Chapter 14: Glucose Catabolism

Matching Or Fill In
Choose the correct answer from the list. Not all the answers will be used.

1)_____ (omit the red ones) The enzyme _____ is not present in animals.

2)_____ Vitamin B_1 is a component of the coenzyme _____.

3)_____ One product of glycolysis under aerobic or anaerobic conditions is _____.

4)_____ Another name for glycolysis is the _____ pathway.

5)_____ The coenzyme _____ is the oxidizing agent in glycolysis.

6)_____ _____ is an inhibitor of enolase.

A) fructose-1,6-bisphosphatase
B) pentose phosphate
C) pyruvate decarboxylase
D) hypoglycemia
E) phosphofructokinase
F) pyruvate
G) thiamine pyrophosphate
H) ATP
I) galactosemia
J) NAD^+
K) fluoride ion
L) Emden-Meyerhof-Parnas

7)_____ A genetic deficiency of a single transferase enzyme causes the medical condition known as _____.

8)_____ The enzyme _____ is the major control point for glycolysis in muscle.

9)_____ NADPH used in lipid biosynthesis is produced by the _____ pathway.

10)_____ The enzyme _____ participates in a regulatory substrate cycle with phosphofructokinase.

Fill In Questions

11) Glucose is converted to _____ in skeletal muscle under anaerobic conditions.

12) Glycolysis produces a net of _____ ATP.

13) _____ catalyzes the transfer of a phosphoryl group from ATP to glucose

14) The enzymes that catalyze glycolysis are located in the _____.

15) Phosphofructokinase is allosterically inhibited by high concentrations of _____.

16) In alcoholic fermentation, acetaldehyde is produced by the decarboxylation of _____.

17) The process by which ATP is formed from ADP in glycolysis is referred to as _____.

Multiple Choice Questions

18) Which is the net equation of glycolysis as it occurs in aerobic cells such as brain cells?
A) Glucose + 2 ATP → 2 lactate + 2 ADP + 2 P_i
B) Glucose + 2 ADP + 2 P_i + 2 NAD^+ → 2 pyruvate + 2 ATP + 2 NADH + 4 H^+
C) Glucose + 2 ADP + 2 P_i → 2 lactate + 2 ATP + 2 H^+
D) Glucose + 2 ADP + 2 P_i → 2 CH_3CH_2OH + 2 CO_2 + 2 ATP
E) Glucose + 2 ADP + 2 P_i + 2 NAD^+ → 2 lactate + 2 ATP + 2 NADH + 4 H^+

19) In which of the following metabolic conversions is ATP "consumed" during glycolysis?
A) 1,3-Bisphosphoglycerate → 3-phosphoglycerate
B) Glucose → glucose-6-phosphate
C) 2-Phosphoglycerate → 3-phosphoglycerate
D) Fructose-1,6-bisphosphate → dihydroxyacetone phosphate + glyceraldehyde-3-phosphate
E) Glucose-6-phosphate → fructose-6-phosphate

20) In eukaryotes, the enzymes that catalyze the reactions of glycolysis are located in:
A) the cell nucleus.
B) the endoplasmic reticulum.
C) the mitochondria.
D) the lysosomes.
E) the cytosol.

21) During glycolysis, the steps between glucose and formation of the triose phosphates:
A) consume two ATP and two NADH molecules.
B) consume two ATP molecules.
C) produce two ADP and two NAD^+ molecules.
D) produce two ATP and two NADH molecules.
E) consume two NADH molecules.

22) In skeletal muscle cells, the NADH that is produced by glycolysis under anaerobic conditions (vigorous exercise) is regenerated to NAD^+ by the conversion of:
A) acetaldehyde → ethanol.
B) lactate → pyruvate.
C) phosphoenolpyruvate → pyruvate.
D) pyruvate → lactate.
E) glyceraldehyde-3-phosphate → 1,3-bisphosphoglycerate.

23) Which of the following metabolic conversions is considered to be the major control point of glycolysis?

A) Fructose-1,6-bisphosphate → dihydroxyacetone phosphate + glyceraldehyde-3-phosphate
B) Glucose → glucose-6-phosphate
C) 2-phosphoglyerate → phosphoenolpyruvate
D) Fructose-6-phosphate → fructose-1,6-bisphosphate
E) pyruvate → lactate

Short Answer Questions
Write your answer in the space provided or on a separate sheet of paper.

24) What is the overall net equation for glycolysis?

25) Some individuals have a genetic deficiency of the enzyme triose phosphate isomerase (TIM). Briefly explain how the absence of this enzyme affects the energy production from glycolysis.

26) Briefly discuss how ATP can be both a substrate and an allosteric inhibitor of phosphofructokinase.

27) $\Delta G^{\circ\prime}$ = + 24 kJ/mol for the conversion of fructose-1,6-bisphosphate to glyceraldehyde-3-phosphate and dihydroxyacetone phosphate as catalyzed by aldolase. Briefly explain how such an unfavorable free energy change can be overcome in glycolysis.

28) Three reactions in glycolysis operate far from equilibrium and are potential sites for major flux control. List the three enzymes and discuss why each enzyme is or is not the major control site of glycolysis.

29) Describe how the exergonic hydrolysis of ATP is coupled to the endergonic synthesis of glucose-6-phosphate.