

Fall 2021 - LIFESCI7A-2 / LIFESCI7A-3 - CHEN / MALOY

Started on Friday, 22 October 2021, 8:00 PM PDT

State Finished

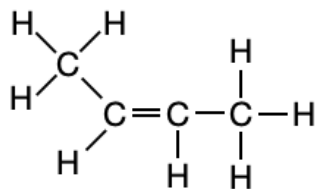
Completed on Friday, 22 October 2021, 8:11 PM PDT

Time taken 10 mins 31 secs

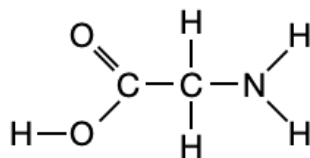
Information

The following image shows four molecules. Use this image to answer the following questions.

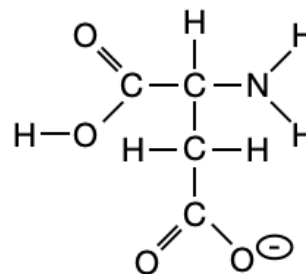
Molecule A



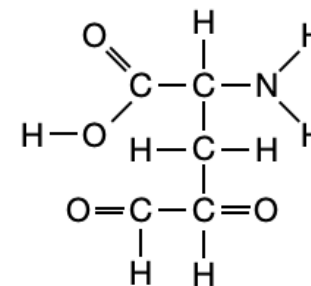
Molecule B



Molecule C



Molecule D



Question 1

Complete

Points out of 1.00

Which of the four molecules depicted above could not exist in nature?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D
- e. All of these could exist

Question 2

Complete

Points out of 1.00

How many non-polar bonds exist in molecule B?

- a. 0
- b. 1
- c. 2
- d. 3
- e. 4
- f. 5
- g. 6 or more

Question 3

Complete

Points out of 1.00

Which of the molecules above is/are completely nonpolar?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D
- e. More than one of these

Question 4

Complete

Points out of 1.00

Which of the molecules above could form hydrogen bonds with water but not with another identical molecule?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D
- e. None of the above

Question 5

Complete

Points out of 1.00

Which of the molecules above is hydrophobic?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D
- e. More than one of the above

Question 6

Complete

Points out of 1.00

Which of the molecules above would have the easiest time passing through a pure lipid bilayer without the assistance of transport proteins?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D

Question 7

Complete

Points out of 1.00

Which of the molecules above would have the hardest time passing through a pure lipid bilayer without the assistance of transport proteins?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D

Question 8

Complete

Points out of 1.00

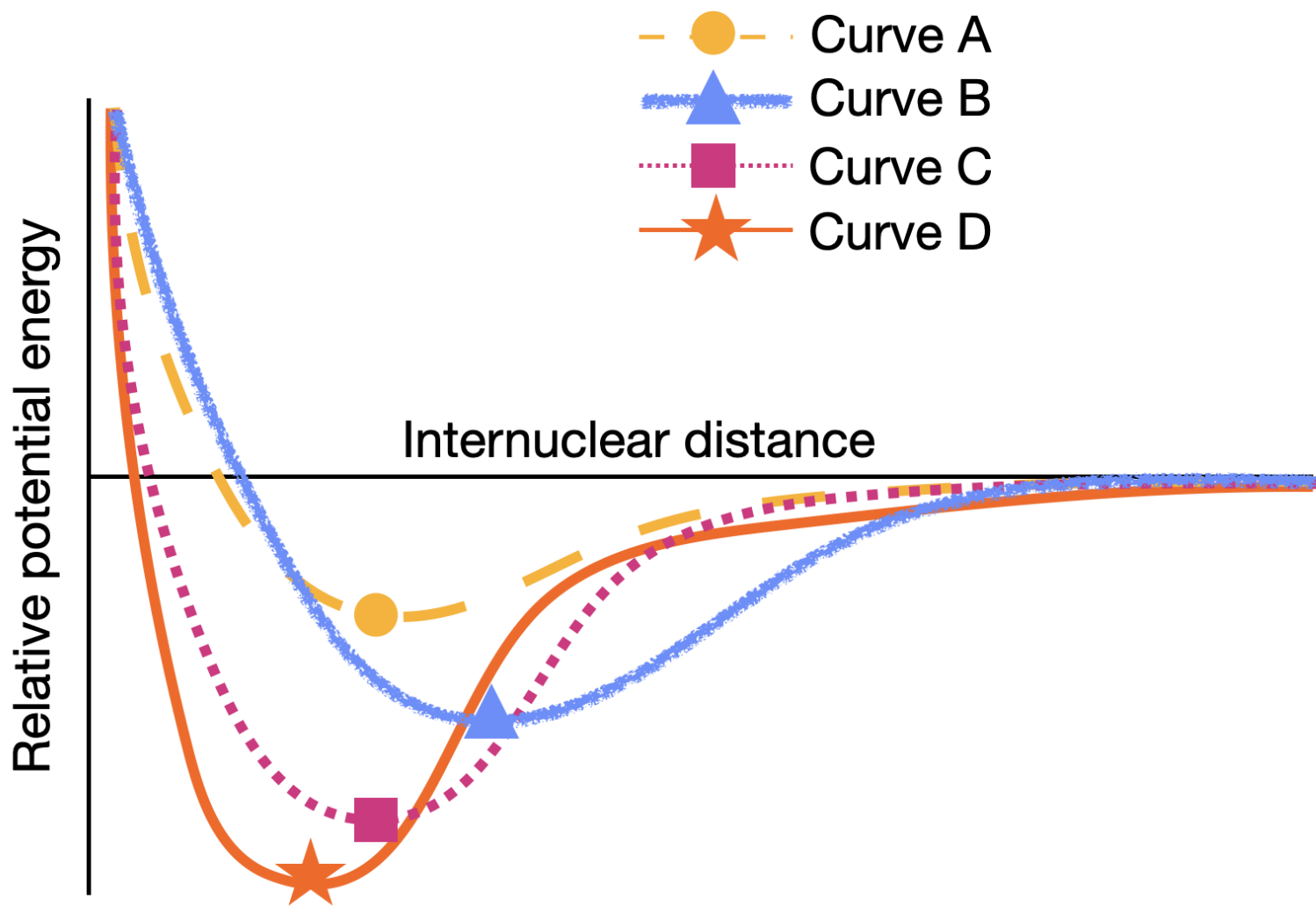
Which of molecules above could form Van der Waals interactions with another identical molecule?

- a. Molecule A
- b. Molecule B
- c. Molecule C
- d. Molecule D
- e. More than one of the above

Information

The following table shows four different bonds along with their observed bond distances and potential energies. The image below the table shows four curves representing interactions between different pairs of atoms. For each curve, the lowest point represents the observed bond distance. Use this information to answer the following questions.

Bond	Potential Energy	Internuclear Distance
C-C	-348 kJ/mol	154 pm
C-O	-358 kJ/mol	143 pm
C-H	-413 kJ/mol	109 pm
C-N	-293 kJ/mol	143 pm



Question 9

Complete

Points out of 1.00

According to the data shown above, which of the following bonds is the weakest bond?

- a. C-C
- b. C-O
- c. C-H
- d. C-N
- e. Not enough information is given to determine this.

Question 10

Complete

Points out of 1.00

According to the information provided above, which bond would require the most energy to break?

