

EXAM 3 Fall 2009
Review Exam
BCHS3304, SECTION # 21734,
GENERAL BIOCHEMISTRY I

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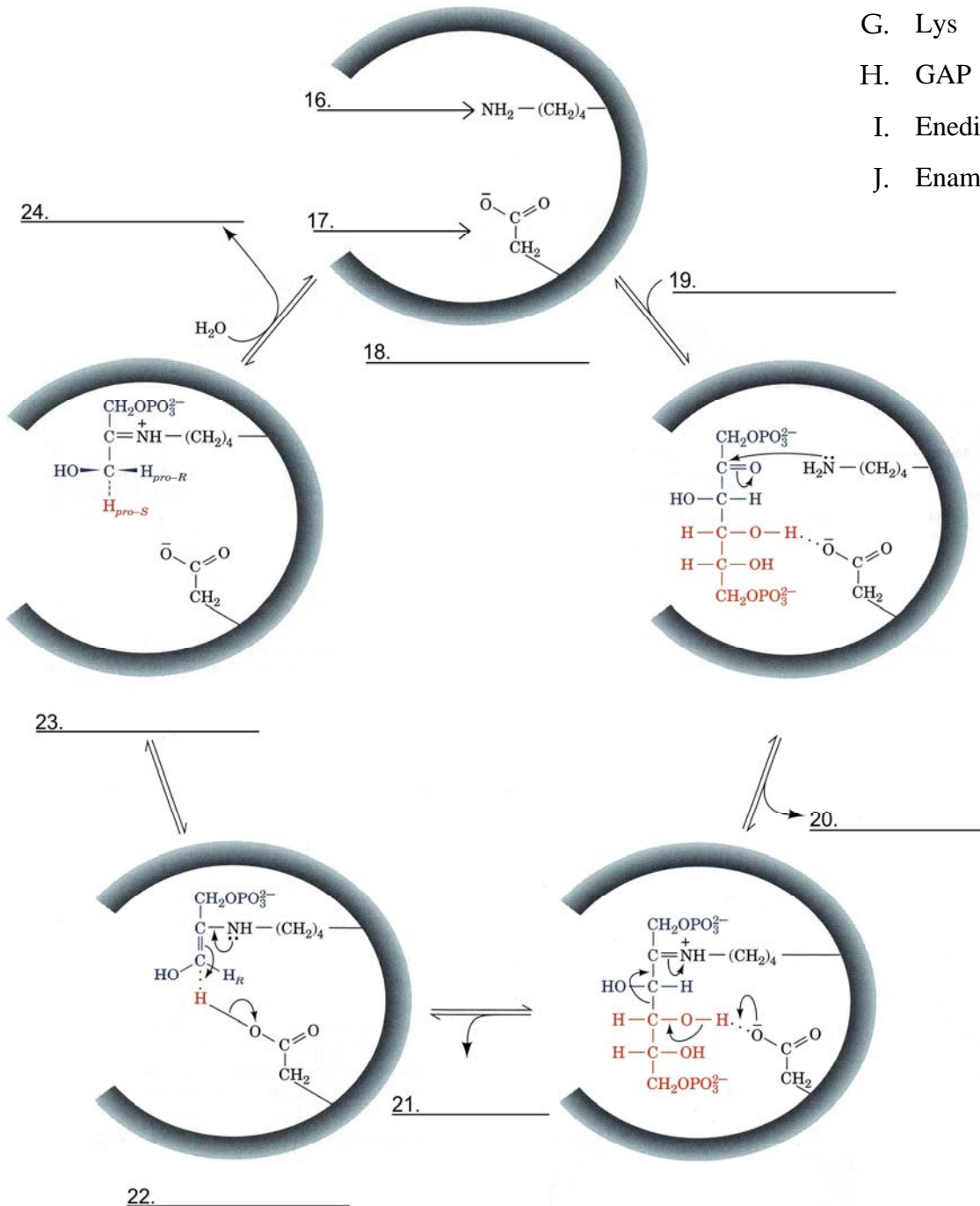
- I. (2 points each) **True (A) or False (B)?** Bubble in the circle marked “A” if the following statement is True or bubble in the circle marked “B” if the following statement is False.

- | | | |
|---|---|--|
| T | F | 1. Formation of glycosidic bonds results in the elimination of a water molecule. |
| T | F | 2. Cyclization of D-fructose to form a hemiketal results in the elimination of a water molecule. |
| T | F | 3. An allosteric effect occurs when the binding of one ligand or substrate influences the binding of a second or additional ligand or substrate. |
| T | F | 4. D-glucose and D-mannose are epimers. |
| T | F | 5. An enzyme of gluconeogenesis which yields ATP is phosphofructokinase. |
| T | F | 6. NADH is a high energy compound produced by the Pentose Phosphate Pathway. |
| T | F | 7. Phosphorylation always down-regulates (inactivates) enzymes. |
| T | F | 8. Glucose-6-phosphate can be used to synthesize ATP through substrate-level phosphorylation. |
| T | F | 9. Under aerobic conditions in muscle NADH reduces pyruvate to lactate. |
| T | F | 10. Hydrolysis of ATP to ADP and P_i is an exergonic process |
| T | F | 11. Glycolysis occurs in the cytosol. |
| T | F | 12. Sucrose is a disaccharide formed from an ($\alpha 1,2\beta$) glycosidic linkage between D-glucose and D-fructose. |
| T | F | 13. In metabolism the three main pathways for energy production are gluconeogenesis, Citric Acid Cycle, and oxidative phosphorylation. |
| T | F | 14. Peptidoglycans are an essential component of bacterial cell walls |
| T | F | 15. Oxidation describes the loss of electrons from an atom, compound or molecule. |

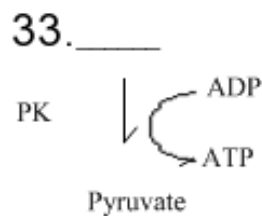
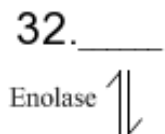
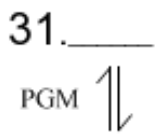
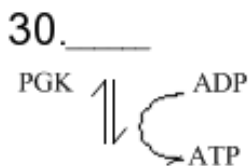
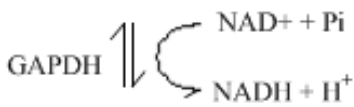
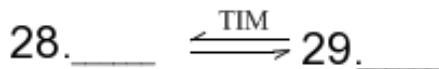
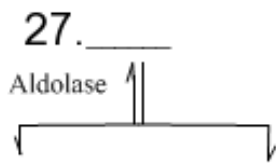
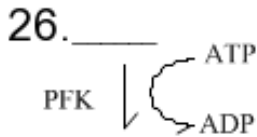
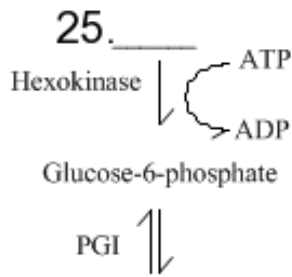
II. Matching

The enzymatic mechanism of aldolase is shown below. For questions 16-24, match the correct substrate/product/intermediate/group or point along the enzyme-catalyzed reaction pathway by selecting "A-J". Note: "A-J" may be used more than once.

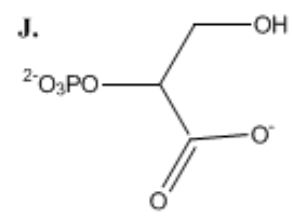
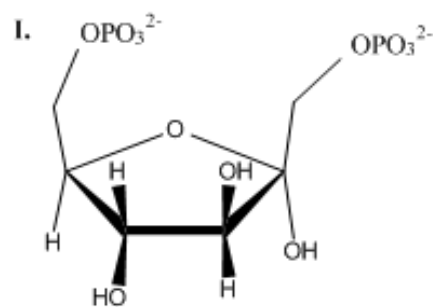
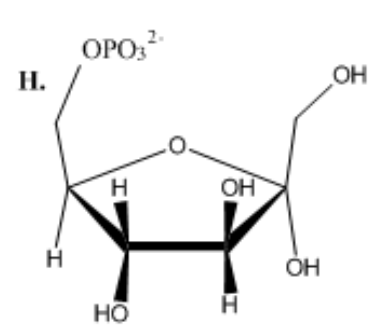
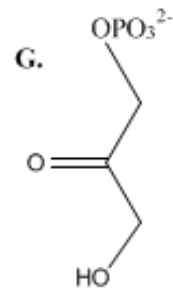
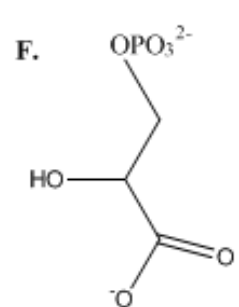
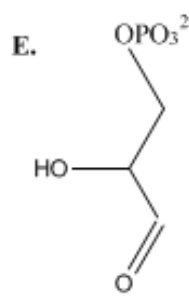
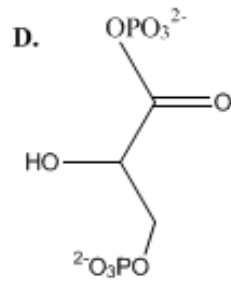
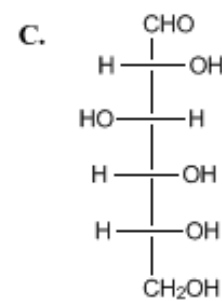
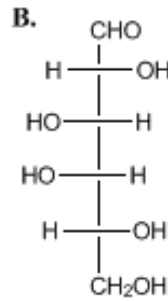
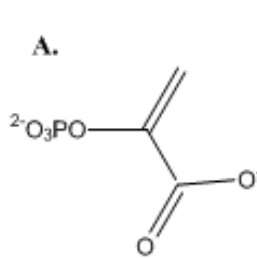
- A. water
- B. FBP
- C. Free Enzyme
- D. DHAP
- E. protonated Schiff base
- F. conjugate base
- G. Lys
- H. GAP
- I. Enediolate
- J. Enamine



II. **Matching: (continued)**



Glycolysis converts glucose ultimately to pyruvate via a series of enzymes. For questions 25-33, match the correct chemical structure with the appropriate step that is produced or consumed in the glycolysis pathway indicated by selecting "A-J". Note: "A-J" may be used more than once.



II. Matching (continued)

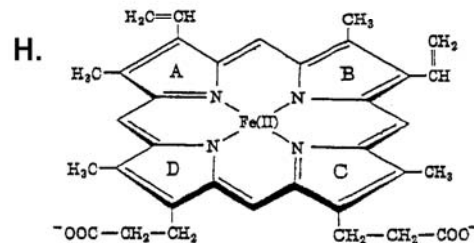
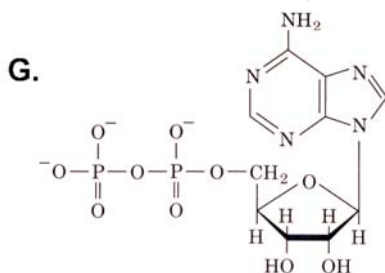
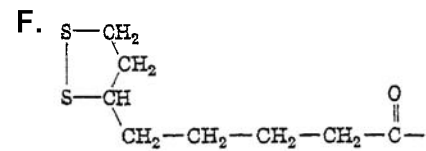
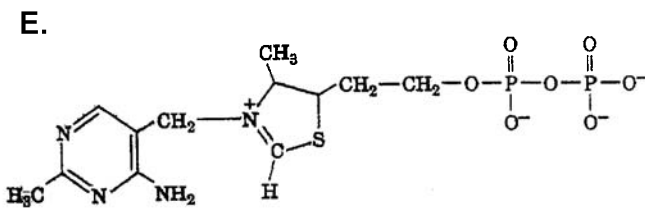
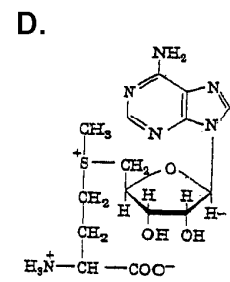
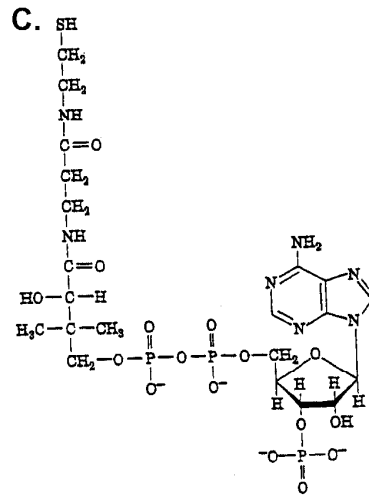
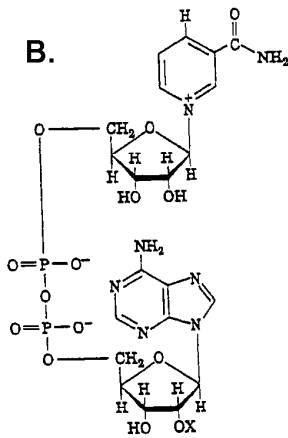
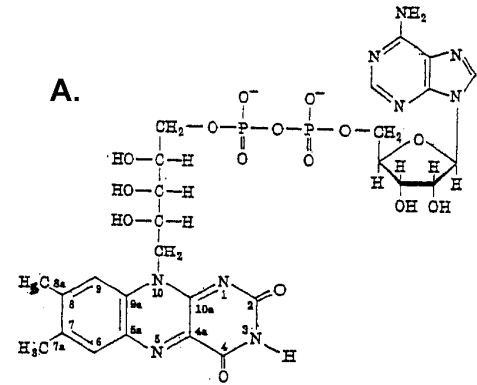
For questions 34-37, match the correct co-factor with its appropriate figure by selecting "A-H" on your scantron sheet. Note: "A-H" may be used more than once.

___ 34. ADP

___ 35. CoASH

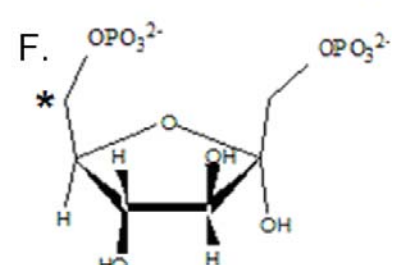
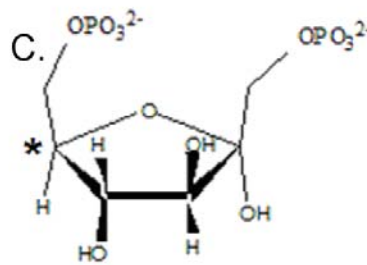
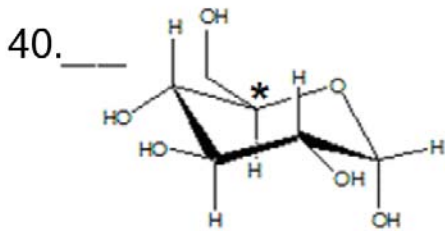
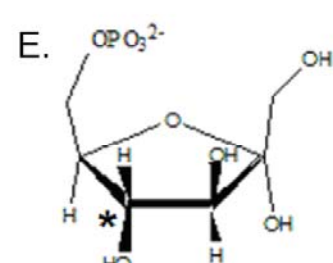
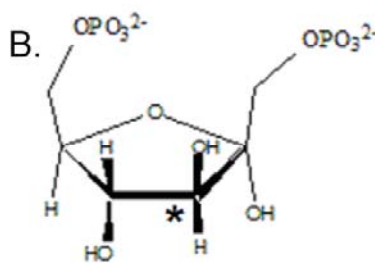
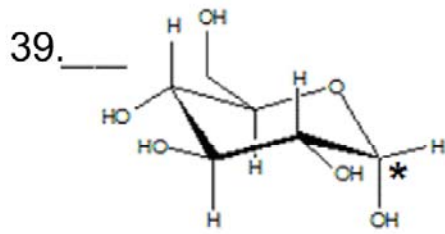
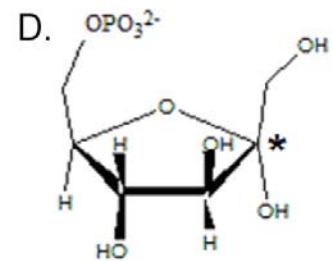
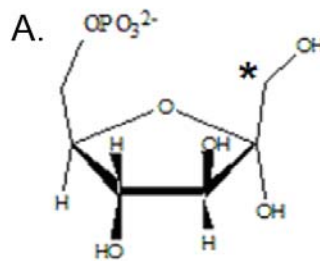
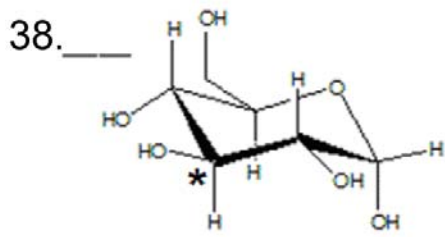
___ 36. NAD⁺

___ 37. TPP



II. Matching (continued)

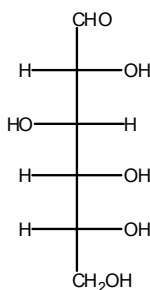
For questions 38-40: If glucose is isotopically labeled with [^{14}C] on a single carbon atom as indicated below (*) and metabolized in the glycolysis pathway, which product in the glycolysis pathway would contain the label? Note: "A-F" may be used more than once.



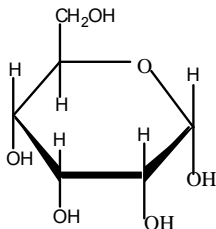
41. Acetyl CoA:
- A. is a high energy compound.
 - B. is a carrier of acetyl or acyl groups.
 - C. can be used to drive endergonic processes.
 - D. is both A. and B.
 - E. is A. B. and C.
42. Glycosidic bonds between two sugars
- A. can form only through a 1-2 linkage.
 - B. can form only through a 1-4 linkage.
 - C. can form only through a 1-6 linkage.
 - D. can form through a 1-2, 1-4 or 1-6 linkage.
 - E. can form only through a peptide bond.
43. What is/are possible metabolic fates of pyruvate in humans?
- A. Conversion to lactate under aerobic conditions
 - B. Conversion to lactate under anaerobic conditions
 - C. Conversion to acetyl CoA under anaerobic conditions
 - D. Conversion to ethanol under anaerobic conditions
 - E. All of the above

44. Sugar molecules can be drawn by either using the Fischer projection (linear form) or the Haworth projection (cyclic form) to illustrate the orientation of the hydroxyl groups. Below to the left is shown the Fischer projection for D-glucose. Which of the Haworth projections to the right represents α -D-glucopyranose?

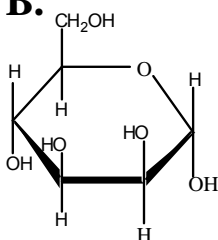
D-glucose



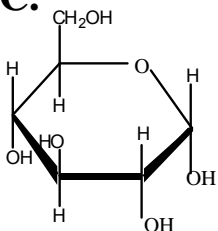
A.



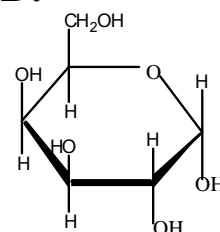
B.



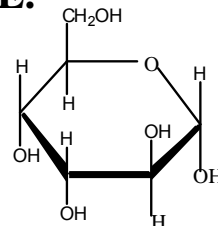
C.



D.



E.

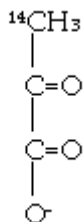


45. Which of the enzymes of Glycolysis are irreversible, and which of those enzymes serves as the primary flux control step?
- Hexokinase, GAP Dehydrogenase, and Pyruvate Kinase; with GAP Dehydrogenase as the flux control step.
 - Hexokinase, Phosphofructokinase, and Pyruvate Kinase; with Pyruvate Kinase as the flux control step.
 - Hexokinase, Phosphofructokinase, and Aldolase; with Hexokinase as the primary flux control step.
 - Phosphoglucose Isomerase, Triose Phosphate Isomerase, and Phosphoglycerate Kinase; with Triose Phosphate Isomerase as the flux control step.
 - Hexokinase, Phosphofructokinase, and Pyruvate Kinase; with Phosphofructokinase as the flux control step.

46. Phosphofructokinase-1:
- A. is inhibited by ATP.
 - B. has a higher affinity for fructose-6P in the presence of AMP.
 - C. is phosphorylated in response to hormones.
 - D. is the most important control point in glycolysis.
 - E. is all of the above.
47. Which of the following statements about glycogen synthesis or breakdown is correct?
- A. Glycogen synthase extends 1-6 linkages through an oxonium ion intermediate.
 - B. There is only one non-reducing end of a glycogen polysaccharide.
 - C. Glycogen synthase extends 1-4 linkages through an oxonium ion intermediate.
 - D. Monosaccharides derived from glycogen produces 2 ATP molecules from glycolysis.
 - E. UDP-glucose pyrophosphorylase catalyses the following reaction:

$$\text{G1P} + \text{UTP} \rightarrow \text{UDP-glucose} + \text{Pi}.$$
48. 2-phosphoglycate inhibits TIM. In an anaerobic system that is metabolizing glucose as a substrate, which of the following compounds would you expect to increase in concentration rapidly following the addition of 2-phosphoglycate?
- A. dihydroxyacetone phosphate
 - B. 1, 3-bisphosphoglycerate
 - C. phosphoenolpyruvate
 - D. glyceraldehyde-3-phosphate
 - E. 2-phosphoglycerate

49. The structure of a [^{14}C]-labeled Pyruvate molecule is given below. Which of the following options "A-E" correctly describe the origin of the label from Glucose?



