PHYSICS 12

NAME: Key

Kinematics I

1) At an average speed of 31.0 km/h, how far will a cyclist travel in 135 min?

$135\text{ min} \div 60 = 2.25\text{ H}$ $\quad d = v \cdot t$

$= (31.0\text{ km/H})(2.25\text{ H}) = 69.75\text{ km} \approx 70\text{ Km}$

2) If you are driving 100 km/h and you look to the side for 2.0 s, how far do you travel during this inattentive period?

$100\text{ Km/H}\left(\frac{1\text{ H}}{3600\text{ s}}\right)\left(\frac{1000\text{ m}}{1\text{ Km}}\right) = 27.8\text{ m/s}$ $\quad d = v \cdot t$

$= (27.8\text{ m/s})(2.0\text{ s}) = 55.6\text{ m}$

3) A dog runs 100 m away from its master in a straight line in 8.4 s, and then runs halfway back in one-third the time. Calculate its average speed and average velocity.

See notes

4) Two locomotives approach each other on parallel tracks. Each has a speed of 120 km/h with respect to the earth. If they are initially 8.5 km apart, how long will it be before they meet.

See notes

5) A sports car is advertised to be able to stop, from a speed of 100km/h within 45 m. What is its acceleration in m/s? How many *g's* is this? ($1g = 9.8\text{ m/s}^2$)

$100\text{ km/H} = 27.8\text{ m/s}$ $\quad v_f^2 = v_0^2 + 2ad$

$v_0 = 27.8\text{ m/s}$ $\quad d = 45\text{ m}$ $\quad 0 = (27.8)^2 + 2(a)(45)$

$v_f = 0$ $\quad a = ?$ $\quad 0 = 773 + 90a$

$a = \frac{-773}{90}$

$= -8.59\text{ m/s}^2$

6) A car decelerates from a speed of 25 m/s to rest in a distance of 120 m. What was its acceleration?

$v_f = 0$ $\quad v_f^2 = v_0^2 + 2ad$

$v_0 = 25\text{ m/s}$ $\quad = (25)^2 + 2(a)(120)$

$d = 120\text{ m}$

$a = ?$ $\quad -625 = 240a$

$a = -2.60\text{ m/s}^2$

7) A car travelling 90 km/h decelerates at a constant rate of 1.6 m/s^2. Calculate:
   a) distance the car goes before it stops

$V_0 = 90\ km/H = 25\ m/s$

$a = -1.6\ m/s^2$

$V_f = 0$

$V_f^2 = V_0^2 + 2ad$

$0 = 25^2 + 2(-1.6)d$

$d = \frac{-625}{-3.2} = 195\ m$

   b) the time it takes to stop

$V_f = V_0 + at$

$0 = 25 + (-1.6)t$

$t = \frac{-25}{-1.6} = 15.6\ s$

8) A ball player catches a ball 4.0 s after throwing it vertically upward. How high does it go and what was its initial velocity?

at top $V_f = 0$, t in air $= 2.0\ s$

$a = -9.8\ m/s^2$

$V_0 = ?$

$V_f = V_0 + at$

$0 = V_0 + (-9.8)(2)$

$V_0 = 19.6\ m/s^2$

$V_f^2 = V_0^2 + 2ad$

$0 = 19.6^2 + 2(-9.8)d$

$d = 19.6\ m$

9) An applied force causes a 1500 kg car to accelerate at 1.2 m/s^2. The car travels a distance of 80 m, reaching a final speed of 22 m/s. What was the initial speed of the car?

$a = 1.2\ m/s^2$

$d = 80\ m$

$V_f = 22$

$V_0 = ?$

$V_f^2 = V_0^2 + 2ad$

$22^2 = V_0^2 + 2(1.2)(80)$

$V_0^2 = 292$

$V_0 = 17.1\ m/s$

10) A car accelerates from 20 m/s to 35 m/s in 3.4 s. How far does it travel during this time?

$V_0 = 20\ m/s$

$V_f = 35\ m/s$

$t = 3.4\ s$

$a = \frac{\Delta V}{\Delta t}$

$= \frac{35-20}{3.4}$

$a = 4.4\ m/s^2$

$d = V_0 t + \frac{1}{2} a t^2$

$= 20(3.4) + \frac{1}{2}(4.4)(3.4)^2$

$= 68 + 25.4$

$d = 93.4\ m$

11) An 1800 kg car initially travelling at 25 m/s brakes to avoid hitting another car. The car accelerates at -2.4 m/s^2 while braking to a stop. How far does the car travel during its acceleration?

$V_f = 0\ m/s$

$V_0 = 25\ m/s$

$a = -2.4\ m/s^2$

$d = ?$

$V_f^2 = V_0^2 + 2ad$

$0 = 25^2 + 2(-2.4)d$

$d = 130\ m$

12) An astronaut on the moon throws a 5.0 kg wrench vertically upwards with an initial speed of 10 m/s. The acceleration due to gravity on the surface of the moon is one-sixth that on the surface of the earth. What is the maximum height reached by the wrench?

$V_0 = 10 m/s$

$a = -9.8 \div 6 = -1.63 m/s^2$

$V_f = 0$

$V_f^2 = V_0^2 + 2ad$

$0 = 10^2 + 2(-1.63)d$

$d = 30.7 m$

13) A ball is thrown straight down with a speed of 50.0 m/s. What would be its' speed after 2 seconds?

$V_0 = 50 m/s$

$a = 9.8 m/s^2$

$t = 2$

$V_f = V_0 + at$

$= 50 + (9.8)(2)$

$= 69.6 m/s$ ← unit error in answer portion

14) An object moving with uniform acceleration changes its speed from 25 m/s to 45 m/s in 5.0s. What is the acceleration?

$V_f = 45 m/s$

$V_0 = 25 m/s$

$t = 5.0 s$

$a = \frac{\Delta V}{\Delta t}$

$= \frac{20 m/s}{5} = 4 m/s^2$

15) How long would it take a truck to uniformly accelerate from 10 m/s to 30 m/s over a distance of 80m?

$V_f = 30 m/s$

$V_0 = 10 m/s$

$d = 80 m$

$t = ?$

$V_f^2 = V_0^2 + 2ad$

$30^2 = 10^2 + 2a(80)$

$900 = 100 + 160a$

$800 = 160a$

$a = 5 m/s^2$

$V_f = V_0 + at$

$30 = 10 + 5(t)$

$20 = 5t$

$t = 4.0 s$

Answers:

1) 69.8 km
2) 56 m
3) 4.5 m/s
4) 2.2 min
5) -8.6 m/s², .88g's
6) -2.6 m/s²
7) 195 m, 16 s
8) 19.6 m, 19.6 m/s
9) 17 m/s
10) 94 m
11) 130 m
12) 31 m
13) 70 s m/s
14) 4.0 m/s²
15) 4 s