

*Circle the letter corresponding to the best answer for each of the following:*

1. The reactions of the Calvin cycle occur in the:

- a) cytosol
- b) lumen
- c) matrix
- d) stroma
- e) endoplasmic reticulum

2. The metal to which water is bound in the oxygen evolving complex is:

- a) Mn
- b) Cu
- c) Fe
- d) Mg
- e) Mo

3. The tissue where ketone body synthesis occurs is:

- a) adipose
- b) brain
- c) heart
- d) muscle
- e) liver

4. Pheophytin differs from chlorophyll in that it has:

- a) an Fe in place of Mg
- b) no metal atom
- c) an extra five-membered ring
- d) no phytol side chain
- e) a saturated pyrrole ring

5. Which of the following metals is associated with plastocyanin?

- a) Fe
- b) Co
- c) Cu
- d) Mn
- e) Zn

6. Which of the following metals is associated with vitamin B<sub>12</sub>?

- a) Fe
- b) Co
- c) Cu
- d) Mn
- e) Zn

7. Which of the following is a product of cyclic electron flow in photosynthesis?

- a) O<sub>2</sub>
- b) ATP
- c) NADPH
- d) none of the above
- e) more than one of the above

8. Which of the following is not activated by glucagon?

- a) adenylate cyclase
- b) acetyl CoA carboxylase
- c) protein kinase
- d) G protein
- e) triacylglycerol lipase

9. In photosystem I, the direct acceptor of electrons from A<sub>0</sub> is?

- a) pheophytin
- b) phylloquinone
- c) plastocyanin
- d) plastoquinone
- e) Fe/S protein

10. Fatty acid synthesis occurs in A and fatty acid oxidation in B.

- |    | <u>A</u> | <u>B</u>       |
|----|----------|----------------|
| a) | cytosol  | cytosol        |
| b) | cytosol  | matrix         |
| c) | matrix   | matrix         |
| d) | matrix   | cytosol        |
| e) | cytosol  | inner membrane |

11. How many photons of light are required in the generation of one O<sub>2</sub> molecule?

- a) 2
- b) 4
- c) 8
- d) 10
- e) 12

12. In ketone body synthesis, what is the product of the following reaction sequence?



- a)  $^-\text{O}_2\text{C}-\text{CH}_2-\text{CH}_2-\text{CO}_2^-$
- b)  $^-\text{O}_2\text{C}-\text{CHOH}-\text{CH}_2-\text{CO}_2^-$
- c)  $\text{CH}_3-\text{CHOH}-\text{CH}_2-\text{CO}_2^-$
- d)  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$
- e)  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CO}_2^-$

13. Fatty acids are primarily transported from the intestines to adipose tissues in the form of:
- a) cholesterol esters
  - b) chylomicrons
  - c) complexes with serum albumin
  - d) ketone bodies
  - e) high density lipoproteins
14. The mobile electron shuttle from the cytochrome  $b_6$  / cytochrome f complex to PSI is?
- a) pheophytin
  - b) ferredoxin
  - c) plastoquinone
  - d) plastocyanin
  - e) phylloquinone
15. The species which donates an electron to  $P680^+$  is?
- a) Chl a
  - b) Pheo a
  - c) Plastocyanin
  - d) Intermediary Z
  - e) Phylloquinone
16. The antiporter which transports triosephosphates out of chloroplasts transports what into the chloroplasts?
- a)  $Mg^{2+}$
  - b)  $Na^+$
  - c)  $H^+$
  - d) Pi
  - e) ADP
17. The energy required to attach polar head groups in phospholipids synthesis comes from?
- a) ATP
  - b) GTP
  - c) CTP
  - d) UTP
  - e) TTP
18. The energy required to attach glucose to fructose in sucrose synthesis comes from?
- a) ATP
  - b) GTP
  - c) CTP
  - d) UTP
  - e) TTP
19. The energy required to attach glucose to starch comes from?
- a) ATP
  - b) GTP
  - c) CTP
  - d) UTP
  - e) TTP

20. Which of the following is the source of energy for the activation of the two carbon units for fatty acid synthesis?

- a) ATP
- b) GTP
- c) CTP
- d) UTP
- e) TTP

21. The molecule to which long-chain length fatty acids are attached for transport into the mitochondrion is?

- a) Coenzyme A
- b) Acyl Carrier Protein
- c) Glycerol
- d) Carnitine
- e) Creatine

22. Which of the following enzymes catalyzes the rate-determining-step in the dark reactions of photosynthesis?

- a) rubisco
- b) fructose-1,6-bisphosphatase
- c) sedoheptulose-1,8-bisphosphatase
- d) Ribulose-5-phosphate kinase
- e) Glyceraldehyde-3-phosphate dehydrogenase

23. Which of the following has the most negative standard reduction potential?

- a) NADPH
- b) P700\*
- c) P680\*
- d) H<sub>2</sub>O
- e) Plastocyanin

24. Acyl carrier protein has which of the following prosthetic groups:

- a) Biotin
- b) CoASH
- c) Lipoic Acid
- d) Pantothenate
- e) Thiaminepyrophosphate

25. In mammalian systems, the product of the reaction catalyzed by 2,4-dienoylCoA reductase is?

- a) cis- $\Delta^2$  enoylCoA
- b) trans- $\Delta^2$  enoylCoA
- c) cis- $\Delta^3$  enoylCoA
- d) trans- $\Delta^3$  enoylCoA
- e) cis- $\Delta^4$  enoylCoA

26. Reducing equivalents for fatty acid biosynthesis are generated by enzymes in the hexosemonophosphate shunt and by?

- a) malate dehydrogenase
- b) pyruvate dehydrogenase
- c) malic enzyme
- d) enoyl-ACP reductase
- e) thioredoxin

27. The formation of acetoacetyl-ACP is catalyzed by?

- a) Acetyl transacylase
- b) Acetyl-CoA carboxylase
- c) Thiolase
- d) 3-hydroxyacyl-ACP dehydratase
- e) 3-ketoacyl-ACP synthase

28. The stereochemistry of the 3-hydroxy intermediate in fatty acid biosynthesis is?

- a) cis
- b) trans
- c) D
- d) L
- e) meso

***Complete the following questions as directed:***

29. Draw the structure of each of the following:

a) Carnitine

b) Phylloquinone

c) HydroxymethylglutarylCoA (use \_SCoA)

d) Xylulose-5-phosphate

e) The products of the reaction catalyzed by citrate lyase

30. Describe in detail, the light-driven control of the activity of the enzyme rubisco.

31. Describe, in detail, the reciprocal allosteric control of fatty acid synthesis and fatty acid oxidation.

32. Match each of the following enzymes with the appropriate cofactor:

\_\_\_\_\_ a) Propionyl CoA carboxylase

A. Biotin

\_\_\_\_\_ b) Malic enzyme

B. CoASH

\_\_\_\_\_ c) Thiolase

C. Cobalamin

\_\_\_\_\_ d) Acyl CoA dehydrogenase

D. FAD

\_\_\_\_\_ e) Transketolase

E. NAD<sup>+</sup>

\_\_\_\_\_ f) Hydroxyacyl CoA dehydrogenase

F. NADP<sup>+</sup>

\_\_\_\_\_ g) Methylmalonyl CoA mutase

G. NADPH

\_\_\_\_\_ h) Ketoacyl ACP reductase

H. Thiamine Pyrophosphate

33. Using the curved-arrow formalism to show electron movement, provide a detailed mechanism for the reaction catalyzed by the enzyme rubisco.