

## Appendix. Example of a set of Assessment problems from the Formative Version

1. (D-level) The process of conversion of glucose to pyruvate in the cytosol is called \_\_\_\_\_.
2. (C-level) Draw a diagram that illustrates and labels the various parts of mitochondria and chloroplasts. Indicate in these diagrams all the places where the following processes occur: Krebs Cycle, Calvin Cycle, electron transport, absorption of light, conversion of oxygen to water, conversion of water to oxygen.
3. (B-level) When proteins are metabolized for energy, the individual amino acids are converted to molecules that are intermediates either in the Krebs Cycle or in the process of conversion of glucose to pyruvate. When fatty acids are metabolized, they are converted directly to molecules of acetyl CoA. Human liver cells can convert proteins to glucose in a process called gluconeogenesis. However, liver cells are not able to synthesize glucose from fatty acid. What do we learn from these observations about the enzymes present in the mitochondria and cytosol of liver cells?
4. (A-level) JC-1 is a fluorescent molecule that measures the electrical potential of the inner mitochondrial membrane. When there is no membrane potential, the probe exists as a monomer. At a large membrane potential, the probe exists as an aggregate. The ratio of aggregate to monomer ("A/M"), then, is proportional to the magnitude of the membrane potential. In panel A of the figure below, isolated mitochondria were incubated in a buffered solution (pH 7.0) in the presence of ATP, ADP, inorganic phosphate, and other ions at concentrations similar to normal cytosol. At the arrow, pyruvate was added to the sample. In a second series of experiments, mitochondria were incubated in a buffered solution (pH 7) containing normal concentrations of ATP, ADP, inorganic phosphate and pyruvate (panels B-D in the figure). Solutions also contained either 100 mM NaCl (solid curves) or 100 mM choline Cl (dashed curves) as the major ions. At the arrow in each panel, a sodium ionophore (artificial ion channel), monensin, was added to each mixture. Choline Cl is an organic salt that behaves like NaCl in terms of charge and osmolarity. However, choline is not transported by monensin. In panel B, the mitochondrial inner membrane potential was measured. In panel C, the pH of the matrix was measured. The concentration of ATP in the mitochondria was monitored in panel D. State in one sentence each the conclusions justified by these data.

