INSTITUTIONAL KSA MATCHING FORM

Exercise Sciences

KSA Numbering System	KSA description
1.1.1	Knowledge of the basic structures of bone, skeletal muscle, and connective tissues.
1.1.2	Knowledge of the basic anatomy of the cardiovascular system and respiratory system.
1.1.3	Knowledge of the definition of the following terms: inferior, superior, medial, lateral, supination, pronation, flexion, extension, adduction, abduction, hyperextension, rotation, circumduction, agonist, antagonist, and stabilizer.
1.1.4	Knowledge of the plane in which each muscle action occurs.
1.1.5	Knowledge of the interrelationships among center of gravity, base of support, balance, stability, and proper spinal alignment.
1.1.6	Knowledge of the following curvatures of the spine: lordosis, scoliosis, and kyphosis.
1.1.7	Knowledge to describe the myotatic stretch reflex.
1.1.8	Knowledge of fundamental biomechanical principles that underlie performance of the following activities: walking, jogging, running, swimming, cycling, weight lifting, and carrying or moving objects.
1.1.9	Ability to define aerobic and anaerobic metabolism.
1.1.10	Knowledge of the role of aerobic and anaerobic energy systems in the performance of various activities.
1.1.11	Knowledge of the following terms: ischemia, angina pectoris, tachycardia, bradycardia, arrhythmia, myocardial infarction, cardiac output, stroke volume, lactic acid, oxygen consumption, hyperventilation, systolic blood pressure, diastolic blood pressure, and anaerobic threshold.
1.1.12	Knowledge to describe normal cardiorespiratory responses to static and dynamic exercise in terms of heart rate, blood pressure, and oxygen consumption.
1.1.13	Knowledge of how heart rate, blood pressure, and oxygen consumption responses change with adaptation to chronic exercise training.
1.1.14	Knowledge of the physiological adaptations associated with strength training.
1.1.15	Knowledge of the physiological principles related to warm-up and cool-down.
1.1.16	Knowledge of the common theories of muscle fatigue and delayed onset muscle soreness (DOMS).
1.1.17	Knowledge of the physiological adaptations that occur at rest and during submaximal and maximal exercise following chronic aerobic and anaerobic exercise training.
1.1.18	Knowledge of the differences in cardiorespiratory response to acute graded exercise between conditioned and unconditioned individuals.
1.1.19	Knowledge of the structure of the skeletal muscle fiber and the basic mechanism of contraction.
1.1.20	Knowledge of the characteristics of fast and slow twitch fibers.
1.1.21	Knowledge of the sliding filament theory of muscle contraction.
1.1.22	Knowledge of twitch, summation, and tetanus with respect to muscle contraction.
1.1.23	Knowledge of the physiological principles involved in promoting gains in muscular strength and endurance.
1.1.24	Knowledge of muscle fatigue as it relates to mode, intensity, duration, and the accumulative effects of exercise.
1.1.25	Knowledge of the basic properties of cardiac muscle and the normal pathways of conduction in the heart.

1.1.26	Knowledge of the response of the following variables to acute static and dynamic exercise: heart rate, stroke volume, cardiac output, pulmonary ventilation, tidal volume, respiratory rate, and arteriovenous oxygen difference.
1.1.27	Knowledge of blood pressure responses associated with acute exercise, including changes in body position.
1.1.28	Knowledge of and ability to describe the implications of ventilatory threshold (anaerobic threshold) as it relates to exercise training and cardiorespiratory assessment.
1.1.29	Knowledge of and ability to describe the physiological adaptations of the respiratory system that occur at rest and during submaximal and maximal exercise following chronic aerobic and anaerobic training.
1.1.30	Knowledge of how each of the following differs from the normal condition: dyspnea, hypoxia, and hypoventilation.
1.1.31	Knowledge of how the principle of specificity relates to the components of fitness.
1.1.32	Knowledge of the concept of detraining or reversibility of conditioning and its implications in fitness programs.
1.1.33	Knowledge of the physical and psychological signs of overtraining and to provide recommendations for these problems.
1.1.34	Knowledge of and ability to describe the changes that occur in maturation from childhood to adulthood for the following: skeletal muscle, bone structure, reaction time, coordination, heat and cold tolerance, maximal oxygen consumption, strength, flexibility, body composition, resting and maximal heart rate, and resting and maximal blood pressure.
