97/100

BMD 322
EXAM #1 Version 2 87 10

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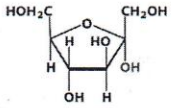
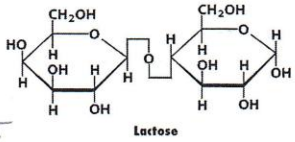
TRUE/FALSE





1. The sugar shown on the right is a furanose T
2. The bond between galactose and glucose in lactose is β (1→4) T
3. The rate of lipid lateral diffusion is faster than the flip-flop across the membrane T
4. The prefix D in D-sugars indicates that these compounds turn the plane of light polarization rightwards. F
5. Co-transport of lactose and H^+ in bacteria is an example of uniport F
6. In ω-3 fatty acids the third bond (between carbons 3 and 4) is a double bond F

MULTIPLE CHOICE

7. Which of the following polysaccharides has the highest degree of branching?

A. cellulose
B. amylose
C. amylopectin
D. glycogen
E. Chitin

8. Which of the following disaccharides contains only glucose?

A. sucrose
B. lactose
C. maltose — yes
D. cellobiose — disaccharide of two glucose molecules β,1-4 linkage
E. C and D

9. What is an anomeric carbon in a sugar?

A. The farthest chiral carbon from the carbonyl group
B. The last carbon in the chain
C. The carbon that determines whether a sugar is D- or L-
D. All chiral carbons are anomeric
E. The carbonyl group after it is converted into a hemiacetal or hemiketal

10. What is the main difference between glycogen and amylopectin?

A. Glycogen has α (1→4) glycosidic bonds while amylopectin has β (1→4) bonds
B. Glycogen has α (1→6) branches every 8-10 monosaccharides while amylopectin has branches every 20-25 monosaccharides.
C. Amylopectin does not have α (1→6) branches
D. Digestion of glycogen produces maltose while with amylopectin the product is cellobiose
E. Glycogen is a storage polysaccharide while the role of amylopectin is structural.

11. Penicillin interferes with:

A. Synthesis of the bacterial wall
B. Crosslinking of peptide chains in peptidoglycans
C. Hydrolysis of an alanine group
D. All of the above
E. None of the above

12. The structural differences among the polysaccharides determining the ABO antigens in glycoproteins include:

A. They do not have any sugar in common
B. Both A and B antigens have one more monosaccharide than O
C. The O antigen has more branches
D. The synthesis of the O antigen is inhibited by penicillin
E. None of the above

13. Hyaluronic acid is a component of:

A. Peptidoglycans
B. Glycoproteins
C. Proteoglycans
D. All of the above
E. None of the above

14. Which of the following is **NOT CORRECT** concerning chitin

A. Found in insect and crustacean shells
B. Found in fungi cell walls
C. Composed of N-acetylglucosamine subunits
D. Composed of linear fibrils like cellulose
E. It is a heteropolysaccharide

15. Sugar derivatives such as N-acetylated sugars or sugar acids may be found in:

A. Gangliosides
B. Chitin
C. Peptidoglycans
D. Glycoproteins
E. All of the above

16. All of the following are correct concerning glycoproteins, **EXCEPT**:

A. They may be found in plasma
B. They may be located on the outer surface of the cell membrane
C. The polysaccharides are synthesized in the endoplasmic reticulum
D. They are stored in the Golgi apparatus – stored in lysosomes.
E. They may be found in the inner mitochondrial membrane

17. All of the following are constituents of the cell membrane **EXCEPT**:

A. glycolipids
B. cholesterol
C. triglycerides
D. phospholipids
E. cerebrosides

18. Which of the following **DOES NOT** affect membrane fluidity:

A. Proteins
B. cholesterol
C. proportion of unsaturated fatty acids.
D. temperature.
E. fatty acid composition.

19. All of the following molecules may form micelles **EXCEPT**?

A. Lysophosphoglycerides
B. Salts of fatty acids
C. Detergents
D. Phosphoglycerides

20. The Na^+/K^+ ATPase is an example of:

A. facilitated diffusion.
B. membrane pore.
C. symport.
D. active transport.
E. passive transport.

21. Above the phase transition temperature:

A. The membrane becomes thinner
B. There is less rotation around -C-C- bonds
C. Lateral diffusion increases
D. All of the above
E. Only A and C are correct

