

20. How many molecules of ATP can be made utilizing one molecule of  $\alpha$ -D-fructose-6-phosphate placed in the cytoplasm of a muscle cell, utilizing the actions of aerobic glycolysis, the PDH complex, the Krebs cycle, electron transport and oxidative phosphorylation? (Assume classical P/O ratios)

- a) 12
- b) 15
- c) 20
- d) 24
- e) 37

21. You wish to see whether any ion gradient across the inner mitochondrial membrane will drive ATP synthesis, so you suspend mitochondria in a solution of 100 mM KCl. However, no ATP production results. Which ONE of the following is likely the BEST explanation for these negative findings?

- a) You really haven't created a positive charge gradient across the inner mitochondrial membrane (IMM) because you have added equimolar quantities of  $K^+$  and  $Cl^-$  outside the IMM.
- b) Likely  $K^+$  ions are too small to flow within the  $F_0F_1$  ATPase that generates ATP on the matrix side.
- c) Likely KCl will break open the IMM, so you wouldn't see an ion gradient anyway.
- d) Likely  $K^+$  will flow into the matrix along with  $H^+$  and thus eliminate the gradient.
- e) Likely the high concentration of  $K^+$  will remove integral proteins from the IMM and allow the gradient to be lost.

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22. Assuming the presence of glycolytic and Krebs cycle enzymes, which option below lists enzymes that are all critical to the liver's ability to make glucose from lactate?

- i) fructose 2,6-bisphosphatase
- ii) alcohol dehydrogenase
- iii) pyruvate carboxylase
- iv) pyruvate dehydrogenase
- v) PEP carboxykinase
- vi) fructose 1,6-bisphosphatase
- vii) cytosolic malate dehydrogenase
- viii) hexokinase
- ix) PFK-1
- x) glucose-6-phosphatase
- xi) PFK-2
- xii) lactate dehydrogenase

- a) iii, v, vi, vii, x
- b) i, v, vii, ix, x, xii
- c) iv, vi, viii, xii
- d) i, v, vii, x, xi, xii
- e) ii, v, vi, viii, xii

23. Which ONE of the following compounds acts as a reciprocal regulator for PFK-1 and fructose 1,6-bisphosphatase in the opposing paths of glycolysis and gluconeogenesis?

- a) fructose-2,6-bisphosphate
- b) citrate
- c) fatty acyl CoA
- d) succinate
- e)  $\text{NAD}^+$

24. Which ONE of the following concerning fatty acids in mammals is INCORRECT?

- a) Fatty acids have 0-6 cis double bonds, and the presence of cis double bonds has a great influence on the physical properties of these unsaturated fatty acids.
- b) Corn oil is rich in triacylglycerols carrying linoleic acid, a precursor of 20:4.
- c) Trans fatty acids (found in French fries, donuts, KFC, fast foods), made during partial hydrogenation of plant oils, are associated with cardiovascular disease.
- d) The fatty acid 18:3 (linolenic acid) is an omega 3 fatty acid made in the body.
- e) Soaps are fatty acid salts and will form micelles when suspended in water.

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25. Which ONE of the following concerning dietary oils is INCORRECT?

- a) Healthy oils include olive oil (an important component of the Mediterranean diet) and canola oil, both of which are rich in oleic acid.
- b) Arachidonic acid is the precursor of eicosanoids, many of which are produced in chronic and acute inflammatory reactions.
- c) Omega 3 fatty acids in fatty fish (salmon, herring, sardine, anchovy) include EPA, a fatty acid with 5 cis double bonds.
- d) EPA can be used as a substrate for COX which produces the polyunsaturated fatty acid 20:4.
- f) ASA will inhibit COX and is given to patients with cardiovascular disease to lower the likelihood of thrombus and embolus formation.

26. Which ONE of the following concerning atherosclerosis is INCORRECT?

- a) Atherosclerotic plaque in artery walls is enriched in cholesterol and often deforms the artery, reducing the artery lumen and producing an area of turbulent flow within the blood vessel.
- b) There is usually a large lipid pool within the atherosclerotic plaque.
- c) LDL can enter the artery wall, especially if the LDL is oxidized during its prolonged lifetime within the circulation.
- d) LDL is a lipoprotein enriched in cholesterol, LDL is generated from VLDL and if LDL is elevated in the blood, the risk for cardiovascular disease is increased.
- e) To reduce levels of cholesterol in blood, drugs called statins are administered which block the uptake of dietary cholesterol by the intestine.