1.1.35	Knowledge of the effect of the aging process on the musculoskeletal and cardiovascular structure and function at rest, during exercise, and during recovery.
1.1.36	Knowledge of the following terms: progressive resistance, isotonic/isometric, concentric, eccentric, atrophy, hypertrophy, sets, repetitions, plyometrics, Valsalva maneuver.
1.1.37	Knowledge of and skill to demonstrate exercises designed to enhance muscular strength and/or endurance of specific major muscle groups.
1.1.38	Knowledge of and skill to demonstrate exercises for enhancing musculoskeletal flexibility.
1.1.39	Ability to identify the major bones and muscles. Major muscles include, but are not limited to, the following: trapezius, pectoralis major, latissimus dorsi, biceps, triceps, rectus abdominis, internal and external obliques, erector spinae, gluteus maximus, quadriceps, hamstrings, adductors, abductors, and gastrocnemius.
1.1.40	Ability to identify the major bones. Major bones include, but are not limited to the clavicle, scapula, strernum, humerus, carpals, ulna, radius, femur, fibia, tibia, and tarsals.
1.1.41	Ability to identify the joints of the body.
1.1.42	Knowledge of the primary action and joint range of motion for each major muscle group.
1.1.43	Ability to locate the anatomic landmarks for palpation of peripheral pulses.
	PATHOPHYSIOLOGY AND RISK FACTORS
1.2.1	Knowledge of the physiological and metabolic responses to exercise associated with chronic disease (heart disease, hypertension, diabetes mellitus, and pulmonary disease).
1.2.2	Knowledge of cardiovascular, respiratory, metabolic, and musculoskeletal risk factors that may require further evaluation by medical or allied health professionals before participation in physical activity.
1.2.3	Knowledge of risk factors that may be favorably modified by physical activity habits.
1.2.4	Knowledge to define the following terms: total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), TC/HDL-C ratio, low-density lipoprotein cholesterol (LDL-C), triglycerides, hypertension, and atherosclerosis.
1.2.5	Knowledge of plasma cholesterol levels for adults as recommended by the National Cholesterol Education Program.
1.2.6	Knowledge of the risk factor concept of CAD and the influence of heredity and lifestyle on the development of CAD.
1.2.7	Knowledge of the atherosclerotic process, the factors involved in its genesis and progression, and the potential role of exercise in treatment.

1.2.8	Knowledge of how lifestyle factors, including nutrition, physical activity, and heredity, influence lipid and lipoprotein profiles.
	HEALTH APPRAISAL, FITNESS AND CLINICAL EXERCISE TESTING
1.3.1	Knowledge of and ability to discuss the physiological basis of the major components of physical fitness: flexibility, cardiovascular fitness, muscular strength, muscular endurance, and body composition.
1.3.2	Knowledge of the importance of a health/medical history.
1.3.3	Knowledge of the value of a medical clearance prior to exercise participation.
1.3.4	Knowledge of the categories of participants who should receive medical clearance prior to administration of an exercise test or participation in an exercise program.
1.3.5	Knowledge of relative and absolute contraindications to exercise testing or participation.
1.3.6	Knowledge of the limitations of informed consent and medical clearance prior to exercise testing.
1.3.7	Knowledge of the advantages/disadvantages and limitations of the various body composition techniques including air displacement, plethysmography, hydrostatic weighing, skinfolds and bioelectrical impedence.
1.3.8	Skill in accurately measuring heart rate, blood pressure, and obtaining rating of perceived exertion (RPE) at rest and during exercise according to established guidelines.
1.3.9	Skill in measuring skinfold sites, skeletal diameters, and girth measurements used for estimating body composition.
1.3.10	Skill in techniques for calibration of a cycle ergometer and a motor-driven treadmill.
1.3.11	Ability to locate the brachial artery and correctly place the cuff and stethoscope in position for blood pressure measurement.
1.3.12	Ability to locate common sites for measurement of skinfold thicknesses and circumferences (for determination of body composition and waist-hip ratio).
