A booklet to be used as part of theory or practical Btec First in Sport lessons. Covering content from Unit 1: Fitness for Sport and Exercise, specifically focusing on Learning aim C: Investigate fitness testing to determine fitness levels.
CONTENTS

THE TESTS

35m Sprint 2
Illinois Agility 3
Sit and Reach 4
Grip Dynamometer 5
Multi-Stage Fitness Test 6
Forestry Step Up test 7
One Minute Press Up 8
One Minute Sit Up 9
BMI 10
Vertical Jump 11

**********

Additional Information

Bioelectrical Impedance Analysis (BIA) 12
Skinfold Testing – Jackson Pollock Nomogram 12-14
VO2 Max 15
Forestry Step Test normative data 16-17

**********

Advantages and Disadvantages of Tests 18-21
# 35m SPRINT

## Purpose of the test –
(What is it measuring/testing?)

## Pre-test procedure -
(Suggest 2 things you should do before performing/administering the test)

- 
- 

## Protocol –
(Fill in the missing words)

- The athlete _________ for 10 minutes
- The assistant marks a 35 metres straight section with cones
- The athlete takes up a **sprint start position**
- The assistant gives the commands “___________, _____, ____” and starts the stopwatch
- The athlete sprints the ___ metres
- The assistance stops the stopwatch when the athlete’s _______ crosses the finishing line and records the time
- The athlete conducts 3 x 35metre sprints with a 5 minute _________ between each sprint
- The assistant uses the _________ time to assess the athlete’s performance

Missing words: fastest, warms up, recovery, take your marks, torso, go, set, 35.

## Equipment –
(List all equipment needed for the test)

## Normative data

<table>
<thead>
<tr>
<th></th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCELLENT</td>
<td>&lt;4.80</td>
<td>&lt;5.30</td>
</tr>
<tr>
<td>GOOD</td>
<td>4.80 - 5.09</td>
<td>5.30 - 5.59</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>5.10 - 5.29</td>
<td>5.60 - 5.89</td>
</tr>
<tr>
<td>FAIR</td>
<td>5.30 - 5.60</td>
<td>5.90 - 6.20</td>
</tr>
<tr>
<td>POOR</td>
<td>&gt; 5.60</td>
<td>&gt; 6.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Your score:</th>
<th>Your rating:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Advantages of the test -
(Consider factors that might make the test practical to perform/administer)

✓
✓

## Disadvantages of the test -
(Consider factors that might make the results unreliable?)

✗
✗
### ILLINOIS AGILITY TEST

<table>
<thead>
<tr>
<th>Purpose of the test – (What is it measuring/testing?)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test procedure- (Suggest 2 things you should do before performing/administering the test)</td>
<td>•</td>
</tr>
<tr>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>
| Protocol – (fill in the missing words) | • The assistants sets up the ______ as detailed in the diagram.  
• The athlete lies __________ on the floor at the “Start” cone.  
• The assistant gives the command “GO” and starts the ______.  
• The athlete ______ to his/her feet and negotiates the course around the cones following the red line route shown in the diagram to the finish  
• The assistant stops the stopwatch and records the time when the athlete passes the “Finish” cone.  
Missing words: course, jumps, stopwatch, face down.  |
| Equipment – (List all equipment needed for the test) |  |
| Normative data | Your score: ___________  
Your rating: ___________  |
| | ![Diagram of agility test course]  |
| **EXCELLENT** | **ABOVE AVERAGE** | **AVERAGE** | **BELOW AVERAGE** | **POOR** |
| **MALE** | <15.2 sec | 15.2 - 16.1 secs | 16.2 - 18.1 secs | 18.2 - 19.3 secs | >19.3 secs |
| **FEMALE** | <17.0 secs | 17.0 - 17.9 secs | 18.0 - 21.7 secs | 21.8 - 23.0 secs | >23.0 secs |
| Advantages of the test- (Consider factors that might make the test practical to perform/administer) | ✓  |
|  |
| Disadvantages of the test- (Consider factors that might make the results unreliable?) | ✗  | ✗  |
# SIT AND REACH TEST

## Purpose of the test –
(What is it measuring/testing?)

## Pre-test procedure-
(Suggest 2 things you should do before performing/administering the test)

1. 
2. 

