

QUIZ 9A: PHYSICS 1710

NAME: Key

I.D: _____; SECTION: 001, 002, 003, 004

1. (6 points) A physics professor stands at the center of a frictionless turntable with arms outstretched and a 6.0 kg dumbbell in each hand. An assistant gives him a small initial angular velocity of 2 rad/s. Find his final angular velocity if he pulls the dumbbell in to his stomach. His moment of inertia (without the dumbbell) is 4.0 kg.m² with arms stretched and 2.0 kg.m² with his hands at his stomach. The dumbbells are 1.1 m from the axis initially and 0.15 m from the axis at the end.

The center of mass passes through rotation axis

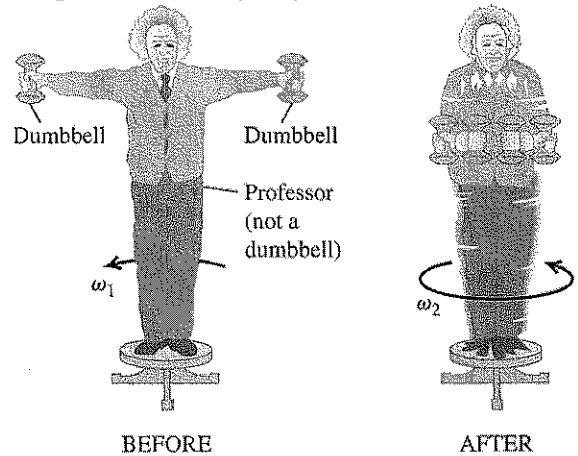
$$L_i = L_f$$

$$I_i \omega_i = I_f \omega_f$$

$$I_i = 4.0 + 2 \times 6.0 \times 1.1^2 = 18.52 \text{ kg.m}^2$$

$$I_f = 2.0 + 2 \times 6.0 \times 0.15^2 = 2.27 \text{ kg.m}^2$$

$$\omega_f = \frac{I_i \omega_i}{I_f} = \frac{18.52 \times 2}{2.27} = 16.3 \text{ rad/s}$$



2. (4 points) What's gravity g on Earth's moon surface?
($G = 6.673 \times 10^{-11} \text{ N.m}^2 / \text{kg}^2$, moon radius = 1738.1 km, moon mass = $7.342 \times 10^{22} \text{ kg}$)

$$g = G \frac{M}{R^2} = 6.67 \times 10^{-11} \frac{7.342 \times 10^{22}}{(1.7381 \times 10^6)^2}$$

$$= 1.62 \text{ m/s}^2$$

QUIZ 9B: PHYSICS 1710

NAME: _____

Key

I.D: _____; SECTION: 001, 002, 003, 004

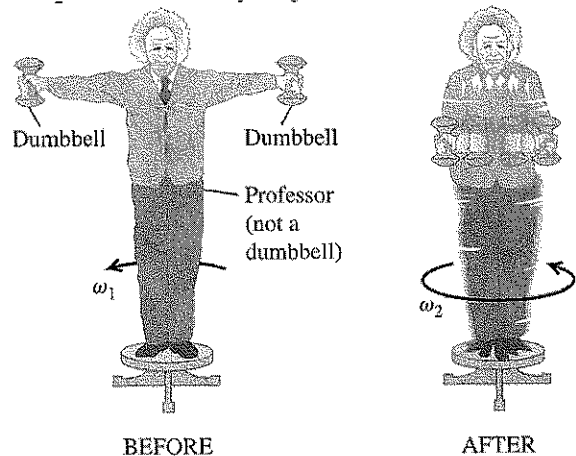
1. (6 points) A physics professor stands at the center of a frictionless turntable with arms outstretched and a 4.0 kg dumbbell in each hand. An assistant gives him a small initial angular velocity of 1.5 rad/s. Find his final angular velocity if he pulls the dumbbell in to his stomach. His moment of inertia (without the dumbbell) is 4.0 kg.m² with arms stretched and 2.0 kg.m² with his hands at his stomach. The dumbbells are 1.1 m from the axis initially and 0.15 m from the axis at the end.

Similar to 9A

$$I_i = 4.0 + 2 \times 4 \times 1.1^2 = 13.68 \text{ kg.m}^2$$

$$I_f = 2.0 + 2 \times 4 \times 0.15^2 = 2.18 \text{ kg.m}^2$$

$$\omega_f = \frac{I_i \omega_i}{I_f} = \frac{13.68 \times 1.5}{2.18} = 9.4 \text{ rad/s}$$



2. (4 points) What's gravity g on Mars surface?
($G = 6.673 \times 10^{-11} \text{ N.m}^2 / \text{kg}^2$, Mars radius = $3.4 \times 10^6 \text{ m}$, Mars mass = $6.42 \times 10^{23} \text{ kg}$)

$$g = G \frac{M}{R^2} = 6.67 \times 10^{-11} \frac{6.42 \times 10^{23}}{(3.4 \times 10^6)^2} = 3.7 \text{ m/s}^2$$