

Question 46

1 pts

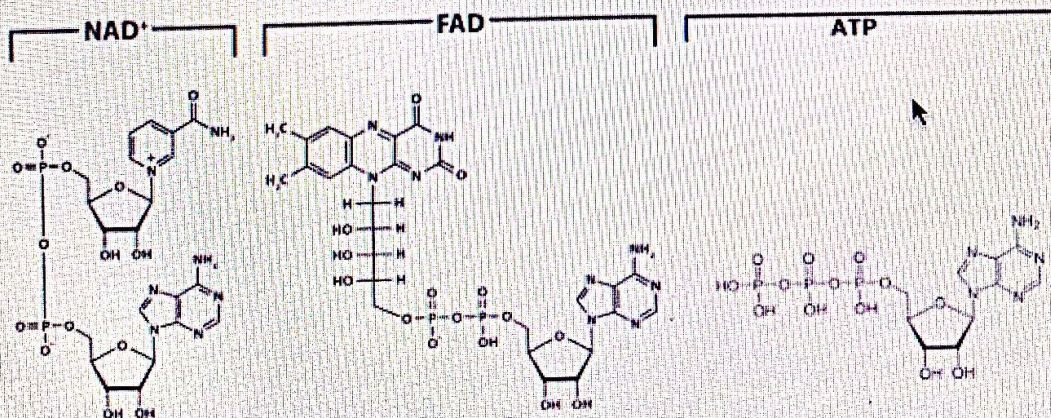
Which of the following features would **NOT** have been utilised by LUCA if it had evolved within alkaline vents?

- ☐ Iron sulfur clusters
- ☐ Reduction of oxygen at the final step of the electron transport chain.
- ☐ Proton gradients
- ☐ ATP synthase

Question 47

1 pts

Which of the statements does **NOT** apply to all the compounds shown below?

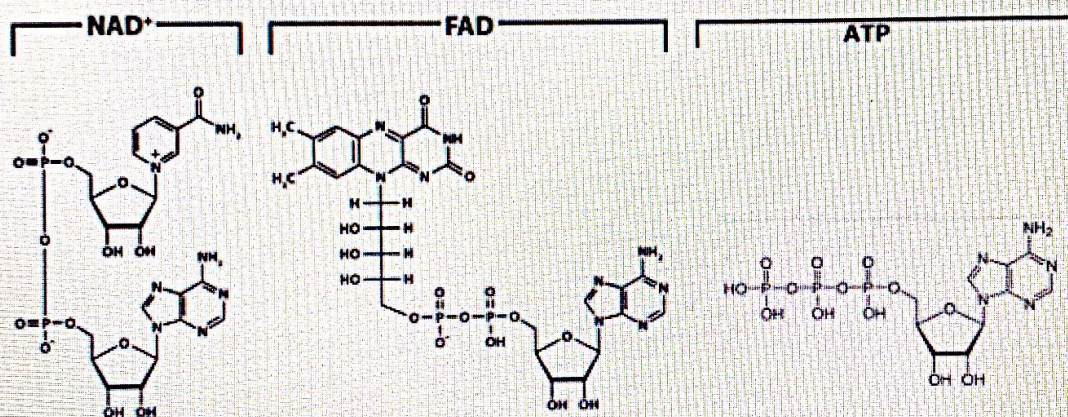


- ☐ They incorporate common structural features
- ☐ They participate in reactions within the mitochondria

Question 47

1 pts

Which of the statements does NOT apply to all the compounds shown below?



- ☐ They incorporate common structural features
- ☐ They participate in reactions within the mitochondria
- ☐ They are involved in reduction oxidation (REDOX) reactions
- ☐ They participate in reactions involving either the electron transport chain or chemiosmosis.

Question 48

1 pts

Which of the following occurs in the cytosol of a eukaryotic cell?

- ☐ fermentation and chemiosmosis



Question 48

1 pts

Which of the following occurs in the cytosol of a eukaryotic cell?

- ☐ fermentation and chemiosmosis
- ☐ oxidation of pyruvate to acetyl CoA
- ☐ glycolysis and fermentation
- ☐ citric acid cycle



Question 49

1 pts

Refer to the table below which shows the standard reduction potentials of some biological important reactions at 25°C and pH 7.

Half reaction	$E^{\circ'}(V)$
pyruvate + $2H^+$ + $2e^- \rightarrow$ lactate	-0.19
fumarate + $2H^+$ + $2e^- \rightarrow$ succinate	0.03
$\frac{1}{2} O_2 + 2H^+ + 2e^- \rightarrow H_2O$	0.82
oxaloacetate + $2H^+$ + $2e^- \rightarrow$ malate	-0.17
$NAD^+ + H^+ + 2e^- \rightarrow NADH$	-0.32
$FAD + 2H^+ + 2e^- \rightarrow FADH_2$	-0.22

Which of the following reactions proceeds spontaneously in the indicated direction?