## Protocol –
(Fill in the missing words)

- The athlete warms up for 10 minutes and then removes their _____
- The assistant secures the ruler to the box top with the tape so that the front edge of the box lines up with the 15cm (6 inches) mark on the ruler and the zero end of the ruler points towards the athlete
- The athlete sits on the floor with their legs fully ________ with the bottom of their bare feet against the box
- The athlete places one hand on top of the other, slowly bends forward and ________ along the top of the ruler as far as possible holding the stretch for two seconds
- The assistant records the distance reached by the athlete's finger ______ (cm)
- The athlete performs the test three times
- The assistant calculates and records the ______ of the three distances and uses this value to assess the athlete's performance

Missing words: tips, extended, reaches, average, shoes.

## Equipment –
(List all equipment needed for the test)

## Normative data

<table>
<thead>
<tr>
<th>Gender</th>
<th>Excellent</th>
<th>Above average</th>
<th>Average</th>
<th>Below average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>&gt;14</td>
<td>14.0 - 11.0</td>
<td>10.9 - 7.0</td>
<td>6.9 - 4.0</td>
<td>&lt;4</td>
</tr>
<tr>
<td>Female</td>
<td>&gt;15</td>
<td>15.0 - 12.0</td>
<td>11.9 - 7.0</td>
<td>6.9 - 4.0</td>
<td>&lt;4</td>
</tr>
</tbody>
</table>

## Advantages of the test-
(Consider factors that might make the test practical to perform/administer)

✓

✓

## Disadvantages of the test-
(Consider factors that might make the results unreliable?)

✗
# Unit 1: Fitness for Sport and Exercise

## GRIP DYNAMOMETER

| Purpose of the test –  
(What is it measuring/testing?) |  |
|---------------------------------|---|

| Pre-test procedure- 
(Suggest 2 things you should do before performing/administering the test) |  |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>●</td>
<td></td>
</tr>
<tr>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

| Protocol –  
(Fill in the missing words) |  |
|---------------------------------|---|
|  ● The athlete using their _________ hand applies as much grip pressure as possible on the dynamometer.  
  ● The assistant records the _________ reading (kg).  
  ● The athlete repeats the test ___ times.  
  ● The assistant uses the _________ recorded value to assess the athlete’s performance. |  |

Missing words: highest, maximum, 3, dominant.

| Equipment –  
(List all equipment needed for the test) |  |
|---------------------------------|---|

| Normative data | Your score: ___________  
Your rating: ___________ |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td><strong>Excellent</strong></td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>&gt;56</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>&gt;36</td>
</tr>
</tbody>
</table>

| Advantages of the test-  
(Consider factors that might make the test practical to perform/administer) | ✓ |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

| Disadvantages of the test-  
(Consider factors that might make the results unreliable?) | ✗ |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>✗</td>
<td></td>
</tr>
</tbody>
</table>
### MULTI-STAGE FITNESS TEST

#### Purpose of the test –
(What is it measuring/testing?)

#### Pre-test procedure-
(Suggest 2 things you should do before performing/administering the test)

- 
- 

#### Protocol –
(Fill in the missing words)

- The assistant measure out a _______ section and marks each end with marker cones
- The assistant starts the _____ and the athlete commences the test
- If the athlete arrives at the end of a _______ before the beep, the athlete must wait for the beep and then resume running
- If the athlete fails to reach the end of the shuttle before the beep they should be allowed _________ further shuttles to attempt to regain the required pace before being withdrawn
- The assistant records the level and number of shuttles completed at that level by the athlete when they are ___________

Missing words: shuttle, withdrawn, 20 metre, 2 or 3, CD.

#### Equipment –
(List all equipment needed for the test)

#### Normative data

<table>
<thead>
<tr>
<th>Age</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 - 16</td>
<td>L12 S7</td>
<td>L11 S2</td>
<td>L8 S9</td>
<td>L7 S1</td>
<td>&lt; L6 S6</td>
</tr>
<tr>
<td>17 - 20</td>
<td>L12 S12</td>
<td>L11 S6</td>
<td>L9 S2</td>
<td>L7 S6</td>
<td>&lt; L7 S3</td>
</tr>
<tr>
<td>21 - 30</td>
<td>L12 S12</td>
<td>L11 S7</td>
<td>L9 S3</td>
<td>L7 S8</td>
<td>&lt; L7 S5</td>
</tr>
<tr>
<td>31 - 40</td>
<td>L11 S7</td>
<td>L10 S4</td>
<td>L6 S10</td>
<td>L6 S7</td>
<td>&lt; L6 S4</td>
</tr>
<tr>
<td>41 - 50</td>
<td>L10 S4</td>
<td>L9 S4</td>
<td>L6 S9</td>
<td>L5 S9</td>
<td>&lt; L5 S2</td>
</tr>
</tbody>
</table>

(results for males)

### Advantages of the test-
(Consider factors that might make the test practical to perform/administer)

✓

✓

### Disadvantages of the test-
(Consider factors that might make the results unreliable?)

✗
FORESTRY STEP TEST

Purpose of the test –
(What is it measuring/testing?)

