Exercise Physiology Self-Assessment Form

Topic	Specification			

Joints, movements and muscles	• shoulder:
	  ○ flexion, extension, abduction, adduction, horizontal flexion/ extension, medial and lateral rotation, circumduction
	  ○ deltoid, latissimus dorsi, pectoralis major, trapezius, teres minor
	• elbow:
	  ○ flexion, extension
	  ○ biceps brachii, triceps brachii
	• wrist:
	  ○ flexion, extension
	  ○ wrist flexors, wrist extensors
	• hip:
	  ○ flexion, extension, abduction, adduction, medial and lateral rotation
	  ○ iliopsoas, gluteus maximus, medius and minimus, adductor longus, brevis and magnus
	• knee:
	  ○ flexion, extension
	  ○ hamstring group: biceps femoris, semi-membranosus , semi-tendinosus
	  ○ quadriceps group: rectus femoris, vastus lateralis, vastus intermedius and vastus medialis
	• ankle:
	  ○ dorsi flexion, plantar flexion
	  ○ tibialis anterior, soleus, gastrocnemius
	• planes of movement:
	  ○ frontal
	  ○ transverse
	  ○ sagittal.			

Functional roles of muscles and types of contraction	• roles of muscles:
	  ○ agonist
	  ○ antagonist
	  ○ fixator
	• types of contraction
	  ○ isotonic
	  ○ concentric
	  ○ eccentric
	  ○ isometric.			

Ankle Joint	• analyse movement with reference to:
	  ○ joint type
	  ○ movement produced
	  ○ agonist and antagonist muscles involved
	  ○ type of muscle contraction taking place.			

Exercise Physiology Self-Assessment Form

Skeletal muscle contraction	• structure and role of motor units in skeletal muscle contraction
	• nervous stimulation of the motor unit:
	  ○ motor neuron
	  ○ action potential
	  ○ neurotransmitter
	  ○ 'all or none' law.			

Muscle contraction during exercise of differing intensities and during recovery	• muscle fibre types:
	  ○ slow oxidative
	  ○ fast oxidative glycolytic
	  ○ fast glycolytic
	• recruitment of different fibre types during exercise of differing intensities and during recovery.			

Cardiovascular system at rest	• the relationship between, and resting values for:
	  ○ heart rate
	  ○ stroke volume
	  ○ cardiac output
	  ○ methods of calculating the above
	• cardiac cycle:
	  ○ diastole
	  ○ systole
	• conduction system of the heart linked to the cardiac cycle.			

Cardiovascular system during exercise of differing intensities and during recovery	• effects of different exercise intensisties and recovery on:
	  ○ heart rate
	  ○ stroke volume
	  ○ cardiac output
	  ○ methods of calculating the above
	• redistribution of cardiac output during exercise of differing intensities and during recovery:
	  ○ vascular shunt mechanism
	  ○ role of the vasomotor centre
	  ○ role of arterioles
	  ○ role of pre-capillary sphincters
	• mechanisms of venous return during exercise of differing intensities and during recovery
	• regulation of heart rate during exercise:
	  ○ neural factors
	  ○ hormonal factors
	  ○ intrinsic factors.			

Respiratory system at rest	• relationship between resting values for:
	  ○ breathing frequency
	  ○ tidal volume
	  ○ minute ventilation
	  ○ methods of calculating the above
	• mechanics of breathing at rest and the muscles involved:
	  ○ diaphragm
	  ○ external intercostals
	  ○ at the alveoli
	  ○ at the muscles.			

