

The many goals of exercise

People exercise for a variety of reasons. While professional athletes may seek fame and fortune, most regular fitness enthusiasts train with completely different goals in mind.

Most fitness enthusiasts aim: to improve their health, advance their physical and mental well-being, lose and maintain their weight, and to enjoy themselves. Some also have aspirations to compete or reach certain results to support these aims. However, all of them have one common interest: to reach their goals in the best possible way. No matter what goals we may have, people want their training experience to be enjoyable and one's level of fitness to always be improving. People exercising for their own pleasure want their training experience to be enjoyable and improving. If the performance level that they have earned through hard work is maintained, they will retain their enthusiasm for a longer time. Those who are more result- oriented also find it important to achieve the desired improvement in performance and to reach good results through training that is as balanced as possible.

Exercise Is the Best Medicine

It has been said that exercise is the best medicine for almost all modern lifestyle

diseases: obesity, elevated blood pressure, heart conditions, musculoskeletal deterioration, excess stress, and psychological issues.

If the benefits of exercise could be compressed into a pill, it would be a true miracle medicine and a surefire best seller. Fortunately for fitness enthusiasts, this is not possible; because in addition to the health benefits, exercising provides numerous big moments, challenges, and experiences – much more so than pill popping. Just as with a course of medicine, you should adhere to certain dosages in your exercise. The correct amount of exercise at the correct time produces the best results. The use of a heart rate monitor would also represent a good prescription.

Your Heart Rate Will Tell You a Lot if You Know How to Listen

A heart rate monitor is an excellent training tool. It provides you with reliable information about how hard your respiratory and cardiovascular systems are working at any given time. A heart rate monitor acts just like a tachometer for your body.

What is an exercise test?

There are different types of exercise tests that may be performed, depending on the questions that need to be answered. Exercise tests usually are performed on a stationary bicycle or a treadmill. The equipment is selected and adjusted to meet the individual needs of each patient. During the exercise test, the resistance pedaling or the speed and elevation of the treadmill are gradually increased until the patient can no longer comfortably keep up with the machine. Patients usually exercise for about 10-15 minutes, and are

monitored for about 10 minutes before and after exercise.

Components of an exercise test:

EKG monitoring — All subjects are hooked up to a special exercise-EKG, system to monitor the heart rhythm during exercise and to assess other exercise-related EKG abnormalities that may indicate the presence of a heart problem.

Metabolic measurements — By having the patient breathe through a snorkel-like mouthpiece that is connected to a special computer, the air that a patient breathes in and out during exercise can be measured, and a great deal of information can be gathered about response of the heart and lungs to exercise.

Blood pressure measurements — Blood pressure cuffs are used to monitor a patient's blood pressure before, during and after exercise.

Pulse oximetry — A pulse oximeter may be attached to a patient's finger to non-invasively measure his/her oxygen saturation before, during and after exercise.

Spirometry — Simple measurements of a patient's lung function may be performed before and/or after exercise. These measurements are performed simply by having the subject blow through a special mouthpiece that is connected to a computer. The results are used to identify lung problems that might affect a patient's ability to exercise and to see whether exercise has an adverse effect on a patient's lung function, which may occur in patients with conditions such as exercise induced asthma.

Echocardiographic measurements — Sometimes it is helpful to perform echocardiographic measurements during, or immediately after, exercise to further assess the effect of exercise on a patient's cardiovascular system.

Myocardial perfusion imaging — Patients who are suspected to have, or are at increased risk for, coronary artery problems may have a special dye injected through an IV before and after exercise. Pictures of the heart may then be obtained to help determine whether the blood flow to any part of the heart is impaired at rest and/or during exercise.

Questions addressed during an exercise test:

What causes a patient to stop exercising?

A cardiovascular problem

A pulmonary problem

Being "out of shape" or overweight

A neuromuscular problem

An orthopedic problem

Emotional issues

Metabolic, hematologic or other medical problems

How does the patient's exercise capacity compare to others of the same age and size?

How does the patient's current status compare to one or more years ago?

What might improve his/her status?

