**Sample calculation for Respiration**

Human

RMR ~ 333 kJ/hr

Human **total** lung volume (LV) ~ 4,000 ml

Tidal volume (amt that goes in and out in a breath) ~ 15% lung volume = 0.15 (4000) = 600 ml at rest

Tidal volume **increases** with exercise

Dead space ~ 3.75% of lung volume = 0.0375 (4000) = 150 ml

VA = alveolar ventilation volume = Vt – Vd = 600 ml – 150 ml = 450 ml

Pressure of oxygen that goes in = pO2inspired = partial pressure of O2 in air

(If water breathing, partial pressure of O2 in water)

pO2inspired = partial pressure of O2 in air = 21 kPa

Tidal – not all air that goes in makes it into the lung; therefore, some mixing occurs, which is described by:

pO2expired = Vd/ Vt (pO2freshair) + VA / Vt (pAO2alveolar air)

= 150ml/600ml (21 kPa) + 450ml/600ml (13 kPa)

= 0.25 (21 kPa) + 0.75 (13 kPa) = 15 kPa

How much O2 for RMR? (333 kJ/hr)

VO2 = (333 kJ/hr)/(20 kJ/LO2) = 16.65 LO2/hr

VO2 (rate of oxygen consumption)

VO2 = (VE (pO2inspired – pO2expired)) / Pbarometric

16.65 LO2/hr = (VE (21 kPa – 15 kPa))/100 kPa = VE (0.06)

VE = 16.65 LO2/hr / 0.06 = 277 Lair/hr

Conversion:

277 LO2/hr (1 hr/60 min) (1000 mL/L) = 4625 ml O2/min

Breath rate = VE / Vt = 4625/600 = 7.7 breaths per minute for a human at rest

During exercise, metabolic rate and tidal volume increase

Recompute respiratory parameters