The Organization of
Professional Exercise Physiologists

American Society of Exercise Physiologists

EPC

Exercise Physiologist Certified

Study Guide

Part II
(Hands-on/Laboratory)

Introduction

The **ASEP Board of Certification** of the American Society of Exercise Physiologists is responsible for preparing the EPC Examination and overseeing the grading. Candidates preparing to take the examination can be aided by knowing its purpose and general objectives. Information about the areas of academic knowledge, hands-on skills, and abilities tested is also needed to prepare properly. Successful completion of the certification examination is required to practice as a "certified" Exercise Physiologist (EPC).

Purpose of the Certification

The EPC examination is used by the ASEP Board of Certification to measure the academic and technical competence of exercise physiology candidates. To understand the importance of the examination as a prerequisite for the EPC certificate, one must recognize the significance of the certification. It is awarded to qualified candidates in accordance with the objectives of the American Society of Exercise Physiologists to professionalize exercise physiology. The certificate is a measure of academic knowledge and practical abilities and thus, ensures the professional competence of individuals offering exercise physiology services to the public as professional exercise physiologists.

The primary objective of the EPC examination is to test the candidate's competence in the profession of exercise physiology. Such professional competence includes adequate academic and technical knowledge, the ability to apply such knowledge skillfully and with good judgment, and an understanding of professional, ethical responsibility. Once a candidate has successfully completed the examination, he or she is recognized as a "Board Certified Exercise Physiologist" and, therefore, can be legally and professionally referred to as an "Exercise Physiologist Certified" (EPC) or "Certified Exercise Physiologist".

Since the EPC certificate is granted under specific professional assumptions enacted in the public interest, it is issued only to properly qualified persons. The public's need for assurance of professional competence on the part of those receiving the EPC designation must be fully satisfied. The examination is also expected to play a role in the licensing procedure by evaluating the candidate's technical competence (including academic outcome knowledge and the application of laboratory- and research-based knowledge) as professional exercise physiologists. Questions selected for the examination are at a level suitable for testing the candidates' academic and hands-on competence.

Study Guide for Part II: The Applied Examination

The following material is a study guide designed to help qualified individuals prepare for the American Society of Exercise Physiologists (ASEP) Exercise Physiologist Certified (EPC) exam. There are four examples of hands-on laboratory experiences (e.g., Stations 1 through 4) that is intended to be used as a resource for important information that will be evaluated during the applied part of the certification exam. The material is designed to provide information only. It is not intended to completely prepare the candidate for the EPC exam. It is recommended that the candidate supplement the use of this material with other preparatory materials.

Station #1

Range of Motion, Body Composition, and Applied Anatomy Assessment

for _____

Introduction

Look over the following material for direction regarding expectations on behalf of the ASEP Board of Certification. The information within this document is organized as a guide (generally, in the form of questions) the Examiner can use at his/her discretion in determining what the EPC Candidate knows and is able to communicate and demonstrate in the laboratory forum.

The Candidate is expected to demonstrate both a correct oral explanation and specific hands-on skills for each major area of examination to pass the objectives of Station #1. Note that the ASEP Board of Certification has identified specific questions important to each area that will be evaluated in the Station experience.

The Examiner may ask the Candidate the questions that have been identified by the Board of Certification. Where appropriate and necessary, the Examiner should record the Candidate's response to each question. If the Examiner should want to ask additional questions, it is entirely the Examiner's right to do so. At the end of the session, the Examiner will grade the Candidate's understanding of the major issues.

The overall grade is either "pass" or "fail". The Candidate is not expected to know everything about all aspects of the Station to pass it. But, the Candidate should know at least 70% of the material and, in particular, demonstrate a clear understanding of the "absolutely essential" points required of the Station. The "essential" points are up to each Examiner to identify and determine on behalf of the Candidate.