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30. If a mixture of active proteolytic enzymes (proteases like trypsin and chymotrypsin) are microinjected into an intact red cell, which ONE of the following is CORRECT?

- a) Glycophorin and other glycoproteins in the red cell will lose most of their carbohydrate.
- b) Glycophorin will lose its C-terminal sequence
- c) Glycophorin will lose its N-terminal sequence
- d) As a result of the incubation, glycophorin will lose most of its amino acids.
- e) Glycolipids like gangliosides will be lost from the membrane.

31. Which ONE of the following is not a feature of the Singer-Nicolson Fluid Mosaic Model?

- a) Integral proteins have one or more transmembrane regions and integral proteins can migrate laterally within the plane of the membrane.
- b) Phospholipids are oriented in a bilayer with their polar head groups facing towards the aqueous regions on either side of the membrane.
- c) Phospholipids can reorient spontaneously within the membrane by transverse migration across the bilayer.
- d) Transmembrane regions of integral proteins interact closely with the hydrophobic core of the membrane and are enriched in non-polar and hydrophobic amino acids.
- e) If integral proteins in red blood cells are tightly associated with a network of peripheral proteins (e.g. the cytoskeleton under the red cell membrane) then the ability of these integral proteins to move laterally within the plane of a membrane will likely be limited.

32. How many molecules of ATP are generated from one molecule of the fatty acyl CoA 20:0 CoA that is formed at the outer mitochondrial membrane in a liver cell during a period of fasting? Consider the complete breakdown of this molecule via  $\beta$ -oxidation and the Krebs cycle and the actions of electron transport and oxidative phosphorylation. [Assume classical P/O ratios]

- a) 80   b) 96   c) 130   d) 165   e) 170

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33. The Atkins Diet has enjoyed considerable popularity as it does indeed seem to work and results in weight loss.

Which ONE of the following is INCORRECT?

- a) The Atkins Diet will interfere with signaling pathways in fat cells, triggered by the binding of epinephrine at the plasma membrane.
- b) The Atkins Diet limits the amount of carbohydrate you eat, because rising levels of blood glucose trigger the release of insulin.
- c) With low levels of circulating insulin, even fat rich diets may not prompt an increase in weight.
- d) Unfortunately the Atkins diet is seen by its adherents as a green light to consume any protein and fat rich foods that they desire, often at the expense of cardiovascular health.
- e) Even though those on the Atkins Diet may lose weight, it is quite possible they may show elevated levels of LDL cholesterol.

34. Which ONE of the following is INCORRECT?

- a) Ketone bodies are principally made in the mitochondria of fat cells (adipocytes) following fat mobilization.
- b) Acetoacetate and  $\beta$ -hydroxybutyrate are ketone bodies and are considerably smaller in molecular size than most dietary fatty acids.
- c) Massive fat mobilization takes place in the absence of insulin (Type I diabetes).
- d) Ketone body levels can be very high in the blood of a Type 1 diabetic, who is not receiving insulin, and ketone bodies can be used as fuels in a variety of tissues.
- e) In the absence of insulin (Type I diabetes) the carnitine shuttle will be functioning rapidly.

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35. For a patient in a diabetic coma because of the absence of insulin (Type I diabetes), which ONE of the following is INCORRECT?

a) The patient is hyperglycemic, with elevated levels of glucose in the blood that support most of his energy needs.

b) The patient is dehydrated because of tissue water loss.

c) Tissues will lose both water and potassium and diabetics can lose considerable amounts of water in profuse urination (polyuria).

d) The patient is in a coma because of severe acidosis and low blood pressure (hypotension), as the cerebral circulation requires significant pressure to supply the brain with oxygen and fuels.

e) The best way to treat the unconscious diabetic is by giving intravenous insulin supported by adequate levels of circulating blood glucose.