Summary of Hemodynamic Formulas

Oxygen Content (CaO_2)

How much oxygen is **CONTAINED** in the blood?

$CaO_2 = (Sat \times Hgb \times 1.36^*) + (0.003 \times PaO_2)^{**}$ =

Saturation  X Hemoglobin 

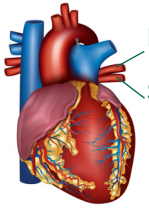
Units of Measure	
SpO_2	%
Hgb	g/dL

Changes in saturation have minimal impact; oxygen content is chiefly a function of hemoglobin level.
Normal CaO_2 = 20 mL O_2 /100 mL blood (regardless of body size)

Oxygen delivery (DO_2)

How much oxygen is **DELIVERED** to the organs?

$DO_2 = SpO_2 \times Hgb \times 1.36 \times CO \times 10^{***}$ =

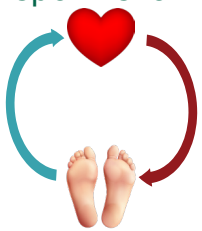
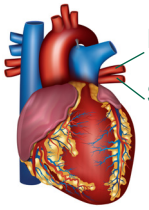
Saturation  X Hemoglobin  X Cardiac Output 

Cardiac output = Heart Rate x Stroke Volume
Stroke volume is a combination of Preload, Contractility, and Afterload
Adult resting normal = 1000 mL O_2/min (varies with body size and activity level)

Tissue Oxygenation Consumption (VO_2)

How much oxygen is **USED** by the tissues?

$VO_2 = (SpO_2 - SvO_2) \times Hgb \times 1.36 \times CO \times 10^{***}$ =

SpO_2 - SvO_2  X Hemoglobin  X Cardiac Output 

* The milliliters of oxygen one gram of hemoglobin can carry. This number varies from 1.31-1.39 depending on the resource consulted
**The amount of oxygen dissolved in the blood. This number is always small and clinically insignificant.
*** Converts L/min to mL/min

Gray text items in these formulas are mathematical constants; they never change. If you are thinking conceptually (rather than doing the math) ignore these numbers.

VO_2 is rarely DIRECTLY measured in trauma patients. Nevertheless, if you understand the variables in the formula, and their relative importance, you can INDIRECTLY measure tissue oxygen consumption (lactate, pH, or base deficit) and can manipulate the variables to treat the patient.
Adult normal = 180-280 mL/min (varies with body size and activity level)
VO_2 varies by a child's size; in a 45kg adolescent, normal = 180-280 mL/min

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