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.

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

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.

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).

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) <u>not</u> 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 γ 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.

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?

$\varepsilon^{o\prime} = -0.315$ V $\quad NAD^+ + H^+ + 2\,e^- \leftrightarrow NADH$

$\varepsilon^{o\prime} = 0.815$ V $\quad 1/2\,O_2 + 2\,H^+ + 2\,e^- \leftrightarrow H_2O$

22) In the reaction in which $FADH_2$ 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?