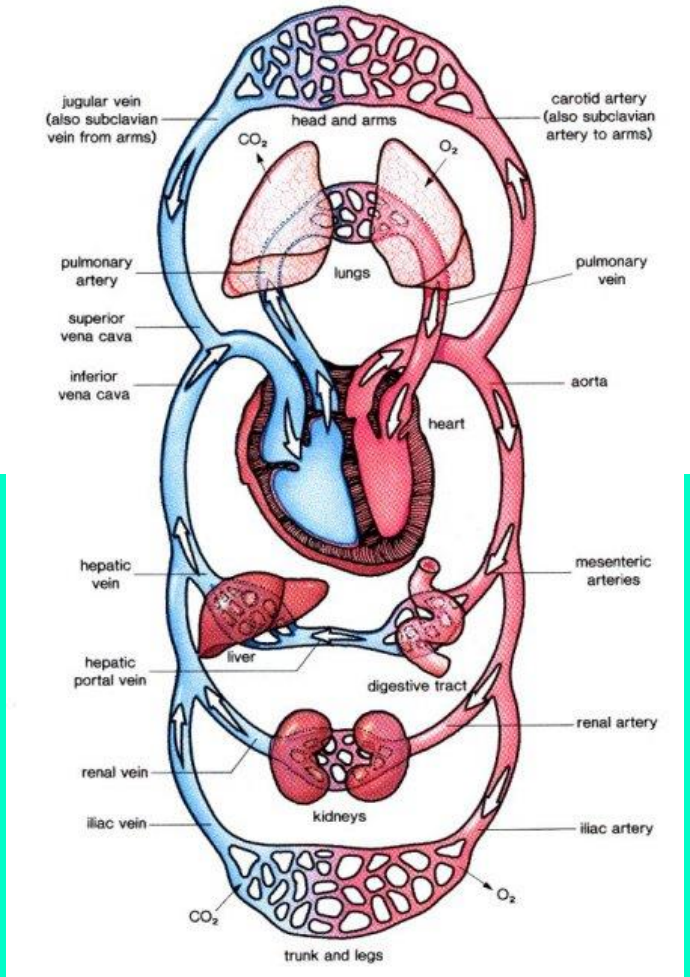
Cardiovascular and Respiratory Systems Working Together



Oxygen Consumption

- Oxygen consumption (VO2): the amount of oxygen taken up and consumed by the body
  - Equal to the amount of oxygen inspired minus the amount of oxygen expired
- VO2 is proportional to workload – the greater the VO2, the greater the amount of O2 used by the body
- a-vO2diff: the average amount of O2 found in the arteries minus the average amount of O2 in the vena cava

VO2max

- VO2max: the maximal amount of oxygen that can be taken in and used for the metabolic production of ATP during intense MAXIMAL exercise
  - This would occur at max. SV, HR and a-vO2dif

VO2 MAX (ABSOLUTE VS RELATIVE)

