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Gravitational Field Inside the Earth: What You Would Weigh in a Mine Shaft

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Many undergraduate physics textbooks show that the gravitational field \( g \) decreases linearly as one moves from the surface to the center of the spherical earth. Experiments, however, have demonstrated that there is an initial increase in \( g \) as one moves down in a mine shaft. A model of the earth was constructed to understand this discrepancy. The model consists of concentric spherical shells of different densities. The gravitational field is determined as a function of the radius. Instead of decreasing monotonically as the uniform density model predicts, the multiple shell model predicts that \( g \) first increases to a maximum beneath the surface before linearly decreasing. This result is in pleasant agreement with the experimental data.