**GLYCOLYSIS**

*Definition:* the first step in cellular respiration, glycolysis is a process for harnessing energy in which one glucose molecule is broken into two pyruvate molecules in the cytoplasm of a cell.

* Glycolysis occurs by a sequence of reactions that takes place in the cytoplasm of the cell.

* All the reactions in glycolysis are catalyzed by a specific enzyme.

* Each glucose molecule has a backbone of 6 carbon atoms, to which H and OH are attached.

1. The first step of glycolysis is “energy-requiring” (does not proceed without energy input / activation energy).

This energy is made available when 2 ATP molecules are hydrolyzed (used).

1. The first ATP attaches a phosphate group to one end of the glucose molecule. This creates a molecule of glucose-6-phosphate.

1. This molecule (glucose-6-phosphate) then gets rearranged into fructose-6-phosphate.

1. The second ATP attaches a phosphate group to the other end of the fructose-6-phosphate molecule. This forms fructose-1,6-diphosphate.

(In effect, each ATP transfers a phosphate group to the 6-carbon backbone.)

1. The backbone then splits apart to form PGAL and dihydroxyacetonephosphate. DPGA is converted into PGAL.

**The formation of these 2 molecules of PGAL marks the start of the energyreleasing steps of glycolysis.**

1. A phosphate is added to each PGAL obtained from atp. NAD+ is *reduced* to form NADH (nicotinamide adenine dinucleotide). This process results an unstable molecule called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(NAD+ is a “reusable” coenzyme that functions at the active site of an enzyme. It accepts protons and electrons and transfers them and again becomes NAD+)

1. 1,3-bisphosphoglycerate readily gives up a phosphate group to \_\_\_\_, forming \_\_\_\_\_. This results in a molecule of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**As a result, 2 \_\_\_\_\_ molecules are formed (one for each G3P). This is called “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” *phosphorylation*, which happens one more time during glycolysis. (With this formation of 2 ATP, the original energy investment is paid off).**

1. The molecule of 3-phosphoglycerate rearranges to its structurally different isomer of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. 2-phosphoglycerate gives up 1 proton (H+) and 1 hydroxide ion (OH-), which combine to form water. The resulting molecule is

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. ( \_\_\_\_ )

1. This molecule, \_\_\_\_\_, is very unstable and breaks down, releasing enough energy to transfer 1 phosphate group to \_\_\_\_\_, forming another molecule of \_\_\_\_\_.

**This produces a net total of 2 molecules of \_\_\_\_\_. (1 for each PEP)**

At this point, the original glucose molecule has been broken down to 2 \_\_\_\_\_\_\_\_\_\_\_ molecules, each with a \_\_\_-carbon backbone.

**In Summary:**

Glycolysis produces \_\_\_ NADH, \_\_\_ ATP (net) and \_\_\_ pyruvate molecules for each molecule of glucose entering the reactions.