

Chapter 11

Muscle Fitness: Basic Principles and Strength

Chapter Overview

CHAPTER SUMMARY

This chapter describes the health and wellness benefits of having good muscle fitness. It explains the difference between strength and muscular endurance, and includes activities for assessing and developing the two. The physiology of muscle structure and how it relates to the building of strength and muscular endurance is explored. Different types of muscular training are presented in this chapter and how they relate to improving muscle fitness. This chapter also discusses how and why strength training for preteens and teens differs from weight training for adults, and it clears up some of the common misconceptions about strength training. It includes instruction in the application of the fitness principles and the FIT formula for improving muscle fitness. Lastly, this chapter provides strategies for starting and, more importantly, sticking with a muscular fitness program.

CHAPTER RESOURCES

Activity: Partner Resistance Exercises

Activity Cards 111-118

Partner Resistance Exercises (PA 11-1)

Class: Muscle Fitness Basics (11.1)

Vocabulary Cards 102-115

OTM 11-A: Some Major Muscle Groups (CR 11-2)

OTM 11-B: Strength/Endurance Continuum (CR 11-3)

OTM 11-C: Repetitions and Sets (CR 11-4)

OTM 11-D: How Muscles Apply Force to Bones (CR 11-5)

Activity: Self-Assessment 11: Determining Your Modified 1RM and Grip Strength

Determining Your Modified 1RM and Grip Strength Worksheet (SW 11-1)

Class: Building Strength (11.2)

Vocabulary Cards 116-117

OTM 11-E: Strength Exercises (CR 11-6)

OTM 11-F: Fitness Target Zones for Strength (CR 11-7)

OTM 11-G: Resistance Machines Versus Free Weights (CR 11-8)

Taking Charge 11: Preventing Relapse (TC 11-1)

Application 11: Strength Training (CR 11-9)

Reinforcement 11: Strength Word Scramble (CR 11-10)

Personal Project 11: Logging and Planning Resistance Training Exercises for Strength (CR 11-11)

Activity: Fundamentals of Weight and Resistance Training

Activity Cards 119-129

Fundamentals of Weight and Resistance Training Worksheet (SW 11-2)

Ancillaries

- ▶ *Fitness for Life DVD Series: Lifelong Fitness and Wellness*
- ▶ *CD-ROM: Fitness for Life Presentation Package*
- ▶ *Audio CD: Physical Education Sound Tracks Volumes 1 and 2*

 Use the chapter 11 **Fitness for Life Presentation Package** to help lead the class discussion for each lesson.

Activity 11.1: Partner Resistance Exercises

11

LESSON OBJECTIVES

Students perform exercises with a partner to build strength and muscular endurance.

EQUIPMENT NEEDED

Bath towels (1 per 2 students), mats, benches, CD player and *Physical Education Sound Tracks Volumes 1 and 2*, Activity Cards 111-118

ADVANCED PREPARATION

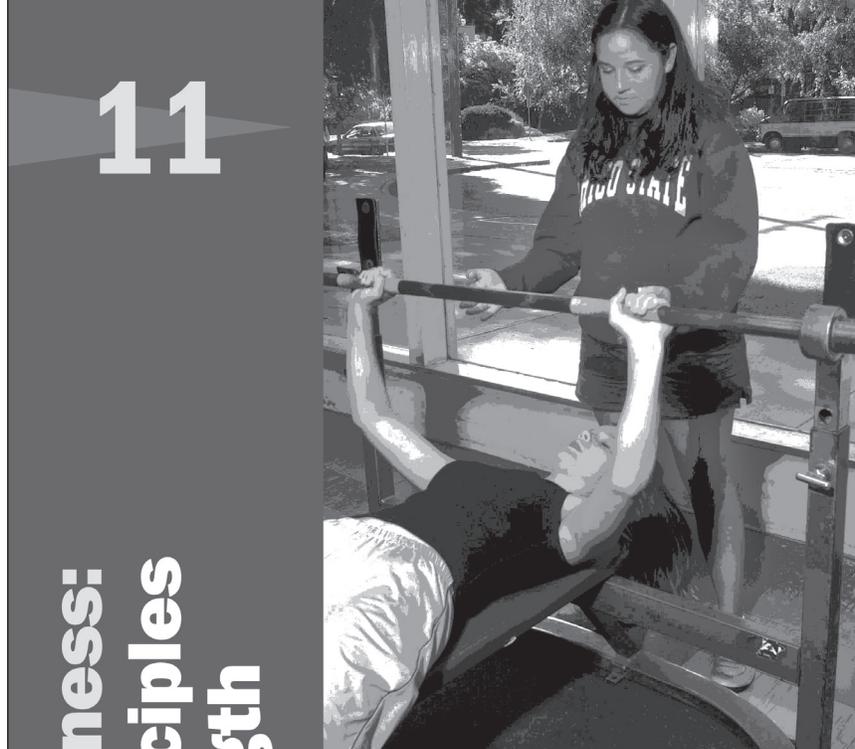
- ▶ Gather the necessary equipment and prepare each station.
- ▶ Print out Activity Cards 111-118 from the *Activity and Vocabulary Cards CD-ROM*. Place the cards in the area where the students will be doing the activity.
- ▶ Print out copies of the Partner Resistance Exercises Worksheet (PA 11-1) from the *Teacher Resources and Materials CD-ROM*. Print one copy for each student.

