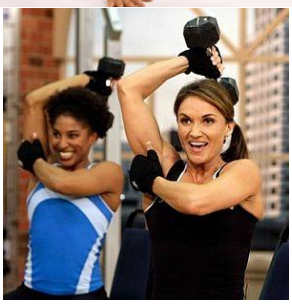
Unit 1: Fitness for Sport & Exercise

Student workbook

BTEC First Diploma in Sport



Name of Module	**Unit 1: Fitness for Sport and Exercise**
Name of Module Tutor	**Mr R Ellerington**
Student Name	

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Week	Date Week commencing	Content	Assessment dates
1	08/09/2014	Introduction to module and assessment Components of Physical Fitness (A.1) Components of Skill Related Fitness (A.2) Reasons fitness components are important for successful sports participation (A.3) **(THEORY)**	
2	15/09/2014	Exercise intensity and how it is determined (A.4) **(PRACTICAL & THEORY)**	
3	22/09/2014	Principles of Training- FITT (A5) Principles of Training- progressive overload, specificity, individual differences, adaptation, reversibility, variation, rest and recovery, and application (A6) **(THEORY)**	
4	29/09/2014	Applying knowledge to different scenarios **(PRACTICAL & THEORY)**	
5	06/10/2014	Fitness Training Methods (B1, B2, B3) **(PRACTICAL & THEORY)**	
6	13/10/2014	Fitness Training Methods (B1, B2, B3) **(PRACTICAL & THEORY)**	
7	20/10/2014	Fitness Training Methods (B1, B2, B3) **(PRACTICAL & THEORY)**	
STUDY REVIEW WEEK			
8	03/11/2014	Applying knowledge to different scenarios **(PRACTICAL & THEORY)**	
9	10/11/2014	Fitness Testing Methods (C.1) Importance of fitness testing to performer and coach (C.2) Requirements for administration of fitness test (C.3) Interpreting Results (C4) (PRACTICAL & THEORY)	
10	17/11/2014	Fitness Testing Methods (C.1) Importance of fitness testing to performer and coach (C.2) Requirements for administration of fitness test (C.3) Interpreting Results (C4) (PRACTICAL & THEORY)	
11	24/11/2014	Fitness Testing Methods (C.1)	

		Importance of fitness testing to performer and coach (C.2) Requirements for administration of fitness test (C.3) Interpreting Results (C4) (PRACTICAL & THEORY)	
12	01/12/2014	Fitness Testing Methods (C.1) Importance of fitness testing to performer and coach (C.2) Requirements for administration of fitness test (C.3) Interpreting Results (C4) (PRACTICAL & THEORY)	
13	08/12/2014	Applying knowledge to different scenarios **(PRACTICAL & THEORY)**	
14	15/12/2014	Mock Exam	**Mock Assessment** **(A, B & C)**
CHRISTMAS BREAK			
15	05/01/2015	Mock exam feedback and revision	
16	12/01/2015	Exam Revision workshop	
17	19/01/2015	Online Assessment	**Online Final Assessment** **(A, B & C)**

INTRODUCTION TO THE MODULE AND ASSESSMENT

What is the module about?

This unit will provide you with details upon a variety of fitness training methods and fitness testing procedures and their application within a fitness training programme relevant to the desired fitness components.

How is the module assessed?

- This unit is externally assessed using an onscreen computer based test.
- The awarding body Edexcel sets and marks the test.
- The test lasts for one hour and has 50 marks.
- The assessment will take place on _____.
- The onscreen test has different types of questions including objective and short-answer questions. Some questions contain graphics, photos, animations or videos.
- An onscreen calculator is available for questions requiring calculations.
- An onscreen notepad is available for making notes.
- Each item will have an accessibility panel that allows a learner to zoom in and out, and apply a colour filter.

About this workbook

You need to keep this workbook in a safe place. You will need to complete parts of the workbook every week and you will be able to use this to revise for your online assessment test.

If you lose or misplace this workbook it will be available on your course Moodle page to download, however all of the notes you have added will not!

Homework

After each lesson an online quiz will be made available on your course Moodle page. This quiz needs to be completed prior to the next lesson and your score will be available immediately. This is to help you and your subject tutor identify the areas which need to be worked upon.

Components of Physical Fitness (A.1)

Aerobic endurance

- Add definition
- Identify alternate names
- What is involved in the CV system?
- What is the CV system responsible for?

Muscular endurance

- Add definition

Flexibility

- Add definition
- Identify the two types of flexibility

Speed

- Add definition
- Identify the three different types of speed

Muscular Strength

- Add definition

Body Composition

- Add definition

Components of Skill Related Fitness (A.2)

Agility

- Add definition

Co-ordination

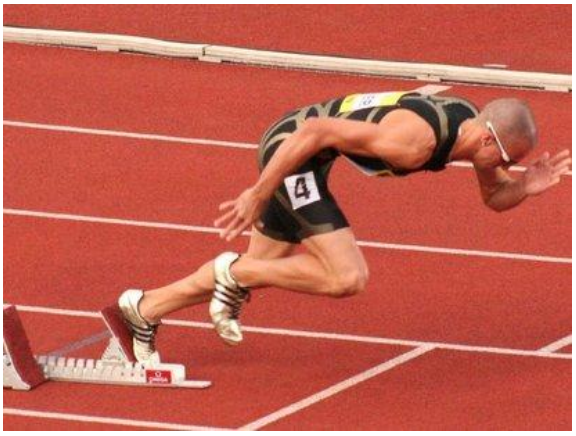
- Add definition

Balance

- Add definition of the two types

Power

- Add definition



Reaction Time

- Add definition

Reasons fitness components are important for successful sports participation (A.3)

Chose four sports and for each sport describe the three most important components of physical fitness

1	
2	
3	
4	

Select 4 sports and rank the importance of each of the physical and skill related fitness components that are required for each sport.

Identify the 3 most important components and describe and/ or explain why they are important.

Sport 1	Aerobic endurance	Muscular endurance	Flexibility	Speed	Strength	Body composition	Agility	Balance	Co-ordination	Power	Reaction time	**Describe/ explain the 3 most important components required for excellence in the sport and where in the sport it is used?**

Sport 2	Aerobic endurance	Muscular endurance	Flexibility	Speed	Strength	Body composition	Agility	Balance	Co-ordination	Power	Reaction time	Describe/ explain the 3 most important components required for excellence in the sport and where in the sport it is used?

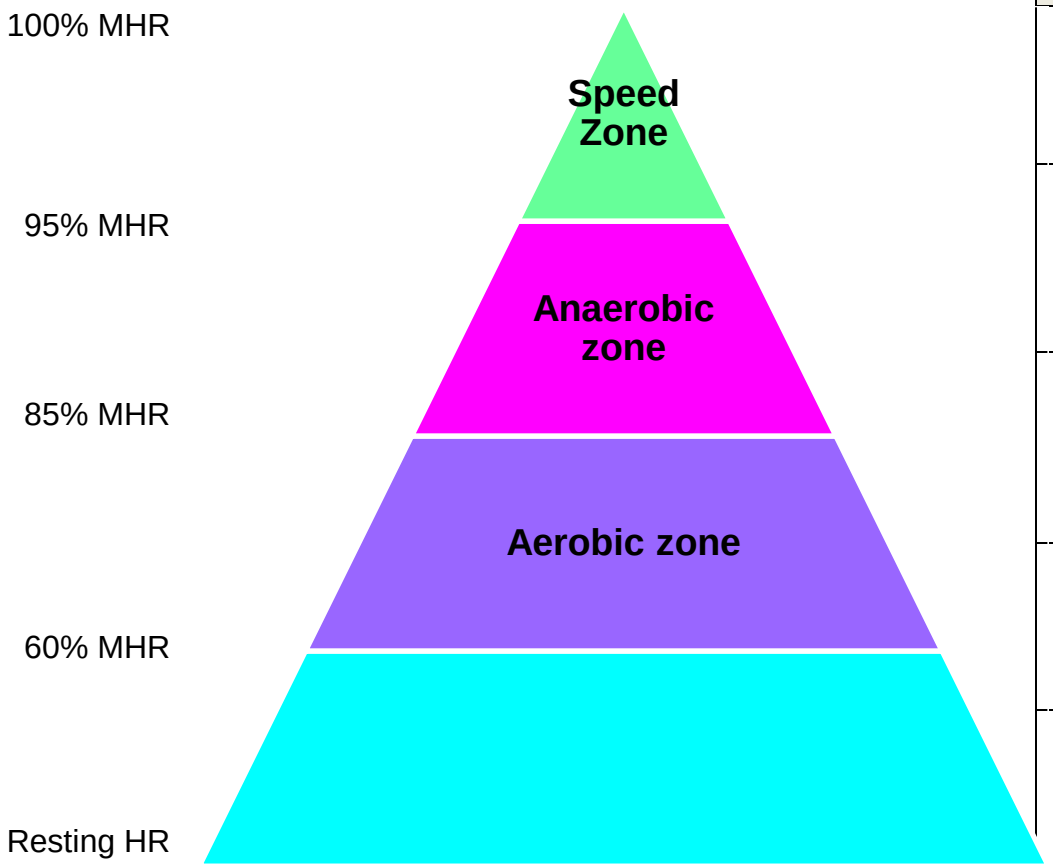
Sport 3	Aerobic endurance	Muscular endurance	Flexibility	Speed	Strength	Body composition	Agility	Balance	Co-ordination	Power	Reaction time	Describe/ explain the 3 most important components required for excellence in the sport and where in the sport it is used?