There are 2 ways VO2 max is measured

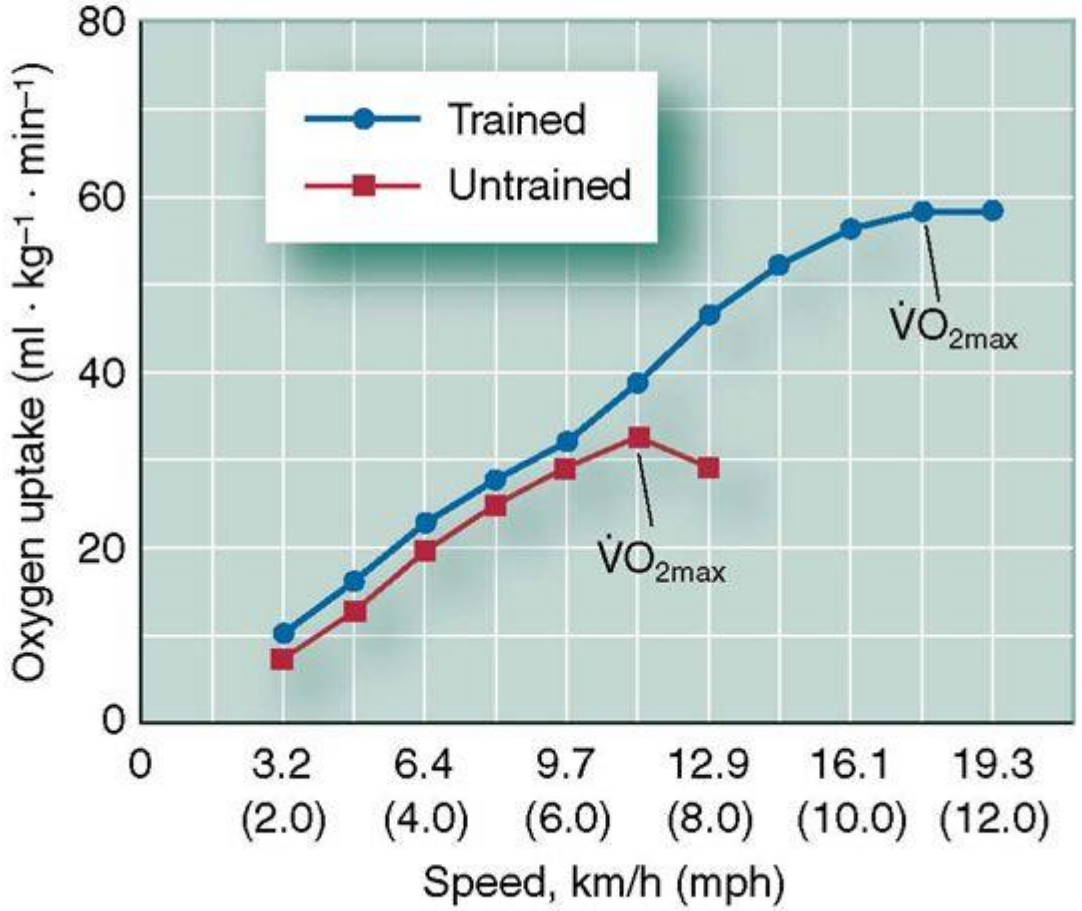
ABSOLUTE:

L/MIN

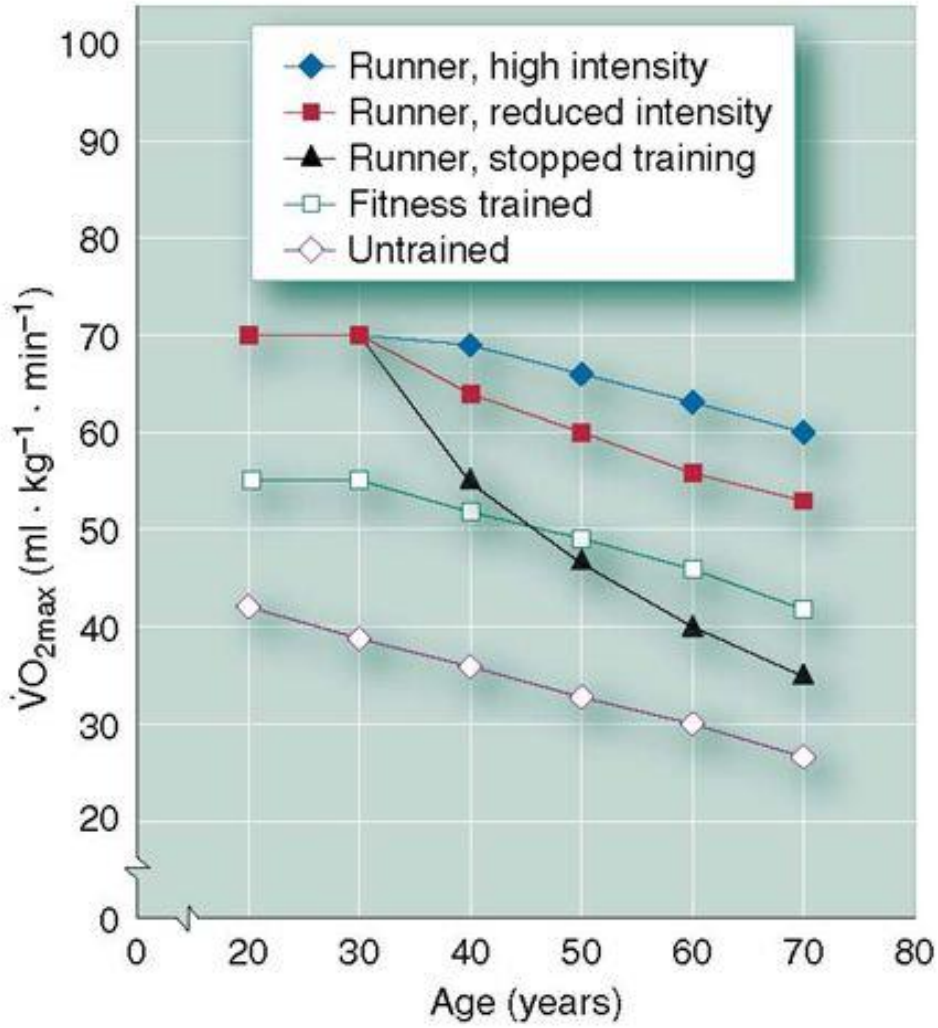
RELATIVE:

