

# Quiz Policies

## **Eligibility**

The NCSF online quizzes are open to any currently certified fitness professional, 18 years or older.

## **Deadlines**

Course completion deadlines correspond with the NCSF Certified Professionals certification expiration date. Students can obtain their expiration dates by reviewing either their certification diploma or certification ID card.

## **Cancellation/Refund**

All NCSF continued education course studies are non-refundable.

## **General Quiz Rules**

- You may not have your quiz back after sending it in.
- Individuals can only take a specific quiz once for continued education units.
- Impersonation of another candidate will result in disqualification from the program without refund.

## **Disqualification**

If disqualified for any of the above-mentioned reasons you may appeal the decision in writing within two weeks of the disqualification date.

## **Reporting Policy**

You will receive your scores within 4 weeks following the quiz. If you do not receive the results after 4 weeks please contact the NCSF Certifying Agency.

## **Re-testing Procedure**

Students who do not successfully pass an online quiz have the option of re-taking. The fees associated with this procedure total \$15 (U.S) per request. There are no limits as to the number of times a student may re-test.

## **Special Needs**

If special needs are required to take the quiz please contact the NCSF so that appropriate measures can be taken for your consideration.

# Quiz Rules

## **What Do I Mail Back to the NCSF?**

Students are required to submit the quiz answer form.

## **What do I Need to Score on the Quiz?**

In order to gain the .5 NCSF continued education units students need to score 80% (8 out of 10) or greater on the CEU quiz.

## **Where Do I Mail My Quiz Answer Form?**

You will mail your completed answer form to:

**NCSF**

**Attn: Dept. of Continuing Education**

**5915 Ponce de Leon Blvd., Suite 60**

**Coral Gables, FL 33146**

## **How Many CEUs Will I Gain?**

Professionals who successfully complete the any continuing education quiz will gain .5 NCSF CEUs per quiz.

## **How Much does each quiz cost?**

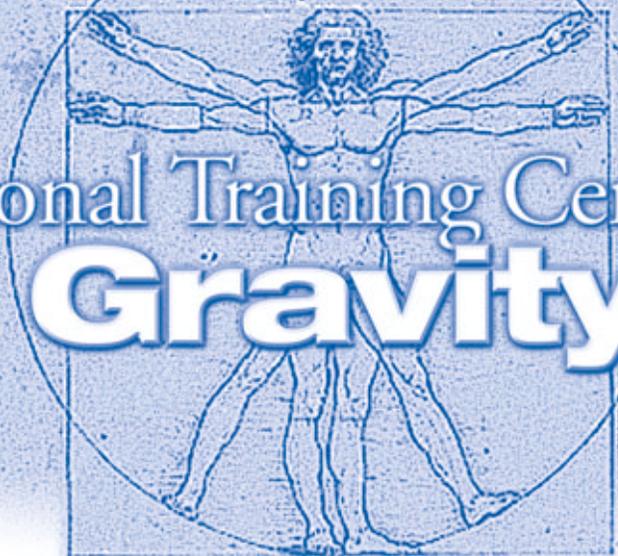
Each quiz costs the student \$15.00.

## **What Will I Receive When The Course Is Completed?**

Students who successfully pass any of the NCSF online quizzes will receive their exam scores, and a confirmation letter.

## **How Many Times Can I Take The Quizzes For CEUs?**

Individuals can take each NCSF quiz once for continuing education credits.



# Functional Training Centers On Gravity

**P**ersonal Training has seen an industry shift towards integrating exercise for function over the past few years. Fitness equipment catalogs are filled with all types of new training devices aimed at stability and multiplanar applications. The concept, of course, is to train clients for improvements in everyday function and improve their quality of life. This move away from traditional training makes sense, since the average client is not a body builder, but rather a middle-aged person looking to improve health and fitness while burning some calories. This shift is further supported by the actual training volumes used in personal training; two or three days a week is not enough time to effectively employ traditional body building techniques.

Functional training is generally aimed at harmonizing movements. The prescription involves combining musculoskeletal actions in varying environments. Isolated force production is reduced while neuromuscular coordination is encouraged. Variations and combinations of multiplanar, unstable, and variable complex exercises are applied based on the client's needs and capabilities. A consistency among functional training program applications, as compared to traditional stable uniplanar exercise, is the change in center of gravity experienced by the participant. Due to the shifts in the center of gravity, the requirements of coordinated neuromuscular activation become more evident. For this reason it is important to understand how changes in the center of gravity affect the difficulty of the movement and what enhances stability throughout the movement.