PROCEDURE

1. Have students do a warm-up before starting the resistance exercises.
2. After the warm-up, have students choose a partner that is of a similar size and strength.
3. Distribute copies of the Partner Resistance Exercises Worksheet.
4. Ask for volunteers to help demonstrate each exercise.
5. Have students follow the directions on the worksheets. Observe and correct technique.
6. Have students do a cool-down after the exercises.

EMPHASIZE

For endurance, use less resistance and more reps; for strength, use more resistance and fewer reps.



Muscle Fitness: Basic Principles and Strength

In this chapter...

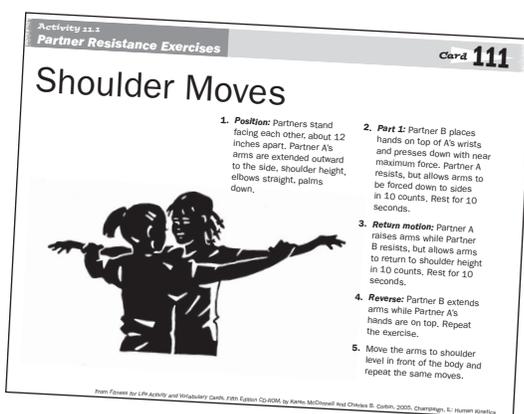
- Activity 1
Partner Resistance Exercises
- Lesson 11.1
Muscle Fitness Basics
- Self-Assessment
Determining Your Modified 1RM and Grip Strength
- Lesson 11.2
Building Strength
- Taking Charge
Preventing Relapse
- Self-Management Skill
Preventing Relapse
- Activity 2
Fundamentals of Weight and Resistance Training

Activity 1

PARTNER RESISTANCE EXERCISES

To build strength and muscular endurance, you have to work your muscles against a resistance. Resistance can be provided by free weights, machines, or your own body weight. But in these exercises, you are going to use a partner's body weight as resistance. Choose a partner who is about your height and weight, then try these exercises. A word of caution: To avoid injuring each other, be gentle when you provide resistance or try to move your partner's body parts.

Partner Resistance Exercises (PA 11-1)



Activity Cards 111-118

Lesson 11.1

Muscle Fitness Basics

Lesson Objectives

After reading this lesson you should be able to

1. Explain the difference between strength and muscular endurance.
2. Describe some of the health benefits of muscle fitness.
3. Describe the various types of muscles and muscle fibers.
4. Describe some of the methods of progressive resistance exercise used to improve muscle fitness.

Lesson Vocabulary

absolute strength (p. 180), calisthenics (p. 180), fast-twitch muscle fibers (p. 177), hypertrophy (p. 176), intermediate muscle fibers (p. 177), isokinetic exercise (p. 180), isometric contraction (p. 177), isotonic contraction (p. 177), one repetition maximum (1RM) (p. 180), progressive resistance exercise (PRE) (p. 175), relative strength (p. 180), reps (p. 176), set (p. 177), slow-twitch muscle fibers (p. 177)



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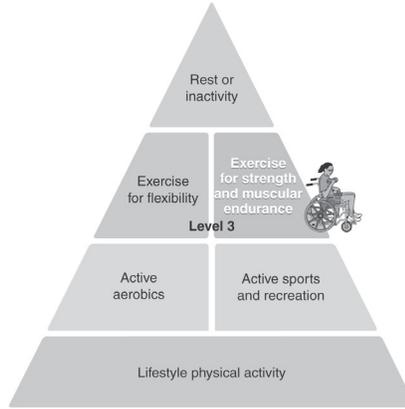
Muscle fitness is comprised of two health-related parts of physical fitness: strength and muscular endurance. Muscular endurance is the ability to contract muscles many times without tiring or to hold a muscle contraction for a long time. The person in the picture needs good muscular endurance to carry the backpack for a long time. Strength indicates the amount of force a muscle can exert. The amount of weight a muscle group can lift one time measures strength. The number of times a muscle group can repeat an exercise or how long a muscle group can hold a contraction without tiring measures muscular endurance.

Both muscular endurance and strength are developed by a **progressive resistance exercise (PRE)**. The exercises are called progressive because you gradually or progressively increase the amount of overload you apply to the muscles. This is consistent with the basic principles of overload and progression. Resistance refers



Hiking with a backpack requires good muscular endurance.

to a force that acts against your muscles. It is usually measured in terms of pounds. You can lift your own body weight, use free weights, or use a weight machine. Some machines use other forces, such as hydraulic pressure, air pressure, or friction to provide resistance. Various activities in levels 1 and 2 of the Physical Activity Pyramid can be helpful in promoting muscle fitness development, but for best results you should use muscle



Lesson 11.1: Muscle Fitness Basics

LESSON OBJECTIVES

1. Explain the difference between strength and muscular endurance.
2. Describe some of the health benefits of muscle fitness.
3. Describe the various types of muscles and muscle fibers.
4. Describe some of the methods of progressive resistance exercise used to improve muscle fitness.

