

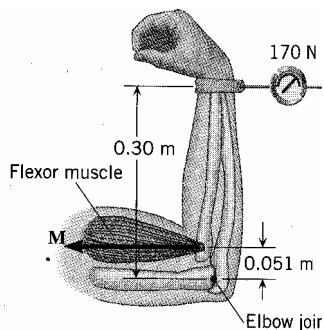
Instructions: Show *all* work. Answers without explanation or support receive no credit.

Box final answers

This is a test given summer 2002 - it is a sample - to show you what the tests are like - it is not meant for practice and these particular problems will probably not be on the test

Problems (14 points each)

1. An 0.15 kg baseball traveling with a horizontal speed of 4.5 m/s is hit by a bat and then moves with a speed of 34.7 m/s in the opposite direction. What is the change in the ball's momentum?
2. Two 1000 kg cars approach an intersection. Both moving at 15 m/s. One from the north and one from the east. They collide and stick together. What is the speed and direction of this pile of junk right after the collision?
3. If the comet Shoemaker-Levy (mass 4×10^{12} kg) velocity 3.7×10^4 m/s had struck earth (mass 6×10^{24} kg). What would have been the change in velocity of the earth?
4. A pulsar is a rapidly rotating neutron star that emits a beam of radio waves every time it rotates. Each time the star rotates the earth receives a pulse of radio waves.
 - a. The pulsar in the crab nebula rotates every 0.033 second, what is the star's angular speed in rad/s?
 - b. The maximum radius of the star may be determined by the fact that points on the surface may not be moving faster than the speed of light (3×10^8 m/s) - determine the maximum radius of the crab pulsar.
5. A person exerts a horizontal force of 170 N in the apparatus shown in the drawing. Find the horizontal force M (magnitude and direction) that his flexor muscle exerts on his forearm.



6. A dentist causes the high-speed to accelerate from an angular speed of 1.05×10^4 rad/s to a speed of 3.14×10^4 rad/s. in the process, the bit turns through 1.88×10^4 rad. Assuming a constant angular acceleration, how long would it take the bit to reach its maximum speed of 7.85×10^4 rad/s, starting from rest.

Short Answer. (4 points each).

1. On Earth, an astronaut and equipment weigh 1960.0 N. While weightless in space, the astronaut fires a 100 N rocket backpack for 2.0 s. What is the resulting velocity of the astronaut and equipment?
2. What is the moment of inertia of a disk with a mass of 4.0 kg and a diameter of 20 cm?
3. A 2.0 kg mass stretches a spring a distance of 2.0 cm, what is the spring constant of the spring?
4. What is the angular acceleration of a 33.3 rpm record playing turntable that stops 2 minutes after it is turned off?
5. A spring has a spring constant of 40 N/m. how much work is required to stretch the spring 2.0 cm from its equilibrium position?