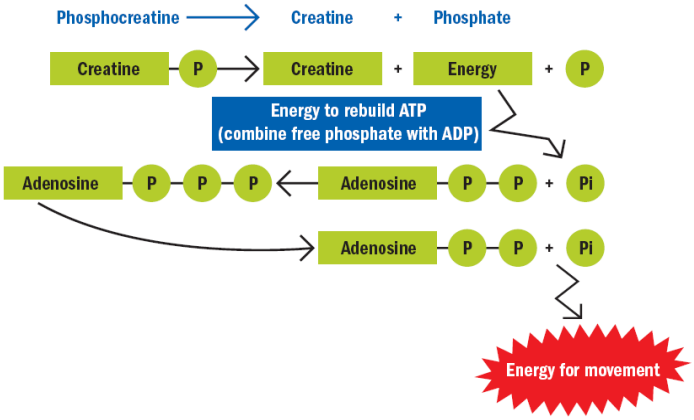
Name: Date:

Topic 3.3 – Nutrition & Energy Systems IB SEHS

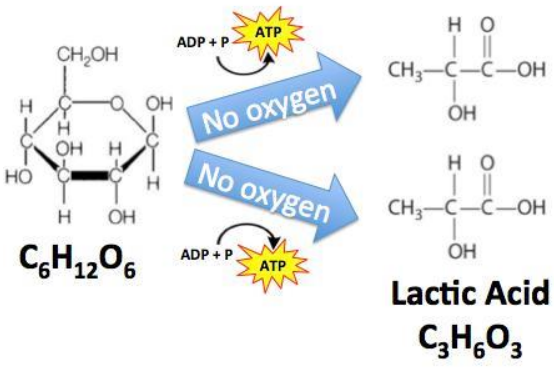
3.3.6 Describe the re-synthesis of ATP by the ATP–CP system.



- Creatine _____ – aka phosphocreatine - (a high energy molecule) is broken down to provide energy for the re-synthesis of ATP that has been _____ during the initial stages of exercise.
- The ATP-PCr energy system can _____ with or without oxygen but because it doesnt rely on the presence of oxygen it said to be _____.
- During the first 5 _____ of exercise **regardless of intensity**, the ATP-PCr is relied on almost exclusively.
- ATP _____ last only a few seconds with PCr buffering the drop in ATP for another 5-8 seconds or so. Combined, the ATP-PCr system can sustain all-out exercise for 3-15 seconds and it is during this time that the _____ rate for power output is at its greatest.

3.3.7 Describe the production of ATP by the lactic acid system

- **Glycolysis** is a _____ pathway present in the cytoplasm that allows all cells to utilize _____. It releases some of the energy in glucose as ATP and creates pyruvate.
  - ATP → Adenosine _____; a molecule that is created from a biochemical energy (found in organic molecules) by catabolic reactions
  - _____ → an organic molecule that helps the body build glucose

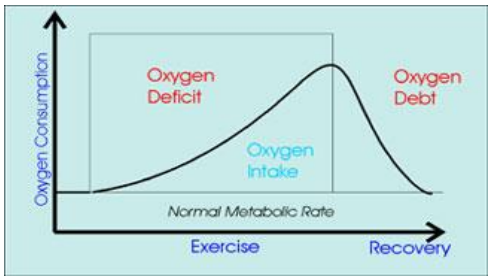


- The way the process occurs is _____ upon the amount of oxygen available. For instance, when the capacity for aerobic metabolism is limited, the _____ is converted to lactate (lactic acid).
- Glycolysis occurs quickly despite producing the small amount of ATP. This energy system **is _____ for exercise that requires _____ levels of energy**. (This process "burns" an incredible amount of glucose really, really quickly)
- However, the downside of this energy system is that it **can only be _____ for a small duration of time**. The lactic acid builds up within muscle, reducing the muscle pH since it is a strong acid. This in turn causes discomfort and also makes it harder for the muscle to _____.
- During more moderate levels of exercise, other energy systems are able to supply the body with sufficient amounts of ATP. This implies that anaerobic glycolysis is not needed during lower intensity workouts.

