Carbohydrate Metabolism

I. MCQ :

Choose the correct answer:

1. _____ and adrenaline _____ glycogen synthase.

a) Glucagon, activate
b) Glucagon, inactivate
c) Insulin inactivate
d) Insulin, activate

2. The enzymes of glycolysis are located in the:

a) intermembrane space
b) plasma membrane
c) cytosol
d) mitochondrial matrix

3. For every one molecule of sugar glucose which is oxidized _____ molecule of pyruvic acid are produced.

a) 1
b) 2
c) 3
d) 4

4. Which of the following statements about the oxidative decarboxylation of pyruvate is correct?

a) The oxidative decarboxylation of pyruvate formed in aerobic glycolysis occurs in the cytosol.
b) The oxidative decarboxylation of pyruvate is catalysed by the enzyme pyruvate decarboxylase
c) The oxidative decarboxylation of pyruvate is reversible since there is a large decrease of free energy in the reaction.
d) The oxidative decarboxylation of pyruvate forms acetyl-CoA which is fed into the citric acid cycle

5. Which of the following statements is true regarding acetyl co-A?

a) It stimulates pyruvate dehydrogenase
b) It stimulates pyruvate carboxylase
c) It inhibits pyruvate carboxylase
d) It stimulates hexokinase

6. Glycolysis converts

a) Glucose into pyruvate
b) Glucose into phosphoenolpyruvate
c) Fructose into pyruvate
d) Fructose into phosphoenolpyruvate

7. A person on ingestion of Primaquine develops hemolytic anemia, what is the possible defect?

a) Deficiency of Iron
b) Glucose-6- phosphatase deficiency
c) Glucose-6-P dehydrogenase deficiency
d) Fructose-1,6 diphosphatase deficiency

8. G6PD is regulated by the amount of NADPH in the cell. What is the most plausible mechanism of regulation?

a) NADPH allosterically inhibits G6PD
b) NADPH allosterically activates G6PD
c) NADP+ allosterically inhibits G6PD
d) Ribose-5-Phosphate allosterically activates G6PD

9. Where does the pentose phosphate pathway take place?

a) cytosol
b) mitochondria
c) peroxisomes
d) smooth ER

10. What enzyme catalyses the rate limiting step of the HMP?

a) phosphogluconolactone hydrolase
b) glucose 6-phophate isomerase
c) glucose 6-phosphate dehydrogenase
d) transketolase

11. Which of the following statements about the use of the pentose phosphate pathway in red blood cells is correct?

a) Mature red blood cells do not need the pentose phosphate pathway since they do not divide
b) Mature red blood cells do not need the pentose phosphate pathway since they do not synthesize fat
c) Mature red blood cells need the pentose phosphate pathway to oxidize the glucose-6-phosphate
d) Mature red blood cells need the pentose phosphate pathway for the production of NADPH

12. What type of transport that glucose utilize for gastrointestinal absorption?

a) Facilitated diffusion against conc.gradient
b) Active transport and facilitated diffusion
c) Passive transport and facilitated diffusion
d) Passive down the concentration gradient

13. Which glucose transporter transports glucose from the intestinal cell into the bloodstream?

a) GLUT2
b) GLUT4
c) SGLUT1
d) SGLUT2

14. For each glucose molecule metabolized in the aerobic glycolytic pathway there is a net production of:

a) 4 ATP
b) 7 ATP
c) 6 ATP
d) 2 ATP

15. The rate limiting enzyme for glycolysis is:

a) Phosphofructokinase-1
b) Glucokinase
c) Glucose- 6- Dehydrogenase
d) Pyruvate Kinase

16. HMP shunt is of great importance in cellular metabolism because it produces

a) ATP
b) ADP
c) Acetyl CoA
d) NADPH

17. Liver glycogen is used in fasting to provide glucose for use by other tissues including the brain. Muscle glycogen is not. What is the explanation for this?

a) Muscle does not have a debranching enzyme
b) Muscle cannot degrade glycogen further than glucose-1-phosphate
c) Muscle lacks glucose-6-phosphatase
d) The liver provides all the glucose necessary for metabolism and there is no need for muscle to do the same.

18. Which of the following is important in transferring energy from the glycolytic pathway to the TCA cycle?

a) NADH + H+
b) FADH2
c) citrate
d) acetyl CoA

19. Which of the following is most likely to occur in a normal individual after ingesting a high-carbohydrate meal?

a) Only insulin levels decrease.
b) Only insulin levels increase.
c) Only glucagon levels increase.
d) Both insulin and glucagon levels decrease.

