

## Assessment of Aerobic Power

### Maximal Oxygen Consumption

A test of aerobic fitness that truly qualifies as a lab test is the Maximal Oxygen Consumption ( $\text{VO}_{2\text{max}}$ ) Test. Although this test may involve a substantial anaerobic contribution to metabolism at the terminal portion of the test, it is primarily an aerobic test.

Whereas the running and cycling tests attempt to predict aerobic power as accurately as possible, the  $\text{VO}_{2\text{max}}$  Test actually measures aerobic power. Various run/walk tests, for example, predict maximal oxygen consumption based on the relationship between maximal oxygen consumption and time or distance of running or walking; step tests and cycle tests estimate the maximal oxygen consumption based on the relationship between heart rate, oxygen consumption and power level. Because the  $\text{VO}_{2\text{max}}$  Test directly measures oxygen consumption, it requires more expensive and sophisticated equipment than that required by field or field/lab tests.

### Equipment

Quinton Treadmill  
Heart rate monitor  
Metabolic measurement system

### Procedure

1. Obtain the subject's height and weight (enter all information into the metabolic system)
2. Place a heart rate monitor on the subject.
3. Position the subject on the treadmill (instruct them to straddle the belt)
4. With the respiratory valve in place position the noseclip.
5. Have the subject warm-up for 2-5 minutes.
6. Follow the Bruce Treadmill Protocol (or other) Table 2 to obtain the proper speed and % grade.
7. Heart rate should be measured every minute during exercise.
8. Ratings of perceived exertion (RPE) should be measured at the end of each stage and at maximal exercise.
9. Upon termination instruct subject to continue walking on the treadmill (i.e. cool-down) for at least 5 minutes

**Computations**

1. Calculate O<sub>2</sub> pulse for each minute during the exercise test.

$$\text{VO}_2 \text{ (mL/min)} \div \text{HR (bts/min)} = \text{O}_2 \text{ pulse (mL*beat)}$$

2. Plot VO<sub>2</sub> (L/min & mL/kg/min), heart rate (bts/min), RER VCO<sub>2</sub> (L/min) and VE (L/min) as a function of exercise time during the treadmill test.
3. Calculate MET values for the last minute of each stage of the exercise test.

$$\text{MET level} = \text{VO}_2 \text{ (mL/kg/min)} / 3.5 \text{ (mL/kg/min)}$$

4. Plot HR as a function of the MET equivalent for each exercise stage of the exercise test.
5. Plot VE (L/min) as a function of VO<sub>2</sub> (L/min) for each minute of the exercise test and try and determine the Ventilatory Threshold. What is the HR at the Ventilatory Threshold?

**Discussion Questions:**

1. What was your subject's fitness ranking according to your previous laboratory? Would this ranking change if the subject were 45 years old?
2. Did the prediction tests performed in the previous laboratory yield a VO<sub>2max</sub> value that was similar to the actual VO<sub>2max</sub> (as obtained from the treadmill test)?
3. If the same subject were to come back in two days and perform a VO<sub>2max</sub> test on a cycle ergometer, What do you think their VO<sub>2max</sub> would be (higher, lower, no change)? Why?
4. Explain the importance of the 'cool-down' during this exercise assessment.

Table 2.  
VO<sub>2max</sub> Report - Bruce Treadmill Protocol

Start Warm-up at \_\_\_\_\_ Start Exercise at \_\_\_\_\_

	Time (min)	Speed (mph)	Grade (%)	VO <sub>2</sub> (mL/kg/min)	RER	HR (b/min)	RPE Overall
Stage 1	0-1	1.7	10				
	1-2						
	2-3						
Stage 2	3-4	2.5	12				
	4-5						
	5-6						
Stage 3	6-7	3.4	14				
	7-8						
	8-9						
Stage 4	9-10	4.2	16				
	10-11						
	11-12						
Stage 5	12-13	5	18				
	13-14						
	14-15						
Stage 6	15-16	5.5	20				
	16-17						
	17-18						

**Total Exercise Time:** \_\_\_\_\_ min

**Maximal Heart Rate:** \_\_\_\_\_ b/min

**RERmax:** \_\_\_\_\_

**VO<sub>2max</sub>:** \_\_\_\_\_ mL/kg/min

**METSmax:** \_\_\_\_\_

**Comments:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