VOCABULARY

absolute strength, calisthenics, fast-twitch muscle fibers, hypertrophy, intermediate muscle fibers, isokinetic exercise, isometric contraction, isotonic contraction, one repetition maximum (1RM), progressive resistance exercise (PRE), relative strength, reps, set, slow-twitch muscle fibers

LESSON OPENER

Show students the Physical Activity Pyramid off the *Teacher Resources and Materials CD-ROM*. Find the muscle fitness section of the pyramid. Ask students to describe some of the health benefits of muscle fitness. Ask them what type of activities they think require muscular endurance and muscular strength.

DISCUSSION GUIDING QUESTIONS

- ▶ What is muscular endurance? (*the ability to contract muscles many times without tiring or to hold a muscle contraction for a long time*)
- ▶ What is strength? (*the amount of force a muscle can exert*)
- ▶ How do you develop muscular endurance and strength? (*progressive resistance exercise*)
- ▶ In Activity 11.1 you used your partner's body weight to provide resistance. What else could you use to provide resistance? (*your own body weight, free weights, machines, etc.*)



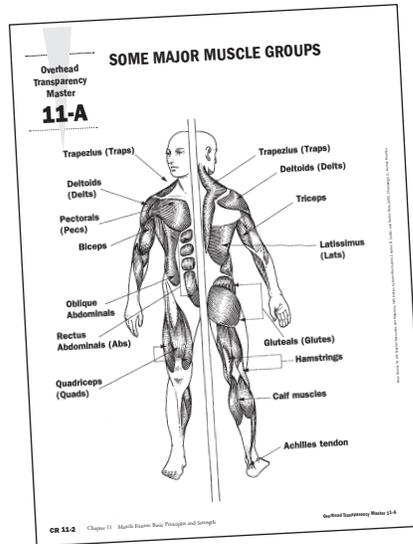
Use Overhead Transparency CR 11-2: Some Major Muscle Groups

Chapter 11 Card 102

Absolute Strength

A term for the total amount of weight you can lift or resistance you can overcome regardless of your body weight.

From: Fitness for Life Activities and Mindbody Goals, 4th Edition (© 2008) by Krista McGinnell and Christine S. Gordon, 2008, Champaign, IL: Human Kinetics



Vocabulary Cards 102-115

DISCUSSION GUIDING QUESTIONS

- ▶ What is hypertrophy? (*increase in muscle size*)
- ▶ Why can a continuum be used to represent the relation between muscle strength and muscle endurance? (*because exercises for both differ only in the number of reps and amount of resistance*)
- ▶ What is the difference in the exercise prescription for building muscle strength versus muscular endurance? (*You can develop strength by using high resistance with few reps and muscular endurance by using low resistance with high numbers of reps.*)
- ▶ Can you explain the terms *reps* and *sets* used in designing a PRE program? (*Reps are the number of lifts in a set; sets are one group of reps.*)

fitness exercises using PRE from level 3 of the Physical Activity Pyramid.

Strength and endurance use resistance in different ways. Strength is developed by doing an exercise for only a few times, but with a lot of resistance. The girl lifting the boxes needs strength. Muscular endurance is developed by doing an exercise many times, but with less resistance, such as the light backpack the girl is wearing in the picture.

Strength training tends to increase the size of muscles as they become stronger. This increase in muscle size is called **hypertrophy**. Because muscular endurance training uses less weight, endurance training does not cause as much hypertrophy.

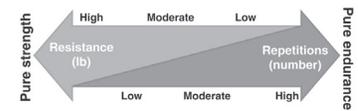
The Muscular Endurance–Strength Continuum

Exercises used to develop muscular endurance and strength differ only in the number of repetitions and the amount of resistance. The relationship between endurance and strength can be illustrated by a continuum. The continuum shown here represents pounds of resistance on one edge and number of repetitions on the other edge.



The girl lifting boxes (left) uses strength while the girl wearing the light backpack (right) uses muscular endurance.

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Muscular endurance–strength continuum.

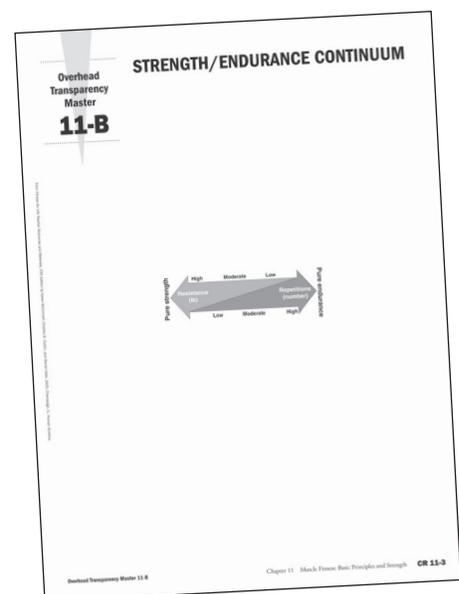
The continuum shows the resistance and repetitions that a person might use to build muscle fitness. You can see that you would use high resistance with few repetitions to develop strength, and a low resistance with a high number of repetitions for endurance. Using the resistance and the number of repetitions from the middle of the continuum would develop both strength and endurance. This continuum also shows that usually when you train for strength you will develop some endurance, and when you train for endurance you will develop some strength.

