

# ANGULAR MOTION

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## At the Masters, Tiger Woods Is a Cautionary Tale and a Favorite

By KAREN CROUSE APRIL 4, 2018

Tiger Woods during a practice round on Monday at Augusta National. Woods, who has had four back operations in four years, will tee off Thursday as one of the early favorites at the Masters, which he has not played since 2015.

AUGUSTA, Ga. — Bryson DeChambeau, a rising star on the PGA Tour, never imagined he would withdraw from a tournament just to avoid pain. DeChambeau, 24, grew up admiring [Tiger Woods](#), who had brought a football mentality to the sport, his toughness immortalized by his victory at the 2008 United States Open despite a left leg in need of surgery. But after DeChambeau wined through the first round of last month's Valspar Championship, he wasn't thinking of the Tiger Woods he had always wanted to become. Instead DeChambeau remembered what Woods had said during a practice round they had played together at Torrey Pines in January, nine months after Woods's fourth lower-back operation since April 2014. He thought about Woods's frank accounts of the pain he had endured, how it had kept him from the game he loves and had compromised his quality of life with his two children. After consulting with his caddie and coach, DeChambeau pulled out of the tournament and didn't touch a club for the next three days. "The first time I've done that in my entire life," he said. Once again — though in a most unexpected way — Woods had served as a model for the next generation of golfers. Now, after a two-year absence, Woods is back at the [Masters](#) as one of the early favorites after top-five finishes at his last two tournaments — his best showings since 2013.



**QUESTIONS:** (a) Convert Tiger's club face speed from 130 mph to ft./s.?, (b) Driver clubs are 45 inches long. Find length in feet?, (c) Find Tiger's final angular velocity in radians/s.?, (d) Consider Tiger's club swing starts from rest and goes through  $\frac{3}{4}$  of a revolution prior to hitting the ball. Find club's angular acceleration (rad./s.<sup>2</sup>)?

**HINTS:** 88 ft./s. = 60 mph, 12 inches/foot,  $v = r \omega$ ,  $\omega^2 = \omega_0^2 + 2 \alpha \theta$

**ANSWERS:** (a)  $v = 190.7$  ft./s., (b)  $r = 3.75$  ft., (c)  $\omega = 50.84$  rad./s., (d)  $\alpha = 274.4$  rad./s.<sup>2</sup>

Woods, at 21, finishing off the first of his four Masters victories, a 12-stroke win in 1997. Some of today's top young golfers say watching Woods in that tournament inspired their careers

### Woods Still Grips It and Rips It

**Despite his age (42) and several back surgeries, Tiger Woods has the highest recorded club-head speed this season. HIGHEST CLUB-HEAD SPEEDS 130 M.P.H. Tiger Woods**

Source: PGA Tour | By The New York Times

| Driver        | Club Speed (mph) | Attack Angle (deg) | Ball Speed (mph) | Smash Factor | Launch Ang (deg) | Spin Rate (rpm) | Max Height (yds) | Land Angle (deg) | Carry (yds) |
|---------------|------------------|--------------------|------------------|--------------|------------------|-----------------|------------------|------------------|-------------|
| Driver        | 113              | -1.3°              | 167              | 1.48         | 10.9°            | 2686            | 32               | 38°              | 275         |
| 3-wood        | 107              | -2.9°              | 158              | 1.48         | 9.2°             | 3655            | 30               | 43°              | 243         |
| 5-wood        | 103              | -3.3°              | 152              | 1.47         | 9.4°             | 4350            | 31               | 47°              | 230         |
| Hybrid 15-18° | 100              | -3.5°              | 146              | 1.46         | 10.2°            | 4437            | 29               | 47°              | 225         |
| 3 Iron        | 98               | -3.1°              | 142              | 1.45         | 10.4°            | 4630            | 27               | 46°              | 212         |
| 4 Iron        | 96               | -3.4°              | 137              | 1.43         | 11.0°            | 4836            | 28               | 48°              | 203         |
| 5 Iron        | 94               | -3.7°              | 132              | 1.41         | 12.1°            | 5361            | 31               | 49°              | 194         |
| 6 Iron        | 92               | -4.1°              | 127              | 1.38         | 14.1°            | 6231            | 30               | 50°              | 183         |
| 7 Iron        | 90               | -4.3°              | 120              | 1.33         | 16.3°            | 7097            | 32               | 50°              | 172         |
| 8 Iron        | 87               | -4.5°              | 115              | 1.32         | 18.1°            | 7998            | 31               | 50°              | 160         |
| 9 Iron        | 85               | -4.7°              | 109              | 1.28         | 20.4°            | 8647            | 30               | 51°              | 148         |
| PW            | 83               | -5.0°              | 102              | 1.23         | 24.2°            | 9304            | 29               | 52°              | 136         |

