M12/4/SPEXS/SP3/ENG/TZ0/XX/M

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MARKSCHEME

May 2012

SPORTS, EXERCISE AND HEALTH SCIENCE

Standard Level

Paper 3

16 pages

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) by e-mail (or telephone) – if by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader by e-mail at any time if they have any problems/queries during the marking process.

Note:
The DHL courier service must be used to send assessment material to your team leader/senior moderator and to IB Cardiff. (However, this service is not available in every country.) The cost is met directly by the IB. It is vitally important that the correct DHL account number is used.

If you have any queries on **administration** please contact:

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the precise point where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded**.

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.

4. Unexplained symbols or personal codes/notations are unacceptable.

5. Record marks in the right-hand margin against each mark allocation shown in square brackets *e.g.* ***[2]***. The total mark for a question must equal the number of ticks for the question.

6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question**.

7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.

8. Where work is submitted on additional sheets the marks awarded should be shown as ticks and a note made on both the additional sheet and in the right-hand margin of the corresponding question part in the body of the script.

9. For each Option: Add the totals for each question in the Option and write it in the Examiner column on the cover sheet.
Total: Add the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.

10. After entering the marks on the cover sheet check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**

11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.

12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **even if the candidate has indicated the question(s) to be marked on the cover sheet**.

13. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect in the left-hand margin.

Subject Details: Sports, Exercise and Health Science SL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **TWO** of the Options **[2 × 20 marks]**.
Maximum total = **[40 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

Option A — Optimizing physiological performance

A1. (a) continuous (training) ***[1]***

(b) power changes are greatest when both dynamic repetitions of concentric (CON) and eccentric (ECC) movements are used;
loading (Rep Max/RM) and volume is 1–3 low / heavy loads are used if the goal is power, 1–3 RM / if the goal is maximum strength, 3–8 RM;
initiate movements from large and stable muscle groups first moving to smaller muscle groups maximizes the total resistance lifted;
executing large muscle mass exercises prior to small muscle mass exercises maximizes the total resistance lifted during the exercise bout / multi-joint large to small;
when prescribing rest periods, if the resistance exercise programme is designed for power then 5–8 minutes between sets is necessary;
explosive, high velocity repetitions;
target specific muscle groups relative to the sport; ***[2 max]***

(c) (i) transition phase is a period of allowing the body to recover from the type of impacts and training experienced in the athletes' competitive training phase;
minimal high intensity work / intensity of training is substantially reduced;
active rest / there are more rest days;
progression of exercise is not a priority;
limited volume; ***[2 max]***

(ii) cross training activities are to be encouraged for this athlete to give their joints a rest / *e.g.* swimming/kayaking/rowing/cycling where the impacts are low but the body is working aerobically; ***[1]***

(d) *overtraining:* ***[2 max]***
is when an athlete attempts to do more training than he/she is able to physically and/or mentally tolerate;
overtraining results in a number of symptoms that are highly individualized such as changes to resting heart rate/chronic muscle soreness/stiffness in muscles and joints/reduced immune function/frequent upper respiratory tract infections (coughs and colds)/sleep disturbance/high fatigue ratings/disturbed mood states (general fatigue/apathy/depression/irritability/loss of competitive drive)/decreased appetite/gastrointestinal disturbance/weight loss;
sudden and unexplained and persistent decrease in performance;
prolonged recovery from typical training/competitive events / with overtraining recovery can take months/years in some cases;

over-reaching: ***[2 max]***
generally results from excessive and protracted overload with inadequate recovery and rest / overreaching is transient overtraining / over-reaching is a systematic attempt to intentionally overstress the body, allowing the body to adapt to the training stimulus beyond the level of adaptation attained during acute overload;
athletes may experience some similar symptoms *e.g.* delayed onset muscle soreness (DOMS)/fatigue;
a possible short term reduction in performance;
the period of full recovery usually takes several days to several weeks; ***[4 max]***

