

### History of the Universe

Use the diagram explained in the History of the Universe Power Point to fill in the blanks to explain what event occurred at each time and the contents of the universe during each era<sup>34</sup>

TIME	ERA	EVENT OR CONTENTS
$t = 0$		Time begins, expansion begins, all forces united, Supersymmetry ... the universe begins
	Planck	Quantum Foam, nature unknown (also in black holes)
$t \approx 10^{-43}$ sec.		Gravity separates from the other three forces
	GUT	Elementary particles of matter and antimatter (leptons & quarks) forming out of energy
$t \approx 10^{-38}$ sec.		The strong force separates from electroweak
	Inflation	Universe undergoes HUGE, RAPID expansion (due to separation of strong force from electroweak)
	Electroweak	Elementary particle (leptons & quarks) soup
$t \approx 10^{-10}$ sec.		Electromagnetic & Weak forces separate
	Particle	Quarks bind into protons & neutrons (2 no for each 7 p+). Ends with matter/antimatter annihilation ... only matter left
$t \approx 10^{-3}$ sec.		Last matter-antimatter annihilation
	Nucleosynthesis	Nuclei of H, He (+ some others) formed by fusion
$t \approx 3$ min.		Fusion ends ... matter is 75% H nuclei, 25% He nuclei
	Nuclei	Plasma of H and He nuclei and electrons.
$t \approx 500,000$ yr.		The universe begins to become transparent, origin of the Cosmic Background Radiation (CBR)
	Atoms	Nuclei capture electrons to form atoms and the universe becomes transparent.
$t \approx 1,000,000$ yr.		First galaxies form
	Galaxies	Stars, galaxies, puppies, kittens and us!