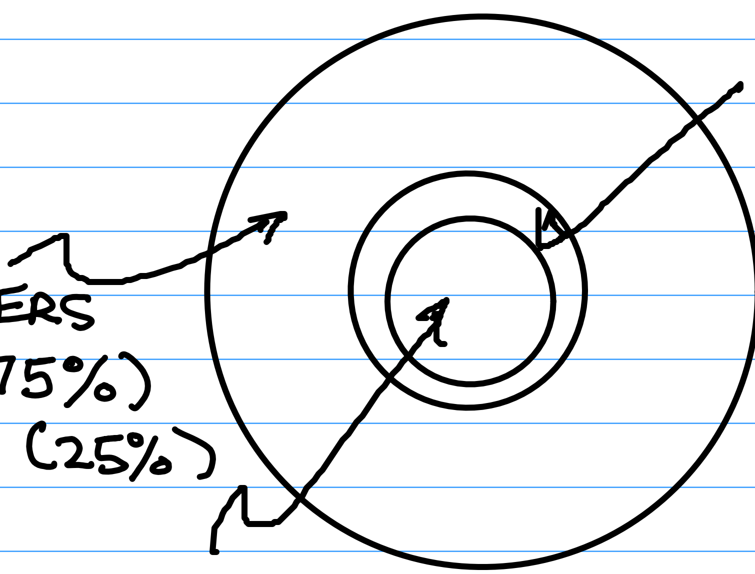
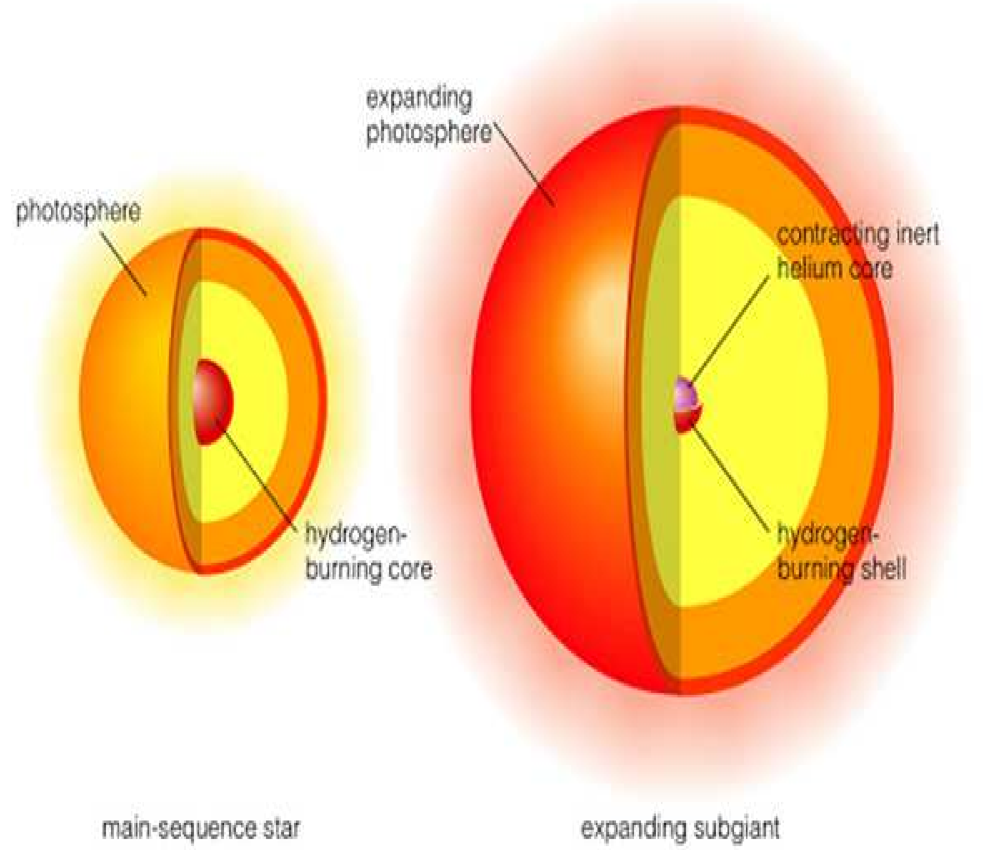
THE FINAL STAGES IN THE LIFE OF A SUN-LIKE STAR

EVENTUALLY ALL OF THE HYDROGEN IN THE CORE IS FUSED INTO HELIUM (IN ABOUT 4.5 – 5 BILLION YEARS).