22. The difference between transport through a channel or pore and passive transport is:

A. Pores always carry lipid soluble metabolites No, water Soluble
B. Passive transport can be saturated yes
C. Passive transport involves energy in a form different than ATP No
D. Pores involve energy consumption No
E. Only in channels movements are favored by a concentration gradient No

23. All of the following statements about of cholesterol are true, **EXCEPT**:

A. It affects membrane fluidity
B. It is a precursor of steroid hormones
C. It is a precursor of bile salts
D. It is a precursor of sphingomyelins
E. Is an alcohol

24. Triacylglycerols cannot form lipid bilayers because they

A. Have hydrophobic tails
B. Do not have polar heads
C. Cannot associate with cholesterol
D. Are amphipatic
E. Cannot engage in hydrophobic interactions

25. Which would you expect for the fatty acyl chains of the membrane phospholipids of bacteria grown at low temperature?

A. Proportion of unsaturated fatty acyl groups increases.
B. Proportion of unsaturated fatty acyl groups decreases.
C. No change in the proportion of saturated versus unsaturated acyl groups.
D. More cholesterol is produced and is inserted between the fatty acyl chains of the membrane.

26. All of the following define allostery **EXCEPT**:

A. Binding an activator or inhibitor to an enzyme at a region different than the active site
B. The allosteric site may be located in a different polypeptide
C. Allosteric interactions involve stabilization of either R or T forms of the enzyme
D. Binding of an allosteric modulator is an irreversible process
E. The allosteric modulator changes the affinity of the enzyme for its substrate

27. An enzyme catalyzed reaction has a Km of 0.1 mM and a Vmax of 2.0 µmoles of product formed per minute per mg of enzyme. The rate of product formation (µmoles per min per mg of enzyme) at a substrate concentration of 0.1 mM is:

$V_0 = \frac{V_{max}[S]}{[S] + K_m}$

$V_0 = \frac{2[.1]}{[.1]+[.1]} = \frac{.2}{.2} = 1$

A. 10
B. 5
C. 2
D. 1
E. 0.1

28. An enzyme has the following effect(s) on the reaction that it catalyzes:

A. shifts the equilibrium to the formation of products
B. increases the activation energy
C. increases the rate of reaction
D. Changes the equilibrium constant
E. All of the above are true.

29. An example of covalent modification:

A. binding of activators or inhibitors to allosteric sites
B. Binding of hormone-receptor complex to nuclear enhancers
C. Phosphorylation of serine groups
D. competitive inhibition
E. formation of quaternary structures

30. How is the reaction rate of an enzymatic reaction if the substrate concentration is much lower than the enzyme's Km?

A. Vmax
B. ½ Vmax
C. Between ½ Vmax and Vmax
D. It will not change by the addition of more substrate.
E. It is proportional to substrate concentration.

ESSAYS

31. Draw the structure of palmitoleic acid (Δ^9 hexadecanoic acid) : 16-Carbons 1-double bond

3

32. What is the effect of unsaturated fatty acids on membrane fluidity? Why? (4 points)

Rotation of double bond fatty acid

Unsaturated fatty acids tend to increase the fluidity of membranes. The increase in fluidity is do to the fact that the double bond forms a kink in the fatty acid chain which upon rotation around the carbon-carbon bond will disrupt the organized packing of fatty acid chains. The disruption of the packing of the fatty acid chains is what causes the membrane to become more fluid

4

33. Describe a characteristic of integral membrane proteins concerning either shape or amino acid composition (two sentences)

Integral membrane proteins tend to span the membrane and are tightly held into place in the membrane, such that extreme measures must be taken to dissociate an integral membrane protein. Porin an integral membrane protein, is composed of a beta sheet with alternating hydrophobic and hydrophilic amino acids allowing an inner pore of hydrophilic residues and an outer core of hydrophobic residues which interact with the hydrophobic fatty acid tails of the membrane.

3

HONOR PLEDGE (sign after the test in completed)

Part I
I have neither given nor received aid from any source during this examination.

Signed.....

Part II
I have not seen help given or obtained by anyone during this examination.