Exercise Physiology Self-Assessment Form

Respiratory system during exercise of differing intensities and during recovery	• effects of differing intensities of exercise and recovery on: ○ breathing frequency ○ tidal volume ○ minute ventilation • mechanics of breathing during exercise of differing intensities and during recovery, including additional muscles involved: ○ inspiration – sternocleidomastoid, pectoralis minor ○ expiration – internal intercostals, rectus abdominis. • regulation of breathing during exercise of different intensities and during recovery ○ neural control ○ chemical control • effect of differing intensities of exercise and recovery on gas exchange at the alveoli and at the muscles ○ changes in pressure gradient ○ changes in dissociation of oxyhaemoglobin.			
Adenosine Triphosphate (ATP) and energy transfer	• ATP as 'energy currency' • principle of energetically coupled reactions: ○ breakdown of ATP to ADP (Adensosine Diphosphate) + P (phosphate) ○ resynthesis of ATP from ADP + P.			
Energy systems and ATP resynthesis	• energy systems: ○ ATP-PC (Phosphocreatine) system ○ glycolytic system ○ aerobic system • for each system: ○ type of reaction (aerobic or anaerobic) ○ chemical or food fuel used ○ specific site of the reaction ○ controlling enzyme ○ ATP yield ○ specific stages within the system ○ by-products.			
ATP resynthesis during exercise of differing intensities and durations	• the energy continuum • predominant energy system used during exercise: ○ how intensity and duration of exercise influence which energy system is predominantly used to resynthesise ATP ○ interpretation of figures relating to the contribution of the three energy systems to exercise of different intensities and durations • interplay of energy systems during intermittent exercise and factors that affect this interplay ○ intensity of exercise ○ duration of exercise ○ recovery periods ○ fitness levels.			

Exercise Physiology Self-Assessment Form

The recovery process	• how the body returns to its pre-exercise state:
	  ○ Excess Post exercise Oxygen Consumption (EPOC)
	• fast components of EPOC, the processes that occur and the duration:
	  ○ replenishment of blood and muscle oxygen stores
	  ○ re-synthesis of ATP and PC
	• slow components of EPOC, the processes that occur and the duration:
	  ○ elevated circulation
	  ○ elevated ventilation
	  ○ elevated body temperature
	  ○ lactate removal and conversion to glycogen
	• effect of exercise intensity on EPOC and implications of the recovery process for planning exercise or training sessions.			

Exercise at altitude	• effect of altitude on the cardiovascular and respiratory systems:
	  ○ reduced arterial PO_2 (partial pressure of oxygen) leading to impaired muscle O_2 delivery
	  ○ elevated heart rate and ventilation
	• acclimatisation, including the importance of timing arrival, at altitude (above 2400m).			

Exercise in the heat	• effect of heat on the cardiovascular and respiratory systems:
	  ○ temperature regulation
	  ○ cardiovascular drift.			

Diet and nutrition	• function and importance of the components of a healthy, balanced diet:
	  ○ carbohydrates
	  ○ proteins
	  ○ fats
	  ○ minerals
	  ○ vitamins
	  ○ fibre
	  ○ water
	• energy intake and expenditure and energy balance in physical activity and performance.			

Ergogenic aids	• use of ergogenic aids; potential benefits and risks:
	  ○ pharmacological aids:
	  – anabolic steroids
	  – erythropoietin (EPO)
	  – human growth hormone (HGH)
	  ○ physiological aids:
	  – blood doping,
	  – intermittent hypoxic training (IHT)
	  – cooling aids			

Exercise Physiology Self-Assessment Form

	○ nutritional aids: – amount of food – composition of meals – timing of meals – hydration – glycogen/carbohydrate loading – creatine – caffeine – bicarbonate – nitrate.			
Aerobic training	• aerobic capacity and maximal oxygen uptake (VO_2max) • how VO_2max is affected by: ○ individual physiological make-up ○ training ○ age ○ gender • methods of evaluating aerobic capacity: ○ laboratory test of VO_2max using direct gas analysis ○ NCF multi-stage fitness test ○ Queen's College step test ○ Cooper 12 minute run • intensity and duration of training used to develop aerobic capacity: ○ continuous training ○ high intensity interval training (HIIT) • the use of target heart rates as an intensity guide • physiological adaptations from aerobic training: ○ cardiovascular ○ respiratory ○ muscular ○ metabolic • activities and sports in which aerobic capacity is a key fitness component.			