1.3.13	Ability to obtain a health history and risk appraisal that includes past and current medical history, family history of cardiac disease, orthopedic limitations, prescribed medications, activity patterns, nutritional habits, stress and anxiety levels, and smoking and alcohol use.
1.3.14	Ability to obtain informed consent.
1.3.15	Ability to explain the purpose and procedures for monitoring clients prior to, during, and after cardiorespiratory fitness testing.
1.3.16	Ability to instruct participants in the use of equipment and test procedures.
1.3.17	Ability to describe the purpose of testing, determine an appropriate submaximal or maximal protocol, and perform an assessment of cardiovascular fitness on the cycle ergometer or the treadmill.
1.3.18	Ability to describe the purpose of testing, determine appropriate protocols, and perform assessments of muscular strength, muscular endurance, and flexibility.
1.3.19	Ability to perform various techniques of assessing body composition,including the use of skinfold calipers.
1.3.20	Ability to analyze and interpret information obtained from the cardiorespiratory fitness test and the muscular strength and endurance, flexibility, and body composition assessments for apparently healthy individuals and those with stable disease.
1.3.21	Ability to identify appropriate criteria for terminating a fitness evaluation and demonstrate proper procedures to be followed after discontinuing such a test.
1.3.22	Ability to modify protocols and procedures for cardiorespiratory fitness tests in children, adolescents, and older adults.
1.3.23	Ability to identify individuals for whom physician supervision is recommended during maximal and submaximal exercise testing.

	ELECTROCARDIOGRAPHY AND DIAGNOSTIC TECHNIQUES
1.4.1	Knowledge of how each of the following differs from the normal condition: premature atrial contractions and premature ventricular contractions.
1.4.2	Ability to locate the appropriate sites for the limb and chest leads for resting, standard, and exercise (Mason Likar) electrocardiograms (ECGs), as well as commonly used bipolar systems (e.g., CM-5).
	PATIENT MANAGEMENT AND MEDICATIONS
1.5.1	Knowledge of common drugs from each of the following classes of medications and describe the principal action and the effects on exercise testing and prescription: antianginals; antihypertensives; antiarrhythmics; bronchodilators; hypoglycemics; psychotropics; and vasodilators.
1.5.2	Knowledge of the effects of the following substances on exercise response: antihistamines, tranquilizers, alcohol, diet pills, cold tablets, caffeine, and nicotine.
	EXERCISE PRESCRIPTION AND PROGRAMMING
1.7.1	Knowledge of the relationship between the number of repetitions, intensity, number of sets, and rest with regard to strength training.
1.7.2	Knowledge of the benefits and risks associated with exercise training in prepubescent and postpubescent youth.
1.7.3	Knowledge of the benefits and precautions associated with resistance and endurance training in older adults.
1.7.4	Knowledge of specific leadership techniques appropriate for working with participants of all ages.
1.7.5	Knowledge of how to modify cardiovascular and resistance exercises based on age and physical condition.
1.7.6	Knowledge of the differences in the development of an exercise prescription for children, adolescents, and older participants.
1.7.7	Knowledge of and ability to describe the unique adaptations to exercise training in children, adolescents, and older participants with regard to strength, functional capacity, and motor skills.
1.7.8	Knowledge of common orthopedic and cardiovascular considerations for older participants and the ability to describe modifications in exercise prescription that are indicated.
1.7.9	Knowledge of selecting appropriate testing and training modalities according to the age and functional capacity of the individual.
1.7.10	Knowledge of the recommended intensity, duration, frequency, and type of physical activity necessary for development of cardiorespiratory fitness in an apparently healthy population.
1.7.11	Knowledge of and the ability to describe exercises designed to enhance muscular strength and/or endurance of specific major muscle groups.
1.7.12	Knowledge of the principles of overload, specificity, and progression and how they relate to exercise programming.
1.7.13	Knowledge of the various types of interval, continuous, and circuit training programs.
2.7.0	Skill in demonstrating appropriate emergency procedures during exercise testing and/or training.
1.7.14	Knowledge of approximate METs for various sport, recreational, and work tasks.
1.7.15	Knowledge of the components incorporated into an exercise session and the proper sequence (i.e., pre-exercise evaluation, warm-up, aerobic stimulus phase, cool-down, muscular strength and/or endurance, and flexibility).

