Higher Special Relativity Answers

1. a) t'- dilated time, t – proper time, v - speed of the object and c – speed of light = $3 \times 10^8 ms^{-1}$.

   b) t' = tɣ.

   c) The dilated time (t') is always greater.

2. a) t' = 20 hours.

    b) t = 5.28ms.

    c) v = $1.66 \times 10^8 ms^{-1}$.

3. At low speeds where **v < 0.4c,** there is no real difference between the dilated time (t')
    and the proper time (t).

    At higher speeds where **v > 0.4c,** a difference is noticeable between the dilated time (t')
    and the proper time (t). **(t' > t)**

    At extremely high speeds where **v > 0.8c**, a big difference is noticeable between
    the dilated time (t') and the proper time (t). **(t' >>> t)**

4. a) t = 50 minutes.

    b) t = 83.3 minutes.

    c) The relativistic effects are only appreciable when an object is travelling at speeds near

       to the speed of light.

5. a) The clock on the spaceship will be running slower than a clock on Earth. However if you were

        the twin on the space mission the clock would have been working correctly as far as you

        were concerned.

    b) 5.7 years.

6. t = 15.2 billion years.

7. v = $1.98 \times 10^8 ms^{-1}$.

8. $t = 2.72 \times 10^{-4}$s.

9. a) l' - contracted length, l – proper length, v - speed of the object and c – speed of light = 3×10^{8}ms^{-1}.

b) l' = l / ɣ.

c) The proper length (l) is always greater.

10. a) l' = 31cm.

b) l = 1519m.

c) $v = 1.92 \times 10^{8}$ms^{-1}.

11. l = 600m.

12. l' = 35.7m.

13. $v = 1.14 \times 10^{8}$ms^{-1}.

14. l = 4.29m.

15. a) $v = 1.40 \times 10^{8}$ms^{-1}.

b) $t = 2.91 \times 10^{8}$s.

c) $t = 2.57 \times 10^{8}$s.