Question 49

1 pts

Refer to the table below which shows the standard reduction potentials of some biological important reactions at 25°C and pH 7.

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$NAD^+ + H^+ + 2e^- \rightarrow NADH$	-0.32
$FAD + 2H^+ + 2e^- \rightarrow FADH_2$	-0.22

Which of the following reactions proceeds spontaneously in the indicated direction?

- ☐ $NAD^+ + \text{lactate} \rightarrow \text{pyruvate} + H^+ + NADH$
- ☐ $\text{Succinate} + FAD \rightarrow \text{fumarate} + FADH_2$
- ☐ $NAD^+ + \text{malate} \rightarrow \text{oxaloacetate} + NADH + H^+$
- ☐ $\frac{1}{2} O_2 + H^+ + NADH \rightarrow H_2O + NAD^+$



Question 50

1 pts



Question 50

1 pts

Which of the following reactions does NOT take place in the mitochondria?

- ☐ $\text{NAD}^+ + \text{lactate} \rightarrow \text{pyruvate} + \text{H}^+ + \text{NADH}$
- ☐ $\text{Succinate} + \text{FAD} \rightarrow \text{fumarate} + \text{FADH}_2$
- ☐ $\text{NAD}^+ + \text{malate} \rightarrow \text{oxaloacetate} + \text{NADH} + \text{H}^+$
- ☐ $\frac{1}{2} \text{O}_2 + \text{H}^+ + \text{NADH} \rightarrow \text{H}_2\text{O} + \text{NAD}^+$

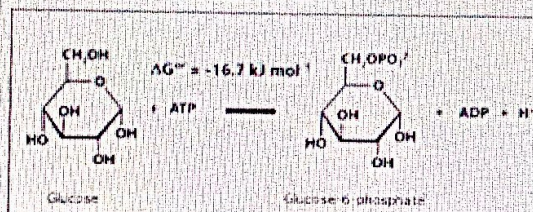


Question 51

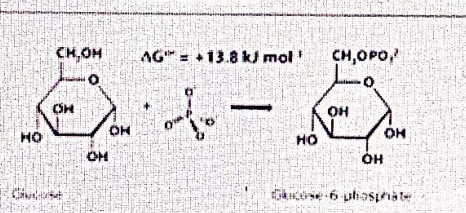
1 pts

Questions 51 and Question 52 refer to the following two reactions:

Reaction 1



Reaction 2

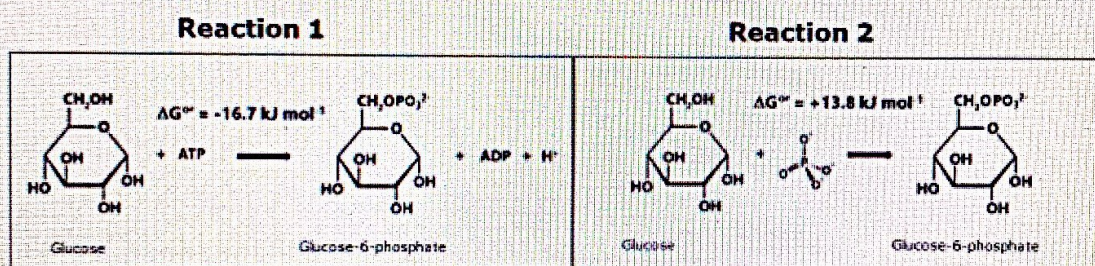


Reaction 1 shows an enzyme-catalysed reaction involving the transfer of a phosphoryl group from

Question 51

1 pts

Questions 51 and Question 52 refer to the following two reactions:



Reaction 1 shows an enzyme-catalysed reaction involving the transfer of a phosphoryl group from ATP to glucose, yielding glucose-6-phosphate and ADP. This reaction proceeds with a negative free energy change under standard conditions ($\Delta G^\circ = -16.7 \text{ kJ mol}^{-1}$). Which of the following statements is **INCORRECT**?

- ☐ The reaction is the first step of glycolysis.
- ☐ In skeletal muscle the reaction is catalysed by the enzyme hexokinase.
- ☐ The reaction is catalysed by glucokinase which has a lower K_M for glucose compared to hexokinase.
- ☐ The reaction is essentially irreversible and proceeds only in the direction shown.