Sport 4	Aerobic endurance	Muscular endurance	Flexibility	Speed	Strength	Body composition	Agility	Balance	Co-ordination	Power	Reaction time	Describe/ explain the 3 most important components required for excellence in the sport and where in the sport it is used?

WEEK 2

Exercise intensity and how it is determined (A.4) (PRACTICAL & THEORY)

The Training Pyramid



Training in this zone

Calculation of maximum Heart Rate (HR)

Age predicted Maximum HR	Max HR= 220 – Age
Please work out your Maximum Heart Rate	

Calculation of Heart Rate (HR) Training Zones

The aerobic zone	= 60-80% of MHR
The anaerobic zone	= 85-95% MHR
The speed zone	= 95-100% MHR

Heart Rate Training Zones

Please work out your age predicted heart rate training zones

220- Age = Max HR **X 0.6 = 60%** **X 0.7 = 70%** **X 0.8 = 80%** **X 0.9 = 90%**	**60%**	**220- age = _____**	**x 0.6 =**	
	70%		**x 0.7 =**	
	80%		**x 0.8 =**	
	85%		**x 0.85 =**	

The Borg Rating of Perceived Exertion (RPE scale)

6	20% effort		
7	30% effort	Very, very light intensity	
8	40% effort		
9	50% effort	Very light intensity	
10	55% effort		
11	60% effort	Fairly light intensity	
12	65% effort		
13	70% effort	Somewhat hard intensity	
14	75% effort		
15	80% effort	Hard intensity	
16	85% effort		
17	90% effort	Very hard intensity	
18	95% effort		
19	100% effort	Very, very hard intensity	
20	Exhaustion		

Suggest a sporting activity that may be appropriate at each stage of the scale.

The suggested following relationship between HR training zones and the BORG scale: RPE x 10 = HR.

e.g. at 14 on the RPE (BORG scale) this would be the equivalent to 140bpm.

Activity

Complete five CV exercises in the gym.

For each of the CV machines identify:

- What levels and /or speeds you would be working out at for 60- 80% maxHR
- How long you worked out on the machine to achieve this level, and
- Rate the intensity on the BORG scale.

Machine	Level	Speed	Time	Intensity rating
Treadmill				
Cross trainer				
Rower				
Stepper				
Bike				

Using one machine identify what speed and level you would need to work out at for the following stages of the BORG scale. Machine _____

7	30% effort	Very, very light intensity	
9	50% effort	Very light intensity	
11	60% effort	Fairly light intensity	
13	70% effort	Somewhat hard intensity	
15	80% effort	Hard intensity	
17	90% effort	Very hard intensity	
19	100% effort	Very, very hard intensity	

WEEK 3

Principles of Training (A5)

Describe the FITT principles.

F	
I	
T	
T	

List 3 ways that the intensity of exercise can be increased

1	
2	
3	

How can fitness levels be improved using FITT principles?

Write a training session for an athlete of your choice using the FITT principles

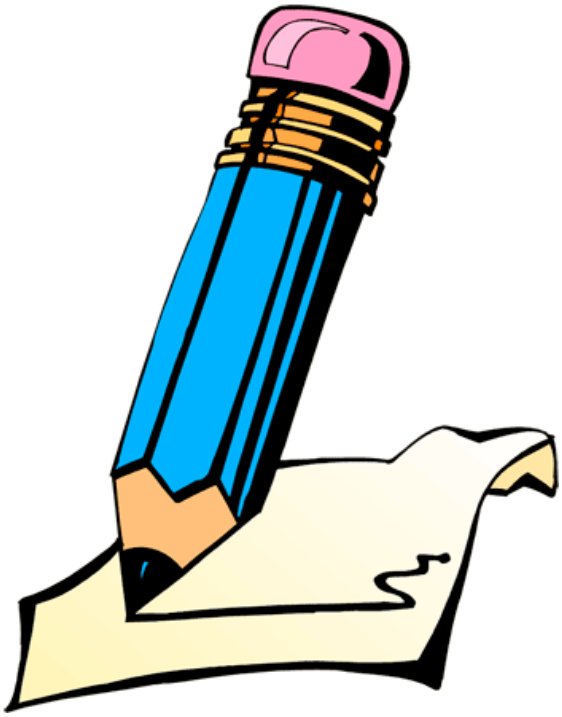
Additional Principles of Training (A6)

Describe the additional principles of training.

Progressive Overload	
Specificity	
Individual differences	
Adaptation	
Reversibility	
Variation	
Rest and recovery	

There are potential hazards of overtraining. Write down as many reasons why overtraining can have a negative effect on fitness.

If you were currently able to lift 10kg, how could you progressively overload to cause adaptation over 6 weeks? Remember this must be realistic!



WORK ON THE TASK PROVIDED BY YOUR TUTOR TO APPLY YOUR KNOWLEDGE

WEEK 5

Fitness Training Methods (B1, B2, B3) - Warm up, cool down and flexibility

(PRACTICAL & THEORY)

Preparation for training

Before undertaking training it is important to consider health & safety.

Complete the blanks in the sentences below.

- The _____ and _____ use of any equipment used.
- The _____ and _____ application of training techniques.
- Undertake a _____ before training.
- Perform a _____ after training to aid recovery.
- Apply the _____ principles correctly for each training method.
- Ensure that the training is _____ to the component of fitness you are trying to develop.

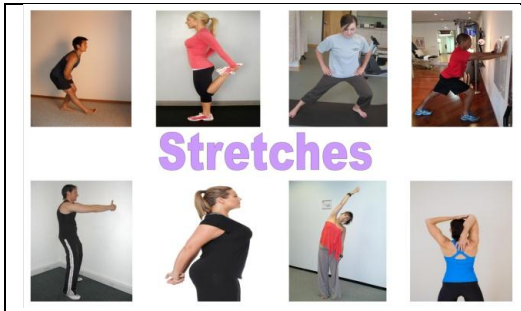
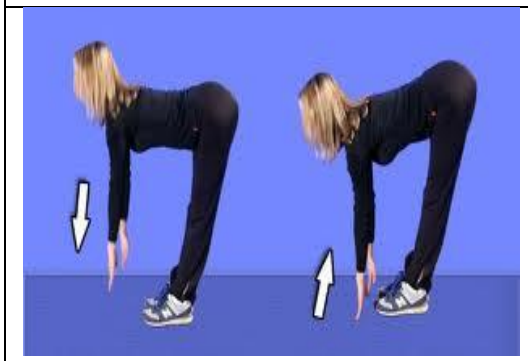
A warm up includes the following 3 phases:

Pulse raising	
Stretching	
Joint mobilization	

A cool down includes the following 3 phases:

Pulse lowering	
Static stretching	
Developmental stretching	

Flexibility Training- describe the stretches you performed

	Static Stretching
	PNF Stretching
	Ballistic Stretching

Devise a warm up for a sport of your choice.

Devise a cool down for a sport of your choice.

WEEK 6

Fitness Training Methods (B1, B2, B3) - Aerobic Endurance and strength training

(PRACTICAL & THEORY)

Aerobic Endurance Training

Define aerobic endurance:

- Endurance training takes part mainly in the aerobic training zone (60-80% MHR).
- The work to rest ratio should be 3:1-
  E.g. if you exercise for 30 minutes you would rest for 10 minutes.

Match up the definitions:

Heart Rate Training	This involves working for a sustained period of time without rest. Usually lasting at least 30 minutes. It improves cardio-vascular fitness.
Interval Training	This training can be called 'Speed play' training. It has no rest and involves varying your speed and the type of terrain over which you run, walk, cycle or ski. It improves aerobic and anaerobic fitness.
Continuous Training	This involves alternating between periods of hard exercise (usually 30 sec- 5 minutes) and rest. It improves anaerobic endurance by increasing the work times and decreasing the rest times. Total work time is at least 20 minutes and rest is one third of the work.
Fartlek Training	This training uses your maximum heart rate (MHR) to calculate how hard you should work your heart to develop either aerobic or anaerobic fitness to calculate MHR: 220 - Age = MHR

Write what you will complete for a continuous training session:

Write what you will complete for a fartlek training session:

Write what you will complete for an interval training session:

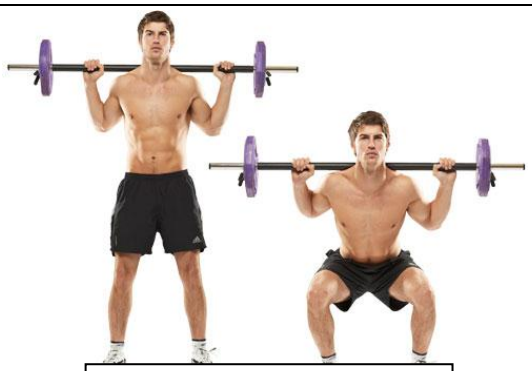
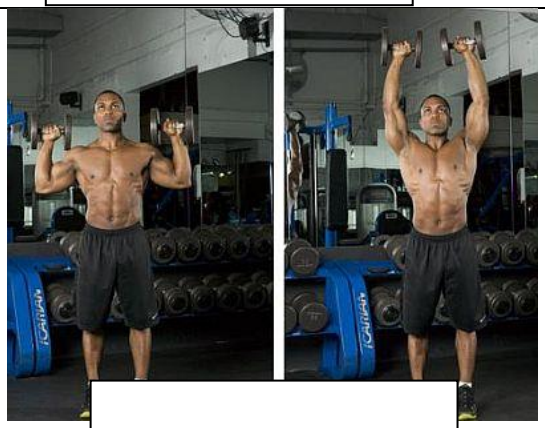
Free weights

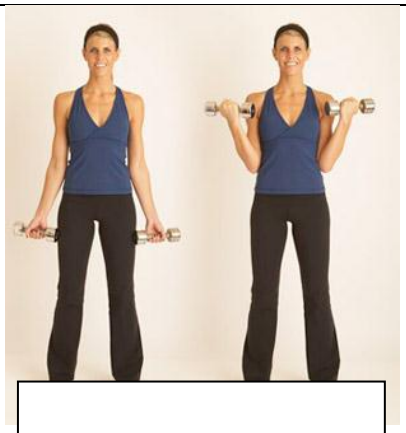
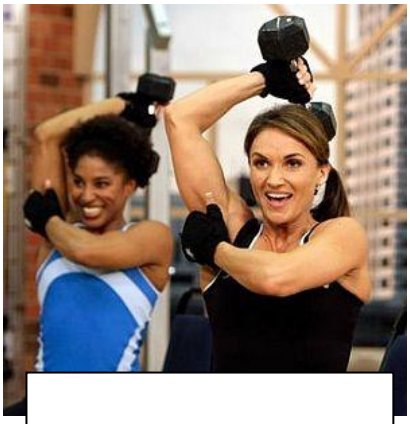
- An effective way to improve muscular strength and endurance.
- Encourages the body to develop core strength as the weight is unstable compared to resistance machines.
- Good techniques vital to prevent injury.
- Ensure you work through a full range of motion (ROM).
- Use a 'spotter' when necessary.
- 1 lift is called 1 'repetition' or 'rep'.
- One repetition maximum (1RM) is the most a person can lift in 1 rep.
- The number of repetitions completed without rest is called a 'set'.
- Rest in between sessions in order to aid recovery- 2 days between sessions will allow muscles to fully recover.

Strength training	Low reps and high resistance	90% 1RM	1-6 reps	Producing movement against high resistance
Muscular endurance training	High reps and low resistance	50-60% 1RM	12-20 reps	Repetitive movements of muscle/ muscle group
Power training	Medium reps and medium load	75% 1 RM	12 reps	Movements in close succession

- Consider the order of exercises performed- compound exercises before isolation exercises.
- If you train regularly- you could complete body part splits (training a different body part each session e.g. legs, back).
- If you train less regularly- you should alternate exercises between upper and lower body (e.g. chest and legs) and/ or between push and pull exercises (chest press and seated row).

Name and complete the following exercises

Leg exercises	 
Back exercise	 
Chest exercises	   
Shoulder exercises	 

Arm exercises		

How many reps of these exercises would you complete if you were working on strength training?

What exercises could you complete for a strength training session to help you achieve your goals?

Who would benefit from strength training?

Complete the table and identify 3 athletes that may benefit from this & reasons why.

Strength- free weights	• • •

WEEK 7

Fitness Training Methods (B1, B2, B3) - Speed, muscular endurance and power training

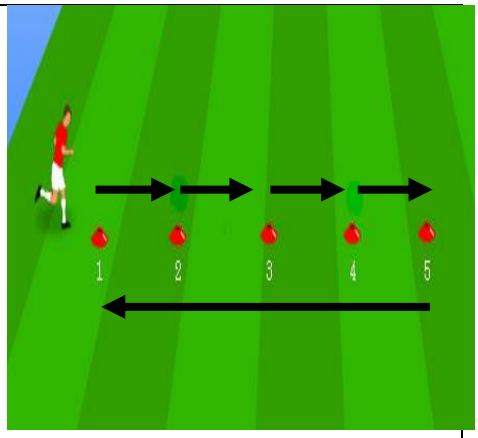
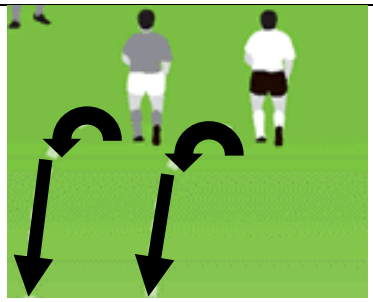
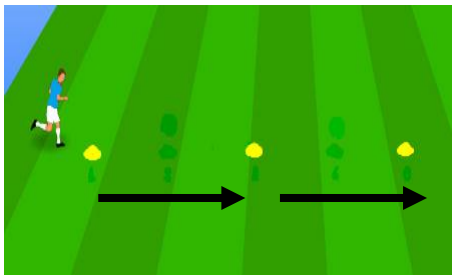
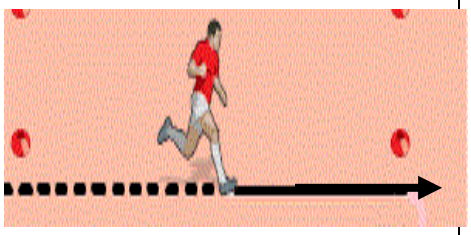
(PRACTICAL & THEORY)

Speed training

Speed training is a method of training that develops a person's speed over short distances.

- It is very high intensity training and so work periods should be short (up to about 15 seconds) and frequently interspersed with lots of short rest periods. (like interval training)
- Work to rest ratio should be 1:6-
  E.g. work for 15 seconds and 90 seconds rest.

Identify the training methods below and complete the training sessions:

Hollow Sprints	Similar to interval training broken up by a 'hollow' period of either rest or lower level work.	Session: • 50m Sprint (6-7 sec) • 50m Jog (25 sec) • 50m Sprint (6-7 sec) • 50m Walk (30 sec) • 50m Sprint (6-7 sec) • 150m walk (90 seconds) Repeated 5 times before a 10 minute rest.	
Acceleration sprints	A form of anaerobic training where running speed is increased from jogging to striding and finally to sprinting at maximum speed. Each change usually takes place after 50m and rest periods of jogging or walking are between each sprint. Can start from a static, rolling or sport specific starting point	Session: • Face away from finish line on 'go' turn and sprint to line • Lie face down on 'go' stand and run toward finish line • Jog to first cone, stride to second cone, sprint to third cone	  
Interval training	Can be used to develop speed. Work periods should be short and close to maximal speed and recovery periods should be longer.	Session: • 6 x 50m sprints with 40 seconds rest	

Circuit training

- A series of arranged exercises arranged in order.
- It can be used to develop strength, power, muscular endurance, agility, aerobic endurance in a limited time period.
- Involves 6-10 different exercises called stations one after another- perform each exercise for a time and then move onto the next station after a timed rest.
- When all the exercises are finished you have completed one circuit.
- You can perform more than one circuit in a session.

To ensure overload is achieved:

