

The logo for Next Step Test Prep is centered in a blue square. It features the words "Next" and "Step" in a large, white, sans-serif font, stacked vertically. Below them, the words "TEST PREP" are written in a smaller, white, all-caps, sans-serif font.

Next
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TEST PREP

Biochemistry

Today's Info Session

- ▶ Welcome to this Info Session!
- ▶ Introduction
- ▶ Biochemistry
 - ▶ Nucleotides
 - ▶ Amino acids
 - ▶ Lipids
- ▶ How Can Next Step Help?
- ▶ Questions?

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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!**



Subjects Tested

Chemical and Physical Foundations

30% general chemistry

25% physics

25% biochemistry

15% organic chemistry

5% biology

Bio and Biochemical Foundations

65% biology

25% biochemistry

5% organic chemistry

5% general chemistry

Psychological and Sociological Foundations

65% psychology

30% sociology

5% biology

“High-Yield” Topics

Warning: anything on the AAMC MCAT outline is fair game!

However, some topics are more likely to appear than others...

Topic	Number of questions
Biology	45
Biochem	30
Physics	15
Gen Chem	20
Organic Chem	11
Psychology	38
Sociology	18
CARS	53
Total	230

Biomolecules

- ▶ **Nucleotides**
- ▶ **Peptides**
- ▶ **Lipids**

- ▶ **What techniques can we use to study these things?**

Nucleotides

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1. Understand how the backbone works

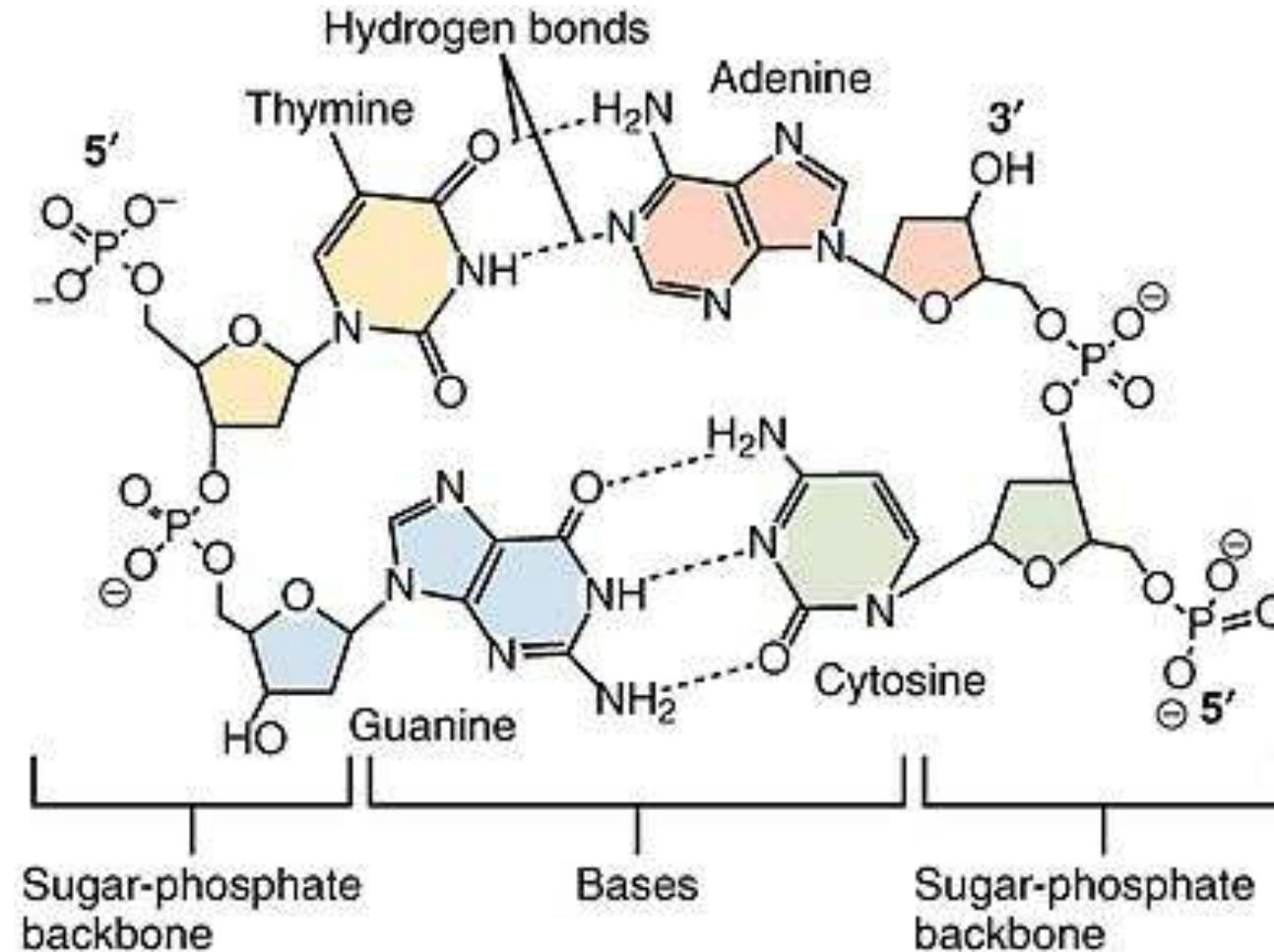
2. Numbered carbons on ribose

3. Purines vs Pyrimidines

▶ CUT the Py

▶ PUR As Gold

4. Hybridization



Nucleases

Nucleases are enzymes that cut nucleotides

- ▶ Endonucleases cut in the middle of a strand
- ▶ Exonucleases cut off the end

5'-AAAAATTTTCCCCAAAAA-3'
3'-TTTTTAAAAGGGGGTTTTT-5'

If I cut at the following sequences,
what happens?