20. Glucose transporter in myocyte stimulated by insulin is:
a) GLUT-1
b) GLUT-2
c) GLUT-3
d) GLUT-4

21. Irreversible steps of Glycolysis are catalyzed by:
a) Hexokinase, Phosphofructokinase-1, Pyruvate Kinase
b) Glucokinase, Pyruvate Kinase, Glyceraldehyde 3 Phosphate Dehydrogenase
c) Hexokinase, Phospho-Glycerate Kinase, Pyruvate Kinase
d) Pyruvate Kinase, Fructose 1,6 Bis-phosphatase, Phosphofructokinase-1

22. Glycolysis occurs in:
a) Cytosol
b) Mitochondria
c) Nucleus
d) Lysosome

23. True statement about glycolysis is:
a) Occurs in mitochondria
b) Complete breakdown of glucose
c) Conversion of glucose to 3C units
d) 3 ATPs are used in anaerobic pathway

24. The number of ATPs produced by glycolysis in RBC is.....
a) 1
b) 2
c) 3
d) 4

25. Gluconeogenesis does not occur significantly from..... in humans:
a) Lactate
b) Fatty acids
c) Pyruvate
d) Amino-acid

26. Acetyl CoA can't be converted into .....:
a) Glucose
b) Fatty acids
c) Cholesterol
d) Ketone bodies

27. Deficiency of ..... is the most common cause enzymatic hemolytic anemia.
a) Hexokinase
b) Phosphofructokinase-1
c) Enolase
d) Pyruvate kinase

28. After overnight fasting, levels of glucose transporters are reduced in:
a) Brain cells
b) RBCs
c) Adipocyte
d) Hepatocyte

29. The tissues with the highest total glycogen content are
a) Muscle and kidneys
b) Kidneys and liver
c) Liver and muscle
d) Brain and Liver

30. Which of the following statements about glycogen and its catabolism is NOT true?
a) The function of glycogen in liver is to supply glucose to the blood when needed.
b) The function of glycogen in muscle is to supply energy for muscle contraction.
c) When glycogenolysis is active in the liver, glycogenesis is usually inactive.
d) Muscle, but not liver, has the enzyme glucose-6-phosphatase.

31. All of the following will result in activation of glycogen phosphorylase in skeletal muscle EXCEPT
a) Increased concentrations of AMP from contraction of muscle
b) Increased epinephrine and cAMP
c) Increased cytosolic [Ca^{++}]
d) Increased protein phosphatase

32. One of the following is not glucogenic
a) Lactate
b) Even chain fatty acids
c) Proteins
d) Glycerol

33. Insulin
a) stimulates gluconeogenesis and glycolysis
b) stimulates gluconeogenesis and inhibits glycolysis
c) inhibits gluconeogenesis and glycolysis
d) inhibits gluconeogenesis and stimulates glycolysis

34. A type 1 diabetic neglects to take his insulin injections while on a weekend vacation. Cells of which tissue will be most greatly affected by this mistake?
a) Brain
b) Liver
c) Muscle
d) Red blood cells

35. Fluoride is added to blood samples for glucose estimation as it prevents glycolysis through inhibition of
a) Phosphofructokinase-I
b) Glucokinase
c) Phosphohexose isomerase
d) Enolase

36. Which of the following does not contribute to glucose by gluconeogenesis?
a) Lactate
b) Acetyl CoA
c) Pyruvate
d) Oxaloacetate

37. Which of the following statements about gluconeogenesis is NOT true?
a) Gluconeogenesis prevents hypoglycemia during prolonged fasting
b) Carbon skeleton of amino acids are involved in gluconeogenesis
c) It is stimulated by insulin.
d) It is stimulated by excess acetyl CoA.

38. _____is the key enzyme of glycogenesis
a) Glycogen lyase
b) Glycogen synthase
c) Glycogen phosphorylase
d) Glucose -6-phosphate dehydrogenase.

39. _____ is the key enzyme of glycogenolysis.
a) Glycogen phosphorylase
b) Glycogen synthase
c) Glucose- 6- phosphatase
d) Glucose -6-phosphate dehydrogenase.

40. Muscle phosphorylase has _____at each catalytic site which has a catalytic role in the enzyme action.
a) Thiamine
b) Niacin
c) Pyridoxal phosphate
d) Lipoic acid

41. The renal threshold for blood glucose is;
a) 180 mg/dL
b) Less than 100 mg/dL
c) Less than 140 mg/dL
d) 200 mg/dL

42. Whenever the cell's AMP supply is increased, which of the following enzyme's activity is increased?
a) Hexokinase
b) Pyruvate kinase
c) Glucokinase
d) Phosphofructokinase-1

MCQ Answers

1-b	2-c	3-b	4-d	5-b	6-a	7-c	8-a	9-a	10-c
11-d	12-b	13-a	14-b	15-a	16-d	17-c	18-d	19-b	20-d
21-a	22-a	23-c	24-b	25-b	26-a	27-d	28-c	29-c	30-d
31-d	32-b	33-d	34-c	35-d	36-b	37-c	38-b	39-a	40-c
41-a	42-d								

II- Match the disease in column A with its enzymatic deficiency in column B

Column (A) Disease	Column (B) Enzyme deficiency
1. Lactose intolerance	a. Glucose 6-phosphatase
2. Hemolytic anemia	b. Fructose 1,6-bisphosphatase
3.Favism	c. Sucrase
4. Von Gierke's disease	d. Pyruvate kinase
5. Sucrose intolerance	e. Lactase
	f. Glucose -6-phosphate dehydrogenase

Matching Answers

1.e	2. d	3.f	4.a	5.c			

III- Define :

1- Hypoglycemia
2- Gluconeogenesis
3- Glucosuria
4- Renal glucosuria