

## Cell\_Biochemistry & Cell\_respiration

For all questions select all answers that apply (some questions may have more than one correct answer)

1) Which of the following statements describes what happens to a molecule that functions as the reducing agent (electron donor) in a redox or oxidation-reduction reaction?

- A) It gains electrons and gains potential energy.
- B) It loses electrons and loses potential energy.
- C) It gains electrons and loses potential energy.
- D) It loses electrons and gains potential energy.

2) Which of the following statements is true for all exergonic reactions?

- A) The products have more total energy than the reactants.
- B) The reaction proceeds with a net release of free energy.
- C) The reaction goes only in a forward direction: all reactants will be converted to products, but no products will be converted to reactants.
- D) A net input of energy from the surroundings is required for the reactions to proceed.

3) When chemical, transport, or mechanical work is done by an organism, what happens to the heat generated?

- A) It is used to power yet more cellular work.
- B) It is captured to store energy as more ATP.
- C) It is used to generate ADP from nucleotide precursors.
- D) It is lost to the environment.

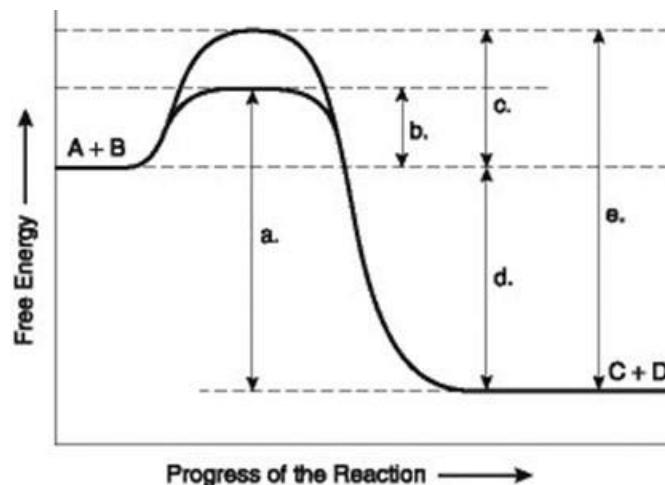
4) \_\_\_\_\_ is a regulatory mechanism in which the end product of a metabolic pathway inhibits an enzyme that catalyzes an early step in the pathway.

- A) Allosteric inhibition
- B) Cooperative inhibition
- C) Feedback inhibition
- D) Metabolic inhibition

5) How does a noncompetitive inhibitor decrease the rate of an enzyme-catalyzed reaction?

- A) by binding to the active site of the enzyme, thus preventing binding of the normal substrate
- B) by binding to an allosteric site, thus changing the shape of the active site of the enzyme
- C) by decreasing the free-energy change of the reaction catalyzed by the enzyme
- D) by binding to the substrate, thus changing its shape so that it no longer binds to the active site of the enzyme

6) Use the following information to answer the question below.



The figure illustrates the energy states associated with the reaction  $A + B \leftrightarrow C + D$ . Which of the following represents the activation energy required for the non-enzyme-catalyzed reaction in the figure?

- A) a
- B) b
- C) c
- D) d

7) Which of the following metabolic processes can occur without a net influx of energy from some other process?

- A)  $ADP + \rightarrow ATP + H_2O$
- B)  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
- C)  $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
- D) Amino acids  $\rightarrow$  Protein

8) Some bacteria are metabolically active in hot springs because

- A) they are able to maintain a lower internal temperature.
- B) high temperatures make catalysis unnecessary.
- C) their enzymes have high optimal temperatures.
- D) their enzymes are completely insensitive to temperature.

9) Which of the following statements about  $NAD^+$  is true?

- A)  $NAD^+$  is reduced to  $NADH$  during glycolysis, pyruvate oxidation, and the citric acid cycle.
- B)  $NAD^+$  has more chemical energy than  $NADH$ .
- C)  $NAD^+$  can donate electrons for use in oxidative phosphorylation.
- D) In the absence of  $NAD^+$ , glycolysis can still function.

10) Starting with one molecule of glucose, glycolysis results in the net production of which of the following sets of energy-containing products?

- A) 2 NAD<sup>+</sup>, 2 pyruvate, and 2 ATP
- B) 2 NADH, 2 pyruvate, and 2 ATP
- C) 4 NADH, 2 pyruvate, and 4 ATP
- D) 6 CO<sub>2</sub>, 2 pyruvate, and 2 ATP

11) Which electron carrier(s) function in the citric acid cycle?

- A) NAD<sup>+</sup> only
- B) NADH and FADH<sub>2</sub>
- C) the electron transport chain
- D) ADP and ATP

12) The synthesis of ATP by oxidative phosphorylation, using the energy released by movement of protons across the membrane down their electrochemical gradient, is an example of which of the following processes?

- A) active transport
- B) allosteric regulation
- C) a reaction with a positive  $\Delta G$
- D) coupling of an endergonic reaction to an exergonic reaction

13) In the absence of oxygen, yeast cells can obtain energy by fermentation, which results in the production of which of the following sets of molecules?

- A) ATP, CO<sub>2</sub>, and ethanol (ethyl alcohol)
- B) ATP, CO<sub>2</sub>, and lactate
- C) ATP, NADH, and ethanol
- D) ATP, CO<sub>2</sub>, and acetyl CoA

14) Why is glycolysis considered to be one of the first metabolic pathways to have evolved?

- A) It produces much less ATP than does oxidative phosphorylation.
- B) It does not involve organelles or specialized structures, does not require oxygen, and is present in most organisms.
- C) It is present in prokaryotic cells but not in eukaryotic cells.
- D) It requires the presence of membrane-enclosed cell organelles found only in eukaryotic cells.

15) Fatty acids usually have an even number of carbons in their structures. Catabolism of fatty acids produces two-carbon fragments that are converted to acetyl CoA molecules. What is the most likely way in which these acetyl CoA molecules would be metabolized in aerobic cellular respiration?

- A) They would directly enter the electron transport chain.
- B) They would directly enter the energy-yielding phase of glycolysis.
- C) They would be converted to pyruvate and then undergo pyruvate oxidation upon transport into mitochondria.
- D) They would directly enter the citric acid cycle.

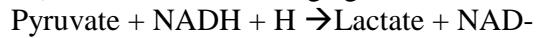
16) The *immediate* energy source that drives ATP synthesis by ATP synthase during oxidative phosphorylation is the

- A) oxidation of glucose and other organic compounds.
- B) flow of electrons down the electron transport chain.
- C) H<sup>+</sup> concentration gradient across the membrane holding ATP synthase.
- D) transfer of phosphate to ADP.

17) In mitochondria, exergonic redox reactions

- A) are the source of energy driving prokaryotic ATP synthesis.
- B) provide the energy that establishes the proton gradient.
- C) reduce carbon atoms to carbon dioxide.
- D) are coupled via phosphorylated intermediates to endergonic processes.

18) What is the oxidizing agent in the following reaction?



- A) oxygen
- B) NADH
- C) lactate
- D) pyruvate