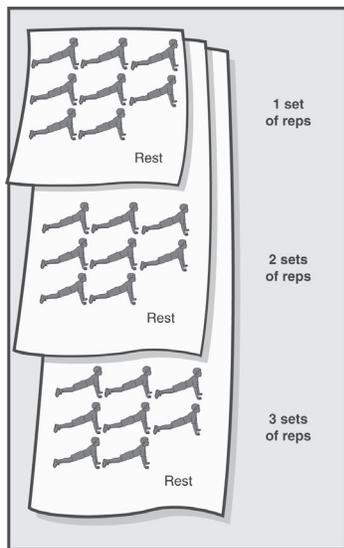
Muscle Fitness Terminology

You probably will hear the terms *reps* and *sets* in relation to muscular endurance exercises. The diagram on the next page can help you understand these terms. Repetitions, or **reps**, are the number of consecutive times you



Use Overhead Transparency CR 11-3:
Strength/Endurance Continuum.





Reps and sets.

do an exercise. A **set** is one group of repetitions. For example, suppose you do an exercise 8 times, then rest; repeat it 8 times, then rest; and repeat another 8 times. Then you will have completed a total of 3 sets of 8 repetitions each.

The Structure of Muscles

The muscles of the body create the movement that allows you to do the activities described in this book. In this section you will learn more about how the muscles work.

Muscle Types

Your body has three types of muscles: smooth, cardiac, and skeletal. Smooth muscles make up the walls of internal organs such as the stomach and blood vessels. Your heart is made of cardiac muscle. Both smooth and cardiac muscles are classified as involuntary muscles because you cannot consciously control their movements.

Skeletal muscles are attached to bones and make movement possible. You use these muscles to do physical activity. They are called voluntary muscles because you control them. Muscles work together to allow a

body part to function. For example, when you contract the biceps muscle (see the figure on the bottom of page 178), your arm bends at the elbow, bringing your hand close to your shoulder. At the same time the triceps relaxes to allow the biceps to do its work.

As the diagram shows, muscles are attached to bones on either side of a joint. The bones act as levers to which the muscles apply force. An **isotonic contraction** is a muscle contraction that pulls on the bones and produces movement of body parts. Isotonic exercises involve isotonic contractions in which body parts move. The two types of isotonic muscle contractions are concentric and eccentric. The first picture shows the biceps muscle doing a concentric, or shortening, contraction. In the second picture, as the arm is slowly straightened the biceps is doing an eccentric, or lengthening, contraction. An **isometric contraction** occurs when muscles contract and pull with equal force in opposite directions, so no movement can occur. Isometric exercises involve isometric contractions and body parts do not move. An example of an isometric contraction would be pushing your hands and arms together in front of your body. You push hard with both hands against the resistance of each other, but no movement exists. (See chapter 15 for examples of isometric exercises.)

Muscle Fibers

Muscle fibers are long, thin, cylindrical muscle cells. Skeletal muscles such as those in the arms and the legs are made of many muscle fibers. The strength and endurance of skeletal muscles depends on whether the muscles are made of slow, fast, or intermediate fibers and how much exercise they get.



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Slow-twitch muscle fibers contract at a slow rate and are usually red in color. These fibers generate less force than fast-twitch muscle fibers but they are able to resist fatigue. For this reason, a muscle with many slow-twitch fibers has good endurance. Slow-twitch fibers are also involved in cardiovascular activities such as running for distance. **Fast-twitch muscle fibers** contract quickly and are white in color. They generate more force when they contract, and for this reason muscles with many fast-twitch fibers are important for strength activities. **Intermediate muscle fibers** have characteristics of both slow- and fast-twitch fibers. They contract quickly and have good endurance. You use them for activities involving both strength and cardiovascular fitness. The types of fibers in your muscles are determined by your genes; however, you can increase the strength and endurance of your muscles with proper training.

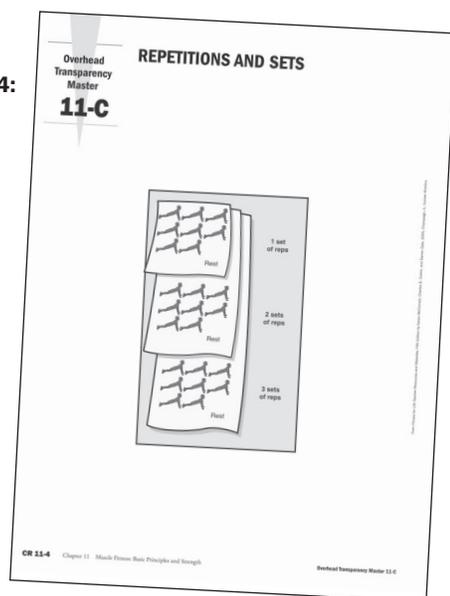
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DISCUSSION GUIDING QUESTIONS

- ▶ What are the three types of body muscles? (*smooth, cardiac, skeletal*)
- ▶ How does skeletal muscle differ from smooth and cardiac muscle? (*Smooth and cardiac muscles are involuntary muscles, because you can't consciously control their movements. Skeletal muscles are voluntary muscles because you control them.*)
- ▶ How do muscles make bones move? (*When the skeletal muscles that are attached to bones contract, they pull on the bones, causing movement.*)
- ▶ What is an isotonic contraction? (*A muscle contracts and changes length—gets shorter or longer, producing movement of body parts.*)
- ▶ What are concentric and eccentric isotonic contractions? (*In a concentric contraction, the muscle shortens under tension. For example, curling a dumbbell toward the shoulder concentrically contracts the bicep. In an eccentric contraction, the muscle lengthens under tension. For example, lowering a dumbbell away from the shoulder eccentrically contracts the bicep.*)
- ▶ What is an isometric contraction? (*A muscle contraction in which muscles contract and pull with equal force in opposite directions so that no movement—lengthening or shortening of the muscle—occurs.*)
- ▶ What are the different types of fibers in skeletal muscle called? (*fast-twitch, slow-twitch, and intermediate*)

