The Most Massive Stars Known

Star	Mass (Sun= 1)	Diameter (Sun=1)	Luminosity (Sun=1)
R136a1	350	35	10,000,000
Eta Carina	250	195	5,000,000
Peony Nebula	175	100	3,200,000
Pistol Star	150	340	6,300,000
HD269810	150	19	2,200,000
LBV1806	130	200	10,000,000
HD93129a	120	25	5,500,000
HD93250	118	18	5,000,000
S Doradus	100	380	600,000

The picture above shows the Tarantula Nebula in the Large Magellanic Cloud, located 165,000 light years from Earth. Astronomers using data from the Hubble Space Telescope and the European Space Observatory's Very Large Telescope in Chile have recently determined that it harbors the most massive known star in our 'corner' of the universe which they call R136a1. The table lists some of the most massive known stars as of July, 2010.

Problem 1 - From the indicated sizes relative to the Sun, create a scale model that shows the relative sizes of these stars compared to the Sun, assuming that in the scaled model the solar disk has a diameter of 1 millimeter.

Problem 2 - The predicted lifespan of a star depends on its luminosity according to the formula

$$T = \frac{10 \text{ billion years}}{M^{2.5}}$$

For the Sun, M = 1 and so its lifespan is about 10 billion years. A star with 10 times the mass of our Sun, M=10, will last about 30 million years! From the table above, what are the predicted life spans for these 'hypergiant' stars to two significant figures?

Problem 3 - How many generations of a 100 solar-mass hypergiant could pass during the life span of a single star like our own Sun?

Problem 1 - From the indicated sizes relative to the Sun, create a scale model that shows the relative sizes of these stars compared to the Sun, assuming that in the scaled model the solar disk has a diameter of 1 millimeter.

Answer: **Example of calculation: R136a1 diameter = 700x sun, so 700 x 1 mm = 0.7 meters in diameter!**

Problem 2 - The predicted lifespan of a star depends on its luminosity according to the formula

$$T = \frac{10 \text{ billion years}}{M^{2.5}}$$

For the Sun, M = 1 and so its lifespan is about 10 billion years. A star with 10 times the mass of our Sun, M=10, will last about 30 million years! From the table above, what are the predicted lifespans for these 'hypergiant' stars?

Answer:

Star	Mass (Sun=1)	Diameter (Sun=1)	Luminosity (Sun=1)	Lifespan (years)
R136a1	350	35	10,000,000	**4,400**
Eta Carina	250	195	5,000,000	**10,000**
Peony Nebula	175	100	3,200,000	**25,000**
Pistol Star	150	340	6,300,000	**36,000**
HD269810	150	19	2,200,000	**36,000**
LBV1806	130	200	10,000,000	**52,000**
HD93129a	120	25	5,500,000	**63,000**
HD93250	118	18	5,000,000	**66,000**
S Doradus	100	380	600,000	**100,000**

Problem 3 - How many generations of a 100 solar-mass hypergiant could pass during the life span of a single star like our own Sun?

Answer: Life span of our sun is 10 billion years. Life span of a 100 solar-mass hypergiant is 100,000 years, so about 10 billion/100,000 = **100,000 generations** could come and go.