S5 Physical Education Practice Paper: Fitness Testing, Energy Systems and Training Intensity, Biomechanics, Sports Nutrition and Hydration, Skill Learning, Injury Care and Sports Ethics (100 marks)

Level: S5 | Subject: Physical Education | 75 minutes | 100 marks | 24 questions | answer key

Part 1 Fitness Testing and Body Composition (16 marks)

Show all formulae, substitutions and calculation steps.

#	Question	Answer	Marks
1	A S5 boy is 1.70 m tall and weighs 65 kg. Calculate his BMI to 1 decimal place and classify it using Asian adult cut-offs.	BMI = 65 / 1.70^2 = 65 / 2.89 = 22.5. The Asian cut-offs are normal 18.5-22.9 and overweight 23-24.9, so 22.5 is normal but close to the overweight boundary.	4
2	A girl weighs 60 kg and her skinfold estimate gives 13.5 kg of fat mass. Calculate her body fat percentage to 1 decimal place and state the healthy range for women.	Body fat = 13.5 / 60 x 100 = 22.5%. The healthy range for women is about 20-28% (athletes may be as low as 15%), so 22.5% is healthy.	4
3	A man has an 84 cm waist and a 96 cm hip. Calculate his waist-to-hip ratio to 2 decimal places and decide whether he is at high risk of central obesity (male cut-off 0.90).	Waist-to-hip ratio = 84 / 96 = 0.875, i.e. 0.88. As 0.88 is below 0.90 he is not in the high-risk band, but the margin is only 0.02, so waist measurement should be monitored.	4
4	A woman is 1.62 m tall and weighs 72 kg. Calculate her current BMI to 1 decimal place, then find the body mass that gives a BMI of 22.0 and the mass she must lose (1 decimal place each).	BMI = 72 / 1.62^2 = 72 / 2.6244 = 27.4, which is obese on Asian cut-offs. Target mass = 22.0 x 2.6244 = 57.7 kg, so she must lose 72 - 57.7 = 14.3 kg.	4

Part 2 Energy Systems and Training Intensity (16 marks)

State the formula and the unit for every heart-rate and energy answer.

#	Question	Answer	Marks
5	A 30-year-old athlete has a resting heart rate of 60 bpm and an estimated maximum of 220 minus age. Use the Karvonen formula to find the target heart rate at 70% intensity (whole number).	HRmax = 220 - 30 = 190; reserve = 190 - 60 = 130; target = 60 + 0.70 x 130 = 151 bpm.	4
6	The same athlete uses the percentage-of-maximum method at 80% intensity. Find the target heart rate (whole number) and explain why the two methods differ.	Target = 190 x 0.80 = 152 bpm. The percentage method ignores resting heart rate, so at high intensity the two are close (152 versus 151) while the gap widens at light intensity.	4
7	An athlete has a relative VO2max of 45 mL/kg/min and a body mass of 60 kg. Find the absolute VO2max in litres per minute to 1 decimal place.	Absolute VO2max = 45 x 60 = 2700 mL/min = 2.7 L/min.	4

8	A 60 kg person runs for 30 minutes at 8 METs. Using kcal = MET x 3.5 x body mass (kg) / 200 x minutes, find the total energy cost (whole number).	Energy per minute = 8 x 3.5 x 60 / 200 = 8.4 kcal; total = 8.4 x 30 = 252 kcal.	4

Part 3 Sports Biomechanics (17 marks)

Give units and direction for all torque, mechanical advantage and projectile answers.

#	Question	Answer	Marks
9	An athlete applies 200 N at a perpendicular distance of 0.35 m from a joint axis. Find the torque in N m and state one way to increase torque without increasing the force.	Torque = 200 x 0.35 = 70 N m. Since torque = force x moment arm, lengthening the moment arm (a longer racket, a more extended limb) raises torque for the same force.	5
10	The calf muscles pull on the heel through the Achilles tendon with an effort arm of 0.05 m and a load arm of 0.15 m. Find the mechanical advantage to 2 decimal places and state the lever class and its trade-off.	Mechanical advantage = effort arm / load arm = 0.05 / 0.15 = 0.33. This is a second-class lever with the load between fulcrum and effort; an MA below 1 means more force but more speed and range, which suits running and jumping.	4
11	A ball is kicked at 12 m/s at 45 degrees to the horizontal (ignore air resistance, g = 9.81 m/s^2). Find the horizontal and vertical components, the flight time and the range (time and range to 1 decimal place).	Horizontal = vertical component = 12 x sin45 = 8.5 m/s; flight time = 2 x 8.5 / 9.81 = 1.7 s; range = 8.5 x 1.7 = 14.7 m.	4
12	A 70 kg athlete pushes on the ground with 2,100 N during a jump. Find the body weight, the net force and the upward acceleration (net force and acceleration to 1 decimal place, g = 9.81 m/s^2).	Weight = 70 x 9.81 = 686.7 N; ground reaction force = 2100 N; net force = 2100 - 686.7 = 1413.3 N; acceleration = 1413.3 / 70 = 20.2 m/s^2 upwards.	4

Part 4 Sports Nutrition and Hydration (17 marks)

Use 4 kcal per gram for carbohydrate and protein in all energy calculations.