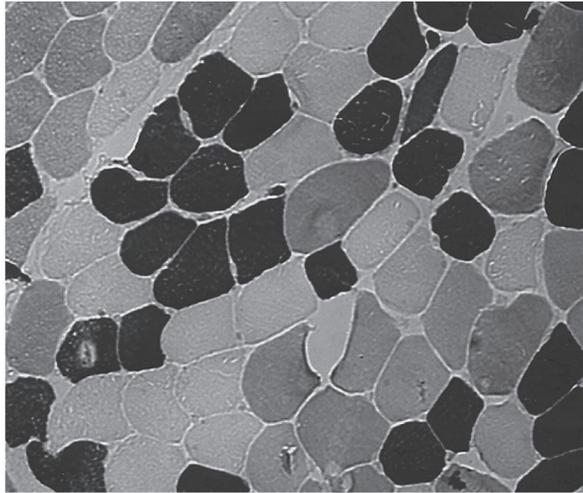


Use Overhead Transparency CR 11-4: Repetitions and Sets.

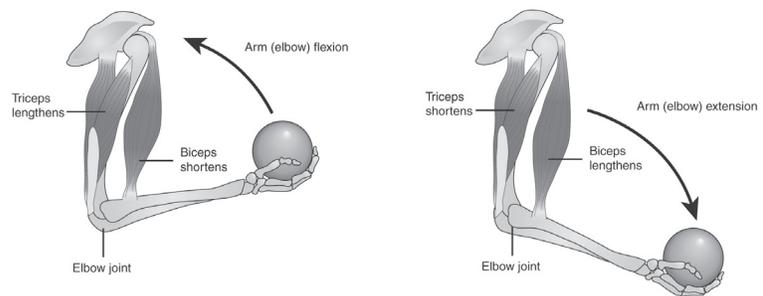


DISCUSSION GUIDING QUESTION

- ▶ How can you define the difference between fast-twitch, slow-twitch, and intermediate muscle fibers? (*Fast-twitch muscle fibers contract at a fast rate and have great strength but very little endurance. Slow-twitch muscle fibers contract at a slow rate and have great endurance. Intermediate muscle fibers have characteristics of both slow and fast-twitch fibers.*)



A photomicrograph that shows slow-twitch (black) and fast-twitch (gray and white) muscle fibers. Reprinted with permission from J.H. Wilmore and D.L. Costill, 2004, *Physiology of sport and exercise*, 3rd ed. (Champaign, IL: Human Kinetics), p. 45.



Muscles work together to move bones to apply force.

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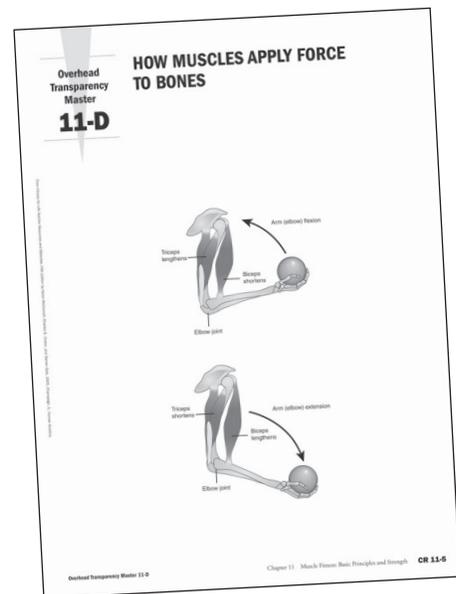


Overhead

Use Overhead Transparency CR 11-5:
How Muscles Apply Force to Bones.

Applying Physics Knowledge

Here is a chance to help students apply their knowledge of physics and reinforce physics vocabulary.





Birds, like humans, have both fast-twitch and slow-twitch muscle fibers. The flying muscles (breast muscles) of a duck or a goose are dark in color because they contain many slow-twitch fibers (typically red in color). The breast of a chicken is made up of mostly fast-twitch fibers (typically white in color) because the chicken needs power to fly up a few feet onto a perch; chickens typically do not fly long distances. For this reason, the breast of a chicken is mostly white meat while the wing muscles have more dark meat.

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Resistance Exercise: Training Method or Sport?

Training is another term often used for exercise, especially for exercises used to build muscle fitness. For example, the term *weight training* is used to describe using weights to perform PRE. A difference exists between training done to improve muscle fitness and activities such as weightlifting.

Weight Training

This form of exercise is done to improve muscular strength and endurance. It can be used by anyone to improve health and fitness. It can also be used for those interested in improving performance for sports or for meeting job requirements. Weight training is not a competitive event.



The sport of bodybuilding can be done competitively. The athletes are judged based on how large and well defined their muscles are rather than how much they can lift.

