

NEWTON'S 2ND LAW

Units 6 & 7 Dr. John P. Cise , Professor of

Physics , Austin Com. College , 1212 Rio Grande St. , Austin Tx 78701 jpcise@austinctc.edu & New York Times , October 26, 2014 by Claire Martin, Dedicated to my soccer playing nephews: Stephen, Andy, & JD McLandrich

Selling a Smaller Soccer Ball



with regular soccer balls, the smaller, lighter Eir balls require less kicking speed to make the same shots.



HEADING
FORCE



65 km./hr. = ~ 40
mph

INTRODUCTION 1: The ball at left hit the head at 65 km./hr. and stopped in 10.23 milliseconds

QUESTIONS: (a) Convert 65 km./hr. to m./s.? (b) millisecond = 10^{-3} s., find ball deceleration a? (c) Convert 13 & 16 oz. to kg.?(d) Find head force to stop ball for each weight ball? (e) Convert head force in newtons to lb.? (f) What % reduction in head force was achieved in using the lighter 13 oz. vs. 16 oz ball?

At age 12 or 13, many soccer players around the world graduate from the soccer balls designed for children to the larger ones used by professionals. But when a Danish youth soccer coach named Majken Gilmartin watched her daughter's team make that transition in 2007, she was alarmed by what she saw. As soon as the girls started using the larger ball, Ms. Gilmartin detected a difference in how they played. "They got fatigued," she says. She worried that the ball might increase their risk of injury. "I thought, 'Why are we training with that size ball in this age?'" she recalls. "**This is a ball that we play with when we are adults.** Why are young girls playing with it?" So, in 2008, she decided to **develop a smaller, softer soccer ball for girls and women.** She now sells the ball through [Eir Soccer](#) (pronounced "air"), a nonprofit she founded in Copenhagen. The organization is named for the Nordic goddess of health. The **Eir ball**, which is made in India and Pakistan using materials from Korea and Japan, **((weighs 13 ounces))** and has a circumference of 26.4 inches. **It is one to three ounces lighter(((pros use a 16 oz. ball))) and a half-inch to one and a half inches smaller in girth than a professional-size soccer ball.** It's also made of softer materials, including foam on the inside that provides extra bounce, and a polyurethane outer layer that Ms. Gilmartin says prevents the ball from absorbing water or expanding, which would make it heavier or more rotund. Dr. Cantu says **children's thinner skulls and weaker necks make them more susceptible to head injuries.**

CONTINUED: HINTS: 3600 s. = 1 hr., 0.02835 kg./oz. , 0.225 N / lb. , $F_{NET} = m a$

ANSWERS: (a) ~ 18.06 m./s. , (b) ~ 1.765×10^3 m./s.² , (c) 0.3686 kg. , 0.4536 kg. , (d) 800 N. vs. 650 N. (e) 180 lb. vs 146.25 lb. , (f) ~ 18.75 % reduction in head force was achieved by using the lighter 13 oz. ball compared to the heavier pro balls at 16 oz. for header hit balls initially moving at 65 km./hr. & stopping in 10.23 ms.