

## Cellular Respiration

### Multiple Choice Quiz

#### Please answer all questions

1. When energy-depleted elements associated with a proton are accepted by an organic molecule, the process is called
  - A) fermentation
  - B) anaerobic
  - C) aerobic
  - D) catabolism
2. An example of anaerobic would be
  - A) production of sulfates from H<sub>2</sub>S
  - B) production of methane by methanogens
  - C) glycolysis by purple bacteria
  - D) utilization of methane by methanogens
3. The end product of glycolysis is
  - A) NADH
  - B) acetyl-CoA
  - C) lactate
  - D) pyruvate
4. The final output of the Krebs cycle includes all of the following except
  - A) NADP
  - B) FADH<sub>2</sub>
  - C) ATP
  - D) CO<sub>2</sub>
5. The usefulness of fermentation as a means of deriving energy is limited because
  - A) it cannot generate enough ATP
  - B) it produces too much NH<sub>2</sub>
  - C) the end products are toxic to the producer
  - D) it uses more energy than it produces
6. Which of the following is not a product of fermentation?
  - A) CO<sub>2</sub>
  - B) O<sub>2</sub>
  - C) ethanol
  - D) lactate
  - E) all of the above are products of fermentation
7. What substance is produced by the oxidation of pyruvate and feeds into the citric acid cycle?
  - A) pyruvate
  - B) glucose
  - C) acetyl-CoA
  - D) O<sub>2</sub>
  - E) CO<sub>2</sub>
8. Glycolysis has an efficiency of approximately
  - A) 2%
  - B) 5%
  - C) 21.5%

- D) 50%
  - E) 78.5%
9. Hans Krebs discovered (worked out the details of)
- A) glycolysis
  - B) fermentation
  - C) the oxidation of pyruvate
  - D) the citric acid cycle
  - E) electron transport and chemiosmosis
10. Oxidative respiration in eukaryotes has an efficiency level of approximately
- A) 2%
  - B) 63%
  - C) 14%
  - D) 36%
  - E) 32%
11. In aerobic cellular respiration, which generates more ATP, substrate-level phosphorylation or chemiosmosis?
- A) substrate-level phosphorylation
  - B) chemiosmosis
  - C) both generate the same amount of ATP
  - D) neither generates any ATP
12. What role does O<sub>2</sub> play in aerobic respiration?
- A) it plays no role
  - B) it combines with acetyl-CoA at the start of the Krebs cycle
  - C) it is given off as a by-product during the oxidation of pyruvate
  - D) it combines with H<sub>2</sub>O to help drive the formation of ATP
  - E) it is the final electron acceptor at the end of the electron transport chain
13. During aerobic respiration, FADH<sub>2</sub> is produced in
- A) glycolysis
  - B) the oxidation of pyruvate
  - C) the Krebs cycle
  - D) the electron transport chain
  - E) fermentation
14. NADH is produced during
- A) glycolysis
  - B) the oxidation of pyruvate
  - C) the Krebs cycle
  - D) all of the above
  - E) none of the above
15. Organisms that do not have the ability to produce or synthesize their own food are called
- A) anaerobic
  - B) autotrophs
  - C) exergonic
  - D) catabolic
  - E) heterotrophs
16. The proper sequence of stages in glycolysis is

- A) glucose priming, cleavage and rearrangement, oxidation, ATP generation
  - B) cleavage and rearrangement, glucose priming, ATP generation, oxidation
  - C) glucose priming, oxidation, cleavage and rearrangement, ATP generation
  - D) ATP generation, oxidation, glucose priming, cleavage and rearrangement
  - E) oxidation, cleavage and rearrangement, ATP generation, glucose priming
17. During what stage of cellular respiration is the most ATP synthesized?
- A) glycolysis
  - B) oxidation of pyruvate
  - C) Krebs cycle
  - D) fermentation
  - E) chemiosmosis
18. Catabolic processes
- A) make complex molecules from simpler ones
  - B) break complex molecules into simpler ones
  - C) occur only in autotrophs
  - D) occur only in heterotrophs
  - E) none of the above
19. What substance is regenerated by fermentation?
- A) O<sub>2</sub>
  - B) NAD<sup>+</sup>
  - C) acetyl-CoA
  - D) ATP
  - E) glucose
20. Which of the following is a multienzyme complex?
- A) glyceraldehyde-3-phosphate (G3P)
  - B) NAD<sup>+</sup>
  - C) FAD<sup>+</sup>
  - D) pyruvate dehydrogenase
  - E) all of the above
21. During chemiosmosis in aerobic respiration, protons are pumped
- A) out of the cell
  - B) out of the mitochondria into the cell cytoplasm
  - C) out of the mitochondrial matrix into the outer compartment of the mitochondria
  - D) out of the cell cytoplasm into the matrix of the mitochondria
  - E) out of the nucleus and into the mitochondria
22. Each molecule of FADH<sub>2</sub> results in the production of how many ATP molecules during aerobic respiration?
- A) 2
  - B) 3
  - C) 4
  - D) 18
  - E) 36
23. Which of the following organisms carries out cellular respiration?
- A) a corn plant
  - B) a dog