Resistance Training

This type of training is the same as weight training except that a machine that provides resistance is used rather than weights.

Circuit Training

Circuit training has been described previously. It can be done to improve many different kinds of fitness such as flexibility and cardiovascular fitness. The circuit training exercises at the end of this chapter include PRE exercises designed to build muscle fitness. Other exercise circuits that build muscle fitness are included in chapters 12, 13, and 15.

Weightlifting

This is an Olympic sport involving the use of free weights; the athletes try to lift a maximum load. There are only two exercises in weightlifting: the snatch, and the clean and jerk.

Powerlifting

This is another competitive sport using free weights. There are only three exercises in powerlifting: the bench press, the squat, and the deadlift. The athletes try to make one maximal lift for each type of lift.

Bodybuilding

This sport can also be done competitively. The athletes are primarily concerned about the appearance of their bodies. They are judged based on how large and well defined their muscles are rather than how much they can lift. They train with more repetitions than weightlifters and powerlifters.

DISCUSSION GUIDING QUESTIONS

- ▶ What factors influence the strength of a muscle? (*how well trained a person is, the speed of the movement being performed, the angle of the joint during a specific lift, age, sex, and heredity—the types of muscle fibers you have*)
- ▶ What is the difference between weight training and circuit weight training? (*Weight training is done to improve muscular strength and endurance; circuit weight training also develops aerobic endurance.*)
- ▶ Can you describe how training programs would differ for the following: weightlifting, powerlifting, bodybuilding? (*Training programs for weightlifting and powerlifting involve heavy weight, low reps. Bodybuilders train with more reps than weightlifters and powerlifters.*)
- ▶ A friend in the weight room challenges you in lifting to see who can lift the most weight. What are some concerns about this situation?

Using Application and Critical-Thinking Skills

The Discussion Guiding Questions are open-ended questions that require students to explain their answers. This open-ended format requires application and critical thinking, which are important skills for success in all subject areas.

DISCUSSION GUIDING QUESTIONS

- ▶ How are strength and endurance usually assessed? (*A one repetition maximum test is considered to be the best test for strength. Calisthenics exercises, like push-ups and curl-ups, are typically used to assess endurance.*)
- ▶ What is the difference between absolute and relative strength? (*Absolute strength is a term for the total amount of weight you can lift or resistance you can overcome regardless of your body weight. Relative strength is the amount of weight or resistance you can overcome for each pound of body weight.*)
- ▶ Why do you need special devices to perform isokinetic exercises? (*The devices keep the speed of movement of a body part constant and provide a constant force throughout range of motion.*)

CLOSING

Review how muscle fitness can be characterized by muscle endurance and muscle strength. Remind students that to improve either area of muscle fitness a specific program of sets and repetitions is required. Highlight the fact that each type of program will give benefits for sports and good health. Provide examples of movements that are concentric and eccentric. Finish with emphasizing that muscle fitness exercises can be done using a wide range of equipment, from home-based equipment to expensive machines in fitness centers.

Muscle Fitness Assessment

You can assess muscle fitness in many ways. A **one repetition maximum (1RM)** test is considered to be the best test for strength. A true 1RM test requires a person to determine the amount of weight that can be lifted or resistance that can be overcome in one repetition. For example, if a person could lift 100 pounds once, but not twice, 100 pounds would be the 1RM for the muscle group being tested. The 1RM test results can be used in several ways. First, the results give you a good idea of your strength. Second, the assessment can be performed for each of the major muscle groups of the body. Finally, 1RM results can be used to determine how much weight or resistance you should use when performing the exercises shown later in this chapter.

The true 1RM test is commonly used by athletes and adults, but most experts recommend that a modified self-assessment be used by teens. The modified 1RM self-assessment provides a good estimate of true 1RM and does not require the lifting of maximal weight or the use of maximal resistance. Teens are advised to use only a percentage of 1RM both in testing strength and performing strength exercises. In the self-assessment in this chapter you will perform the modified 1RM test that uses multiple repetitions or lower than maximal weight (resistance) to estimate 1RM. This self-assessment is safe for teens when performed properly. You can do a 1RM test for many muscle groups, but two assessments, one for the upper body (arm press) and one for the lower body (leg press), are most often used. A dynamometer is often used to test isometric strength. You will learn more about these tests in the self-assessment for this chapter.

For muscular endurance, various exercises—often called **calisthenics**—are typically used for self-assessment. In these assessments the number of repetitions is counted. Examples include the push-up and curl-up. You will get the opportunity to try several self-assessments of muscular endurance in the next chapter.

Absolute Versus Relative Strength

Absolute strength is measured by how much weight or resistance you can overcome regardless of your body

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FITNESS Technology

In recent years, tremendous technological advances have been made in resistance exercise machines. Innovations have included adjustable benches and chairs so that machines fit people of all sizes. Systems for changing resistance have made machines easier to use. Another innovation is isokinetic resistance machines. **Isokinetic exercise** is a type of isotonic exercise in which the velocity of movement is kept constant through the full range of motion. New isokinetic machines are now available. They use special hydraulics or electronics to regulate movement velocity and to allow full exertion at all angles of joint movement during an exercise. With traditional free weights or resistance machines, the resistance is often greater at the first part of a movement than at the end of the movement. Also, the speed of the movement may be greater at one point than another. Other advantages include extra safety and the advantage of building power, a part of fitness important to athletic performance. Isokinetic machines are often used by researchers and in rehabilitating injuries. Disadvantages are the expense of the machines and that many isokinetic machines do not allow eccentric contractions, which are often used in sports performances.

