100 MULTIPLE CHOICE QUESTIONS
WITH ANSWERS HIGHLIGHTED IN RED
For each question there is only ONE correct answer.

CHAPTER 1

1 Metabolism is determined by the:
(a) size of proteins in the cell
(b) availability of amino acids
(c) proteins formed as dictated by the genetic material
(d) protein composition of the DNA
(e) activity of enzymes produced in the nucleus

2 In sprint events, improvements in performance may come from:
(a) faster reaction times
(b) increased power generating ability of muscles
(c) improved resistance to fatigue
(d) all of the above
(e) (a) and (b) only

3 Women’s world record performances have improved rapidly in recent years mainly because:
(a) women have evolved a greater muscle mass
(b) women can now run faster than men
(c) women have started training at an earlier age
(d) more women are now engaged in sport
(e) the use of ergogenic aids has increased in women
4 Endurance training increases the muscle’s capacity to:
(a) contract faster
(b) breakdown phosphocreatine
(c) burn fat and carbohydrate
(d) generate energy anaerobically
(e) produce more blood cells

5 Which of the following factors does not influence success in sport?
(a) ability to tolerate heavy training without succumbing to illness or injury
(b) tactics
(c) the diet
(d) skill
(e) ingestion of carnitine during exercise

CHAPTER 2
1 The two principal contractile proteins found in skeletal muscle are:
(a) actin and troponin
(b) actin and myosin
(c) troponin and tropomyosin
(d) myosin and tropomyosin
(e) actin and tropomyosin

2 The sarcoplasmic reticulum in muscle cells acts as a:
(a) store of digestive enzymes
(b) store of sodium ions
(c) store of lipid
(d) store of calcium ions
(e) buffer of hydrogen ions
3 An action potential arriving at the motor endplate causes release of:
(a) acetylcholine which traverses the neuromuscular junction
(b) sodium ions which binds to sodium receptors on the muscle membrane
(c) calcium ions which initiate an action potential along the muscle fibre
(d) noradrenaline which increases muscle metabolic activity
(e) none of the above

4 The trigger to initiate the contractile process in skeletal muscle is:
(a) potassium binding to myosin
(b) calcium binding to tropomyosin
(c) ATP binding to the myosin cross bridges
(d) calcium binding to troponin
(e) ATP breakdown by actin

5 After calcium ions have been released from the sarcoplasmic reticulum they:
(a) initiate an action potential
(b) cause sodium channels to open in the sarcolemmal membrane
(c) bind to troponin
(d) bind to actin
(e) cause oxygen to be released from myoglobin

6 A muscle fibre relaxes when:
(a) the nerve stimulus is removed
(b) the nerve stimulus is too forceful
(c) the actin binding sites are uncovered
(d) the actin binding sites are saturated
(e) all the ATP is used up

7 Fast-twitch fibres contain:
(a) a relatively large number of mitochondria and low ATPase activity
(b) a relatively small number of mitochondria and low ATPase activity
(c) a relatively small number of mitochondria and high ATPase activity
(d) a relatively large number of mitochondria and high ATPase activity
(e) no mitochondria and high ATPase activity
8 Type I muscle fibres have the following characteristics:
(a) white, glycolytic, slow contracting
(b) white, oxidative, slow contracting
(c) red, oxidative, fast contracting
(d) red, glycolytic, slow contracting
(e) red, oxidative, slow contracting

9 Which of the following is not an amino acid?
(a) glutamic acid
(b) aspartic acid
(c) glutamine
(d) palmitic acid
(e) leucine

10 What type of covalent bonds link the amino acids in a protein?
(a) peptide bonds
(b) hydrogen bonds
(c) ionic bonds
(d) glycosidic bonds
(e) ester bonds

11 Which of the following is an amino acid that is found in proteins?
(a) adenosine
(b) adenine
(c) alanine
(d) linoleic acid
(e) creatine

