

Ventilator Pocket Guide

Foundational Equations

Ohm's Law	$\Delta P = FR = P_{aw} - P_{alv} = P_{pl} - PEEP_{total}$						
Equation of Motion	$P_{aw} = FR + \frac{V_t}{C} + PEEP_{total}$						
Compliance	$C = \frac{\Delta V}{\Delta P}$						
Natural Decay Equation	$V_i(t) = \frac{V_o}{e^{\frac{t}{RC}}} = \frac{V_o}{e^{\frac{t}{\tau}}}$						
Calculating τ, General Case	$\tau = \frac{V_t}{F} \cdot \left(\frac{PIP - P_{plt}}{PEEP_{total}} \right)$						
Alveolar Gas Equation	$P_{AO_2} = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{P_{aCO_2}}{RQ}$, where $RQ = 0.80$						
Alveolar Gas Equation, Substituted RQ	$P_{AO_2} = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{VO_2}{V_a}k$						
Patient	Mode	TV	Rate	Ppeak	Pplat	PEEPauto	PEEPset

- [Vent Waveforms](#)

Alveolar Gas Equation

$$PAO_2 = FiO_2(P_{atm} - P_{H_2O}) - \frac{PaCO_2}{RQ}$$

substituting back in to RQ equation: $RQ = \frac{P_{ACO_2}}{\frac{V_{AP_{ACO_2}}}{kV_{O_2}}} = \frac{V_{O_2}}{V_a}k$

$V_T = V_A + V_D$, where $V_A = 350$ and $V_D = 150$

Dead Space Fraction

$$\frac{V_D}{V_T} = \frac{P_{ACO_2} - P_{ECO_2}}{P_{ACO_2}}$$

Formal measurement of P_{ECO_2} requires volumetric capnography, which requires a capable ventilator or a dedicated measurement device.

Thankfull, $P_{ECO_2} \approx ETCO_2$, so an approximation would $\frac{V_D}{V_T} = \frac{P_{ACO_2} - ETCO_2}{P_{ACO_2}}$

Alveolar ventilation

$$P_{A}O_2 = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{P_{AO_2}}{RQ}$$

$$\dot{V}_A = k \frac{\dot{V}CO_2}{P_{ACO_2}} \implies \dot{V}CO_2 = \frac{\dot{V}_{AP_{ACO_2}}}{k}$$

To convert F_{ACO_2} into P_{ACO_2} , we have $F_{ACO_2}(P_{atm} - P_{H_2O}) = P_{ACO_2}$ Similarly, using F_{ECO_2} , we can show $P_{ECO_2} = F_{ECO_2}(P_{atm} - P_{H_2O})$

$$Volume_{expiredCO_2} = Volume_{producedAlvCO_2}$$

$$V_{TF_ECO_2} = V_{AF_ACO_2}$$

$V_{TF_ECO_2} = (V_T - V_D)F_{ACO_2}$, and we can convert F_{ACO_2} into P_{ACO_2}

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Last update: **2023/12/22 19:13**