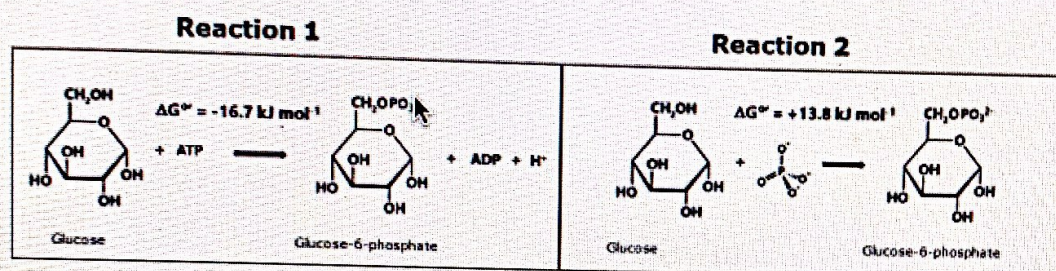
Question 52

1 pts

Question 52

1 pts

Question 51 and Question 52 refer to the following two reactions:



Reaction 2 shows the same reaction except that the phosphoryl group is derived from inorganic phosphate instead of ATP. Here, the free energy change is positive ($\Delta G = +13.8 \text{ kJ mol}^{-1}$) under standard conditions.

Which of the following statements BEST explains these opposing free energy changes for reaction 1 and reaction 2?

- ☐ The reaction rate is lower for reaction 2 because the concentration of inorganic phosphate is much less than ATP under standard conditions.
- ☐ The product, glucose-6-phosphate, can revert back to glucose.
- ☐ The reaction between glucose and ATP (but not inorganic phosphate) involves a transfer of electrons.
- ☐ The negative free energy change associated with the conversion of ATP to ADP drives the phosphorylation of glucose for reaction 1.

Question 53

1 pts

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Question 53

1 pts

Alpha-D-glucose and beta-D-glucose are examples of:

- ☐ enantiomers
- ☐ epimers.
- ☐ oligosaccharides.
- ☐ anomers



Question 54

1 pts

When a muscle cell metabolises glucose under anaerobic conditions (i.e. without oxygen), which of the following molecules is **NOT** produced?

- ☐ pyruvate
- ☐ acetyl-CoA
- ☐ lactic acid.
- ☐ ATP



Question 55

1 pts



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Question 55

1 pts

The free energy released by the oxidation of glucose to CO_2 and water is 2870 kJ.mol^{-1} whereas the free energy required for the reduction of

NAD^+ to NADH is 222 kJ.mol^{-1} . Why are only two molecules of NADH formed during glycolysis when it appears that as many as a dozen could be formed?

- ☐ Glycolysis is inefficient, with much of the energy of glucose released as heat.
- ☐ Most of the free energy available from the oxidation of glucose remains in pyruvate, one of the products of glycolysis.
- ☐ Most of the free energy available from the oxidation of glucose is used in the production of ATP in glycolysis.
- ☐ CO_2 and water are not products of glycolysis.



Question 56

1 pts

A suspension of yeast cells is being grown under anaerobic conditions (i.e. without oxygen) such that glucose is degraded to ethanol and carbon dioxide. Adding an inhibitor of alcohol dehydrogenase to the yeast cell suspension results in rapid cell death. Why?

- ☐ Without alcohol dehydrogenase, the acetaldehyde concentration increases to levels that are toxic to the yeast cells.
- ☐ Loss of this enzyme during anaerobic glucose degradation leads to an increased requirement for ATP, which cannot be met.
- ☐ NADH generated during glycolysis cannot be recycled back to NAD^+ , thus anaerobic ATP production through glycolysis cannot be maintained.
- ☐ Pyruvate is no longer being produced for use in gluconeogenesis, so the cells quickly use up this energy source.



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Question 57

1 pts

Which of the following reactions is **NOT** a direct metabolic fate of pyruvate?

- ☐ conversion to acetyl CoA
- ☐ conversion to oxaloacetate
- ☐ conversion to phosphoenol pyruvate
- ☐ conversion to alanine



Question 58

1 pts

In glycolysis, there are three kinase enzymes that provide the main points of regulation. What do the reactions catalysed by these enzymes have in common?

- ☐ They proceed with a large negative free energy change.
- ☐ They occur before the 6-carbon glucose backbone is split into two 3-carbon compounds.
- ☐ They are coupled to the synthesis of ATP from ADP.
- ☐ Chemical oxidation of the glucose backbone takes place.



Question 59

1 pts

Which of the following statements about the Cori cycle is **INCORRECT**?



Question 59

1 pts

Which of the following statements about the Cori cycle is **INCORRECT**?

