

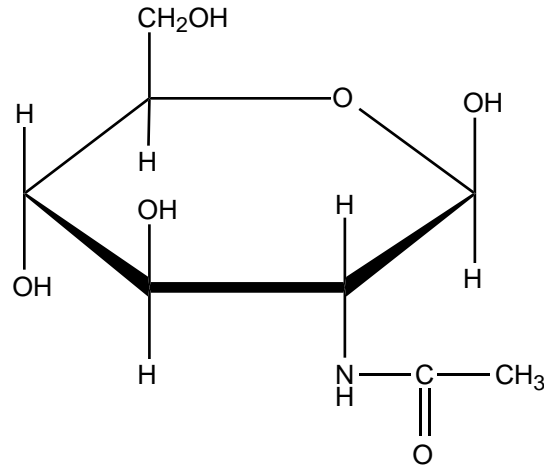
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Score: _____

Please provide short answers to the following 25 questions.

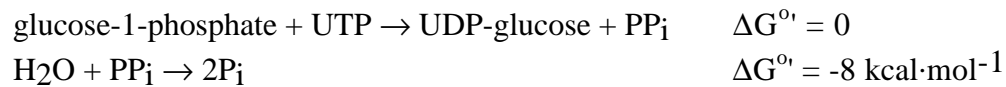
1. Which is the major storage carbohydrate in humans?
glycogen
2. What is the relative affinity of hexokinase for glucose and fructose, in order of increasing affinity?
fructose < glucose
3. List two effects of glucagon on metabolism in liver tissue.
stimulates glycogenolysis and gluconeogenesis
4. Which GLUT transporter is insulin-dependent and in which tissue is it found?
GLUT4, muscle, heart, adipose
5. Coenzyme Q (ubiquinone) facilitates electron transfer between which complexes of the electron transport chain?
complex I → complex III and complex II → complex III
6. Which enzyme and coenzyme allow lactate to enter the gluconeogenic pathway?
lactate dehydrogenase and NAD⁺
7. How would ATP levels change if glucose molecules were diverted through the pentose phosphate pathway during the production of pyruvate?
ATP levels would decrease, 1 glyceraldehyde-3-phosphate re-enters the pathway
8. Describe the change in ATP levels in an individual who accidentally ingests a compound that uncouples electron transport from ATP production?
decrease in ATP levels
9. Very high intravenous feeding levels of fructose will deplete the liver of which molecule?
orthophosphate (P_i) or ATP
10. Which compound is used in muscle as a reservoir for ATP?
creatine phosphate
11. Indicate two important functions of glycoproteins.
signal transduction (hormones), recognition (immunoglobulins)

12. Provide the complete name of the structure shown below.



N-acetyl- β -D-glucosamine

13. Briefly explain why UDP-glucose formation is a favorable process.



overall reaction is driven by the hydrolysis of pyrophosphate

14. Which one activity is simultaneously stimulated by epinephrine in heart muscle and inhibited by epinephrine in liver?

glycolysis

15. Following a diet fad meal of skim milk and yogurt, an adult female patient experiences abdominal distention, nausea, cramping, and pain followed by a watery diarrhea. This set of symptoms has been observed each time that the meal is consumed. Which enzyme is likely missing in this individual?

lactase (a disaccharidase)

16. With respect to ATP accounting, what is the advantage of using glycogen rather than glucose as the starting point for glycolysis?

one less ATP is needed because the pathway begins with glucose-6-phosphate

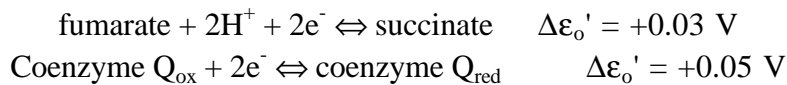
17. In which mitochondrial subcompartment will the citric acid cycle enzymes be found?

matrix

18. List two enzymes involved in the malate-aspartate shuttle.

aspartate transaminase (glutamate-oxaloacetate transaminase) and malate dehydrogenase

19. List two compounds that inhibit complex I of the electron transport chain.
amytal and rotenone
20. List two characteristics of glycosaminoglycans.
polyanionic, sulfated, linear chain, hexosamine and uronic acid sugar units
21. A person eats a high-carbohydrate meal on Sunday night and nothing else afterwards for the rest of the week. List the metabolic processes, in relative chronological order, that are responsible for maintaining blood glucose levels.
glycolysis, glycogenolysis, gluconeogenesis
22. Nerve impulses and covalent modifications activate phosphorylase kinase. Which two low-molecular-weight intracellular molecules are involved in these different activation modes?
cAMP, IP₃, DAG, Ca²⁺
23. List two major roles of the pentose phosphate pathway.
production of NADPH, ribose-5-phosphate, glycolytic intermediates
24. List two enzymes from the carbohydrate metabolic pathways require riboflavin as a coenzyme?
succinate dehydrogenase, dihydrolipoyl dehydrogenase (pyruvate dehydrogenase, α-ketoglutarate dehydrogenase), NADH dehydrogenase
25. Predict the integral number of ATP molecules that could be produced from the oxidation of succinate involving coenzyme Q.



$$\Delta G^\circ = -nF \Delta\varepsilon_o' \text{ where } F = 23 \text{ kcal V}^{-1} \text{ mol}^{-1}$$

$$\Delta G^\circ = -2(23 \text{ kcal V}^{-1} \text{ mol}^{-1})[(0.05-0.03) \text{ V}] = -46(0.02) \text{ kcal mol}^{-1} = -0.9 \text{ kcal mol}^{-1}$$

$$\# \text{ ATP} = -0.9 \text{ kcal mol}^{-1}/(-7.3 \text{ kcal mol}^{-1} \text{ ATP}^{-1}) = 0.1$$

0 ATP can be potentially produced (Lecture 8; D pp. 247-248)