SLE123 – Week 2 – solutions:

1) Similar problem in Week 2 lecture slide

a) 2.47 s

b) 24.25 m/s

2) Because the skier slows steadily, her deceleration is a constant during the glide and we can use the kinematic equations of motion under constant acceleration. Since we know the skier's initial and final speeds and the width of the patch over which she decelerates, we will use Equation 4.

$$v^2{}_f - v^2{}_i = 2a\Delta x$$

Rearrange:

$$a = \frac{v^2{}_f - v^2{}_i}{2\Delta x}$$

Substitute in values:

$$a = \frac{(6.0\,m/s)^2 - (8.0\,m/s)^2}{2(5.0m)} = -2.8\,m/s^2$$

The magnitude of this acceleration is 2.8 m/s^2.

3) Because the car slows steadily, the deceleration is a constant and we can use the kinematic equations of motion under constant acceleration. Since we know the car's initial and final speeds and the width of the patch over which she decelerates, we will use Equation 4.

$$v^2{}_f - v^2{}_i = 2a\Delta x$$

$$2a = \frac{(0m/s - 100m/s)}{150}$$

$$a = -33.33\,m/s^2$$

4) Since we know the eagle's initial speed, its acceleration and the distance over which it accelerates, so we will use Equation 4.

$$v^2{}_f = v^2{}_i + 2a\Delta x$$

$$v^2{}_f = 0\,m/s + 2(5\,m/s^2)(90m) = 30\,m/s$$

Which is 108 km/h.

5) Use kinematic equation 4 from for constant acceleration. Assume the gannet is in free fall during the dive.

$$\left(v_y\right)_f^2 = \left(v_y\right)_i^2 + 2g\Delta y$$

$$\Delta y = \frac{\left(v_y\right)_f^2}{2g} = \frac{(32\,m/s)^2}{2(9.8\,m/s^2)} = 52m$$

More questions for practice solutions: **(Assume $g = 10\ m/s^2$)**

1.1 constant acceleration

$u = 0$

$x = 5\ m$

$t = 1\ sec$

$x = ut + \frac{1}{2}at^2$

$5 = 0 + \frac{1}{2}a(1^2)$

$\Rightarrow 5 = \frac{a}{2}$

$\Rightarrow a = 10\ m/sec^2 \quad (= 10\ m\ sec^{-2})$

$v = u + at$

$= 0 + (10)(1)$

$= 10\ m/sec \quad (= 10\ m\ sec^{-1})$

(either format is acceptable)

1.2 $t = 0.18\ sec$

$u = 50\ km/h = \frac{50000}{3600}\ m/sec \approx 13.8\ m/sec$

$v = 0$

(a) $v = u + at$

$\Rightarrow 0 = 13.8 + a(0.18)$

$\Rightarrow a = -\frac{13.8}{0.18}$

$= -77.2\ m/sec^2$

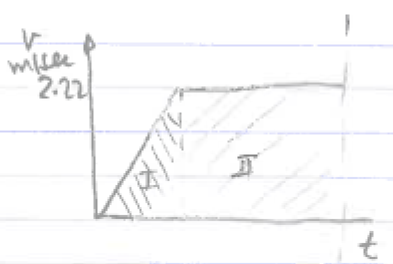
(b) $a = -\frac{77}{10} \times g = -7.7\ g$

1.3 $u = 0$

$v = 8\ km/h = \frac{8 \times 1000}{3600} = 2.22\ m/sec$

$t = 5$

$\Rightarrow a = \frac{v-u}{t} = \frac{2.22}{5} = 0.44$



distance : area I $= \frac{1}{2}(2.22 \times 5) = 5.55$

1.3 (cont)

need to travel $20 - 5.55 = 14.45$ m

time ~~to~~ travel remaining distance $= \frac{14.45}{2.22} = 6.51$ sec

total time $= 5 + 6.51$ sec

$= 11.51$ sec.

(~ 12 sec) (2 significant figures)

1.4.

difference in velocity $= 60 - 50 = 10$ km/h

$= 2.78$ m/sec

(a) To travel the 30 m difference, the red car must travel for $\frac{30}{2.78} = 10.8$ sec

(≈ 11 secs)

(b) The blue car will travel:

$s = v.t$

$= (50\text{ km/h})(10.8)$

$= (13.89\text{ m/sec})(10.8)$

$= 150$ m.