- a. C-C
- b. C-O
- c. C-H
- d. C-N
- e. Not enough information is provided to determine this.

Question 11

Complete

Points out of 1.00

Which curve represents the interaction between two carbon atoms?

- a. Curve A
- b. Curve B
- c. Curve C
- d. Curve D
- e. Not enough information is provided to determine this.

Question 12

Complete

Points out of 1.00

T/F: The data above are consistent with the hypothesis that polar bonds are stronger than nonpolar bonds.

Select one:

- True
- False

Information

You are studying a collection of eukaryotic cell samples in the lab. Unfortunately, all of the labels have fallen off of the samples! Each question below represents one of the cell samples you are studying. Use the answer choices to designate which organelle would be the most helpful for correctly distinguishing each sample from the other samples based on the known functions of your cells.

Question 13

Complete

Points out of 1.00

Human stomach cells that secrete lots of digestive enzymes.

- a. Chloroplasts
- b. Mitochondria
- c. Lysosomes
- d. Golgi
- e. Vacuoles

Question **14**

Complete

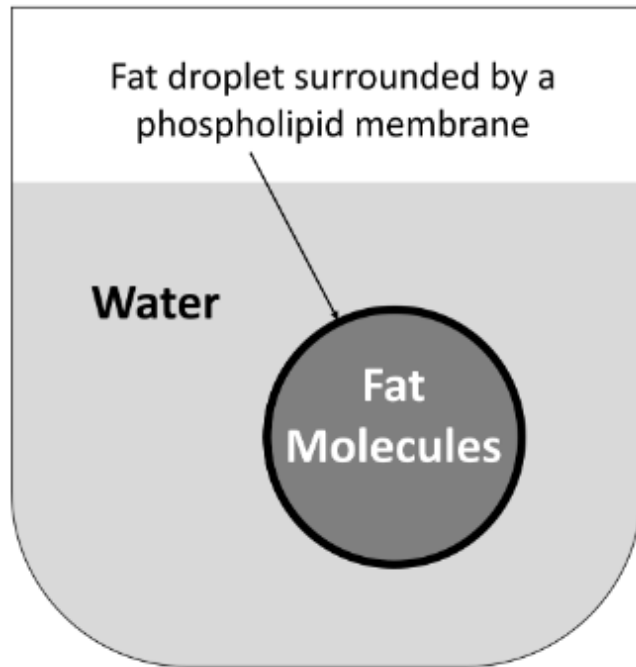
Points out of 1.00

Oophila amblystomatis cells. Oophila amblystomatis is an algae that lives inside of salamander eggs and uses photosynthesis to metabolize carbon dioxide from the eggs and produce oxygen that the eggs need.

- a. Chloroplasts
- b. Mitochondria
- c. Lysosomes
- d. Golgi
- e. Vacuoles

Information

Milk is an aqueous (watery) substance full of spherical fat droplets. Each fat droplet contains only hydrophobic fat molecules. The outside of the droplet is surrounded by a phospholipid membrane. A diagram of a fat droplet in a glass of milk is shown below (drawing is not to scale). Use this information to answer the following questions.



Question 15

Complete

Points out of 1.00

The membrane of the fat droplet could be a double layer of phospholipids (a bilayer).

Select one:

- True
- False

Question 16

Complete

Points out of 1.00

The membrane of the fat droplet could be a single layer of phospholipids (a monolayer).

Select one:

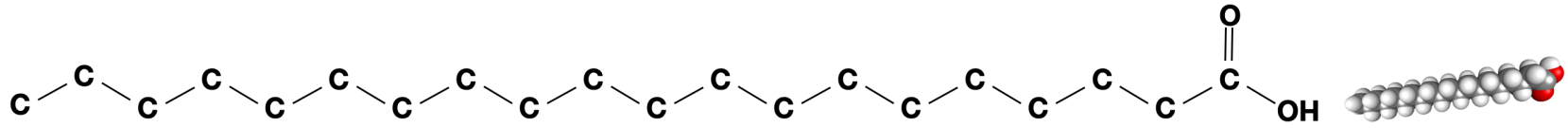
- True
- False

Information

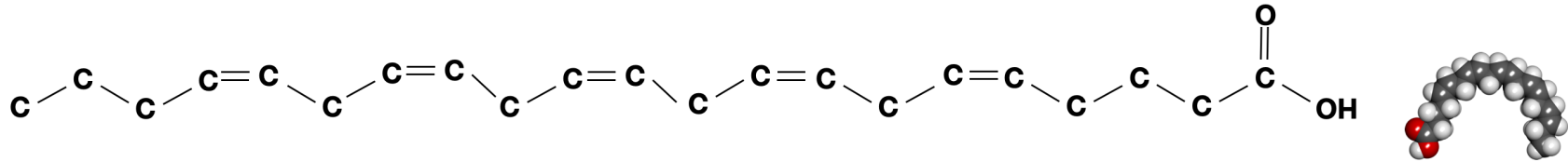
The brown bear is a large species of bear found across Eurasia and North America. Brown bears live in regions that undergo large seasonal changes in climate. In order to survive long, cold winters, they hibernate for around five months of the year. The normal body temperature of a brown bear is between 37.7 °C and 38.3 °C, but during hibernation their body temperature drops to around 31 °C. To help them adapt to these changing body temperatures in different seasons, brown bears adapt their diet in summer versus pre-hibernation months. This allows brown bears to consume different compositions of fatty acids so that they can adjust the composition of their cell membranes to maintain membrane fluidity throughout hibernation months.

The three fatty acids shown below represent major components of a brown bear's diet at different times of the year. To the right of each molecule is an image representing a space-filling model of the same molecule to show what that molecule looks like in three dimensional space. Use these images and what you know about fatty acids to answer the following questions.

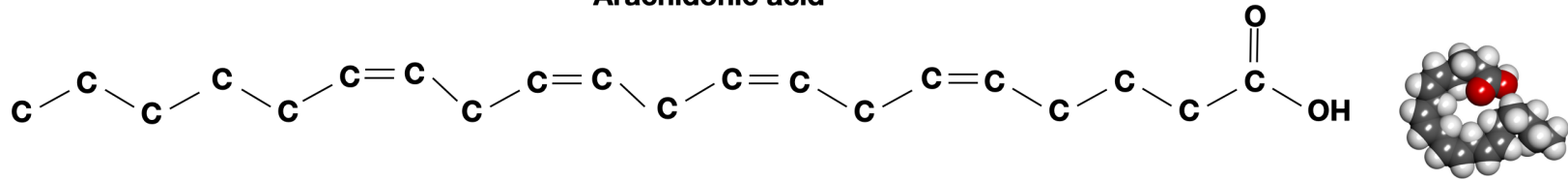
Arachidic acid



Eicosapentaenoic acid



Arachidonic acid



Question 17

Complete

Points out of 1.00

If brown bears did not change the composition of their cell membranes during winter months, what would be the effect on the fluidity of their cell membranes?

- a. Their cell membranes would become more fluid
- b. Their cell membranes would maintain similar fluidity
- c. Their cell membranes would become less fluid

Question 18

Complete

Points out of 1.00

Which of the following foods would you expect to become a less important part of a brown bear's diet leading in to hibernation months?