- C) a yeast
  - D) a bacterium
  - E) all of the above
24. 24 Oxidizing which of the following substances yields the most energy?
- A) proteins
  - B) glucose
  - C) fatty acids
  - D) alcohol
  - E) water
25. 25 The oxidation of glucose to two molecules each of pyruvate, ATP, and NADH is called \_\_\_\_\_ and occurs in the \_\_\_\_\_.
- A) glycolysis; cytoplasm
  - B) fermentation; cytoplasm
  - C) the Krebs cycle; matrix of the mitochondrion
  - D) anaerobic respiration; cytoplasm
  - E) the respiratory electron transport chain; cristae of the mitochondrion
26. 26 A cell culture was supplied with radioactively labeled O<sub>2</sub>. The cells were monitored. In a few minutes the radioactive oxygen atoms were present in which of the following compounds:
- A) carbon dioxide
  - B) NADH and FADH<sub>2</sub>
  - C) water
  - D) ATP
  - E) lactic acid
27. 27 During respiration, NADH donates two electrons to the carrier known as ubiquinone. When this happens, ubiquinone:
- A) becomes oxidized.
  - B) passes the electrons directly to O<sub>2</sub> which is reduced to water.
  - C) pumps protons across the inner mitochondrial membrane.
  - D) all of the above.
  - E) a and b, but not c.
28. 28 The final electron acceptor in lactic acid fermentation is:
- A) NAD<sup>+</sup>
  - B) pyruvate
  - C) O<sub>2</sub>
  - D) lactic acid
  - E) ATP
29. 29 Under normal conditions, as electrons flow down the electron transport chain of the mitochondria:
- A) NADH and FADH<sub>2</sub> are oxidized.
  - B) the pH of the matrix increases.
  - C) the electrons lose free energy.
  - D) an electrochemical gradient is formed.
  - E) all of the above.
30. 30 Pyruvate is oxidized when oxygen is present.
- A) True
  - B) False

31. 31 During the oxidation of glucose, a net gain of ATP only occurs under aerobic conditions.
- A) True
  - B) False
32. 32 ATP can be formed through substrate-level phosphorylation and this process requires
- A) an input of energy
  - B) a high-energy phosphate group that is transferred directly to ADP
  - C) a concentration gradient of protons
  - D) the protein ATPsynthase
  - E) all of the above
33. 33 Proteins and fats can be nutritional sources of energy provided that
- A) they are converted into glucose
  - B) they enter their own pathways that are separate from the glucose metabolic pathways
  - C) they are degraded completely into atoms before entering a pathway
  - D) they are modified so that they can enter the glucose metabolic pathways
  - E) both b and c
34. 34 ATP formation by glycolysis
- A) occurs through aerobic respiration
  - B) is an extremely efficient method of acquiring energy by the cell
  - C) requires oxygen
  - D) involves substrate-level phosphorylation
  - E) both a and c
35. 35 Under which condition would you expect the mitochondrial proton gradient to be highest and therefore ATP synthesis to proceed?
- A) pyruvate (present)-oxygen (present)-ATP levels (high)
  - B) pyruvate (present)-oxygen (present)-ATP levels (low)
  - C) pyruvate (present)-oxygen (absent)-ATP levels (high)
  - D) pyruvate (absent)-oxygen (present)-ATP levels (low)
  - E) pyruvate (absent)-oxygen (absent)-ATP levels (high)
36. 36 In the course of the cell's breakdown of one glucose molecule, the mitochondrion takes up certain reactants and releases certain products. Indicate some of these reactants and products below by selecting the best choice from each numbered set of letters: REACTANTS (materials entering)
- A) 6 carbon dioxide molecules
  - B) 2 pyruvates
  - C) 1 glucose
  - D) 2 lactates
  - E) 2 PEP
- 37.
- A) ATP
  - B) 2 ADP + 32 Pi
  - C) 2 ATP
  - D) 4 ADP + 34 Pi
  - E) 4 ATP
- 38.
- A) 6 oxygen molecules
  - B) 12 water molecules

- C) 12 oxygen molecules
- D) reduced cytochromes
- E) 6 oxygen + 12 water molecules

39. PRODUCTS (materials leaving)

- A) 4 carbon dioxide molecules
- B) 2 pyruvates
- C) 1 glucose
- D) 2 lactates
- E) 2 PEP

40.

- A) ATP
- B) 2 ADP + 32 Pi
- C) 2 ATP
- D) 4 ADP + 34 Pi
- E) 4 ATP

41.

- A) 6 oxygen molecules
- B) 12 water molecules
- C) 12 oxygen molecules
- D) reduced cytochromes
- E) 6 oxygen + 12 water molecules