Pre-test procedure -
(Suggest 2 things you should do before performing/administering the test)

●
●

Protocol –
(Fill in the missing words)

● Participant steps up and down on a ________/ step for five minutes.
● Participant steps up and down in time with the beat of a _______________ set at 90bpm (approximately 22.5 steps per minute).
● Ensure feet are wholly on the bench each time. Participant is allowed to change lead leg.
● At the end of _______ minutes participant sits on bench. Locate pulse and start counting within 10 seconds of completion.
● Record __________ over one minute.
● Compare to ______________- use your age, post exercise heart rate and body weight to calculate maximal aerobic power using the tables.
● Refer to norm chart for your age.

Missing words: VO₂max tables, metronome, pulse, bench, five.

Equipment –
(List all equipment needed for the test)

Normative data

<table>
<thead>
<tr>
<th>Maximum Oxygen consumption (ml/kg/min)</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>57+</td>
<td>54+</td>
</tr>
<tr>
<td>20</td>
<td>56+</td>
<td>53+</td>
</tr>
<tr>
<td>Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>56-52</td>
<td>53-49</td>
</tr>
<tr>
<td>Very good</td>
<td>51-47</td>
<td>48-44</td>
</tr>
<tr>
<td>Good</td>
<td>46-42</td>
<td>43-39</td>
</tr>
<tr>
<td>Fair</td>
<td>41-37</td>
<td>38-34</td>
</tr>
<tr>
<td>Poor</td>
<td>36-32</td>
<td>33-29</td>
</tr>
<tr>
<td>Very poor</td>
<td>&lt;32</td>
<td>&lt;31</td>
</tr>
</tbody>
</table>

Advantages of the test -
(Consider factors that might make the test practical to perform/administer)

✓
✓

Disadvantages of the test -
(Consider factors that might make
# ONE-MINUTE PRESS UP

- **Purpose of the test** — (What is it measuring/testing)
- **Pre-test procedure** — (Suggest 2 things you should do before performing/administering the test)
- **Protocol** — (Fill in the missing words)
- **Equipment** — (List all equipment needed for the test)
- **Normative data**

**Your score:** ____________  ____________  ____________  ____________  ____________  ____________  ____________  ____________  ____________

<table>
<thead>
<tr>
<th>Age</th>
<th>Excellent</th>
<th>Good</th>
<th>Average</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 29</td>
<td>&gt;54</td>
<td>45 - 54</td>
<td>35 - 44</td>
<td>20 - 34</td>
<td>&lt;20</td>
</tr>
<tr>
<td>30 - 39</td>
<td>&gt;44</td>
<td>35 - 44</td>
<td>25 - 34</td>
<td>15 - 24</td>
<td>&lt;15</td>
</tr>
<tr>
<td>40 - 49</td>
<td>&gt;39</td>
<td>30 - 39</td>
<td>20 - 29</td>
<td>12 - 19</td>
<td>&lt;12</td>
</tr>
<tr>
<td>50 - 59</td>
<td>&gt;34</td>
<td>25 - 34</td>
<td>15 - 24</td>
<td>8 - 14</td>
<td>&lt;8</td>
</tr>
<tr>
<td>60+</td>
<td>&gt;29</td>
<td>20 - 29</td>
<td>10 - 19</td>
<td>5 - 9</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

**Advantages of the test** — (Consider factors that might make the test practical to perform/administer)

✓

✓

**Disadvantages of the test** — (Consider factors that might make the results unreliable)

✗

✗
# ONE-MINUTE SIT UP

## Purpose of the test –
(What is it measuring/testing?)

## Pre-test procedure-
(Suggest 2 things you should do before performing/administering the test)

- 
- 

## Protocol –
(Fill in the missing words)

- Lie on a carpeted or cushioned floor with your ____________ bent at approximately right ____________, with feet flat on the ground.
- Your hands should be resting on your thighs.
- Squeeze your ____________, push your back flat and raise high enough for your hands to slide along your thighs to touch the _________ of your knees.
- Don’t _________ with you neck or head and keep your lower back on the floor. Then return to the starting position.

Missing words: tops, angles, pull, knees, stomach.

