



Relativity Calculator



Web Relativity Calculator site

## Galilean - Newton Relativity vs. Special and General Relativity

### Essential Galilean ( Newton ) Relativity Postulates:

1. absolute time, motion and space as defined in Newton's "Philosophiae Principia Mathematica"
2. lengths or distances are absolute no matter what is the velocity
3. infinitely many inertial frames of reference, each one in relative motion to absolute space
4. universal time throughout space where all inertial frames share this universal time
5. all laws of physics are the same in all inertial frames of reference whether at rest or in motion relative to absolute space
6. speed of light is instantaneous ( information transmission is instantaneous )
7. all possibilities of unbounded, relative motion
8. Newton's Law of Universal Gravitation holds as derived from Newton's "Axioms, or Laws of Motion"
9. inertial frames of reference are related by Galilean rules of transformation - i.e., simple vector addition and subtraction

### Derived Consequence of Galilean ( Newton ) Relativity:

10. action at a distance - corpuscular theory of the ( luminiferous ) aether
11. Euclidean geometry of space - Cartesian or polar coordinates systems
12. Conservation Laws of energy, mass and momentum
13. Gravity attraction is directly related to mass and inversely to absolute distance
14. bodies or objects are constituted of matter whose measure is the amount of ( inertial ) mass
15. energy and mass are distinct entities as is force

note: the above outline framework is somewhat arbitrary as, in truth, the entire package of statements constitutes the Galilean - Newtonian Relativity assumptions.



### The Relativity Postulates:

1). The Principle of Relativity - All the laws of physics in their simplest reduced form are transformable and hence invariant as between an infinite number of moving reference systems ( inertial systems ), each one of which is moving uniformly and rectilinearly with respect to any other system and where no one system is privileged or preferred over any other reference ( inertial ) system when measurements of length or time are taken.

2). The Principle of the Constancy of the Speed of Light - The speed of light in empty ( vacuo ) space is a universal constant as measured in any reference ( inertial ) system when measured with rods and clocks of the same kind. This is always true notwithstanding any "relativistic effects" of either the Lorentz length contraction or time dilation as demonstrated by the Michelson - Morley Experiment ( 1887 ).

3). The Principle of Equivalency in General Relativity - The effects of acceleration upon a body's inertial mass is equivalent to its gravitational mass in an accelerated frame of reference, but this equivalence can be eliminated by choosing an alternative inertial, non - accelerated, frame of reference where acceleration does not exist.

#### Corollaries to The Relativity Postulates:

1. no absolute time, motion or space, rather ( space - time ) spacetime
2. lengths contract at velocities approaching  $c$  relative to stationary observers.
3. infinitely many inertial frames of reference, each one in relative motion to each other
4. each inertial frame has its own time dilation
5. all laws of physics are the same in all inertial frames of reference which leads to the invariance of the speed of light,  $c$
6. speed of light is finite ( information is finite transmitted )
7. all possibilities of unbounded, relative motion with upper limit of velocities of bodies and particles held at  $c$ , speed of light
8. Newton's Law of Universal Gravitation is only true as an approximation of physical reality for relative velocities  $v \ll c$
9. inertial frames of reference are related by ( Fitzgerald - ) Lorentz Transformation rules

#### Further Derived Consequences of Special and General Relativity:

10. no action at a distance, no corpuscular theory of the ( luminiferous ) aether - this is replaced by electromagnetic *field concepts*
11. non - Euclidean ( geo ) metrics of space - Minkowski four - dimensional coordinate geometry
12. Conservation Laws of energy, mass and momentum are maintained but in relativistic terms with finite  $c$
13. Gravitational mass is directly related to spacetime metric curvature which motivates equivalent amounts of acceleration in General Relativity
14. bodies or particles are constituted of particle - waves at the subatomic level in Quantum Theory; at the macro level, gravitational mass better defines mass.
15. energy and mass are equivalent, force being a manifestation of energy

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