

FLUIDS-HYDROSTATIC PRESSURE $p = \rho g h$

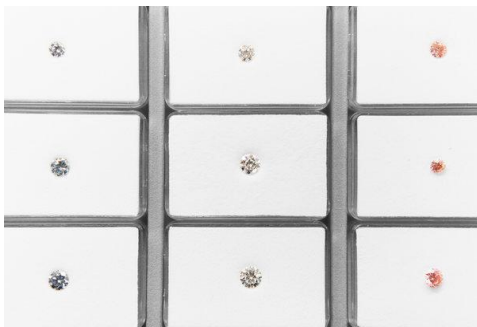
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Diamonds Are Forever, and Made by Machine

De Beers is getting into the lab-created diamond business with a new line of fashion jewelry and an aggressive pricing strategy.

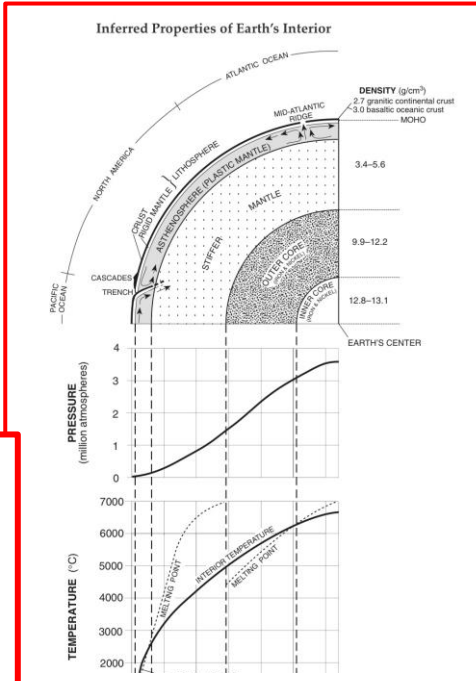
A transparent sheet of polished diamond used in high-powered lasers. The market for synthetic diamonds has been growing in recent years as costs have fallen and quality has improved. By Elizabeth Paton and Vanessa Friedman

OXFORDSHIRE, England — In a white industrial building in the rolling hills of the English countryside 16 miles from Oxford, silver machines shaped like spaceships hum inside vast laboratories. They are replicating the extreme pressure and temperatures found deep in the earth's crust and producing, in mere weeks, what historically nature managed only over billions of years: flawless diamonds. This is the Element Six Innovation Center, the industrial arm of De Beers, the diamond behemoth that has operated mines from the Arctic to South Africa, that created (and for most of the 20th century controlled) the global diamond market, that convinced the world "[a diamond is forever](#)" and that made diamonds synonymous with engagement rings.



A tray of synthetic fashion diamonds.

INTRODUCTION: Goal of this application is to verify lower statement pressure to produce diamonds is akin to Eiffel tower Weight on a can of coke. According to data from Smithsonian.com the natural pressure needed under earth's (see chart at right for density data) mantle at 150 Km. to produce diamonds is $[P = \rho_{\text{MANTEL}} g h]$ is about 5 giga PAs ($5 \times 10^9 \text{ N/m}^2$).



QUESTIONS: (a) Knowing from chart at left the density of mantle is about $3.4 \times 10^3 \text{ kg./m}^3$ find the pressure to produce natural diamonds at 150 km. Which is about 93 miles deep in earth. $[P = \rho_{\text{MANTEL}} g h.]$?, (b) Find question (a) pressure in units of psi?, (c) Weight of Eiffel tower is listed as 7300 tons. Find weight of Eiffel tower in pounds? (d) Find area of a typical 16 oz. coke can?, ((e) Is answer (d) plausible?

HINTS: 0.000145 psi/ PA, 2000 lb./ton
 $P = \text{force/ unit area} = F/A$

ANSWERS: (a) $5000 \times 10^6 \text{ PA}$,
(b) 740,000 psi, (c) $14.6 \times 10^6 \text{ lb.}$,
(d) $A \sim 19.74 \text{ in}^2$, (e) Vary plausible considering a typical coke can is 1.25 " In radius and 4" tall. Plausible! Yes.

Until recently, De Beers scientists were focused on making diamonds for industrial and other uses.

Focused for decades on things as diverse **as tools for oil and gas drillers**, high-powered lasers and state-of-the-art speaker systems, the De Beers scientists at Element Six have moved into new territory in recent months as the company sets its sights on a lucrative market it traditionally shunned: the production of synthetic jewelry stones. On Tuesday, De Beers will introduce Lightbox, a fashion jewelry label selling (relatively) **low-budget gems** with mass-market appeal. (Think a sweet 16 gift, not an engagement ring.) Pastel pink, white and baby-blue lab-grown studs and pendants, priced from \$200 for a quarter carat to \$800 for one carat, will be presented in candy-colored cardboard gift boxes and initially sold directly to consumers via e-commerce. **Although diamonds made by companies like Diamond Foundry in the United States and New Diamond Technology of Russia usually cost 30 to 40 percent less than their natural counterparts, they are nowhere near as cheap as the ones from Lightbox, which will undercut its competitors by roughly 75 percent.** Through its aggressive pricing and pointed marketing, De Beers clearly aims to be a dominant player in this growing market, while simultaneously protecting its core business.

"Given the pressure required to create lab-grown diamonds, it's (((akin to the Eiffel Tower being stacked on a can of Coke,)))" he said. "If you look at the detailed numbers, the energy consumption levels between natural and man-made diamonds are in the same ballpark."