- a. Salmon - High in eicosapentaenoic acid
- b. Nuts and seeds - high in arachidic acid
- c. Moose meat - high in arachidonic acid

Question 19

Complete

Points out of 1.00

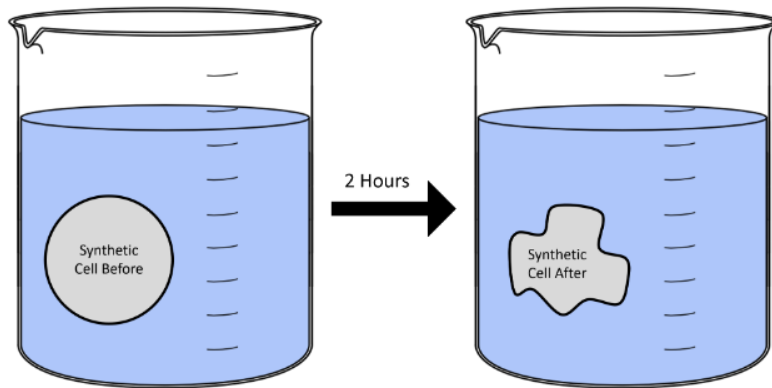
Which of these fatty acids would you expect to increase membrane fluidity compared to the membrane shown below?



- a. Arachidic acid
- b. Eicosapentaenoic acid
- c. Arachidonic acid
- d. More than one of the above

Information

A synthetic cell filled with a 15% sucrose solution is placed in an unlabeled beaker filled with an unknown aqueous solution. The synthetic cell is surrounded by a semipermeable membrane that allows the free passage of water but is not permeable to sucrose. After 2 hours, the synthetic cell in the beaker decreases in volume and becomes floppy.



Question 20

Complete

Points out of 1.00

The observation above suggests that at the beginning of the experiment, the solution inside the synthetic cell was _____ compared to the solution in the beaker.

- a. Hypertonic
- b. Hypotonic
- c. Isotonic
- d. Not possible to tell

Question 21

Complete

Points out of 1.00

Based on the observation above, the contents of the beaker could have been:

- a. 5% sucrose
- b. 15% sucrose
- c. 25% sucrose

Question **22**

Complete

Points out of 1.00

Suppose you repeat the experiment above, but this time you use a synthetic cell with a membrane that is permeable to both water and sucrose. All other conditions are the same. After 2 hours, the volume of this synthetic cell will be _____ compared to the volume of the synthetic cell at the end of the original experiment described above.

- a. Smaller
- b. Larger
- c. The same size

Information

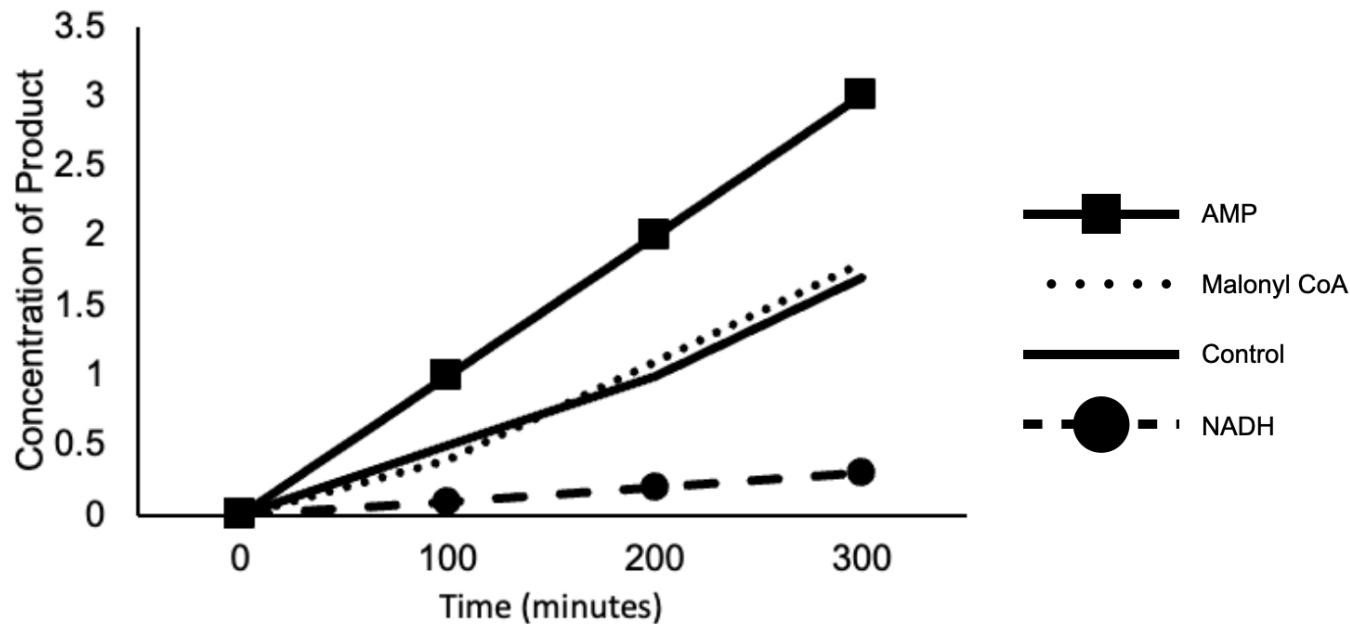
You are interested in studying how different molecules affect the activity of the enzyme pyruvate dehydrogenase. You set up four different reactions and then measure the relative amount of enzyme activity in each reaction by looking at the accumulation of product. The conditions of the reactions and your experimental results are shown below. Use this information to select the best conclusions that you can draw from the results of your experiments.

Control: Pyruvate Dehydrogenase + Substrate

AMP: Pyruvate Dehydrogenase + Substrate + AMP

NADH: Pyruvate Dehydrogenase + Substrate + NADH

Malonyl CoA: Pyruvate Dehydrogenase + Substrate + Malonyl CoA



Question 23

Complete

Points out of 1.00

T/F: These data are consistent with the hypothesis that AMP is an allosteric activator of pyruvate dehydrogenase.

Select one:

True

False

Question 24

Complete

Points out of 1.00

T/F: These data are consistent with the hypothesis that NADH is an allosteric inhibitor of pyruvate dehydrogenase.

