A. PHASE 1.

Glycolysis: (in cellular respiration, series of anaerobic chemical reactions in the cytoplasm that break down glucose to pyruvic acid; forms a net profit of two ATP molecules)

Glycolysis is an anaerobic (chemical reactions that do not require the presence of oxygen) process.

Glycolysis takes place in the cytoplasm of the cell.

Under ideal conditions, glycolysis will produce 2 ATP molecules.

1. Two molecules of ATP are used to start glycolysis.
2. Only four ATP molecules are produced. This makes glycolysis not very efficient with only a net profit of two ATP molecules for each glucose molecule broken down.
3. Glycolysis uses an electron carrier called NAD+ (nicotinamide adenine dinucleotide) that forms NADH when it is carrying an electron.
4. Glucose is broken down.
5. Pyruvic acid is formed.

6. Following glycolysis, the pyruvic acid molecules move to the mitochondria, the organelles that produce ATP for the cell. Before the next two phases can begin, pyruvic acid undergoes a series of reactions in which it loses a molecule of CO₂ and combines with coenzyme A to form acetyl CoA. The reaction with coenzyme A produces a molecule of NADH and H⁺.

B. PHASE 2.

Citric Acid Cycle or Krebs Cycle (in cellular respiration, series of chemical reactions that break down glucose and produce ATP; energizes electron carriers that pass the energized electrons on the electron transport chain)

Citric acid cycle is an aerobic (chemical reactions that require the presence of oxygen) process.

Citric acid takes place in the mitochondrion of the cell.

Under ideal conditions, the citric acid cycle will produce 2 ATP molecules.

1. The two carbon compound acetyl CoA reacts with a four-carbon compound called oxaloacetic acid to form citric acid, a six-carbon molecule.
2. A molecule of CO₂ is formed, reducing the citric acid to a five-carbon compound. Another molecule of CO₂ is released, forming a five-carbon compound, oxaloacetic acid. One molecule of ATP and a molecule of NADH are also produced.
3. Through the chemical reactions (steps 7 & 8),
   a. NADH & FADH₂ (nicotinamide adenine dinucleotide & flavin adenine dinucleotide, both are carrying electrons), as well as ATP is produced.
C. PHASE 3.

**Electron Transport Chain** (a series of proteins embedded in a membrane along which energized electrons are transported; as electrons are passed from molecule to molecule, energy is released)

The electron transport chain is an **aerobic** (chemical reactions that require the presence of oxygen) process.

The electron transport chain takes place in the inner membrane of the mitochondrion of the cell.

Under ideal conditions, the electron transport chain will produce 32-34 ATP molecules.

10. NADH and FADH$_2$ pass energized electrons from protein to protein within the membrane, slowly releasing small amounts of energy contained within the electron. Some of the energy is used directly to form ATP; some is used to pump H$^+$ ions into the center of the mitochondrion.

11. The final electron acceptor in the chain is oxygen. This is why oxygen is so important to our bodies. Without oxygen, the proteins in the electron transport chain cannot pass along the electrons. If a protein can’t pass an electron along, it cannot accept another electron either.

12. Oxygen reacts with hydrogen ions, H$^+$, to form water.