12 Which of the following factors can affect enzyme activity?
(a) temperature
(b) pH
(c) the presence of certain metal ions
(d) the addition or removal of phosphate
(e) all of the above
13 Prosthetic groups are:
(a) required by all enzymes in the cell
(b) loosely bound to enzymes via hydrogen bonds
(c) sites on the enzyme molecule that permit allosteric modification of enzyme activity
(d) linked to phosphate groups
(e) tightly bound to enzymes and are required for their activity

14 The initial rate of an enzyme catalysed reaction depends on:
(a) the concentration of the enzyme
(b) the concentration of the substrate
(c) the affinity of the enzyme for its substrate
(d) all of the above
(e) none of the above

15 Kinase reactions:
(a) inhibit ATP breakdown
(b) involve the addition or removal of a phosphate group
(c) involve the addition or removal of a ketone group
(d) involve the addition or removal of an amino acid to a polypeptide chain
(e) involve the transfer of hydrogen atoms

16 The energy for all forms of muscle contraction is provided by:
(a) ATP
(b) ADP
(c) phosphocreatine
(d) oxidative phosphorylation
(e) generated in the mitochondria of the cell

17 For very high force contractions lasting 1-2 seconds, the initial energy source is from:
(a) glycolysis
(b) creatine phosphorylation
(c) phosphocreatine stores
(d) ATP stores
(e) none of the above
18  Which of the following statements is false?
(a)  after a resistance training session the rate of protein synthesis in the exercised muscles is increased
(b)  after a resistance training session the rate of protein breakdown in the exercised muscles is increased
(c)  both (a) and (b)
(d)  protein cannot be used as a fuel for exercise
(e)  exercise increases the rate of secretion of growth hormone

19  Which of the following is true?
(a)  increasing the protein intake above 3 grams per kg body mass per day will stimulate muscle growth and increase strength
(b)  creatine supplements can increase muscle strength and power
(c)  amino acid supplements can increase muscle strength and power
(d)  muscle damage is induced by shortening contractions
(e)  there is an inverse relationship between dietary protein intake and total energy intake

CHAPTER 3

1  Anaerobic metabolism refers to the generation of ATP:
(a)  without the involvement of ADP
(b)  without the use of glycogen
(c)  without the use of oxygen
(d)  in the absence of available oxygen
(e)  by the conversion of pyruvate to lactate

2  The most rapid method to resynthesise ATP during exercise is through:
(a)  glycolysis
(b)  phosphocreatine breakdown
(c)  tricarboxylic acid cycle (Krebs’ cycle)
(d)  glycogenolysis
(e)  gluconeogenesis
3. In general, the higher the intensity of exercise, the greater the proportional contribution of:

(a) aerobic energy production  
(b) **anaerobic energy production**  
(c) the TCA cycle (Krebs’ cycle) to the production of ATP  
(d) the electron transfer chain to the production of ATP  
(e) fat oxidation

4. The energy charge of the cell is:

(a) the difference between the charge on the outside and inside of a cell  
(b) generated by the sodium-potassium ATPase  
(c) the overall rate of energy use by the cell  
(d) **the extent to which the total adenine nucleotide pool is phosphorylated**  
(e) the sum of the ATP, ADP and AMP concentrations in the cell

5. The energy released from the breakdown of the high-energy phosphates, ATP and phosphocreatine, can sustain maximal exertion exercise for about:

(a) 1-2 seconds  
(b) **5-10 seconds**  
(c) 30-40 seconds  
(d) 50-60 seconds  
(e) 240 seconds

6. The loss of adenine nucleotides from muscle cells during high intensity exercise results from:

(a) an increase in pH  
(b) the dephosphorylation of ATP to ADP and inorganic phosphate  
(c) the deamination of AMP to IMP and ammonia  
(d) the dephosphorylation of AMP to adenosine  
(e) both (c) and (d)
7 Glycolysis is the name given to the pathway involving the conversion of:
(a) glycogen to glucose-6-phosphate
(b) glycogen or glucose to fructose
(c) glycogen or glucose to pyruvate or lactate
(d) glycogen or glucose to pyruvate or acetyl CoA
(e) glucose or fatty acids to pyruvate or acetyl CoA