#	Question	Answer	Marks
13	An athlete has a BMR of 1,600 kcal and a physical activity level of 1.7. Find the daily total energy expenditure, then the grams of carbohydrate needed if carbohydrate supplies 60% of that energy.	Total expenditure = 1,600 x 1.7 = 2720 kcal; carbohydrate energy = 2720 x 0.60 = 1632 kcal; carbohydrate = 1632 / 4 = 408 g.	5
14	An endurance athlete weighing 65 kg takes 1.6 g of protein per kilogram of body mass. Find the daily protein intake in grams and the energy it supplies in kcal.	Protein = 1.6 x 65 = 104 g; energy = 104 x 4 = 416 kcal, about 15.3% of a 2,720 kcal daily total.	4
15	Body mass falls by 1.2 kg during a session. Replacing 1.5 L of fluid per kilogram lost, find the recommended replacement volume in litres to 1 decimal place and how it should be taken.	Replacement = 1.2 x 1.5 = 1.8 L, drunk in small volumes of 150-250 mL over the next 2-4 hours, with some sodium included.	4
16	An athlete loses 1.2 L of sweat over a 2-hour session with a sweat sodium concentration of 800 mg/L. Find the total sodium loss in mg and suggest one way to replace it.	Sodium loss = 800 x 1.2 = 960 mg. Replace it with an electrolyte drink or with salted foods such as soup and salted yoghurt at the next meal.	4

Part 5 Skill Learning and Sports Psychology (17 marks)

Show your working; use RT = a + b x log2(n) for reaction-time items.

#	Question	Answer	Marks
17	A player has a simple reaction time of 200 ms and needs 150 ms more per additional choice (Hick law). Find the choice reaction time for 4 possible responses, in ms.	log2(4) = 2, so choice reaction time = 200 + 150 x 2 = 500 ms. More choices mean slower decisions, so players should reduce unnecessary options.	5
18	A coach splits 60 minutes of technical practice into 4 equal blocks with 5 minutes of rest between blocks. Find the length of each block and the total session time, and name the practice distribution used.	Each block = 60 / 4 = 15 min; rest = 3 x 5 = 15 min; total session = 60 + 15 = 75 min. This is distributed practice, which suits beginners.	4
19	An athlete currently completes 76 repetitions per set and sets a target of 100. Find the increase needed and the percentage improvement to 1 decimal place, and name the type of goal set.	Increase = 100 - 76 = 24 reps; improvement = 24 / 76 x 100 = 31.6%. This is a specific, measurable performance goal, which works better than a vague aim.	4
20	A student improves from 40 to 52 skips in 30 seconds over three weeks. Find the gain in repetitions and the percentage improvement to 1 decimal place, and give one likely cause.	Gain = 52 - 40 = 12 skips; improvement = 12 / 40 x 100 = 30.0%. Likely causes are better neuromuscular coordination, a more economical action and greater confidence, which is typical of early learning.	4

Part 6 Injury Care, First Aid and Sports Ethics (17 marks)

Give numerical values with units for all first-aid doses and timings.

#	Question	Answer	Marks
21	A player sprains an ankle and RICE is applied. If ice is applied for 20 minutes every 2 hours, find the maximum number of ice applications in 24 hours and state what each letter of RICE stands for.	Applications = 24 / 2 = 12. R = rest, I = ice, C = compression bandaging, E = elevation of the injured limb above heart level.	5
22	Adult CPR is performed at 30:2 with compressions at 110 per minute. Find the number of complete cycles in 2 minutes to 1 decimal place and the number of compressions actually delivered.	30 compressions take 30 / 110 x 60 = 16.4 s, plus about 5 s for 2 breaths, giving 21.4 s per cycle; 120 / 21.4 = 5.6 cycles, i.e. 5 complete cycles with 150 compressions and 10 breaths.	4
23	A player complains of headache and confusion after a blow to the head. State three principles of immediate concussion management and explain why immediate return to play is not allowed.	Three principles: remove the player from play at once, have a qualified medical officer assess with SCAT5, and monitor symptoms for 24 hours. A second impact can cause brain swelling, so a graded return-to-play protocol is mandatory.	4
24	An athlete using EPO sees haematocrit rise from 44% to 52%. Find the rise in percentage points and explain why this is both unfair and dangerous.	Rise = 52 - 44 = 8 percentage points, above the usual male limit of 50%. Thicker blood raises cardiac workload and the risk of thrombosis and stroke, and the advantage comes from the drug rather than training, breaching fair play and the World Anti-Doping Code.	4

TutorZone - original practice paper. Time allowed: 75 minutes. Total: 100 marks.