1. TTTCCC

2. AAATTT

Sticky ends vs Blunt ends

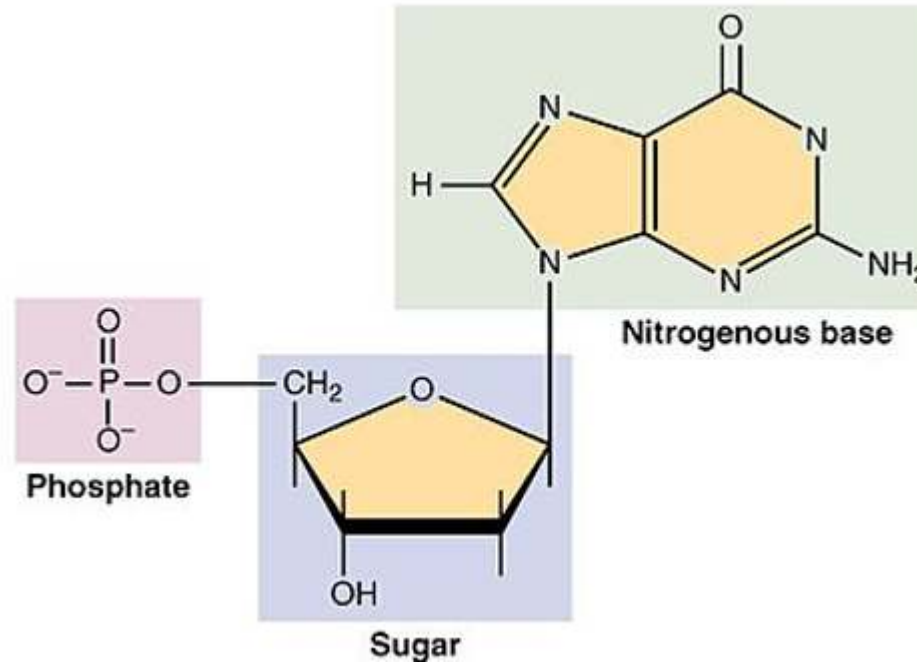
Blunt restriction enzymes cut in the center of the sequence

Sticky cuts off center

Questions

What is the nucleotide shown?

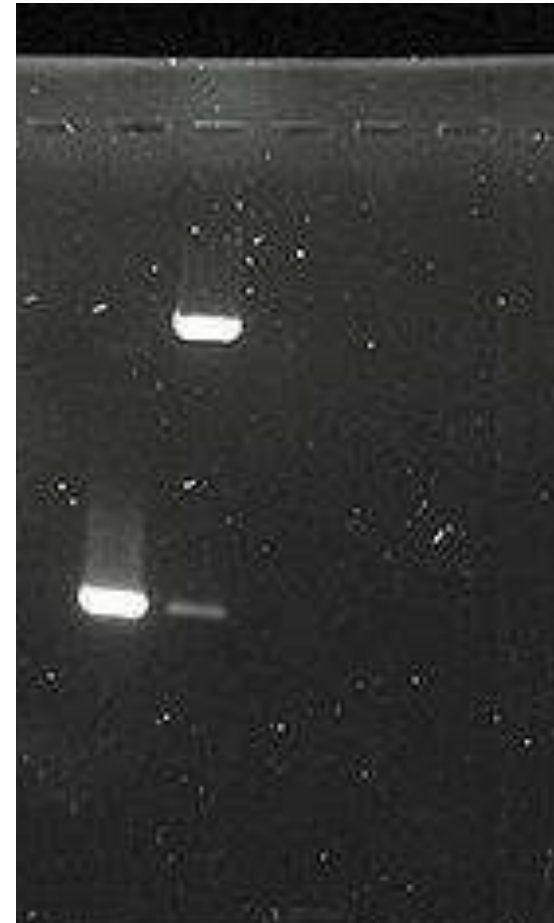
- A. Adenine
- B. Guanine
- C. Thymine
- D. Uracil



Questions

I ran a gel with two sets of the same DNA and ended up with the gel shown. I also may have done some other things before I ran the gel. Which of the following is most likely?

- A. I added mononucleotides to one sample.
- B. I added an exonuclease to one sample.
- C. I added an endonuclease to one sample.
- D. I heated one sample.



Questions

Which of the following techniques would be most useful for identifying changes to DNA?

- A. Southern Blot
- B. Northern Blot
- C. Western Blot
- D. Far Eastern Blot

Questions

Which of the following genetic sequences would be best for use with restriction enzyme?

- A. ACAGTTCAGAAT
- B. TTATGCATGATTC
- C. GCAAGATTACGA
- D. GACCAGGTAGCC

5'ATGCAT
TACGTA 5'

Amino Acids

All Amino acids have the same overall structure with the difference being the R group.

The R groups can give all different properties:

