S5 Physical Education Practice Paper: fitness assessment, energy systems, training principles and periodisation, biomechanics, sports psychology, injury and policy (100 marks)

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

Section A: Fitness and Health Assessment (18 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
1	An athlete weighs 68.4 kg and is 1.72 m tall. (a) Calculate the BMI (1 d.p.). (b) State the adult classification. (c) Explain one limitation of BMI for a highly muscular athlete.	(a) BMI = 68.4 / 1.72^2 = 23.1. (b) 18.5-24.9, normal weight. (c) Muscle is denser than fat, so BMI overestimates body fat and cannot separate fat mass from lean mass.	5
2	A 22-year-old student has a resting heart rate of 58 bpm. Using the Tanaka formula (HRmax = 208 - 0.7 x age) and the Karvonen method, find the target heart rate at 75% intensity (nearest integer).	HRmax = 208 - 0.7 x 22 = 192.6; target = 58 + 0.75 x (192.6 - 58) = 158.9, i.e. about 159 bpm.	5
3	A player squats 62.5 kg for 6 repetitions. Estimate the 1RM using the Epley formula (1RM = load x (1 + reps/30)).	1RM = 62.5 x (1 + 6/30) = 62.5 x 1.2 = 75.0 kg.	4
4	A student covers 2,650 m in the 12-minute run. Estimate VO2max using the Cooper formula (VO2max = (distance - 504.9)/44.73), in ml/kg/min to 1 d.p.	VO2max = (2,650 - 504.9)/44.73 = 48.0 ml/kg/min.	4

Section B: Energy Systems and Metabolism (16 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
5	Compare the ATP-PCr, lactic and aerobic systems: (a) state the net ATP yield per molecule of glucose (or phosphocreatine); (b) identify the dominant system for a 400 m sprint.	(a) ATP-PCr: 1 ATP per phosphocreatine; lactic: 2 ATP net per glucose; aerobic: 38 ATP net per glucose. (b) A 400 m sprint lasts about 50-60 s, so the lactic system dominates with the ATP-PCr system for the start.	4
6	A 55 kg student runs up stairs of height 3.2 m in 4.5 s (g = 9.81 m/s^2). (a) Find the work done (J). (b) Find the average power (W).	(a) W = mgh = 55 x 9.81 x 3.2 = 1726.6 J. (b) P = 1726.6/4.5 = 383.7 W, about 384 W.	4
7	A 65 kg student exercises at 9 METs for 40 minutes. Using kcal/min = MET x 3.5 x body mass/200, find the total energy expenditure (kcal, integer).	Per minute = 9 x 3.5 x 65/200 = 10.24 kcal; over 40 minutes = 409.5 kcal, about 410 kcal.	4
8	A 10 km run burns 700 kcal, of which 60% comes from fat (1 g fat = 9 kcal). Find the fat oxidised (g, 1 d.p.) and explain why low-intensity prolonged exercise favours fat oxidation.	Fat energy = 700 x 0.6 = 420 kcal; fat mass = 420/9 = 46.7 g. At low intensity the proportion of energy from fat is higher and exercise can last longer, so total fat oxidation is greater.	4

Section C: Training Principles and Programme Design (18 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
9	A trainee improves the squat 1RM from 80 kg to 86 kg. (a) Find the percentage improvement (1 d.p.). (b) Explain the link between progressive overload and reversibility.	(a) Improvement = (86 - 80)/80 x 100% = 7.5%. (b) The body adapts only to loads above the habitual level; without overload the adaptation is lost (reversibility), so load must keep progressing.	5
10	A four-week strength block starts at 20 sets, adds 10% in weeks 2 and 3, then tapers to 70% of week 3 in week 4. Find the weekly set totals (1 d.p.) and the week-4 reduction relative to week 3.	Week 1 20.0; week 2 22.0; week 3 24.2; week 4 16.9 sets (a 30% reduction).	5
11	For the same student (HRmax 192.6, resting 58), use the Karvonen method to find the target heart rates at 60% and 85% (nearest integer).	60%: 58 + 0.6 x (192.6 - 58) = 138.8, about 139; 85%: 58 + 0.85 x 134.6 = 172.4, about 172 bpm.	4
12	A ten-week plan has 3 sessions per week of 60 minutes each. Find the total training minutes and hours, and state how rest days should be arranged to avoid overtraining.	Total = 3 x 60 x 10 = 1800 minutes = 30 hours. Keep at least 1-2 full rest days per week, allow 48 hours between sessions for the same muscle group, and alternate high and low intensity days.	4