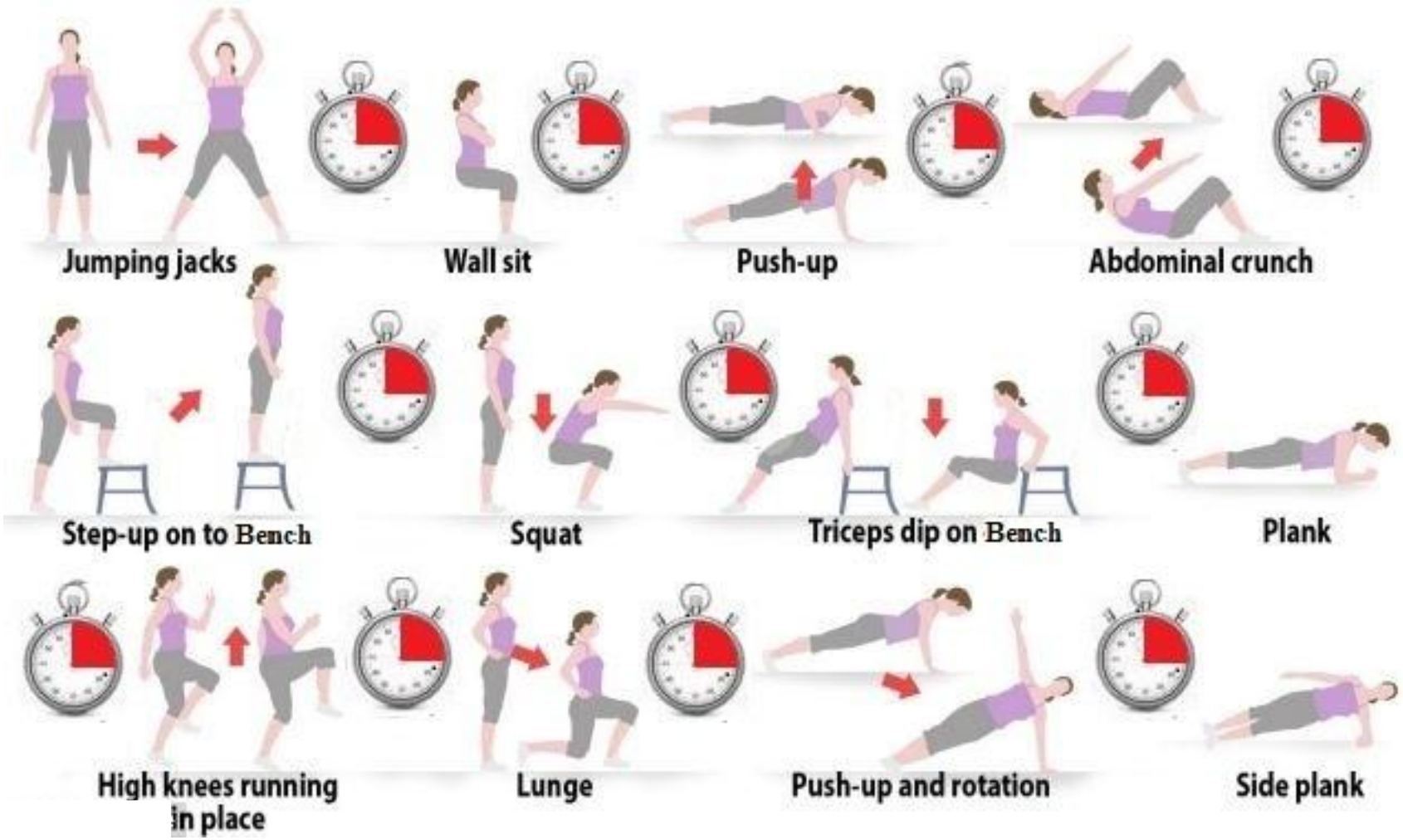
- Reduce target times to complete number of repetitions
- Reducing rest times between exercises
- Increase exercise resistance
- Increase repetitions
- Increase stations
- Increase circuits

Who would benefit from muscular endurance training?

Complete the table and identify 3 athletes that may benefit from this & reasons why.

Muscular endurance- circuit training	• • •

Complete the following circuit- exercising for 45 seconds and resting for 15 seconds.



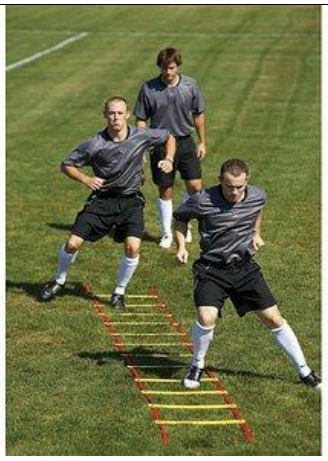
The key point to remember when designing a circuit is not to exercise the same body part in consecutive exercises- alternate body parts.

Plyometric Training

- This type of training is designed to improve strength and explosive power.
- It involves performing a jumping or throwing type of exercises where the performer moves quickly.
- It involves an eccentric muscle action which lengthens the muscles followed quickly by a concentric action which shortens the muscle and produces more power.
- Think about when you stretch an elastic band- the further you stretch the band the more powerfully it contracts back.
- Exercises may include jumping, hopping, skipping, incline press ups, drop jumps, hurdles and lunging.
- You are more likely to suffer DOMS (Delayed onset of muscular soreness from plyometric training).

Complete the following plyometric exercises- 30 seconds on each exercise.

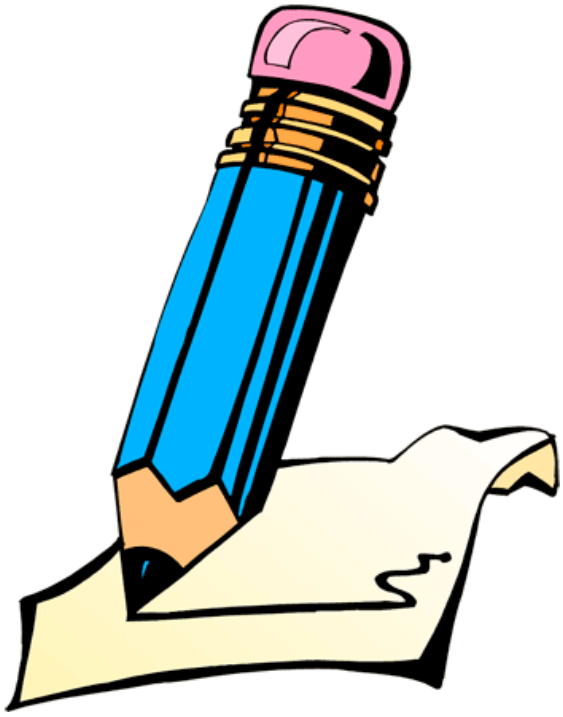
1	**Squat jumps**		3	**Speed skater**	
2	**Hurdle jumps**		4	**Switch jump lunges**	

5	Ball slams		7	Ladder jumps	
6	Bench jumps		8	Press ups	
9	Hill climber		10	Burpees	

Who would benefit from power training?

Complete the table and identify 3 athletes that may benefit from this & reasons why.

Power-plyometrics	• • •



WORK ON THE TASK PROVIDED BY YOUR TUTOR TO APPLY YOUR KNOWLEDGE

Fitness Testing Methods (C.1) Importance of fitness testing to performer and coach (C.2) Requirements for administration of fitness test (C.3) Interpreting Results (C4)

(PRACTICAL & THEORY)

Considerations prior to conducting a fitness test

What do you need to check regarding equipment?

Why is it important to gain written informed consent?

Choosing and carrying out fitness tests

- You need to establish which components are important for the individual and what the purpose of each test is so that they are appropriate.
- Consider the cost, practicality as well as the advantages and disadvantages of each test
- Follow the test protocol and ensure that you record the results and compare these to the normative data- this helps to identify strengths and areas for improvement.
- Reliability- can the test be repeated in the same way and give the same result.
- Validity- whether the test measures what it is supposed to test.
- Practicality- whether the tests are realistic and convenient to perform

SIT AND REACH TEST

What is tested: Static flexibility of hamstrings and lower back muscles

Equipment needed: Sit and reach box or a box and measuring tape

Purpose of test: To test the flexibility of the hamstrings and Erector Spinae muscles

Procedure & Measurement:

- Warm the client up for 5 minutes using CV exercise and modified hurdlers hamstring stretch
- The test should be done with shoes off and in non-restrictive clothing
- The client sits with legs together and straight, and with feet flat against the sit and reach box.
- Client places one hand on top of the other and leans forward from the hips as far as possible reaching along the top of the box- hold position for 2 seconds.
- Record the furthest point the client reaches
- Perform the test three times and record the best measurement.

Notes: Doing this test with cold muscles may result in muscle strain. Ensure knees not bent!

Expected level	Male footballer	Male gymnast
Regional	7-10cm	10-12cm
National	9-13cm	13-17 cm
International/ Professional	>15cm	>18cm

	Male	Female
Average 16-19 year old	7-10cm	7-11cm

(Barsby *et al*, 2013)

AEROBIC ENDURANCE- MULTISTAGE FITNESS TEST (BLEEP TEST)

What is tested: VO_2 max- aerobic fitness level

Equipment needed: Stereo; bleep test CD; cones, tape measure

Purpose of test: To estimate VO_2 max (maximal oxygen uptake) by administering a progressive shuttle run test.

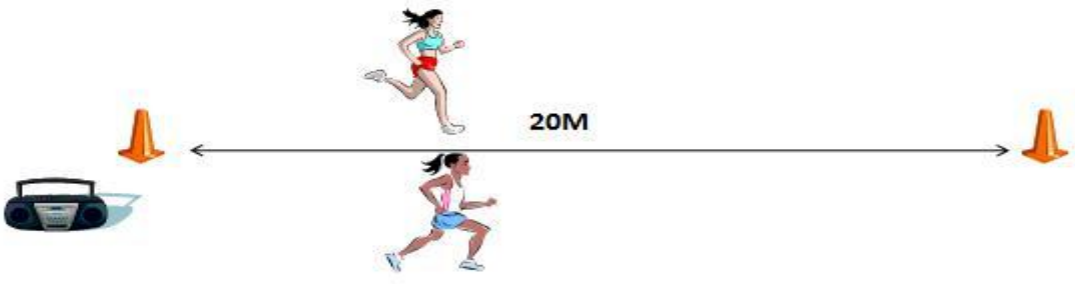
Procedure & Measurement:

- Measure a distance of 20 metres and mark with two cones.
- Perform a short 5 minute cardiovascular warm up
- Start the CD, the participants will run 20 metres to the furthest cone when the first 3 bleeps sound.
- When the bleep sounds on the CD the participant turns around to run back. You must reach the other line on or before the bleep.
- The participants continue to run between the cones and the time between the bleeps becomes shorter- hence the participants need to run faster to reach the cones.
- If the participant fails to get to the other end before the bleep on 3 consecutive occasions then they are out (2 chances).
- Record the level at which the participant stopped the test.
- Compare to norm tables.
- Work out your VO_2max using the table.