A2. evaporation of sweat is the primary avenue for heat dissipation during exercise;
evaporation can account for about 80 % of total heat loss during physical activity / at rest evaporation accounts for about 10 % to 20 % of body heat loss;
water vaporizing from the body transfers heat to the environment / each litre of water that vaporizes extracts approximately 580 kcal (approximately 680 W/2428 kJ of heat) from the body and transfers it to the environment / evaporation of sweat from the body exerts a cooling effect / cooled skin cools the blood diverted from interior tissues to the surface;
when ambient temperature exceeds body temperature, sweat evaporates readily from the skin and from the respiratory tract;
generally, increases in ambient temperature induce proportionate increases in sweating rate;
three factors influence the total amount of sweat vaporized from the skin and/or pulmonary surfaces – surfaces exposed to the environment, temperature and relative humidity of the ambient air/convective air currents about the body;
relative humidity is the most important factor determining the effectiveness of evaporative heat loss;
sweat *per se* does not cool the body (skin), evaporation cools the body (skin) / sweat must evaporate for any heat loss to occur / non-evaporated sweat contributes nothing to body cooling / sweat that drips off the skin provides little/no cooling;
sweating begins within several seconds of the start of exercise and will eventually reach equilibrium in direct relation to the exercise load;
as body core temperature increases, sweat production increases;
while cooling of the body (skin) occurs as sweat evaporates from wet clothing surfaces, the cooling power is less than for evaporation directly from the body (skin) to air;
the heat energy needed to evaporate the water comes from the body; ***[3 max]***

A3. (a) *mechanical aids*:
e.g. nasal strips;
e.g. parachutes;

pharmacological:
e.g. caffeine;
e.g. protein supplements;

physiological aids:
e.g. sports massage;
e.g. sauna;

nutritional aids:
e.g. carbohydrate loading;
e.g. sports drinks;

psychological aids:
e.g. counselling;
e.g. relaxation; ***[1 max]***

Refer to World Anti-Doping agency 2010 prohibited list.
*Award **[1]** for two examples.*

(b) a way/method of controlling threats to internal validity (during research) / *OWTTE*;
a placebo is used to evaluate whether the observed effect is produced by the treatment or is a psychological effect / *OWTTE* / the placebo effect is the measurable, observable, or felt improvement in health/performance not attributable to an actual treatment;
a control condition in which participants receive the same attention from and interaction with the experimenter, but the treatment administered does not relate to performance on the dependent variable / *OWTTE*;
internal validity refers to the extent to which the results can be attributed to the treatments/trials used in the study / *OWTTE*; ***[2 max]***

(c) stimulates red blood cell production/volume / regulates red blood cell production by stimulating bone marrow cells / is the primary regulator of red blood cell formation / increases hemoglobin concentration/hematocrit;
important hormone in our adaptation to training;
improved oxygen carrying capacity;
improved VO_2 /enhanced aerobic capacity / removes carbon dioxide from tissues;
improved performance in endurance races/increased endurance capacity;
use of EPO as an ergogenic aid can be detrimental to an athlete's health by stressing the cardiovascular system / increased viscosity of the blood due to elevated red blood cell count; ***[4 max]***

Option B — Psychology of sport

B1. (a) inverted-U hypothesis/theory ***[1]***

(b) the two curves show different levels of optimal arousal for performance;
the curves represent a person's different abilities within different sporting events;
the curves represent the difficulty/nature of a task;
curve X is a task that requires a comparatively low level of arousal for an optimal performance;
curve X, the task may be complex requiring a high degree of precision;
curve X, the person may find the task difficult;
curve Y is a task that requires a higher level of arousal for an optimum performance for this person;
curve Y, the reasons could be that the person is extremely proficient and in order for the task to be optimized it needs to be a bit stressful; ***[4 max]***

