

The logo for Next Step Test Prep is centered in a blue square. It features the words "Next" and "Step" stacked vertically in a large, white, sans-serif font. Below them, the words "TEST PREP" are written in a smaller, white, all-caps, sans-serif font. The background of the slide is dark blue with a repeating pattern of small white plus signs. A large white arrow points downwards from the top of the slide, framing the logo.

Next  
Step  
TEST PREP

**Batteries and Bio**

# Today's Info Session

- ▶ Welcome to this Info Session!
- ▶ Introduction
- ▶ Electrochem
- ▶ Electron transport chain
- ▶ How Can Next Step Help?
  - ▶ (Coupon codes for the course & free 2 hour tutoring session)
- ▶ Questions?

Next  
Step  
TEST PREP

**MCAT**  
Medical College  
Admission Test

WHAT IS YOUR NEXT STEP?

# Introduction

**Hi, I'm Phil!**

- ▶ **MCAT Content writer**
  - ▶ **Tutored and taught for 9+ years**
  - ▶ **Attended University of Nebraska Medical Center as an MD/PhD student.**
- ✓ **Next Step is a team of test prep and educational experts committed to excellence.**

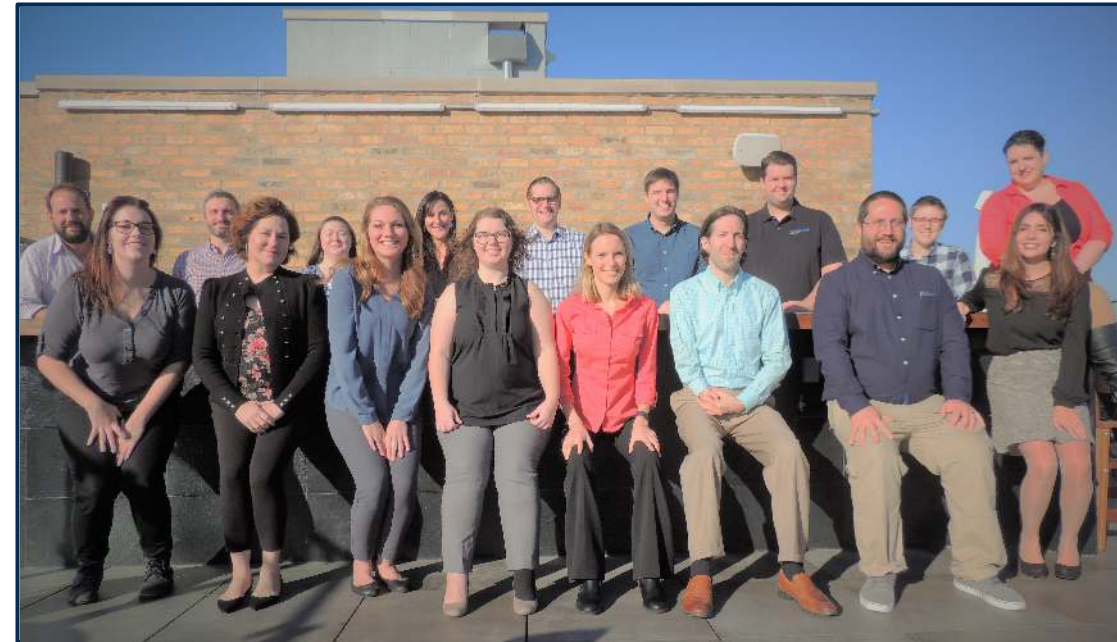


# Who Is Next Step?

Next  
Step  
TEST PREP

- Began in 2009 as a tutoring company
- Focus on graduate admissions tests only
- Team of educational experts
- First company to have materials built from ground up for 2015 MCAT format
- Now the first company to have new 2018 MCAT Interface

✓ **We never stop improving our materials!**





# How much do you want it\*?

What wants electrons more, Na or F?