THE MASS OF THE SUN IS NOT HIGH ENOUGH TO IGNITE THE He-CORE RIGHT AWAY. He-CORE CONTRACTS UNDER ITS GRAVITY AND HEATS UP





THE TEMPERATURE OF CONTRACTING He-CORE IS VERY HIGH AND THE RATE OF HYDROGEN FUSION IN THE SHELL IS VERY HIGH ($\propto T^4$) - IT IS HIGHER THAN THE RATE OF FUSION IN H-CORE DURING THE MAIN SEQUENCE STAGE. THE HIGH RATE OF ENERGY PRODUCTION RESULTS IN HIGH TEMPERATURE AND HIGH GAS PRESSURE WHICH PUSHES THE TOP LAYERS AND THE STAR EXPANDS. AS A RESULT, THE SURFACE TEMPERATURE DROPS BECAUSE THE SURFACE IS AT THE GREATER DISTANCE FROM ENERGY PRODUCING REGION.

THE NET RESULT:

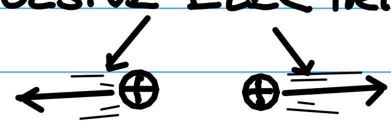
- THE LUMINOSITY INCREASES (MORE ENERGY IS PRODUCED)

- THE SURFACE TEMPERATURE OF THE STAR DROPS AND ITS COLOUR CHANGES TO ORANGE-RED

A STAR LIKE OUR SUN IS IN THE FIRST RED GIANT STAGE (THE SUN WOULD EXPAND TO THE SIZE OF THE ORBIT OF MERCURY; THIS STAGE WOULD LAST FOR 1 BILLION YEARS).

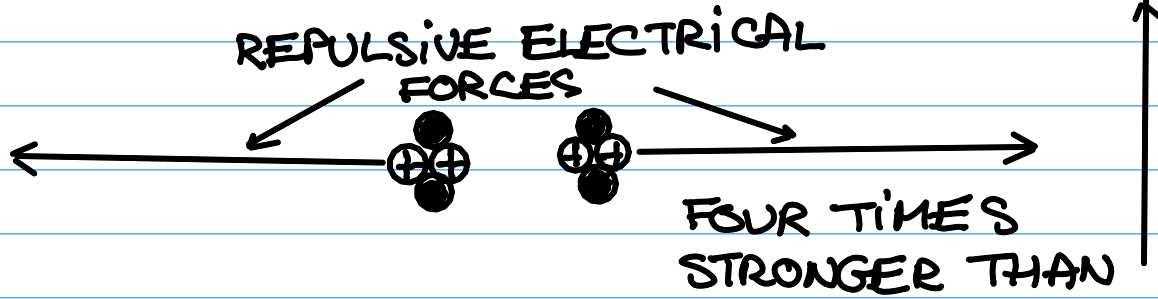
WHEN THE TEMPERATURE OF SHRINKING AND HEATING He CORE REACHES <u>100 MILLION K</u> THE ^{4}He NUCLEI WILL START FUSING INTO ^{12}C.

H-FUSION: REPULSIVE ELECTRICAL FORCES



TEMPERATURE OF AT LEAST 10 MILLION K IS NEEDED FOR THE PROTONS TO GET CLOSE ENOUGH SO THAT THEY CAN BE FUSED INTO ^{2}H BY THE STRONG, BUT SHORT-RANGED, NUCLEAR FORCE

He FUSION:



THE FORCE OF ELECTRICAL REPULSION BETWEEN THE NUCLEI IS PROPORTIONAL TO THE PRODUCT OF THEIR ELECTRIC CHARGES. THUS, HIGHER TEMPERATURE (AT LEAST 100 MILLION K) IS NEEDED TO FUSE ^{4}He INTO ^{12}C.

THE FUSION OF ^{4}He INTO ^{12}C IS ACHIEVED VIA <u>TRIPLE-ALPHA PROCESS</u>.