Signed.....

88.5 92.5 TW

BMD 322
EXAM #2 Version 1

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-7.5

1. If a reaction is in equilibrium:

A. $\Delta G > 0$
B. $\Delta G < 0$
C. $\Delta G = 0$
D. $\Delta G^{o} = 0$
E. $\Delta G^{o} > 0$

2. Which of the following thermodynamic parameters is related to Keq?

$\Delta G = \Delta G^{o'} + RT \ln Keq$

@ Equil.brium $\Delta G = 0$ $\therefore \boxed{\Delta G^{o'} = -RT \ln Keq}$

A. ΔG
B. $\Delta G°$
C. ΔH
D. ΔS
E. ΔE ?

~~$\Delta G = \Delta H - T\Delta S$~~

3. The subscript i and s in G proteins indicates:

A. Whether they inhibit or stimulate a GTPase activity
B. Whether they inhibit or stimulate the enzyme phosphodiesterase
C. Whether they inhibit or stimulate phospholipase C
D. Whether they inhibit or stimulate protein kinase C
E. Whether they inhibit or stimulate cAMP production

4. The GTP binding polypeptide in G proteins is:

A. The α subunit
B. The β subunit
C. The γ subunit
D. The $\alpha\ \beta\ \gamma$ complex
E. The receptor

5. Binding of insulin to its receptors triggers:

A. Gi proteins
B. Gs proteins
C. Insulin is a lipid and does not have membrane receptors
D. Self phosphorylation
E. Activation of serine kinases

6. Binding of a hormone to Gq proteins leads to all of the following **EXCEPT** :

A. Activation of phospholipase C
B. Increase cytoplasmic Ca
C. Activation of protein kinase C
D. Self-phosphorylation on tyrosine groups
E. Release of IP_3 to the cytosol

7. Yeast make ethanol in order to:

A. Reoxidize NADH produced during glycolysis
B. Reduce NAD to NADH
C. Make ATP in the process
D. Eliminate lactic acid
E. calm their anxiety

8. The main difference between PFK-1 and PFK-2 is:

A. PFK-2 uses fructose 6 phosphate as a substrate but PFK-1 doesn't
B. PFK-2 is part of the glycolytic pathway
C. PFK-2 makes an activator for PFK-1
D. PFK-1 is a target of protein kinase A in the liver
E. Phosphorylation of PFK-1 in the liver converts the enzyme into a phosphatase

No - PFK-2

NO PFK-2

9. Fructose-2,6-bis-P:

A. Activates PFK-1 – yes – glycolysis
B. Activates hexokinase
C. Inactivates fructose-1,6-bisphosphatase – gluconeo
D. A and B are correct
E. A and C are correct

– 1.5

10. Hexokinases have a relatively low Km (10^{-4} to 10^{-6} M) **EXCEPT**

A. Hexokinase I
B. Hexokinase II
C. Hexokinase III
D. Hexokinase IV – glucokinase

11. All of the following proteins are found in the **liver EXCEPT**:

A. The glucose carrier GLUT4 – muscle & brain adipose tissue
B. Hexokinase IV (Glucokinase) – yes
C. Glucagon receptors – yes
D. Glucose-6-phosphatase – gluconeogenesis
E. Fructose-1,6-bisphosphatase – gluconeogenesis

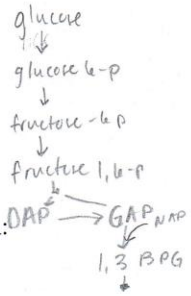
– 1.5

12. In the **liver**, pyruvate kinase (last enzyme in glycolysis) is controlled:

A. Allosterically
B. Via covalent modification by protein kinase A
C. The liver form of the enzyme is not subjected to regulation
D. A and B are correct

13. The only oxidation during glycolysis is accompanied by:

A. ATP formation
B. ATP conversion to ADP
C. splitting of fructose 1,6-bisphosphate into two trioses
D. NAD^+ reduction and incorporation of inorganic phosphate



14. Conversion of PFK-2 to fructose 2,6 bisphosphatase by protein kinase A:

A. Results in activation of PFK-1
B. Results in activation of fructose 1,6 bisphosphatase for gluconeogenesis
C. Increases the intracellular concentration of fructose 2,6 bisphosphate
D. Results in activation of pyruvate kinase
E. Is inhibited by cAMP