(A) RANGE OF MOTION ASSESSMENT

Present the **Candidate** with the following case study:

> **You are responsible for the range of motion assessment of Mr. John Smith. His age is 38. His body weight is 180 lb, and he is 5'6" in height. He is sedentary with occasional low back pain (i.e., once or twice per year). Recently, he has noticed some difficulty when standing up with the back straight after sitting. Would you recommend flexibility training and, if so, which areas of the body do you feel need an increase in flexibility? What specific test would you use? How would you go about the assessment?**

The Examiner should then ask the Candidate to demonstrate his/her knowledge and hands-on skills. The Candidate's response should be to use the "traditional sit-and-reach

test". The equipment for assessing Mr. Smith's low back flexibility is in the room. The Candidate should adhere to most of the following steps:

1. The Candidate should lead Mr. Smith through simple calisthenics and/or static stretching for 2 to 3 minutes to warm-up the low back and hamstrings.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should have Mr. Smith to remove his shoes and assume a sitting position on the sit-and-reach equipment with the lower limbs extended with the feet press against the metal foot position of the measurement box.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should instruct Mr. Smith to place one hand on top of the other (side-by-side is O.K., too) and reach forward as far as possible while exhaling.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should have Mr. Smith perform 3 trials without bouncing, while noting the farthest reach on the 3rd trial.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. Based on the *Flexibility Norm Chart for Sit-and-Reach Tests*, have the Candidate identify Mr. Smith's flexibility. Note: Show the Candidate the *Chart*.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. Ask the Candidate questions such as: (1) What if Mr. Smith's range of motion assessment had been rated as poor? (2) What flexibility exercises would be used to increase low back and hip extensor flexibility?

   Typical response: Have Mr. Smith do sit-straddle-and-reach exercises.

Why sit-straddle-and-reach vs. standing up and bending forwards? As the Candidate for an explanation.

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

7. Then, ask the Candidate to identify several "general" guides for stretching.

   Typical response: A warm-up should precede a stretch program. Start with simple exercises and progress accordingly. Avoid holding one's breath, wear loose clothing, and avoid bouncing to the extreme.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. Ask the candidate about specific "precautions" for stretching, such as:

   a) What about forcing a joint beyond it normal range?
   b) Exercising people with suspected osteoporosis?
   c) Is vigorous stretching bad?
   d) Is it proper to do stretching the next day if joint pain or muscle soreness continues for more than 24 hours?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. What is a "disadvantage" of passive stretching and active stretching?

   Typical response: During passive stretching, the partner, if used, may apply pressure incorrectly. During active stretching, the stretch may initiate the stretch reflex.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. Identify the muscles that are stretched when in the "sit-straddle-and-reach" stretch exercise.

    Typical response: The lower back muscles, including but not limited to the latissimus dorsi, gluteal muscles, hamstrings, adductors, and when the feet are dorsi-flexed, the plantar flexors as well.

Where appropriate, have the Candidate be more specific about the origin and insertion of the hamstrings. Also, ask the Candidate and why Mr. Smith might need more range of motion training due to his sedentary lifestyle. The Candidate might speak to the muscles undergoing adaptive shortening with inactivity and the sitting posture.

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

(B) BODY COMPOSITION ASSESSMENT

Present the **Candidate** with the following circumstances:

You are responsible for determining Mr. Smith's body composition. He is sedentary and appears to enjoy consuming his number of daily calories. Recently, he has had some concerns about his body weight, particularly his percent body fat. Using the caliper, determine Mr. Smith's percent body fat (using chest, abdomen, and thigh). What is your recommendation?

The Candidate should adhere to most of the following steps:

1. The Candidate should measure the thickness of a skinfold on the right side of the body.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should firmly pinche the skin and subcutaneous fat between the thumb and index finger.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should open the caliper and measure the skinfold approximately 1 cm below his/her fingers.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should not release the skinfold from between the fingers while the caliper is attached to it.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. The skinfold measurement should follow the natural cleavage of the skin, and was normally parallel to the muscle immediately below the measurement.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. The Candidate should take "3" measurements, at least 15 seconds apart, at each skinfold site.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. The Candidate should read the gauge of the caliper to the closest 0.5 mm to 1 mm.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. The Candidate should record the average of the "3" skinfold measurements.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. The Candidate should use gender-specific measurement sites (for Mr. Smith).

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. The sites used (for this Station) should be the chest, abdomen, and mid-thigh.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

11. Have the Candidate define the boundaries of one skinfold site, such as the thigh.

    Typical response: **Thigh**: A vertical fold on the anterior midline of the thigh, halfway between the ASIS and the knee joint.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

12. Have the Candidate use the "Percent Fat Estimate Chart for Men" and the "Standard Values for Men % Body Fat" to make a recommendation to Mr. Smith regarding his caloric consumption, body fat, and/or a need for exercise and so forth.

    Typical response: Given Mr. Smith's age, weight, and height, it is likely that his percent body fat is slightly high. The recommendation would be to reduce caloric intake and/or increase caloric output (such as by exercising to loose a few pounds).