Notes: As this is a **maximal** test, certain precautions should be taken. Participants should have no apparent health problems. A qualified First Aider should be present during the test.

Expected level	Female footballer	Female gymnast
Regional	Level 9	Level 8
National	Level 10	Level 9
International/ Professional	Level 12+	Level 10

(Barsby *et al*, 2013)



Male					
Age	**Excellent**	**Above Average**	**Average**	**Below Average**	**Poor**
14 - 16	L12 S7	L11 S2	L8 S9	L7 S1	< L6 S6
17 - 20	L12 S12	L11 S6	L9 S2	L7 S6	< L7 S3
21 - 30	L12 S12	L11 S7	L9 S3	L7 S8	< L7 S5
Female					
Age	**Excellent**	**Above Average**	**Average**	**Below Average**	**Poor**
14 - 16	L10 S9	L9 S1	L6 S7	L5 S1	< L4 S7
17 - 20	L10 S11	L9 S3	L6 S8	L5 S2	< L4 S9
21 - 30	L10 S8	L9 S2	L6 S6	L5 S1	< L4 S9

(Davis, 2010)

The following table of predicted maximum oxygen uptake values (VO2 Max) for the Multistage Fitness Test continues over the next few pages and was introduced by the Department of Physical Education & Sports Science Loughborough University, 1987.

Level	Shuttle	VO2 Max
4	2	26.8
4	4	27.6
4	6	28.3
4	9	29.5

Level	Shuttle	VO2 Max
5	2	30.2
5	4	31
5	6	31.8
5	9	32.9

Level	Shuttle	VO2 Max
6	2	33.6
6	4	34.3
6	6	35
6	8	35.7
6	10	36.4

Level	Shuttle	VO2 Max
7	2	37.1
7	4	37.8
7	6	38.5
7	8	39.2
7	10	39.9

Level	Shuttle	VO2 Max
8	2	40.5
8	4	41.1
8	6	41.8
8	8	42.4
8	11	43.3

Level	Shuttle	VO2 Max
9	2	43.9
9	4	44.5
9	6	45.2
9	8	45.8
9	11	46.8

Level	Shuttle	VO2 Max
10	2	47.4
10	4	48
10	6	48.7
10	8	49.3
10	11	50.2

Level	Shuttle	VO2 Max
11	2	50.8
11	4	51.4
11	6	51.9
11	8	52.5
11	10	53.1

Level	Shuttle	VO2 Max
12	2	54.3
12	4	54.8
12	6	55.4
12	8	56
12	10	56.5
12	12	57.1

Level	Shuttle	VO2 Max
13	2	57.6
13	4	58.2
13	6	58.7
13	8	59.3
13	10	59.8
13	13	60.6

Level	Shuttle	VO2 Max
14	2	61.1
14	4	61.7
14	6	62.2
14	8	62.7
14	10	63.2
14	13	64

Level	Shuttle	VO2 Max
15	2	64.6
15	4	65.1
15	6	65.6
15	8	66.2
15	10	66.7
15	13	67.5

Level	Shuttle	VO2 Max
16	2	68
16	4	68.5
16	6	69
16	8	69.5
16	10	69.9
16	12	70.5
16	14	70.9

Level	Shuttle	VO2 Max
17	2	71.4
17	4	71.9
17	6	72.4
17	8	72.9
17	10	73.4
17	12	73.9
17	14	74.4

Level	Shuttle	VO2 Max
18	2	74.8
18	4	75.3
18	6	75.8
18	8	76.2
18	10	76.7
18	12	77.2
18	15	77.9

Level	Shuttle	VO2 Max
19	2	78.3
19	4	78.8
19	6	79.2
19	8	79.7
19	10	80.2
19	12	80.6
19	15	81.3

(http//:www.brianmac.com)

Level	Shuttle	VO2 Max
20	2	81.8
20	4	82.2
20	6	82.6
20	8	83
20	10	83.5
20	12	83.9
20	14	84.3
20	16	84.8

Level	Shuttle	VO2 Max
21	2	85.2
21	4	85.6
21	6	86.1
21	8	86.5
21	10	86.9
21	12	87.4
21	14	87.8
21	16	88.2

Interpreting maximum oxygen uptake results

Category	Males ($ml/O_2/kg/min^{-1}$)	Females ($ml/O_2/kg/min^{-1}$)
Extremely high	70+	60+
Very High	63-69	54-59
High	57-62	49-53
Above average	52-56	44-48
Average	44-51	35-43

(BTEC Level 3 Sport and Exercise Science, 2010)

AEROBIC ENDURANCE- FORESTRY STEP TEST

What is tested: Cardio-respiratory efficiency- how heart rate increases with steady state exercise

Equipment needed: **S**tep/ bench- 33cm for females and 40cm for males; metronome, stopwatch; heart rate monitor

Purpose of test: To determine cardio-respiratory endurance- how heart rate increases with steady state exercise.

Procedure & Measurement:

- Participant steps up and down on a bench/ step for five minutes.
- Participant steps up and down in time with in time with the beat of a metronome 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 five minutes participant sits on bench. Locate pulse and start counting within 10 seconds of completion.
- Record pulse over one minute.
- Compare to VO_2max tables- 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.

VO_2max table- Forestry Non- adjusted Aerobic Fitness Values (ml/kg/ min) for Women													
Pulse count	**HR (bpm)**	**Maximal Oxygen Consumption (VO2max)**											
45	180										29	29	29
44	176								30	30	30	30	30
43	172							31	31	31	31	31	31
42	168			32	32	32	32	32	32	32	32	32	32
41	164			33	33	33	33	33	33	33	33	33	33
41	160			34	34	34	34	34	34	34	34	34	34
39	156			35	35	35	35	35	35	35	35	35	35
39	152			36	36	36	36	36	36	36	36	36	36
37	148			37	37	37	37	37	37	37	37	37	37
36	144		37	38	38	38	38	38	38	38	38	38	38
35	140	38	38	39	39	39	39	39	39	39	39	39	39
34	136	39	39	40	40	40	40	40	40	40	40	40	40
33	132	40	40	41	41	41	41	41	41	41	41	41	41
32	128	41	41	42	42	42	42	42	42	42	42	42	42
31	124	42	42	43	43	43	43	43	43	43	43	43	43
30	120	43	43	44	44	44	44	44	44	44	44	44	44
29	116	44	44	45	45	45	45	45	45	45	45	45	45
28	112	45	45	46	46	46	46	47	47	47	47	47	47
27	108	46	46	47	48	48	49	49	49	49	49		
26	104	47	48	49	50	50	51	51	51	51			
25	100	49	50	51	52	52	53	53					
24	96	51	52	53	54	54	55						
23	92	53	54	55	56	56	57						
Weight (lb)		80	90	100	110	120	130	140	150	160	170	180	190
Weight (kg)		36.4	40.9	45.4	50	54.5	59.1	63.5	68.2	72.7	77.3	81.8	86.4

VO_2max tables- Forestry Non- adjusted Aerobic Fitness Values (ml/kg/ min) for Men														
Pulse count		**Maximal Oxygen Consumption (VO2max)**												
45		33	33	33	33	33	32	32	32	32	32	32	32	32
44		34	34	34	34	33	33	33	33	33	33	33	33	33
43		35	35	35	34	34	34	34	34	34	34	34	34	34
42		36	36	35	35	35	35	35	35	35	35	34	34	34
41		36	36	36	36	36	36	36	36	36	36	35	35	35
41		37	37	37	37	37	37	37	35	35	35	35	35	35
39		38	38	38	38	38	38	38	38	38	38	37	37	37
39		39	39	39	39	39	39	39	39	39	39	38	38	38
37		41	40	40	40	40	40	40	40	40	40	39	39	39
36		42	42	41	41	41	41	41	41	41	41	41	40	40
35		43	43	42	42	42	42	42	42	42	42	42	42	41
34		44	44	43	43	43	43	43	43	43	43	43	43	43
33		46	45	45	45	45	45	44	44	44	44	44	44	44
32		47	47	46	46	46	46	46	46	46	46	46	46	46
31		48	48	48	47	47	47	47	47	47	47	47	47	47
30		50	49	49	49	48	48	48	48	48	48	48	48	48
29		52	51	51	51	50	50	50	50	50	50	50	50	50
28		53	53	53	53	52	52	52	52	51	51	51	51	51
27		55	55	55	54	54	54	54	54	54	53	53	53	52
26		57	57	56	56	56	56	56	56	56	55	55	54	54
25		59	59	58	58	58	58	58	58	58	56	56	55	55
24		60	60	60	60	60	60	60	59	59	58	58	57	
23		62	62	61	61	61	61	61	60	60	60	59		
22		64	64	63	63	63	63	62	62	61	61			
21		66	66	65	65	65	64	64	64	62				
20		68	68	67	67	67	67	66	66	65				
Weight (lb)		120	130	140	150	160	170	180	190	200	210	220	230	240
Weight (kg)		54.5	59.1	63.6	66.2	72.7	77.3	81.8	86.4	91	95.4	100	104.5	109

Normative tables for age and gender.

