



CURRICULUM ON Wellness: Physical Training

Strand W3 Individual Fitness

Level 11

This Strand is composed of the following components:

- A. Fitness and Testing
- B. Physical Training**
- C. Facts about Fitness

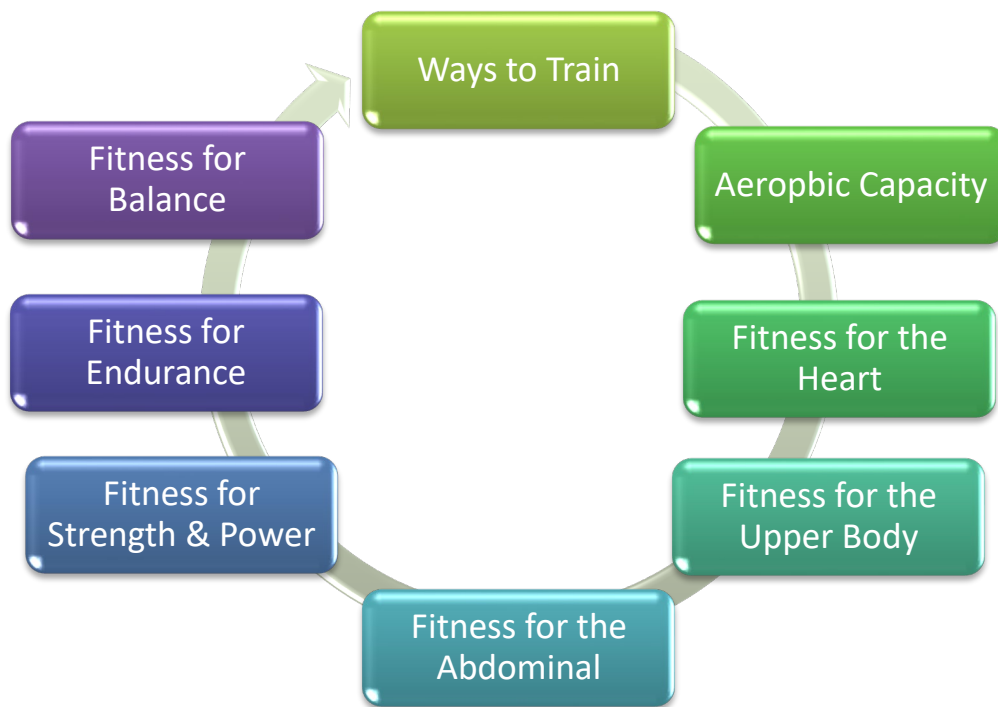


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B. Physical Training

STANDARD #4: Cadets participate in a variety of fitness and wellness activities.

OBJECTIVES

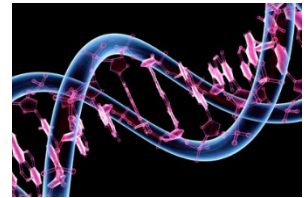
DESIRED OUTCOME (Leadership)

The desired outcome of this unit is for students to learn a majority of the encumbered scientific applications to training for bettering fitness, using the five components of fitness, anatomy of the human body, and calculating individualized training values.

1. *Understand the different ways to train the body using skills related to fitness and fitness abilities.*
2. *Execute a flexibility Range of Motion exercise/test/assessment.*
3. *Explain components of Aerobic Capacity, including VO₂Max, the various tests and how to calculate it.*
4. *Understand heart health, the anatomy of blood supply of the heart and how cholesterol impacts the heart health.*
5. *Find/Calculate heart rate, max heart rate/threshold.*
6. *Identify exercises to continue to provide heart health and at what value of the five components of fitness with a rating of excellent, good, fair and poor.*
7. *Identify upper body muscles and exercises that coincide with each muscle group.*
8. *Identify and define, isotonic, isometric and isokinetic exercises, as well as isotonic and isometric contractions.*
9. *Identify and define abdominal muscles and their role in whole body health, and exercises to maintain health through exercises.*
10. *Understand the difference between strength and power, how to calculate strength, power and endurance using equations.*
11. *Explain the difference between the difference between Aerobic and Anaerobic power.*
12. *Understand the primary muscle fiber types, identify by name and secondary name.*
13. *Calculate and forecast caloric burn using the METs equation for a daily calorie burn to balance their energy.*

B1. Ways to Train

Skill related fitness refers to a group of basic abilities that helps you perform well in sports and activities requiring certain physical skills. The skill related fitness components are made of five elements: agility, balance, coordination, reaction time, and speed. Previously discussed in W3 A1, these elements are basic skill sets that build up to being able to grow or develop individual fitness or athletic skills. A **Skill** is being able to do a task through knowledge and practice. Skills together are referred in two separate references physical skills and motor skills. **Physical/motor skills** are skills that refer to muscles and nerves working together to complete a series of movements that together are applied to fitness, and recreational movement. Fitness Abilities and Physical Skills are not the same. **Fitness abilities** are the natural talents and abilities based on genetics or strict conditioning; good balance can translate to gymnastics; foot speed can translate to running because of scientific make up (heredity) and body composition. Personal Determinants such as heredity, age, gender, disability or other factors can affect the way some people condition or plan out their fitness.

