About 14 billion years ago, our entire universe came into existence in an event called the 1)_____. Because this state of matter, energy, light, space and time were so unimaginably extreme, astronomers prefer to call it the 2)_____. Before this event, mathematical models predict that there was no space, time, matter or energy at all. Just a pure 3)_____. No sooner did the event begin, but space and time began to 4)_____, causing the matter and energy to cool at a fantastic rate. After the first second following the Big Bang, matter and energy were still 1000 times hotter than the center of our sun. No matter where you looked in the universe, all you would see was this intensely hot matter and radiation far brighter than our own 5)_____. It took over three minutes for the universe to cool to the temperature of our own sun's interior. Through 6)_____ reactions, only hydrogen and 7)_____ nuclei were formed, but the intense 8)_____ of light still existed everywhere in space. It would take another million years before the universe had cooled to a few thousand degrees. This allowed then free 9)_____ to combine with the hydrogen and helium nuclei to form normal atoms. After another 100 million years had passed, the intense fireball light had finally dimmed to 10)_____ and the universe entered the 11)_____. During this time, the universe was completely dark with no visible light anywhere. Within this darkness, clouds of hydrogen and helium gas began to form and collapse under their own gravity forming the first generations of stars. These stars exploded as 12)_____ and littered the universe with carbon, 13)_____ and other elements. After 200 million years the first 14)_____ formed, and after another 9 billion years our own sun and 15)_____ formed.

Word Bank

+6 Earth	+2 nuclear	-3 expand
-2 Dark Ages	+9 fireball	+8 helium
-1 sun	+1 galaxies	+15 supernova
+10 Singularity	+4 electrons	+27 invisibility
+5 Big Bang	+7 nothingness	+19 oxygen

Solve these questions and use the integer to find the word from the Word Bank

1) The distance between two galaxies increases from 100 to 500. What is the dilation factor?
2) Distance between the points (+3,+5) and (-3, +13)
3) Solve for x: $3x10^{3} \times 4x10^{x} = 1.2x10^{11}$
4) y=3x+5 and y=2x+2 intersect at the point (x,-4) what is x?
5) Use 2-point distance formula to solve for x: (x,+3) and (+5,+11) where distance = 10.
6) A figure is dilated by 8 and contracted by 4, what is its final dilation factor?
7) Solve for x: $6x10^{15}/3x10^{x} = 2x10^{7}$
8) $T=10^{10}/t^{1/2}$. What is our universe's temperature T after t = 100 seconds: $1x10^{x}$.
9) Slope of the line perpendicular to y = -0.25x+3
10) After universe expanded three times, what was the volume increase?
11) Largest factor (a or b) of $x^{2}+5x+6$: (x+a)(x+b)
12) Distance from (4,2) to (1,-2) after a dilation of 3x
13) T = 2.7 (1+z). At what redshift, z, will the cosmic temperature equal 54 degrees?
14) Solve for intersection of $x^{2}+3x-1$ and y=2x+1 (x,+3)
15) Distance between (3,6) and (0,3) after a dilation of $2^{1/2}$

About 14 billion years ago, our entire universe came into existence in an event called the 1)__**Big Bang**__. Because this state of matter, energy, light, space and time were so unimaginably extreme, astronomers prefer to call it the 2)_**Singularity**__. Before this event, mathematical models predict that there was no space, time ,matter or energy at all. Just a pure 3)_**Nothingness**__. No sooner did the event begin, but space and time began to 4)_**expand**, causing the matter and energy to cool at a fantastic rate. After the first second following the Big Bang, matter and energy were still 1000 times hotter than the center of our sun. No matter where you looked in the universe, all you would see was this intensely hot matter and radiation far brighter than our own 5)__**sun**__. It took over three minutes for the universe to cool to the temperature of our own sun's interior. Through 6)__**nuclear**__ reactions, only hydrogen and 7)_ **helium**__ nuclei were formed, but the intense 8)_**fireball**__ of light still existed everywhere in space. It would take another million years before the universe had cooled to a few thousand degrees. This allowed the free 9)_**electrons**__ to combine with the hydrogen and helium nuclei to form normal atoms. After another 100 million years had passed, the intense fireball light had finally dimmed to 10)__**invisibility**__ and the universe entered the 11)_**Dark Ages**__. During this time, the universe was completely dark with no visible light anywhere. Within this darkness, clouds of hydrogen and helium gas began to form and collapse under their own gravity forming the first generations of stars. These stars exploded as 12)_**supernova**__ and littered the universe with carbon, 13)__**oxygen**__ and other elements. After 200 million years the first 14)__**galaxies**__ formed, and after another 9 billion years our own sun and 15)__**Earth**__ formed.

1) The distance between two galaxies increases from 100 to 500. What is the dilation factor? Answer: 500/100 = +5, word = **Big Bang**

2) Distance between the points (+3,+5) and (-3, +13): $d^2 = (-3-3)^2 + (13-5)^2 = 100$ so d = +10 word = **Singularity**

3) Solve for x: $3x10^3 \times 4x10^x = 1.2x10^{11}$ so 3+x +1 = 11, so x = +7 word = **Nothingness**

4) y=3x+5 and y=2x+2 intersect at the point (x,-4). 3x+5 = 2x+2, so x=-3 and word = **expand**

5) Use 2-point distance formula to solve for x: (x,+3) and (+5,+11) where distance = 10. $100 = (5-x)^2 + (11-3)^2$ so $100 - 64 = (5-x)^2$; $36 = (5-x)^2$ so x = -1 and word = **sun**

6) A figure is dilated by 8 and contracted by 4, what is its final dilation factor? 8/4 = 2 word = **nuclear**.

7) Solve for x: $6x10^{15}/3x10^x = 2x10^7$ answer: 15-x = 7 so x = +8 and word = **helium**

8) $T=10^{10}/t^{1/2}$. What is the universe temperature T after t = 100 seconds: 1x10x. $T = 10^{10}/(100)^{1/2} = 10^9$ so x = +9 and word = **fireball**

9) Slope of the line perpendicular to y = -0.25x+3: answer: m = 4.0 word **= electrons**

10) After universe expanded three times, what was the volume increase? $3^3 = 27$ so word = **invisibility**

11) Largest factor (a or b) of x^2+5x+6 : (x+a)(x+b) a=+3, b=+2 so x=-3, x=-2 and –2 is largest so word = **Dark Ages**.

12) Distance from (4,2) to (1,-2) after a dilation of 3x. Answer: $d^2 = (1-4)^2 + (-2-2)^2 = 25$, d = 5 and 5x3 = 15. Word = **supernova.**

13) T = 2.7 (1+z). At what redshift, z, will the cosmic temperature equal 54 degrees? Answer: 54=2.7(1+z) so z = +19. The word = **oxygen**

14) Solve for intersection of x^2+3x-1 and y=2x+1 (x,+3) : Answer: $x^2+3x-1 = 2x+1$ so x^2+x-2 factors (x+2)(x-1) x=-2, x=+1 The two intersection points are (-2, -3) and (+1, +3) so x = +1 and word = **galaxies**.

15) Distance between (3,6) and (0,3) after a dilation of $2^{1/2}$. Answer: $d^2 = (0-3)^2 + (3-6)^2 = 18$ $d = (18)^{1/2}$ then after dilation $d = (18)^{1/2} \times (2)^{1/2} = (36)^{1/2} = +6$ or -6, but since no word exists for x=-6, we have word = **Earth**.