**Question ##:**

In the science fiction series Star Trek, Captain Kirk orders the starship Enterprise to travel from Earth on a rescue mission to Alpha Centauri (4.2 light-years away). Due to battle damage, the fastest speed that the Enterprise can travel at is just below the speed of light. The crew includes twins and while one of two identical twins is on the mission to Alpha Centauri the other remains on Earth.

1. The Enterprise can only manage a speed of 0.98*c* (*c* = speed of light). At this speed, how long will the starship take to travel to Alpha Centauri and return as seen from Earth?

t = =

At 0.98c 8.4 ÷ 0.98 = 8.572 years (1 mark)

t = 2.71 × 108 s

(2 marks)

1. For the crew on board, what appears to be the time taken to travel to Alpha Centauri and return? (2 marks)

(1 mark)

= 1.706 years (1 mark)

t0 = 5.38 × 107 s

1. On the return to Earth the twins are no longer the same age, one is older. Which twin has aged more and by how much? (2 marks)

The Earth twin is older. (1 mark)

The age difference is 8.572 – 1.706 = 6.866 years. (1 mark)

= 2.17 × 108 s