## Equipment –
(List all equipment needed for the test)

## Normative data

<table>
<thead>
<tr>
<th>Age</th>
<th>18-25</th>
<th>26-35</th>
<th>36-45</th>
<th>46-55</th>
<th>56-65</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>&gt;49</td>
<td>&gt;45</td>
<td>&gt;41</td>
<td>&gt;35</td>
<td>&gt;31</td>
<td>&gt;28</td>
</tr>
<tr>
<td>Good</td>
<td>44-49</td>
<td>40-45</td>
<td>35-41</td>
<td>29-35</td>
<td>25-31</td>
<td>22-28</td>
</tr>
<tr>
<td>Average</td>
<td>35-38</td>
<td>31-34</td>
<td>27-29</td>
<td>22-24</td>
<td>17-20</td>
<td>15-18</td>
</tr>
<tr>
<td>Below Average</td>
<td>31-34</td>
<td>29-30</td>
<td>23-26</td>
<td>18-21</td>
<td>13-16</td>
<td>11-14</td>
</tr>
<tr>
<td>Poor</td>
<td>25-30</td>
<td>22-28</td>
<td>17-22</td>
<td>13-17</td>
<td>9-12</td>
<td>7-10</td>
</tr>
<tr>
<td>Very Poor</td>
<td>&lt;25</td>
<td>&lt;22</td>
<td>&lt;17</td>
<td>&lt;13</td>
<td>&lt;9</td>
<td>&lt;7</td>
</tr>
</tbody>
</table>

(Results for males)

## Advantages of the test-
(Consider factors that might make the test practical to perform/administer)

✓

✓

## Disadvantages of the test-
(Consider factors that might make
| Purpose of the test —   
(What is it measuring/testing?) | BMI |
|---------------------------|-----|
| Pre-test procedure-       
(Suggest 2 things you should do before performing/administering the test) | •    |
| Protocol —                
(Fill in the missing words) | • BMI stands for Body _______ Index. It is a measure of body composition.  
• BMI is calculated by taking a person’s ___________ and dividing by their height squared. For instance, if your height is 1.82 meters, the divisor of the calculation will be (1.82 * 1.82) = 3.3124. If your weight is 70.5 kilograms, then your BMI is 21.3 (70.5 / 3.3124) (see calculator links below).  
• The ___________ the figure the more overweight you are.  
• Like any of these types of measures it is only an indication and other issues such as body type and shape have a bearing as well.  
• Remember, BMI is just a guide - it does not accurately apply to elderly populations, pregnant women or very ___________ athletes such as weight lifters. |
| Missing words: Weight, higher, muscular, mass. | |
| Equipment —              
(List all equipment needed for the test) | |
| Normative data           | Your score: ___________ Your rating: ___________ |
|                          | **BMI score** |
| Underweight              | < 18.5       |
| Ideal weight             | 18.5 – 24.9  |
| Over ideal weight        | 25 – 29.9    |
| Obese                    | 30 – 39.9    |
| Very obese               | 39.9 <       |
| (NHS Direct 2011)        | |
| Advantages of the test-  
(Consider factors that might make the test practical to perform/administer) | ✓ |
| Disadvantages of the test- | X |
**VERTICAL JUMP TEST**

**Purpose of the test** –
(What is it measuring/testing?)

**Pre-test procedure** -
(Suggest 2 things you should do before performing/administering the test)

- 
- 

**Protocol** –
(Fill in the missing words)

- The athlete chalks the end of his/her finger tips
- The athlete stands ________ onto the wall, keeping both feet remaining on the ground, reaches up as high as possible with one hand and marks the wall with the ________ of the fingers
- The athlete from a ___________ position jumps as high as possible and marks the wall with the chalk on his fingers
- The assistant measures and records the distance __________ the two marks
- The athlete repeats the test 3 times
- The assistant calculates the __________ of the recorded distances and uses this value to assess the athlete’s performance

Missing words: between, side, average, static, tips.

**Equipment** –
(List all equipment needed for the test)

**Normative data**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Excellent</th>
<th>Above average</th>
<th>Average</th>
<th>Below average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>&gt;65cm</td>
<td>56 - 65cm</td>
<td>50 - 55cm</td>
<td>49 - 40cm</td>
<td>&lt;40cm</td>
</tr>
<tr>
<td>Female</td>
<td>&gt;60cm</td>
<td>51 - 60cm</td>
<td>41 - 50cm</td>
<td>35 - 40cm</td>
<td>&lt;35cm</td>
</tr>
</tbody>
</table>

The following table is for 15 to 16 year olds (Beashel 1997)