(c) a (volleyball) player's interpretation of arousal is central to explaining and predicting the effect of emotions on performance;

optimal arousal theory (Hebb, 1955):
boredom would be a state of under arousal;
with boredom, the player would have a low heart rate and level of excitement/stress;
with boredom, their performance may be not to the standard that they can actually perform to (*e.g.* they may not try so hard to ensure the ball is kept alive);
an excited player will be closer to the optimal level of arousal;
an excited player will have a slightly elevated heart rate and good cognitive engagement;
an excited player will be closer to optimal performance (*e.g.* they will be trying to serve well and save any loose balls);

reversal theory (Kerr, 1985):
excitement is likely to be associated with high arousal;
excitement can be pleasant and it makes the player want to engage with the activity/try hard/invest effort;
excitement can lead to positive performance/tactical/skill execution in volleyball;
boredom is likely to be associated with low arousal, but it is unpleasant and therefore players will lack motivation/cease the desire to participate;
players who are bored do not see any value in playing/tactical/skill execution in volleyball; ***[4 max]***

B2. (a) "those relatively stable and enduring aspects of individuals which distinguish them from other people, making them unique but at the same time permit a comparison between individuals" (Gross, 1992); ***[1]***

(b) demonstration is a powerful teaching tool in skill acquisition/learning sport;
athletes/performers are involved in observational learning when they copy the sports coach's demonstration;
social learning theory states that skilled behaviour is learned through observation of demonstrations;

there are four processes in observational learning:
attention – sports coaches use social learning theory when they demand that players attend to instructions/provide cues about how best to perform;
retention – the process of remembering the demonstrated behaviour cues / good coaches help this process by repetition/making learning interesting/encouraging mental imaging of a skill;
motor reproduction – the attempt by the performer of the demonstrated skill / it is important that the coach demonstrates correctly / it is important that the learner has the physical ability to do the task;
motivation – performers tend to imitate when they are interested in a task and have been motivated to achieve / good sports coaches understand what motivates their players and use this as an important coaching tool / good sport coaches use reinforcement to enhance motivation; ***[4 max]***

B3. stress is defined as a substantial imbalance between the demand (physical/psychological) and response capability, under conditions where failure to meet that demand has important consequences;
causes of stress (environmental demand);
stress response (persons reactions);
stress experience (psychological interpretation);
actual behaviour (outcome); ***[3 max]***

B4. extrinsic rewards seen as controlling of behaviour;
extrinsic rewards provide information about the level of performance;
extrinsic rewards will enhance intrinsic motivation when the reward provides positive information with regard to the performer level of competence;
intrinsic motivation arises when an activity is pursued for its own sake/for the pride and satisfaction that is achieved/regardless of what anyone else thinks of one's efforts;
intrinsic motivation derives directly from participating in the activity/is self perpetuating;
extrinsic motivation stems from other people, through positive and negative reinforcement/from tangible rewards (*e.g.* trophies/badges/payment/award schemes); ***[3 max]***

Option C — Physical activity and health

C1. (a) hardening/thickening of the walls of arteries / narrowing of these vessels;
mechanisms responsible are incompletely understood / the disease begins with an injury to the lining of an artery;
when blood flow is restricted by around 45 % symptoms develop/tissues supplied by the artery become ischemic/the disease process begins to limit normal function; ***[1 max]***

(b) Brunei Darussalam ***[1]***

(c) 395 approximately (accept ± 3) ***[1]***

(d) *modifiable risk factors*:
poor diet resulting in dyslipidaemia/elevated total cholesterol/LDL cholesterol concentrations/depressed HDL cholesterol concentrations/elevated triglyceride concentrations/high saturated fat and trans fat intake/high salt consumption causing hypertension;
cigarette smoking;
obesity (particularly central/abdominal obesity) from poor caloric intake and energy expenditure management;
low levels of physical activity in the population;

non-modifiable risk factors:
family history/first degree relatives (parents/siblings/offspring) with premature atherosclerotic disease;
age – higher risk in older individuals;
gender – higher risk in males than females;
ethnic background/higher risk in South Asians (may be due to higher prevalence of diabetes in this group); ***[4 max]***