Reduction half-reaction	$E^\circ(\text{V})$
$\text{F}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{F}^-(\text{aq})$	2.87
$\text{Ce}^{4+}(\text{aq}) + \text{e}^- \rightarrow \text{Ce}^{3+}(\text{aq})$	1.61
$\text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\ell)$	1.51
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$	1.36
$\text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}(\ell)$	1.23
$\text{Br}_2(\ell) + 2\text{e}^- \rightarrow 2\text{Br}^-(\text{aq})$	1.06
$\text{NO}_3^-(\text{aq}) + 4\text{H}^+(\text{aq}) + 3\text{e}^- \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}(\ell)$	0.96
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	0.80
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	0.77
$\text{I}_2(\text{s}) + 2\text{e}^- \rightarrow 2\text{I}^-(\text{aq})$	0.54
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$	0.34
$\text{AgCl}(\text{s}) + \text{e}^- \rightarrow \text{Ag}(\text{s}) + \text{Cl}^-(\text{aq})$	0.222
$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}^{2+}(\text{aq})$	0.15
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	0.000
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pb}(\text{s})$	-0.126
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni}(\text{s})$	-0.25
$\text{Cr}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Cr}^{2+}(\text{aq})$	-0.41
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$	-0.44
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	-0.76
$\text{Ba}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ba}(\text{s})$	-1.57
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Al}(\text{s})$	-1.66
$\text{Mg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mg}(\text{s})$	-2.37
$\text{Na}^+(\text{aq}) + \text{e}^- \rightarrow \text{Na}(\text{s})$	-2.714
$\text{Li}^+(\text{aq}) + \text{e}^- \rightarrow \text{Li}(\text{s})$	-3.045