How might the effectiveness of these interventions be assessed?

Does exercise pose any risks for the patient?

Can anything be done to minimize those risks?

Can the effectiveness of the risk lowering strategies be assessed?

If the patient is having symptoms during exercise, what might the cause of the symptoms be?

What is the patient's prognosis?

Test & Measurement:

Testing and measurement are the means of collecting information upon which subsequent [performance evaluations and decisions are made](#) but in the analysis we need to bear in mind the [factors that may influence the results](#).

Objective

To monitor the development of the athlete's [general endurance](#) ([VO2 max](#)).

[Melt Flow Testing, HR Evaluations, Train to Run Faster than the rest! Best Program EVER - Increase Speed.](#)

To do this testing you need Equipment for measuring what you wanted?

Many tests, and many equipments you can find in the Egypt Sport Science laboratory- Faculty of Physical Education- Helwan University.

Performance Evaluation Tests

Performance is an assessment of how well a task is executed and the success of a training program is largely dependent upon satisfying the performance aims associated with it.

How can performance be monitored?

Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made.

What is the evaluation process?

The whole measurement/evaluation process is a six stage, cyclic affair, involving:

- The selection of characteristics to be measured
- The selection of a suitable method of measuring
- The collection of that data
- The analysis of the collected data
- The making of decisions

- The implementation of those decisions

All of the above stages should be completed with the athlete-especially the analysis of the collected data and making decision of appropriate way forward.

What are the requirements of a test?

In constructing tests it is important to make sure that they really measure the factors required to be tested, and are thus objective rather than subjective. In doing so all tests should therefore be specific (designed to assess an athlete's fitness for the activity in question), valid (the degree to which the test actually measures what it claims to measure), reliable (capable of consistent repetition) and objective (produce a consistent result irrespective of the tester).

In conducting tests the following points should be considered:

- Each test should measure ONE factor only
- The test should not require any technical competence on the part of the athlete (unless it is being used to assess technique).
- Care should be taken to make sure that the athlete understands exactly what is required of him/her, what is being measured and why?
- The test procedure should be strictly standardized in terms of administration, organization and environmental conditions.

What are the benefits of testing?

The results from tests can be used to:

- predict future performance
- indicate weaknesses
- measure improvement
- enable the coach to assess the success of his training program
- place the athlete in appropriate training group
- motivate the athlete
- Tests additionally break up, and add variety to, the training program.
- They can be used to satisfy the athlete's competitive urge out of season. Since they demand maximum effort of the athlete, they are useful at times as a training unit in their own right.

What factors may influence test results?

The following factors may have an impact on the results of a test (test reliability):

- The ambient temperature, noise level and humidity
- The amount of sleep the athlete had prior to testing

- The athlete's emotional state
- Medication the athlete may be taking
- The time of day
- The athlete's caffeine intake
- The time since the athlete's last meal
- The test environment - surface (track, grass, road, gym)
- The athlete's prior test knowledge/experience
- Accuracy of measurements (times, distances etc.)
- Is the athlete actually applying maximum effort in maximal tests Inappropriate warm up
- People present
- The personality, knowledge and skill of the tester

Why record information?

For the coach and athlete it is important to monitor the program of work, to maintain progression in terms of the volume of work and its intensity. Both coach and athlete must keep their own training records. A training diary can give an enormous amount of information about what has happened in the past and how training has gone in the past. When planning future training cycles, information of this kind is invaluable.

What should be recorded?

The information to be recorded falls into two broad categories: -

- The day-to-day information from training.
- State of the athlete (health, composure).

Physiological data (body weight, resting heart rate, etc.).

The training unit (speed, speed endurance, strength, technique).

The training load (the number of miles, the number of sets and repetitions, the number of attempts).

The training intensity (kilograms, percentage of maximum, percentage of VO₂)

The prevailing conditions (wet, windy, hot etc.)

The response to training (the assignments completed, the resultant heart rate recovery, felt tired, etc.)