8 The conversion of one molecule of glucose to two molecules of pyruvate results in the net formation of:
(a) six molecules of water
(b) two molecules of ATP
(c) three molecules of ATP
(d) thirty-eight molecules of ATP
(e) thirty-nine molecules of ATP

9 The creatine kinase reaction is:
(a) irreversible
(b) slow compared with glycolysis
(c) not activated until all the ATP has been used up
(d) inhibited by low pH in the muscle
(e) not important for sprinting

10 The complete resynthesis of phosphocreatine after very high intensity exercise normally takes:
(a) about 10 seconds
(b) about 30 seconds
(c) about 1 minute
(d) about 4 minutes
(e) more than 10 minutes
CHAPTER 4

1. The enzymes of glycolysis are located in the:
   (a) mitochondrion
   (b) nucleus
   (c) cytoplasm
   (d) lysosomes
   (e) interstitial fluid

2. Glycogen breakdown in exercising muscle is activated by:
   (a) insulin
   (b) cortisol
   (c) increased pH
   (d) amylase
   (e) none of the above

3. If the mean rate of oxygen consumption of a male athlete during a training session is 2 l/min, then his rate of energy expenditure is approximately:
   (a) 400 kJ/min
   (b) 200 kJ/min
   (c) 80 kJ/min
   (d) 40 kJ/min
   (e) 20 kJ/min

4. After what period of time does maximal dynamic exercise become predominantly aerobic?
   (a) 10 seconds
   (b) 30 seconds
   (c) 1 minute
   (d) 4 minutes
   (e) 10 minutes
5 Hydrogen ions are formed when:
(a) glycogen becomes depleted
(b) phosphocreatine breakdown occurs
(c) pyruvate is converted to lactate
(d) pyruvate is converted to acetyl CoA
(e) glycolysis is being used as a major means of resynthesising ATP

6 The net production of ATP via substrate-level phosphorylation in glycolysis is:
(a) 2 from glucose and 3 from glycogen
(b) 2 from glucose and 4 from glycogen
(c) 3 from glucose and 4 from glycogen
(d) 3 from glucose and 2 from glycogen
(c) 3 from glucose and 3 from glycogen

7 The average intensity of exercise (%VO₂max) for an elite middle distance runner during a 1500 m race will be about:
(a) 80%VO₂max
(b) 100%VO₂max
(c) 120% VO₂max
(d) 200%VO₂max
(e) 300%VO₂max

8 Muscle lactate production increases when:
(a) oxygen is readily available
(b) pyruvate cannot be formed from glucose breakdown
(c) the pH of the muscle falls
(d) glycolysis is activated at the onset of exercise
(e) muscle glycogen becomes depleted
9 Which of the following generates free glucose during the enzymatic breakdown of glycogen in skeletal muscle?
(a) phosphorylase
(b) debranching enzyme
(c) α-1-6-amylloglucosidase
(d) amylase
(e) glucose-6-phosphatase

10 Approximately how many kJ of energy are expended if an athlete’s steady-rate oxygen uptake averages 3.0 l/min for 5 minutes of exercise?
(a) 60 kJ
(b) 150 kJ
(c) 300 kJ
(d) 500 kJ
(e) 600 kJ

11 The rate of blood lactate accumulation is determined by:
(a) the rate of muscle lactate production and the rate of muscle lactate efflux
(b) the rate of anaerobic glycolysis
(c) the rate of muscle glucose uptake
(d) the rate of muscle glycogen depletion
(e) the difference between the rate of lactate appearance and the rate of lactate clearance

