Overview of Calculations

It is important to now combine computations from expired gas analysis indirect calorimetrry (EGAIC) with the equation from ATPS to STPD gas volume conversion so that both oxygen consumption (VO_2) and carbon dioxide production (VCO_2) can be calculated in STPD conditions.

The first step that I recommend is to convert VE ATPS to VE STPD, shown again in Equation 1.

$$VE_{STPD} = VE_{ATPS} \times \left(\frac{273}{(273 + T_{room})} \right) \times \left(\frac{(PB - P_{H20})}{760} \right)$$ Equation 1

In this example, let us assume that we are quantifying **resting metabolic rate (RMR)** and have a resting ventilation measurement of 6 L/min, a room temperature of 19 °C (T_{room} = 19 °C), and a barometric pressure of 720 mmHg. The gas volume was measured at the mixing chamber and expired gas temperature had equilibrated to room air temperature. Thus water vapor pressure from Table 1 is 16.5 mmHg, and computed data is presented in Equation 2.

$$VE_{STPD} = VE_{ATPS} \times \left(\frac{273}{(273 + 19)} \right) \times \left(\frac{(720 - 16.5)}{760} \right)$$ Equation 2

$$= 6 \times (0.9349) \times (0.9257) = 5.1926\ L/\min$$

For final computations like this, try to express all numbers to at least 4 decimal places.

Now that VE is converted to STPD conditions, compute VI as shown in Equation 3.

Expired gas fractions were as follows; FEO_2 = 0.1652 and $FECO_2$ = 0.0355.

$$VI_{STPD} = VE_{STPD} \times \left((0.9906 - (FEO_2 + FECO_2)) \Big/ 0.7808 \right)$$

$$= 5.1926 \times \left((0.9906 - (0.1652 + 0.0355)) \Big/ 0.7808 \right) = 5.2531\ L/\min$$ Equation 3

Now that both VE and VI are computed to STPD conditions, compute VO_2, VCO_2 and RER as shown in Equations 4, 5 and 6.

$$VO_2 = (VI \times 0.2095) - (VE \times FEO_2)$$

$$= (5.2531 \times 0.2095) - (5.1926 \times 0.1652) = 0.2427\ L/\min$$ Equation 4

$$VCO_2 = (VE \times FECO_2) - (VI \times 0.00033)$$

$$= (5.1926 \times 0.0355) - (5.2531 \times 0.00031) = 0.1829$$ Equation 5

Overview of Calculations

$$RER = \frac{VCO_2}{VO_2} = \frac{0.1826}{0.2558} = 0.7536$$ Equation 6

Congratulations, you have just made it through the computations of EGAIC. Remember that some computerized systems do these computations every breath, which can occur every 1 s during intense exercise, as will be explained in the Topic on "Systems Used in EGAIC".

Table 1. Water vapor pressure for saturated air at different temperatures.

Temp (°C)	P_{H2O} (mmHg)
14	12.9
15	13.5
16	14.1
17	14.9
18	51.5
19	16.5
20	17.5
21	18.7
22	19.8
23	21.1
24	22.4
25	23.8
26	25.2
27	26.7
28	28.3
29	30.0
30	31.8
31	33.7
32	35.7
33	37.7
34	39.9
35	42.2
36	44.6
37	47.1
38	49.4
39	52.0
40	54.7

Glossary Words

Resting metabolic rate (RMR) is the metabolic rate for the body at rest, typically measured as a VO_2 early in the morning in a dark room, with the subject awake.