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Answers

Exam-style questions

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Check your answers to the questions in this issue.

The biomechanics of throwing (pp. 10–13)

- 1 Height of release – the greater the height of release, the greater the horizontal distance because the javelin is in the air for longer and will travel further at a given speed.

Speed of release – the faster the speed of release, the greater the horizontal distance because the javelin will travel further in a given time in the air.

Angle of release – if both the release height and the landing height are equal, then the optimum angle of release is 45° . If the release height is greater than the landing height, in the discus for example, then the optimum angle of release needs to be less than 45° .
- 2 The Bernoulli principle says that the speed and pressure of a fluid are inversely proportional. For a discus, this applies to the air. If the discus is throw at an appropriate angle of attack, air must travel further over the top of the discus than under it. Therefore, air travels faster across the top of the discus and at a lower pressure. Air travels slower underneath the discus and therefore at a higher pressure. This creates an upward pressure gradient (high to low pressure), which acts upon the discus' centre of gravity. This is known as a lift force and acts in opposition to weight, prolonging the flight of the discus so that it travels further.
- 3 Angular velocity (rads/s) = angular displacement (rads) / time (s)
 $= 8\pi \text{ rads} / 2\text{s}$
 $= 12.56 \text{ rads/s}$ or $4\pi \text{ rads/s}$

Variables that might affect the stability of the thrower:
 - Lowering their centre of mass (such as being in a sitting position) increases stability.
 - Having both feet on the ground (two points of contact) while turning increases stability.
 - Having the feet further apart widens the base of support and increases stability.
 - Ensuring that the line of gravity downwards from their centre of mass falls as close as possible to the middle of the base of support increases stability.
 - Having a greater body mass increases stability.

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