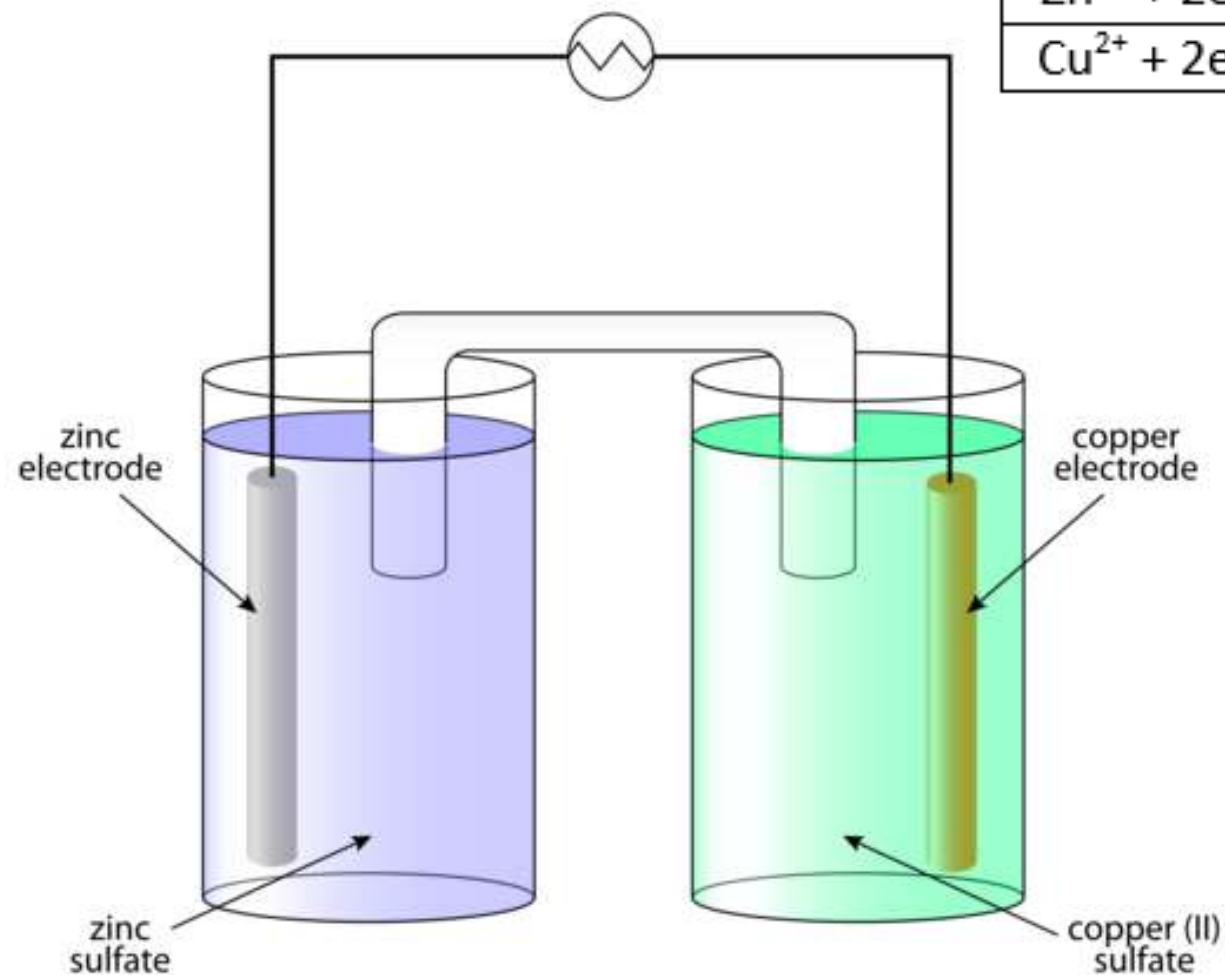
\* It = electron

# Anatomy of an Galvanic Cell

## Rules of thumb

- *Galvanic = spontaneous*
  - $E^\circ_{cell} > 0$
- *Electrolytic = nonspontaneous*
  - $E^\circ_{cell} < 0$
- *The cathode is the site of reduction in ALL cells.*
- *The anode is the site of oxidation in ALL cells.*

Reaction	$E^\circ$
$\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn(s)}$	-0.76
$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu(s)}$	+0.34



# Electrolytic vs Galvanic Cells

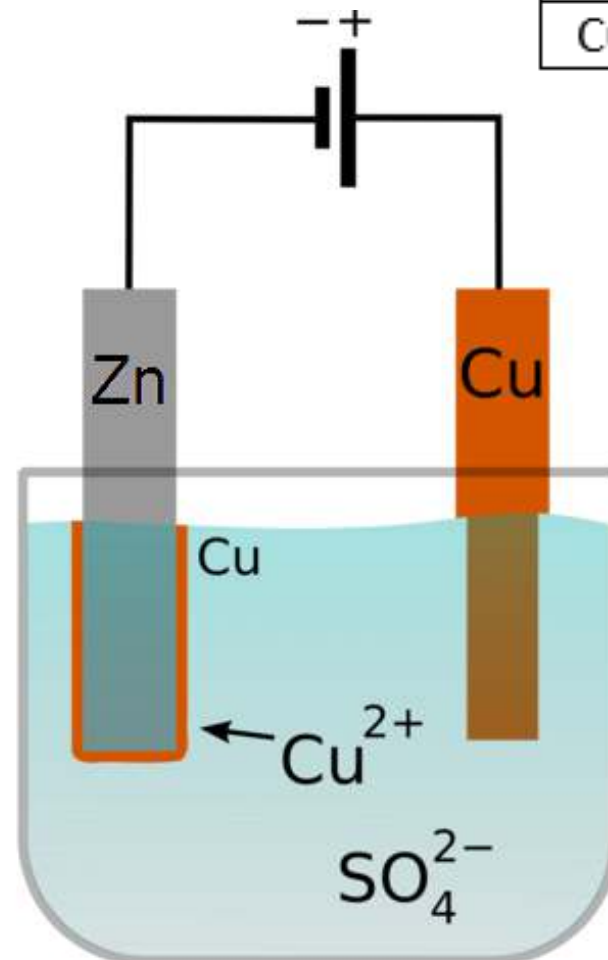
What is the  $E_{\text{cell}}$  of this cell?

What is the charge on the anode?

On the cathode?

The standard reduction potential of Species A is +0.27 V, while the standard **oxidation potential** of Species B is +1.40 V. What is the  $E^{\circ}_{\text{cell}}$  of an electrolytic cell constructed using these species?