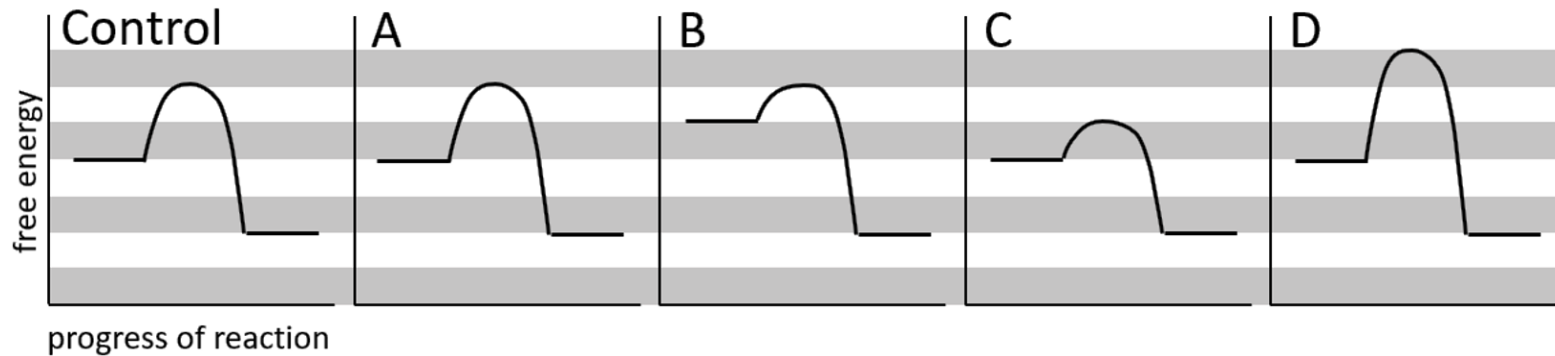
Select one:

True

False

Information

Refer to the pyruvate dehydrogenase data above to answer the following questions. Based on your experimental results, predict how AMP, NADH, and Malonyl CoA affect the free energy graph of the reaction catalyzed by pyruvate dehydrogenase. The free energy graph for the control experiment is labeled "Control" below. Use the other graphs [A-D] as answer choices for the questions below. You may assume that the y-axis is the same for all of the graphs. Answer choices may be used more than once or not at all.



Question 25

Complete

Points out of 1.00

Free energy graph that best represents the Malonyl CoA experiment

- a. Graph A
- b. Graph B
- c. Graph C
- d. Graph D

Question 26

Complete

Points out of 1.00

Free energy graph that best represents the AMP experiment

- a. Graph A
- b. Graph B
- c. Graph C
- d. Graph D

Question 27

Complete

Points out of 1.00

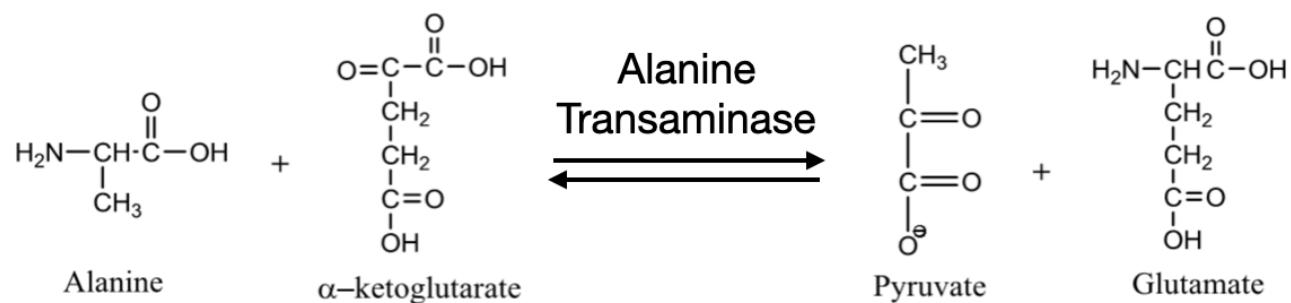
Free energy graph that best represents the effect of increasing the concentration of substrate by 10x in the control experiment.

- a. Graph A
- b. Graph B
- c. Graph C
- d. Graph D

Information

Alanine transaminase (ALT) is an enzyme that is found in different tissues throughout your body but is most abundant in your liver. The amount of ALT in your blood is commonly measured as part of blood panels to assess liver function. ALT catalyzes a reversible reaction shown below. The ΔG° of the forward reaction is +1.86 kcal/mol. Use this information to answer the following questions.

$$\Delta G^\circ = +1.86 \text{ kcal/mol}$$



Question 28

Complete

Points out of 1.00

T/F: The forward reaction will only proceed in a cell when it is coupled to an exergonic reaction.

Select one:

True

False

Question 29

Complete

Points out of 1.00

T/F: After this reaction has reached equilibrium, ALT will continue catalyzing the reaction.

Select one:

True

False

Question 30

Complete

Points out of 1.00

T/F: If standard entropy (S°) increases over the course of this reaction, then ΔH° could be negative.

Select one:

- True
- False

Question 31

Complete

Points out of 1.00

Under certain cellular conditions, the ΔG of the reaction catalyzed by alanine transaminase is +7.5 kcal/mol. Which of the following reactions could be coupled to the alanine transaminase reaction to allow it to proceed under these conditions?

- a. Aspartate transaminase reaction; $\Delta G=+7.4$ kcal/mol
- b. Alkaline phosphatase reaction, $\Delta G=-5$ kcal/mol
- c. Gamma-glutamyl transferase reaction, $\Delta G=+12$ kcal/mol
- d. ATP hydrolysis reaction, $\Delta G=-7.3$ kcal/mol
- e. Hexokinase reaction, $\Delta G=-7.9$ kcal/mol

Information

E. coli is a bacterium that normally exists in your gut and does not cause harm, but some strains of *E. coli* can be associated with foodborne illnesses when consumed. If you get sick with an *E. coli* infection, your doctor may prescribe you antibiotics to help you get better. However, in recent years it is becoming more and more common for bacteria to exhibit antibiotic resistance, meaning that the drugs we normally use to treat them are not effective anymore. One mechanism *E. coli* use to develop resistance to antibiotics is drug efflux proteins that move antibiotics from inside the cell to outside the cell.

The diagram below shows an *E. coli* cell membrane. Note that unlike eukaryotic cells, some bacteria have two membranes, an inner membrane and an outer membrane, with an extra compartment called the periplasm in between. To resist being killed by drugs, *E. coli* need to move drugs from the cytoplasm to the periplasm, and then out to the extracellular space (although different drugs work in different ways, for the sake of this problem assume that a drug must be present in the cytosol of the bacterium to be effective). The figure below figure shows a set of membrane proteins involved in this process. Below the figure you will find a description of these membrane proteins.