**Advantages of the test** -
(Consider factors that might make the test practical to perform/administer)

✓

✓

**Disadvantages of the test** -
(Consider factors that might make
the results unreliable?)

✗
ADDITIONAL FITNESS TESTING POSSIBILITIES

BODY COMPOSITION

BIOELECTRICAL IMPEDENCE ANALYSIS – PREDICTION OF PERCENTAGE BODY FAT

Body fat scales use the Bioelectrical Impedance Analysis (BIA) technique. This method measures body composition by sending a low, safe electrical current through the body. The current passes freely through the fluids contained in muscle tissue, but encounters difficulty/resistance when it passes through fat tissue. This resistance of the fat tissue to the current is termed 'bioelectrical impedance', and is accurately measured by body fat scales. When set against a person’s height, gender and weight, the scales can then compute their body fat percentage.

SKINFOLD TESTING - JACKSON-POLLOCK NOMOGRAM - PREDICTION OF PERCENTAGE BODY FAT

Skinfold testing can be used to predict percent body fat. In this section you will be using the Jackson-Pollock nomogram method to predict your percent body fat.

PROTOCOL

- Measurements should be taken on dry skin on the right side of the body. Exceptions to this would be if the participant has a tattoo or deformity on the site location, which means the left side of the body would need to be used.
- The participant should keep their muscles relaxed during the test.
- Mark each skinfold site with a pen and use a tape measure to find the mid-points.
- Grasp the skinfold firmly between your thumb and index finger and gently pull away from the body. The skinfold should be grasped about 1 cm away from the site marked.
- Place the skinfold callipers perpendicular to the fold, on the site marked, with the dial facing upwards.
- Maintaining your grasp, place the callipers midway between the base and tip of the skinfold and allow the callipers to be fully released so that full tension is placed on the skinfold.
- Read the dial of the skinfold callipers to the nearest 0.5 mm, two seconds after you have released the callipers. Make sure you continue to grasp the skinfold throughout testing.
- Take a minimum of two measurements at each site. If repeated tests vary by more than 1 mm, repeat the measurement. If consecutive measurements become smaller, this means that the fat is being compressed, and the results will not be accurate. If this happens, go to another site and then come back to the site to be tested later.
- Make sure you record each measurement as it is taken.
- The final value is the average of the two readings (mm).

It is important to practise the technique for skinfold testing to ensure that results are valid and reliable.
**Skinfold site selection for males**

Male participants will need to gain skinfold results (mm) for the following three sites:

- **Chest** – A diagonal fold, which is one half of the distance between the anterior auxiliary line and the nipple. (The anterior auxiliary line is the crease where the top of your arm, when hanging down, meets the chest.) The chest skinfold is used only for males.

- **Abdominal** – A vertical fold, which is 2 cm to the right side of the umbilicus (belly button).

- **Thigh** – A vertical fold, on the front of the thigh, halfway between the hip joint and the middle of the knee cap. The leg needs to be straight and relaxed.

**Skinfold site selection for females**

Female participants will need to gain skinfold results (mm) for the following three sites:

- **Triceps** – A vertical fold on the back midline of the upper arm, over the triceps muscle, halfway between the acromion process (bony process on the top of the shoulder) and olecranon process (bony process on the elbow). The arm should be held freely by the side of the body.

- **Suprailiac** – A diagonal fold just above the hip bone and 2–3 cm forward.

- **Thigh** – A vertical fold, on the front of the thigh, halfway between the hip joint and the middle of the knee cap. The leg needs to be straight and relaxed.

**Results**

- Add up the sum of your three skinfolds (mm).
- Obtain your percent body fat result by plotting your age in years and the sum of the three skinfolds (mm) on the nomogram.
- Use a ruler and sharpened pencil to join up the two plots, which will cross over the percent body fat (wavy) vertical lines.
- Read your percent body fat result to the closest 0.5%, according to your gender.
Answer the following questions about the Jackson-Pollock Nomogram data above:

1. How old was the individual? _______________
2. What total did their three skinfold measurements add up to? _______________
3. If the individual was male, what would their body fat percentage? _______________
4. If the individual was female, what would be their body fat percentage? _______________
CARDIO-RESPIRATORY ENDURANCE - VO2 MAX

Definition: VO2 max is the maximal oxygen uptake or the maximum volume of oxygen that can be utilized in one minute during maximal or exhaustive exercise. Fitness can be measured by the volume of oxygen you can consume while exercising at your maximum capacity. It is measured as millilitres of oxygen used in one minute per kilogram of body weight (ml/kg/min).