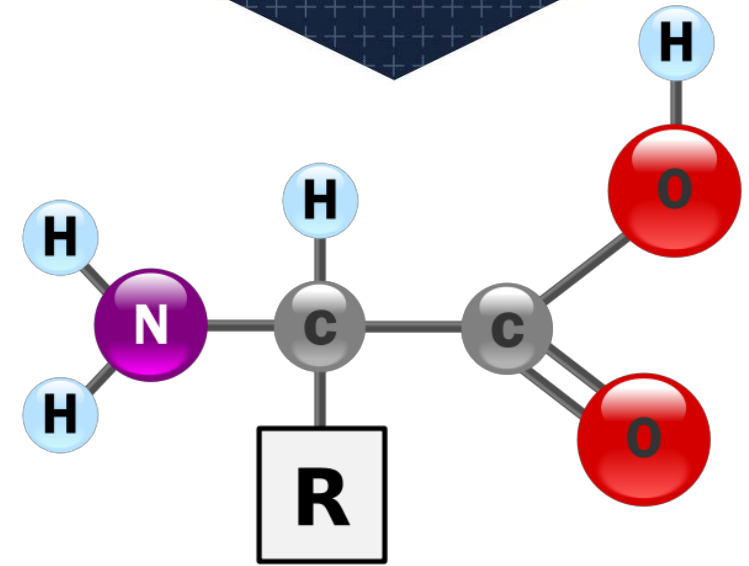
Aromatic

Hydrophobic

Charged

Create kinks

Allow disulfide bridges

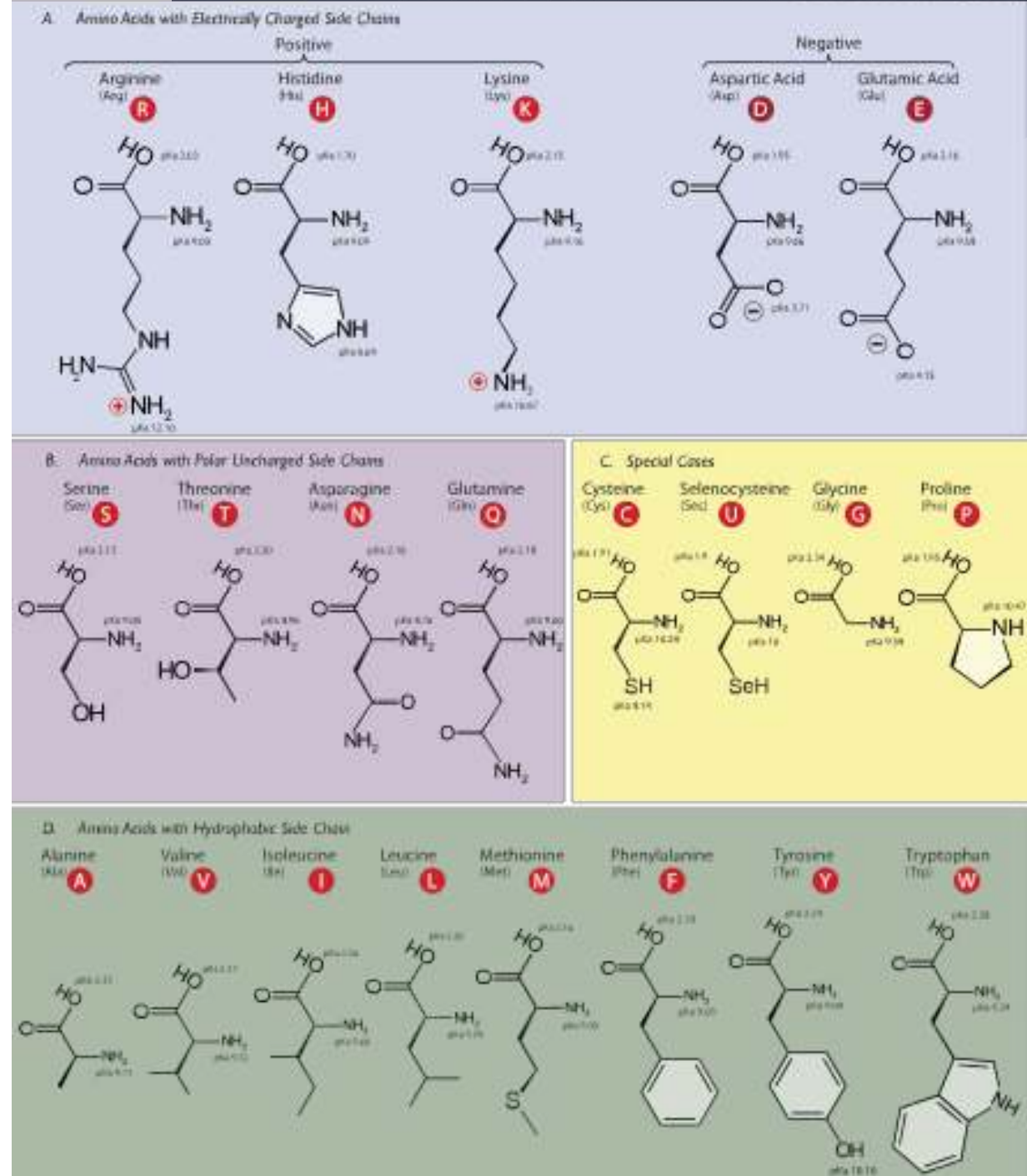


Amino Acids

HIGH YIELD!

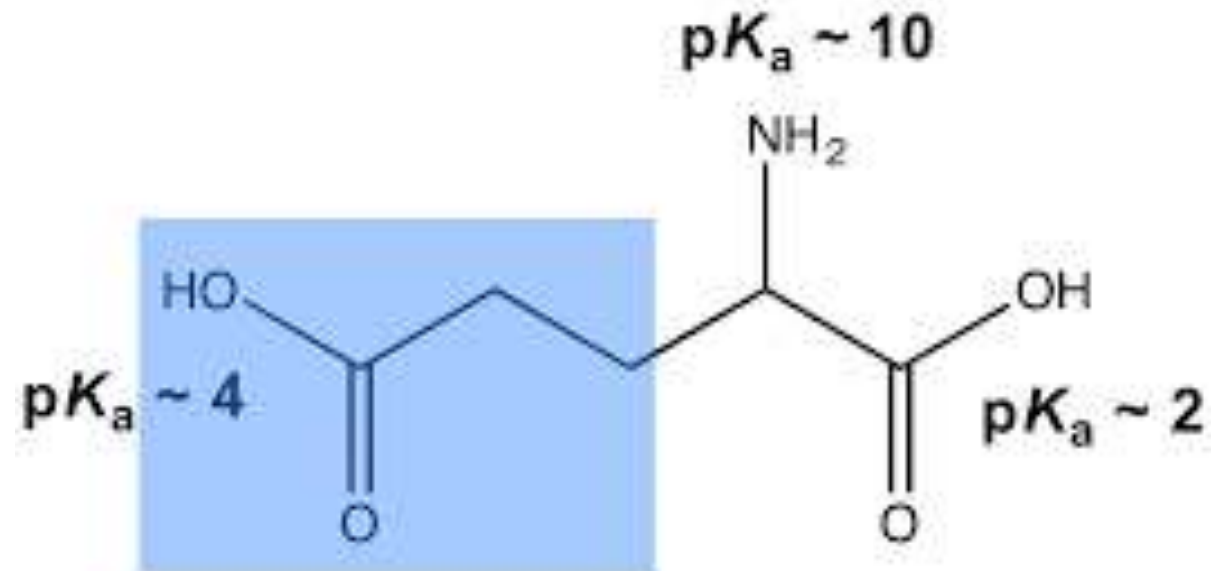
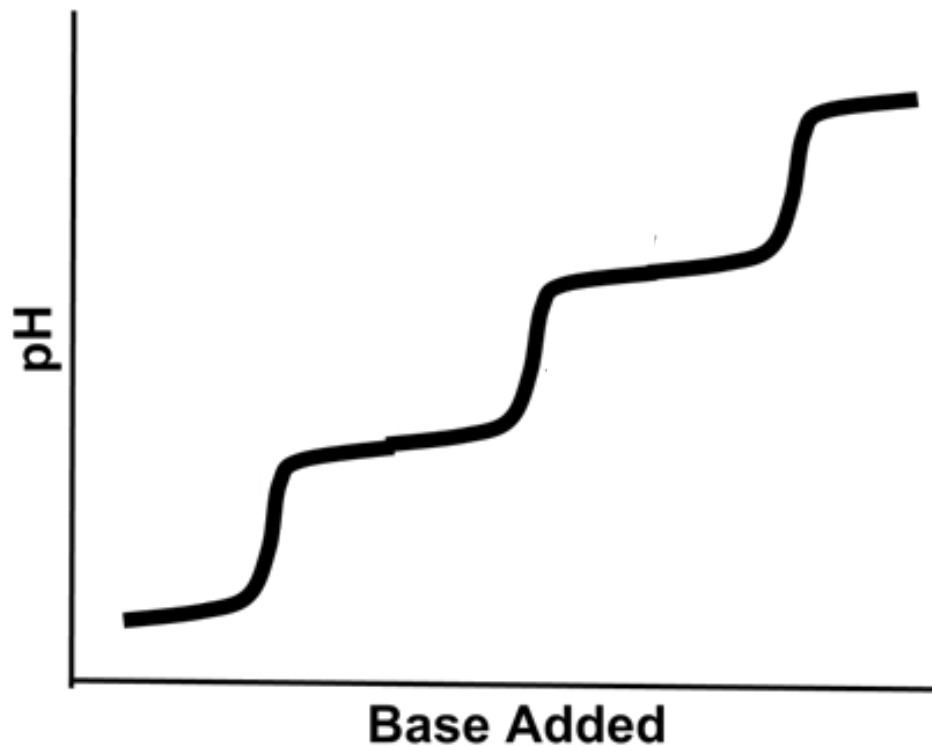
You must make sure you know:

1. Polar, charged, nonpolar
2. 3 letter symbols and 1 letter symbols
3. Understand the difference between D and L vs R and S
4. How will pH affect activity
5. Weird special cases



Amino Acids

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Glutamic Acid
One Letter Code: E
Three Letter Code: Glu

Amino Acids

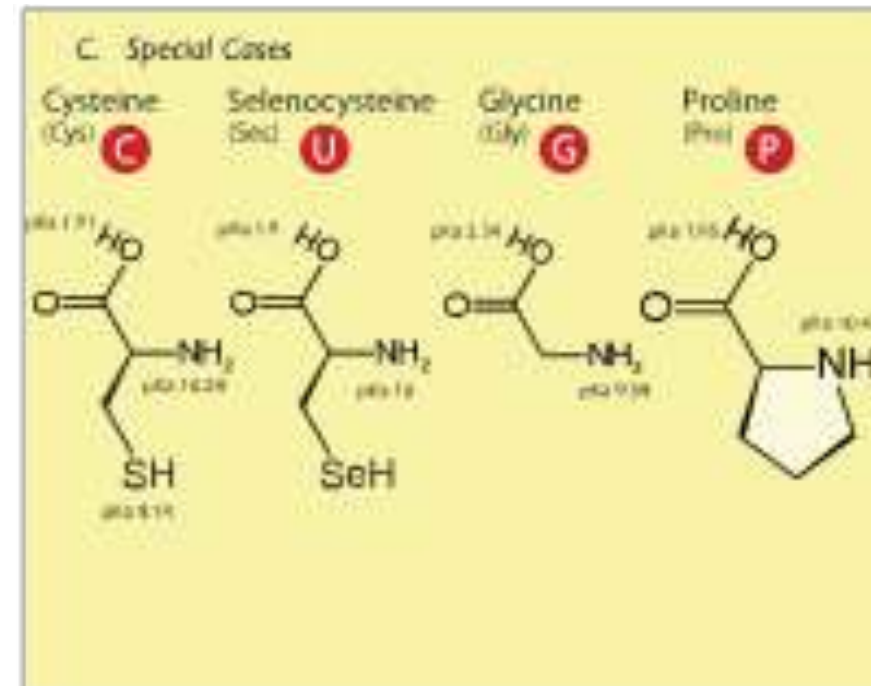
Special Cases:

1. Glycine

2. Proline

3. Cysteine

4. Selenocysteine

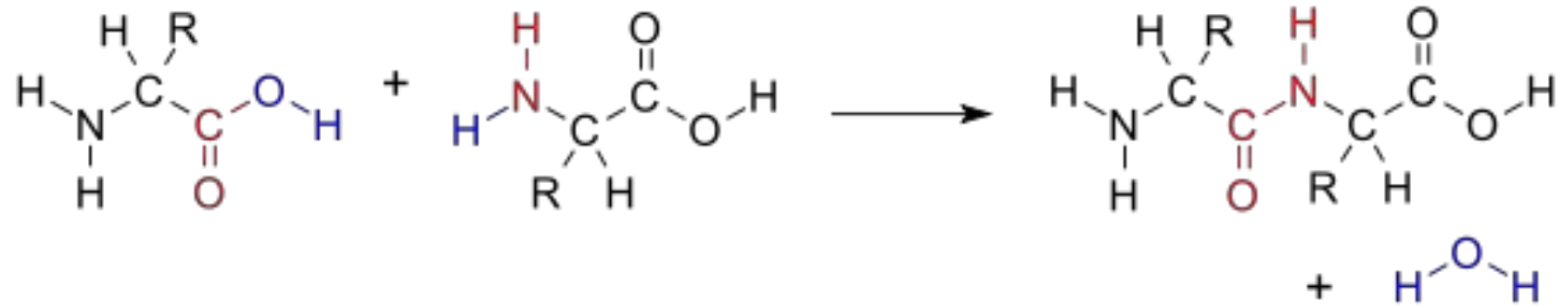


Amino Acids

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Putting it all together!

Peptide bonds:



Structure:

Primary

Secondary

Tertiary

Quaternary

Questions

Which of the following techniques would be most useful for identifying changes protein structure?

- A. Southern Blot
- B. Northern Blot
- C. Western Blot
- D. Far Eastern Blot

Questions

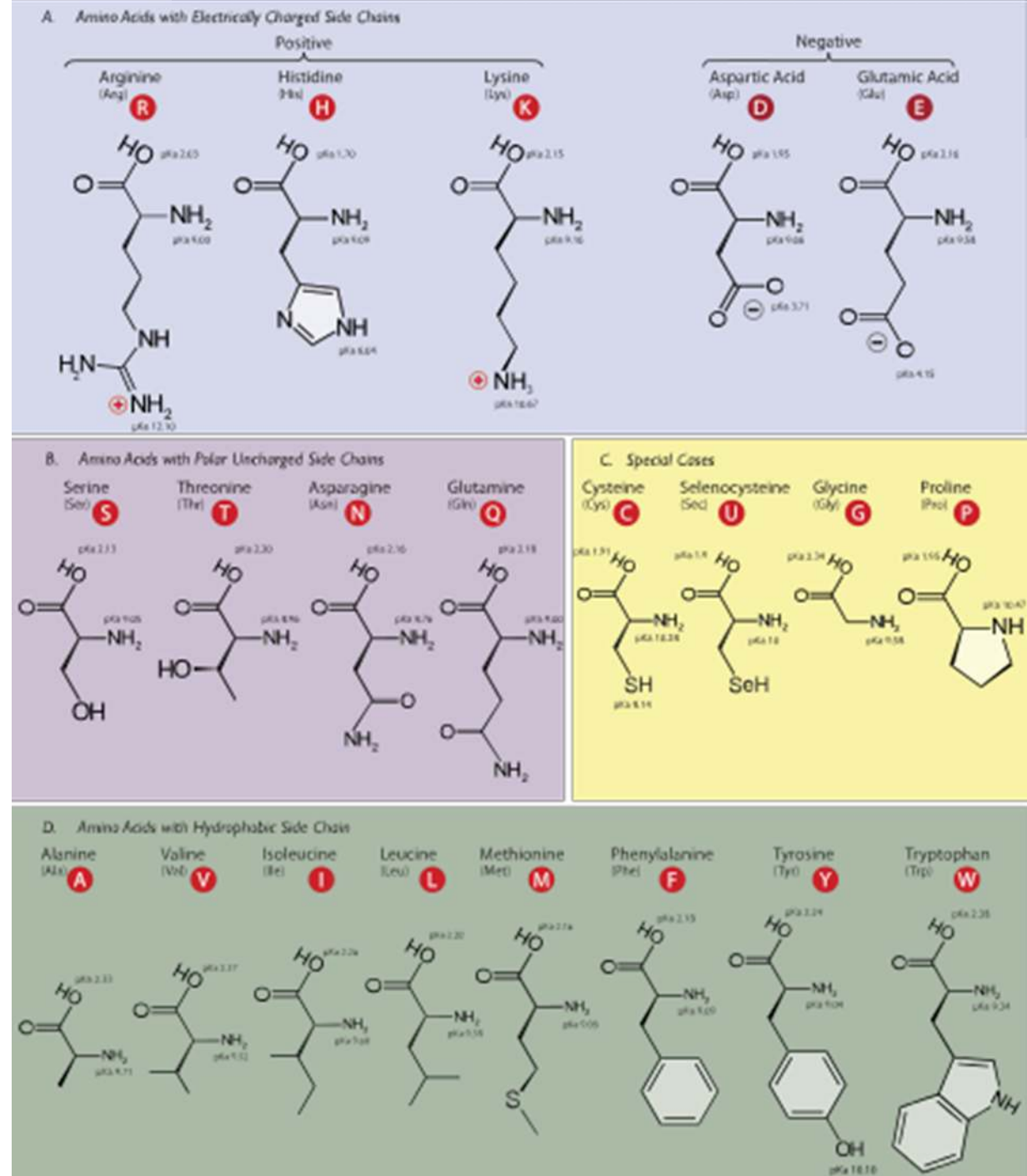
Which of the following amino acids is most likely to be found on the surface of a transmembrane domain of a protein?

