THIS IS FORM A. Please put Form A on your scantron before you begin this exam!

1. Please select the ***True*** statement regarding the TCA cycle.
   a. The reaction catalyzed by citrate synthase requires NAD^+ and produces NADH.
   b. Malate dehydrogenase catalyzes an oxidative decarboxylation and produces NADH and CO_2.
   c. Two products of Succinyl CoA synthetase are GTP (or ATP) and Coenzyme A
   d. Succinate dehydrogenase is a reversible enzyme that produces alpha ketoglutarate and $FADH_2$.

2. Please select the ***true*** statement regarding regulation of the TCA cycle:
   a. Alpha-ketoglutarate dehydrogenase activity is increased by high [succinyl CoA].
   b. Isocitrate dehydrogenase activity is increased by high [ATP]
   c. Malate dehydrogenase is down-regulated by a high ratio of NADH to NAD^+
   d. The reaction catalyzed by malate dehydrogenase cannot be used to produce glucose.

3. What is the correct downstream effect of glucagon?
   a. Increase of intracellular [cAMP].
   b. Phosphorylation of glycogen phosphorylase kinase, which increases the activity of this enzyme.
   c. Phosphorylation of glycogen phosphorylase, which increases the activity of this enzyme.
   d. Phosphorylation of glycogen synthase, which increases the activity of this enzyme.
   e. All the above are true.
   f. Only a, b, and c are true.
   g. Only a, b, and d are true.
   h. Only b and c are true.

4. Please use the options in ***Text Box 1*** to describe **VLDL particles**.
   a. I, III, and VI
   b. I, IV, and VI
   c. I, IV, and VII
   d. I, V, and VI
   e. I, V, and VII
   f. II, IV, and VI
   g. II, IV, and VII
   h. II, V, and VII
   i. III, and VI

Text Box 1
I. Produced in the liver
II. Produced in the small intestine
III. Carries mostly insulin
IV. Carries mostly triacylglycerol (triacylglyceride)
V. Carries mostly cholesterol and cholesterol esters
VI. Contains Apo B48

5. Please use the options in ***Text Box 1*** to describe **LDL particles.**
   a. I, III, and VI
   b. I, IV, and VI
   c. I, IV, and VII
   d. I, V, and VI
   e. I, V, and VII
   f. II, IV, and VI
   g. II, IV, and VII
   h. II, V, and VII
   i. III, and VI

6. Which of the following is ***False*** regarding familial hypercholesteremia (FH):
   a. FH/FH (homozygous individuals) have higher serum cholesterol levels, even in childhood, than +/+ normal individuals.
   b. In FH/FH (homozygous individuals), LDL receptor concentration at the cell membrane or LDL receptor function may be lower than normal.
   c. In FH/FH (homozygous individuals), the high serum cholesterol causes increase of LDL receptor synthesis to bring more cholesterol out of the blood and reduce serum cholesterol.

d. FH/+ (heterozygous individuals) have higher serum cholesterol levels at middle age than +/+ normal individuals.

7. The enzyme, HMG Co A reductase, catalyzes the first committed step of cholesterol synthesis. ***True False***

8. The production of cholesterol and the production of ketone bodies both require acetyl CoA. ***True False***

9. In cells that primarily require a **great deal of NADPH, but not nucleotides**, which of the pathways in ***Text Box II*** will be used in these cells, and in what direction? Select the correct, and most complete answer.
    a. i only, in the forward direction.
    b. i and ii, in the forward direction
    c. ii only, in the reverse direction
    d. i and ii, in the reverse direction
    e. i, ii, and iv, in the forward direction
    f. i, ii, iii and v, in the forward direction

Text Box II
i) Oxidative reactions of the pentose phosphate pathway.
ii) Non-oxidative reactions of the pentose phosphate pathway
iii) Glycolysis
iv) Gluconeogenesis
v) The TCA cycle and oxidative phosphorylation

10. Cells engaged in lipid require both **NADPH and ATP equally**; which of the pathways in ***Text Box II*** will be used in these cells, and in what direction? Select the correct, and most complete answer.
    a. i only, in the forward direction.
    b. i and ii, in the forward direction
    c. ii only, in the reverse direction
    d. i and ii, in the reverse direction
    e. i, ii, and iv, in the forward direction
    f. i, ii, iii and v, in the forward direction

11. Please select the ***True*** statement:
    a. In liver cells with high [glucose], *glycogen phosphorylase a* will be inhibited.
    b. Insulin activation of the insulin receptor results in the phosphorylation of glycogen synthase
    c. Alpha-1,6 glycosidic bonds are broken by glycogen phosphorylase.
    d. All the above are true.
    e. There are no true statements here.

12. In liver, the activation of alpha- and beta-adrenergic receptors by epinephrine has the downstream effect of activating glycogen phosphorylase. ***True False***

13. Please identify the ***true*** statement:
    a. The electron transport chain includes Cytochrome C, which is a mitochondrial integral membrane protein.
    b. Fumarase catalyzes a stereospecific addition of water across the double bond of malate to make fumarate.
    c. Ubiquinol is an uncoupler of oxidative phosphorylation.
    d. None of the above is true.

14. Please select the ***True*** statement:
    a. In the malate aspartate shuttle, glutamate receives an amino group from aspartate to yield alpha-ketoglutarate.
    b. In the glycerol 3-phosphate shuttle, electrons passed from NADH finally enter the electron transport chain through reduction of ubiquinone.
    c. In the malate aspartate shuttle, oxaloacetate is transported directly into the mitochondrial matrix.
    d. None of the above is true.