3.3.8 Explain the phenomena of oxygen deficit and oxygen debt.

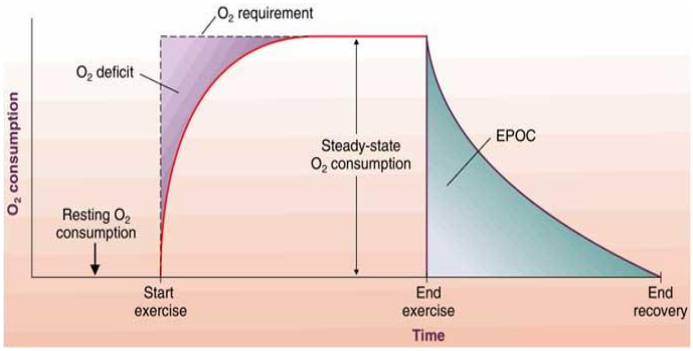
- These terms refer to a lack of oxygen while training/racing and after such activity is over.

- **Oxygen Deficit.** While exercising _____ the body is sometimes unable to fulfill all of its energy needs.



  - In order to make up the _____ without sacrificing the output, the body must tap into its anaerobic metabolism. These terms refer to a lack of oxygen while training/racing and after such activity is over.
  - This where the body goes into a mix of _____ and anaerobic energy production.
  - While not hugely detrimental, oxygen deficits can grow to a level that the anaerobic energy system cannot cover. This can cause _____ to deteriorate.

- **Oxygen Debt.** This term describes how the body _____ back its debt incurred above after the exercise is over.



  - You will notice that even after you have _____ racing you will continue to breath hard. At this point your body is still trying to repay the oxygen debt that was created when you were working hard.
  - Technically, it is _____ post-exercise oxygen consumption (EPOC).

3.3.9 Describe the production of ATP from glucose and fatty acids by the aerobic system.

- ATP is produced by the _____ cycle and the electron transport chain
  - All depends on _____ conditions in cells
- **Glucose**:
  - Less demanding _____ conditions pyruvate is converted to acetyl CoA
  - This enters the Krebs cycle in the _____ where chemical reactions that involve oxygen turn it into water and carbon dioxide
  - During glycolysis & Krebs cycle, _____ ions are released
  - Specific _____ bind the hydrogen ions and carry them to the electron transport chain where energy is produced
    - This energy forms ATP

- Lipids / fatty acids

- Free fatty acid _____ enter mitochondria and a process called β-_____ sequentially removes two-carbon units from fatty acid chains
- Enzymes of the β-oxidation are in the _____ of the mitochondria

→this process produces acetyl CoA (shares same fate in oxidative metabolism as the produced from glucose)

- Fat cannot (in any way) be used _____

After all this has happened…..another G word….

- **Gluconeogenesis** is a metabolic _____ that results in the generation of glucose from certain non-carbohydrate carbon substrates
  - _____ is one of several main mechanisms used by humans and many other animals to maintain blood glucose levels

3.3.10 Discuss the Characteristics of the Three Energy Systems

- Creatine _____ System:
  - The phosphocreatine system is the most powerful when it comes to _____ your body with energy.
  - This system provides the _____ form of energy that is burned very quickly; energy from this system is needed typically during high intensity _____ for short bursts of time.
  - Examples of this systems energy aid in exercise include:

    -High weight/low rep weightlifting

    -Sprinting

    -Boxing

- Lactic Acid System:
  - Glycolysis in _____→ Glucose split into pyruvate
  - Releases some energy as ATP
  - When the cells run out of _____, the pyruvate is converted into lactic acid.
  - This makes this system optimal for short intense exercise → as more lactic acid is produced, the pH in the cells is reduced, _____ their ability to contract

- Aerobic System:
  - Includes the Krebs cycle and _____ transport chain (ETC)
  - Pyruvate from glycolysis → Acetyl CoA, which enters Krebs cycle in mitochondria
  - Through _____ involving oxygen, acetyl CoA→ water, carbon dioxide, and hydrogen ions
  - These ions are taken to the ETC→ energy is _____, and ATP is formed

3.3.11 Evaluate the relative contributions of the three energy systems during different types of exercise.

	Creatine Phosphate System	Lactate Acid System	Aerobic System
Fuel Used	• Creatine Phosphate • Stored ATP	• Blood Glucose • Muscle & Liver Glycogen	• Blood Glucose • Muscle & Liver Glycogen • Adipose & intramuscular fat
Energy (ATP) Produced	• Very Low	• Low	• Very High
ATP production speed	• Very High	• High	• Low
Duration of Activity Used	• 5-15 seconds	• 30 seconds to 2 minutes	• Any exercise longer