relationships among closely related concepts

Identify the relationships between different representations of concepts (verbal, symbolic, graphic)

Identify examples of observations that illustrate scientific principles

Use mathematical equations to solve problems

At Kaplan, we simply call these Science Knowledge or Skill 1 questions. Another way to think of Skill 1 questions is as “one-step” problems. The single step is either to realize which scientific concept the question stem is suggesting or to take the concept stated in the question stem and identify which answer choice is an accurate application of it. Skill 1 questions are particularly prominent among discrete questions (those not associated with a passage). These questions are an opportunity to gain quick points on Test Day—if you know the science concept attached to the question, then that’s it! On Test Day, 35% of the questions in each science section will be Skill 1 questions.

Here are some sample Skill 1 question stems:

How would a proponent of the James–Lange theory of emotion interpret the findings of the study cited in the passage?

Which of the following most accurately describes the function of FSH in the human menstrual cycle?

If the products of Reaction 1 and Reaction 2 were combined in solution, the resulting reaction would form:

Ionic bonds are maintained by which of the following forces?

Skill 2: Scientific Reasoning and Problem-Solving

The MCAT science sections do, of course, move beyond testing straightforward science knowledge; Skill 2 questions are the most common way in which it does so. At Kaplan, we also call these Critical Thinking questions. Skill 2 questions will require you to do the following:

Reason about scientific principles, theories, and models

Analyze and evaluate scientific explanations and predictions

Evaluate arguments about causes and consequences

Bring together theory, observations, and evidence to draw conclusions

Recognize scientific findings that challenge or invalidate a scientific theory or model

Determine and use scientific formulas to solve problems

Just as Skill 1 questions can be thought of as “one-step” problems, many Skill 2 questions are “two-step” problems, and more difficult Skill 2 questions may require three or more steps. These questions can require a wide spectrum of reasoning skills, including integration of multiple facts from a passage, combination of multiple science content areas, and prediction of an experiment’s results. Skill 2 questions also tend to ask about science content without actually mentioning it by name. For example, a question might describe the results of one experiment and ask you to predict the results of a second experiment without actually telling you what underlying scientific principles are at work—part of the question’s difficulty will be figuring out which principles to apply in order to get the correct answer. On Test Day, 45% of the questions in each science section will be Skill 2 questions.

Here are some sample Skill 2 question stems:

Which of the following experimental conditions would most likely yield results similar to those in Figure 2?

All of the following conclusions are supported by the information in the passage EXCEPT:

The most likely cause of the anomalous results found by the experimenter is: