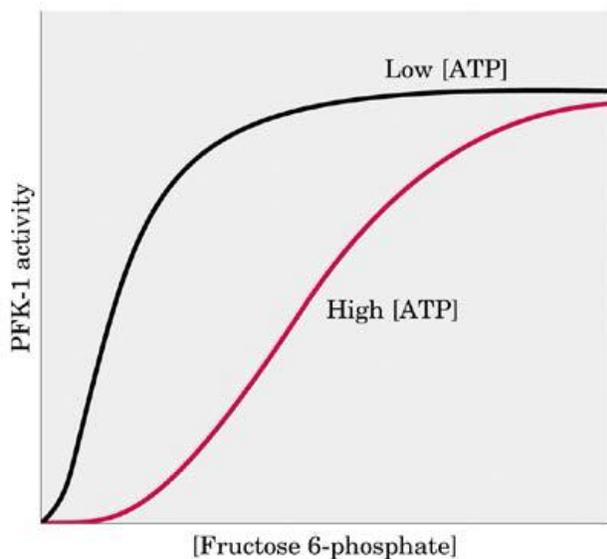
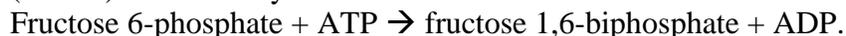


Training Question 3. Shown below is the activity profile for the enzyme phosphofructokinase-1 (PFK-1) which catalyzes the reaction:



Describe the different patterns of regulation for different ATP levels. Explain the why such regulation is appropriate for this enzyme, given its role in metabolism.

Scoring rubric for Question 3:

Assigned Core Concept: # 1: *ENERGY IS REQUIRED BY AND TRANSFORMED IN BIOLOGICAL SYSTEMS*

Core concept learning objective: *1b. Given a description of a known regulatory molecule, students should be able to **predict** how pathway(s) would respond to changes in regulator levels.*

Bloom's level: a) Level 2 comprehension
b) Level 3 application

High proficiency (3)

Answer should have made three points:

- Described the curve at low ATP to show typical enzyme (or Michaelis Menten) kinetics, in which the enzyme activity increases exponentially with substrate concentration, and
- Described the curve for high ATP to show a less active enzyme with a sigmoidal curve suggesting an allosteric inhibition or non-competitive inhibition by ATP



c) Explained that inhibition by high ATP is consistent with an enzyme that would be down-regulated at times when production of ATP was not needed, and example of feedback inhibition

OR

a) Described the curve at low ATP as condition where the enzyme is more active and

b) Described the curve for high ATP as condition where the enzyme is less active, showing allosteric inhibition or non-competitive inhibition by ATP

c) Explained that inhibition by high ATP is consistent with an enzyme that would be down-regulated at times when production of ATP was not needed, and example of feedback inhibition

Some proficiency (2)

1. Answered provided only two of the a, b and c above

OR

2. Answered stated two of a, b and c above correctly, but stated the third of these incorrectly

OR

3. Three of the above except that for c) stated enzyme was inhibited at high ATP, but did not mention sigmoidal/allosteric pattern

OR

4. Three of the above except that for c) stated enzyme was inhibited at high ATP, but did not mention sigmoidal/allosteric pattern

Not yet proficient (1)

1. One of the three points outlined for highly proficient answer plus other points that are not correct

OR

2. Answer described pattern with low ATP as less active, curve for high ATP as more active

Answer not applicable (0)

1. Answer left blank

OR

2. Answer stated only incorrect options.

Or

3. Answer not relevant to question