Exercise Physiology Self-Assessment Form

Strength training	• types of strength:
	  ○ strength endurance
	  ○ maximum strength
	  ○ explosive/elastic strength
	  ○ static and dynamic strength
	• factors that affect strength:
	  ○ fibre type
	  ○ cross sectional area of the muscle
	• methods of evaluating each type of strength:
	  ○ grip strength dynamometer
	  ○ 1 Repetition Maximum(1RM)
	  ○ press up or sit-up test
	  ○ vertical jump test
	• training to develop strength:
	  ○ repetitions
	  ○ sets
	  ○ resistance guidelines used to improve each type of strength
	  ○ use of multi-gym
	  ○ weights
	  ○ plyometrics
	  ○ circuit/interval training:
	  – work intensity
	  – work duration
	  – relief interval
	  – number of work/relief intervals
	• physiological adaptations from strength training:
	  ○ muscle and connective tissues
	  ○ neural
	  ○ metabolic
	• activities and sports in which strength is a key fitness component.			

Flexibility training	• types of flexibility:
	  ○ static flexibility (active and passive)
	  ○ dynamic flexibility
	• factors that affect flexibility:
	  ○ type of joint
	  ○ length of surrounding connective tissue
	  ○ age
	  ○ gender
	• periodisation cycles:
	  ○ macrocycle
	  ○ mesocycle
	  ○ microcycle
	• phases of training:
	  ○ preparatory
	  ○ competitive
	  ○ transition
	• tapering to optimise performance
	• how to plan personal health and fitness programmes for aerobic, strength and flexibility training.			

Exercise Physiology Self-Assessment Form

Periodisation of training	• periodisation cycles:
	  ○ macrocycle
	  ○ mesocycle
	  ○ microcycle
	• phases of training:
	  ○ preparatory
	  ○ competitive
	  ○ transition
	• tapering to optimise performance
	• how to plan personal health and fitness programmes for aerobic, strength and flexibility training.			

Impact of training on lifestyle diseases	• the effect of training on lifestyle diseases:
	  ○ cardiovascular system :
	  – coronary heart disease (CHD)
	  – stroke
	  – atherosclerosis
	  – heart attack
	  ○ respiratory system
	  – asthma
	  – chronic obstructive pulmonary disease (COPD).			

Acute and chronic injurie	• acute injuries resulting from a sudden stress to the body:
	  ○ hard tissue injuries
	  ○ soft tissue injuries
	  ○ concussion
	• chronic injuries resulting from continuous stress to the body:
	  ○ soft tissue injuries
	  ○ hard tissue injuries.			

Injury prevention	• intrinsic risk factors:
	  ○ individual variables
	  ○ training effects
	• extrinsic risk factors:
	  ○ poor technique/training
	  ○ incorrect equipment/clothing
	  ○ inappropriate intensity, duration or frequency of activity
	• debate surrounding effective warm up and cool down.			

Exercise Physiology Self-Assessment Form

Responding to injuries and medical conditions in a sporting context	• assessing sporting injuries using 'SALTAPS'
	  ○ See
	  ○ Ask
	  ○ Look
	  ○ Touch
	  ○ Active
	  ○ Passive
	  ○ Strength
	• acute management of soft tissue injuries using 'PRICE'
	  ○ Protection
	  ○ Rest
	  ○ Ice
	  ○ Compression
	  ○ Elevation
	• recognising concussion: IRB's 'Recognise and Remove' 6 R's
	  ○ Recognise
	  ○ Remove
	  ○ Refer
	  ○ Rest
	  ○ Recover
	  ○ Return.			

Rehabilitation of injury	• treatment of common sporting injuries:
	  ○ injuries:
	  – fractures – simple, stress
	  – joint injuries – dislocation, sprain, torn cartilage
	  – exercise-induced muscle damage
	  ○ treatments:
	  – stretching
	  – massage
	  – heat, cold and contrast therapies
	  – anti-inflammatory drugs
	  – physiotherapy
	  – surgery.			