12 The low intake of carbohydrate in the diet:
(a) does not influence exercise performance in events lasting less than 10 minutes
(b) affects the resting muscle pH
(c) may impair high intensity exercise performance
(d) results in greater reliance on muscle glycogen during exercise
(e) is associated with a metabolic alkalosis
Sodium bicarbonate ingestion improves middle distance running performance by:

(a) elevating the pH and buffering capacity of the extracellular fluid allowing a faster efflux of hydrogen ions from muscle
(b) reducing the pH and buffering capacity of the extracellular fluid allowing a faster efflux of hydrogen ions from muscle
(c) elevating the pH and buffering capacity of the extracellular fluid allowing a faster influx of hydrogen ions into muscle
(d) elevating the pre-exercise muscle pH
(e) inhibiting muscle lactate production

CHAPTER 5

1 Embedded in the inner membrane of the mitochondrion are:
(a) the enzymes of the tricarboxylic acid cycle (Krebs’ cycle)
(b) the components of the electron transport chain
(c) glycogen molecules
(d) triacylglycerol molecules
(e) GLUT4 molecules

2 Glucose enters muscle cells mostly by:
(a) simple diffusion
(b) facilitated diffusion using a specific glucose transporter
(c) co-transport with sodium
(d) co-transport with amino acids
(e) active transport

3 Aerobic resynthesis of ATP occurs:
(a) in the mitochondria in a process called glycogenolysis
(b) in the mitochondria in a process called oxidative phosphorylation
(c) in the cytosol
(d) in the sarcoplasmic reticulum
(e) only in Type I muscle fibres
4 The synthesis of glucose from lactate, glycerol, or amino acids is called:
(a) glycogenolysis
(b) glycolysis
(c) lipolysis
(d) gluconeogenesis
(e) transamination

5 The major source of carbohydrate in a typical Western diet is:
(a) starch
(b) cellulose
(c) glycogen
(d) sucrose
(e) saccharin

6 Liver glycogen breakdown is stimulated by:
(a) insulin
(b) glucagon
(c) adrenaline
(d) both (a) and (b)
(e) both (b) and (c)

7 The process of breaking down triacylglycerol into free fatty acids and glycerol is called:
(a) beta oxidation
(b) lipogenesis
(c) lipolysis
(d) both (a) and (c) are correct
(e) none of the above are correct
8 Most of the free fatty acids are transported in the blood:
(a) inside the red blood cells
(b) as lipoproteins
(c) combined with glucose
(d) **bound to albumin**
(e) bound to antibodies

9 Fatty acids are transported into the mitochondria bound to
(a) thiokinase
(b) coenzyme A (CoA)
(c) acetyl-CoA
(d) **carnitine**
(e) phosphate

10 The β-oxidation of a molecule of palmitic acid, CH₃(CH₂)₁₄CO₂H:
(a) yields 8 molecules of acetyl-CoA and some ATP and water
(b) yields 16 molecules of acetyl-CoA only
(c) yields carbon dioxide and water only
(d) does not involve oxygen
(e) uses more ATP than it generates

11 Which of the following releases most energy when completely oxidised in the body?
(a) one gram of glucose
(b) **one gram of palmitic acid**
(c) one gram of leucine
(d) one gram of alcohol
(e) one gram of protein
12 When branched chain amino acids are deaminated in muscle, the ammonia produced is mostly:
(a) converted into arginine and released from the muscle
(b) converted into alanine and glutamine and released from the muscle
(c) converted into urea and released from the muscle
(d) used to synthesise purines and pyrimidines in the muscle
(e) oxidised to form nitric oxide

13 Which of the following promotes glucose and amino acid uptake by muscle?
(a) adrenaline
(b) insulin
(c) glucagon
(d) cortisol
(e) glycogen

14 During exercise, adrenaline secretion from the adrenal glands is stimulated by:
(a) increased plasma glucose
(b) increased plasma fatty acids
(c) increased plasma ACTH
(d) increased sympathetic nerve activity
(e) negative feedback