15. How many molecules of ATP/GTP are required to make a molecule of glucose from pyruvate?

A. 1
B. 2
C. 4
D. 6
E. 8

16. Which of the following glucose carriers is found in the liver but not in muscle?

A. SGLUT-1
B. GLUT 1
C. GLUT 2
D. GLUT 4

17. Which of the following glucose carriers is expressed **ONLY** when insulin is released in circulation?

A. SGLUT
B. GLUT 1
C. GLUT 2
D. GLUT 4

18. The reoxidation of glycolytic NADH may be accomplished by the following processes **EXCEPT**

A. Conversion of pyruvate to lactate
B. Conversion of dihydroxyacetone phosphate (DHAP) to glycerol-P
C. Conversion of oxaloacetate to malate
D. Transfer of NADH to the mitochondrial matrix followed by oxidation by Complex I

19. One of the following respiratory components is not a protein

A. NADH dehydrogenase
B. coenzyme Q
C. cytochrome c.
D. succinate dehydrogenase (Complex II)
E. cytochrome oxidase (aa_3)

20. Both pyruvate dehydrogenase and α–ketoglutarate dehydrogenase complexes are similar in all of the following **EXCEPT**?

A. Both require coenzyme A as cosubstrate
B. Both involve three enzymes in the reaction they catalyze (E1, E2 and E3)
C. Both require NAD^+ as cosubstrate
D. Both produce CO_2
E. Both are regulated by a kinase and a phosphatase

-3

21. How many molecules of NAD are reduced as one molecule of acetyl CoA is metabolized through one turn of the Krebs' (TCA) cycle?

A. 0
B. 1
C. 2
D. 3
E. 4

22. Which of the steps in the Krebs' cycle produces NADH but NOT CO_2?

A. isocitrate dehydrogenase
B. succinate dehydrogenase
C. citrate synthetase
D. fumarase
E. malate dehydrogenase

23. Which of the following is incorrect regarding cytochrome aa_3 (cytochrome oxidase) complex IV

A. Contains copper
B. Is a terminal electron carrier in the respiratory chain. — Oxygen is the terminal e^- acceptor
C. Is reduced directly by cytochrome b.
D. Contains heme
E. It transfers electrons to oxygen.

-3

24. Which of the following mitochondrial Complexes is inhibited by cyanide?

A. Complex I
B. Complex II
C. Complex III
D. Complex IV
E. Complex V

-4

25. Which of the following mitochondrial Complexes **DOES NOT** pump H^+ through the inner mitochondrial matrix?

A. Complex I
B. Complex II
C. Complex III
D. Complex IV

26. Oxidation of cytoplasmic NADH via the glycerol-phosphate produces _____ molecules of ATP while when it occurs through the malate-aspartate shuttle it produces _____ molecules of ATP

A. 1.5 and 1.5
B. 1.5 and 2.5
C. 2.5 and 1.5
D. 2.5 and 2.5

27. How many active sites are there in the ATP synthase complex (Complex V)

A. 1
B. 2
C. 3
D. 4
E. 5

TRUE/FALSE

28. GTP formation in the Krebs' cycle (TCA cycle) is an example of substrate-level phosphorylation T

29. Activation of protein kinase A inhibits glycolysis in skeletal muscle F
cpl → Need energy so... Stimulate

30. The pH in the mitochondrial matrix is more acidic than in the intermembrane space F

31. Uncoupled mitochondria **CANNOT** make ATP. T

32. Reentry of protons into the matrix causes parts of Fo and other subunits to turn T

ESSAY:

33. Answer the following questions:

a) Are all the active sites in ATP synthase (Complex V) in the same configuration at any given time? Explain in 2 or 3 sentences (2 points)

No, at any given time, the β subunits of Complex V are in a different configuration due to rotation of the Fo unit which causes rotation of the δ subunit of ATP synthase. As δ rotates each of the active sites faces a different face of δ subunit thus they are in different configurations. For example the β subunits could be in T, O, and L conformations at the same time, but they could not be in T, T, and L at the same time.

