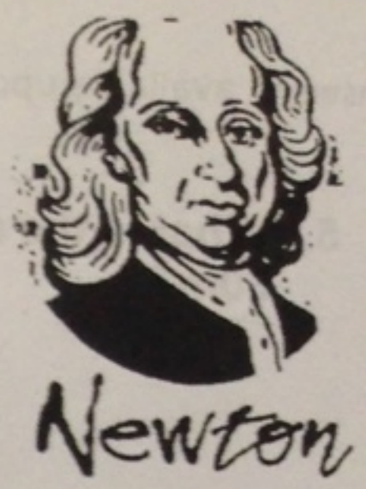
Answers available upon request

Solutions



Kinematics problem

November 8, 2012

NB: for this exercise sheet. round off answers to one decimal place

1. How long does it take a car to decelerate from 80 m/s to 15 m/s at 10 m/s ^{2}

$V_i = 80\ m/s$

$V_f = 15\ m/s$

$a = -10\ m/s^2$

$t = ?$

$t = \frac{V_f - V_i}{a}$

$t = \frac{15-80}{-10}$

$t = \frac{-65}{-10}$

$t = 6.5\ sec$

2. A train accelerates at 2.5 m/s ^{2} from 20 m/s to 30 m/s. What distance does it travel while accelerating?

a V_i V_f

$V_f^2 = V_i^2 + 2ad$

$d = V_f^2 - V_i^2$

$\overline{2a}$

$d = \frac{(30)^2 - (20)^2}{2(2.5)}$

$d = 100\ m$

3. What distance does a car travel while accelerating from 72 km/hr at 11 m/s ^{2} for 5 seconds?

V a t

$V_i = 72\ km/hr \times \frac{1000\ m}{km} \times \frac{1\ hr}{3600}$

$V_i = 20\ m/s$

① $V_f = V_i + at$

$= 20 + (11)(5)$

$V_f = 75\ m/s$

② $d = \frac{V_f^2 - V_i^2}{2a}$

$= \frac{75^2 - 20^2}{2(11)}$

$d = 257.5\ m$

4. What is the acceleration due to gravity on the moon, if an object is dropped 20m above the surface and then hits the surface within 5.0 s ?

d t

$V_i = 0$

$d = \cancel{V_i t}^{0} + \frac{1}{2} a t^2$

$d = \frac{1}{2} a t^2$

$a = \frac{2d}{t^2} = \frac{2(20)}{5^2}$

$a = 1.6\ m/s^2$

Inspired from Kirk/Micheline handouts. (starts at question 5)

Answers available upon request

5. **What is the deceleration of a car if it slows down from 30 m/s to a stop over a distance of 60m?**

d $\quad v_i$ $\quad v_f = 0$

$$v_f^2 = v_i^2 + 2ad$$

$$a = \frac{v_f^2 - v_i^2}{2d}$$

$$a = \frac{0 - (30)^2}{2(60)}$$

$$\boxed{a = -7.5\ m/s^2}$$

6. **What is the final speed of a train that decelerates from 108 km/h at 5 m/s ^{2} for 1.2 seconds**

$v_f = ?$ $\quad v_i$ $\quad a$ $\quad t$

$v_i = 108 km/hr \times 1000 \div 3600$

$v_i = 30 m/s$

$$v_f = v_i + at$$

$$v_f = (30\ m/s) + (-5\ m/s^2)(1.2\ s)$$

$$\boxed{v_f = 24 m/s}$$

7. **What is the acceleration of a flying saucer that goes from 360 km/hr to 540 km/hr over a distance of 20m ?**

v_i $\quad v_f$

$v_i = 360\ km/hr \times \frac{1000}{3600}$

$v_i = 100 m/s$

$v_f = 540 km/hr \times \frac{1000}{3600}$

$v_f = 150 m/s$

$$v_f^2 = v_i^2 + 2ad$$

$$a = \frac{v_f^2 - v_i^2}{2d}$$

$$a = \frac{(150)^2 - (100)^2}{2(20)}$$

$$\boxed{a = 312.5 m/s^2}$$

8. **A ball is thrown straight up into the air at 19.6 m/s How high does it go?**

$$v_f^2 = v_i^2 + 2gd$$

$$\frac{v_f^2 - v_i^2}{2g} = d$$

$$\frac{0 - (19.6)^2}{2(-9.8)} = d$$

$$\boxed{d = 19.6 m}$$

Inspired from Kirk/Micheline handouts. (starts at question 5)