- A. Aspartic acid
- B. Lysine
- C. Threonine
- D. Leucine

Questions

Which of the following mutations is least likely to influence protein activity?

- A. S112N
- B. C212A
- C. L114P
- D. D72E



Questions

What functional group is created during a peptide bond?

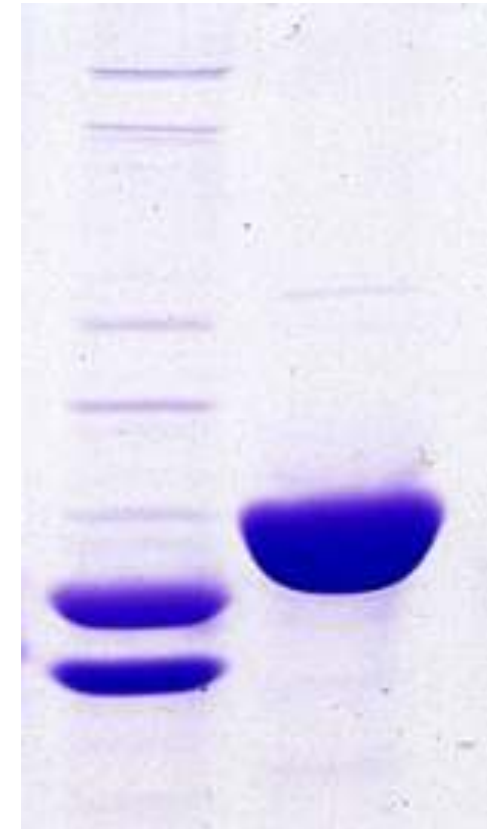
- A. Ether
- B. Ester
- C. Amide
- D. Amine

Questions

I ran the following western blot of the same protein in different conditions. Which of the following could explain the difference:

- I. Heat was added to one sample
- II. A protease was added to one sample
- III. A reducing agent was added to one sample

- A. I only
- B. I and II
- C. II only
- D. II and III



Lipids

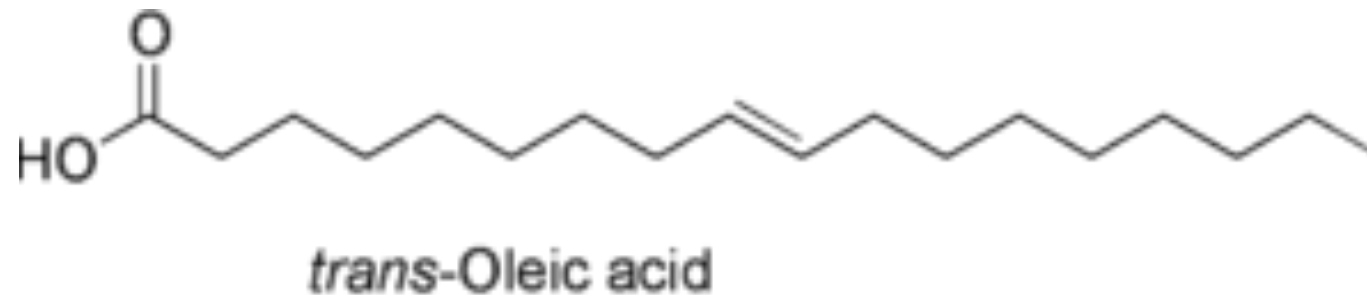
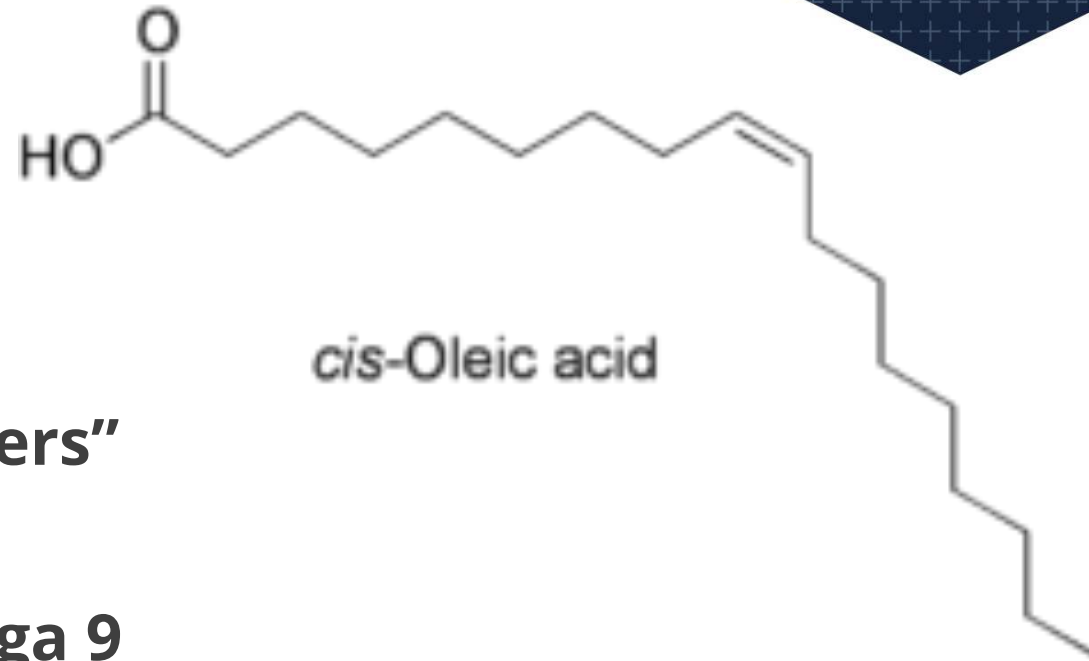
Behavior: related to the structure that you see it in.