Information that measures status. This can take the form of a test. If the test is repeated throughout the program, it can then be used as a measure of progress within the training discipline. Examples of such tests are:

- Time trials - speed, speed endurance, endurance
- Muscular endurance - chins, push ups, dips
- Strength maximum - single repetitions, maximum repetitions
- Explosive strength - power bounding, vertical jump, overhead shot putt

- Mobility - objective measurements of the range of movement
- Event specific

Cycle Ergometer for Research and Sports Medicine

Requirements:

- Proven accuracy and reliability for fitness assessment and stress testing.
- Extreme workloads (at least 1400 Watt) if used also for anaerobic testing.
- Fully adjustable (seate, pedals handlebar).
- Revolution independent.
- Controlled by PC different fixed modes & individual programmable.
- Parameters: Workload, revolution, time, distance, torque.
- Usable with external equipment (interface) e.g. ECG.
- Monark Electronic Ergometer Ergo-medic: Exercise Test Cycle
- Sports & Medical is a section of Monark Exercise AB with focus on products for testing and training in Medicine, Sports, Healthcare and Rehabilitation.

Options

The Excalibur Sport can be extended with the following options:

- Programmable control unit. Next to the features of the standard control unit, the programmable control unit has an additional display which can show the energy and target heart rate (combined with the heart rate option). Up to 50 user-defined protocols can be programmed using: step, ramp, isokinetic, linear, heart rate, torque and repeat modes in any combination. A programmable control unit that can display the oxygen saturation (SpO₂) is optional available.
- Blood pressure module. Using this option you can extend the Excalibur Sport with an accurate stress testing blood pressure monitor with 3-Dimensional K-sound Analysis (DKA), triggered by a TTL pulse from an ECG system or by the optional heart rate receiver. The robust microphone has a double-sided pick up element for increased sensitivity and noise reduction.
- Heart rate option. This option allows heart rate controlled stress testing. It consists of a Polar belt and receiver. The heart rate is displayed on the control unit. In combination with the programmable control unit, it offers the possibility to programme heart rate controlled protocols.
- Lode Ergometry Manager (LEM). With the LEM software, the ergometer can be controlled by a PC. LEM is the generic term for various software modules that enable e.g. read-out, printing, monitoring, saving and analysing the

measured data of the ergometer. LEM enables you to programme protocols, control the ergometer, use special pre-programmed tests and make analyses.

- Pedal Force Measurement. This option measures the force exerted on the left and right pedal. It is supplied with angle detection (each 2 degree). The forces are measured by strain gauges. An accurate and interference free method of measuring has been established. With this option, the LEM software is included as standard.
- Wingate Software. With the optional Wingate software module (with correction of the moment of inertia) it is possible to perform a Wingate sprint test in the "constant torque mode". The Wingate test is a 30 seconds sprint test during which the torque is kept constant at a rate depending on the body weight. With this option, on-line information about anaerobic capacity and power is obtained.
- Pediatric option. This option makes the Excalibur Sport the perfect solution for testing young children. It consists of a small saddle and adjustable cranks suitable for subjects with a minimum leg length of 640 mm with a minimum saddle height of 560 mm.
- Adjustable cranks. Available in 2 models: paediatric (80-170 mm, 10 mm steps) and sports (135-185 mm, step-less with indication click each 2.5 mm).
- 0-watt start up system. This option drives the ergometer without load (0 watt) up to any preset velocity between 30-80 rpm.
- Comfort set. More suitable for elderly subjects and non cyclists, the Excalibur Sport can be supplied with Lode's standard handlebar and saddle, ensuring a more comfortable seating position for these test subjects.

Cycle Ergometer for Education (1 unit)

Requirements:

- Proven accuracy and reliability for fitness tests and work-tests.
- Easy to calibrate.
- Workloads (up to 1400 Watt) – stable frame.
- Adjustable seat height and handlebar.
- Display: Heart rate, pedal turns/min.; cycling speed, cycling time; power.



