

# Metabolic Equations for Gross VO<sub>2</sub> in Metric Units

## Walking

$$\text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = (0.1 \cdot S) + (1.8 \cdot S \cdot G) + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$$

## Running

$$\text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = (0.2 \cdot S) + (0.9 \cdot S \cdot G) + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$$

## Leg Cycling

$$\text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = 1.8(\text{work rate}) / (\text{BM}) + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1} + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$$

## Arm Cycling

$$\text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = 3(\text{work rate}) / (\text{BM}) + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$$

## Stepping

$$\text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = (0.2 \cdot f) + (1.33 \cdot 1.8 \cdot H \cdot f) + 3.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$$

VO<sub>2</sub>- is gross oxygen consumption in mL.kg<sup>-1</sup>.min<sup>-1</sup>

S- is speed in m.min<sup>-1</sup>

BM- is body mass (kg)

G- is the percent grade expressed as a fraction

Work rate- (kg.m.min<sup>-1</sup>)

f- is the stepping frequency in minutes

H- is step height in meters

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**The 3-Minute Step Test** measures your **aerobic (cardiovascular) fitness level** based on how quickly your heart rate returns to normal after exercise.

**Equipment needed:** Stopwatch or clock with a second hand; a friend to help you keep count; a 12-inch bench, box, or step; a metronome (if you don't have one, use the free online version at [www.MetronomeOnline.com](http://www.MetronomeOnline.com))

**Goal:** Step on and off the bench for 3 minutes straight while keeping a consistent pace and then see how quickly your heart rate will come back down.

**Execution:** This test is based on a 12-inch step, so use one as close to 12 inches as possible, otherwise your results will be skewed. Set the metronome to 96 beats per minute and make sure you can hear the beat. Stand facing the step. When ready to begin, start the clock or stopwatch and march up and down on the step to the metronome beat (up, up, down, down) for 3 consecutive minutes. (You can rest if you need to, but remain standing.) When 3 minutes are up, stop immediately, sit down on the step, and count (or have a friend count) your pulse (use your wrist or neck) for one full minute.

**What this measures:** This test assesses your fitness level based on how quickly your heart rate recovers after exercise. The fitter you are, the quicker your heart rate will return to normal after exercise.

**Scoring:** Here are the age-adjusted standards based on guidelines published by YMCA.

#### Ratings for Men, Based on Age

	18-25	26-35	36-45	46-55	56-65	65+
<b>Excellent</b>	50-76	51-76	49-76	56-82	60-77	59-81
<b>Good</b>	79-84	79-85	80-88	87-93	86-94	87-92
<b>Above Average</b>	88-93	88-94	92-88	95-101	97-100	94-102
<b>Average</b>	95-100	96-102	100-105	103-111	103-109	104-110
<b>Below Average</b>	102-107	104-110	108-113	113-119	111-117	114-118
<b>Poor</b>	111-119	114-121	116-124	121-126	119-128	121-126
<b>Very Poor</b>	124-157	126-161	130-163	131-159	131-154	130-151

#### Ratings for Women, Based on Age

	18-25	26-35	36-45	46-55	56-65	65+
<b>Excellent</b>	52-81	58-80	51-84	63-91	60-92	70-92
<b>Good</b>	85-93	85-92	89-96	95-101	97-103	96-101
<b>Above Average</b>	96-102	95-101	100-104	104-110	106-111	104-111
<b>Average</b>	104-110	104-110	107-112	113-118	113-118	116-121
<b>Below Average</b>	113-120	113-119	115-120	120-124	119-127	123-126
<b>Poor</b>	122-131	122-129	124-132	126-132	129-135	128-133
<b>Very Poor</b>	135-169	134-171	137-169	137-171	141-174	135-155

Maybe you'll find that you're doing well. But even if you couldn't register on the chart, that's OK. Everyone starts somewhere! Just try to improve gradually over time from where you started. Remember, you are looking for improvement in *yourself*, regardless of what a chart says or how well someone else does.

**How to improve:** To improve your scores on this test, develop a regular cardio (aerobic) exercise routine and stick to it. Increase your intensity and duration gradually and you'll boost your endurance over time. Use the Spark People resources below for more tips to improve your aerobic fitness.

- Cardio Workouts: [10-Minute Jump Rope Cardio Workout](#), [10-Minute Jump Start Cardio Workout](#), and [10-Minute Bootcamp Cardio Routine](#)
- At-home exercise: [Step-Ups](#)
- Training Tips: [Spark Your Way to a 5K](#), [Run a Mile Without Stopping](#), and [Get Results with Interval Training](#)

**How to know its working:** When you're done testing, you can track your results on Spark People to keep track of your progress! Over time, you should be able to recover from exercise more quickly. Keep in mind that if you're on any type of medication that affects your heart rate, this test might not be very accurate for you.

This test is a great tool to see how you are doing. If you don't score as well as you like, just remember to focus on improving your own scores periodically. As long as you are improving, your fitness plan is working. If you find you aren't making the progress that you feel you should be seeing, it may be time to change your workout routine.

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