ML/KG/MIN

Relationship Between Exercise Intensity and Oxygen Uptake in Trained and Untrained Man



Changes in $\dot{V}O_{2max}$ With Age for Trained and Untrained Men



Vo2 Max

- Can only be measured in a lab using computers while the participant performs incremental exercise to exhaustion
  - Incremental exercise means that the workload progressively becomes more difficult every minute – performed until participant can no longer continue or they vomit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Limiting Factors for VO2max

- Respiratory factors: inadequate ventilation, oxygen diffusion limitations
- Cardiovascular factors: inadequate blood flow or cardiac output, inadequate oxygen-carrying capacity (hemoglobin concentration)
- Muscular factors: lack of mitochondria

Rest to Exercise Transition

- During incremental exercise, pulmonary ventilation initially increases at a rate proportional to the increase in workload
- Eventually a point is reached where ventilation increases much more rapidly than workload – this is referred to as ventilatory threshold
  - Normally occurs at 65-85% of VO2max

CONT...

- Increase in ventilation occurs because of an increase in the accumulation of lactic acid in the blood
- When energy demands can no longer be met, the anaerobic systems are also used to meet energy requirements
- The body increases ventilation to deal with the accumulation of lactic acid

Oxygen Deficit

- When we breathe heavily during intense exercises, it is to meet the demand for oxygen in working muscles
- A major function of the cardiorespiratory system is to allow the body to address this deficit
- **Oxygen deficit** represents the difference between the oxygen required to perform a task and the oxygen actually consumed prior to reaching a new steady state