Free fatty acids

▶ Cis vs trans

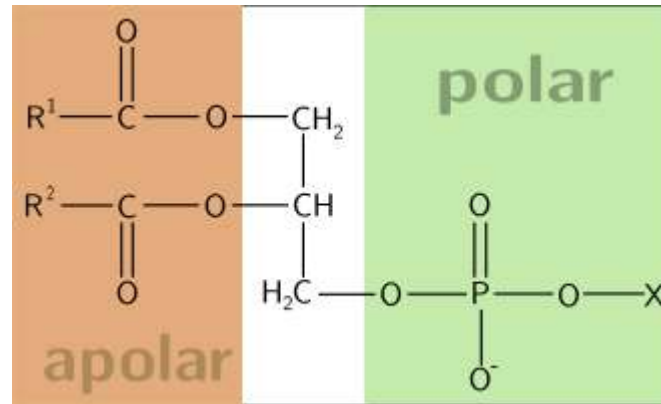
Often described with “lipid numbers”

- ▶ 18:1 *cis*-9
- ▶ Omega- Oleic acid is an Omega 9

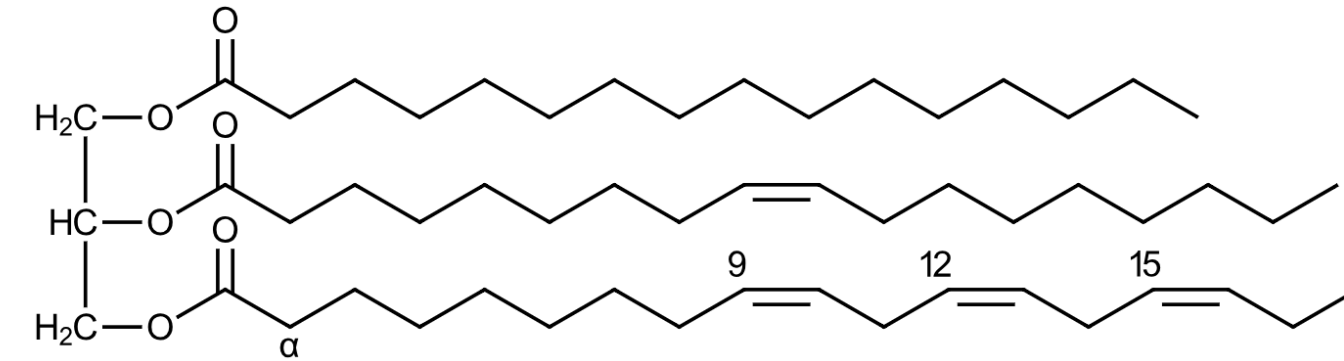


Lipids

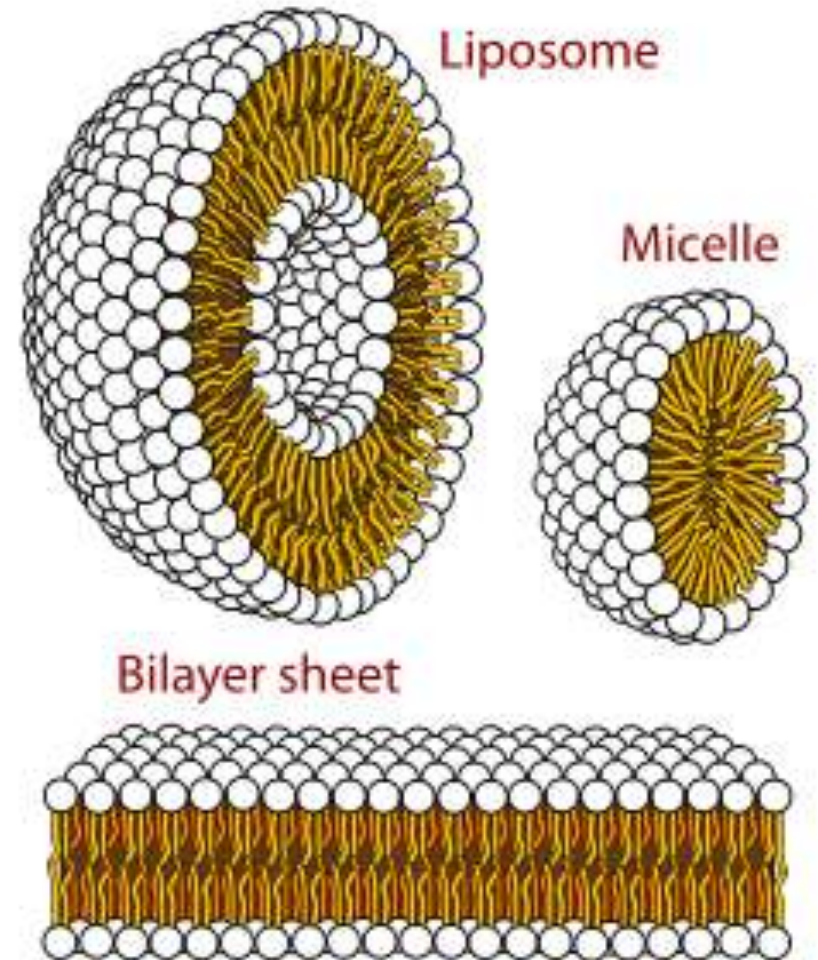
Phospholipids



Triglycerides



Larger structures



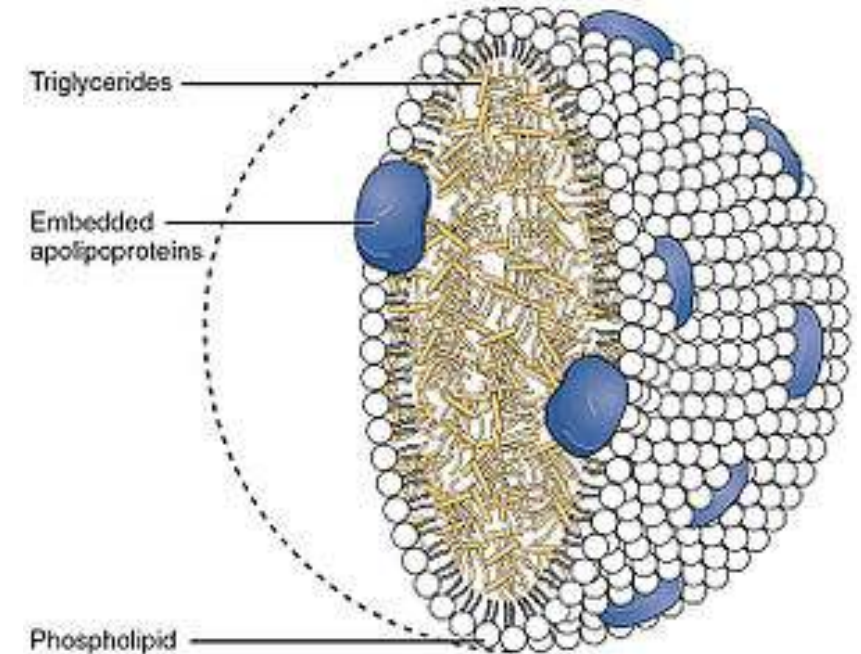
Lipids

Lipoproteins

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Size (and density) organizations:

- ▶ **Chylomicron** carry triglycerides from the intestine
- ▶ **VLDL** carry newly made triglycerides from liver
- ▶ **LDL** are associated with atherosclerosis
- ▶ **HDL** pick up fat and take it to the liver