	Maximum Oxygen consumption (ml/kg/min)			
	Male		Female	
Age	**15**	**20**	**15**	**20**
Superior	57+	56+	54+	53+
Excellent	56-52	55-51	53-49	52-45
Very good	51-47	50-46	48-44	47-43
Good	46-42	45-41	43-39	42-38
Fair	41-37	40-36	38-34	37-33
Poor	36-32	35-31	33-29	32-28
Very poor	<32	<31	<31	<28

(Barsby *et a*l, 2013)

SPEED- 35 METRE SPRINT

What is tested: Speed

Equipment needed: Cones; stopwatch, flat running surface (ideally a running track), tape measure.

Purpose of test: To test speed.

Procedure & Measurement:

- Perform a full warm up prior to the test- cardiovascular and stretches for all major muscle groups.
- Measure out the 35 metres and mark with cones
- The participant will line up on the start line, in a standing start position.
- The starter will shout 'GO' and the participant will sprint to the end as quickly as possible.
- Time the run and record the time.
- This run should be repeated after 30 second recovery whilst walking back to the start.
- An average of the two runs taken.
- Relate the times to the normative table.

TIME (SECS) FOR 35m SPRINT		
Rating	**Males**	**Females**
Excellent	<4.8	<5.30
Good	4.8- 5.09	5.30- 5.59
Average	5.10- 5.29	5.60- 5.89
Below average	5.30- 5.60	5.90- 6.20
Poor	> 5.60	>6.20

(Arkinstall et al. 2010)

PUSH UP TEST

What is tested: Muscular endurance of pectoral and triceps muscles

Equipment needed: Mat, stop watch and partner

Purpose of test: To test local muscular endurance in the pectoral and triceps muscles

Procedure & Measurement:

For **men** the Push Up Test is conducted as follows:

- Lie on the mat, hands slightly wider than shoulder width apart & fully extend the arms - see Figure 1
- Lower the body until the chest is 2cm off the floor, maintaining a straight back - see Figure 2
- Return to the starting position with the arms fully extended - see Figure 1
- The push up action is to be continuous with no rest
- Record the total number of successful push ups

Figure 1

Figure 2

For **women** the Push Up Test is conducted as follows:

- Lie on the mat, hands shoulder width apart, bent knee position & fully extend the arms - see Figure 3
- Lower the upper body until the elbows reach 90° - see Figure 4
- Return to the starting position with the arms fully extended - see Figure 3
- The push up action is to be continuous with no rest
- Record the total number of successful push ups

Figure 3

Figure 4

MALES- Age	Excellent	Very good	Good	Fair	Needs improvement
15-19	39≥	29-38	23-28	18-22	≤17
FEMALES- Age	**Excellent**	**Very good**	**Good**	**Fair**	**Needs improvement**
15-19	≥33	25-32	18-24	Dec-17	≤11

(The Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Health-Related Appraisal and Counseling Strategy, 2010)

SIT UP TEST

What is tested: Muscular endurance of abdominal muscles

Equipment needed: Mat, stop watch and partner

Purpose of test: To measure local muscular endurance in abdominal muscles

Procedure & Measurement:

- Participant lies on mat on their back, knees bent, feet flat on the floor and arms folded across the body.
- Your feet may be held by a partner if required though needs to by noted down in results section.
- On the command of go the participant raises to a 90 degree angle and perform a sit ups.
- They return back to the start position with their head touching the floor. That will be one repetition.
- The participant repeats this for 1 minute.
- Count number of successful sit ups.
- Consult normative table.

Notes: **This test is not recommended for those with lower back problems.** Those with no apparent back problem should be careful not to perform this exercise too quickly and risk hurting the lower back.

	Age	Excellent	Above average	Average	Below average	Low
Males	**16-19**	>30	26-30	20-25	17-19	<17
Females	**17-19**	>25	21-25	15-20	Sep-14	<9

(Davis , 2000)

ILLINOIS AGILITY TEST

What is tested: Agility

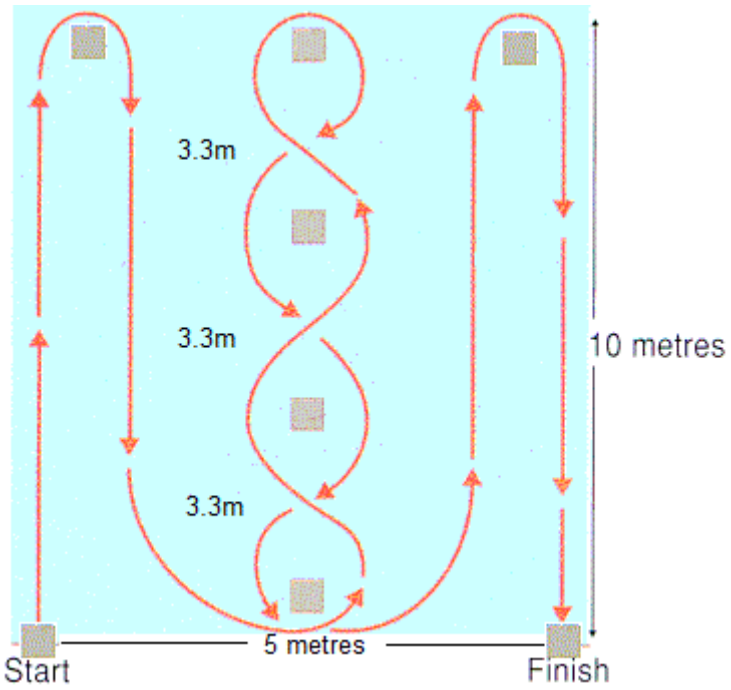
Equipment needed: Grip dynamometer

Purpose of test: To measure grip strength, which is a recognised indicator of overall muscular strength

Procedure & Measurement:

- Ensure to warm up prior to test
- The course is set up the course as detailed in the diagram below
- Lie face down on the floor at the “Start” cone
- On the command “GO” jump up to your feet and negotiate the course around the cones following the red line route shown in the diagram to the finish
- An assistant stops will use a stop watch to time and record the time when you pass the “Finish” cone

Notes: Ensure participant moves around the cones.



Gender	Excellent	Above Average	Average	Below Average	Poor
Male	<15.2 secs	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

(Davis, 2010)

VERTICAL POWER- VERTICAL JUMP

What is tested: Anaerobic power of the quadriceps muscles

Equipment needed: Takei jump metre

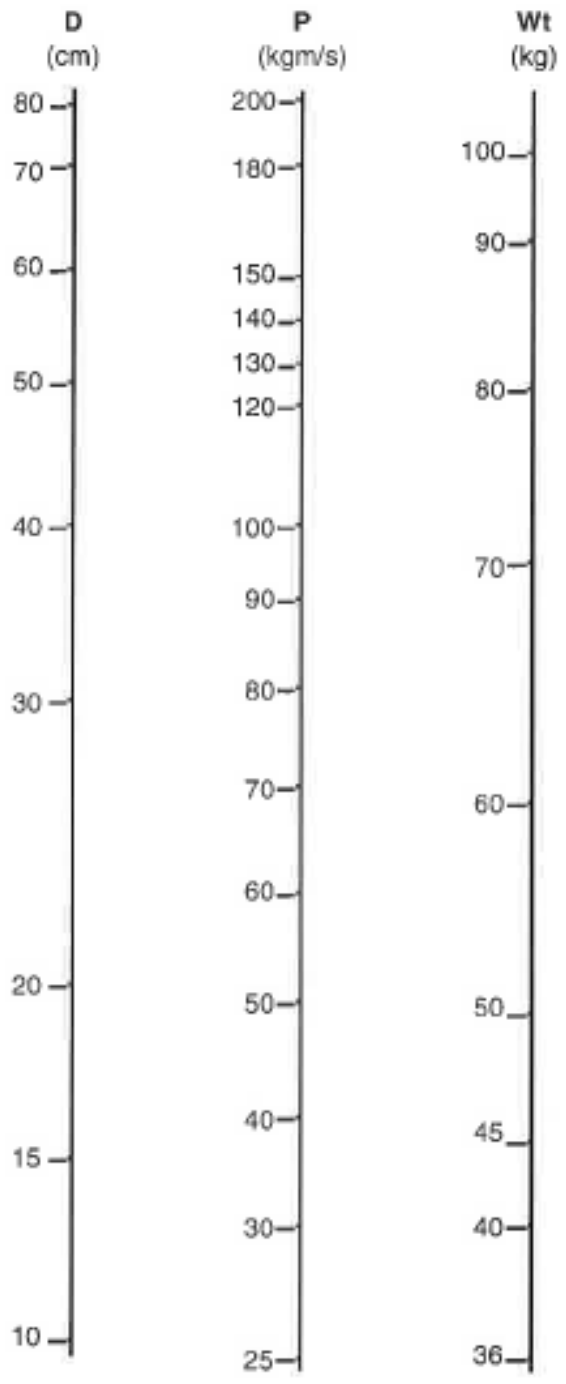
Purpose of test: To measure the power of the legs

Procedure & Measurement:

- The athlete chalks the end of his/her finger tips
- The athlete stands side on to the wall, keeping both feet remaining on the ground, reaches up as high as possible with one hand and marks the wall with the tips of the fingers (M1- standing reach)
- The athlete from a static position jumps as high as possible and marks the wall with the chalk on his fingers (M2)
- The assistant measures and records the distance between M1 and M2 (D)
- The athlete repeats the test 3 times
- The best of the three attempts is plotted on the Lewis nomogram on line 'D'.
- Weigh yourself and record your weight in kilograms on the nomogram on line 'W'
- Use a ruler and a sharp pencil to join up the two plots- this will cross the 'P' line- this is your power measured in kg/s.

