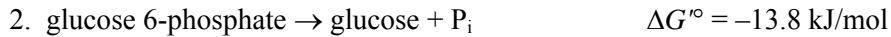


### MCB102: Quiz 3

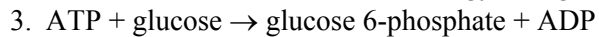
NAME: \_\_\_\_\_

SECTION: \_\_\_\_\_

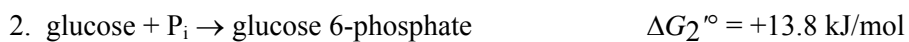
1. (1pt) Given  $\Delta G^\circ$  for each of the following reactions,



show how you would calculate the standard free-energy change ( $\Delta G^\circ$ ) for the reaction:



**Ans:** Reaction 3 is the sum of reaction 1 and the reversal of reaction 2. Because of the additivity of free energy changes, the overall  $\Delta G^\circ$  for reaction 3 is the sum of the free energy changes for reaction 1 and the reversal of reaction 2:



$$\Delta G_3^\circ = \Delta G_1^\circ + \Delta G_2^\circ = (-30.5 + 13.8) \text{ kJ/mol} = -16.7 \text{ kJ/mol}$$

2. (1pt) Why is it important to recycle NADH produced during glycolysis to  $\text{NAD}^+$ ?

**Ans:** Cells contain a limited supply of  $\text{NAD}^+$  and NADH. The oxidation of glyceraldehyde 3-phosphate requires  $\text{NAD}^+$  as an electron acceptor—it converts  $\text{NAD}^+$  to NADH. Unless this NADH is recycled to  $\text{NAD}^+$ , oxidative metabolism in this cell will cease for lack of an electron acceptor. Under aerobic conditions, NADH passes electrons to  $\text{O}_2$ ; under anaerobic conditions, NADH reduces pyruvate to lactate, and is thereby recycled to  $\text{NAD}^+$ .

3a. (1pt) Describe the part of the glycolytic pathway from fructose 6-phosphate to glyceraldehyde 3-phosphate. Show structures of intermediates, enzyme names, and indicate where any cofactors participate.

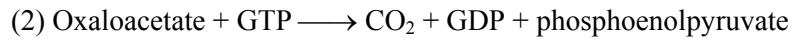
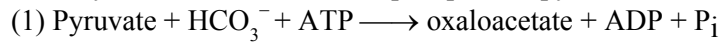
**Ans:** This part of the pathway involves the reactions catalyzed by phosphofructokinase-1, aldolase, and triose phosphate isomerase. (Fig 14-2)

3b. (1pt) Describe the glycolytic pathway from fructose 1,6-bisphosphate to 1,3-bisphospho-glycerate, showing structures of intermediates and names of enzymes. Indicate where any cofactors participate.

**Ans:** The answer should show the reactions catalyzed by aldolase, triose phosphate isomerase, and glyceraldehyde 3-phosphate dehydrogenase. (Fig 14-2)

4. (1pt) In gluconeogenesis, how do animals convert pyruvate to phosphoenolpyruvate? Show structures, enzymes, and cofactors.

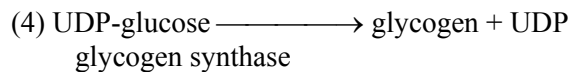
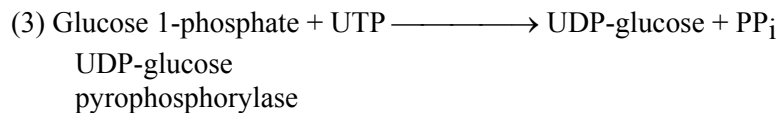
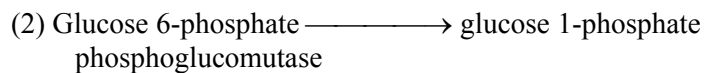
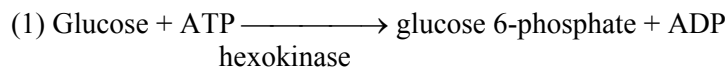
**Ans:** Pyruvate is converted into phosphoenolpyruvate in two steps:



The first reaction is catalyzed by pyruvate carboxylase, which requires biotin as a cofactor; the second, by phosphoenolpyruvate carboxykinase. Fig 14-17.

5. (1pt) Diagram the pathway from glucose to glycogen; show the participation of cofactors and name the enzymes involved.

**Ans:**



6. (1pt) Order the steps leading to glycogen breakdown resulting from the stimulation of liver cells by glucagon.

- 1) Activation of protein kinase A (PKA)
- 2) cAMP levels rise
- 3) Phosphorylation of phosphorylase *b*
- 4) Phosphorylation of phosphorylase *b* kinase
- 5) Stimulation of adenylyl cyclase

**Ans:** The correct temporal order is 5-2-1-4-3.