Cont…

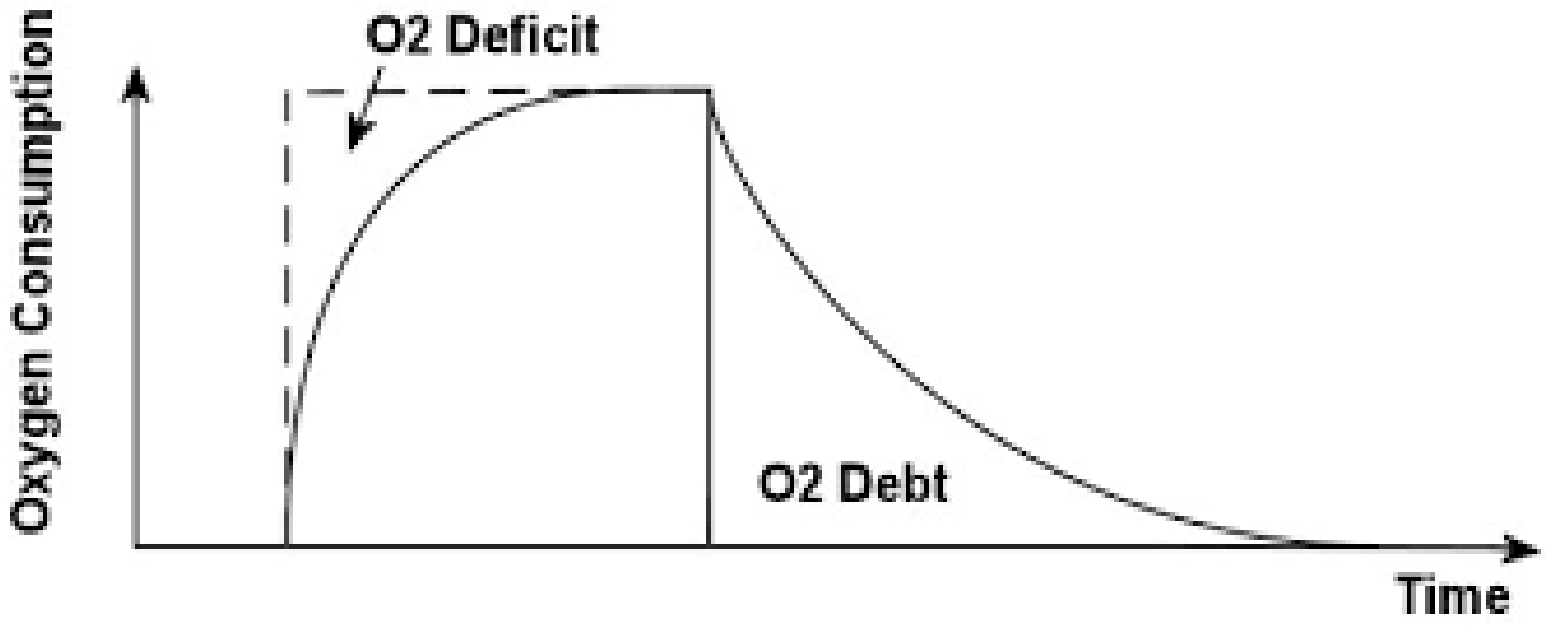
- "Steady state" occurs when oxygen uptake and heart rate level off
  - Energy demands and energy production are evenly balanced
  - The body maintains a steady level of exertion for an extended period of time

What is EPOC?

- What happens to our breathing post exercise?
- What does our body have to do to recover?