15 Within the inner matrix of the mitochondrion are:
(a) the enzymes of the tricarboxylic acid cycle (Krebs’ cycle)
(b) the components of the electron transport chain
(c) glycogen molecules
(d) the enzymes of gluconeogenesis
(e) the enzymes creatine kinase and carnitine acyl transferase 1
16 How many CO₂ and ATP molecules are formed during one complete turn of the tricarboxylic acid cycle (Krebs’ cycle)?
(a) 2CO₂ and 2ATP
(b) 2CO₂ and 16ATP
(c) 2CO₂ and 12ATP
(d) 2CO₂ and 1ATP
(e) 1CO₂ and 5ATP

17 Oxygen is used:
(a) in glycolysis
(b) in the conversion of fatty acids to acetyl CoA
(c) in the tricarboxylic acid cycle (Krebs’ cycle)
(d) in glycogenolysis
(e) in Type I fibres only

18 Which of the following is not a true statement?
(a) muscle glycogen is broken down enzymatically to glucose-1-phosphate
(b) elite endurance runners have a high proportion of Type I fibres in their leg muscles
(c) liver glycogen is important in the maintenance of the blood glucose concentration
(d) insulin promotes glucose uptake by all tissues in the body
(e) glucagon has generally antagonistic actions to those of insulin

19 The oxidative deamination of the amino acid alanine in muscle produces:
(a) one molecule of pyruvic acid and a molecule of ammonia
(b) one molecule of pyruvic acid and a molecule of carbon dioxide
(c) one molecule of pyruvic acid and another amino acid
(d) one molecule of pyruvic acid and a molecule of water
(e) one molecule of pyruvic acid and a molecule of urea
20 Substrate-level phosphorylation differs from oxidative phosphorylation in that:
(a) substrate-level phosphorylation involves the transfer of electrons
(b) substrate-level phosphorylation only occurs in the cytosol
(c) oxidative phosphorylation only occurs in the cytosol
(d) oxidative phosphorylation involves the transfer of electrons
(e) GTP is always involved in substrate-level phosphorylation

21 Which of the following statements is false?
(a) phosphofructokinase is the rate limiting enzyme in glycolysis
(b) phosphorylase activity is higher in Type II fibres than in Type I fibres
(c) endurance training increases the amount of TCA cycle enzymes in muscle
(d) oxygen is consumed in the TCA cycle
(e) the heart can oxidise lactate

22 Pairs of electrons carried in the form, FADH₂ and NADH+H⁺, collectively contain enough free energy to rephosphorylate:
(a) 6 ATP
(b) 5 ATP
(c) 4 ATP
(d) 3 ATP
(e) none of the above are correct

23 How many ATP molecules can be derived from each molecule of acetyl CoA that enters the Krebs’ Cycle?
(a) 6
(b) 12
(c) 18
(d) 38
(e) 39
24 Muscle and liver glycogen stores in a well nourished athlete would be sufficient to sustain approximately how many minutes of submaximal exercise (if this were the only energy source used)? The exercise is club level marathon pace.

(a) 30 minutes
(b) 90 minutes
(c) 180 minutes
(d) 210 minutes
(e) 300 minutes

25 Approximately how much energy is liberated when one gram of carbohydrate is completely oxidised?

(a) 4 kJ
(b) 8 kJ
(c) 16 kJ
(d) 24 kJ
(e) 38 kJ

26 Resting oxygen uptake for a 70 kg person is approximately:

(a) 1.0 l.min^{-1}
(b) 2.5 ml.min^{-1}
(c) 0.25 l.min^{-1}
(d) 45 ml.min^{-1}
(e) none of the above