Ferial Darwish





Excalibur Cycle Ergometer for Researcher and Sport

Heart Rate Monitors for Research

- Get a comprehensive physiological analysis of your training on your PC
- Monitor your real-time Training Effect and EPOC
- Use the altimeter to monitor your hill and altitude performance
- Measure your speed, distance, and cadence with optional Suunto PODs
- Customizable screen layout for individual information needs
- Pair with the included Suunto Comfort Belt to calculate real-time heart rate and calorie consumption
- Colour options: Fusion, Black and Red Arrow
- Available also in Suunto Performance Packs - ready to go solutions with PODs for triathlon, cycling, running, and multi-sport

Heart Rate Monitors for Teaching / Education RS 100

- The RS100 is a simple, no-fuss solution that's perfect for entry level runners who want to get on the right track to fitness. It comes with a variety of uncomplicated yet highly effective features.
- Measures your heart rate combined with flexible timing features
- Automatically sets your heart rate aerobic zones depending on how hard you want to train
- Shows you how many calories and the percentage of fat you've burned
- Calculate your time spent on each exercise, how well you've kept to certain sport zones and how many calories you've burned
- Records up to 99 lap/splits for every training session so you can work to improve on your best time and monitor your heart rate over time.



Heart Rate Monitor (Polar RS100)

Suunto t6 – (http://www.suunto.com/suunto/main/index.jsp?bmLocale=de_DE)

- The professional's choice
- The Suunto t6 provides a sports-laboratory-accurate assessment of your cardiovascular training, guiding you toward optimal condition in the shortest time possible. Unique among personal training devices, the Suunto t6 calculates seven different body parameters including:
 - Heart Rate
 - Energy consumption
 - Ventilation
 - Oxygen consumption (VO₂)
 - Respiratory rate
 - Training Effect
 - EPOC (Excess Post-exercise Oxygen Consumption)



Coupled with Suunto Training Manager PC software, the Suunto t6 helps you or your trainer create and continuously update the ideal training program. Wristop features include dual time, date, alarm, stopwatch with splits and laps, altimeter with hill and altitude performance, barometer and thermometer. Speed and distance are available with optional Suunto PODs.

Exercise ECG

Features: (has to be used with PC, and printer, additional work station)

- PC-based or standalone operation
- 12 simultaneous leads
- Resting ECG including interpretation (optional) for children and adults
- ECG Measurement program included in standard version
- Exercise ECG for treadmill and bicycle
- Printout on laser or inkjet printer
- On-screen editing
- On-board data management
- Fully automatic exercise testing program

RS-232 port for peripheral devices such as treadmills, bicycles etc.

For exercise ECG, several standard protocols are available for bicycle and treadmill ergometers; the user can either select a standard protocol from a table or define a new protocol

J-point settings: J+20,+40,+60,+80 ms; default: +60 ms

Blood pressure (Blood pressure measurement: Automatic if a bicycle contains an interface for the blood pressure transfer or manual)

10-sec. printout: A 10-sec. printout can be initiated at any time on the internal thermal printer

Spirometry

- Unique disposable sensor SP-250 minimizes the risk of contamination

- SP-260 with reusable sensor
- Simple and fast calibration
- Memory for up to 40 records

Inspiratory and expiratory tests; pre and post medication tests

- Selectable predicted value tables
- Real-time curves and measurement
- information on the large screen

The skinfold technique

The skinfold technique assesses the thickness of skinfolds taken at various parts of the body. This method is quicker, with a slightly higher margin of error. ($\pm 3.5\%$ error)

CALIPER FOR RESEARCH

Feature:

- accurate measurement of subcutaneous tissue. ($\pm 1\text{mm}$)
- easy-to-read scale up to 60mm
- constant standard pressure
 - Lange Skinfold Caliper (http://www.beta-technology.com/lange_caliper.html)
 - Jamar® Medical Skinfold Caliper 5028
 - Harpenden Skinfold Caliper
 - Skyndex Skinfold Caliper

CALIPER FOR EDUCATION

Very accurate low cost calliper. Accurate enough for professional use. This is the most widely used professional calliper in the world.