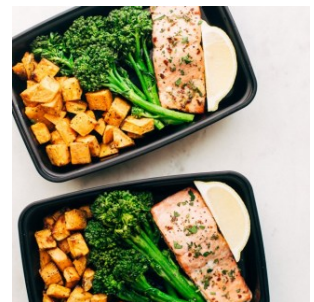


The **Principle of Specificity** is to choose a sport or activity that aligns with a person's skill-related fitness abilities. For example, a person who is flexible and agile might select gymnastics, dance or cheerleading based off the characteristics needed to be successful. Whereas, an individual who has quick reaction time, is tall, cross coordinated (both sides of body) and flexible can specifically fit as a hockey goalie, boxer, baseball pitcher, etc.

There are many ways to train for fitness; it is all based on what type of fitness level and degree of work the individual wants to achieve. There are different levels of fitness goals: i.e. lose fat to improve body composition, to gain muscle mass, to fine tune current muscle, to strengthen defined muscles, improve cardiovascular endurance, improve flexibility and many more. ALL training combinations are coupled with a diet or a preferred addition to daily dietary expectations.

- **Muscular Strength**

- Develop a plan that includes a gradual increase in amounts of resistance or weight and repetitions after the ability to complete it becomes relatively easy:
- Workout options: Lifting Weights, Resistance bands, Stair Climbing, Cycling, Rowing, Push Ups, Sit Ups, Squats, Yoga/ Pilates; the one you most enjoy.
- Dietary Needs: Drink lots of water, red meats, fish, seafood, whole grains, nuts, oatmeal, green vegetables, brown rice, beans, salad, fruit.



- **Muscular Endurance** – the ability to use your muscles many times without tiring.

- To lose fat/weight/ improve body composition-
- Develop a plan that includes a cardiovascular component and a gradual increase in amounts of resistance or weight (aerobic exercises) and repetitions after the ability to complete it becomes relatively easy:
 - Running
 - Swimming
 - Cycling

- Rowing
 - Lift weights
 - Resistance bands
- **Cardiovascular Endurance**, the ability to exercise your entire body for a long time without stopping.
 - Aerobic exercises will increase energy, stamina, control blood pressure and cholesterol, and burns more calories.
 - According to the University of Sports Medicine at University of Colorado, a person should engage in activities that target large muscle groupings, especially the legs; are continuous or follow a rhythm; and challenge your heart and lungs. This can be accomplished with:
 - Slow moderate distance training
 - moderate to high intensity interval training
 - continuous high-intensity workouts.
 - Building cardiovascular endurance is best if you increase the amount of time exercising, and frequency the exercises are completed (University of Colorado, 2003). The key is to push further, farther, longer, faster, heavier each time you have a workout, the “Bigger, Faster, Stronger” (BFS) approach.

ELA Practice Opportunity- The article *Training for Cardiovascular Fitness* is attached as a Handout to this document, in case the commandant would like to have students to do collaboration activities such as gallery walks, think-pair-share, group discussions, group reading, annotations etc.

- **Flexibility** - the ability to use your joints through a full range of motion without injury. In most cases flexibility relies on genetics, body build, gender, age, and routine stretching. Genetics and heredity determine body build, and females tend to be more flexible than males. Usually younger people are more flexible, due to muscles growing shorter with age (if they are exercised less).
- **Range of motion (ROM)** - the amount of movement in a specific joint that is considered to be healthy (neither too little nor too much).

Partner Activity opportunity- The worksheet Range of Motion Evaluation Chart is attached as a Handout to this lesson. Have students pair up and “evaluate their range of motion” using the range of motion worksheet

Check on Understanding:

1. Skill related fitness is just one skill related to a sport or activity. (T/F)
2. If a person has asthma, that is considered a fitness ability. (Yes/ No)
3. To build muscular strength what is recommended that you do for your diet?