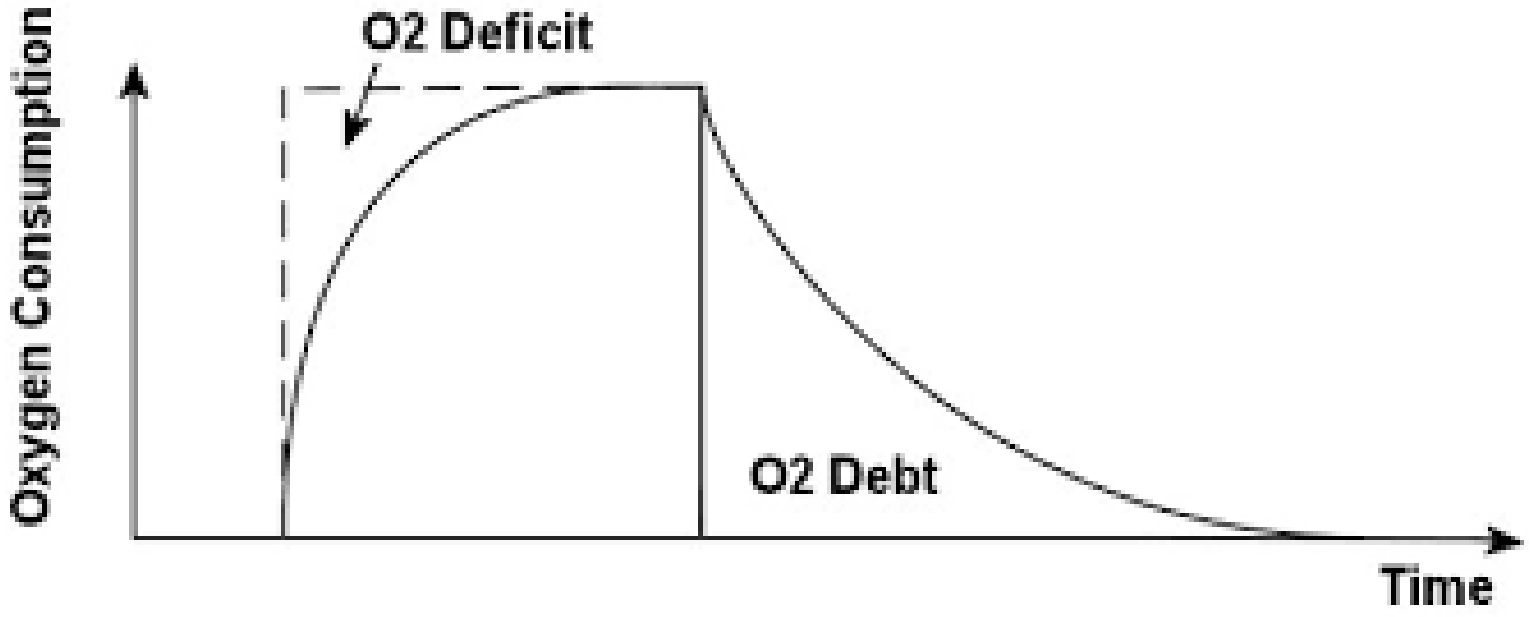
Excess Post-Exercise Oxygen Consumption (EPOC)

- When intense exercise terminates, a period of time elapses before the body returns to a resting state



EPOC

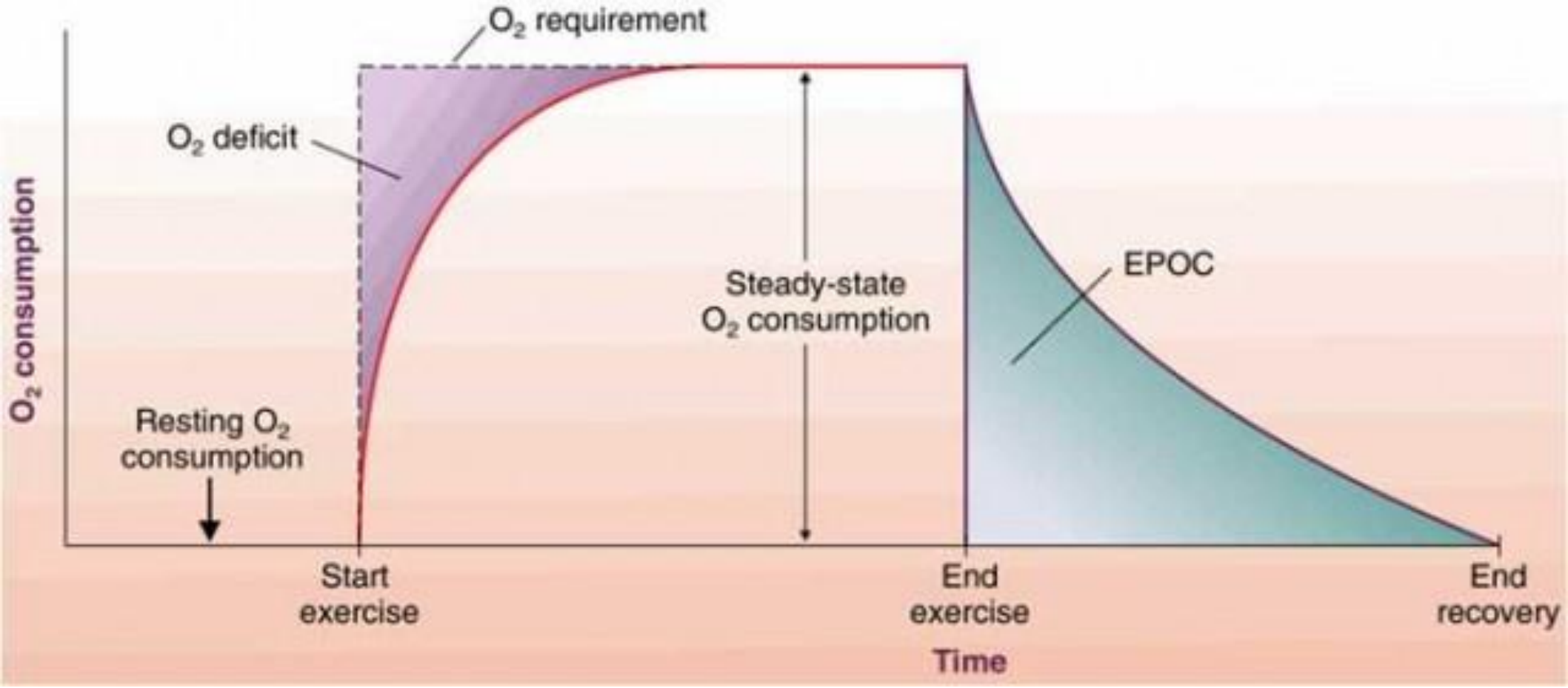
- The additional oxygen taken in during this recovery period is referred to as excess post-exercise oxygen consumption (EPOC)