VO2 max or maximal oxygen uptake is one factor that can determine an athlete’s capacity to perform sustained exercise and is linked to aerobic endurance. It is generally considered the best indicator of cardiorespiratory endurance and aerobic fitness.

Elite endurance athletes typically have a high VO2 max. And some studies indicate that it is largely due to genetics, although training has been shown to increase VO2 max up to 20 percent. A major goal of most endurance training programs is to increase this number.

Numerous studies show that you can increase your VO2 max by working out at an intensity that raises your heart rate to between 65 and 85% of its maximum for at least 20 minutes three to five times a week. A mean value of VO2 max for male athletes is about 3.5 litres/minute and for female athletes it is about 2.7 litres/minute.

Measuring VO2 max

Accurately measuring VO2 max involves a physical effort sufficient in duration and intensity to fully tax the aerobic energy system. In general clinical and athletic testing, this usually involves a graded exercise test (either on a treadmill or on a cycle ergometer) in which exercise intensity is progressively increased while measuring ventilation and oxygen and carbon dioxide concentration of the inhaled and exhaled air. VO2 max is reached when oxygen consumption remains at steady state despite an increase in workload.

Tests measuring VO2 max can be dangerous in individuals who are not considered normal healthy subjects, as any problems with the respiratory and cardiovascular systems will be greatly exacerbated in clinically ill patients. Thus, many protocols for estimating VO2 max have been developed for those for whom a traditional VO2 max test would be too risky. These generally are similar to a VO2 max test, but do not reach the maximum of the respiratory and cardiovascular systems and are called sub-maximal tests.

There are several other reliable tests and VO2 max calculators to estimate VO2 max, most notably the multi-stage fitness test (or beep test), based on the research paper by Leger and Lambert, "A Maximal Multi-Stage 20-m Shuttle Run Test to predict VO2 Max”.

ANSWER THE FOLLOWING QUESTIONS BY USING THE TEXT ABOVE. WRITE THE ANSWER IN THE SPACE BELOW BUT ALSO UNDERLINE IT WITHIN THE TEXT.

1. To improve VO2 max what recommendations are made in relation to:
   a. Frequency – ______________________________
   b. Intensity – ______________________________
   c. Time – ______________________________

2. What units is VO2 measured in?
   ______________________________

3. Instead of testing VO2 in a lab, what test could we do as an estimate of your VO2 max?
   ______________________________

4. Would it be safe for anyone to be tested for their VO2 max? explain your answer below:
   ______________________________
### FORESTRY STEP TEST—Normative data

**VO₂max tables- Forestry Non- adjusted Aerobic Fitness Values (ml/kg/ min) for Men**

<table>
<thead>
<tr>
<th>Pulse count</th>
<th>Maximal Oxygen Consumption (VO₂max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>33 33 33 33 33 32 32 32 32 32 32 32</td>
</tr>
<tr>
<td>44</td>
<td>34 34 34 34 34 33 33 33 33 33 33 33 33 33</td>
</tr>
<tr>
<td>43</td>
<td>35 35 35 34 34 34 34 34 34 34 34 34 34 34</td>
</tr>
<tr>
<td>42</td>
<td>36 36 35 35 35 35 35 35 35 35 35 35 35 35</td>
</tr>
<tr>
<td>41</td>
<td>36 36 36 36 36 36 36 36 36 36 36 36 35 35</td>
</tr>
<tr>
<td>41</td>
<td>37 37 37 37 37 37 37 37 37 37 37 37 37 37</td>
</tr>
<tr>
<td>39</td>
<td>38 38 38 38 38 38 38 38 38 38 38 38 37 37</td>
</tr>
<tr>
<td>37</td>
<td>41 40 40 40 40 40 40 40 40 40 40 40 39 39</td>
</tr>
<tr>
<td>36</td>
<td>42 42 41 41 41 41 41 41 41 41 41 41 40 40</td>
</tr>
<tr>
<td>35</td>
<td>43 43 42 42 42 42 42 42 42 42 42 42 41 41</td>
</tr>
<tr>
<td>34</td>
<td>44 44 43 43 43 43 43 43 43 43 43 43 43 43</td>
</tr>
<tr>
<td>33</td>
<td>46 45 45 45 45 45 45 44 44 44 44 44 44 44</td>
</tr>
<tr>
<td>32</td>
<td>47 47 46 46 46 46 46 46 46 46 46 46 46 46</td>
</tr>
<tr>
<td>31</td>
<td>48 48 48 47 47 47 47 47 47 47 47 47 47 47</td>
</tr>
<tr>
<td>30</td>
<td>50 49 49 49 48 48 48 48 48 48 48 48 48 48</td>
</tr>
<tr>
<td>29</td>
<td>52 51 51 51 50 50 50 50 50 50 50 50 50 50</td>
</tr>
<tr>
<td>28</td>
<td>53 53 53 53 52 52 52 52 51 51 51 51 51 51</td>
</tr>
<tr>
<td>27</td>
<td>55 55 55 54 54 54 54 54 54 53 53 53 53 52</td>
</tr>
<tr>
<td>26</td>
<td>57 57 56 56 56 56 56 56 56 55 55 55 54 54</td>
</tr>
<tr>
<td>25</td>
<td>59 59 58 58 58 58 58 58 58 58 58 58 56 56</td>
</tr>
<tr>
<td>24</td>
<td>60 60 60 60 60 60 60 60 59 59 59 58 58 57</td>
</tr>
<tr>
<td>23</td>
<td>62 62 61 61 61 61 61 61 60 60 60 60 60 59</td>
</tr>
<tr>
<td>22</td>
<td>64 64 63 63 63 63 63 62 62 62 61 61 61 61</td>
</tr>
<tr>
<td>21</td>
<td>66 66 65 65 65 65 64 64 64 64 64 64 62</td>
</tr>
<tr>
<td>20</td>
<td>68 68 67 67 67 67 66 66 66 66 66 66 66 65</td>
</tr>
</tbody>
</table>