Section D: Biomechanics and Movement Analysis (16 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
13	In a calf raise a 700 N body weight acts at the ankle (load arm 0.12 m) and the Achilles tendon has an effort arm of 0.18 m. (a) Find the tendon force (N). (b) Find the mechanical advantage and state the lever class.	(a) Effort = 700 x 0.12/0.18 = 466.7 N, about 467 N. (b) MA = 0.18/0.12 = 1.50, a class-2 lever with the load between fulcrum and effort.	4
14	A ball is released at 8.5 m/s at 42 degrees (ignore air resistance, g = 9.81). Use R = v^2 sin(2 theta)/g to find the horizontal range (m, 2 d.p.).	R = 8.5^2 x sin 84 deg / 9.81 = 7.32 m.	4
15	A 60 kg runner at 6 m/s collides with a stationary 80 kg opponent and they move off together (perfectly inelastic). Find the common velocity (m/s, 2 d.p.).	Momentum: 60 x 6 = (60 + 80) x v, so v = 360/140 = 2.57 m/s.	4
16	A figure skater pulls the arms in, reducing the moment of inertia from 4.8 to 1.6 kg m^2, with an initial angular velocity of 2.5 rad/s. Find the new angular velocity and name the law used.	Conservation of angular momentum: 4.8 x 2.5 = 1.6 x w, so w = 7.5 rad/s, three times faster.	4

Section E: Sports Psychology and Skill Learning (16 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
17	Explain the inverted-U theory and state how the optimal arousal level differs	Performance rises to an optimum with arousal then falls, giving an inverted U. Closed skills are	4

	between closed skills (e.g. gymnastics) and open skills (e.g. basketball).	predictable so a higher arousal is optimal; open skills need wide attention, so a lower arousal is optimal.	
18	A student improves the 100 m time from 13.4 s to 12.9 s. Find the percentage improvement (2 d.p.) and write one SMART short-term goal.	Improvement = (13.4 - 12.9)/13.4 x 100% = 3.73%. SMART example: run 100 m inside 13.0 s consistently within four weeks, timing twice a week and logging results.	4
19	A coach gives knowledge of results (KR) on only 12 of 30 trials. Find the KR rate (%) and explain the problem with too much and too little KR.	KR rate = 12/30 x 100% = 40%. Too much: learners depend on external feedback and ignore proprioception; too little: errors go uncorrected and motivation drops.	4
20	Immediate post-test score is 82 and the retention test seven days later is 79. Find the retention rate (%, 1 d.p.) and explain why retention tests better reflect learning.	Retention = 79/82 x 100% = 96.3%. An immediate test can reflect temporary performance effects such as warm-up or cueing, while a delayed test removes them and shows long-term memory.	4

Section F: Injury, Rehabilitation and Sports Policy (16 marks)

Answer all questions and show your working with units.

#	Question	Answer	Marks
21	A player suffers an acute ankle sprain. State the four RICE steps with their immediate effects, and two practices to avoid in the first 48 hours.	Rest to stop further damage; ice for 15-20 minutes to limit swelling and pain; compression to restrict bleeding; elevation to aid venous return. Avoid heat and deep massage in the first 48 hours because they increase bleeding and swelling.	4
22	Body mass is 62.0 kg before and 60.8 kg after 90 minutes of exercise, with 400 mL drunk and 100 mL of urine. Find the total sweat loss (mL) and the hourly rate.	Sweat = (62.0 - 60.8) x 1000 + 400 - 100 = 1500 mL; hourly = 1500/1.5 = 1000 mL/h.	4
23	Rehabilitation starts at 40 kg and increases 8% each week for six weeks. Find the week-6 load (kg, 1 d.p.) and explain why rehabilitation loading is more conservative than normal training.	Week 6 = 40 x 1.08^6 = 63.5 kg. Injured tissue has not regained full tensile strength, so loading too fast re-tears it; progress must be guided by pain and swelling responses.	4
24	Of 1,200 students, 372 join an after-school sports scheme. Find the participation rate (%). How many more students are needed to reach 40%?	Rate = 372/1,200 x 100% = 31%. 40% of 1,200 is 480, so 108 more students are needed.	4