1.7.16	Knowledge of special precautions and modifications of exercise programming for participation at altitude, different ambient temperatures, humidity, and environmental pollution.
1.7.17	Knowledge of the importance of recording exercise sessions and performing periodic evaluations to assess changes in fitness status.
1.7.18	Knowledge of the advantages and disadvantages of implementation of interval, continuous, and circuit training programs.
1.7.19	Knowledge of the types of exercise programs available in the community and how these programs are appropriate for various populations.
1.7.20	Knowledge of the concept of "Activities of Daily Living" (ADLs) and its importance in the overall health of the individual.
1.7.21	Skill to teach and demonstrate the components of an exercise session (i.e., warm-up, aerobic stimulus phase, cool-down, muscular strength/endurance, flexibility).
1.7.22	Skill to teach and demonstrate appropriate modifications in specific exercises for the following groups: older adults, pregnant and postnatal women, obese persons, and persons with low back pain.
1.7.23	Skill to teach and demonstrate appropriate exercises for improving range of motion of all major joints.
1.7.24	Skill in the use of various methods for establishing and monitoring levels of exercise intensity, including heart rate, RPE, and METs.
1.7.25	Ability to identify and apply methods used to monitor exercise intensity, including heart rate and rating of perceived exertion.
1.7.26	Ability to describe modifications in exercise prescriptions for individuals with functional disabilities and musculoskeletal injuries
1.7.27	Ability to differentiate between the amount of physical activity required for health benefits and the amount of exercise required for fitness development.
1.7.28	Ability to determine training heart rates using two methods: percent of age-predicted maximum heart rate and heart rate reserve (Karvonen).
1.7.29	Ability to identify proper and improper technique in the use of resistive equipment such as stability balls, weights, bands, resistance bars, and water exercise equipment.
1.7.30	Ability to identify proper and improper technique in the use of cardiovascular conditioning equipment (e.g., stairclimbers, stationary cycles, treadmills, elliptical trainers).
1.7.31	Ability to teach a progression of exercises for all major muscle groups to improve muscular strength and endurance.
1.7.32	Ability to communicate effectively with exercise participants.
1.7.33	Ability to design, implement, and evaluate individualized and group exercise programs based on health history and physical fitness assessments.
1.7.34	Ability to modify exercises based on age and physical condition.
1.7.35	Knowledge and ability to determine energy cost, V.O<sb>2, METs, and target heart rates and apply the information to an exercise prescription.
1.7.36	Ability to convert weights from pounds (lb) to kilograms (kg) and speed from miles per hour (mph) to meters per minute (m.min<su>-1).
1.7.37	Ability to convert METs to V.O<sb>2 expressed as mL.kg<su>-1.min<su>-1, L.min<su>-1, and/or mL.kg FFW<su>-1.min<su>-1.
1.7.38	Ability to determine the energy cost in METs and kilocalories for given exercise intensities in stepping exercise, cycle ergometry, and during horizontal and graded walking and running.
1.7.39	Ability to prescribe exercise intensity based on V.<sb>O2 data for different modes of exercise, including graded and horizontal running and walking, cycling, and stepping exercise.

1.7.40	Ability to explain and implement exercise prescription guidelines for apparently healthy clients, increased risk clients, and clients with controlled disease.
1.7.41	Ability to adapt frequency, intensity, duration, mode, progression, level of supervision, and monitoring techniques in exercise programs for patients with controlled chronic disease (e.g., heart disease, diabetes mellitus, obesity, hypertension), musculoskeletal problems, pregnancy and/or postpartum, and exercise-induced asthma.
1.7.42	Ability to design resistive exercise programs to increase or maintain muscular strength and/or endurance.
1.7.43	Ability to evaluate flexibility and prescribe appropriate flexibility exercises for all major muscle groups.
1.7.44	Ability to design training programs using interval, continuous, and circuit training programs.
1.7.45	Ability to describe the advantages and disadvantages of various commercial exercise equipment in developing cardiorespiratory fitness, muscular strength, and muscular endurance.
