Fundamental Forces

Science Study Guide Version 3.1

Fundamental Forces	Details
strong nuclear force	or strong interaction; the most powerful force at short distances; holds **protons and neutrons** together in the atomic nucleus, and holds **quarks** together in **hadrons**; mediated by **gluons**; described by **quantum chromodynamics** (**QCD**), which concerns **color charge**
weak nuclear force	or weak interaction; responsible for **beta decay**; mediated by **W** and **Z bosons**; unified with the electromagnetic force as the electroweak force by **Glashow, Salam, and Weinberg**
gravity	weakest fundamental force; hypothetically mediated by gravitons; causes acceleration of **9.8 meters per second squared** (meters per second per second) on Earth; in **general relativity**, is accounted for by the curvature of spacetime; gravitational waves have been detected by **LIGO**; subject of an inverse-square law created by Newton called his **Universal Law** of it
electromagnetism	or electromagnetic force or electromagnetic interaction; mediated by **photons**; unified with the weak force as the electroweak force by **Glashow, Salam, and Weinberg**; governed by **Maxwell's equations**

Theories and Models	Details
Grand Unified Theory	or GUT; theories that unify the **strong**, **weak**, and **electromagnetic** forces; first GUT was proposed by **Georgi and Glashow**
Theory of Everything	or TOE; theories that unify all four fundamental forces by unifying a GUT with **gravity**
Standard Model	a theory that classifies the **elementary particles**, including quarks, leptons, and **gauge bosons** and accounts for all fundamental forces except gravity
Quantum Chromodynamics	or QCD; a part of the **Standard Model** that assigns **color charges** to gluons and quarks