### Metabolic Equations for Estimating Gross VO₂ (ACSM 2000)

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<th>Exercise mode</th>
<th>Gross VO₂ (ml·kg⁻¹·min⁻¹)</th>
<th>Resting VO₂ (ml·kg⁻¹·min⁻¹)</th>
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</table>
| Walking VO₂ = (Sᵃ x 0.1) + (S x Gᵇ x 1.8) | +3.5 | 1. For speeds of 50-100 m·min⁻¹ (1.9-3.7 mph)  
2. 0.1 ml·kg⁻¹·m⁻¹ = O₂ cost of walking horizontally  
3. 1.8 ml·kg⁻¹·m⁻¹ = O₂ cost of walking on incline (% grade of treadmill) |
| Running VO₂ = (Sᵃ x 0.2) + (S x Gᵇ x 0.9) | +3.5 | 1. For speeds >134 m·min⁻¹ (>5.0 mph)  
2. If truly jogging (not walking), this equations can also be used for speeds of 80-134 m·min⁻¹ (3-5 mph)  
3. 0.2 ml·kg⁻¹·m⁻¹ = O₂ cost of running horizontally  
4. 0.9 ml·kg⁻¹·m⁻¹ = O₂ cost of running on incline (% grade of treadmill) |
| Leg ergometry VO₂ = (Wᶜ/Mᵈ x 10.8) + 3.5 | +3.5 | 1. For work rates between 50 and 200 W (300-1200 kgm·min⁻¹)  
2. 10.8 ml·kg⁻¹·W⁻¹ = O₂ cost of cycling against external load (resistance)  
3. 3.5 ml·kg⁻¹·min⁻¹ = O₂ cost of cycling with zero load |
| Arm ergometry VO₂ = (Wᶜ/Mᵈ x 18.0) + none | +3.5 | 1. For work rates between 25 and 125 W (150-750 kgm·min⁻¹)  
2. 18.0 ml·kg⁻¹·W⁻¹ = O₂ cost of cycling against external load (resistance)  
3. None = due to small mass of arm musculature, no special term for unloaded (zero load) cycling is needed |
| Stepping VO₂ = (Fᵉ x 0.2) + (F x htᶠ x 1.8 x 1.33) | +3.5 | 1. Appropriate for stepping rates between 12 and 30 steps/min and step heights between 0.04 m (1.6 in.) and 0.40 m (15.7 in.)  
2. 0.2 ml·kg⁻¹·m⁻¹ = O₂ cost of moving horizontally  
3. 1.8 ml·kg⁻¹·m⁻¹ = O₂ cost of stepping up (bench height)  
4. 1.33 includes positive component of stepping up (1.0) + negative component of stepping down (0.33) |

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ᵃ S= speed of treadmill in m·min⁻¹; 1 mph = 26.8 m·min⁻¹.  
ᵇ G= grade (% incline) of treadmill in decimal form; e.g., 10% = 0.10.  
ᶜ W= power output in watts; 1 W = 6 kgm·min⁻¹.  
ᵈ M= body mass in kilograms; 1 kg = 2.2 lb.  
ᵉ F= frequency of stepping in steps per minute.  
ᶠ ht= bench height in meters; 1 in. = 0.0254 m.