EPOC

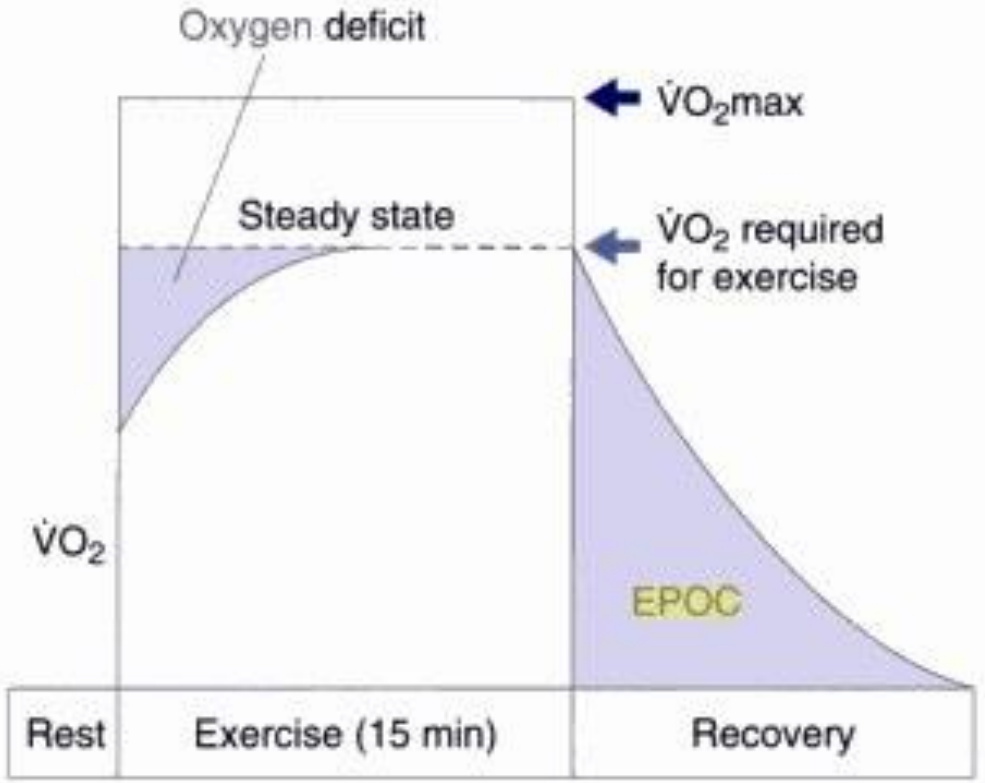
- The additional oxygen requirements during this period are due to the demands from the body to replenish oxygen to the various body systems that were taxed during exercise