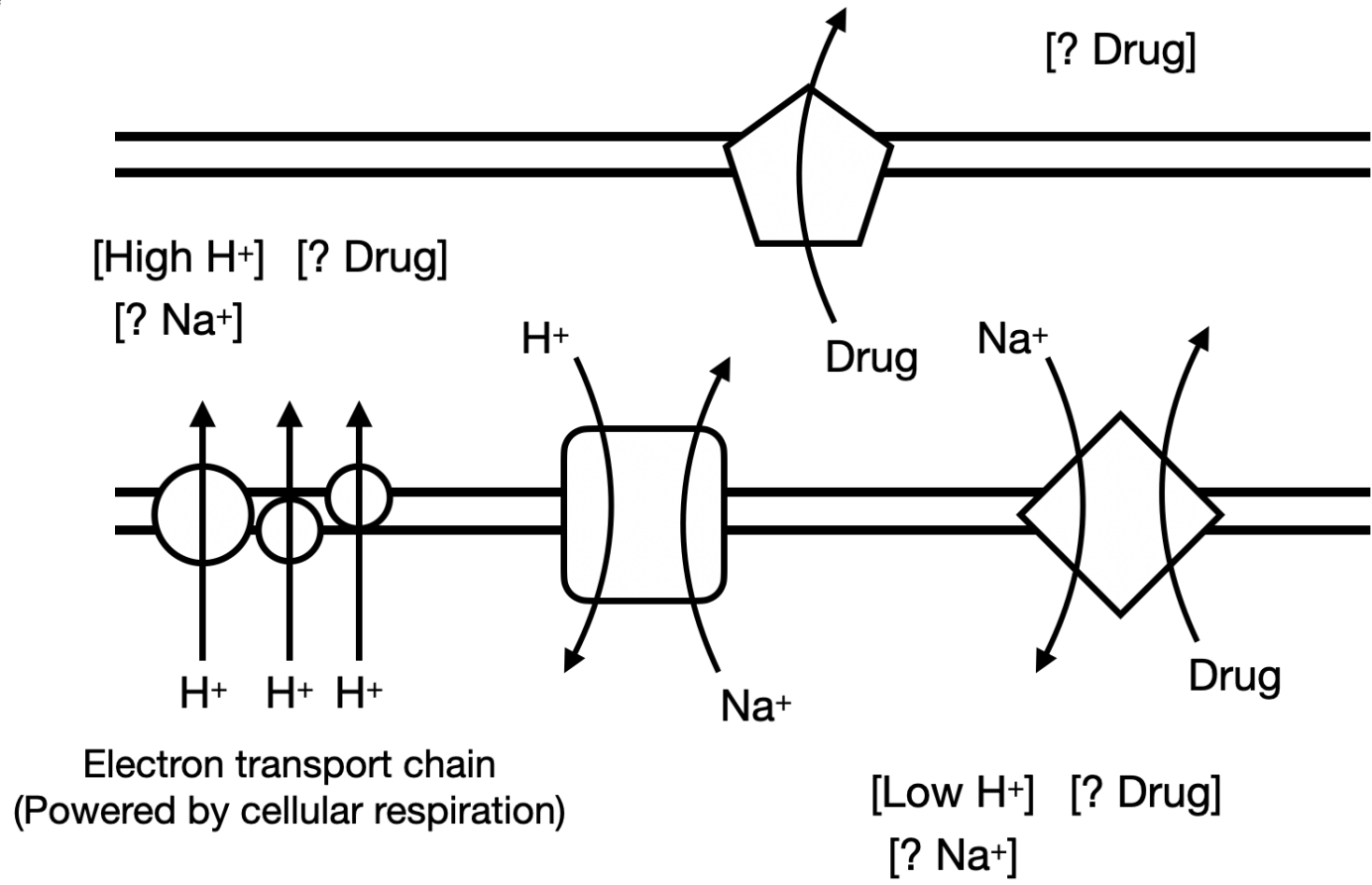
Extracellular space

Outer membrane

Periplasm

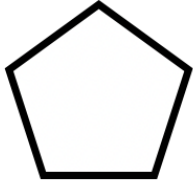
Inner membrane

Cytoplasm

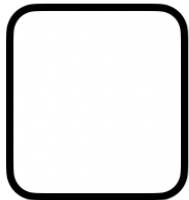




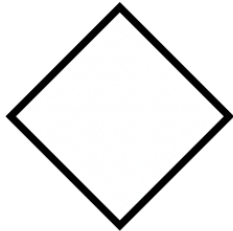
Electron transport chain. Uses energy from sugars to pump protons from the cytosol into the periplasm. (Similar to primary active transport).



Outer membrane protein. This protein utilizes facilitated diffusion to move the drug from one side of the outer membrane to the other.



H⁺/Na⁺ exchanger. Secondary active transporter.



Drug efflux protein. Secondary active transporter.

Question 32

Complete

Points out of 1.00

Based on this diagram, the concentration of sodium is _____ in the periplasm compared to the cytoplasm.

- a. Higher
- b. Lower
- c. Equal

Question 33

Complete

Points out of 1.00

Based on this diagram, the concentration of drug is _____ in the extracellular space compared to the periplasm.

- a. Higher
- b. Lower
- c. Equal

Question 34

Complete

Points out of 1.00

Based on this diagram, if the electron transport chain were to stop working in this bacterium, the concentration of drug in the periplasm would _____.

- a. Increase
- b. Decrease
- c. Not change

Question 35

Complete

Points out of 1.00

Based on this diagram, if the pH of the periplasm were increased what effect would you expect that to have on the susceptibility of this bacterium to an antibiotic?

- a. More susceptible
- b. More resistant
- c. No change

Question **36**

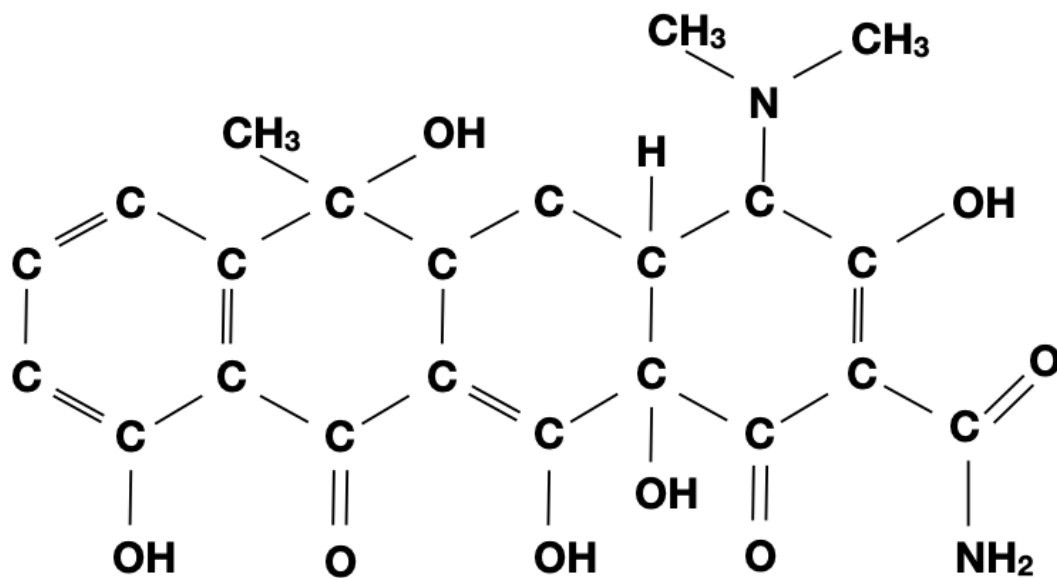
Complete

Points out of 1.00

Based on this diagram, if an additional sodium channel were present in the outer membrane, what impact would the opening of that channel have on the rate of drug moving from the periplasm to the extracellular space via the outer membrane protein?

- a. The rate would increase
- b. The rate would decrease
- c. The rate would not change

One of the antibiotics pumped out of *E. coli* using this system is tetracycline. The chemical structure of tetracycline is shown below. Note that because of the complexity of this structure, not all hydrogen atoms are shown, but you may assume that every atom in this molecule has the appropriate number of bonds. Use this image to answer the following questions.



Tetracycline

Question 37

Complete

Points out of 1.00

Based on the image above, tetracycline could form hydrogen bonds with another molecule of tetracycline.