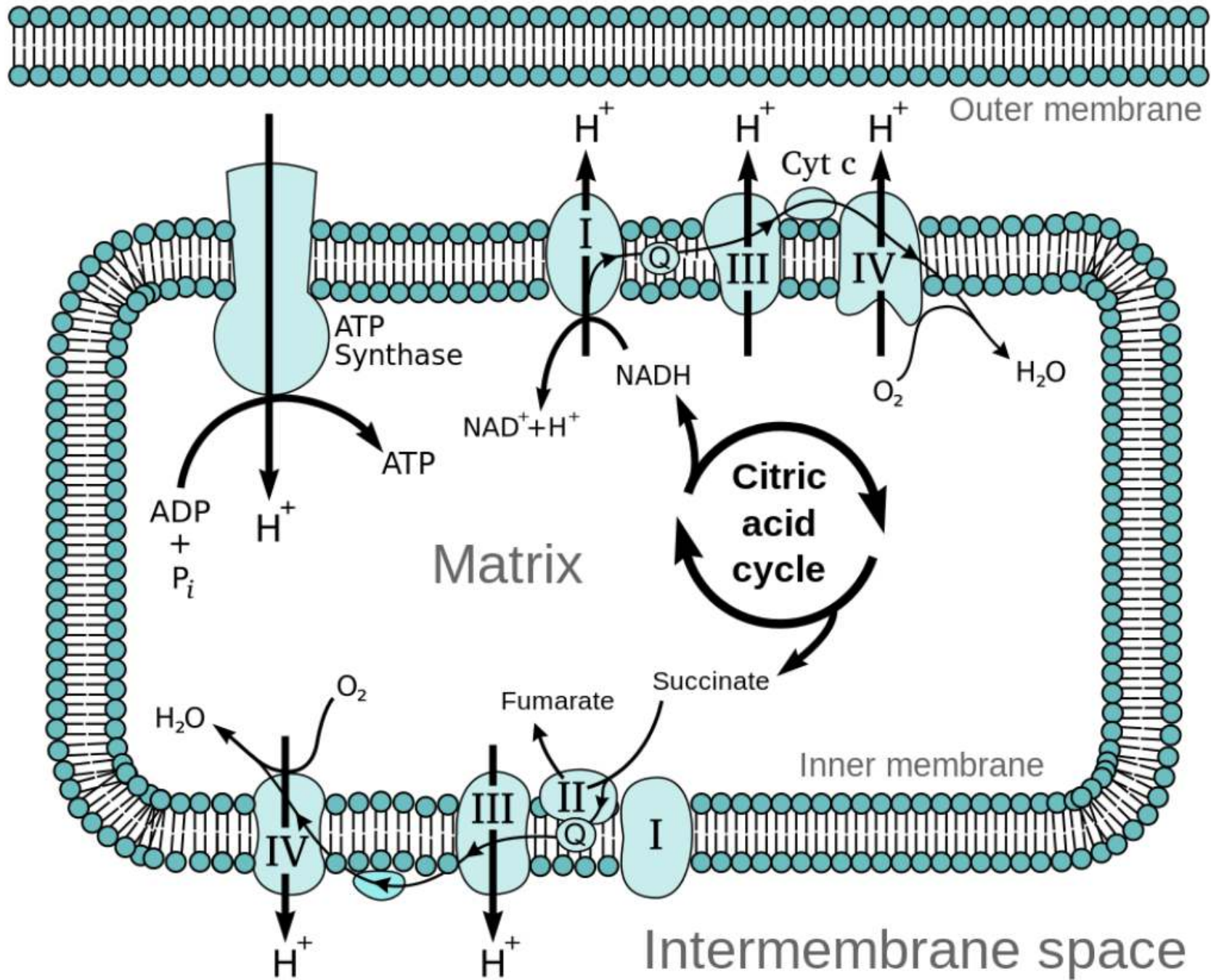
Reaction	$E^{\circ}$
$\text{Zn}^{2+} + 2\text{e}^{-} \rightarrow \text{Zn}(\text{s})$	-0.76
$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$	+0.34



Reaction	$E^\circ$
$\text{Zn}^{2+} + 2e^- \rightarrow \text{Zn(s)}$	-0.76
$\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu(s)}$	+0.34

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0592 \text{ V}}{n} \log Q$$





Ubiquinone and ubiquinol, which is reduced?

What has the highest reduction potential of the things shown here.

What has the highest red potential,  $FADH_2$  or  $NADH$ ?

The logo for Next Step Test Prep is centered in a blue square. The words "Next" and "Step" are stacked vertically in a large, white, sans-serif font. Below them, the words "TEST PREP" are written in a smaller, white, all-caps, sans-serif font. The background of the slide is dark blue with a repeating pattern of small white plus signs. A large white inverted triangle is positioned at the bottom of the slide, pointing upwards towards the logo.