Center of gravity (COG) can easily be defined as the point about which a body would balance without a tendency to rotate. The center of gravity is based on two conditions: 1) all linear forces acting on the body must be balanced and 2) all torques, or rotary forces, must be balanced. For balance or equilibrium to be attained the sum of all forces acting on the body must be equal. Linear downward forces must be met by equal upward forces. At the same time any clockwise rotational force is counteracted by an equal but opposite rotational force. Identifying the center of gravity in a stationary object is relatively easy but the problem facing

personal trainers is that very few exercises are done in a fixed position. The dynamics of movement constantly challenge the body to maintain equilibrium. When movements are rehearsed in varying environments, the stress on the neuromuscular system leads to adaptations which enable a more efficient attainment of equilibrium whenever the body experiences COG variations.

This is an important consideration when designing training programs for performance or functional improvements. Clients who have been sedentary or relatively inactive may have very poor balance and stability, even with basic unloaded movements such as lunging or squatting. In addition to the decline of neural efficiency seen with physical inactivity over time, the system becomes further challenged by physiological and postural changes in the body over that same period. Increases in adiposity (particularly regional storage), changes in gait and static postures, and reductions in flexibility affect the COG, making neuromuscular learning more difficult, even if the activity was once performed fairly regularly. This may explain why postural sway above the base of support increases with age.

As stated, the goal of functional training is to enhance movement efficiency and to develop stable equilibrium. For this to occur the muscles must produce appropriate force to account for undesired movement (stabilizing and neutralizing) while concurrently producing the force to accomplish the intended task. An example is the walking lunge performed in a controlled manner with little to no lateral sway, and the same lunge performed with undesired sway and compensating movements such as arm swing or hip translation in attempts to regain balance. In the first lunge an additional variable (medicine ball passed to the exerciser) may be applied and controlled by the body (caught without movement interruption) which would suggest stable equilibrium. Unstable equilibrium exists when balance cannot be maintained under a condition variance, such as a slight push. In situations with unstable equilibrium, the COG is immediately lowered in compensation. It is not uncommon to see COG shifts in response to additional force application

or muscle fatigue during the execution of an activity. For humans the constant gravitational pull requires regular postural adjustments (both conscious and unconscious) throughout the day to account for equilibrium requirements of the task or environment.

With this knowledge, the relevance of stability training becomes increasingly significant in improving the performance of human movement. This is true whether applied slowly in a stable environment or quickly in a less stable environment. To design programs that address the muscular fitness deficiencies of a client or emphasize performance enhancement, it makes sense to match the need and capabilities of the client with the exercise variations and subsequent progressions. To do so, one must first understand the factors that effect stability. Comprehension of these factors will allow for modifications (or individual accommodations) to the exercise technique, essentially increasing or decreasing the level of difficulty.

Ask any engineer about stability, and they will all say it begins with a good foundation or base of support. They realize that the base of support is the primary factor in the stability of an object. This is easily illustrated when you consider balancing on one foot on the ground versus balancing it on a tight rope. The narrower the base of support the more difficult it is to stabilize the body since maintaining the center of gravity over the base of support is a requisite for equilibrium. With this in mind it is logical to investigate the effects different stances and load assignments will have on the difficulty of the action or activity. Narrow stance, split stance, wide stance, and staggered stance variations can dramatically modify the actual and perceived effort experienced by the exerciser, even if the basic exercise is the same. This is illustrated by cable rows in each of these different stance positions. They will be different even though the rowing action is the same. This neuromuscular challenge is further influenced by the direction of force in comparison to the shape of the base. For instance, when engaging in a tug of war it is recommended to assume a wide stance in the direction of the force (split stance position). If a puller were to take a wide natural stance position with the base perpendicular to the force, the equilibrium would be easily interrupted. For mechanical improvements in stability the COG should be over the base of support with the stance widened in the direction of the oncoming force. If the goal is to challenge the core stabilizers then the stance position should be moved in a direction that reduces mechanical stability and increases coordinated postural stability requirements.

Once the stance is decided upon, the activity can be further manipulated by raising the height of the COG. By extending the resistance-arm upward, the COG adjusts accordingly causing an increase in the difficulty to maintain

one's equilibrium. Consider canoeing versus kayaking. The likelihood of an inexperienced water sport enthusiast flipping a canoe is much higher than flipping a kayak in the same environmental conditions. The canoe maintains a higher COG and consequently a reduced equilibrium. By raising the COG the difficulty of the exercise is increased. This concept can be applied to squatting, pressing, or any other movement.

Postural equilibrium can be further challenged by moving the line of gravity farther from the base of support. An example of this would be to carry a heavy suitcase using one arm. Forces must be applied by the body via the contralateral musculature to maintain postural equilibrium. If the load is too great or the stabilizing muscles fatigue and the unilateral load is not reduced, the body will either fall to the side of the

load or compensate by leaning or laterally flexing opposite to the load to encourage a COG shift over the base of support. Asymmetrical loading is another excellent technique to facilitate enhancements in postural stabilization.

