S5 Physical Education Practice Paper: Health-related Fitness, Energy Systems and Metabolism, Training Principles and Periodisation, Biomechanics and Levers, Skill Learning and Sport Psychology, Sports Injury and First Aid

S5 | Physical Education | Time: 75 minutes | Total: 100 marks | 24 questions

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Health-related Fitness

Part A: Health-related fitness indicators (16 marks)

1. A student is 1.75 m tall and weighs 70 kg. Find his body mass index (BMI). [4]

Answer: BMI = 70 / 1.75^2 = 70 / 3.0625 = 22.9, which is in the normal range of 18.5 to 22.9.

2. The maximum heart rate of a 16-year-old is estimated by 220 minus age. Find the heart rate range for moderate intensity training at 50% to 70%. [4]

Answer: Maximum heart rate = 220 - 16 = 204 beats/min; 50% = 102 and 70% = 142.8, so the range is 102 to 143 beats/min.

3. An athlete has a resting heart rate of 60 beats/min and a maximum heart rate of 200 beats/min. Use the heart rate reserve (Karvonen) method to find the target heart rate at 60% intensity. [4]

Answer: Heart rate reserve = 200 - 60 = 140; target = 140 x 0.60 + 60 = 144 beats/min.

4. A person weighs 70 kg and 14 kg of that is fat. Find the body fat percentage. [4]

Answer: Body fat percentage = 14 / 70 x 100% = 20%.

Energy Systems and Metabolism

Part B: Energy systems and metabolism (16 marks)

5. A 60 kg athlete performs a squat in which the centre of gravity rises 1.5 m vertically (g = 9.81 m/s^2). Find the work done against gravity. [4]

Answer: W = mgh = 60 x 9.81 x 1.5 = 882.9 J, about 883 J.

6. Running burns 8 kcal per minute. After running for 30 minutes, find the total energy used and convert it to kJ using 1 kcal = 4.184 kJ. [4]

Answer: Total = 8 x 30 = 240 kcal; 240 x 4.184 = 1004.16 kJ, about 1004 kJ.

7. The ATP-CP system can supply energy for high intensity work for about 10 seconds. An athlete takes 25 seconds to run 200 m. State the main energy system used and calculate the time beyond the ATP-CP limit. [4]

Answer: 25 s is longer than 10 s by 15 s, so the main system is anaerobic glycolysis (the lactate system).

8. During vigorous exercise the carbon dioxide output is 2.55 L/min and the oxygen uptake is 3.00 L/min. Find the respiratory exchange ratio and state the main substrate used. [4]

Answer: RQ = 2.55 / 3.00 = 0.85; a value near 0.85 indicates a mixture of carbohydrate and fat.

Training Principles and Periodisation

Part C: Training principles and periodisation (17 marks)

9. An athlete has a 1RM of 80 kg. The coach asks for 10 repetitions at 70% of 1RM. Find the load to be used. [4]

Answer: Load = 80 x 0.70 = 56 kg.

10. Following the rule that weekly volume should not rise by more than 10%, how far may an athlete who currently runs 40 km per week run next week? [4]

Answer: Upper limit = 40 x 1.10 = 44 km, that is at most 4 km more per week.

11. An athlete has a maximum heart rate of 196 beats/min and trains at 75% of maximum. Find the training heart rate. [4]

Answer: Training heart rate = 196 x 0.75 = 147 beats/min.

12. A training year has 52 weeks and the preparatory phase lasts 8 weeks. Find the preparatory phase as a percentage of the year (one decimal place) and state its main purpose. [5]

Answer: 8 / 52 x 100% = 15.4%; the preparatory phase builds a general fitness base such as aerobic capacity, strength and basic technique before the specific phase.

Biomechanics and Levers

Part D: Biomechanics and levers (17 marks)

13. A force of 20 N is applied 0.40 m from a pivot. Find the torque about the pivot. [4]

Answer: Torque = F x d = 20 x 0.40 = 8.0 N m.

14. In a heel raise the effort arm (Achilles tendon) is 0.05 m and the resistance arm is 0.15 m. Find the mechanical advantage and state the class of lever. [4]

Answer: Mechanical advantage = 0.15 / 0.05 = 3.0; with the toes as fulcrum, body weight as load and calf muscle as effort, it is a second class lever.

15. A ball is thrown at 20 m/s at 45 degrees to the horizontal (g = 9.81 m/s^2, air resistance ignored). Find the horizontal range. [4]

Answer: R = v^2 sin 2(theta) / g = 400 x 1 / 9.81 = 40.8 m.

16. A diver completes a 360 degree twist in 0.80 s. Find the average angular velocity in degrees per second and in rad/s. [5]

Answer: 360 / 0.80 = 450 degrees per second; 450 x pi / 180 = 7.85 rad/s.

Skill Learning and Sport Psychology

Part E: Skill learning and sport psychology (17 marks)

17. A coach records 10 reaction times in seconds: 0.22, 0.25, 0.23, 0.24, 0.26, 0.21, 0.25, 0.24, 0.23, 0.27. Find the mean. [4]

Answer: Sum = 2.40 s; mean = 2.40 / 10 = 0.24 s.

18. A player scores from 12 of 20 shots. Find the success rate and state how many goals would be needed to reach 75% with the same 20 shots. [4]

Answer: Success rate = 12 / 20 x 100% = 60%; 75% x 20 = 15 goals, so 3 more goals are needed.

19. A runner currently covers 40 laps in 12 minutes and sets a target of a 20% improvement in 12 weeks. Find the target number of laps and state the type of goal it represents. [4]

Answer: Target = 40 x 1.20 = 48 laps; it is specific, measurable and time-bound, so it is a performance goal under the SMART principle.

20. An athlete scores 62, 85 and 58 at arousal levels of 3, 6 and 9 out of 10. Using the inverted-U theory, state the optimal arousal level and explain why. [5]

Answer: The best is 6, scoring 85; the inverted-U theory holds that too little arousal gives no drive while too much causes anxiety and muscle tension, so moderate arousal gives the best performance.

Sports Injury and First Aid

Part F: Sports injury and first aid (17 marks)

21. An acute ankle sprain is managed with RICE: ice for 20 minutes every 2 hours, at most 6 times a day. Find the total icing time per day. [4]

Answer: 20 x 6 = 120 minutes, so no more than 2 hours of icing per day.

22. An athlete loses 1.5 kg of body mass during exercise. Using 1.5 L of fluid for every 1 kg lost, find the fluid needed for replacement. [4]

Answer: 1.5 x 1.5 = 2.25 L, taken in small amounts and including electrolytes.

23. Distinguishing heat exhaustion from heat stroke: a person has a core temperature of 40 degrees C, hot dry skin and confusion. Which condition is it and what is the first aid priority? [4]

Answer: A core temperature of 40 degrees C with confusion is heat stroke, a medical emergency; call for help at once and cool the body fast with cold water immersion or ice on the large vessels, and do not rely on drinking water.

24. Cardiopulmonary resuscitation follows a ratio of 30 chest compressions to 2 rescue breaths. After 5 cycles, find the total number of compressions. [5]

Answer: Each cycle has 30 compressions, so 5 x 30 = 150 compressions, while using an AED and waiting for help.