(Pulse count is for 15 seconds – for ‘ratings’ refer back to the fitness test sheet earlier in this booklet).

**Answer the following:**

For a 15yr old male who had a pulse count of 23, weight of 160lbs – what would be his rating?
### VO$_{2\text{max}}$ table- Forestry Non- adjusted Aerobic Fitness Values (ml/kg/ min) for Women

<table>
<thead>
<tr>
<th>Pulse count</th>
<th>HR (bpm)</th>
<th>Maximal Oxygen Consumption (VO$_{2\text{max}}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>180</td>
<td>29 29 29</td>
</tr>
<tr>
<td>44</td>
<td>176</td>
<td>30 30 30</td>
</tr>
<tr>
<td>43</td>
<td>172</td>
<td>31 31 31</td>
</tr>
<tr>
<td>42</td>
<td>168</td>
<td>32 32 32</td>
</tr>
<tr>
<td>41</td>
<td>164</td>
<td>33 33 33</td>
</tr>
<tr>
<td>41</td>
<td>160</td>
<td>34 34 34</td>
</tr>
<tr>
<td>39</td>
<td>156</td>
<td>35 35 35</td>
</tr>
<tr>
<td>39</td>
<td>152</td>
<td>36 36 36</td>
</tr>
<tr>
<td>37</td>
<td>148</td>
<td>37 37 37</td>
</tr>
<tr>
<td>36</td>
<td>144</td>
<td>38 38 38</td>
</tr>
<tr>
<td>35</td>
<td>140</td>
<td>39 39 39</td>
</tr>
<tr>
<td>34</td>
<td>136</td>
<td>40 40 40</td>
</tr>
<tr>
<td>33</td>
<td>132</td>
<td>41 41 41</td>
</tr>
<tr>
<td>32</td>
<td>128</td>
<td>42 42 42</td>
</tr>
<tr>
<td>31</td>
<td>124</td>
<td>43 43 43</td>
</tr>
<tr>
<td>30</td>
<td>120</td>
<td>44 44 44</td>
</tr>
<tr>
<td>29</td>
<td>116</td>
<td>45 45 45</td>
</tr>
<tr>
<td>28</td>
<td>112</td>
<td>46 46 46</td>
</tr>
<tr>
<td>27</td>
<td>108</td>
<td>47 47 47</td>
</tr>
<tr>
<td>26</td>
<td>104</td>
<td>48 48 48</td>
</tr>
<tr>
<td>25</td>
<td>100</td>
<td>49 49 49</td>
</tr>
<tr>
<td>24</td>
<td>96</td>
<td>50 50 50</td>
</tr>
<tr>
<td>23</td>
<td>92</td>
<td>51 51 51</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (lb)</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
<th>160</th>
<th>170</th>
<th>180</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>36.4</td>
<td>40.9</td>
<td>45.4</td>
<td>50</td>
<td>54.5</td>
<td>59.1</td>
<td>63.5</td>
<td>68.2</td>
<td>72.7</td>
<td>77.3</td>
<td>81.8</td>
<td>86.4</td>
</tr>
</tbody>
</table>

**Answer the following:**

For a 15yr old female who had a pulse count of 36, weight of 130lbs – what would be her rating?