Next  
Step  
TEST PREP

**Q&A**

# Personalized Options

Next  
Step  
TEST PREP

- ✓ No matter your study style, subject expertise, or MCAT goal, Next Step has an option for your personal needs and lifestyle.
- **Self-Prep Materials and Planning**
- **Guided Online Study with Free Extra Help**
- **One-on-One Tutoring**



# Next Step: Educate Every Da

- ✓ Start your prep with high-value FREE practice to build a study plan suited to your goals, needs, and schedule.

## Industry's Best Free MCAT Practice Bundle

- Half-length MCAT diagnostic
- Full-length MCAT exam
- 500+ Question Science Content Diag exam
- Test Review Videos
- Multiple QBank Samples
- 16 Test & 4 Content Review Videos
- Proprietary Study Plan Generator
- Aligned to new MCAT 2018 Interface

Get your  
**FREE MCAT Practice  
Bundle**

<https://nextstestprep.com/>



# Additional Free Resources

Next  
Step  
TEST PREP

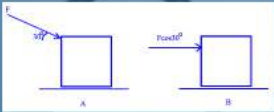
✓ Supplement your prep with additional support tools

- Question of the Day Quick Prep
- YouTube, Facebook and Instagram Content
- Ongoing Public Webinars and Q&A Sessions
- MCAT Blog: Content and Admissions
- Next Step MCAT Forum

NextStep  
TEST PREP

### Question of the Day

Two people push a box along a frictional surface. One pushes the box at an angle of  $30^\circ$  to horizontal with force  $F$  while the other pushes the box horizontally with force  $F\cos 30^\circ$ . Which person does the most work?

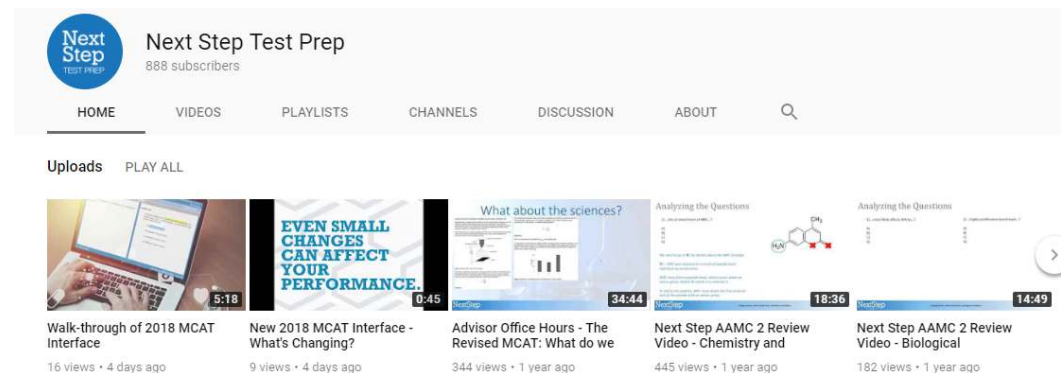


A) Person A  
B) Person B  
C) Person A and B do equal amounts of work  
D) cannot be determined