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

(C) APPLIED ANATOMY ASSESSMENT

Present the **Candidate** with the following circumstances:

You are responsible for determining Mr. Smith's general muscular strength and endurance. Again, he is sedentary and, perhaps, somewhat overweight. He is concerned about his general lack of handgrip strength. What equipment do you have to test his forearm muscle strength? Also, explain to Mr. Smith the different exercises used to develop muscles of the arm and shoulder region, including but not limited to the hip extensors, knee extensors and flexors, and the plantar flexors of the leg.

The Candidate should adhere to most of the following steps:

1. The Candidate should pick up the handgrip dynamometer to measure handgrip strength.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

2. The Candidate should have Mr. Smith test his handgrip strength while in the standing position.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should help Mr. Smith adjust his grip size to that the middle finger's midportion is about at a right angle.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should place Mr. Smith's forearm between 90 and 180 degrees of the arm, and tell Mr. Smith to exert maximally and quickly after hearing the Candidate's instructions: (1) Are you ready? (2) Squeeze as hard as you can. (3) Harder….Harder….

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. The Candidate should record the force in kg, and then use the best of two trials for each hand.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. The Candidate should look to the percentiles "table" for assessment.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. The Examiner should then ask the Candidate to identify different muscles of the upper and lower limbs and exercises that would be considered useful in developing the muscles.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. The Candidate to should identify the muscles (even origins and insertions) that produce shoulder flexion.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. The Candidate to should identify the muscles (even origins and insertions) that produce elbow flexion.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. The Candidate to should identify the muscles (even origins and insertions) that produce hip extension.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

11. The Candidate to should identify the muscles (even origins and insertions) that produce knee extension.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

12. The Candidate to should identify the muscles (even origins and insertions) that produce heel raises.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

    Note: It is important to point out that the Candidate is suppose to know the origin, insertion, and function(s) of individual muscles as well as the nerves to the muscles.

After considering all of the candidate's responses, please provide a final grade for Station #1.

The candidate either PASSED or FAILED. Thank you.

Candidate's name: _____

(a) Passed _____

(b) Failed _____

Signature of the Examiner: _____

Date: _____

Station #2

Maximum Oxygen Uptake, Exercise Prescription/Training, and Blood Pressure Assessment

for _____

Introduction
Look over the following material for direction regarding expectations on behalf of the ASEP Board of Certification. The information within this document is organized as a guide (generally, in the form of questions) the Examiner can use at his/her discretion in determining what the EPC Candidate knows and is able to communicate and demonstrate in the laboratory forum.

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The Examiner may ask the candidate the questions that have been identified by the Board of Certification. Where appropriate and necessary, the Examiner should record the Candidate's response to each question. If the Examiner should want to ask additional questions, it is entirely the Examiner's right to do so. At the end of the session, the Examiner will grade the Candidate's understanding of the major issues.

The overall grade is either "pass" or "fail". The Candidate is not expected to know everything about all aspects of the Station to pass it. But, the Candidate should know at least 70% of the material and, in particular, demonstrate a clear understanding of the "absolutely essential" points required of the Station. The "essential" points are up to each Examiner to identify and determine on behalf of the Candidate.

(A) MAXIMUM OXYGEN UPTAKE ASSESSMENT

Present the **Candidate** with the following circumstances:

> **You are responsible for determining Mr. Paul John's maximum oxygen uptake. His age is 57. His body weight is 190 lb, and he is 5'10" tall. He is sedentary and has been for most of his life. He is not on any medication, and he has no known heart disease. Just recently, however, he has noticed some difficulty in breathing and recovers slowly after an occasional game of tennis. Would you recommend an exercise prescription and, if so, what specific bike protocol would you use, and how would you go about the assessment of the major components of exercise training?**

The Candidate's immediate response may be a number of different submaximal and/or maximal exercise tests. As the Examiner, you are especially interested in the Candidate's knowledge of the *Astrand Cycle Test*. Tell the candidate that you want him/her to administer the Astrand Cycle Test to determine Mr. John's fitness rating. The equipment for assessing Mr. John's cardiorespiratory system is in the room. The Examiner may consider the following points as a logical presentation and progression by which the Candidate demonstrates an understanding of the test and the exercise prescription steps.