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size. Big people typically have more absolute strength than smaller people. On average males are larger than females, so the average absolute strength for males is higher than for females. Your 1RM score is an example of absolute strength. **Relative strength** is strength adjusted for your body size. The most common method for determining relative strength is to divide your weight into your absolute strength score to get a “strength per pound of body weight” score. Relative strength scores are considered to be fairer assessments of strength for those who do not have large bodies. The ratings in the self-assessment in this chapter are for relative strength.

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Lesson Review

1. What is the difference between strength and muscular endurance?
2. What are some of the health benefits of muscle fitness?
3. What are the various types of muscles and muscle fibers?
4. What are some of the methods of progressive resistance exercise used to improve muscle fitness?

Applying Physics Knowledge

The Fitness Technology Feature gives students an opportunity to apply their knowledge of physics and reinforce physics vocabulary.



Self-Assessment

Determining Your Modified 1RM and Grip Strength



PART 1: Estimating Your 1RM

As you know, 1RM means one repetition maximum. It represents the maximum weight a group of muscles can lift one time (or resistance they can overcome). Because beginners should begin gradually (without heavy lifting), a modified method has been developed that allows you to determine your 1RM without overexerting your muscles. The results you get will allow you to see how strong you are.

The modified 1RM can be done with free weights or machines, but the instructions that follow will be for machine use. Resistance machines are recommended for these self-assessments, especially for beginners, because they are safer. Two tests are used most often, and the ones performed in this self-assessment activity are for the upper body (arm press) and the lower body (leg press). If a person performing the arm press on a resistance machine can lift 50 pounds one time, but not more than one time, this number would represent the 1RM for the arm press. Similarly, if the person could move a resistance of 150 pounds one time with the leg press, but not more than one time, 150 would be the 1RM for the leg press. As mentioned earlier in this chapter, 1RM scores for the arm press and leg press will be *estimated* to avoid maximal lifting, something that is discouraged for teens.

Follow these directions for each of the two self-assessments:

- ▶ Choose a weight (resistance) that you think you can lift 5 to 10 times but is too heavy for you to lift more than 10 times. Do not use a weight that you can lift fewer than 5 times.
- ▶ Using correct technique, lift the weight as many times as you possibly can. Count the number of lifts and write the number on your record sheet. If you were able to do more than 10 lifts, wait until another day before you try a heavier weight for that exercise. Go to the next muscle group exercise.
- ▶ If you can tell that you will not be able to lift the weight at least 5 times, stop and choose a lighter weight.
- ▶ If you were able to do 5 to 10 lifts and no more, then refer to table 11.1. Find the weight you lifted in the left-hand column. Now find the number of reps you did in the top row. Your 1RM score is the number in the box where the horizontal weight row and the vertical rep column intersect.
- ▶ Divide each of the two 1RM scores by your body weight to get a strength per pound of body weight score. The strength per pound of body weight score adjusts for body size (relative strength). For example, a person weighing 150 pounds and has a 1RM of 100 pounds on the arm press has a score of .67 pounds per pound of body weight. Use tables 11.2 and 11.3 to determine your fitness rating. Fitness ratings are only determined for the arm and leg press.
- ▶ If time allows, perform this procedure to determine your 1RM for other exercises included in the activity at the end of this chapter. Do the 1RM self-assessment for as many exercises as time allows. You do not need to determine a strength per pound of body weight score for these exercises. Use the 1RM scores to help you determine how much resistance to use for your PRE program.

Safety Tips: Proper form is essential for safety. Before you do the 1RM test, read the descriptions of the exercises and the directions that follow. Before performing the assessment, practice each of the two exercises and have a teacher check your form. During the assessment, have a partner spot you and follow the resistance training guidelines on page 189.

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Self-Assessment 11: Determining Your Modified 1RM and Grip Strength

LESSON OBJECTIVES

Students perform strength self-assessments to determine 1RM and grip strength.

EQUIPMENT NEEDED

Weight training equipment, grip dynamometer

ADVANCED PREPARATION

- ▶ Gather the necessary equipment and place an identifying sign by the weight machine or free weights at each station.
- ▶ Print out copies of the Determining Your Modified 1RM and Grip Strength Worksheet (SW 11-1) from the *Teacher Resources and Materials CD-ROM*. Print one copy for each student.
- ▶ Read with students the introductory text for Self-Assessment 11 and give an overview of procedures for grip strength exercises and determining 1RM.

Determining Your Modified 1RM and Grip Strength Worksheet (SW 11-1)

Name _____ Class _____ Date _____

11 Self-Assessment

Objective: To perform strength self-assessments to determine 1RM and grip strength.

Procedure: Follow the instructions in the text on page 181-184. In the chart for reps, record the weight lifted, the number of reps, your estimated 1RM, your calculated strength-to-weight ratio, and your fitness rating.