- ☐ Glucose is converted to lactate in muscle which travels to the liver.
- ☐ Glucose is regenerated through gluconeogenesis in the liver.
- ☐ Glucose is converted to alanine in muscle which is then transported to the liver.
- ☐ The liver resupplies muscle with glucose so that glycolysis can continue.



Question 60

1 pts

Of the electron transfer complexes associated with the inner mitochondrial membrane, which does **NOT** directly contribute towards developing a proton gradient?

- ☐ NADH-Q reductase (complex I)
- ☐ Q-cytochrome c oxidoreductase (complex III)
- ☐ Cytochrome c oxidase (complex IV)
- ☐ Succinate-Q reductase (complex II)



Question 61

1 pts

Which of the following statements about the electron transport chain is **INCORRECT**?



Question 61

1 pts

Which of the following statements about the electron transport chain is **INCORRECT**?

- ☐ it proceeds with a large negative free energy change
- ☐ it involves the reduction of FAD to FADH₂
- ☐ it is located on the inner membrane of the mitochondrion
- ☐ it involves iron sulfur groups that alternate between reduced and oxidized forms



Question 62

1 pts

In chemiosmosis, what is the most direct source of energy that is used to convert ADP to ATP?

- ☐ No external source of energy is required because the reaction is exergonic.
- ☐ Energy released from substrate level phosphorylation.
- ☐ Energy released as electrons flow through the electron transport system.
- ☐ Energy released from movement of protons through ATP synthase, down an electrochemical gradient.



Question 63

1 pts

Dr. Ploomes, a research scientist, investigated how various molecules affect oxygen consumption in isolated mitochondria. When incubated with pyruvate, NAD⁺ and ADP, the mitochondria displayed a



Question 63

1 pts

Dr. Ploomes, a research scientist, investigated how various molecules affect oxygen consumption in isolated mitochondria. When incubated with pyruvate, NAD^+ and ADP, the mitochondria displayed a maximum rate of oxygen consumption.

When Dr. Ploomes then added oligomycin, an inhibitor of ATP synthase, the mitochondria completely stopped consuming oxygen. However, when Dr. Ploomes added dinitrophenol, the mitochondria started consuming oxygen again at a rate comparable to that before oligomycin was added. Which of the following statements is **NOT** consistent with these experimental observations?

- ☐ The pyruvate, NAD^+ and ADP enable the mitochondria to generate ATP and reducing power.
- ☐ Dinitrophenol increases oxygen consumption because it increases mitochondrial number.
- ☐ Dinitrophenol acts like uncoupling protein (UCP) to allow protons within the intermembrane space to enter the mitochondrial matrix.
- ☐ The complete inhibition of oxygen consumption in the presence of oligomycin indicates the absence of uncoupling protein (UCP) in the mitochondria.



Question 64

1 pts

Which part of the cellular respiration process produces the greatest amount of ATP?

- ☐ oxidative phosphorylation
- ☐ alcoholic fermentation

uncoupling protein (UCP) in the mitochondria.



Question 64

1 pts

Which part of the cellular respiration process produces the greatest amount of ATP?

- ☐ oxidative phosphorylation
- ☐ alcoholic fermentation
- ☐ glycolysis
- ☐ the Krebs cycle.



Question 65

1 pts

How many ATP molecules can be ultimately derived through cellular respiration from two molecules of acetyl CoA entering the Krebs Cycle? (Assume NADH yields 2.5 ATP and FADH_2 yields 1.5 ATP).

- ☐ 20
- ☐ 10
- ☐ 9
- ☐ 38



Question 66

1 pts





Question 66

1 pts

When a person is sprinting the actively contracting muscle cells will progressively convert the pyruvate generated through glycolysis into lactate. What benefit do muscle cells gain through this process?

- ☐ All of the other options are correct.
- ☐ It enables the muscle cell to still generate two ATP molecules from every glucose molecule entering glycolysis even under conditions where oxygen is limiting.
- ☐ Converting pyruvate to lactate enables the muscle cell to regenerate NAD^+ so that glycolysis can continue.
- ☐ The muscle cell can ultimately reuse the lactate it produces and releases into the bloodstream through the Cori cycle.



Question 67

1 pts

During sustained exercise, the ATP/AMP ratio in muscle cells decreases. What effect does this decreased ATP/AMP ratio have on the activity of phosphofructokinase and pyruvate kinase?

- ☐ The activity of both enzymes increases.
- ☐ Phosphofructokinase activity increases and pyruvate kinase activity decreases.
- ☐ The activity of both enzymes remains the same, maintaining normal glucose metabolism.
- ☐ The activity of both enzymes decreases due to a lack of allosteric binding of ATP.