The Candidate should demonstrate most of the following steps:

1. The Candidate should "calculate" Mr. John's predicted maximum heart rate based on the regression equation: 220 minus age, and then record the results on the Astrand Cycle Test Form.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should help placed the heart rate monitor around Mr. John's chest.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should calculate 60% and 70% of Mr. John's age-predicted heart rate maximum.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should have Mr. John sit on the cycle ergometer to adjust for seat height so that one leg is almost fully extended when the heel of the foot is positioned on the pedal at its lowest point.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. Using a metronome, the Candidate should set the cadence at 100 bpm to produce a pedal rate of 50 revolutions per minute.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. Once the proper cadence has been achieved, the Candidate is expected to set the resistance to the prescribed workload. In general, the workload could vary from one subject to the next. Most Candidates usually start with a 150 kgm/min and progress by 150 kgm/min with each change in workload.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. The Candidate should determine the exercise heart rate during the second minute of each 2-minute exercise stage.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. The Candidate should continue the workload after each stage until Mr. John reaches a workload that elicits a steady state heart rate greater or equal to 70% of age-predicted heart rate maximum.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. The Candidate should then lower the workload to allow Mr. John to recover for a duration of 2 to 3 minutes.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. Using the *Astrand nomogram* (which should be given to the candidate by the Station Evaluator), the Candidate should determine Mr. John's non-adjusted aerobic capacity (using the steady state heart rate and the final workload).

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

11. The Candidate should then multiply Mr. John's non-adjusted maximum oxygen consumption by the "age-correction factor" (which should be given to the candidate, when requested).

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

12. The Candidate should convert Mr. John's age-adjusted maximum oxygen consumption from "absolute" units to "relative" units.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

13. The Candidate should then determine Mr. John's cardiorespiratory fitness rating using *Norm Chart*.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

(B) EXERCISE PRESCRIPTION AND TRAINING PROCEDURES

Present the **Candidate** with the following circumstances:

You are responsible for the developing an exercise prescription for Mr. John. Now that you have his estimated maximum heart rate, develop an exercise prescription using the Karvonen method of calculating the lower and upper limits of the heart rate range (given that Mr. John's resting heart rate is 72 bpm).

The Candidate should be able to engage in a conversation about the following topics:

(a) How does the Karvonen method compare to the "percentage of maximal heart rate method?
(b) What is the value in prescribing exercise by METs?
(c) What are the weaknesses, if any, using the "rating of perceived exertion method" of prescribing exercise?
(d) What are the 3 components (i.e., intensity, duration, and frequency) of an exercise prescription, and what are the general guidelines for developing an exercise program?

Comment: The Candidate's response to each of the questions is likely to define his/her understanding of the general issues underlying the development of an exercise program. It is up to the Examiner to conclude the correctness of the candidate's responses.

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

(D) BLOOD PRESSURE ASSESSMENT

Comment: Since the measurement of blood pressure is so important to the exercise physiologist, and given that not exercise physiologists understand the specifics of how to measure blood pressure accurately, the Examiner is responsible for evaluating the Candidate's ability to measure blood pressure.

Instructions: Tell the Candidate that you want Mr. John's blood pressure measured. The Candidate should do so in accordance with the following procedures:

1. The Candidate should ask Mr. John to sit down with his sleeves rolled up to position the cuff tightly around the upper arm at heart level.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should make sure that the lower edge of the cuff is approximately one inch above the antecubital space.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should place the stethoscope about 1 cm above the antecubital space over the brachial artery.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should quickly inflate the cuff to one of the following levels:

   a. 160 to 200 mm Hg
   b. 20 mm Hg above the expected or known systolic pressure

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. The Candidate should slowly release the pressure at a rate of 2 to 4 mmHg per heart beat or 2 to 6 mmHg per second, noting the first Korotkoff sound and continuing to the pressure disappears (fourth or fifth phase) and, then, finally opening the valve completely to exhaust all of the air from the cuff.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. The Candidate should allow at least 10 seconds between blood pressure readings, but perform at least two readings that will be averaged to determine Mr. John's blood pressure.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. The Examiner should ask the Candidate about extraneous factors that may alter blood pressure (such as smoking, anxiety, talking, physical exertion, and medications) and sources of potential error in measuring blood pressure (such as improper cuff size, bad equipment, wrong position of the arm, and slow bladder inflation).

