S6 Physical Education Practice Paper: Exercise Physiology and Energy Systems, Biomechanics and Movement Analysis, Fitness Testing and Assessment, Training Principles and Periodisation, Sports Psychology and Skill Learning, Sport in Society and Health Promotion

S6 | Physical Education | Time: 75 minutes | Total: 100 marks | 24 questions

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Part A: Exercise Physiology and Energy Systems (16 marks)

Show your working and include units in your answers.

1. An athlete has a resting heart rate of 60 bpm and a maximum heart rate of 200 bpm. Using the Karvonen (heart rate reserve) method, find the target heart rate at 70% intensity. [4]

Answer: HR reserve = 200 - 60 = 140; target HR = 60 + 0.70 x 140 = 158 bpm.

2. A student covers 2,400 m in the Cooper 12-minute run. Use VO2max = (distance - 504.9) / 44.73 to estimate maximum oxygen uptake. [4]

Answer: VO2max = (2,400 - 504.9) / 44.73 = 1,895.1 / 44.73 = 42.37 ml/kg/min.

3. Explain two differences between the ATP-PC system and the aerobic system in terms of peak intensity and sustainable duration. [4]

Answer: Intensity: ATP-PC supports near-maximal effort while the aerobic system only supports low to moderate intensity; duration: ATP-PC is depleted within about 10 seconds whereas the aerobic system can last tens of minutes when oxygen supply is adequate.

4. A student weighs 62 kg and is 1.68 m tall. Calculate the BMI and classify it using under 18.5 underweight, 18.5-22.9 normal, 23-24.9 overweight, 25 or above obese. [4]

Answer: BMI = 62 / 1.68^2 = 62 / 2.8224 = 21.97, about 22.0, which is normal.

Part B: Biomechanics and Movement Analysis (17 marks)

Take g = 9.81 m/s2 and ignore air resistance.

5. A football is kicked at 12 m/s at an angle of 30 degrees. Find the horizontal range. [4]

Answer: R = v^2 sin(2 theta) / g = 144 x sin 60 / 9.81 = 124.71 / 9.81 = 12.71 m.

6. Using the same kick, find the maximum height reached by the ball. [4]

Answer: Maximum height = (v sin theta)^2 / (2g) = (12 x 0.5)^2 / 19.62 = 36 / 19.62 = 1.83 m.

7. A force of 250 N acts perpendicular to a lever arm 0.35 m from the axis. Find the moment about the axis and state two ways to increase the moment. [4]

Answer: Moment = 250 x 0.35 = 87.5 N m; increasing the force or lengthening the lever arm (for example gripping further from the axis) increases the moment.

8. An athlete lifts a 50 kg barbell through 1.2 m ten times in 20 seconds. Find the total work done and the average power. [5]

Answer: Total work = 50 x 9.81 x 1.2 x 10 = 5,886 J, about 5.89 kJ; average power = 5,886 / 20 = 294.3 W. Bending the knees lowers the centre of gravity and widens the base of support, which increases stability.

Part C: Fitness Testing and Assessment (17 marks)

Give the sample standard deviation to 2 decimal places.

9. Eight students score the following sit-up counts in one minute: 24, 30, 28, 35, 22, 26, 31, 29. Find the mean and the sample standard deviation. [4]

Answer: Mean = 225 / 8 = 28.125, about 28.13; sample standard deviation = 4.12.

10. Using the data above, find the z-score of the student who scored 35 and explain its meaning. [4]

Answer: z = (35 - 28.125) / 4.121 = 1.67; the score is about 1.67 standard deviations above the mean, among the better performers in the group.

11. An athlete weighs 70 kg with 18 percent body fat. Find the fat mass and the lean body mass. [4]

Answer: Fat mass = 70 x 0.18 = 12.6 kg; lean mass = 70 - 12.6 = 57.4 kg.