- A. the label was from Carbons 3 or 4 in glucose.
- B. the label was from Carbons 2 or 5 in glucose.
- C. the label was from Carbons 1 or 6 in glucose
- D. the label came from Carbon 2 in glucose
- E. the label came from Carbon 1 in glucose
50. Which of the carbon(s) of glucose must be labeled with [^{14}C] for the end products of alcoholic fermentation to be unlabeled ethanol and [$^{14}\text{CO}_2$]?

- A. 4- [^{14}C]-glucose
- B. 3- [^{14}C]-glucose
- C. 2- [^{14}C]-glucose
- D. 1- [^{14}C]-glucose
- E. Both A. and B.

51. Which of the following best describes the reaction catalyzed by pyruvate carboxylase?

- A. Catalyses the formation of phosphoenol pyruvate from pyruvate through cleavage of ATP to ADP.
- B. Catalyses the formation of phosphoenol pyruvate from pyruvate through cleavage of GTP to GDP.
- C. Catalyses the formation of oxaloacetate from pyruvate and bicarbonate through cleavage of ATP to ADP.
- D. Catalyses the formation of oxaloacetate from pyruvate and bicarbonate through cleavage of GTP to GDP.
- E. None of the above.

52. Which of the following enzymes are directly involved in glycogen breakdown or synthesis?
- A. Glycogen phosphorylase
 - B. Glycogen debranching enzyme
 - C. Phosphofructokinase
 - D. Both A and B
 - E. All of the above.
53. A monosaccharide is defined as which of the following?
- A. A sugar such as sucrose
 - B. An aldehyde or ketone derivative of a straight chain polyhydroxyl alcohol that contains at least three carbon atoms
 - C. An aldehyde derivative of a straight chain polyhydroxyl alcohol that contains at least three carbon atoms
 - D. A ketone derivative of a straight chain polyhydroxyl alcohol that contains at least three carbon atoms
 - E. None of the above
54. Pyruvate formed by glycolysis is found to be [^{14}C]-labeled at the methyl position when cells are fed a [^{14}C]-labeled glucose. At which carbon position(s) in the labeled glucose was the source of the radioactive label?
- A. C1
 - B. C3 or C1
 - C. C5 or C1
 - D. C2 or C1
 - E. C4 or C2
 - F. C6 or C1

55. How many stereoisomers can be formed from a ketopentose and an aldopentose respectively in their linear forms?
- A. 2 and 4
B. 4 and 2
C. 4 and 8
D. 8 and 4
E. 8 and 16
F. 16 and 8
56. Which of the following redox half reactions best describes the reduction of NAD^+ ?
- A. $\text{NAD}^+ + \text{H} \rightarrow \text{NADH}$
B. $\text{NAD}^+ + \text{H}^+ + \text{e}^- \rightarrow \text{NADH}$
C. $\text{NAD}^+ + \text{H}^+ + 2\text{e}^- \rightarrow \text{NADH}$
D. $\text{NAD}^+ + \text{H}^+ \rightarrow \text{NADH} + 2\text{e}^-$
E. $\text{NAD}^+ + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{NADH}$
57. What drives the large conformational change in hexokinase?
- A. ATP substrate binding
B. D-glucose substrate binding
C. Mg^{2+} cofactor binding
D. AMP allosteric activator binding
E. Both A. and B.

58. What is the number of ATPs that are consumed, generated and overall yield for the conversion of one D-glucose to two pyruvates in glycolysis?
- A. 2 consumed, 4 generated, yield 2 D. 6 consumed, 2 generated, yield 4
B. 2 consumed, 6 generated, yield 4 E. 2 consumed, 2 generated, yield 0
C. 4 consumed, 2 generated, yield 2
59. What is the primary role of Mg^{2+} in hexokinase?
- A. oxidation/reduction D. binding D-glucose
B. water ionization E. electrostatic stabilization
C. generating a nucleophile
60. During glycolysis, which carbon in GAP is oxidized by GAPDH?
- A. The ketone at the C2 position
B. The aldehyde at the C2 position
C. The ketone at the C1 position
D. The aldehyde at the C1 position
E. Both B. and C.

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