Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

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

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

2.3

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

3.1

(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

(b) it slows down

3.2

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

(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