



OXYGEN CONTENT

$$= \text{Hg-bound } O_2 + \text{Dissolved } O_2$$

$$C_vO_2 = (\text{Hg} \times 1.34 \times S_vO_2) + (P_vO_2 \times 0.003)$$

$$C_aO_2 = (\text{Hg} \times 1.34 \times S_aO_2) + (P_aO_2 \times 0.003)$$

C_vO₂ = mixed venous oxygen content
C_aO₂ = arterial oxygen content
Hg = hemoglobin
 1.34 = volume of O₂ bound to 1 gram of saturated Hg
S_vO₂ = % Hg fully saturated with O₂ in venous blood
S_aO₂ = % Hg fully saturated with O₂ in arterial blood
P_vO₂ = partial pressure of O₂ dissolved in venous blood
P_aO₂ = partial pressure of O₂ dissolved in arterial blood
 0.003 = solubility coefficient of O₂ dissolved in blood

OXYGEN DELIVERY

$$DO_2 = CO \times C_aO_2$$

OXYGEN CONSUMPTION

$$VO_2 = CO \times (C_aO_2 - C_vO_2)$$

OXYGEN EXTRACTION RATIO

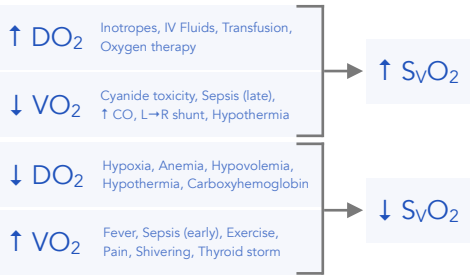
$$ER_{O_2} = (VO_2 \div DO_2) \times 100$$

DO₂ = oxygen delivered
VO₂ = oxygen consumption
ER_{O2} = oxygen extraction ratio
CO = cardiac output
C_aO₂ = arterial oxygen content
C_vO₂ = mixed venous oxygen content

FICK EQUATION

$$S_vO_2 = S_aO_2 - [VO_2 \div (CO \times Hg \times 1.34)]$$

S_vO₂ = mixed venous O₂ saturation (normal: 65-75%)
S_aO₂ = arterial O₂ saturation
VO₂ = total body O₂ consumption
CO = cardiac output
Hg = hemoglobin
S_vO₂ ∝ *S_aO₂*, *CO*, *Hg*
S_vO₂ ∝ 1/*VO₂*



APNEIC TIME

$$= (FRC \times EtO_2) \div VO_2$$

FRC = functional residual capacity
EtO₂ = end-tidal oxygen percent
VO₂ = oxygen consumption
 Pre-oxygenation (denitrogenation) can be achieved by Tidal volume breathing 100% O₂ over 3 mins OR by 8 vital capacity breaths over 1 minute

USEFUL 'ANCHOR' POINTS

SO₂	50%	75%	85%	90%	97%
PO₂ (mmHg)	27	40	50	60	100

MEAN ARTERIAL PRESSURE

$$MAP = CO \times SVR$$

SYSTEMIC VASCULAR RESISTANCE

$$SVR = 80 \times (MAP - CVP) \div CO$$

CARDIAC OUTPUT

$$CO = HR \times SV$$

STROKE VOLUME

$$SV = \text{Preload} \times \text{Contractility} \times \text{Afterload}$$

MAP = mean arterial pressure
CO = cardiac output
SVR = systemic vascular resistance
 80 = conversion factor to change woods units 'mmHg/L/min' to metric units 'dynes/sec/cm⁵'
CVP = central venous pressure (surrogate for right atrial pressure, RAP)
SBP = systolic blood pressure
DBP = diastolic blood pressure
HR = heart rate
SV = stroke volume

Parameter	Normal Values
Cardiac Output (CO)	5-6 L/min
Cardiac Index (CI)	2.5-4 L/min/m ²
Pulmonary Capillary Wedge Pressure (PCWP)	4-12 mmHg
Central Venous Pressure (CVP)	8-12 mmHg
Mixed Venous O ₂ Saturation (S _v O ₂)	75 %
Mixed Venous O ₂ Partial Pressure (P _v O ₂)	40 mmHg
Systemic Vascular Resistance (SVR)	700-1500 dynes/sec/cm ⁵
Oxygen consumption (VO ₂)	250 cc/min

ALLOWABLE BLOOD LOSS

$$= EBV \times (H_i - H_f) \div H_i$$

EBV = estimated blood volume
H_i = initial (starting) hematocrit
H_f = final (lowest acceptable) hematocrit

VOLUME TO TRANSFUSE

$$= EBV \times (H_{desired} - H_{current}) \div H_{transfused}$$

EBV = estimated blood volume
H_{desired} = desired hematocrit
H_{current} = current hematocrit
H_{transfused} = hematocrit of transfused blood

Age	Estimated Blood Volume (mL/kg)
Preemie	100
Neonate	90
< 1 year	80
< 12 years	75
Men ♂	70
Women ♀	65 (~90 in pregnancy)