

Laboratory Practical 1

Measuring Aerobic Capacity

The body's ability to perform exercise is dependent on the ability of the exercising muscles to harness the available energy. The release of energy for prolonged periods in exercising muscles is driven by the availability of oxygen. The uptake of oxygen is driven by the respiratory system whilst the transport of oxygen to the muscles is driven by the cardiovascular system which pumps oxygenated blood to the muscles. The effectiveness and efficiency of these systems to provide the muscles with oxygen and of the muscles themselves to utilise oxygen in the release of energy can be termed aerobic fitness (VO_2^{max}). An individual's aerobic fitness can be measured in a number of ways, either by using complex laboratory based equipment and procedures (taught in level 5) or by using simpler, less complex predictive tests which give an estimate of the body's ability to supply and utilise oxygen. This laboratory session introduces two of the commonly used predictive tests of aerobic fitness.

Procedure Astrand Rhyming Cycle Test

1. Adjust the saddle height of the ergometer and set the exercise intensity to 100 W (e.g. 50 rpm at 2 kg).
2. Ask the subject to cycle for 3 minutes and record the heart rate at the end of the 3rd minute.
3. If the heart rate is less than 120 beats per minute increase the exercise intensity by 50 W and ask the subject to continue exercising for a further

3 minutes. If the heart rate is greater than 170 beats per minute stop the exercise test.

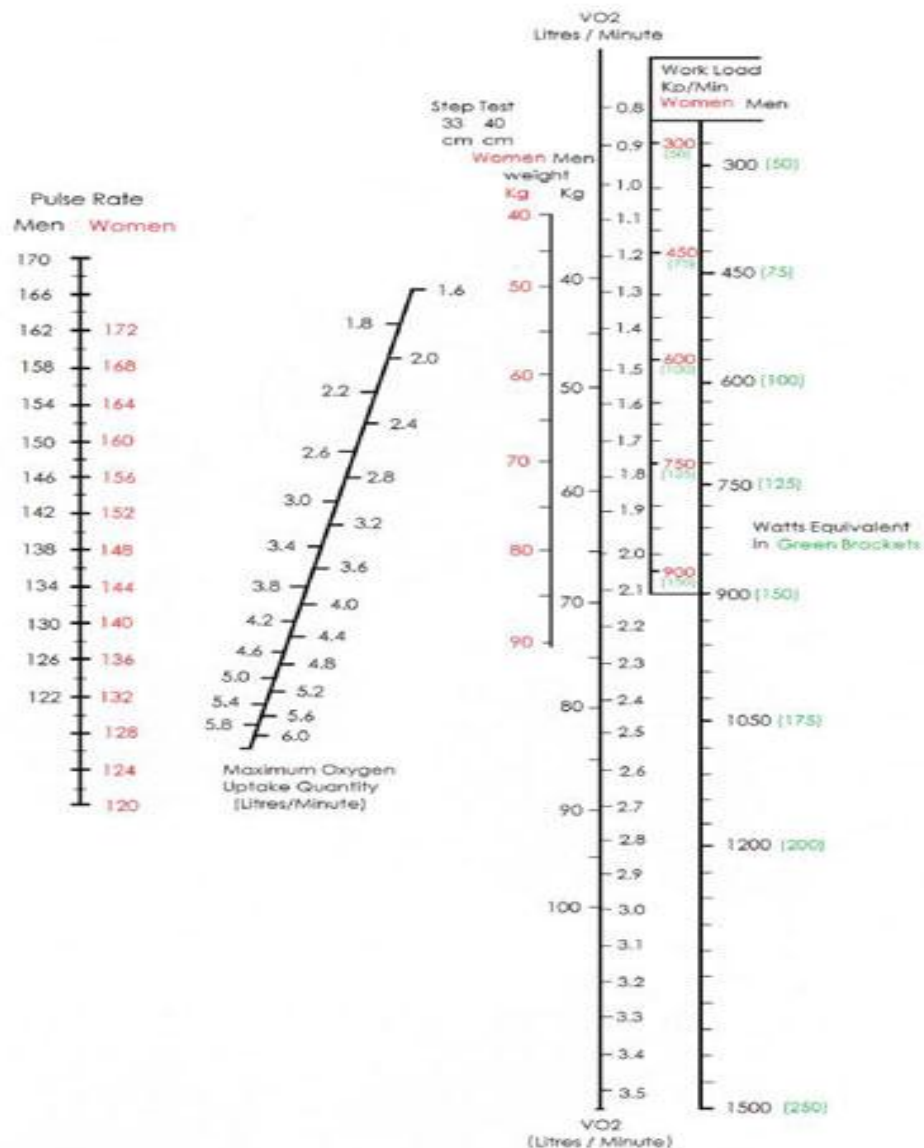
4. Record the heart rate and exercise intensity in the table below.