2

c) How is the energy of the proton gradient used to modify the configuration of each active site? Answer in 2 or 3 sentences. (2 points)

As protons move into the cytoplasmic proton channel, they cause rotation of parts of F_o, which are bound to the γ subunit causing it to rotate thereby changing the configuration of each active site. F_o rotates until the proton that entered the cytoplasmic proton channel leaves via the matrix proton channel.

2

HONOR PLEDGE (sign after the test in completed)

Part I

I have [redacted] source during this examination.

Signe[redacted]

Part II

I have [redacted] nyone during this examination.

Signe[redacted]

BMD 322
EXAM #3 Version 1

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1. Addition of a molecule of dietary glucose to glycogen **in the muscle** requires:

A. glycogen✓
B. UTP✓
C. ATP
D. Insulin to stimulate transport stimulates glycogen synthesis
E. all of the above

2. The products of the reaction catalyzed by glycogen synthase include:

A. glucose
B. UDP
C. $glycogen_{(n+1)}$
D. A and B
E. B and C

3. The synthesis of UDPG requires:

A. UDP and glucose
B. UDP and glucose-1-P
C. UTP and G-1-P
D. UTP and G-6-P
E. UTP and glucose

4. The cleavage of an α1→ 4 glycosidic bond by glycogen phosphorylase generates:

A. free glucose
B. glucose-6-phosphate
C. glucose-1-phosphate
D. maltose
E. an oligosaccharide

5. The cleavage of an α1→ 6 glycosidic bond during glycogen degradation generates:

A. free glucose
B. glucose-6-phosphate
C. glucose-1-phosphate
D. maltose
E. an oligosaccharide

6. The following occurs in **BOTH** liver and muscle (not just in one organ) upon binding of epinephrine to a β-adrenergic receptor:

A. Activates glycogen phosphorylase
B. Inhibits glycogen synthesis
C. Releases free glucose into circulation
D. A and B are correct
E. All are correct

7. Which of the following is more likely to occur in liver during **OVERNIGHT** fast?

A. phosphorylation of glycogen phosphorylase
B. phosphorylation of glycogen synthase
C. increased synthesis of fatty acids
D. A and B
E. all of the above

8. The activation of fatty acids to acyl CoA involves the conversion of:

A. 1 ATP to AMP
B. 2 ATP to 2 ADP
C. ~~1 ATP to AMP~~
D. 2 ATP to 2 AMP
E. 2 ATP to ADP and AMP

9. The first oxidation in the β-oxidation process produces a total of _____ ATP:

A. 1
B. 1.5
C. 2.5
D. 4
E. 5

10. There are four steps in the β-oxidation pathway. Some reaction types are listed below. Give the proper sequence of reactions, starting from a molecule of fatty acyl CoA.

1. oxidation of an alcohol to ketone
2. formation of a double bond
3. thiolysis
4. hydration

A. 2,3,1,4
B. 2,1,4,3
C. 3,1,2,4
D. 4,2,1,3
E. 2,4,1,3

FA synthesis

11. How many ATPs are required to convert cytoplasmic acetyl CoA into malonyl CoA?

A. 1
B. 2
C. 3
D. 4
E. 5

12. Ketone bodies are synthesized in

A. muscle for utilization in brain and liver.
B. brain for utilization in liver.
C. liver for utilization in muscle.
D. liver for utilization in liver.
E. brain for utilization in brain.

13. The plasma lipoprotein fraction usually associated with the transport of dietary fat from intestine to peripheral tissues and liver is

A. HDL
B. LDL
C. VLDL
D. chylomicrons
E. albumin

14. Which of the following is responsible for binding free (non-esterified) fatty acids released from the adipose tissue?

A. HDL
B. LDL
C. VLDL
D. chylomicrons
E. albumin

15. Which one of the following enzymes is involved in the degradation of triacylglycerol transported by VLDL, releasing fatty acids for storage in the adipose tissue?