C2. (a) loss of vision / retinopathy / blindness;
kidney disease / nephropathy;
nerve/peripheral nervous system damage / neuropathy;
cardiovascular disease / heart and coronary circulation problems / coronary heart disease;
cerebrovascular disease / brain and cerebral circulation problems;
peripheral vascular disease / lower limb vascular problems;
diabetic foot (ulceration / amputation) / foot disease/fractures; ***[3 max]***

(b) *type 1* ***[2 max]****:*
an autoimmune disorder resulting in the destruction of the insulin producing cells of the pancreas/pancreatic beta cells;
the pancreas is not able to produce insulin;
insulin must be injected regularly to control blood glucose concentration (insulin cannot be given orally because gastrointestinal enzymes would digest it);
treated with insulin;
usually manifests in young people/before adulthood;

type 2 ***[2 max]****:*
a disease of insulin resistance (particularly in skeletal muscle);
the capacity of the pancreas to secrete insulin is impaired (although some secretion is maintained);
usually occurs in overweight/obese adults (aged 40 years and over);
can occur in children;
is the most common form of diabetes (accounting for 85 % – 95 % of all diabetes in developed countries);
treated with diet and exercise / oral medication / insulin; ***[4 max]***

Past terms for these disorders include insulin dependent and non-insulin-dependent diabetes (IDDM and NIDDM), which are no longer used.

C3. females have a lower bone density than their male peers;
females lose their bone mass more quickly as they age compared to males;
estrogen plays a role in keeping bones strong/healthy;
while premenopausal females have more estrogen than male peers, they will experience dramatic drops in estrogen production due to menopause;
females are at increased osteoporosis risk related to estrogen levels if they experience irregular/infrequent periods/begin their periods at a later than normal age/have had their ovaries removed/are going through menopause/are going through menopause at an early age;
athletic amenorrhea/female triad;
an inadequate intake of calcium throughout life/history of eating disorders;
an inactive lifestyle puts females at a higher risk;
females who smoke/drink alcohol have a higher incidence of osteoporosis; ***[2 max]***

C4. *Candidates should discuss any two of the barriers below.*

uncontrolled disease state (e.g. unstable angina/poorly controlled diabetes/uncontrolled hypertension): ***[2 max]***
making it risky for a person to exercise / the raising of their heart rate due to exercise may over stress the heart and body systems, especially exercise that is at a high intensity (maximal)/involves static contractions;
a person should be looking to manage these conditions with medication if appropriate, good diet and regular sub maximal low intensity exercise;

hazards of exercise (e.g. cycling accidents/environmental conditions): ***[2 max]***
may affect a person psychologically especially if they have had a previous bad experience / an accident may have injured a person so that they are unable to exercise / a gradual approach to building up confidence and fitness works best;
therapy needs to be applied in order to manage the healing process;
the environmental conditions may make it too hazardous or impractical to actually do some forms of exercise (*e.g.* extreme cold/heat / lack of space / pollution);

muscular skeletal injuries:
may affect a person so that they are unable to exercise due to restricted movement/pain;
appropriate therapy (often involves cast setting that maximises the recovery process together with the prescription of a variety of appropriate exercises) can be applied to manage this process;

triggering of other health issues (e.g. heart attack/respiratory tract infections): ***[2 max]***
this is where the stress of the exercise is too much for our systems and they cannot cope/it may also be that we overdo the volume of exercise;
people must be mindful of this when embarking on exercise programmes especially when they have been sedentary for a period;
completing a questionnaire (PAR-Q) and visiting a doctor for a check up before starting is a recommendation in order to minimize these factors arising; ***[4 max]***

Accept responses that consist of a valid example and discussion.
*Award **[1]** for listing (no discussion) of two issues/examples.*