27 The respiratory exchange ratio (RER) is the ratio of:

(a) volume of oxygen consumed ÷ volume of carbon dioxide produced
(b) volume of carbon dioxide produced ÷ volume of oxygen consumed
(c) volume of oxygen produced ÷ volume of carbon dioxide consumed
(d) volume of oxygen consumed ÷ body mass
(e) volume of oxygen consumed ÷ lung ventilation
28 Which of the following factors stimulate insulin secretion?
   (a) a rise in the blood glucose concentration
   (b) a rise in the blood amino acid concentration
   (c) a rise in the blood adrenaline concentration
   (d) both (a) and (b)
   (e) none of the above

CHAPTER 6

1 The average intensity of exercise during professional soccer play is about:
   (a) 25%VO₂max
   (b) 50%VO₂max
   (c) 75%VO₂max
   (d) 90%VO₂max
   (e) none of the above

2 With an increasing number of sprints the:
   (a) anaerobic contribution progressively increases
   (b) pH of the muscle falls below 6.0
   (c) blood glucose concentration falls below 3 mmol/L
   (d) relative contribution of aerobic metabolism increases
   (e) maximum power generated increases

3 The pyruvate dehydrogenase complex:
   (a) is located in the sarcoplasm
   (b) catalyses the conversion of pyruvate to acetyl CoA
   (c) catalyses the conversion of pyruvate to lactate
   (d) catalyses the conversion of lactate to pyruvate
   (e) uses molecular oxygen to remove a molecule of carbon dioxide from pyruvate
4 Phosphocreatine resynthesis during recovery from exercise is inhibited by:
(a) an excess of creatine
(b) hyperventilation
(c) an excess of oxygen
(d) a lack of oxygen
(e) submaximal muscle contractions

5 The recommended dose of creatine to load the muscles of a 70 kg man within one week is:
(a) 2 g/day
(b) 5 g/day
(c) 10 g/day
(d) 20 g/day
(e) 30 g/day

6 An expected side effect of creatine supplementation is:
(a) muscle weakness
(b) gain in body mass
(c) muscle cramps
(d) loss of electrolytes
(e) all of the above

CHAPTER 7
1 In a double stranded molecule of DNA, the ratio of purines : pyrimidines is:
(a) variable
(b) determined by the base sequence in RNA
(c) genetically determined
(d) always 1:1
(e) determined by the number of purines in the sense strand of the DNA
2 Which of the following nucleotide bases is not found in RNA?
(a) thymine
(b) adenine
(c) uracil
(d) guanine
(e) cytosine

3 Which of the following molecules does not form part of DNA?
(a) purine
(b) pyrimidine
(c) deoxyribose
(d) amino acid
(e) phosphate

4 The transcription of DNA to a molecule of messenger RNA occurs:
(a) on the ribosomes
(b) in the cytosol
(c) in the nucleus
(d) only during cell division
(e) when amino acids are made available by transfer RNA

5 The process of translation requires the presence of:
(a) mRNA, tRNA and ribosomes
(b) mRNA, ribosomes and RNA polymerase
(c) DNA, mRNA and RNA polymerase
(d) chromatin, DNA and amino acids
(e) free nucleotide bases, amino acids and ribosomes

6 Codons are composed of:
(a) triplet sequences of nucleotide bases in mRNA
(b) triplet sequences of nucleotide bases in DNA
(c) triplet sequences of amino acids in polypeptide chains
(d) triplet sequences of deoxyribose sugars in DNA
(e) none of the above
7 The mode of action of a steroid hormone involves:
(a) binding to a cell membrane receptor
(b) activation of protein kinases
(c) binding to calmodulin
(d) covalent modification of enzyme activity
(e) modifying gene transcription

8 Mutations are errors in DNA that:
(a) are always harmful
(b) only occur in the presence of carcinogens
(c) increase tumour growth
(d) occur spontaneously at a low rate
(e) only occur on the X chromosome

