1. *In terms of ATP generation, differentiate oxidative phosphorylation and substrate-level phosphorylation.*

In oxidative phosphorylation, ATP is generated in the cell using electrons derived from the electron transport chain, this makes ATP generation via oxidative phosphorylation to be dependent on the ETC. On the other hand, substrate-level phosphorylation provides a quicker, less efficient source of ATP, independent of external electron acceptors.

1. *Which chemical processes in cellular respiration generates of ATP and NADH? How about NADH only? How about ATP only?*

Among the four major processes of cellular respiration, the first process which is glycolysis, produces both ATP and NADH for the whole other process to use, on the PRP or preparatory reaction phase, NADH is formed from a reduced NAD+. The citric acid cycle also known as the krebs cycle produces only ATP along with acetyl CoA and other molecules. Lastly, both ATP and NADP are formed along the electron transport chain.

1. *What molecular product/s will indicate that glucose have already been completely oxidized in cellular respiration?*

After glycolysis, krebs cycle and oxidation, the final product of a fully oxidized glucose are carbon dioxide and water.

1. *Explain (you may use an analogy) the process by which ATP synthase generates ATP.*

ATP synthase is an enzyme that directly generates adenosine triphosphate (ATP) during the process of cellular respiration. ATP is the main energy molecule used in cells. ATP synthase forms ATP from adenosine diphosphate (ADP) and an inorganic phosphate (Pi) through oxidative phosphorylation, a process where enzymes oxidize nutrients to form ATP.

1. *Differentiate, cell respiration and fermentation? Which process yields more ATP? Can humans survive with fermentation alone?*

Cellular respiration uses oxygen as the electron acceptor in the formation of ATP, while fermentation uses inorganic donors, such as sulfur and methane in the formation of ATP. Both cellular respiration and fermentation convert nutrients from sugar, amino acids, and fatty acids to form ATP, but they differ in their processes and levels of energy that they release. Cellular respiration produces 38 ATP, while fermentation produces only 2 ATP.

Fermentation is an anaerobic respiration, meaning "no oxygen", and only microbes, such as yeasts and bacteria, can live for long periods without oxygen. In the absence of oxygen, muscle cells can resort to anaerobic respiration (lactic acid fermentation). This process only releases 2 ATPs as opposed to aerobic cellular respiration which releases 38 ATPs. Fermentation is a much less efficient way of obtaining energy from our resources. It stops part-way, so to speak, generating toxic acids or alcohol instead of going all the way to water and carbon dioxide.It’s highly inefficient and doesn’t generate ATP at a rate even nearly adequate to support life of the mammalian body.

1. *Reactant or product? What are the roles of CO2 and H2O in cellular respiration and photosynthesis?*

The roles of these molecules differ depending on the process it has been used for, in cellular respiration CO2 is released as a waste product, while in photosynthesis it is used as a reactant. Water is used to produce and store energy by means of photosynthesis, water is a reactant-only since it is used in cellular respiration as a consumable source of energy.

1. *Compare and contrast (similarity and difference) the flow of electrons in mitochondria and chloroplasts. Use these main points: primary electron donors and terminal/final electron acceptors, and difference in terms of initial and final energy states (low or high free energy).*
2. *To synthesize one glucose molecule, the Calvin cycle uses 6 # molecules of CO2, 18 # molecules of ATP, and 12 # molecules of NADPH.*