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. Engage the Candidate in a discussion of the value of knowing blood pressure. For example, how does blood pressure relate to double product and/or myocardial oxygen consumption? What is the significance of an exercise blood pressure that decreases with exercise?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. Ask the Candidate how measure blood pressure would be measured during an incremental exercise test protocol?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

   Comment: It may not be surprising for the Candidate to say that it is essentially impossible to measure blood pressure while a subject is exercising. Therefore, how would blood pressure be determined?

After considering all of the candidate's responses, please provide a final grade for Station #2.

The candidate either PASSED or FAILED. Thank you.

Candidate's name: _____

(a) Passed _____

(b) Failed _____

Signature of the Examiner: _____

Date: _____

Station #3

Treadmill Test Procedures and Cardiovasular Assessment

for _____

Introduction

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(A) Treadmill Test Procedures

Present the **Candidate** with the following circumstances:

> **You are responsible for evaluating Mr. Adam's aerobic endurance. His is 28 years old. His body weight is 240 lb, and he is 5'10" tall. He is sedentary and considered a poorly fit subject. He is not on any medication, although his blood pressure is slightly high at rest (140 mm Hg). Recently, he has noticed some difficulty in breathing when climbing stairs and recovers slowly after any kind of physical work. Would you recommend that Mr. Adam's undergo an exercise test on the treadmill? Which test protocol would you use? Would you recommend the direct assessment of Mr. Adam's endurance by determining his oxygen uptake capacity?**

Comment: As Examiner, you are interested in the Candidate's knowledge of the pre-test and test procedures as well as the procedures used to collect cardiovascular and hemodynamic data. The Examiner should tell the candidate to administer an appropriate treadmill test (by choosing from several examples provided by the Examiner). This is Step #4 in the Pre-Test Procedures. Of course, the Examiner can cut short any procedure, when appropriate, to ensure that all aspects of the assessment is completed to his/her satisfaction. The equipment for assessing Mr. Adam's cardiorespiratory system is in the room (i.e., the Biodex treadmill, Physio-Control, and Cardio2 metabolic analyzer). The Candidate should demonstrate most of the following steps when asked by the Examiner about the PRE-TEST PROCEDURES for an appropriate treadmill protocol:

1. The Candidate should state to the Examiner that before starting the exercise test, Mr. Adam should complete a *health screening questionnaire*.

   Important: Note that the *Physical Activity Readiness Questionnaire* (PAR-Q) is available for the candidate to use.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should screen for potential contraindications prior to exercise testing, such as uncontrolled hypertension, unwillingness of Mr. Adam to give informed consent, Mr. Adam's changes his mind and does not want to be tested, suspected intoxication or drug use.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should sit Mr. Adam down and record resting heart rate, blood pressure, and age-predicted maximum heart rate.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should determine which test protocol to use.

   Important: The Examiner is provided several exercise test protocols. Present them to the Candidate and ask: "Which one is appropriate for Mr. Adam and why is it appropriate."

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. The Candidate should discuss with Mr. Adam's the following test procedures:

    a) The purpose of the test.
    b) Explain stage changes.
    c) Placement of the 3-lead ECG for heart rate (using the Physio-Control).
    d) Describe the stopping procedures, including but not limited to Mr. Adam's wish to stop or when the pre-established criteria are met.
    e) Place the oxygen consumption mouthpiece in Mr. Adam's mouth and, then place a nose clip securely on his nose.
    f) Start the metabolic analyzer.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

6. The Candidate should have Mr. Adam straddle the treadmill belt and hold on to the handrails for support. Turn on the treadmill power and have Mr. Adam stroke the belt with one foot. Once comfortable, have him start by stepping onto the belt using a heel-toe gait pattern.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

7. The Candidate should have Mr. Adam remove is hands (one at a time) from the handrails and walk normally, and to look forward (meaning, head up) while walking.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

Comment: The Candidate should demonstrate most of the following steps when asked by the Examiner about the actual TEST PROCEDURES for an appropriate treadmill protocol:

8. The Candidate should inform Mr. Adam when the treadmill speed and grade changes.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

9. The Candidate should take exercise heart rate at the end of each minute and blood pressure at the end of each stage (and where necessary, stop a continuous exercise test protocol to measure blood pressure and then resume the test).

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. The Candidate should continue data collection for each minute of each stage until one or more criteria for stopping the test are met.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

Comment: After a few minutes into the test, the Examiner should stop the test and ask the following questions or similar questions:

a) Given the exercise test protocol you used to test Mr. Adam. Had he finished the stages, his projected oxygen consumption would have been?
b) If the value is 10 METs, is that good, bad, indifferent or what?
c) How do METs convert to oxygen consumption in ml/kg/min?