The relationship of the line of gravity to the base of support is further complicated when the concept of segmental alignment is applied. Humans are multi-segmented with numerous articulations. In the case of a stack of blocks, the maximum stability would arise from exact placement of one atop another in perfect alignment. If any of those blocks were shifted, shortening the distance between the line of gravity and the margin of the base of support, the likelihood of the

block tower falling would increase. This is also true of human segments. Although connected, the human segments are subject to the same physics as the stack of blocks. In erect posture the jointed vertebral column is aligned in a single vertical line and each segment contributes proportionally to maintain equilibrium. When strength deficiencies, fatigue, or other factors cause misalignment of one segment, the body compensates with additional misalignment of other segments in an attempt to return the vertical line over the base of the support. When a person carries additional load, whether a medicine ball, child, or back pack, the load is considered an additional segment. The weight, height, and location of the load will ultimately determine the resultant center of gravity and the particular requirements to stabilize it statically or dynamically. Since the COG will be displaced in the direction of the added weight and the line of gravity will shift accordingly, varying locations of loads will determine the musculature responsible for accommodating the additional weight. This factor is important for correct biomechanics. When segment misalignment occurs to assist the compensation requirements for equilibrium, the resistance is too heavy.

The weight or mass of an object should also be considered when motion occurs or an external force is being applied. This is easily exemplified by throwing a heavy medicine ball at a

Center of gravity (COG) can easily be defined as the point about which a body would balance without a tendency to rotate.

## Principles of Stability

1. Other things being equal, the lower the center of gravity, the greater will be the body's stability.
2. Greater stability is obtained if the base of support is widened in the direction of the line of the force.
3. For maximum stability the line of gravity should intersect the base of support at a point that will allow the greatest range of movement within the area of the base in the direction of the forces causing motion.
4. Other things being equal, the greater the mass of a body, the greater will be its stability.
5. Other things being equal, the most stable position of a vertical segmented body (such as a column of blocks or the erect human) is one in which the center of gravity of each weight-bearing segment lies in a vertical line centered over the base of support or in which deviations in one direction produce torques that must be balanced by deviations producing torque in the opposite direction.
6. Other things being equal, the greater the friction between the supporting surface and the parts of the body in contact with it, the more stable a body will be.
7. Other things being equal, a person has better balance in locomotion under difficult circumstances when the vision is focused on stationary objects rather than on disturbing stimuli.
8. There is a positive relationship between one's physical and emotional state and the ability to maintain balance under difficult circumstances.
9. Regaining equilibrium is based on the same principles as maintaining it.

person of relatively low mass. A twenty-pound medicine ball thrown at a 125 lb. person would require dramatic compensation force to absorb the force of the moving object without significantly affecting the person's equilibrium. Compare this to the same object being thrown at a 220 lb. person maintaining the same base of support. The individual with the greater mass experiences a lesser disturbance to equilibrium. As Newton stated, the amount of force needed to effect a change in motion is proportional to the mass being moved ( $F = ma$ ). When selecting the weight of an object used for acceleration training such as medicine ball passes, it is important to determine the stability requirements of the exerciser. Incorrect weight selection can cause injury even if the weight is relatively light when held statically. The actual force generated when the object is accelerated is dramatically higher than the weight of the object itself.

The body determines relative responses to factors which may affect equilibrium based on the data collected in the brain. When forces are applied to the body, proprioceptors attempt to relay the data to the brain initiating the appropriate series of corrective actions. Proprioception is further enhanced by observational data. Visual data has a rather dramatic influence on balance. To identify the amount

of visual data actually contributing to body equilibrium, perform a walking lunge with your eyes open and then do the same activity with your eyes closed. Equilibrium is more difficult to sustain when the body must rely solely on internal communicators. This is improved with rehearsal, over time. This concept is further fueled when the observational data is affected by psychological factors. When a person walks on a plank placed on the ground it is relatively easy to maintain a stabilized body position. When the plank is raised fifty feet in the air the elevation suddenly becomes a detriment to stability. The risks of injury or death act as a disturbing stimulus to the basic movement previously performed easily on the ground. This, in fact, occurs for exercisers performing techniques they view as difficult. The thought of falling or fear of embarrassment affect the performance. A teaching cue to compensate for this mental disturbance is to fix the eyes on a stationary spot above the perceived danger area. This will facilitate reliance on neuromuscular data rather than visual data (complicated by psychological data). Removing visual stimuli is an excellent way to enhance neuromuscular control and subsequently improve stability.