__________
ADVANTAGES AND DISADVANTAGES OF EACH FITNESS TEST

35 m SPRINT

Advantages

● Minimal equipment required.
● Simple to set up and conduct.
● Can be conducted almost anywhere.

Disadvantages

● Specific facilities required - non slip surface.
● Human error in timekeeping can lead to incorrect or misleading results.
● Assistant required to administer the test.

ILLINOIS AGILITY

Advantages

● Minimal equipment required therefore cheap to conduct.
● Simple to set up and conduct.
● Can be conducted almost anywhere.

Disadvantages

● Human error can lead to inaccuracies in timing.
● Weather conditions and surface can affect the results.
● Assistant required to administer the test.

ONE MINUTE PRESS UP

Advantages

● No equipment required.
● Simple to set up and conduct.
● The test can be administered by the athlete.
● Can be conducted almost anywhere.

Disadvantages

● The press-up must be technically correct for it to count, and what makes a technically correct press-up is open to interpretation. This can lead to disputes about the total number.
● The performer will get tired if they stay in the ready position for too long. This can make testing many people simultaneously difficult.

For a 20yr old female who had a pulse count of 25, weight of 45.4kgs – what would be her rating?
ONE MINUTE SIT UP TEST

Advantages

- Minimal equipment required.
- Simple to set up and conduct.
- Can be conducted almost anywhere.

Disadvantages

- It can be difficult to determine when a correct sit-up has been performed so there may be a dispute about the total number.
- Assistant required to administer the test.

SIT AND REACH

Advantages

- Minimal equipment required.
- Simple to set up and conduct.
- Can be conducted almost anywhere.
- Well known test that often has lots of normative data to use for comparisons.

Disadvantages

- Specialist equipment required.
- Assistant required to administer the test.
- Variations in length of people’s arms, legs and trunk can make comparisons between people misleading.
- The test specifically looks at measuring just the lower back and hamstrings so it does not measure the flexibility of other parts of the body.

GRIP STRENGTH

Advantages

- Minimal equipment required.
- Simple to set up and conduct.
- Can be conducted almost anywhere.

Disadvantages

- Specialist equipment required.
- The dynamometer must be adjusted for hand size. How well this is done has an effect on the accuracy of the measurement
MULTI STAGE FITNESS TEST

Advantages

- Simple to set up and conduct.
- More than one athlete can conduct the test at the same time.
- Large groups can do it at the same time.
- Can be conducted indoors or outdoors.
- The test measures up to maximum capacity, unlike many other tests, which measure endurance.

Disadvantages

- Practise, motivation, and state of mind can massively influence the score attained.
- The scoring can be subjective.
- If the test is conducted outside, environmental conditions could affect the results.
- Specialist equipment required - CD & CD Player.
- Assistant required to administer the test.

FORESTRY STEP TEST

Advantages

- This simple test requires minimal equipment and costs.
- Can be performed indoors or out.
- It is possible to self-administer this test.

Disadvantages

- Some subjects may not have the fitness or coordination to maintain the required stepping rate.

BMI

Advantages

- Only simple calculations are required from standard height and weight measurements.

Disadvantages

- Muscle weighs more than fat.
- In certain populations BMI can be inaccurate as a measure of body fatness, for example large and muscular though lean athletes may score high BMI levels which incorrectly rates them as obese.
JACKSON-POLLOCK NOMOGRAM

Advantages

- It provides an accurate score for your body fat percentage.

Disadvantages

- It is complicated and will require specialist help.
- It requires specialist equipment.
- Some people may feel uncomfortable stripping down in front of the tester.
- Requires a good knowledge of how to accurately measure skinfolds.
- It can be difficult to ensure that the results are valid and reliable if the tester is inexperienced.

BIOELECTRICAL IMPEDANCE ANALYSIS (BIA)

Advantages

- The test accurately measures what percentage of your total body weight is made up of bone, muscle, fat and water.
- It is quick and gives instant results.
- The test can be administered repeatedly over time without adverse effects.

Disadvantages

- It requires expensive equipment and technical knowledge.

VERTICAL JUMP

Advantages

- Minimal equipment required.
- Simple to set up and conduct.
- The test can be administered by the athlete.
- Can be conducted almost anywhere.

Disadvantages

- Technique plays a big part in achieving a good score because the performer must mark the wall at the top of their jump.
- Technique of arm swing affects height gained, therefore it is not just power in legs that is being measured.
- Assistant required to administer the test