1.7.46	Ability to modify exercise programs based on age, physical condition, and current health status.
	NUTRITION AND WEIGHT MANAGEMENT
1.8.1	Knowledge of the role of carbohydrates, fats, and proteins as fuels for aerobic and anaerobic metabolism.
1.8.2	Knowledge to define the following terms: obesity, overweight, percent fat, lean body mass, anorexia nervosa, bulimia, and body fat distribution.
1.8.3	Knowledge of the relationship between body composition and health.
1.8.4	Knowledge of the effects of diet plus exercise, diet alone, and exercise alone as methods for modifying body composition.
1.8.5	Knowledge of the importance of an adequate daily energy intake for healthy weight management.
1.8.6	Knowledge of the difference between fat-soluble and water-soluble vitamins.
1.8.7	Knowledge of the importance of maintaining normal hydration before, during, and after exercise.
1.8.8	Knowledge of the USDA Food Pyramid.
1.8.9	Knowledge of the importance of calcium and iron in women's health.
1.8.10	Knowledge of the myths and consequences associated with inappropriate weight loss methods (e.g., saunas, vibrating belts, body wraps, electric simulators, sweat suits, fad diets).
1.8.11	Knowledge of the number of kilocalories in one gram of carbohydrate, fat, protein, and alcohol.
1.8.12	Knowledge of the number of kilocalories equivalent to losing 1 pound of body fat.
1.8.13	Knowledge of the guidelines for caloric intake for an individual desiring to lose or gain weight.
1.8.14	Knowledge of common nutritional ergogenic aids, the purported mechanism of action, and any risk and/or benefits (e.g., carbohydrates, protein/amino acids, vitamins, minerals, sodium bicarbonate, creatine, bee pollen).
1.8.15	Knowledge of nutritional factors related to the female athlete triad syndrome (i.e., eating disorders, menstrual cycle abnormalities, and osteoporosis).
1.8.16	Knowledge of the NIH Consensus statement regarding health risks of obesity, Nutrition for Physical Fitness Position Paper of the American Dietetic Association, and the ACSM Position Stand on proper and improper weight loss programs.

1.8.17	Ability to describe the health implications of variation in body fat distribution patterns and the significance of the waist to hip ratio.
	HUMAN BEHAVIOR AND COUNSELING
1.9.1	Knowledge of at least five behavioral strategies to enhance exercise and health behavior change (e.g., reinforcement, goal setting, social support).
1.9.2	Knowledge of the five important elements that should be included in each counseling session.
1.9.3	Knowledge of specific techniques to enhance motivation (e.g., posters, recognition, bulletin boards, games, competitions). Define extrinsic and intrinsic reinforcement and give examples of each.
1.9.4	Knowledge of extrinsic and intrinsic reinforcement and give examples of each.
1.9.5	Knowledge of the stages of motivational readiness.
1.9.6	Knowledge of three counseling approaches that may assist less motivated clients to increase their physical activity.
1.9.7	Knowledge of symptoms of anxiety and depression that may necessitate referral to a medical or mental health professional.
1.9.8	Knowledge of the potential symptoms and causal factors of test anxiety (i.e., performance, appraisal threat during exercise testing) and how it may affect physiological responses to testing.
	SAFETY, INJURY PREVENTION, AND EMERGENCY PROCEDURES
1.10.1	Knowledge of and skill in obtaining basic life support and cardiopulmonary resuscitation certification.
1.10.2	Knowledge of appropriate emergency procedures (i.e., telephone procedures, written emergency procedures, personnel responsibilities) in a health and fitness setting.
1.10.3	Knowledge of basic first aid procedures for exercise-related injuries, such as bleeding, strains/sprains, fractures, and exercise intolerance (dizziness, syncope, heat injury).
1.10.4	Knowledge of basic precautions taken in an exercise setting to ensure participant safety.
1.10.5	Knowledge of the physical and physiological signs and symptoms of overtraining.
1.10.6	Knowledge of the effects of temperature, humidity, altitude, and pollution on the physiological response to exercise.
1.10.7	Knowledge of the following terms: shin splints, sprain, strain, tennis elbow, bursitis, stress fracture, tendonitis, patellar femoral pain syndrome, low back pain, plantar fasciitis, and rotator cuff tendonitis.
