

1. Your friend is diabetic and asks you to help her figure out how much insulin she needs to take. The nutrition information label for the product she is eating shows the carbohydrate breakdown below:

Total carbohydrate 31 g

Dietary Fibre 3 g

Sugars 5 g

She says her doctor told her to calculate the amount of insulin she needs, she has to subtract the fibre from the total carbohydrates. She doesn't understand why she has to do that.

a) How would you explain why she has to subtract the fibre from the total carbohydrates? (3)

b) Now your friend is interested to know more about carbohydrates. She says "I thought sugar was a carbohydrate. Why is it listed separately? What other kinds of carbs are there?" What would you tell her about the carbohydrates in plants and animals and their connection to glucose? (3)

Suggested Response

A)

- Fiber is not digested by humans
- Fiber is cellulose
- Fiber does not affect blood glucose so should not be counted
- Monomers are connected by β links
- She would take too much insulin if she didn't subtract fiber

B)

- The two groups of carbs in our diet are simple (sugars) and complex (starches)
- Glycogen is a storage carbohydrate in animals while starch is a storage carbohydrate in plants
- These carbohydrates are all polymers of glucose
- Glucose is moved quickly into the blood so is immediately available to cells
- It is listed separately because it affects blood glucose quickly

2. Proteins perform a huge variety of functions in cells and each protein has a unique, 3-D shape that is crucial to its function.

a) Identify how amino acids contribute to the shape of a protein. (1)

b) In a particular protein, amino acid 27 is supposed to be aspartic acid (negatively charged) but is replaced by lysine (positively charged). Predict the changes you would expect in the three dimensional structure and the function of the protein. (3)

c) In another experiment, they noticed that adding salt had no effect on the function of an enzyme but heating the enzyme slightly made it unable to work. They don't understand but they know you're in Bio 12 so they ask you to explain how this is possible. What do you say? (2)

Suggested Response

A)

- Amino acids have different R groups
- The R groups interact in different ways to form the shape of a protein

B)

- The positive charge of lysine would be attracted to negatively charged amino acids and repelled by positively charged amino acids
- This would create different ionic bonds
- The shape of the protein would change as the normal bond would be broken and new ionic bonds formed
- The change in shape would cause a loss of function because the shape of proteins is important to their function

C)

- Salt disrupts ionic bonds and gentle heat disrupts hydrogen bonds
- The salt had no effect which means there were few, if any ionic bonds
- Gentle heat affected the function of the enzyme, indicating the structure was partially formed using hydrogen bonds