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	>65cm	50 - 65cm	40 - 49cm	30 - 39cm	<30cm
Female	>58cm	47 - 58cm	36 - 46cm	26 - 35cm	<26cm

(Davis, 2010)



Lewis nomogram

VERTICAL POWER- VERTICAL JUMP

What is tested: Anaerobic power of the quadriceps muscles

Equipment needed: Takei jump metre

Purpose of test: To measure the power of the legs

Procedure & Measurement:

- Place the rubber plate on the floor and hold the Takei Jump meter in your hand.
- Place the Takei Jump meter around your waist
- Turn the pulley to take the slack out of the rope
- Press ON/C to start the test
- Jump as high as possible and repeat the test 3 times
- **Your score is the best of three attempts**

Age	Male	Female
10	34.9	32.8
11	39.0	36.6
12	43.2	38.5
13	49.2	41.3
14	54.7	42.5
15	57.5	42.9
16	60.2	43.2
17	61.6	43.7
18	60.6	42.9
19	60.2	42.3
20	59.9	41.8
21	58.6	41.0
22	58.1	40.2
23	58.3	40.2
24	58.2	39.7
25	57.8	39.7
26	57.5	39.2
27	56.7	39.1
28	56.8	38.8
29	56.2	38.5

Age	Male	Female
30	55.5	38.1
31	54.8	37.4
32	54.0	37.4
33	53.5	37.1
34	53.1	36.5
35	52.8	25.9
36	52.4	36.1
37	51.5	35.5
38	51.1	35.1
39	51.0	35.0
40	50.4	34.6
41	49.9	34.1
42	48.6	33.7
43	48.8	33.3
44	48.0	32.7
45	47.6	32.2
46	46.7	31.8
47	46.0	31.2
48	45.8	30.7
49	45.2	30.4

Age	Male	Female
50	44.5	29.7
51	44.0	29.0
52	43.0	28.5
53	42.6	28.2
54	42.3	27.8
55	41.6	27.4
56	40.6	26.8
57	40.1	26.4
58	39.5	25.9
59	38.5	25.1
60	37.5	24.0
61	36.5	23.6
62	35.5	23.6
63	34.5	23.2
64	33.5	23.0
65	32.7	22.3
66	31.9	21.3
67	30.8	20.5
68	30.0	20.0
69	29.0	19.5
70	28.0	18.5

GRIP STRENGTH DYNAMOMETER

What is tested: Muscular strength- forearm

Equipment needed: Grip dynamometer

Purpose of test: To measure grip strength, which is a recognised indicator of overall muscular strength

Procedure & Measurement:

- Switch on dynamometer.
- Adjust grip to comfortable position, to fit size of hand
- Hold dynamometer by side and squeeze as hard as you can for 5 seconds, without moving your arm and breathing out as you do so.
- Repeat test with other hand.
- Repeat 3 times on each side, there should be 1 minute rest between trials.
- Record three readings and choose the highest to refer to normative data chart.

Notes: It is important to breathe out with the exertion of this test.

Gender	Excellent	Good	Average	Fair	Poor
Male	>56	51-56	45-50	39-44	<39
Female	>36	31-36	25-30	19-24	<19

(Davis, 2010)

BODY COMPOSITION- SUM OF SKINFOLDS

What is tested: Subcutaneous adipose tissue (predicts percentage of body fat)

Equipment needed: Skinfold calipers; marker

Purpose of test: Skinfold measurements give an indication of body composition- body fat percentage. It is the most commonly used field test for this component of fitness, but needs practice!

Procedure & Measurement:

- Ensure client is comfortable with procedure.
- Take the measurements on the **RIGHT** side of the body with subject standing upright and muscles relaxed.
- Mark each skinfold point with a pen
- Grasp the skin with the thumb and finger 1 cm above the marked site and pull the fat away from the muscle
- Place the calipers perpendicular (at right angles to) to the fold at the marked point and with the dial facing upwards
- Maintain the grasp while reading the caliper.
- Allow the calipers to settle for one or two seconds before reading and read the dial to the nearest 5.5mm and record the result.
- Allow skin to settle and repeat- take a minimum of 2 measurements per site (3 is best).
- Add up the total of the four skinfold site measurements.
- Calculate body fat percentage using the table**.

Notes: **Open the calipers before you remove from the skin.**

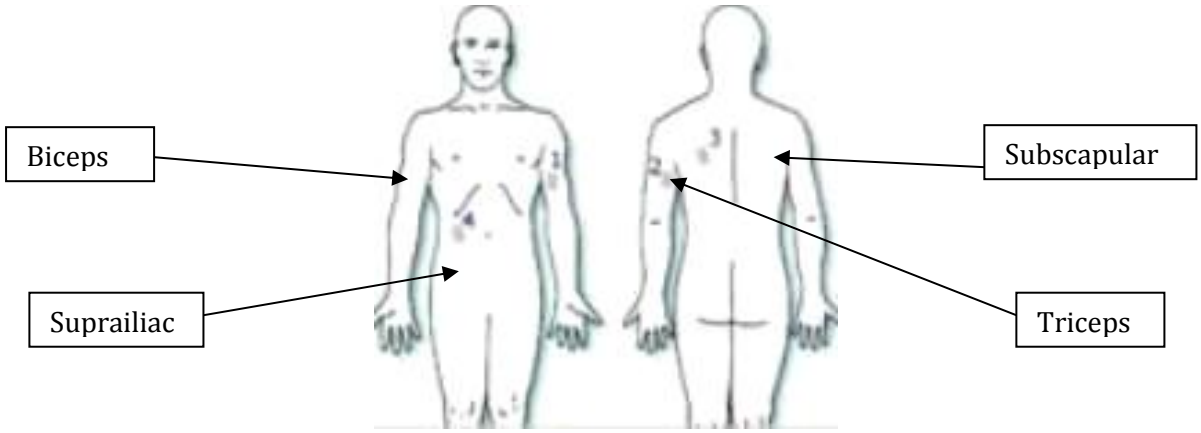
You can take the best of three for increased reliability. Take measurements at all sites, record results. Take a sum of the Skin folds and refer to norm tables for results.

Desirable Body fat ranges:

Rating	**Male**	**Female**
16 – 29	14 – 18%	22 – 25%

This is done using the Durnin and Wormsley (1974) sites as follows:

Area	Description of Site
Triceps	A vertical grasp, taken halfway between the shoulder and the elbow on the centre line of back of the arm.
Biceps	A vertical grasp, taken 1cm above the site for the triceps on the front of the arm.
Subscapular	A diagonal fold, at a 45 degree angle, taken 2cm below the lowest point of the shoulder blade.
Suprailiac	A diagonal fold, taken just above the iliac crest (hip bone), directly below the front of the shoulder.



Area	**Measurement**
Triceps	
Biceps	
Subscapular	
Suprailiac	
Total sum of skin folds	

Sum of Skinfolds

Males		Females	
Sum of Skinfolds	Body Fat %	Sum of Skinfolds	Body Fat %
		14	9.4
		16	11.2
		18	12.7
20	8.1	20	14.1
22	9.2	22	15.4
24	10.2	24	16.5
26	11.2	26	17.6
28	12.1	28	18.6
30	12.9	30	19.5
35	14.7	35	21.6
40	16.3	40	23.4
45	17.7	45	25.0
50	19.0	50	26.5
55	20.2	55	27.8
60	21.2	60	29.1
65	22.2	65	30.2
70	23.2	70	31.2
75	24.0	75	32.2
80	24.8	80	33.1
85	25.6	85	34.0
90	26.3	90	34.8
95	27.0	95	35.6
100	27.6	100	36.3
110	28.8	110	37.7
120	29.9	120	39.0
130	31.0	130	40.2

140	31.9	140	41.3
150	32.8	150	42.3
160	33.6	160	43.2
170	34.4	170	44.6
180	35.2	180	45.0

(BTEC National Diploma Sport Development, Coaching and Fitness, 2007)

Interpreting your results

	Age					
MALES	18-25	26-35	36-45	46-55	56-65	65+
Very Lean	4-7%	8-12%	10-14%	12-16%	15-18%	15-18%
Lean	8-10%	13-15%	15-18%	17-20%	19-21%	19-21%
Leaner than average	11-13%	16-18%	19-21%	21-23%	22-24%	22-23%
Average	14-18%	19-21%	22-24%	24-25%	25-26%	24-25%
Fatter than average	18-20%	22-24%	25-26%	26-28%	27-28%	26-27%
Fat	22-26%	25-28%	27-29%	29-31%	28-31%	20-30%
Over fat	28-37%	29-37%	31-38%	32-38%	32-38%	31-38%
	Age					
FEMALES	18-25	26-35	36-45	46-55	56-65	65+
Very Lean	13-17%	13-18%	15-19%	18-22%	18-23%	16-18%
Lean	18-20%	19-21%	20-23%	23-25%	24-26%	22-25%
Leaner than average	21-23%	22-23%	24-26%	26-28%	27-30%	27-29%
Average	24-25%	24-26%	27-29%	29-31%	31-33%	30-32%
Fatter than average	26-28%	27-30%	30-32%	32-34%	24-36%	33-35%
Fat	29-31%	31-35%	33-36%	35-38%	37-38%	36-38%
Over fat	33-43%	36-48%	39-48%	40-49%	39-46%	39-44%

BODY MASS INDEX B.M.I.

