

GRAVITATIONS

when $h = \text{small}$

$$g' = g \left(1 - \frac{2h}{R}\right)$$

* Variation of 'g' with depth:



$$g' = g \left(1 - \frac{d}{R}\right)$$

$$g'_{\text{center}} = 0$$

* Variation of 'g' due to rotation of earth:



$$g' = g - R\omega^2 \cos^2 \phi$$

$$g'_{\text{pole}} = g - R\omega^2 \times 0$$

$$g' = g \text{ at pole}$$

$$\text{at equator} = g' = g - R\omega^2$$

* If you want to feel weightless, then your ω must be

$$\omega = \sqrt{\frac{g}{R}}$$

* Variation in 'g' due to shape of earth:



$$g = \frac{GM}{R^2}$$

$g_{\text{pole}} = \frac{GM}{R_P^2}$ The polar radius is 21 km less than the equatorial radius.

* Relation of 'g' in terms of ρ density:

$$g = G \frac{4}{3} \rho \pi R$$

* Potential energy of point mass system:



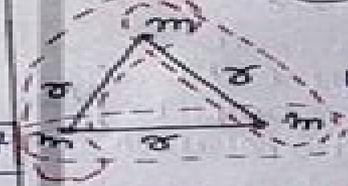
$$U = -\frac{Gm_1m_2}{r}$$



$$U = -\frac{GMm}{r}$$

$$V = \frac{U}{m} = \text{Potential}$$

$$V = -\frac{GM}{r}$$

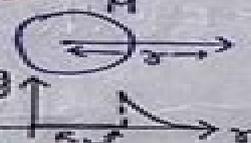


$$U = \frac{-GM \times 3}{r}$$

* Hollow sphere:

$$g_{\text{inside}} = 0$$

$$g_{\text{out}} = \frac{GM}{r^2}$$



* Solid sphere:

$$g_{\text{in}} = \frac{GM r}{R^3}$$

$$g_{\text{outside}} = \frac{GM}{r^2}$$



* Energy of satellite:



$$\frac{mv^2}{R}$$

$$\frac{GMm}{r^2}$$

* GRAVITATIONAL FORCE:-



$$F = \frac{Gm_1m_2}{r^2}$$

G = same always

$$G = 6.67 \times 10^{-11}$$

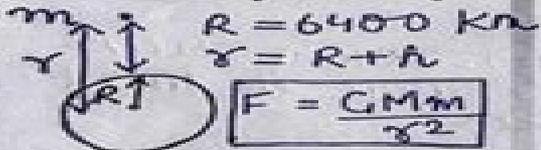
Vector:-

$$\frac{Gm_1m_2}{r^2} \hat{r}$$

$$\hat{r} = \frac{\vec{r}}{r}$$

* Gravitational field:-

$$g = \frac{F}{m} = \text{acc}^n \text{ due to gravity}$$



$$g = \frac{GM}{r^2}$$

$$g = \frac{GM}{(R+h)^2}$$

If we take $h = 0$ (at surface of earth);

$$g = \frac{GM}{R^2}$$

* Variation of 'g' with height:-

$$g = \frac{GM}{r^2} = \frac{GM}{(R+h)^2}$$

$$g' = \frac{gR^2}{(R+h)^2}$$

g' = value of g at some height g .

$$g' = \frac{g}{\left(1 + \frac{h}{R}\right)^2}$$

Physics Notes 12 Science Gravitation Chapter

Anthony Zee



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On Gravity Anthony Zee, 2020-03-10 Of the four fundamental forces of nature gravity might be the least understood and yet the one with which we are most intimate From the months each of us spent suspended in the womb anticipating birth to the moments when we wait for sleep to transport us to other realities we are always aware of gravity In *On Gravity* physicist A Zee combines profound depth with incisive accessibility to take us on an original and compelling tour of Einstein's general theory of relativity Inspired by Einstein's audacious suggestion that spacetime could ripple Zee begins with the stunning discovery of gravity waves He goes on to explain how gravity can be understood in comparison to other classical field theories presents the idea of curved spacetime and the action principle and explores cutting edge topics including black holes and Hawking radiation Zee travels as far as the theory reaches leaving us with tantalizing hints of the utterly unknown from the intransigence of quantum gravity to the mysteries of dark matter and energy Concise and precise and infused with Zee's signature warmth and freshness of style *On Gravity* opens a unique pathway to comprehending relativity and gaining deep insight into gravity spacetime and the workings of the universe Publisher's website [New Paths Towards Quantum Gravity](#) Bernhelm Booß-Bavnbek, Giampiero Esposito, Matthias Lesch, 2010-07-23 Aside from the obvious statement that it should be a theory capable of unifying general relativity and quantum field theory not much is known about the true nature of quantum gravity New ideas and there are many of them for this is an exciting field of research often diverge to a degree where it seems impossible to decide in which of the many possible directions the ongoing developments should be further sustained The division of the book in two overlapping parts reflects the duality between the physical vision and the mathematical construction The former is represented by tutorial reviews on non commutative geometry on space time discretization and renormalization and on gauge field path integrals The latter one by lectures on cohomology on stochastic geometry and on mathematical tools for the effective action in quantum gravity The book will benefit everyone working or entering the field of quantum gravity research [The Singularity](#) Uziel Awret, 2016-11-23 This volume represents the combination of two special issues of the *Journal of Consciousness Studies* on the topic of the technological singularity Could artificial intelligence really out think us and what would be the likely repercussions if it could Leading authors contribute to the debate which takes the form of a target chapter by philosopher David Chalmers plus commentaries from the likes of Daniel Dennett Nick Bostrom Ray Kurzweil Ben Goertzel Frank Tipler among many others Chalmers then responds to the commentators to round off the discussion **The Physical Sciences** V. Lawrence Parsegian, 1968 [Quantum Systems under Gravitational Time Dilation](#) Magdalena Zych, 2017-02-06 This thesis introduces a new theoretical tool to explore the notion of time and temporal order in quantum mechanics the relativistic quantum clock framework It proposes novel thought experiments showing that proper time can display quantum features e.g when a clock runs different proper times in superposition The resulting new physical effects can be tested in near future laboratory experiments with atoms molecules

and photons as clocks The notion of time holds the key to the regime where quantum theory and general relativity overlap which has not been directly tested yet and remains largely unexplored by the theory The framework also applies to scenarios in which causal relations between events become non classical and which were previously considered impossible to address without refuting quantum theory The relativistic quantum clock framework offers new insights into the foundations of quantum theory and general relativity *Matter & Gravity in Newton's Physical Philosophy* Adolph Judah Snow,1926

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