Next Step Test Prep  
888 subscribers

HOME VIDEOS PLAYLISTS CHANNELS DISCUSSION ABOUT Q

Uploads PLAY ALL



Walk-through of 2018 MCAT Interface  
16 views • 4 days ago

NEW 2018 MCAT Interface - What's Changing?  
9 views • 4 days ago

Advisor Office Hours - The Revised MCAT: What do we  
344 views • 1 year ago

Next Step AAMC 2 Review Video - Chemistry and  
445 views • 1 year ago

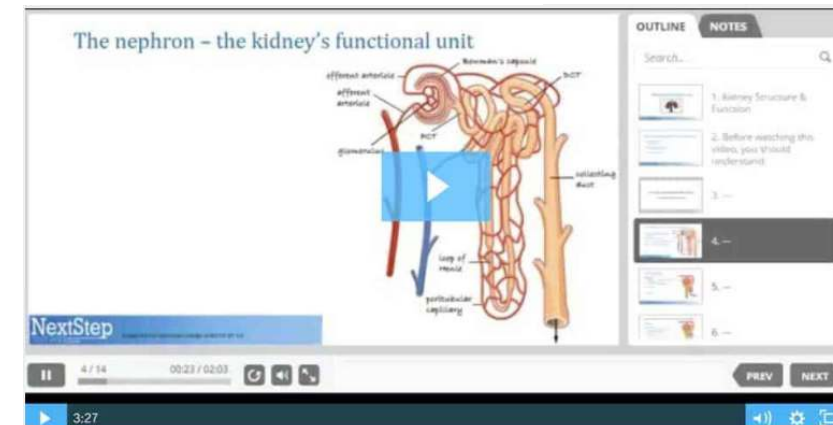
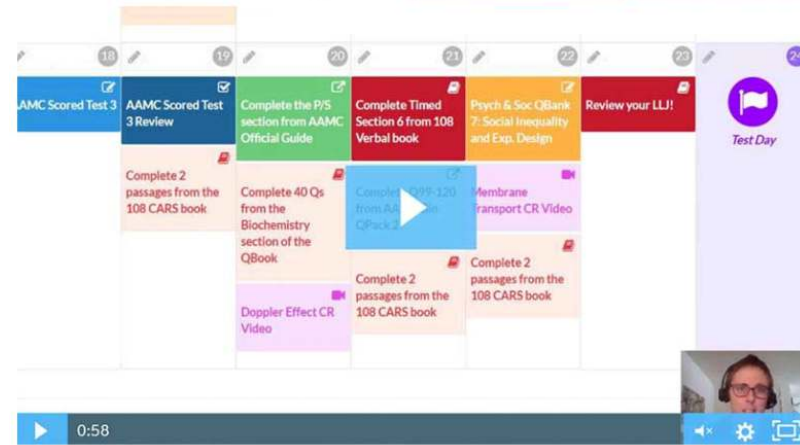
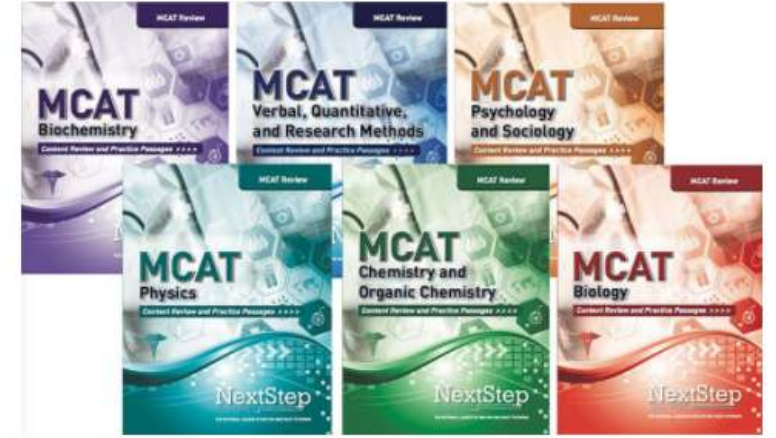
Next Step AAMC 2 Review Video - Biological  
182 views • 1 year ago



# Take the Best Next Step

✓ Others say it. We deliver it.

- Most up-to-date Lesson Review Books in 4-color
- QBank with passage and discrete question types
- Exclusive Study Plan Generator personalized for you
- Hundreds of hours of videos
- Private, small-group Office Hours 5 days a week
- Direct access to MCAT Content Team
- Affordable prep options: from books to tutoring



# MCAT Study Options

- **Best-in-Class MCAT Tutoring Packages**
  - Variety of packages: Crash Course to Elite
  - Choices include our MCAT Online Course
  - Personalized Study Plan for each student
  - Top-scoring tutors
- **Most up-to-date MCAT Course**
  - All new books in 4-color, all online AAMC resources
  - 10 full-length exams aligned to new interface
  - Live online office hours for any Q&A held 5 days per week
  - Study Plan Generator to match each student's strengths, weaknesses and schedule needs.
- **MCAT Practice Test Bundles**
  - Available in 4-, 6-, and 10-pack bundles

✓ **All aligned to new 2018 interface**

Coupon codes

\$300 of the course:

**Bio300**

# Math on the MCAT

## Chemistry and Physics

## Bio

Hardy Weinberg  
Recombination frequencies  
Enzyme rates  
 $IC_{50}$   
DATA!!!!!!