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

Comment: The Examiner should consider asking the candidate about the advantages and disadvantages of treadmill testing, such as:

a) Advantages
   1) walking is a familiar exercise
   2) can vary speed and grade
   3) allows for a more precise control of work
   4) oxygen consumption is usually higher when walking

b) Disadvantages
   1) Noisy, bulky, expensive
   2) may be difficult for some clients
   3) requires coordination
   4) may be difficult to get exercise blood pressure

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

(B) Cardiovascular Assessment

The Candidate should answer the following questions pertaining to both the "table of data" and other related questions that demonstrate an understanding of the client's cardiovascular and hemodynamic responses either at rest or during exercise.

Comment: The Table of Data refer to the cardiovascular responses to a 10-minute back rub. The Examiner should give a copy of the Table to the Candidate for a quick review to answer the following questions:

1. Ask the Candidate to describe the research design.

   Important: Following the description and purpose of the study, ask the Candidate about the appropriateness of the statistics used.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. Ask the Candidate to discuss the physiological data. Are they appropriate for the purpose of the study?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. Did the **Treatment** alter oxygen uptake and, if so, how? Was there an effect after the back rub?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. What is the relationship of PVR to Q?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. What is a formula for calculating tissue extraction, MAP, and DP?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. Is ventilation related to oxygen uptake and, if so, how?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. Did the back rub increase tissue extraction?

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

8. Ask the Candidate to state the "conclusions" of the study.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

9. Ask the Candidate to calculate myocardial oxygen uptake using a regression equation.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

10. Using Cotes formula, how do the Q values compare? Any thoughts?

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

Comment: Any additional questions regarding the Table and/or cardiovascular and hemodynamic data should be considered if there is any concern that the Candidate needs extra assessment.

After considering all of the candidate's responses, please provide a final grade for Station #3.

The candidate either PASSED or FAILED. Thank you.

Candidate's name: _____

(a) Passed _____

(b) Failed _____

Signature of the Examiner: _____

Date: _____

Station #4

12-Lead ECG Procedures and Hemodynamic Measurements

for _____

Introduction

Look over the following material for direction regarding expectations on behalf of the ASEP Board of Certification. The information within this document is organized as a guide (generally, in the form of questions) the Examiner can use at his/her discretion in determining what the EPC Candidate knows and is able to communicate and demonstrate in the laboratory forum.

The Candidate is expected to demonstrate both a correct oral explanation and specific hands-on skills for each major area of examination to pass the objectives of Station #1. Note that the ASEP Board of Certification has identified specific questions important to each area that will be evaluated in the Station experience.

The Examiner may ask the candidate the questions that have been identified by the Board of Certification. Where appropriate and necessary, the Examiner should record the Candidate's response to each question. If the Examiner should want to ask additional questions, it is entirely the Examiner's right to do so. At the end of the session, the Examiner will grade the Candidate's understanding of the major issues.

The overall grade is either "pass" or "fail". The Candidate is not expected to know everything about all aspects of the Station to pass it. But, the Candidate should know at least 70% of the material and, in particular, demonstrate a clear understanding of the "absolutely essential" points required of the Station. The "essential" points are up to each Examiner to identify and determine on behalf of the Candidate.

(A) 12-LEAD ECG PROCEDURES

Present the **Candidate** with the following circumstances:

> **You are responsible for a 12-lead ECG assessment of Mr. Bob. His is 59 years old. His body weight is 164 lb, and he is 5'9" tall. He does not exercise, partly because of fear associated with his heart attack a year ago. Aside from an occasional use of Nitroglcerin for chest pain, he is taking a daily dose of a calcium channel blocker. His blood pressure is 140 mmHg at rest. During the past several months, he has noticed some difficulty in breathing and recovers slowly after any kind of physical work. Mr. Bob is interested in the NEW "heart stress test" using a *tilt table.* You are responsible for administering the 12-lead ECG during three positions (standing, supine, and head-down tilt) and using the ECG responses (along with Mr. Bob's heart**

rate and blood pressure responses at each position) to understand the appropriateness of his ECG and hemodynamic responses.

Comment: As Examiner, tell the Candidate that you want Mr. Bob prepared for a 12-lead ECG assessment. The equipment (including blood pressure cuff and tilt table) and all necessary supplies (electrodes) are in the room.