5. Use the nomogram provided to estimate the maximum oxygen uptake (VO₂max) score.

Results Predicted Maximum Oxygen Uptake

Subject	Astrand-Rhyming Cycle Test			
	HR @ 3min	Final HR	Final Exercise Intensity	Predicted VO ² Max
Subject	Queens College Step Test			
	Final Heart Rate 15secs			Predicted VO ² Max
Subject	Coopers 12min Test			
	Distance travelled			Predicted VO ² Max

Modified Astrand-Ryhming Nomogram



Reference: ACSM Guidelines for Exercise Testing & Prescription, Edition 5

To convert Litres per minute (L.min⁻¹) to millilitres per kilogram per minute (ml.kg.min⁻¹) use the following formula

ml.kg.min⁻¹ = divide L.min⁻¹ by the subject's body weight in kg, then multiply x 1000 = **[L.min⁻¹ / BW(Kg)] x 1000**

Queens College Step Test

This requires the athlete to step up and down on the step for 3 minutes at the following rate: male 24 steps/minute and female 22 steps/minute

- The athlete warms up (standardise)
- The assistant sets up the metronome to the required steps/minute pace (Male 24 and Female 22)
- The assistant gives the command “GO”, starts the stopwatch and the athlete commences the test
- The assistant ensures the athlete maintains the required steps/minute pace
- The assistant stops the test after 3 minutes and records the athlete’s heart rate for 15 seconds (PR)

TO CALCULATE YOUR ESTIMATED VO² MAX

Using the following calculations estimate VO²Max (McArdle et al.,1972)

- Men: $VO^2_{\text{max}} \text{ (ml/kg/min)} = 111.33 - 0.42 \times \text{heart rate (bpm)}$
- Women: $VO^2_{\text{max}} \text{ (ml/kg/min)} = 65.81 - 0.1847 \times \text{heart rate (bpm)}$

Modified Cooper Treadmill Test

The Cooper 12 minute run test requires the person being tested to run or walk as far as possible in a 12 minute period. The objective of the test is to measure the maximum distance covered by the individual during the 12 minute period and is carried out on treadmill in this circumstance to enable measuring of the distance.

A stopwatch is required for ensuring that the individual runs for the correct amount of time.

- **Equipment.** You'll need a timer to know when 12 minutes are up.
- **Location.** To perform the test on a treadmill, but be sure to raise the incline to one degree to simulate outdoor running.
- **Run or Walk.** When you are warmed up, get going. Run or walk as far as you can in 12 minutes.
- **Record Your Distance.** Record the total number of miles or kilometres you travelled in 12 minutes.

TO CALCULATE YOUR ESTIMATED VO2 MAX

To calculate your estimated VO2 Max results (in ml/kg/min) use either of these formulas:

- **In Miles:** $VO2max = (35.97 \times \text{miles}) - 11.29$.
- **In Kilometres:** $VO2max = (22.351 \times \text{kilometres}) - 11.288$