A. pancreatic lipase
B. lipoprotein lipase
C. hormone-sensitive lipase
D. A and C are correct
E. All are correct

16. All of the following metabolic conversions occur in mitochondria **EXCEPT**:

A. palmitoyl CoA→acetyl-CoA
B. malonyl CoA →malonyl ACP cytoplasm FA synthesis
C. acetyl-CoA → acetoacetate (liver)
D. acetoacetate → acetyl-CoA (peripheral tissues)
E. acetyl CoA → CO_2

17. Synthesis of triacylgycerides and phospholipids have the following intermediates in common **EXCEPT:**

A. Fatty acyl CoA
B. Glycerol-phosphate
C. Phosphatidic acid
D. Mono-acyl-glycerol

18. An increase in intracellular _____ **ACTIVATES** the enzyme acetyl-CoA carboxylase:

A. cAMP
B. citrate
C. malate
D. malonyl CoA
E. NADPH

19. Which enzyme generates cytosolic acetyl-CoA for fatty acid biosynthesis in adipocytes?

A. citrate lyase
B. acetyl-CoA carboxylase
C. citrate synthase
D. pyruvate dehydrogenase
E. acyl CoA carnitine transferase II

20. All the following enzymes produce NADPH **EXCEPT**:

A. Malate dehydrogenase
B. Malic enzyme
C. Glucose-6-phosphate dehydrogenase
D. 6-phosphogluconate dehydrogenase

21. Free fatty acids released from adipocytes under fasting conditions are most likely to be used:

A. as a substrate for triacylglyceride synthesis
B. to produce energy in the brain
C. by erythrocytes
D. to produce energy in the muscle and liver
E. None of the above

22. In patients with normal hypercholesterolemia (not familial hypercholesterolemia), inhibitors of HMG-CoA reductase will cause all of the following **EXCEPT:**

A. lower cholesterol in circulation
B. increase the number of membrane receptors for LDL in peripheral tissues
C. increase chylomicron uptake by peripheral tissues
D. inhibit endogenous cholesterol synthesis in peripheral tissues

23. How many ATPs are needed to convert mevalonic acid into isopentenyl pyrophosphate for the synthesis of cholesterol?

A. 1
B. 2
C. 3
D. 4
E. 5

24. The synthesis of cholesterol involves all of the following processes **EXCEPT:**

A. Conversion of citrate to acetyl CoA
B. Conversion of acetyl CoA to malonyl CoA
C. Conversion of acetyl CoA to isopentenyl pyrophosphate
D. Conversion of isopentenyl pyrophosphate to squalene
E. Conversion of squalene to cholesterol

25. Derivatives of cholesterol include all of the following **EXCEPT**:

A. testosterone
B. bile salts
C. ketone bodies
D. Vitamin D
E. Estrogens

TRUE/FALSE

26. Protein phosphatase-1 cleaves glucose subunits from the non-reducing ends of glycogen F

27. Ketone bodies are oxidized to CO_2 in the mitochondria of peripheral tissues F T

28. Malonyl CoA inhibits acyl CoA-carnitine transferase I F T

29. The synthesis of palmitic acid (16 C) requires 8 molecules of malonyl CoA F

30. Peripheral tissues in patients with familial hypercholesterolemia lack LDL receptors T

31. Apolipoprotein B-100 recognizes the LDL receptor T

ESSAY

32. The net production of ATP during the complete oxidation of palmitic acid (C16) is 106. Explain. (**Hint**: one turn to the TCA cycle leads to 10 ATPs). 3

During complete oxidation of palmitic acid, 7 bonds are broken, therefore 7 $FADH_2$ and 7 NADH are produced, 1 per bond broken. Also, complete oxidation produces 8 molecules of acetyl CoA. For each $FADH_2$ 1.5 ATP are produced. For each NADH 2.5 ATP are produced, and for each acetyl CoA 10 ATP are produced from the TCA cycle and ETC. Therefore, $7 \times 1.5 = 10.5 + 7 \times 2.5 = 17.5 + 8 \times 10 = 80 = 108$, however, the equivalent of two ATP are used in activation of the fatty

33. Why are ketone bodies produced in the liver and not in other tissues

Ketone bodies are produced in the liver first of all, because the liver has all of the enzymes necessary to produce the ketone bodies. But, also, ketone bodies are produced in the liver because the liver is not able to use ketone bodies thus they can be delocated between other tissues that can use ketone bodies for energy

why? 1