Option D — Nutrition for sport, exercise and health

D1. (a) 0.8 accuracy score improvement / *OWTTE* ***[1]***

(b) a trained person will have a greater water content in their body both intra and extracellularly;
a trained and fit person has improved temperature regulatory processes (lower sweat response, greater sweat produced, enlarged sweat glands, and an increase in total blood volume);
fat tissue has a low water content (5 %) as opposed to lean tissue (muscle, organs 75 %);
an untrained person will have less lean muscle mass;
and possibly a greater percentage of body fat;
an untrained person will have less blood plasma volume;
and a reduced sweat response; ***[4 max]***

(c) monitor urine volume;
plasma osmolarity / osmolality;
specific gravity;
urine colour;
variation in body mass / monitor body weight stability; ***[3 max]***

(d) water intake helps maintain hydration/avoid dehydration;
water intake helps maintain plasma volume;
reduction in body water during prolonged exercise may lead to a decline in athletic performance;
reduction in body water during prolonged exercise may lead to serious medical problems (*e.g.* heat exhaustion / heat stroke);
water loss during prolonged exercise may evoke stress on the cardiovascular system;
water loss during prolonged exercise may result in inadequate heat transfer to the skin and environment;
water loss during prolonged exercise is associated with increased plasma osmolality;
water loss during prolonged exercise is associated with decreased plasma volume;
water loss during prolonged exercise may affect the intracellular and extracellular electrolyte balance; ***[3 max]***

D2. a balanced/recommended dietary approach;
diet pills;
fad/crash diets;
high protein diets aiming to increase muscle mass; ***[2 max]***

D3. amino acids cross the brush-border membrane of the intestinal cells;
pass through the cytosol of the absorptive cell;
cross the basolateral membrane;
then enter into the capillary network that surrounds the intestine; ***[2 max]***

D4. (a) Type I: low glycogen content
Type IIb: high glycogen content ***[1]***
*Both required to award **[1]**.*

(b) *classic/traditional method:*
3–4 day depletion phase of hard training and low carbohydrate intake;
followed by a 3–4 day loading phase of high carbohydrate and exercise taper;
reduce the muscles' glycogen content with prolonged steady state of exercise about 6/7 days before competition;
glycogen super compensation occurs only in the specific muscles depleted by exercise, therefore athletes must engage the muscles activated in their sport;
the traditional method of increasing muscle and liver glycogen stores after prolonged exercise to exhaustion is to eat a diet low in carbohydrate for the first three days of recovery and then switch to a high carbohydrate diet for the next three days;
depriving the muscle of carbohydrate has the effect of increasing the activity of glycogen synthase (responsible for glycogen synthesis);
glycogen synthase activity is "boosted" during the days of eating a low carbohydrate diet, hence a high carbohydrate diet for the three days before the competition/event results in increased muscle glycogen storage;
although the traditional method of carbohydrate loading is effective, athletes generally find that even light training during the low carbohydrate phase is unpleasant and so alternative ways of restocking glycogen stores have been developed;

taper method:
supercompensate glycogen stores without a severe depletion or glycogen "stripping" phase;
three days of high carbohydrate intake and taper;
a more practical competition preparation that avoids the fatigue and complexity of the extreme diet and training requirements of the first 3–4 days of the "traditional" method;
the taper method involves the athletes tapering/reducing their training intensity and volume during the week leading up to competition;
the taper method involves increasing the carbohydrate content of the athlete's diet during the last 3–4 days before the event/time trial;
the high carbohydrate diet periods should also contain adequate daily protein, minerals, and vitamins and abundant water;
optimal refuelling can be achieved within 36–48 h following the last exercise session when the athlete rests and consumes adequate carbohydrate;

marathon runners should maximize carbohydrate availability before, during and after training sessions/competition to enhance the training adaptation response / most evidence strongly supports the notion that carbohydrate feeding is ergogenic during training/athletic events lasting 1 hour, which has led sports nutrition organizations to recommend consuming 30 to 60 g carbohydrate per hour to help optimize performance;
carbohydrate loading is less effective when competitions are over multiple days; ***[4 max]***