Part 1: Estimating Your 1RM

Exercise	Weight	Number of reps	Estimated 1RM	Strength-to-weight ratio	Rating
Seated Arm Press					
Leg Press					
Additional exercises (optional; see pages 193-196 for descriptions)					
Bench Press					
Front Squat					
Hamstring Curl					
Biceps Curl					
Heel Raise					
Lat Pull-Down					
Triceps Press					

Part 2: Grip Strength

To test the strength of your hand grip using the dynamometer, follow the instructions on textbook page 184. Use the chart below to record your results. Then use the Grip Strength Rating Chart to determine your strength rating.

Hand used	First trial	Future trial	Future trial
	Date: _____	Date: _____	Date: _____
Right hand	Best score		
Left hand	Best score		
	Total score		
	Grip strength rating		

Self-Assessment 11 Record Sheet

Chapter 11 Muscle Fitness: Basic Principles and Strength SW 11-1

Table 11.1

Predicted 1RM Based on Reps to Fatigue

Weight	Repetitions						Weight	Repetitions					
	5	6	7	8	9	10		5	6	7	8	9	10
30	34	35	36	37	38	39	140	157	163	168	174	180	187
35	40	41	42	43	44	45	145	163	168	174	180	186	193
40	46	47	49	50	51	53	150	169	174	180	186	193	200
45	51	53	55	56	58	60	155	174	180	186	192	199	207
50	56	58	60	62	64	67	160	180	186	192	199	206	213
55	62	64	66	68	71	73	165	186	192	198	205	212	220
60	67	70	72	74	77	80	170	191	197	204	211	219	227
65	73	75	78	81	84	87	175	197	203	210	217	225	233
70	79	81	84	87	90	93	180	202	209	216	223	231	240
75	84	87	90	93	96	100	185	208	215	222	230	238	247
80	90	93	96	99	103	107	190	214	221	228	236	244	253
85	96	99	102	106	109	113	195	219	226	234	242	251	260
90	101	105	108	112	116	120	200	225	232	240	248	257	267
95	107	110	114	118	122	127	205	231	238	246	254	264	273
100	112	116	120	124	129	133	210	236	244	252	261	270	280
105	118	122	126	130	135	140	215	242	250	258	267	276	287
110	124	128	132	137	141	147	220	247	255	264	273	283	293
115	129	134	138	143	148	153	225	253	261	270	279	289	300
120	135	139	144	149	154	160	230	259	267	276	286	296	307
125	141	145	150	155	161	167	235	264	273	282	292	302	313
130	146	151	158	161	167	173	240	270	279	288	298	309	320
135	152	157	162	168	174	180	245	276	285	294	304	315	327

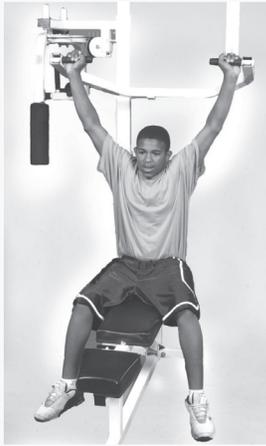
Predicted 1RM Based on Reps to Fatigue. This chart is used as modified from the *Journal of Physical Education, Recreation, and Dance*, January 1993, page 69. JOPERD is a publication of the American Alliance for Health, Physical Education, Recreation and Dance, 1900 Association Drive, Reston, VA 22091.

PROCEDURE

1. Have students do a warm-up before starting the test exercises.
2. Distribute copies of the Determining Your Modified 1RM and Grip Strength worksheet.
3. Divide the class into six groups and assign each group a station.
4. Have students read the directions and then practice the assigned exercise.
5. Have each group demonstrate their safe exercise to the class.

Reading and Math Skills: Interpreting Charts and Tables

This activity offers students an opportunity to practice interpreting tables.



This test evaluates the strength of triceps and pectoral muscles.

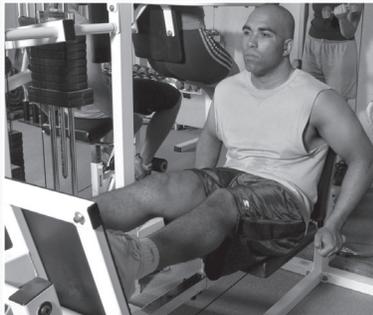
Seated Arm Press

1. Sit on the stool of a seated press machine, the handles even with your shoulders. Grasp the handles with your palms facing away from you. Tighten your abdominal muscles.
2. Push upward on the handles, extending your arms until the elbows are straight.



Caution: Do not arch your back. Do not lock your elbows.

3. Lower to the starting position.
4. If a seated press machine is not available, you can substitute the bench press. This exercise is described in the activity at the end of the chapter.



This test evaluates the strength of the quadriceps, the gluteals, and calf muscles.

Leg Press

1. Adjust the seat distance on a leg press machine for leg length comfort. The closer the seat, the greater the range for working and the greater the intensity. Sit with your feet resting on the pedal.
2. Push the pedal until your legs are straight.



Caution: Do not lock your knees.

3. Slowly return to your starting position.

6. Specify the number of sets and reps for each exercise.
7. Have each group return to their starting station and perform the assigned exercise.
8. Ask students to record the repetitions they performed, the weight lifted, the estimated 1RM, the calculated strength-to-weight ratio, and their fitness rating for each exercise.
9. When the signal is given, tell groups to rotate to the next station.
10. Have students estimate their 1RM on their record sheets.