Range of Joint Motion Evaluation Chart

NAME OF PATIENT		CLIENT IDENTIFICATION NUMBER	
INSTRUCTIONS: For each affected joint, please indicate the existing limitation of motion by drawing a line(s) on the figures below, showing the maximum possible range of motion or by notating the chart in degrees. Provide a complete description of all affected joints in your narrative summary. If range of motion was normal for all joints, please comment in your narrative summary. If joints which do not appear on this chart are affected, please indicate the degree of limited motion in your narrative.			
1. Back Extension 25° Flexion 50° Degrees Degrees		2. Lateral (flexion) Left 25° Right 25° Degrees Degrees	
3. Neck Extension 50° Flexion 50° Degrees Degrees		4. Neck (lateral bending) Left 45° Right 45° Degrees Degrees	
5. Neck (rotation) Left 50° Right 50° Degrees Degrees		6. Hip (backward extension) Left 30° Right 30° Degrees Degrees	
7. Hip (flexion) Left Knee Flexed 100° Knee Extended 100° Degrees Degrees Right Knee Flexed 100° Knee Extended 100° Degrees Degrees		8. Hip (adduction) Left 20° Right 20° Degrees Degrees	
9. Hip (abduction) Left 40° Right 40° Degrees Degrees		10. Knee (flexion) Left 150° Right 150° Degrees Degrees	

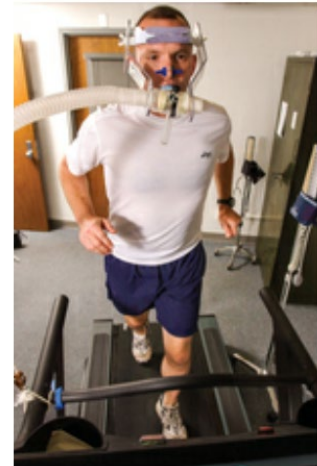
B2. Fitness Measures: Aerobic Capacity

Aerobic Capacity is the ability of the cardiorespiratory system to provide oxygen during hard exercises over a specific amount of time.

VO₂Max is the maximum amount of oxygen the body can utilize during a specified period of usually intense exercise. The difference between VO₂Max and Aerobic Capacity is that VO₂Max includes the athlete's body weight.

Maximal oxygen uptake test is a reliable assessment for determining cardiovascular fitness, completed by running on a treadmill while connected to a gas meter; as difficulty increases it measures the amounts of oxygen used.

A **VO₂Max Test** or **Graded Exercise Test** is administered by a health professional, where the individual being tested is closely monitored through blood pressure cuffs, speed and treadmill grade difficulty while the individual keeps going until complete exhausted. Example photo of an individual taking a graded exercise test is found in this photo (Corbin & Le Masurier, 2014). An interesting fact about **VO₂Max Test** is that there is often a person involved in administration of the test called the "catcher" who is supposed to catch the individual getting tested if they get to the point of exhaustion and come close to or fall off the treadmill.



Check on Understanding:

1. There is no difference between VO₂MAX and Aerobic capacity. (T/F)
2. What does VO₂Max stand for? Define it.
3. What is the purpose of the gas meter in the Maximal Oxygen Uptake test?

B3. Fitness for the Heart

The heart has to be a powerful pump to keep the body operating at **homeostasis** (the stability and balance of all systems within the human body). In order to improve or keep heart health fit for life-longevity is exercise, proper diet, and awareness of heredity. The circulatory system is constructed of **arteries** that carry oxygenated blood from the heart to all parts of the body and **veins** which carry de-oxygenated blood or waste-filled blood back to the heart. Exercises that are best to keep the heart fit through work are **aerobic exercises** - activities that increase the speed of blood flow in the blood vessels. Proper/healthy diets and food choices play a large part in heart maintenance. Some foods contain high fat content; fat builds up in the blood vessels and can cause negative actions of the heart. This is usually in the form of **cholesterol**, a substance found in meat, dairy, and eggs, that collects and forms a waxy and fatty texture that sticks to the interior walls of blood vessels and arteries. Cholesterol is in primarily in two forms. "Bad cholesterol" is **low-density lipoprotein (LDL)** - it carries the cholesterol to your body that contributes to **atherosclerosis** - fat build up in blood vessels that constricts blood flow in the arteries. **High-density lipoprotein (HDL)** is nicknamed "good cholesterol." It carries the excess cholesterol out of the bloodstream to the liver so the body can eliminate or excrete it from the body.

Heart attacks occur when there is a significant restraint or reduction of blood supply causing areas of muscles in the heart to die. (Corbin, 2014)

When you exercise, your goal should be to reach your Target Heart Rate and keep at that pace throughout your workout. You want to keep your heartrate between the threshold heartrate and the target ceiling. Exercises and activities that are good for the heart

to remain in good working order or for improvement are those that work the heart past the resting heart rate, and help the individual to reach their heart rate target. Calculating the heart rate target is shown in the example in this table.

- **Maximum heartrate** is 220 minus the individual's age
- **Resting Heartrate** is the rate your heart beats normally when your body is at rest
- **Heartrate Reserve** is Max HR minus Resting HR
- **Threshold Heartrate** is the percentage of heart rate an individual can sustain during exercise over a long period (10-60+ minutes) (Corbin, 2014)

Examples of exercises that are good for the heart and heart health are running, swimming, cardio kickboxing, zumba, dancing, cycling etc. - any activity that raises the heart rate for the duration of the exercise time period. In order to train the heart for meeting the heart rate target zone, and enduring *into* the ceiling, gradually build up the endurance over a period of time. A list of great aerobic activities are in the next table. The activity does not need to be formal sport or exercise routine, but can be a leisure activity. The best activity to use in order to maintain or increase endurance in heart fitness is the one that you enjoy – so you do it often.

TABLE 8.6 Calculating Heart Rate Target Zone (% HRR Method)

Threshold HR	Step 1:	204 (max HR)*
	Step 2:	- 67 (resting HR)
		137 (HRR)
Target ceiling	Step 3:	× 0.6 (threshold %)
		82
		+ 67 (resting HR)
		149 (threshold HR)
Target ceiling	Step 1:	204 (max HR)*
	Step 2:	- 67 (resting HR)
		137 (HRR)
Target HR zone	Step 3:	× 0.8 (ceiling %)
		110
		+ 67 (resting HR)
		177 (target ceiling HR)
Target HR zone		149–177 beats per min

*The example is for a 16-year-old with a resting HR of 67 with cardiorespiratory endurance in the good fitness zone.

TABLE 9.2 Health-Related Benefits of Selected Vigorous Physical Activities

Activity	Develops cardiorespiratory endurance	Develops strength	Develops muscular endurance	Develops flexibility	Helps control body fat
Aerobic dance*+	Excellent	Fair	Good	Fair	Excellent
Aerobics machine+	Excellent	Fair	Good	Poor	Excellent
Backpacking+	Fair	Fair	Excellent	Poor	Good/Excellent
Badminton+	Fair	Poor	Fair	Fair	Fair/Good
Baseball/Softball*	Poor	Poor	Poor	Poor	Poor/Fair
Basketball, half-court*+	Fair	Poor	Fair	Poor	Poor/Fair
Basketball, full-court*+	Excellent	Fair	Good	Poor	Excellent
Biking+	Good	Fair	Good	Poor	Good/Excellent
BMX cycling	Good	Good	Excellent	Fair	Good
Canoeing+	Fair	Fair	Fair	Poor	Fair/Good
Circuit training+	Good	Good	Good	Fair	Good/Excellent
Football*	Fair	Good	Fair	Poor	Fair
Gymnastics	Fair	Excellent	Excellent	Excellent	Fair
Handball/Racquetball*+	Good/Excellent	Fair	Good	Poor	Good/Excellent
Hiking	Fair	Fair	Fair/Good	Poor	Good
Hip-hop dance	Good/Excellent	Fair	Good	Fair	Good/Excellent
Horseback riding+	Poor	Poor	Poor	Poor	Poor
Kayaking*+	Good	Good	Good	Fair	Good
Martial arts*+	Good	Fair	Fair	Fair	Fair
Mountain or rock climbing*+	Good	Good	Good	Poor	Good
Racquetball*+	Good/Excellent	Fair	Good	Poor	Good/Excellent
Rowing (crew)*	Excellent	Fair	Excellent	Poor	Excellent
Sailing+	Poor	Poor	Poor	Poor	Poor
Skating (roller or ice)*+	Good	Fair	Good	Fair	Good
Skiing (cross-country)*+	Excellent	Fair	Good	Poor	Excellent
Skiing (downhill)*+	Fair/Good	Fair	Good	Poor	Fair/Good
Snowboarding*+	Fair/Good	Fair	Good	Fair	Fair/Good
Soccer*	Excellent	Fair	Good	Fair	Excellent
Social dance+	Fair	Poor	Fair	Fair	Fair
Surfing*+	Fair	Poor	Good	Fair	Fair/Good
Swimming+	Good	Fair	Good	Fair	Good/Excellent
Table tennis*+	Poor	Poor	Poor/Fair	Poor	Poor/Fair
Tennis*+	Good/Excellent	Fair	Good	Poor	Good/Excellent
Volleyball*+	Fair	Fair	Good	Poor	Fair/Good
Waterskiing*+	Fair	Fair	Good	Poor	Fair/Good

*Fitness needed to prevent injury.

+Lifetime activity.

(Corbin, 2014)

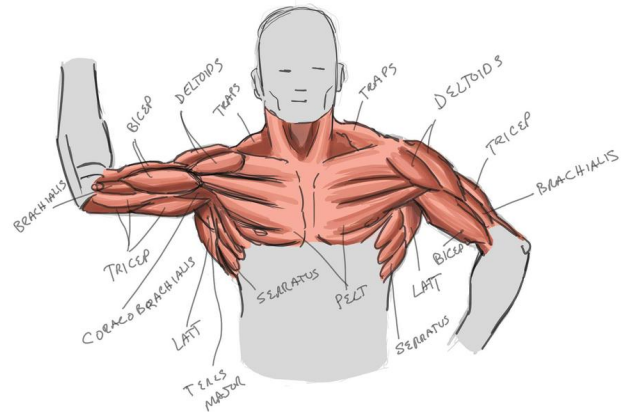
Check on Understanding:

1. Define cholesterol. Explain the different types of cholesterol and their role.
2. To improve or maintain heart fitness one should exercise below the threshold and the target ceiling. (T/F)
3. What are examples of heart fitness exercises?

B4. Fitness for the Upper Body

The upper body is the muscles above the navel to the top of the shoulders and extending through the arms to the hands. This grouping consists of the major muscle groups:

- trapezius (traps)
- deltoid
- triceps
- brachioradialis
- biceps
- latissimus dorsi (lats)
- pectoralis major (pecs)



In upper body fitness, there are different approaches to take in order to build or grow muscle endurance, strength, or size of the muscle. This is called **hypertrophy** and is completed through various exercise types and contraction types.

- **Isotonic fitness** of muscles uses two types of contractions
 - **concentric contractions** - shortening of the muscle
 - **eccentric contractions** - lengthening of the muscle
- **Isotonic contractions** pull on bones to result in body movement.
- **Isotonic exercises** are where the muscle must contract to move body parts, like lifting weights.
- **Isometric contraction**, also known as a *static* contraction, is when a muscle is activated in opposite directions with equal force but does not shorten or lengthen.
- **Isometric exercise** is when the body does not move during the exercise. An example of this would be holding a plank, flexed arm hangs etc.
- **Isokenetic exercise** uses a constant speed no matter how much effort you expend. Specialized machines control the pace of an exercise by fluctuating resistance throughout your range of motion. Your speed remains consistent despite how much force you exert.

Upper body exercises broken down by muscle groups.

Trapezius

- Farmers carry
- Shrugs (barbell or dumbbell)
- Inclined Dumbbell Shrug
- Barbell Deadlifts
- Upright Rows
- Face Pull

Deltoids

- Upright Rows

- Rear Delt Fly
- Fly
- Burpee
- Bent rows

Triceps

- Bench press
- Dips
- Pushdowns
- Push Ups

Brachioradialis

- Hammer Grip Curls
- Pull Ups
- Cable Lat Pulldowns
- Dumbbell cross body hammer curls

Biceps

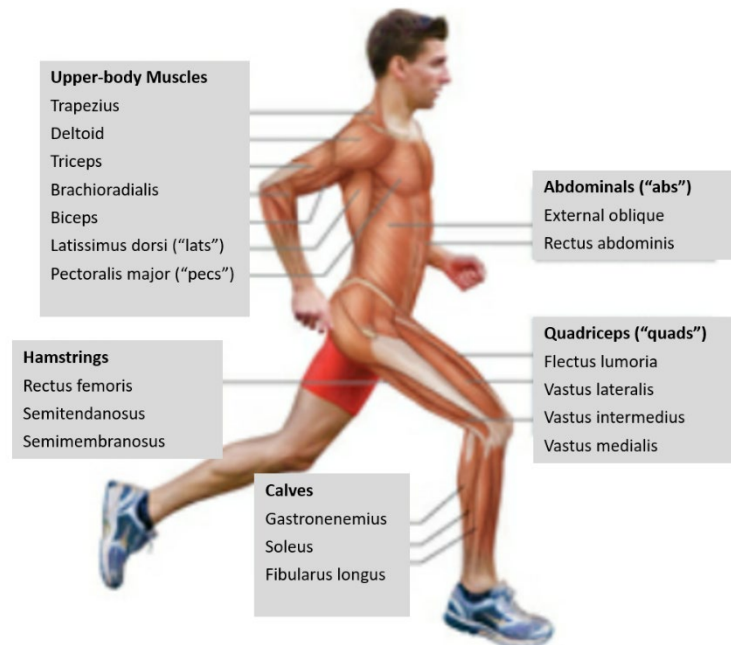
- Barbell curl
- Chin-ups
- Hammer Curls
- Concentration Curls
- Low-pulley curls

Latissimus dorsi

- Pull-up
- Cable Lat Pulldown
- Bent-over rows
- Reverse-grip barbell

Pectoralis major

- Pullover
- Fly
- Push-up
- Cable cross-over
- Svend Press or Weight Plate front raise
- Triceps dips



Check on Understanding:

1. There are only 8 muscles in the upper body. (T/F)
2. Increase in muscle size is _____.
3. What is the best type of exercise? Isotonic, isometric, isokinetic? Explain your answer as to why you feel that way. Use deductive reasoning.

B5. Abdominal Fitness

The abdominal structure is also known as the **core** or **abs** or **trunk** (even though the muscles are not only in the trunk area). All the muscles in the core are needed for the whole body to operate the way it is intended. The abdominal muscles are constructed for support of the spine, to stabilize the rib cage and pelvis and hold the body's posture, working with the back muscles (Corbin, 2014). All the core muscles are used in many aspects of daily operations of the body, such as expelling substances through vomiting, coughing, fecal matter, and childbirth. The abdominal muscles are divided into groupings, the major and minor muscles. Major muscles are those that are in the belly areas, middle back and lower back sections. The lower back are those muscles used for expelling waste located in the pelvic area.

The major belly core muscles are

- the **obliques** - the sides of the belly or love handle area

- the **transversus abdominis** - the area below the navel to the pelvic area
- the **rectus abdominis** - the “six pack area” center body front.

The minor muscles are

- the **gluteus maximus** - the butt muscles
 - the **latissimus dorsi** - the middle back big flat muscle that wraps towards the front of the body
 - the **trapezius** - the upper back muscle that leads from middle spine up towards the neck.
- (Ellsworth, 2010)

Having a weak core can cause posture issues as well as back issues. A weak core puts unneeded stresses on the short back muscles and cause poor posture that causes health issues such as **ptosis** (the abdomen to protrude causing a round belly look), **lordosis** (excessive back arch), and **kyphosis** (rounded back or swayback also nicknamed *hunchback* or *humpback*). (Corbin, 2014)

Strengthening and maintaining core, back and posture is only completed through exercises, stretching, and executing lifting/carrying objects correctly. Core muscle fitness is accomplished using various exercises, such as curl ups, crunches, trunk lifts, sit ups, planks, and arm and leg lifts. These exercises are commonly executed in Pilates. Exercises completed through using all or part of the body weight to create resistance is known as **calisthenics**. Stretching will help in flexibility of all the muscles.

Exercises for core strength:

- Curl Ups
- Trunk Lift
- Side Plank
- Reverse Curl
- Bridging
- Supine Leg lifts (on back)
- Push Ups
- Prone Arm lift (face down/ belly down)
- Stride Jump
- Side Leg Lift
- Knee to Nose (mountain climber)

Measuring abdominal strength and endurance can be done by comparing the number of Curl Ups you can do as shown in **Table 3.1 (below)** (Corbin, 2014). **Also refer to Lesson W3/ A4.**

TABLE 3.1 Rating Chart: Curl-Up (Number of Repetitions)

	13 years old		14 years old		15 years or older	
	Male	Female	Male	Female	Male	Female
High performance	≥41	≥33	≥46	≥33	≥48	≥36
Good fitness	21–40	18–32	24–45	18–32	24–47	18–35
Marginal fitness	18–20	15–17	20–23	15–17	20–23	15–17
Low fitness	≤17	≤14	≤19	≤14	≤19	≤14

Data based on Fitnessgram.

Check on Understanding:

- Are the abdominal muscles only in the trunk or belly area of the human body? (T/F)
- Other than aiding in body posture what else do the abdominal muscles support?
- Three “sis” suffix conditions listed due to poor abdominal strength. Name and explain them in your own words, or define.

B6. Strength and Power

Strength and power are often confused for each other. **Strength** is the max amount of force muscles can exert. **Power** is the capacity to use strength and speed quickly. (Corbin, 2014) Another way of understanding power is it is the product of velocity and speed, transforming metabolic energy into work or heat. A measure for strength is shown as 1RM, or **1-repetition maximum**; it's the max amount of weight a person can lift or press once, being unable to lift or press it again. If the person is able to lift or press it again, then weight must be added until the person *maxes out*. **Static Strength** is completed through exercises that involve no movement - also known as isometric exercises, like the flexed arm hang. **Dynamic Strength** is completed through exercises that involve joint movement, also known as isokinetic exercises, like weightlifting.

Muscular power is defined and found through the equation $Power = \frac{Force \times Distance}{Time}$.

Speed is found through the equation $Speed = \frac{Strength + Distance}{Time}$.

Examples of power and strength calculations are found (Wilmore, 2012) in **Table 9.1**. (Wilmore, 2012)

Aerobic Power is an indicator of cardiovascular fitness and development in the weight bearing endurance sports such as cross country running and Nordic skiing. Aerobic power indicates the oxygen intake per unit of body weight and is directly correlated to performance in activities lasting 5-15 minutes.

TABLE 9.1 Strength, Power, and Muscular Endurance of Three Athletes Performing the Bench Press

Component	Athlete A	Athlete B	Athlete C
Strength ^a	100 kg	200 kg	200 kg
Power ^b	100 kg lifted 0.6 m in 0.5 s = 120 kg · m/s = 1,177 J/s or 1,177 W	200 kg lifted 0.6 m in 2.0 s = 60 kg · m/s = 588 J/s or 588 W	200 kg lifted 0.6 m in 1.0 s = 120 kg · m/s = 1,177 J/s or 1,177 W
Muscular endurance ^c	10 repetitions with 75 kg	10 repetitions with 150 kg	5 repetitions with 150 kg

^aStrength was determined by the maximum amount of weight the athlete could bench press just once (i.e., the 1RM).

^bPower was determined as the athlete performed the 1RM test as explosively as possible. Power was calculated as the product of force (weight lifted) times the distance lifted from the chest to full arm extension (0.6 m or about 2 ft), divided by the time it took to complete the lift.

^cMuscular endurance was determined by the greatest number of repetitions that could be completed using 75% of the 1RM.

Anaerobic Power is energy that is stored in muscles and that can be accessed without the use of oxygen. Tennis, basketball, racquetball, soccer, volleyball, football and other start-and-stop sports are anaerobic because of the high heart rates, short durations and longer recovery periods you experience when you play them.

Check on Understanding:

1. What is strength?
2. Dynamic Strength is completed by using isokinetic exercises or isometric exercises?
3. What type of power does not involve uptake of oxygen?

B7. Endurance

Muscular endurance is the ability of a muscle or group of muscles to resist fatigue, or to sustain repeated contractions for an extended time period and not tire. (Wilmore, 2012) This type of

endurance does not rely on oxygen or the respiratory system, but on muscle fibers. There are three primary muscle fiber types:

Type I: Fast-Twitch – muscle fibers that facilitate powerful movements while having least endurance, used in strength activities – explosive, short term or highly intensive exercises

Type II: Slow-Twitch – muscle fibers that help long endurance

Intermediate-Twitch fibers mirror both characteristics of slow and fast twitch fibers.

Based on body make up and heredity, genetics determines if a person has more slow, fast or intermediate twitch fibers. More fast-twitch are more prone to be better at sprinting and jumping activities, and slow-twitch are commonly better at endurance running and swimming. Training can help evolve fiber functions (Corbin, 2014).

Check on Understanding:

1. What is the definition of muscular endurance?
2. A high jumper is an example of what type of muscle fiber? Type I or Type II? Explain why.
3. Fast-twitch fibers is a perfect example of what would be expected to be found in long distance runners. (T/F)

B8. Balance

Muscular Balance is defined as an ability to remain in an upright position while standing or moving. It is a component of skill-related fitness. It is a specific skill where its strength is a necessity of select sports/activities, but it is not a crucial component for success in other sports or activities. For example, excellent balance related skills are critical for, bicycling, dance, gymnastics, skating/ice skating, skiing and tai chi. The “good” category sports/activities for muscular balance is less specified and more modern such as baseball, basketball, bowling, extreme sports, football, and martial arts. The majority of sports/activities fall into the “fair” category of muscular balance strong skills, such as tennis, golf, soccer, softball, and volleyball. The “poor” category activities for muscular balance are jogging and swimming.

Balancing energy is balancing intake with output, such as food intake with energy output through exercises and activities. (Corbin, 2014) To balance energy output with food/caloric intake there is an equation to help calculate the exact number of calories an individual uses just doing their everyday life. It is an additive to calculating how many calories individuals need to balance, increase or decrease for individual fitness. It uses a measure called **metabolic equivalent (METs)**, a unit that measures the metabolic cost (oxygen consumption) of any physical activity or exercise. Its mathematical definition is $3.5\text{ml of O}_2 \text{ multiplied by kg multiplied by min. } METS = 3.5\text{ml} \times \text{kg} \times \text{mins.}$ For example, a 155-pound person is (rounded) 70kg's, (lbs. to kg is how many lbs. divided by 2.2), who spends 8 hours resting ($8 \times 60 = 480$ minutes) utilizes roughly, 588 calories. $\frac{(1\text{met} \times 3.5\text{ml} \times 70)}{200} \times 480 = 588 \text{ calories.}$ As shown, it is divided by 200 (calories per minute) then multiplied by the number of minutes. Another example is the same person who pushes a lawn mower for 2 hours burns 955.5 calories. In order to calculate a whole day of activity for an individual, the number of hours must equal 24 hours of various activities to get the truest calculation of caloric output needed and how to then learn to balance their diet or caloric input. There is a list of how many METs is equivalent to the activity as seen in **Table 20.2** below. (Wilmore, 2012)