Identifying and employing the nine principles of stability will encourage greater neuromuscular adaptations and goal-oriented outcomes when employing function based training (*see shaded box at left*). It expands the number of exercise variations, progressions, and training possibilities. Additionally, knowledge in these principles will allow for better decision making and subsequent modifications in programming and training technique to best meet the particular needs of different clients. ●

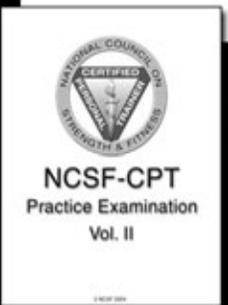
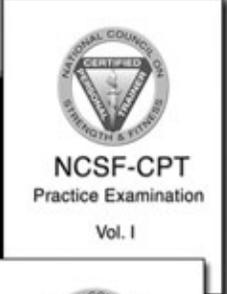
**Practice**

**NCSF Practice Exams Now Available**

The NCSF Board for Certification has released two practice examinations to assist candidates in certification preparation. These new additions to the certification prep materials allow candidates to review the types of question and format of the questions they will see on the NCSF-CTP Exam. The practice exams mirror the distribution of questions by content area and difficulty level. These tools serve as a valuable gauge for certification preparedness.

The practice exams come in two volumes; **Practice Exam Volume I** covers Functional Anatomy, Exercise Physiology, Health and Physical Fitness, Health Screening and Evaluation and Special Population; **Volume II** covers Nutrition, Weight Management, Exercise Prescription and Training Instruction Methods.

Each volume can be purchased for \$29.00 or bundled together for a savings price of \$50.00.



# CEU Quiz

## Center of Gravity

1. What is the definition of Center of Gravity?
  - A. The point about which a body would balance without a tendency to rotate
  - B. The middle of an object
  - C. The radius of an object when centered in a circle
  - D. The heaviest point of an object
2. What is required for balance or equilibrium?
  - A. Functional ROM at all joints
  - B. Sum of all forces acting on the body are equal
  - C. Forces from the front are balanced with those from the back
  - D. Heaviest point is in the base of support
3. What can affect the posture of an individual over a life span?
  - A. Increases in fat mass
  - B. Reduction in flexibility
  - C. Postural muscle weakness
  - D. All of the above
4. What effect does raising the center of gravity have on stability?
  - A. Increase stability
  - B. Decreases stability
  - C. No change in stability
  - D. Depends on the situation
5. Which of the following would occur if the line of gravity is moved away from the base of support?
  - A. Increased stability
  - B. Lower center of gravity
  - C. Requisite compensation in the opposite direction
  - D. All of the above
6. Which of the following can affect segmental alignment?
  - A. Adding an additional segment
  - B. Strength deficiencies
  - C. Flexibility
  - D. All of the above
7. When stability becomes compromised what is the normal compensation by the body?
  - A. Raise the center of gravity
  - B. Lower the center of gravity
  - C. Widen the base of support
  - D. Shift the COG laterally
8. What is the primary factor in stability?
  - A. Mass of the object
  - B. Length of the object
  - C. Base of support
  - D. Height of the object
9. Which is correct when increasing stability?
  - A. The base of support should be widened in the direction of force
  - B. The line of gravity should be centered in the base of support
  - C. Lower the center of gravity
  - D. All are true statements
10. Which is true of regaining stability?
  - A. The amount of force required for stability is twice the disruptive force
  - B. Regaining equilibrium is based on the same principles as maintaining it
  - C. For stability to be regained the height of the center of gravity must be increased between the margins of the base
  - D. All are true

# Quiz Answer Form

FIRST NAME \_\_\_\_\_ LAST NAME \_\_\_\_\_ M.I. \_\_\_\_\_

TITLE \_\_\_\_\_

ADDRESS \_\_\_\_\_ APT. \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

COUNTRY \_\_\_\_\_ POSTAL CODE \_\_\_\_\_

CERTIFICATION NO. \_\_\_\_\_ CERTIFICATION EXP. \_\_\_\_/\_\_\_\_/\_\_\_\_

MEMBERSHIP NO. \_\_\_\_\_ MEMBERSHIP EXP. \_\_\_\_/\_\_\_\_/\_\_\_\_

Quiz Name	Member Price	Total
	\$15	



Discover



Visa



Mastercard



Amex



Check/Money Order

Account No. \_\_\_\_\_

Exp. Date \_\_\_\_\_

Security Code \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

## Quiz Answers

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

Fill in each blank with the correct choice on the answer sheet. To receive 0.5 CEUs, you must answer 8 of the 10 questions correctly.

Please mail this Quiz answer form along with the proper enclosed payment to:

NCSF  
5915 Ponce de Leon Blvd., Suite 60  
Coral Gables, FL 33146

Questions? 800-772-NCSF