BONE CALIPER (1 unit large, 1 small)

Campell 20 (wide sliding)

Campell 10 (small bone)

<http://www.quickmedical.com/anthropometry/>

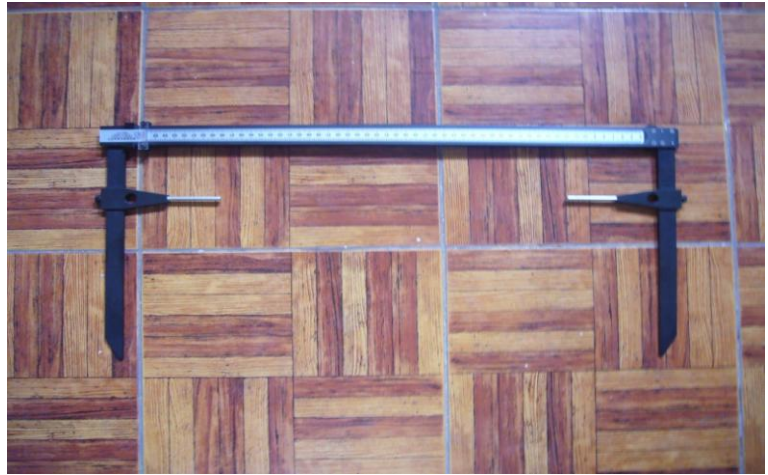
<http://www-rohan.sdsu.edu/~lcarter/kina/catalog.pdf>

http://www-rohan.sdsu.edu/~lcarter/kina/rosscraft_products_update.pdf



Small Bone Calliper Campbell 10

Large Bone Calliper



Large Skin Fold Calliper for Research

Hand-grip Dynamometer

- α) Jamar Hydraulic Hand Dynamometer
- β) Jamar Plus digital Hand dynamometer
- γ) Smedley Spring Dynamometer
- δ) Noraxon (combining dynamometer / flexometer / goniometer)

<http://www.nexgenergo.com/medical/jamar.html>

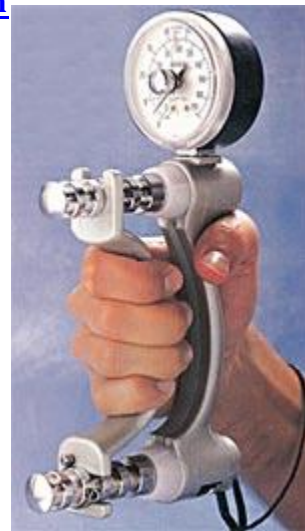
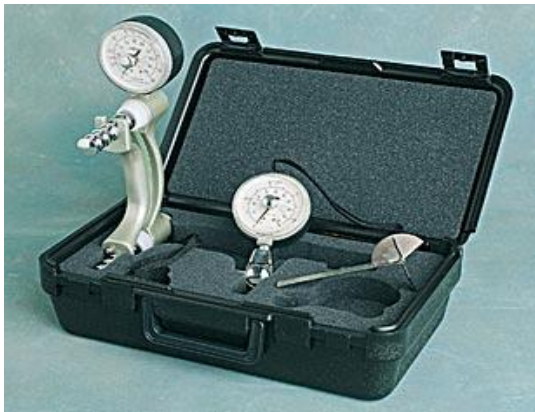
<http://www.nexgenergo.com/medical/baseline1.html>

<http://www.velamed.com/downloads/SensorAds.pdf>

<http://www.nexgenergo.com/medical/baseline17.html>

<http://www.noraxon.com/products/sensors/dynamometer.php>

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Handgrip Dynamometer Jamar Hydraulic Dynamometer



Digital Goniometer



Portable Defibrillator

Body Composition "Inbody"

Body composition testing (also referred to as percent body fat testing) can be performed using several techniques. Body composition methods available at SFSU include: (1) hydrostatic weighing, (2) air displacement plethysmography, and (3) the skinfold technique.

- Accurately assess body-composition, and body fat in particular but also Fat Mass, Fat Free Mass, Fat%, Total Body Water
- Features:
- Accurately quantify and localize adipose tissue stores
- High predictive value
- Low cost
- Easy and quick to perform.



Balance Testing

Standardised test results are what help recognise movement deficiencies. Within 30 seconds, stability, symmetry and sensorimotor functions are individually measured.