Select one:

True

False

Question 38

Complete

Points out of 1.00

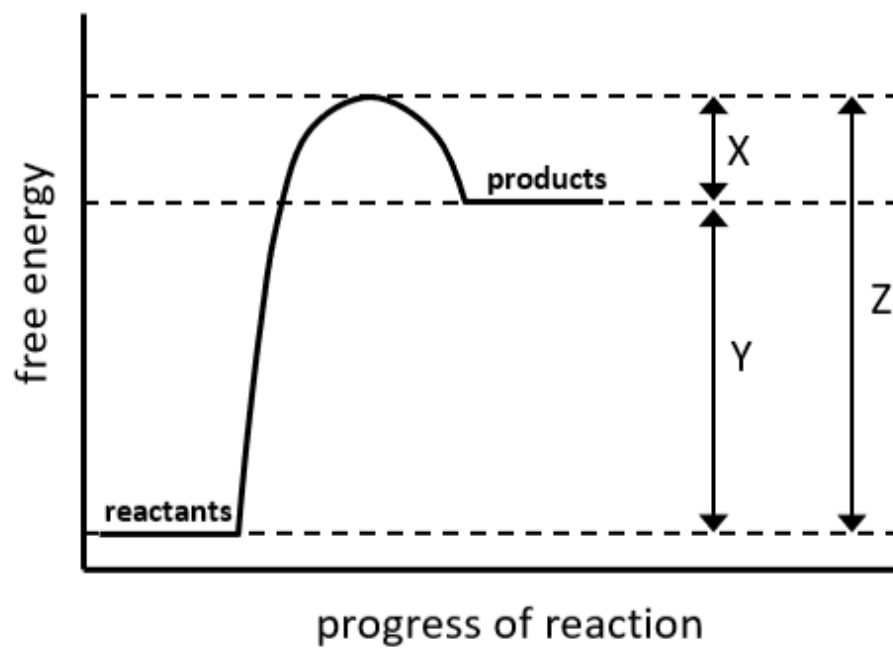
Based on the structure of tetracycline, you would expect a pure lipid bilayer to be very permeable to tetracycline molecules.

Select one:

True

False

The diagram shows the changes in free energy that occur over the course of a reaction. Use the diagram to answer the questions below.



Question 39

Complete

Points out of 1.00

T/F: this free energy diagram depicts an endergonic reaction.

Select one:

True

False

Question 40

Complete

Points out of 1.00

Adding an enzyme to this reaction would _____ the size of region Z.

a. Increase

b. Decrease

c. Not change

Question 41

Complete

Points out of 1.00

Adding an enzyme to this reaction would _____ the size of region Y.

- a. Increase
- b. Decrease
- c. Not change

Question 42

Complete

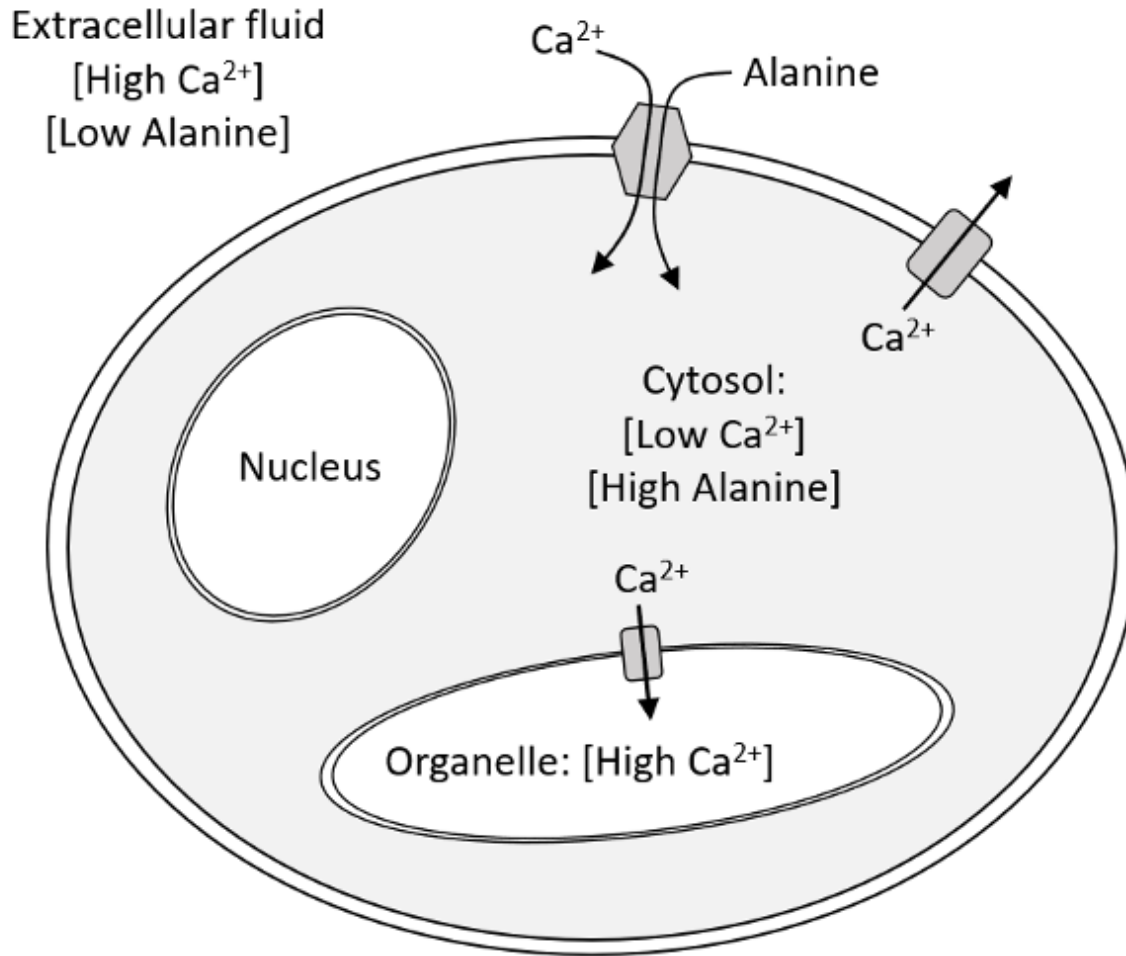
Points out of 1.00

Making the value of ΔH more negative for this reaction would _____ the size of region Y.

- a. Increase
- b. Decrease
- c. Not change

Information

The diagram below represents an imaginary cell. This cell has a nucleus plus one additional membrane-bound organelle. The cell's plasma membrane and organelle membrane are phospholipid bilayers, just like the cell membranes you learned about in class. This particular cell maintains a high concentration of a molecule called Alanine in its cytosol. Use the diagram below to answer the following questions.



Ca^{2+} Transporter



$\text{Ca}^{2+}/\text{Alanine}$ Co-Transporter

Question **43**

Complete

Points out of 1.00

The Ca^{2+} Transporter is a primary active transporter.

Select one:

True

False

Question **44**

Complete

Points out of 1.00

If the Ca^{2+} Transporter stopped working, the Co-Transporter would eventually stop working.

Select one:

True

False

Question **45**

Complete

Points out of 1.00

This cell could be a prokaryotic cell.

