

Fun facts on impact forces in sports

$$F_{ave} = \frac{m(v_2 - v_1)}{\Delta t}$$

Golf

Golf ball weight: $mg = 0.114 \text{ lb (0.510 N)}$

Impact duration: $\Delta t = 0.5 \text{ msec}$

Impact force: $F_{ave} = 2000 \text{ lb (8900 N)}$

Observation: During impact, the force exerted on the club head by the shaft is negligible compared to the impact force between club head and ball. Hence, during impact the club head can be treated as a free body. This is a very useful simplification when performing a dynamic analysis of the club head during impact.

<https://www.real-world-physics-problems.com/physics-of-golf.html>

Baseball

Baseball weight: $mg = 0.320 \text{ lb (1.42 N)}$

Impact duration: $\Delta t = 0.7 \text{ msec}$

Impact force: $F_{ave} = 4200 \text{ lb (18245 N)}$ for 90 mph pitch and 110 mph hit

<https://www.acs.psu.edu/drussell/bats/impulse.htm>

Soccer (header impact)

Soccer ball weight: $mg = 1.00 \text{ lb (4.45 N)}$

Impact duration: $\Delta t = 5 \text{ msec}$

Impact force: $F_{peak} = 742 \text{ lb (3300 N)}$ for 49 ft/s (15 m/s) ball velocity

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0240162>