TABLE 7.3 Metabolic Calculations for the Estimation of Energy Expenditure ($\dot{V}O_{2max}$, [mL · kg^{-1} · min^{-1}]) During Common Physical Activities

	Sum of Resting + Horizontal + Vertical/Resistance Components			
Activity	**Resting Component**	**Horizontal Component**	**Vertical Component/ Resistance Component**	**Limitations**
Walking	3.5	0.1 × speed[a]	1.8 × speed[a] × grade[b]	Most accurate for speeds of 1.9–3.7 mi · h^{-1} (50–100 m · min^{-1})
Running	3.5	0.2 × speed [a]	0.9 × speed [a] × grade[b]	Most accurate for speeds >5 mi · h^{-1} (134 m · min^{-1})
Stepping	3.5	0.2 × steps · min^{-1}	1.33 × (1.8 × step height[c] × steps · min^{-1})	Most accurate for stepping rates of 12–30 steps · min^{-1}
Leg cycling	3.5	3.5	(1.8 × work rate[d])/ body mass[e]	Most accurate for work rates of 300–1,200 kg · m · min^{-1} (50–200 W)
Arm cycling	3.5		(3 × work rate[d])/ body mass[e]	Most accurate for work rates between 150–750 kg · m · min^{-1} (25–125 W)

[a]Speed in m · min^{-1}.

[b]Grade is percent grade expressed in decimal format (*e.g.*, 10% = 0.10).

[c]Step height in m.

Multiply by the following conversion factors:

lb to kg: 0.454; in to cm: 2.54; ft to m: 0.3048; mi to km: 1.609; mi · h^{-1} to m · min^{-1}: 26.8; kg · m · min^{-1} to W: 0.164; W to kg · m · min^{-1}: 6.12; $\dot{V}O_{2max}$ L · min^{-1} to kcal · min^{-1}: 4.9; $\dot{V}O_2$ MET to mL · kg^{-1} · min^{-1}: 3.5.

[d]Work rate in kilogram meters per minute (kg · m · min^{-1}) is calculated as resistance (kg) × distance per revolution of flywheel × pedal frequency per minute. Note: Distance per revolution is 6 m for Monark leg ergometer, 3 m for the Tunturi and BodyGuard ergometers, and 2.4 m for Monark arm ergometer.

[e]Body mass in kg

$\dot{V}O_{2max}$, maximal volume of oxygen consumed per unit of time.

Adapted from (8).