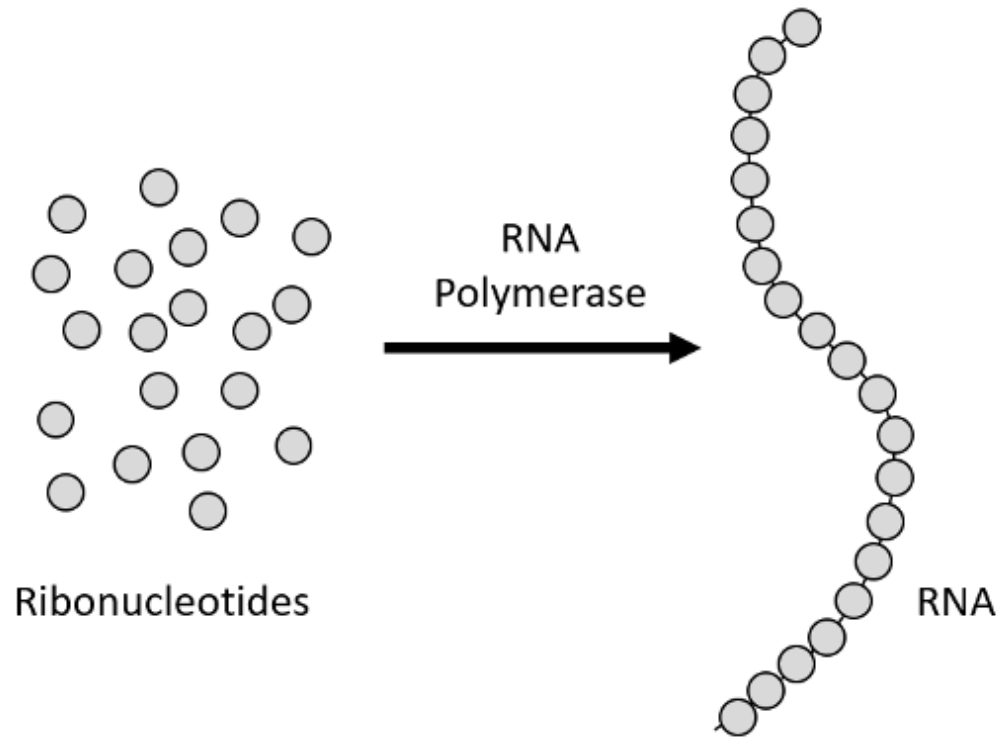
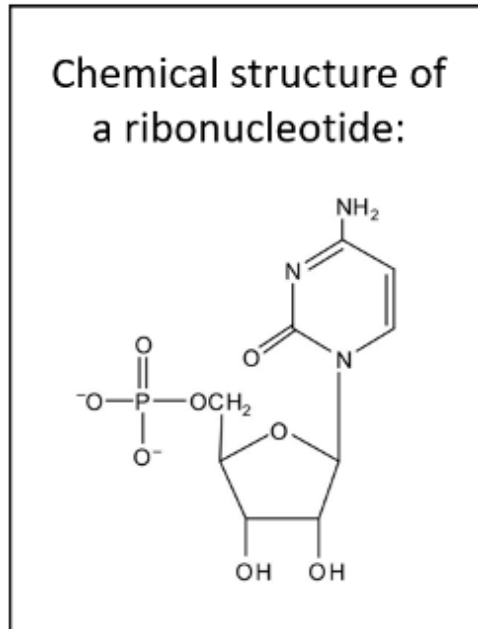
Select one:

True

False

Information

The following chemical reaction shows the synthesis of a ribonucleic acid (RNA) molecule from many individual ribonucleotides. This reaction is catalyzed by an enzyme called RNA polymerase. Based on this information and the diagram, answer the following questions.



Question 46

Complete

Points out of 1.00

A ribonucleotide could cross a phospholipid bilayer via simple diffusion.

Select one:

- True
- False

Question 47

Complete

Points out of 1.00

The entropy of the ribonucleotides is lower than the entropy of the RNA.

Select one:

- True
- False

Question 48

Complete

Points out of 1.00

As this reaction proceeds, a small amount of energy will be released as heat.

Select one:

True

False

Question 49

Complete

Points out of 1.00

T/F: RNA Polymerase provides the energy required to make this reaction proceed in the direction shown by the arrow.

Select one:

True

False

Question 50

Complete

Points out of 1.00

T/F: RNA Polymerase is used up in this reaction

Select one:

- True
- False

Question 51

Complete

Points out of 1.00

Based on the chemical structure shown above, ribonucleotides are hydrophilic.

Select one:

- True
- False

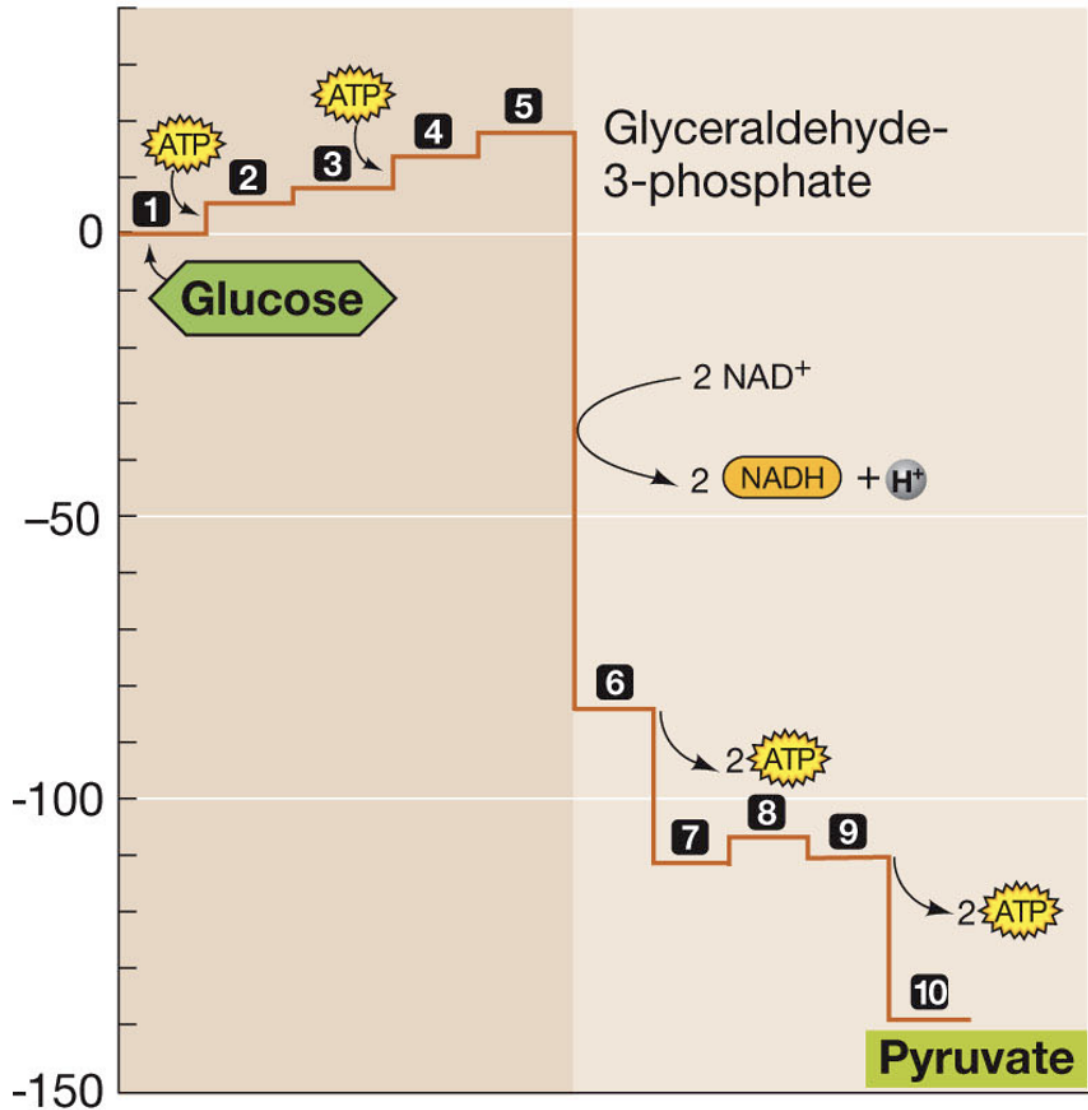
Information

The following image is a model illustrating the process of glycolysis. Use this diagrams to answer the following questions.