1.10.8	Knowledge of hypothetical concerns and potential risks that may be associated with the use of exercises such as straight leg sit-ups, double leg raises, full squats, hurdlers stretch, yoga plough, forceful back hyperextension, and standing bent-over toe touch.
1.10.9	Knowledge of safety plans, emergency procedures, and first aid techniques needed during fitness evaluations, exercise testing, and exercise training.
1.10.10	Knowledge of the health/fitness instructor's responsibilities, limitations, and the legal implications of carrying out emergency procedures.
1.10.11	Knowledge of potential musculoskeletal injuries (e.g., contusions, sprains, strains, fractures), cardiovascular/pulmonary complications (e.g., tachycardia, bradycardia, hypotension/hypertension, tachypnea) and metabolic abnormalities (e.g., fainting/syncope, hypoglycemia/hyperglycemia, hypothermia/hyperthermia).

1.10.12	Knowledge of the initial management and first aid techniques associated with open wounds, musculoskeletal injuries, cardiovascular/pulmonary complications, and metabolic disorders.
1.10.13	Knowledge of the components of an equipment maintenance/repair program and how it may be used to evaluate the condition of exercise equipment to reduce the potential risk of injury.
1.10.14	Knowledge of the legal implications of documented safety procedures, the use of incident documents, and ongoing safety training.
1.10.15	Skill to demonstrate exercises used for people with low back pain.
1.10.16	Skill in demonstrating appropriate emergency procedures during exercise testing and/or training.
1.10.17	Ability to identify the components that contribute to the maintenance of a safe environment.
	PROGRAM ADMINISTRATION, QUALITY ASSURANCE, AND OUTCOME ASSESSMENT
1.11.1	Knowledge of the health/fitness instructor's role in administration and program management within a health/fitness facility.
1.11.2	Knowledge of and the ability to use the documentation required when a client shows signs or symptoms during an exercise session and should be referred to a physician.
1.11.3	Knowledge of how to manage of a fitness department (e.g., working within a budget, training exercise leaders, scheduling, running staff meetings).
1.11.4	Knowledge of the importance of tracking and evaluating member retention.
1.11.6	Ability to administer fitness-related programs within established budgetary guidelines.
1.11.7	Ability to develop marketing materials for the purpose of promoting fitness-related programs.
1.11.8	Ability to create and maintain records pertaining to participant exercise adherence, retention, and goal setting.
1.11.9	Ability to develop and administer educational programs (e.g., lectures, workshops) and educational materials.
	CARDIOVASCULAR: PATHOPHYSIOLOGY AND RISK FACTORS
2.2.1	Knowledge of cardiovascular risk factors or conditions that may require consultation with medical personnel before testing or training, including inappropriate changes of resting or exercise heart rate and blood pressure, new onset discomfort in chest, neck, shoulder, or arm, changes in the pattern of discomfort during rest or exercise, fainting or dizzy spells, and claudication.
2.2.2	Knowledge of the causes of myocardial ischemia and infarction.
2.2.3	Knowledge the pathophysiology of hypertension, obesity, hyperlipidemia, diabetes, chronic obstructive pulmonary diseases, arthritis, osteoporosis, chronic diseases, and immunosuppressive disease.
2.2.4	Knowledge the effects of the above diseases and conditions on cardiorespiratory and metabolic function at rest and during exercise.
	PULMONARY: PATHOPHYSIOLOGY AND RISK FACTORS

3.2.1	Knowledge of respiratory risk factors or conditions that may require consultation with medical personnel before testing or training, including asthma, exercise-induced bronchospasm, extreme breathlessness at rest or during exercise, bronchitis, and emphysema.
	METABOLIC: PATHOPHYSIOLOGY AND RISK FACTORS
4.2.1	Knowledge of metabolic risk factors or conditions that may require consultation with medical personnel before testing or training, including body weight more than 20% above optimal, BMI > 30, thyroid disease, diabetes or glucose intolerance, and hypoglycemia.
	ORTHOPEDIC/MUSCULOSKELETAL: PATHOPHYSIOLOGY AND RISK FACTORS
5.2.1	Knowledge of musculoskeletal risk factors or conditions that may require consultation with medical personnel before testing or training, including acute or chronic back pain, osteoarthritis, rheumatoid arthritis, osteoporosis, tendonitis, and low back pain.