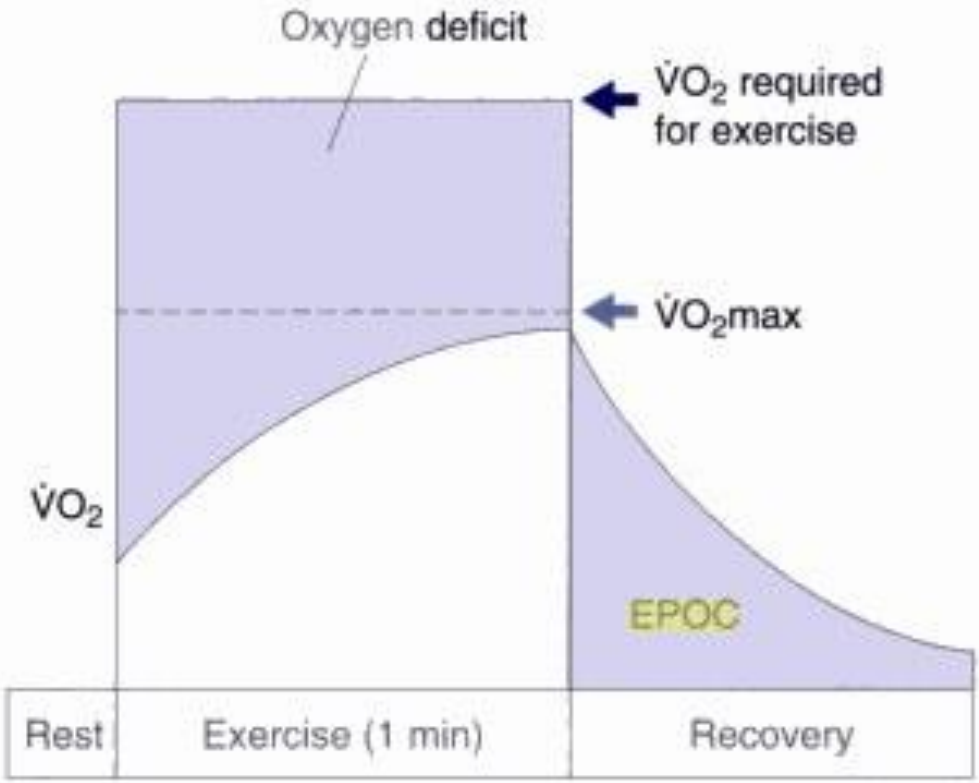
EPOC


O_2 requirement
O_2 deficit
Steady-state O_2 consumption
EPOC
Resting O_2 consumption
O_2 consumption
Start exercise
End exercise
End recovery
Time

What's The Difference between a Trained Individual and an Untrained Individual?

What is the Difference in EPOC between Low Intensity Exercise and High Intensity Exercise?


Oxygen deficit
V̇O2max
Steady state
V̇O2 required for exercise
V̇O2
EPOC
Rest
Exercise (15 min)
Recovery


Oxygen deficit
V̇O2 required for exercise
V̇O2max
V̇O2
EPOC
Rest
Exercise (1 min)
Recovery

Cont.....

- Changes that occur:
  - Refilling phosphocreatine reserves in muscles
  - Replenishing oxygen in blood and tissue
  - Lowering elevated heart rate and breathing
  - Lowering body temperature
  - Increasing blood lactate removal