Questions

Bile is an emulsifier that increases lipid solubility in chyme. It does this by creating:

- A. Micelles**
- B. Tryglycerides**
- C. Free fatty acids**
- D. Chylomicrons**

Questions

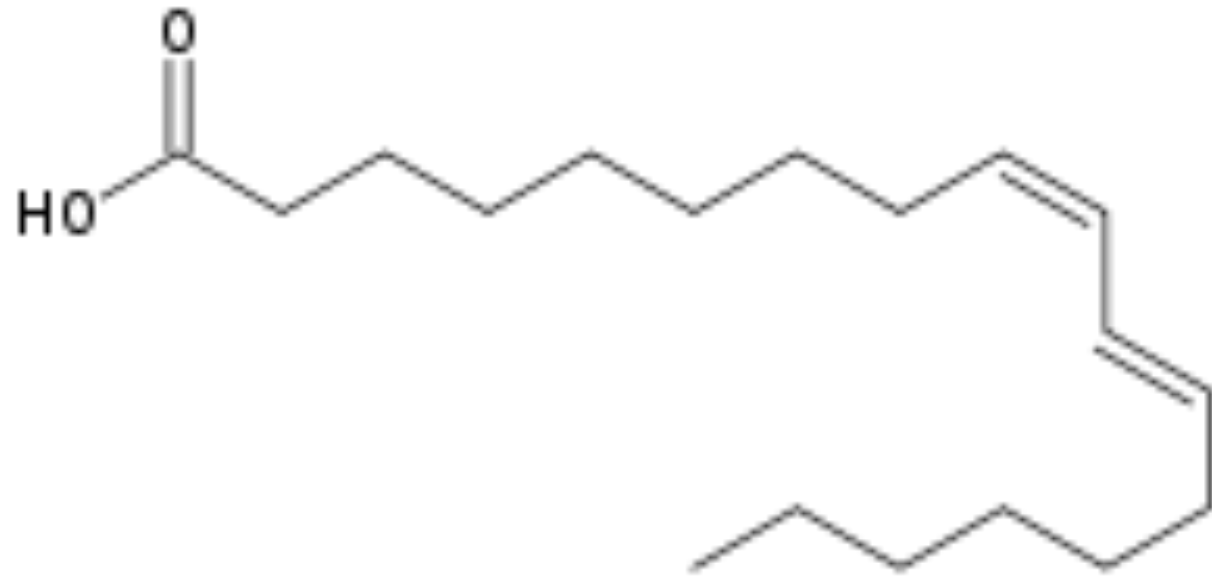
Saponification is a process through which a triglyceride is broken into free fatty acids which can create micelles. What sort of a functional group is destroyed in the process?

- A. Ether
- B. Ester
- C. Ketone
- D. Aldehyde

Questions

What is the lipid number for the following compound?

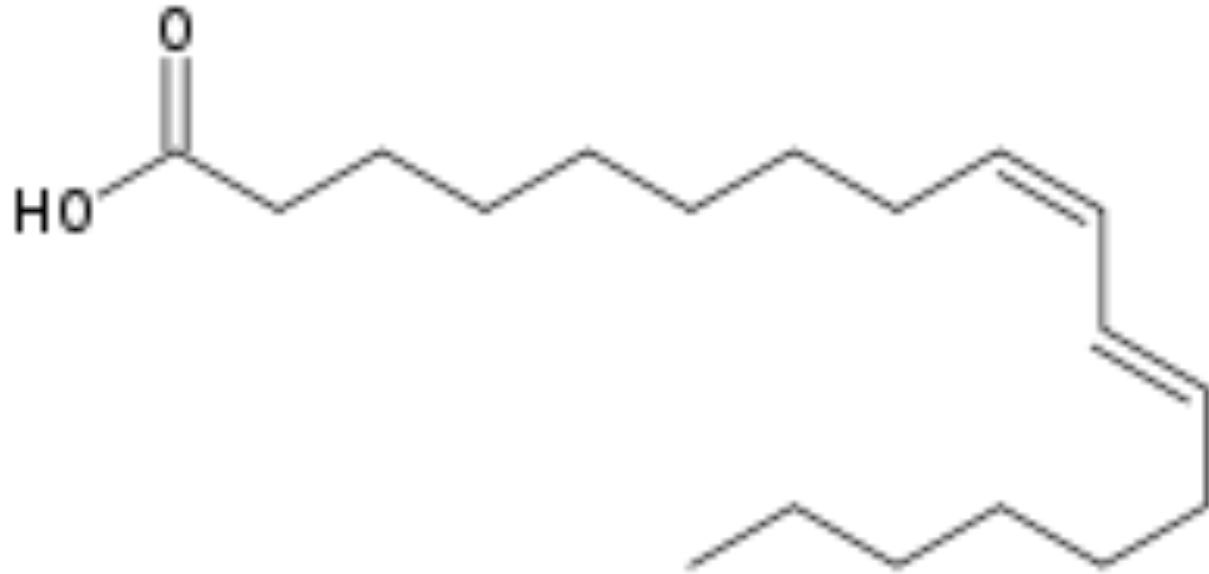
- A. 17:2
- B. 18:2
- C. 19:2
- D. 20:2



Questions

This would be considered what kind of a fatty acid?