Change in standard free energy (kcal/mol)

ENERGY-INVESTING REACTIONS

ENERGY-HARVESTING REACTIONS



Each glucose yields: 2 Pyruvate, 2 ATP, 2 NADH + 2 H⁺

Question 52

Complete

Points out of 1.00

Based on the free energy diagram of glycolysis above, which of the following steps in glycolysis will occur most quickly in the cell?

- a. Conversion of intermediate 6 to intermediate 7
- b. Conversion of intermediate 5 to intermediate 6
- c. Conversion of intermediate 3 to intermediate 4
- d. No way to tell from the given information

Question 53

Complete

Points out of 1.00

T/F: The ΔG for the reaction that converts intermediate 8 to intermediate 9 in glycolysis will become more positive if the concentration of intermediate 8 increases.

Select one:

- True
- False

Question 54

Complete

Points out of 1.00

Glycolysis is an example of a catabolic pathway. Therefore, each step of glycolysis is exergonic.

Select one:

- True
- False

Question 55

Complete

Points out of 1.00

In a certain cell, the ΔG of ATP hydrolysis is -7.3 kcal/mol. In this cell, what could be the ΔG of converting intermediate 6 to intermediate 7 during glycolysis?

- a. $+16.0$ kcal/mol
- b. $+14.0$ kcal/mol
- c. -14.0 kcal/mol
- d. -16.0 kcal/mol

Question **56**

Complete

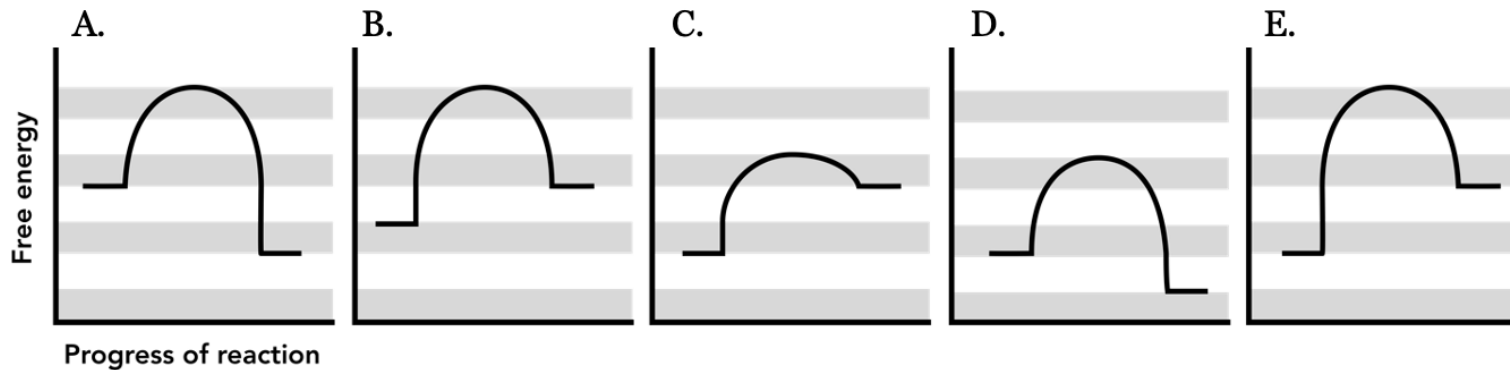
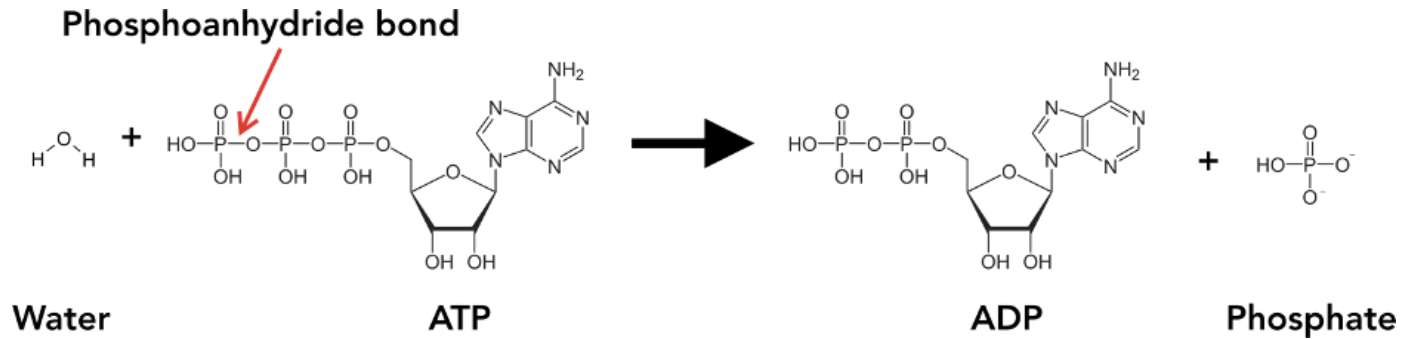
Points out of 1.00

As we discussed in class, different biological models have advantages and disadvantages and can be used in different situations. Which of the following represents a disadvantage of the model of glycolysis shown above?

- a. It does not indicate which reactions are endergonic versus exergonic.
- b. It does not indicate the relative rates of each reaction.
- c. It does not show what the inputs and outputs of the glycolysis pathway are.
- d. It does not show the order in which glycolysis reactions occur.
- e. More than one of the above are drawbacks of this model.

Information

The following diagram shows the ATP hydrolysis reaction. During ATP hydrolysis, the phosphoanhydride bond shown is broken, resulting in the production of ADP and inorganic phosphate. The ΔG° of ATP hydrolysis is -7.3 kcal/mol. Below the reaction, you will find multiple free energy diagrams that may be associated with this reaction or other coupled reactions. Answer the following questions about these diagrams.



Question **57**

Complete

Points out of 1.00

The breaking of the phosphoanhydride bond in ATP:

- a. Releases energy
- b. Requires energy
- c. Sometimes releases energy, sometimes requires energy

Question **58**

Complete

Points out of 1.00

T/F: Free energy diagram A could represent ATP hydrolysis.

Select one:

- True
- False

Question 59

Complete

Points out of 1.00

T/F: Free energy diagram D could represent ATP hydrolysis.

Select one:

True

False

Question 60

Complete

Points out of 1.00

T/F: The reaction depicted in free energy diagram A would occur more quickly than the reaction depicted in free energy diagram E.

Select one:

True

False

[◀ LS 7A Midterm 1 F21 ...](#)

Jump to...

[Answer change reasoning ... ▶](#)