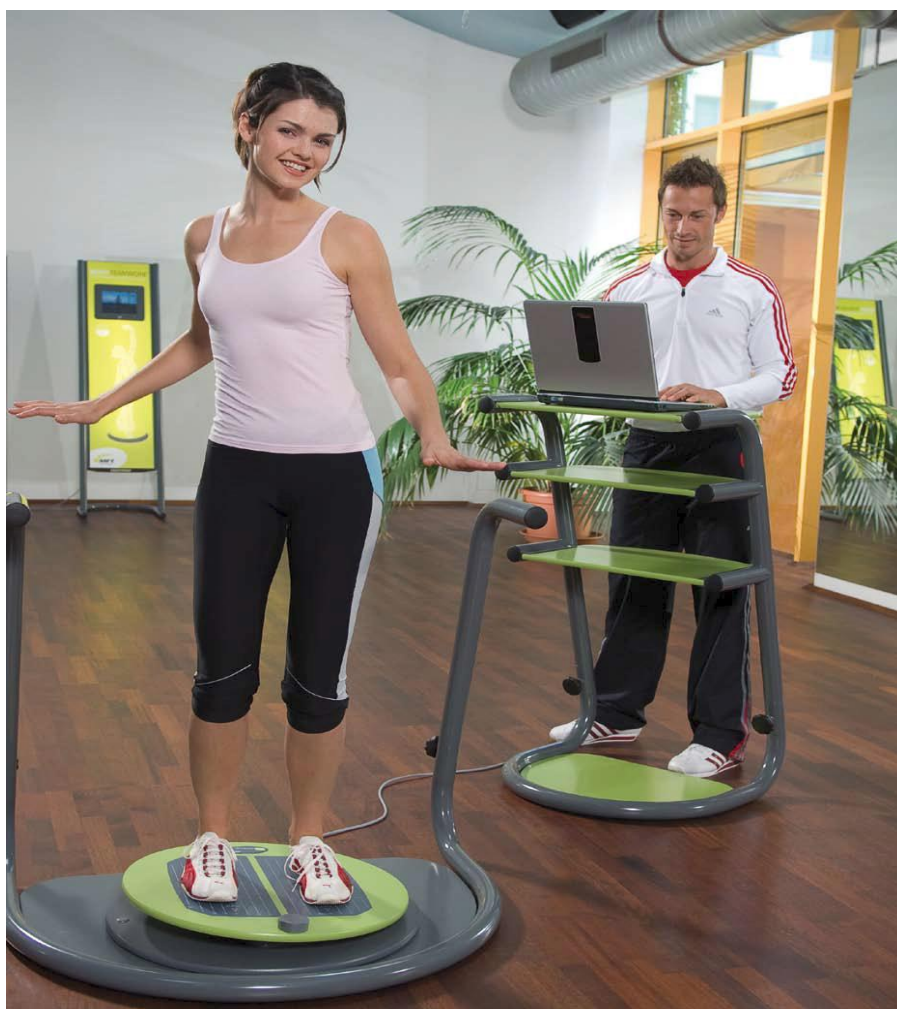
These separate results are then combined for an overall S3 score, which can be compared to an international coordination standard.

Always being able to compare ones results to an overall standard means that success in training and *physical therapy are always easily monitored. A training program is automatically generated from test scores.*

Measures:

- Back and Forward balance.
- Right and Left balance.
- Single Leg balance.
- Measurement of stability
- Symmetry
- Sensomotorics





EMG Measurement:

Measures:

- Maximum EMG level
- Average EMG level
- Minimum EMG level
- Median EMG value.
- Number of the maximum EMG peaks
- Onset time,
- Activation order of the muscles.
- Work/ Load of a selected muscle.
- Median frequency,
- Mean power frequency,
- Fatigue analysis
-



Lactate Measurement

However if it is not planned to draw blood samples on a routine basis portable devices which are much cheaper make sense are in the meantime accurate and are not that expensive although the price for the single sample is more costly.

Measures:

- Measuring the ratio of lactic acid in the blood.
- Calculate the proportion of lactic acid in the blood before - during and after the performance of the effort.



