

# Chapter 17: Electron Transport and Oxidative Phosphorylation

## Matching Or Fill In

Choose the correct answer from the list. Not all the answers will be used.

- 1) \_\_\_\_\_ The inner, convoluted mitochondrial membrane encloses the \_\_\_\_\_.
- 2) \_\_\_\_\_ Complexes I and II each transfer electrons to \_\_\_\_\_.
- 3) \_\_\_\_\_ Electrons from the cytosol are transferred to the matrix via \_\_\_\_\_ systems.
- 4) \_\_\_\_\_ (omit the red questions) Protons moving across the membrane by jumping through an arrangement of hydrogen-bonded groups are described as moving through a proton \_\_\_\_\_.
- 5) \_\_\_\_\_ Bacteriorhodopsin is a \_\_\_\_\_ proton pump.
- 6) \_\_\_\_\_ The cytochromes contain \_\_\_\_\_ groups.
- 7) \_\_\_\_\_ Cytochrome *c* oxidase contains four redox centers, which include two \_\_\_\_\_ atoms.
- 8) \_\_\_\_\_ Bacteria carry out electron transport in the \_\_\_\_\_ membrane
- 9) \_\_\_\_\_ The stoichiometric relationship of ATP synthesis to \_\_\_\_\_ is referred to as the P/O ratio.
- 10) \_\_\_\_\_ Molecules that prevent oxidative damage by the superoxide radical possess \_\_\_\_\_ properties.

A) shuttle  
B) matrix  
C) respiration  
D) copper  
E) heme  
F) chaperone  
G) plasma  
H) Coenzyme Q  
I) reducing  
J) antioxidant  
K) wire  
L) light-driven

## Fill In Questions

- 11) A typical eukaryotic cell contains about \_\_\_\_\_ mitochondria.
- 12) Around three ATP molecules can be synthesized from the oxidation of \_\_\_\_\_ NADH molecule(s).

## Chapter 17: Electron Transport and Oxidative Phosphorylation

- 13) The imbalance of protons that is used to drive the synthesis of ATP is referred to as the \_\_\_\_\_.
- 14) The aerobic metabolism of one glucose molecule provides up to \_\_\_\_\_ times as much ATP as its anaerobic metabolism.

### Multiple Choice Questions

- 15) The electrons formed from the oxidation of glucose are:
- A) directly transferred to  $O_2$  during the citric acid cycle.
  - B) transferred to the coenzymes  $NAD^+$  and FAD.
  - C) transferred to succinate and arachidonic acid.
  - D) A and B
  - E) none of the above
- 16) Which of the following statements about the mitochondrial inner membrane is (are) not true?
- A) The inner membrane is permeable to  $CO_2$ ,  $H_2O$ , and small ions.
  - B) The inner membrane contains about 75% protein.
  - C) The inner membrane contains many respiratory proteins.
  - D) The inner membrane is highly invaginated.
  - E) all of the above are true
- 17) Several prosthetic groups act as redox centers in Complex I, including:
- A) FMN, ubiquinone, iron-sulfur clusters, heme.
  - B) FMN, ubiquinone, iron-sulfur clusters.
  - C) heme, ubiquinone, iron-sulfur clusters.
  - D) all of the above
  - E) none of the above
- 18) Which of the following statements are true about oxidative phosphorylation?
- A) Electron transport provides energy to pump protons into the intermembrane space.
  - B) An electrochemical gradient is formed across the inner mitochondrial membrane.
  - C) Potassium and sodium ions form an ionic gradient across the inner mitochondrial membrane.
  - D) A and B
  - E) A, B, and C
- 19) Which of the following are true statements about the structure of ATP synthase?
- A) It has a membrane-embedded component called  $F_0$  and a component found in the matrix referred to as  $F_1$ .
  - B) The  $\gamma$  subunit acts as a “cam” shaft in the rotational motor.
  - C) The structure has a “lollipop” shape.
  - D) A and B
  - E) A, B, and C
- 20) Oxidative phosphorylation is regulated by:
- A) the availability of reduced cofactors from catabolic pathways.

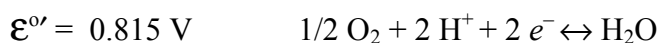
## Chapter 17: Electron Transport and Oxidative Phosphorylation

- B) the availability of the dNTPs.
- C) the availability of ADP and  $P_i$ .
- D) A and C
- E) A, B, and C

### Short Answer Questions

*Write your answer in the space provided or on a separate sheet of paper.*

- 21) Write the net oxidation–reduction reaction based on the following half-reactions. In what direction does this reaction proceed?



- 22) In the reaction in which  $\text{FADH}_2$  transfers hydrogen atoms to Q, which molecule is oxidized and which is reduced? What are the reaction products?
- 23) What oxidation states can FMN adopt in the electron transport chain?
- 24) What is the chemiosmotic theory?
- 25) What evidence is provided for the chemiosmotic theory postulated by Mitchell?