TABLE 20.2 Selected Activities and Their Respective MET Values

Activity	MET Value	Activity	MET Value
REST AND SELF-CARE ACTIVITIES			
Rest (supine)	1.0	Showering	2.0
Sitting	1.5	General grooming, standing	2.0
Eating	1.5	Dressing or undressing, standing	2.5
Bathing	1.5		
HOME ACTIVITY			
Knitting or hand sewing, light effort	1.3	Vacuuming (general, moderate effort)	3.3
Washing dishes	1.8	Making beds, changing linens	3.3
Ironing	1.8	Cleaning (scrubbing floor, washing car, washing windows)	3.5
Laundry, folding or hanging clothes	2.0-2.3	Sweeping, moderate effort	3.8
Cooking or food preparation	2.0-3.5	Moving furniture, carrying boxes	5.8
Machine sewing	2.8	Scrubbing floors on hands and knees, vigorous effort	6.5
OCCUPATIONAL			
Sitting tasks, office work, working at a computer	1.5	Construction (outside)	4.0
Driving a delivery truck, taxi, school bus, etc.	2.0	Hotel housekeeper	4.0
Cook, chef	2.5	Yard work	4.0
Standing tasks, light to moderate effort	3.0-4.5	Manual or unskilled labor	2.8-6.5
Custodial work	2.5-4.0	Farming, light to vigorous effort	2.0-7.8
Carpentry (general, light to moderate effort)	2.5-4.3	Fire fighter on the job	6.8-9.0
PHYSICAL CONDITIONING			
Walking			
2.5 mph, level	3.0	4.5 mph, level	7.0
3.5 mph, level	4.3	5.0 mph, level	8.3
4.0 mph, level	5.0	5.0 mph, 3% grade	9.8
Jogging or running on level surface			
4.0 mph	6.0	10.0 mph	14.5
6.0 mph	9.8	12.0 mph	19.0
8.0 mph	11.8	14.0 mph	23.0
Swimming			
Freestyle, vigorous effort	9.8	Breaststroke, recreational/training and competition	5.3/10.3
Freestyle, slow to moderate	5.8	Sidestroke, general	7.0

(continued)

TABLE 20.2 (continued)

Activity	MET Value	Activity	MET Value
PHYSICAL CONDITIONING			
Backstroke, recreational/training and competition	4.8/9.5		
Cycling			
Leisure, 5.5 mph	3.5	Leisure, 14.0-15.9 mph (vigorous effort)	10.0
Leisure, 10.0-11.9 mph (slow, light effort)	6.8	Racing, 16.0-19.0 mph (vigorous effort)	12.0
Leisure, 12.0-13.9 mph (moderate effort)	8.0	Racing, >20 mph (vigorous effort)	15.8
RECREATIONAL ACTIVITIES			
Aerobic dance	5.0-7.3	General resistance training	3.5-6.0
Video game activities	2.3-6.0	Rowing machines	4.8-12.0
Stationary cycle ergometer	3.5-14.0	Water aerobics	5.3
Circuit training	4.3-8.0	Video exercise workouts, light to vigorous	2.3-6.0
SPORT ACTIVITIES			
Archery	4.3	Rock or mountain climbing	5.0-8.0
Badminton	5.5-7.0	Roller skating	7.0
Basketball	6.0-9.3	Rugby	6.3-8.3
Bowling/Lawn bowling	3.0-3.8	Skateboarding	5.0-6.0
Football, flag or touch	4.0-8.0	Soccer	7.0-10.0
Golf	4.8	Softball	5.0-6.0
Handball	12.0	Squash	7.3-12.0
Hockey, field	7.8	Table tennis (ping pong)	4.0
Hockey, ice	8.0-10.0	Tennis, singles	7.3-8.0
Horseback riding	5.8-7.3	Tennis, doubles	4.5-6.0
Lacrosse	8.0	Volleyball	3.0-4.0
Orienteering	9.0	Volleyball, competitive	8.0
Racquetball	7.0-10.0	Volleyball, competitive beach	6.0

Data from Ainsworth et al. Healthy Lifestyles Research Center, College of Nursing and Health Innovation, Arizona State University. Retrieved 7/21/2011 from <http://sites.google.com/site/compendiumofphysicalactivities>

Check on Understanding:

1. Balance definition only refers to muscular. (T/F)
2. What does METS stand for? Define it.
3. Calculate this person's metabolic output in calories burned (round kg and all answers to closest whole)
 - a. Patient is 175 lbs.
 - b. Averages 8 hours of sleep

- c. Does a moderate gym routine for 2 hours
 - i. Treadmill at 3.5 mph for 1 hour
 - ii. Swims slow moderate front crawl/freestyle for 1 hour
- d. Does office work for 8 hours
- e. Showers for 30 minutes
- f. Grooms for 30 minutes
- g. Eats for 15 minutes 4 times a day
- h. Relaxes at home for 4 hours before bed.

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