Portable Lactate Measuring Unit

Portable Cardio Pulmonary Exercise Testing

Features:

- Pulmonary Gas Exchange (VO_2 , VCO_2)
- Breath by Breath Technology
- Telemetry Data Transmission up to 800m
- Indirect Calorimetry
- Integrated GPS System
- Integrated Oxygen Saturation (SpO_2)
- Integrated 12-lead Stress Testing ECG

<http://www.cosmed.it/products.cfm?p=1&fi=1&a=1&cat=1>

<http://www.jaeger-toennies.com/english/products/cardio-respiratory/cardiopulmonary-ex-testing/oxycon-mobile/oxycon-mobile.html>

http://www.jaeger-toennies.com/produkt-pdf/cardio/de/oxyconmobile_d.pdf

http://www.viasyshealthcare.com/prod_serv/downloads/286_DE_Oxycon_Mobile_Brochure.pdf



Measures:

- VT (Tidal volume),
- BF (Breathing Frequency),
- $\text{V}'\text{E}$ (Minute Ventilation),
- $\text{V}'\text{max}$ (Expiratory peak flow),
- BR (Breath reserve),
- $\text{V}'\text{O}_2$ (Oxygen uptake),

Measures:

- FVC= Forced Expiratory Vital Capacity
- FEV1= Forced Expiratory Volume in 1 sec
- FEV1/FVC%= FEV1 as a percentage of FVC
- PEF= Peak Expiratory Flow
- FEV0.5= Forced Expiratory Volume in 0.5 sec.
- FEV6= Forced Expiratory Volume in 6 sec
- FEV1/FEV6= FEV1 as a percentage of FEV6
- FEV6/FVC%= FEV6 as a percentage of FVC
- Best FVC= Best Forced Expiratory Vital Capacity
- Best FEV1= Best Forced Expiratory Volume in 1 sec
- Best PEF= Best Peak Expiratory Flow
- Vmax25%= Expiratory Flow @25% of the FVC
- Vmax50%= Expiratory Flow @50% of the FVC
- Vmax75%= Expiratory Flow @75% of the FVC
- FEF25-75%= Mid-exp flow between 25-75%FVC
- FET100%= Forced expiratory time
- ERV= Expiratory Reserve Volume
- IRV= Inspiratory Reserve Volume
- IC= Inspiratory Capacity
- VE= Expiratory Minute Ventilation
- Vt= Tidal Volume
- Rf= Respiratory Frequency
- Ti= Duration of Inspiration
- Te= Duration of Expiration
- Ttot= Duration of Total breathing cycle
- Ti/T_{tot} = Ti/T_{tot} ratio
- Vt/ti = Vt/ti ratio



Basic Lung Function Testing Desktop Spirometer

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- FEV6= Forced Expiratory Volume in 6 sec
- FEV1/FEV6= FEV1 as a percentage of FEV6
- FEV6/FVC%= FEV6 as a percentage of FVC
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- Vmax75%= Expiratory Flow @75% of the FVC
- FEF25-75%= Mid-exp flow between 25-75%FVC
- FET100%= Forced expiratory time
- ERV= Expiratory Reserve Volume
- IRV= Inspiratory Reserve Volume
- IC= Inspiratory Capacity
- VE= Expiratory Minute Ventilation
- Vt= Tidal Volume
- Rf= Respiratory Frequency
- Ti= Duration of Inspiration
- Te= Duration of Expiration
- Ttot= Duration of Total breathing cycle
- Ti/Ttot= Ti/Ttot ratio
- Vt/ti= Vt/ti ratio



Basic Lung Function Testing Desktop Spirometer

Accelerometer Actigraph (GTX3)

Measures:

monitors are designed to monitor human activity and record energy expenditure :
(calories spent during normal, everyday activity and exercise).



Accelerometer Actigraph (GTX3)

Sam Deluxe Skeleton, on 5 feet roller Stand with brake



Complete Dual Sex Muscular, with Internal Organs, 33 part.

Blood Pressure Arm