- A. Omega 7
- B. Omega 9
- C. Omega 7,9
- D. Omega 8,10



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Q&A

Next Step: Core Values

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Authenticity



Professionalism



Ownership

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4.7



Personalized Options

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- **Self-Prep Materials and Planning**
- **Guided Online Study with Free Extra Help**
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Additional Free Resources

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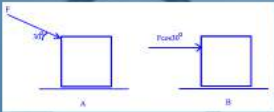
✓ Supplement your prep with additional support tools

- 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

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Question of the Day

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

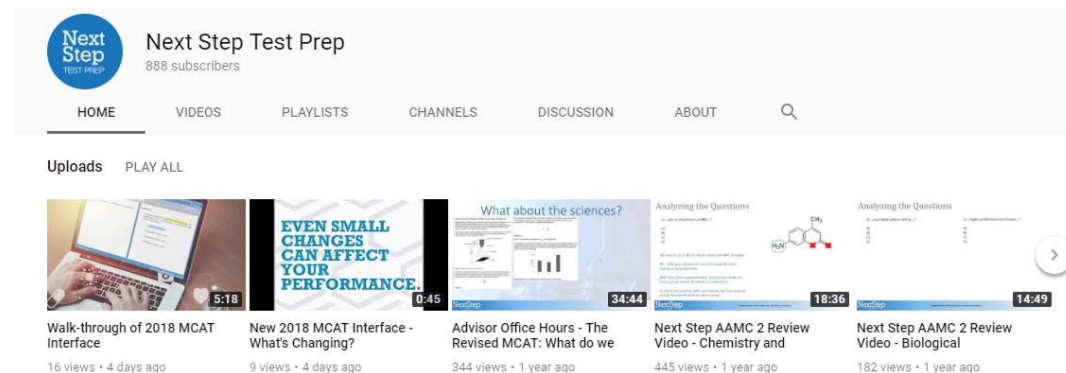


A) Person A
B) Person B
C) Person A and B do equal amounts of work
D) cannot be determined

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New 2018 MCAT Interface

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- New highlighting features
- New strikethrough features
- New keyboard shortcuts
- New Navigation/Review Screens

Next Step is ready. Are you?

Medical College Admission Test - Clara Gillan Time Remaining: 01:21:34 18 of 59

Highlight Strikethrough

Remove Highlight

Pause

Figure 1 Eosinophil activation as measured by percent of CD69-positive cells after 3 and 12 hours of co-culture (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)

Next, researchers aimed to assess the effect of NK co-culture on eosinophil degranulation. After 3 and 12 hours of co-culture, samples were centrifuged at 1500 rpm, and ECP levels were measured in the supernatants (Figure 2). No ECP was detected in supernatant culture of NK cells alone.

Question 18

Which of the statements below is supported by the experimental results, as shown in Figures 1 and 2?

- A. The duration of Eos co-culture with NK cells directly and linearly correlates to the amount of ECP found in the supernatant after centrifugation.
- B. Cells cultured with a 1:1 NK-to-Eos ratio displayed statistically similar levels of activation to cells cultured with a 5:1 NK-to-Eos ratio, as measured by CD69 expression.
- C. NK co-culture stimulates Eos activation while inhibiting degranulation.
- D. Co-culture with NK cells significantly increased Eos degranulation in all groups, as compared to Eos cells cultured alone.

Periodic Table Review Screen

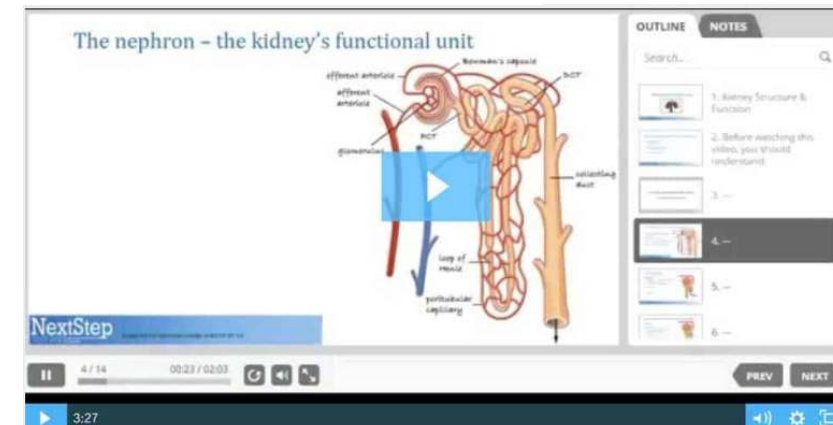
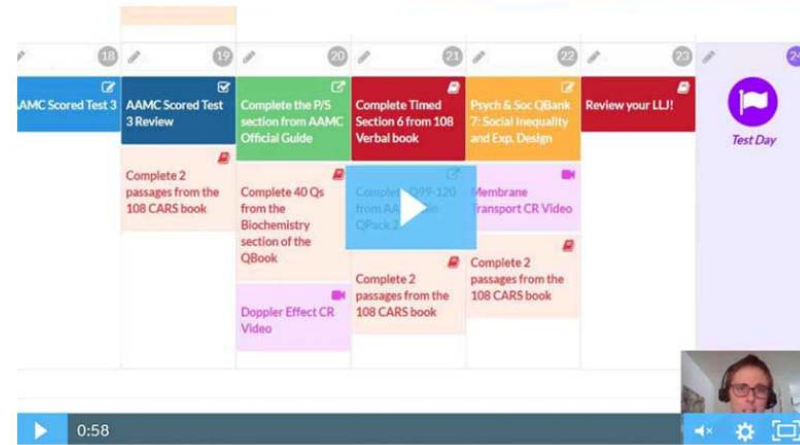
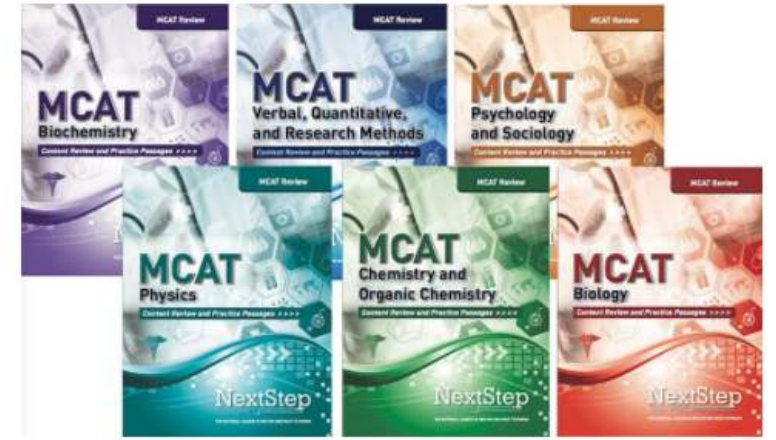
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Glycolysis

Gluconeogenesis

KREBS and ETC

Glycogen

Fatty acid oxidation

Pentose phosphate pathway.

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