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Answers

Exam-style questions

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Check your answers to the questions in this issue.

Elite athletes: an interview with Jodie Gibson (pp. 9–13)

1 Plyometric exercises involve an eccentric contraction, followed by a brief amortisation phase and an explosive concentric contraction. This is known as the stretch-shortening cycle. Plyometric exercises are effective in developing power and might be used by a high/long/triple jumper.

Physiological adaptations that may result from plyometrics include:

- Increased force production
- Increased rate of force production
- Improved tendon, ligament/bone strength
- Improved neuromuscular coordination.

2 This type of training is high intensity interval training (HIIT). Aerobic capacity refers to the body's ability to take in, transport and utilise oxygen.

Physiological adaptations that may result from HIIT include:

- Cardiac hypertrophy
- Capillarisation
- Increased red blood cell count
- Increased mitochondrial density
- Increased aerobic enzymes.

Biomechanics of tennis (pp. 22–26)

1 The centre of mass is the point through which an object is balanced in all directions, where its mass can be said to be concentrated and forces, including weight, are said to act.

For example, in tennis:

- **The height of the centre of mass:** the lower the centre of mass, the more stable an object is. A tennis player will flex their knees into a slight squat position before hitting a shot.

- **Area of base of support:** the wider the base of support, the more stable an object is. A tennis player will take up a wider stance before hitting a shot.
- **Position of line of gravity:** the closer the line of gravity from the centre of mass downwards is to the middle of the base of support, the more stable an object is. A tennis player will ensure that their centre of base is between their legs before hitting shot.

2 Newton's first law (law of inertia) states that an object will remain in a state of uniform motion (it remains at rest or at a constant velocity) unless a force acts upon it. For example, a tennis ball remains at rest in the server's hand until they apply a force to the ball to toss it up at the start of the serve.

Newton's second law (law of acceleration) states that the acceleration, or rate of change in velocity, of an object is proportional to the size and direction of the force acting upon it. For example, when playing a smash shot, a tennis ball accelerates rapidly on a downwards trajectory at a rate proportional to the force applied to it by the strings of a racket and in the direction in which the force is applied.

Newton's third law (law of reaction) states that for every action (force) there is an equal and opposite reaction. For example, a tennis ball accelerates at a rate proportional to the force applied to it by the strings of a racket and the ball applies an equal and opposite force to the strings.

3 Explanation of how a tennis player might use spin to outwit an opponent (one mark for each answer, maximum of 6 marks):

- Spin is created by an eccentric force, i.e. a force applied away from the ball's centre of mass.
- The spinning ball creates a rotating boundary layer of air around the ball.
- Air on one side of the ball travels faster than the air on the other side of the ball as it is sped up or slowed down by the oncoming air particles.
- Given that airspeed and air pressure are inversely proportional, one side of the ball, where the airspeed is faster, experiences an area of lower pressure. At the same time, the other side of the ball, where the airspeed is slower, experiences an area of higher pressure.
- The difference in pressure on either side of the ball creates a pressure gradient. This generates a Magnus force from the area of high pressure to the area of low pressure.
- This causes the ball to deviate from its expected flight path and is known as the Magnus effect.
- Reference to type of spin and change in trajectory, e.g. topspin causes the ball to dip in flight and have a lower trajectory, closer to the net.

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