Exercise walk-through

5.2
Stability, rotation and projectiles

International Baccalaureate · IB Diploma · Sports, Exercise and Health Science · SL

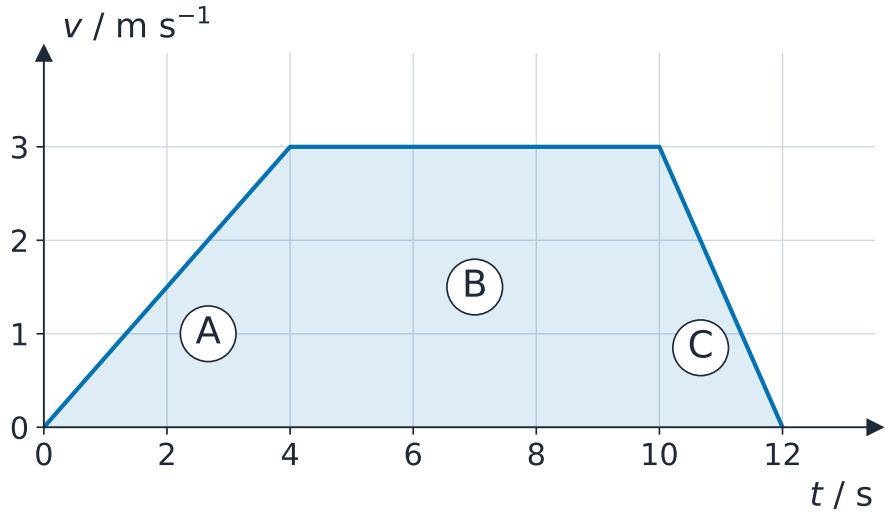
Can follow-through keep changing a ball after racket separation?

Choose the body, direction and interval

B2 connects Newton's laws, stability, coordinated movement, projectile paths and movement phases.

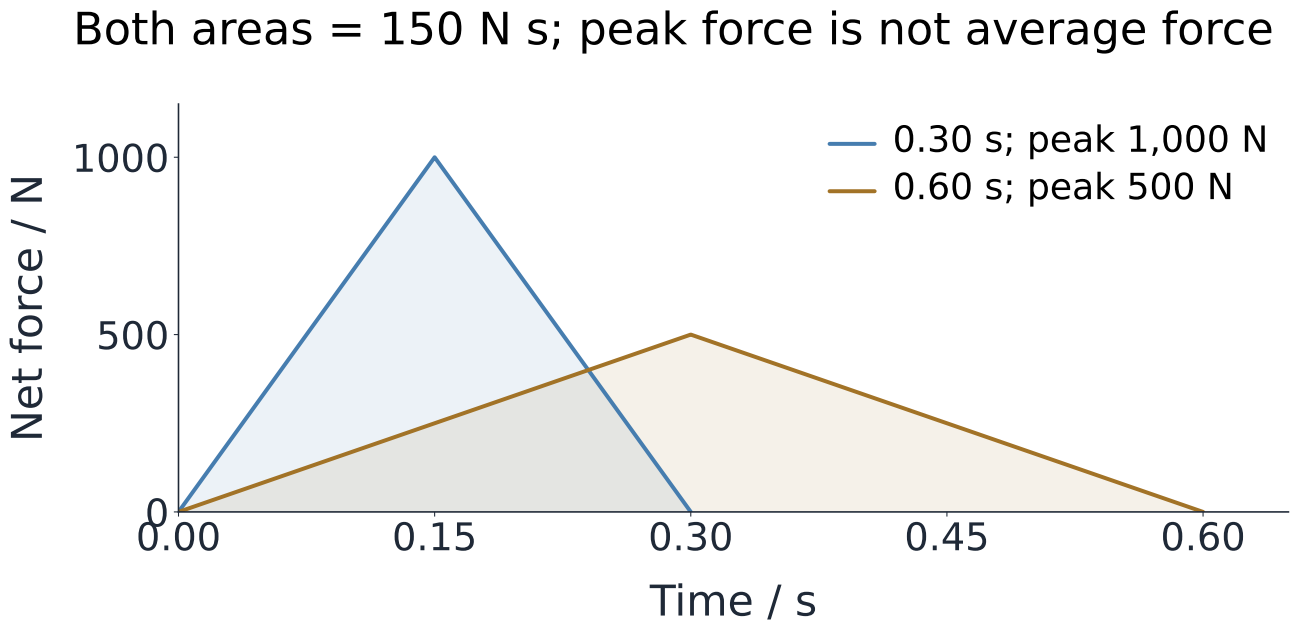
All numerical examples and diagrams are invented. Movement after separation cannot supply continued racket–ball contact force.

Three stages on one graph



Find each acceleration from the gradient and the distance from the area

Signed area measures impulse; peak height does not



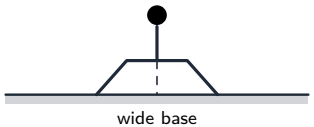
Equal areas can arise from different durations and peaks.

Exercises 2.1·2.2

2.1 Define centre of mass, and state where it is for a person standing upright. [2]



2.2 Explain **three** ways a wrestler can make himself more stable. [3]



Exercises 2.1·2.2

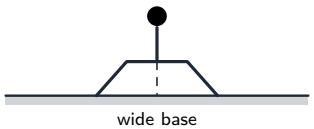
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2.1

the point where the mass of the body can be considered to be concentrated / where gravity acts; about hip level, behind the navel

2.2 Explain **three** ways a wrestler can make himself more stable. [3]

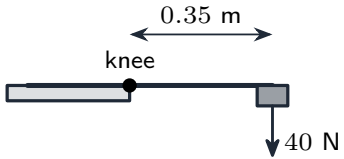


2.2

widen his base of support, e.g. feet further apart; lower his centre of mass by bending the knees; keep his line of gravity near the centre of the base, so a push must move it further to topple him

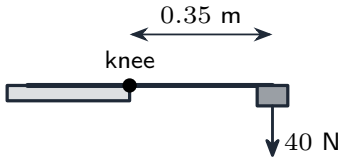
Exercise 2.3

2.3 A 40 N ankle weight is 0.35 m from the knee joint, acting at right angles to the shin. Calculate the torque about the knee, and state the torque if the perpendicular distance halves. [3]



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torque $= 40 \times 0.35 =$ **14** N m; halved distance: **7** N m

Exercise 3.1 (a)

3.1 A diver leaves the board, tucks tightly, then opens out before entering the water.

(a) Explain, using angular momentum, why the diver spins faster in the tuck. [3]



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(a) angular momentum ($L = I\omega$) is constant in the air; tucking brings mass closer to the axis, so moment of inertia falls; so angular velocity must rise

Exercise 3.1 (b)

3.1 A diver leaves the board, tucks tightly, then opens out before entering the water.

(b) State what happens to the rate of spin when the diver opens out. [1]

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(b) State what happens to the rate of spin when the diver opens out. [1]

(b) it slows down

Exercise 3.2 (a)

3.2 A shot-putter releases the shot about 2 m above the ground.

(a) State **three** factors that affect the horizontal distance of the throw. [3]



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(a) release speed; release angle; release height (also air resistance)

Exercise 3.2 (b)

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(b) Explain why the best release angle for the shot put is less than 45°. [3]

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(b) Explain why the best release angle for the shot put is less than 45°. [3]

(b) the shot is released above the landing height; so it lands later and further at a lower angle; 45° is best only when release and landing heights are the same; also the athlete can produce more release speed at lower angles, because the muscles push more horizontally