What is tested: Assessment of body composition- body fat

Equipment needed: Height measure or tape measure; weighing scales

Purpose of test: To get an indication of physical dimension

Procedure: Height – stand with heels against wall, with bare feet, eyes looking straight ahead.

Weight – Stand on scales in minimal clothing, ensuring scales are set to zero and standing on a hard, even surface.

Measurement: Height - **Measure in metres**.

Weight – **Measure in kilograms**.

Calculate **Body Mass Index** with the following equation:

$$\text{BMI} = \frac{\text{WEIGHT (Kg)}}{\text{(HEIGHT x HEIGHT) (m)}}$$

Relate your score to the normative tables.

Notes: BMI is a common way of indicating whether a client is obese- though does not actually measure body composition.

Work out your body mass index (BMI)

$$\frac{\text{Your weight in kilograms}}{\text{(Height in metres x height in metres)}}$$

Example

1. $\frac{\text{61.6 kg}}{\text{1.74m x 1.74m}}$
2. $\frac{\text{61.6}}{\text{2.89}}$
3. = BMI

Write your calculations here:

NORMATIVE TABLE FOR BMI

BMI	**Classification**	**Associated risk**
<18.5	Underweight	Increasing health risk
18.5– 24.9	Normal weight (grade 0)	Lowest health risk
25-29.9	Overweight	Medium risk
30-34.9	Obesity (grade I)	Gradually Increasing
35-39.9	Obesity (grade II)	Health risk with
40+	Extremely obese (grade III)	Gradually increasing BMI

(ACSM's Guidelines for Exercise Testing and Prescription, 2010)

BODY COMPOSITION- BIOELECTRICAL IMPEDANCE (BIA)

What is tested: **Subcutaneous adipose tissue (body fat)**

Equipment needed: **Body Stat Monitor**

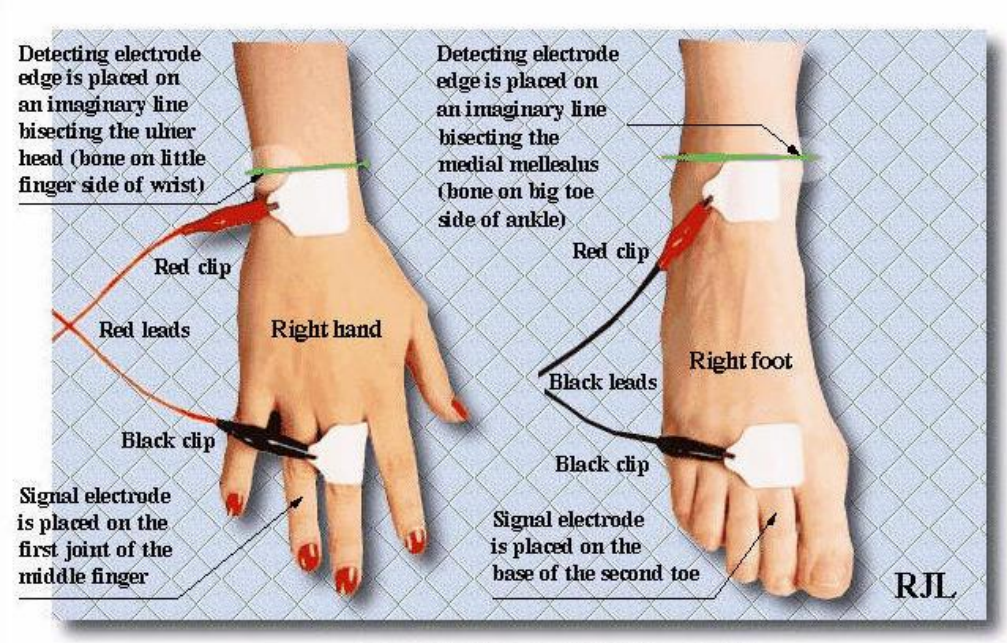
Purpose of test: To give an indication of body composition. Though not as accurate as the skin fold measurement as it is easier to implement and is less intrusive to the participant.

Procedure:

- The subject should not have exercised or taken a sauna within 8 hours of the test.
- The subject should refrain from alcohol intake for 12 hours prior to the study.
- The subject's height and weight should be accurately measured and recorded.
- The subject should lie quietly during the entire test.
- The individual must lay flat on the floor with their arms not touching their sides and their legs not touching one another.
- The electrode sites may need to be cleaned with alcohol, particularly if the skin is dry or covered with lotion.
- Electrodes are placed, two on the **RIGHT** hand and two on the **RIGHT** foot. *See diagram below*
- Information regarding the individual in relation to their height, weight and activity levels is inputted into the monitor.
- Within a few seconds the readings are sent through to the monitor display screen to be recorded.

Measurement: The theory is that muscle will conduct the electricity (due to water content), while fat will resist the path of the electricity.

Therefore the more electricity that comes out of the body, the more muscle a person has.



(http://www-rohan.sdsu.edu/~ens304l/bia.htm)

Body stat Body Composition Results

Name …….. Date …….

Age ……... Height……..……..... Weight …….

Activity levels		
	Very low	
	Low/ medium	
	Medium	
	Medium/ high	
	Very high	

Results

	Readings	**Recommended Range**
Fat %		
Fat Mass (kg)		
Lean mass %		
Lean mass (kg)		
Total body weight (kg)		
Water %		
Total body water (l)		

Estimate RMR	
Estimated energy requirement	

Comments/ Recommendations

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MY RESULTS SHEET

Fitness Component	Name of Fitness Test	Result	Rating from Normative Data
Aerobic endurance	**Multi Stage Fitness Test**		
Flexibility	**Sit and reach**		
Strength	**Hand Grip Dynamometer**	**L=** **R=**	
Power	**Vertical Jump**	Takei meter Lewis nomogram	

Fitness Component	Name of Fitness Test	Result	Rating from Normative Data
Speed	**35m sprint test**		
Muscular endurance	One minute sit ups One minute press ups		
Body Composition	**Skin folds**	**Sum=** **%=**	
	BMI		

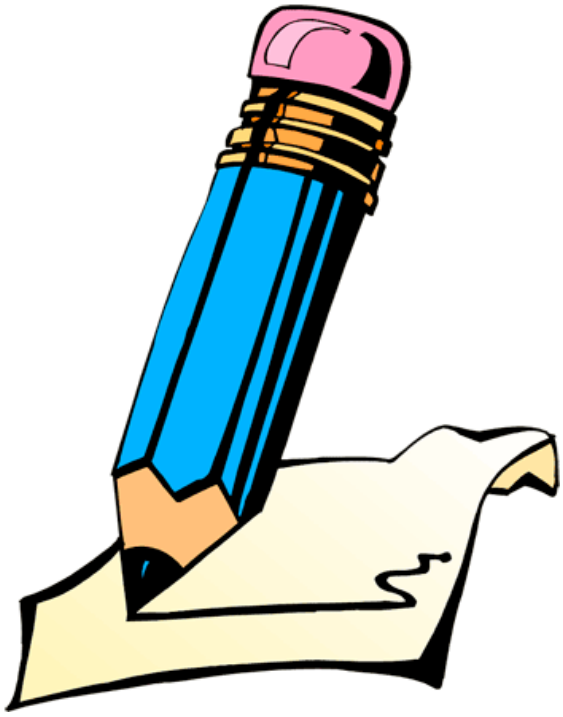
ADVANTAGES & DISADVANTAGES

Test	Advantages	Disadvantages
Sit and reach test		
MSFT		
Forestry step test		

Test	Advantages	Disadvantages
35m sprint test		
Push up test		
Sit up test		

Test	Advantages	Disadvantages
Illinois agility test		
Vertical jump- 1		
Vertical jump-2		

Test	Advantages	Disadvantages
Grip strength		
Body composition- skinfolds		
Body composition- BMI/ BIA		



WORK ON THE TASK PROVIDED BY YOUR TUTOR TO APPLY YOUR KNOWLEDGE

NOTES FOR EXAM REVISION