What is Carbohydrate Metabolism?

Worksheet

Carbohydrate metabolism covers glycolysis (glucose pyruvate + ATP), glycogenesis (glucose glycogen storage), and glycogenolysis (glycogen glucose release), keeping blood glucose stable and supplying cells with energy.

Questions

1. What is the net ATP yield of glycolysis per glucose molecule?

A) 1 ATP
B) 2 ATP
C) 4 ATP
D) 36 ATP

2. Which hormone triggers glycogenolysis when blood sugar is low?

A) Insulin
B) Glucagon
C) Estrogen
D) Thyroxine

3. Where does glycolysis take place in the cell?

A) Mitochondrial matrix
B) Nucleus
C) Cytoplasm
D) Golgi apparatus

4. Which organ's glycogen can directly raise blood glucose levels?

A) Muscle only
B) Liver
C) Kidney only
D) Pancreas only

5. One glucose molecule goes through glycolysis. The investment phase uses 2 ATP and the payoff phase produces 4 ATP. What is the net ATP yield?

6. A liver glycogen granule holds 12,000 glucose units. Glycogen phosphorylase releases one glucose-1-phosphate per residue removed. How many glucose-1-phosphate molecules come from breaking down the whole granule?

7. Glycogenesis adds 800 glucose units to a glycogen chain, costing about 1 UTP-equivalent high-energy bond per glucose added. How many high-energy bonds are consumed?

8. Define: What is glycolysis?

9. Define: What is glycogenesis?

10. Define: What is glycogenolysis?

Answer Key

1. B) 2 ATP - 4 ATP are produced in the payoff phase minus 2 ATP invested = net 2 ATP.

2. B) Glucagon - Glucagon (and adrenaline) activate glycogen phosphorylase to release glucose.

3. C) Cytoplasm - Glycolysis occurs entirely in the cytoplasm, without requiring oxygen.

4. B) Liver - Liver glycogen is broken down to free glucose that enters the bloodstream; muscle glycogen lacks the enzyme (glucose-6-phosphatase) to do this.

5. ATP produced ATP invested 4 ATP 2 ATP = 2 ATP Result: net yield is 2 ATP per glucose (plus 2 NADH)

6. Each glucose unit removed yields one glucose-1-phosphate 12,000 units 1 G1P/unit = 12,000 G1P Result: 12,000 glucose-1-phosphate molecules released

7. Bonds consumed = glucose units added 1 bond/unit 800 1 = 800 Result: 800 high-energy phosphate bonds are used

8. The breakdown of one glucose molecule into two pyruvate molecules in the cytoplasm, yielding a net 2 ATP and 2 NADH.

9. The process of linking glucose molecules into glycogen for storage, stimulated by insulin.

10. The breakdown of glycogen back into glucose units, stimulated by glucagon and adrenaline.