The Candidate should demonstrate the following steps when asked by the Examiner about the ECG procedures, heart rate, and blood pressure responses:

1. The Candidate should get Mr. Bob to sign an informed consent form prior to preparing for a 12-lead ECG tracing by prepping the "electrode" sites followed by attaching the cables to the appropriate electrode.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

Important: The Examiner should ask specific questions about: (1) the identification of specific electrode sites; (2) removal of any chest hair; (3) the cleaning of each electrode site; (4) the use of an abrasive device (or rubbing alcohol); and (5) the placement of the "chest" leads, the configuration of the 12 leads, especially regarding the reasons underlying the basic structure of the ECG (e.g., why are the P and R waves positive in standard lead I, and what are the criteria for left axis deviation and so forth).

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

2. The Candidate should make a recording of 12-lead ECG tracing during the standing, supine, and head-down positions.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

3. The Candidate should record heart rate and blood pressure during the standing, supine, and head-down positions.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

4. The Candidate should determine blood pressure with arm at the heart reference level, regardless of the body position.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

5. The Candidate should discuss with Mr. Bob the following test procedures:

   a. The purpose of the tilt table test.
   b. Explain tilt table test prior to initiating the changes in body position.
   c. Placement of the blood pressure cuff.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

6. The Candidate **should not** measure blood pressure during the head-down tilt position with the arms in the dependent overhead position. However, the Examiner may want to ask what the reading might be (increase or decrease) in the dependent overhead position vs. the heart reference level.

   Performed correctly _____
   Performed essentially right _____
   Failed to carry out _____

7. The Candidate should be able to interpret the physiologic responses with transition from one to the other.

   In particular, the **Examiner** should ask the **Candidate** about the following:

   1) With the transition from standing to lying down, heart rate should decrease, blood pressure should stay the same and, therefore, double product should be slightly decreased. The latter adjustment suggests a reduction in the heart's need for oxygen (given the relationship between double product and myocardial oxygen consumption).
   2) It may be appropriate to ask the Candidate about myocardial oxygen consumption and how it might be estimated using a regression equation, etc. With the transition from lying to head-down tilt, heart rate is likely to decrease even further while systolic blood pressure remains the same.
   3) It may be useful to ask the Candidate, "What are the anatomical reasons for the decrease in heart rate?"
   4) Also, since heart rate is related to cardiac output (and thus stroke volume), it may be appropriate to ask the Candidate about the cardiac output response from standing to the head-down tilt position.

5) Similarly, it would be useful to determine the Candidate's knowledge of the reversal in the responses, that is, from the head-down position to the standing position (and its relationship to orthostatic intolerance).

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

8. The Candidate should also be questioned about abnormal responses to standing up from lying down. As an example, what are the mechanisms involved in syncope and how does heart rate attempt to compensate for the decrease in preload upon standing.

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

9. The Candidate should be questioned about Mr. Bob's peripheral resistance during the "three" body positions. If cardiac output increases from standing to head-down, then, does SVR increase, decrease, or stay the same?

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

10. Just as there are indications for stopping an exercise test, it is logical that the same indications could be used to stop the *tilt table test*. Have the Candidate identify several indications that would suggest sufficient reason to stop the ECG *tilt table test.*

Consider, for example:

a. an acute MI or suspicion of one
b. chest pain and/or the progression of the pain
c. ventricular tachycardia
d. lightheadedness
e. vertigo or visual problems
f. subject requests to stop
g. equipment failure

Performed correctly _____
Performed essentially right _____
Failed to carry out _____

11. The Examiner should consider asking the Candidate about the "Angina Scale" since it is possible that the increase in preload may bring on increased chest pain. For example, "What if Mr. Bob is experiencing 3+ on the Angina Scale, would you continue the tilt table test?" What does 3+ on the scale mean, and is it a useful index of chest pain?

    a. 1+ light, barely noticeable
    b. 2+ moderate, bothersome
    c. 3+ severe, very uncomfortable
    d. 4+ most severe pain ever experience

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

12. Using the ECG strips provided as part of this Station, present each one to the Candidate and ask for an explanation of what is happening and why.

    Performed correctly _____
    Performed essentially right _____
    Failed to carry out _____

After considering all of the candidate's responses, please provide a final grade for Station #4.

The candidate either PASSED or FAILED. Thank you.

Candidate's name: _____

(a) Passed _____

(b) Failed _____

Signature of the Station Evaluator: _____

Date: _____