### Electricity and Magnetism

$$F = kQ_1Q_2 / r^2$$

$$F = qVB\sin\theta$$

$$F = iLB\sin\theta$$

$$V = IR$$

$$P = IV$$

$$R = \rho L / A$$

$$V_{rms} = V_{max} / \sqrt{2}$$

$$I_{rms} = I_{max} / \sqrt{2}$$

**Resistors in series:**

$$R_{tot} = R_1 + R_2 \dots$$

**Resistors in parallel:**

$$1/R_{tot} = 1/R_1 + 1/R_2 \dots$$

**Capacitors in series:**

$$1/C_{tot} = 1/C_1 + 1/C_2 \dots$$

**Capacitors in parallel:**

$$C_{tot} = C_1 + C_2 \dots$$

$$C = Q/V$$

$$\text{Energy} = (1/2)QV$$

$$F = qE$$

$$V = Ed$$

$$\text{Energy} = qEd$$

$$E = kQ/r^2$$

$$\text{Energy} = kQq/r$$

$$V = kQ/r$$

$$\Delta G = -nFE$$

$$E_{cell} = E_{cath} - E_{an}$$

### Waves

$$v = f\lambda$$

$$T = 1/f$$

### Light

$$n_1\sin\theta_1 = n_2\sin\theta_2$$

$$\sin\theta_c = n_2/n_1$$

$$E = hf$$

$$m = -d_i / d_o$$

$$P = 1/f$$

$$f = (1/2)r$$

$$n = c/v$$

$$1/f = 1/d_i + 1/d_o$$

### Sound

$$d\beta = 10 \log(I/I_0)$$

$$L = n\lambda/2 \quad (n=1, 2, \dots)$$

$$L = n\lambda/4 \quad (n=1, 3, \dots)$$

$$f_{beat} = |f_1 - f_2|$$

$$f = f_e[v \pm v_d] / [v \pm v_s]$$

### Fluids

$$\rho = m/V$$

$$P = F/A$$

$$P = P_{atm} + \rho g d$$

$$F_b = \rho g V$$

$$Q = Av$$

$$P + \rho g y + (1/2)\rho v^2 =$$

constant

### Gases

$$PV = nRT$$

$$\text{Boyle: } PV = k$$

$$\text{Guy-Lussac: } P/T = k$$

$$\text{Charles: } V/T = k$$

$$\text{Avogadro: } n/V = k$$

$$R_1/R_2 = \sqrt{m_2/m_1}$$

$$P_A = X_A \times P_{tot}$$

### Solutions

$$pH = pK_a + \log(A^-/HA)$$

$$M = \text{mol} / L$$

$$m = \text{mol} / \text{kg}$$

$$N = M \times \# \text{ of } H^+$$

$$pH = -\log[H^+]$$

$$M_i V_i = M_f V_f$$

$$\Pi = MRT$$

$$\Delta T_f = i k_f m$$

$$\Delta T_b = i k_b m$$

$$X_A = \text{mol}_A / \text{mol}_{tot}$$

### Thermo

$$\Delta U = Q - W$$

$$\Delta U = (3/2)nRT$$

$$W = P\Delta V$$

$$Q = mc\Delta T$$

$$Q = mH_L$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta H_{rxn} = \Delta H_{prod} - \Delta H_{react}$$

### Kinematics

$$v_f = v_o + at$$

$$d = v_o t + (1/2)at^2$$

$$v_f^2 = v_o^2 + 2ad$$

$$a_c = v^2 / r$$

$$F_c = mv^2 / r$$

$$v_x = v_o \cos\theta$$

$$v_y = v_o \sin\theta$$

### Mechanics

$$F = ma$$

$$F_{a \text{ on } b} = -F_{b \text{ on } a}$$

$$F_{fric} = \mu F_N$$

$$F_g = GM_1 m_2 / r^2$$

$$F_g = mg$$

$$F = kx$$

$$\tau = rF \sin\theta$$

$$P = W/t$$

$$W = Fd \cos\theta$$

$$E_K = (1/2)mv^2$$

$$U = mgh$$

$$U = -GM_1 m_2 / r$$

### Inclined Plane

$$F_{incline} = mg \sin\theta$$

$$F_N = mg \cos\theta$$

$$F_{fric} = \mu mg \cos\theta$$

The logo for Next Step Test Prep is centered in the upper half of the image. It consists of a blue square containing the words "Next Step" in a large, white, sans-serif font, with "TEST PREP" in a smaller, white, sans-serif font below it. The background of the entire image is dark blue with a repeating pattern of small white plus signs. A large white arrow points downwards from the top, framing the logo.

Next  
Step  
TEST PREP

— — — — —

**Step**

**CALL 888-530-6398 FOR A FREE CONSULT**