9 The sex of a child is dictated by the inheritance of:
(a) the number of X chromosomes from the mother
(b) a recessive allele on the X chromosome
(c) a single Y chromosome from the mother
(d) a single Y chromosome from the father
(e) Y chromosomes from the mother and father

CHAPTER 8
1 The capacity of the aerobically trained muscle to use fatty acids as a fuel results in:
(a) reduction in lactic acid formation
(b) sparing of muscle glycogen
(c) sparing of blood glucose
(d) all of the above (a - c) are correct
(e) none of the above (a-c) are correct
2  Training for strength or power has little effect on:
(a) muscle mass
(b) muscle strength
(c) anaerobic capacity
(d) aerobic capacity
(e) muscle buffering capacity

3  Training for endurance has little effect on:
(a) muscle mass
(b) muscle triacylglycerol and glycogen content
(c) mitochondrial content of muscle
(d) aerobic capacity
(e) capillary density of muscle

4  Cardiovascular adaptations to endurance training include:
(a) increased maximal cardiac output
(b) lower resting heart rate
(c) increased blood volume
(d) (a), (b) and (c)
(e) (a) and (b) only

5  Which of the following cannot be considered as a metabolic adaptation to endurance training:
(a) increased maximal oxygen uptake
(b) increased antioxidant capacity
(c) increased maximal rate of fat oxidation
(d) increased adrenaline response to exercise
(e) lower RER during submaximal exercise
6 Prolonged exercise impairs immune cell function due to:
   (a) inhibitory effects of elevated stress hormones such as cortisol
   (b) a reduction in the number of circulating white blood cells during exercise
   (c) the removal of all the available glutamine from the circulation during exercise
   (d) the elevated body temperature promoting bacterial growth
   (e) all of the above

7 Which of the following immune functions would **not** be performed by a neutrophil?
   (a) antibody production
   (b) chemotaxis
   (c) phagocytosis
   (d) degranulation
   (e) respiratory burst

8 During prolonged exercise increased amounts of interleukin-6 are released from:
   (a) macrophages and cause suppression of other immune cell functions
   (b) lymphocytes and inhibit macrophage function
   (c) all muscles in the body and influence carbohydrate metabolism
   (d) exercising muscle and influence carbohydrate and fat metabolism
   (e) exercising muscle and promote glycogen breakdown in other muscles

9 Which amino acid is very important for optimal immune function and exhibits a reduced plasma concentration during heavy training?
   (a) glycine
   (b) glutamine
   (c) phenylalanine
   (d) isoleucine
   (e) leucine
10 Which of the following is not a dietary antioxidant?
(a) vitamin C
(b) lipoic acid
(c) vitamin K
(d) beta-carotene
(e) vitamin E

11 The main source of increased free radical production during exercise is thought to be from:
(a) electron leak from the sarcolemma
(b) electron leak from the mitochondrial respiratory chain
(c) electron leak from the sarcoplasmic reticulum
(d) release of reactive oxygen species from haemoglobin and myoglobin
(e) production of reactive oxygen species by activated lymphocytes
# MCQ ANSWER SHEET

## CHAPTER 1

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CHAPTER 4

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4  c
5  e
6  a
7  c
8  d
9  c
10 c
11 e
12 c
13 a

CHAPTER 5

1  b
2  b
3  b
4  d
5  a
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 6 | e |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 7 | c |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 8 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 9 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|10 | a |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|11 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|12 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|13 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|14 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|15 | a |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|16 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|17 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|18 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|19 | a |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|20 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|21 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|22 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|23 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|24 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|25 | c |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|26 | c |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|27 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|28 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

**CHAPTER 6**

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1 | c |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 2 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 3 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 4 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5 | d |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 6 | b |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

28
CHAPTER 7
1  d
2  a
3  d
4  c
5  a
6  a
7  e
8  d
9  d

CHAPTER 8
1  d
2  d
3  a
4  d
5  d
6  a
7  a
8  d
9  b
10 c
11 b