12. Explain what validity and reliability of a fitness test mean, and give one practical way to improve reliability. [5]

Answer: Validity is whether a test measures what it claims to measure; reliability is whether repeated trials give similar results. Improve reliability by standardising procedures (same instructions, same venue, same warm-up) and using the same tester.

Part D: Training Principles and Periodisation (17 marks)

Include units and show the calculation.

13. An athlete has a 1RM of 80 kg and trains at 75 percent 1RM for 3 sets of 10 repetitions. Find the load used and the total training volume in kg. [5]

Answer: Load = 80 x 0.75 = 60 kg; total volume = 60 x 10 x 3 = 1,800 kg.

14. An athlete has a maximum heart rate of 200 bpm. Using the percentage of maximum heart rate method, find the target heart rate range for 60 to 80 percent. [4]

Answer: Lower limit = 200 x 0.60 = 120 bpm; upper limit = 200 x 0.80 = 160 bpm, that is 120 to 160 bpm.

15. A runner covers 30 km in week one and increases the weekly distance by 10 percent each week. Find the distance in week four. [4]

Answer: Week four = 30 x 1.1^3 = 30 x 1.331 = 39.93 km.

16. State three signs of overtraining and explain the purpose of tapering before competition. [4]

Answer: Signs: rising resting heart rate, poorer sleep, performance plateau or decline, irritability. Tapering reduces training volume while keeping intensity so that fatigue dissipates and glycogen and muscle repair are completed, allowing peak performance on competition day.

Part E: Sports Psychology and Skill Learning (17 marks)

Show working for calculation questions.

17. A player records eight reaction times in seconds: 0.34, 0.31, 0.29, 0.33, 0.30, 0.32, 0.35, 0.28. Find the mean reaction time. [4]

Answer: Sum = 2.52 s; mean = 2.52 / 8 = 0.315 s.

18. Using the SMART principle, write one training goal for a player with a low free-throw percentage and explain the S and M parts. [4]

Answer: Example goal: practise free throws three times a week, 50 shots per session, and raise the success rate from 55 to 70 percent within four weeks. S is specific (free throws, volume, sessions); M is measurable (success rate in percent).

19. Explain the inverted-U theory, describing how low, moderate and high anxiety affect performance, and give one example. [4]

Answer: Too little anxiety means low motivation and loose attention, so performance is poor; moderate anxiety gives optimal arousal and the best performance; too much causes muscle tension and narrowed attention, so performance drops. Example: a shooter becomes too tense on a decisive free throw and misses.

20. Player A scores 21 of 30 shots and player B scores 25 of 40. Find both success rates and explain why comparing only the number of successful shots is misleading. [5]

Answer: A = 21 / 30 = 70.0 percent; B = 25 / 40 = 62.5 percent. B made more shots but also took far more, so the success rate is lower; comparisons must use rates rather than absolute counts.

Part F: Sport in Society and Health Promotion (16 marks)

Include units in your answers.

21. A 60 kg student runs for 30 minutes at an intensity of 8.3 METs. Using calories = MET x body mass in kg x hours, calculate the energy expenditure. [4]

Answer: Hours = 30 / 60 = 0.5; expenditure = 8.3 x 60 x 0.5 = 249 kcal.

22. The WHO recommends 150 minutes of moderate activity per week for adolescents. A student exercises 40 minutes a day for 5 days a week. Find the weekly total and the percentage of the recommendation. [4]

Answer: Total = 5 x 40 = 200 minutes; percentage of the guideline = 200 / 150 x 100 = 133.3 percent, so the target is exceeded.

23. Explain the four steps of the RICE protocol for acute sports injury and the purpose of each. [4]

Answer: Rest avoids further damage; ice reduces pain and swelling by constricting blood vessels; compression limits swelling; elevation aids venous return and reduces oedema.

24. In a school sports day 420 of 1,200 students competed. Find the participation rate and the number of additional students needed to reach a 50 percent target. [4]

Answer: Participation = 420 / 1,200 x 100 = 35.0 percent; the 50 percent target is 600 students, so 600 - 420 = 180 more students are needed.