

Problem 1

During a hard sneeze, your eyes might shut for $0.50s$. If you are driving a car at $90km/h$ during such a sneeze, how far does the car move during that time?

(01小題)

the distance=_____m

01: ANS:=12.5

Solution:

$$v = \frac{90km/h * 100m/km}{3600s/h} = 25m/s,$$

in $0.50s$,
the car travels a distance

$$d = vt = 25m/s * 0.5s = 12.5m$$

Problem 2

A car travels up a hill at a constant speed of $35\text{km}/h$ and returns down the hill at a constant speed of $60\text{km}/h$. Calculate the average speed for the round trip.

(01小題)

the average speed=_____km/h

02: ANS:=44.2

Solution:

$$v_{avg} = \frac{D_{up} + D_{down}}{t_{up} + t_{down}} = \frac{2D}{\frac{D}{v_{up}} + \frac{D}{v_{down}}} = \frac{2v_{up}v_{down}}{v_{up} + v_{down}}$$

$$v_{up} = 35\text{km}/h$$

$$\text{and } v_{down} = 60\text{km}/h$$

$$v_{avg} = \frac{2(35)(60)}{35 + 60} = 44.2\text{km}/h$$

Problem 3

The position of an object moving along an x axis is given by $x = 3t - 4t^2 + t^3$, where x is in meters and t in seconds. Find the position of the object at the following values of t: (a) 1s, (b) 2s, (c) 3s, and (d) 4s. (e) What is the object's displacement between $t = 0$ and $t = 4s$? (f) What is average velocity for the time interval from $t = 2s$ to $t = 4s$?

(06小題)

(a)the position of the object=_____

03: ANS:=0

(b)the position of the object=_____

04: ANS:=-2

(c)the position of the object=_____

05: ANS:=0

(d)the position of the object=_____

06: ANS:=12

(e)the object's displacement=_____

07: ANS:=12

(f)the average velocity=____m/s

08: ANS:=7

Solution:

$$(a)x = 3(1) - 4(1)^2 + (1)^3 = 0$$

$$(b)x = 3(2) - 4(2)^2 + (2)^3 = -2$$

$$(c)x = 3(3) - 4(3)^2 + (3)^3 = 0$$

$$(d)x = 3(4) - 4(4)^2 + (4)^3 = 12$$

(e)12

$$(f)v_{avg} = \frac{\Delta x}{\Delta t} = \frac{12 - (-2)}{2} = 7m/s$$

Problem 4

Two trains, each having a speed of $30\text{km}/h$, are headed at each other on the same straight track. A bird that can fly $60\text{km}/h$ flies off the front of one train when they are 60 km apart and heads directly for the other train. On reaching the other train, the bird flies directly back to the first train, and so forth. (We have no idea why a bird would behave in this way.) What is the total distance the bird travels before the trains collide?

(01小題)

x=_____km

09: ANS:=60

Solution:

Recognizing that the gap between the trains is closing at a constant rate of $60\text{km}/h$, the total time that elapses before they crash is

$$t = \frac{60\text{km}}{60\text{km}/h} = 1h$$

During this time, the bird travels a distance of

$$x = vt = (60\text{km}/h)(1h) = 60\text{km}$$

Problem 5

You drive on Interstate 10 from San Antonio to Houston, half the time at 55km/h and the other half at 90km/h . On the way back you travel half the distance at 55km/h and the other half at 90km/h . what is your average speed (a) from San Antonio to Houston, (b) from Houston back to San Antonio, and (c) for the entire trip? (d) What is your average velocity for the entire trip?

(04小題)

(a) $v = \underline{\hspace{2cm}}$ km/h

10: ANS:=72.5

(b) $v = \underline{\hspace{2cm}}$ km/h

11: ANS:=68.3

(c) $v = \underline{\hspace{2cm}}$ km/h

12: ANS:=70

(d) $v = \underline{\hspace{2cm}}$ km/h

13: ANS:=0

Solution:

$$(a) v_{avg} = \frac{55 * \frac{T}{2} + 90 * \frac{T}{2}}{T} = 72.5\text{km/h}$$

$$(b) v_{avg} = \frac{D}{\frac{D/2}{55} + \frac{D/2}{90}} = 68.3\text{km/h}$$

$$(c) v_{avg} = \frac{2D}{\frac{D}{72.5} + \frac{D}{68.3}} = 70\text{km/h}$$

(d) 0

Problem 6

At a certain time a particle had a speed of 18m/s in the positive x direction, and 2.4s later its speed was 30m/s in the opposite direction. What is the average acceleration of the particle during this 2.4s interval?

(01小題)

the average acceleration=_____m/s²

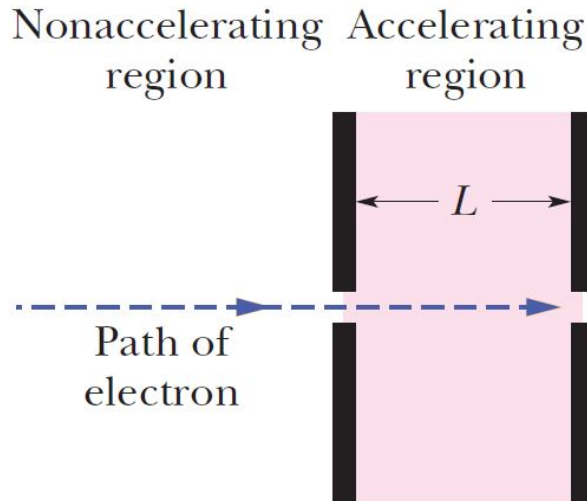
14: **ANS:=-20**

Solution:

$$v = \frac{(-30\text{m/s}) - 18\text{m/s}}{2.4\text{s}} = -20\text{m/s}^2$$

Problem 7

An electron with an initial velocity $v_0 = 1.5 * 10^5 m/s$ enters a region of length $L = 1cm$ where it is electrically accelerated. It emerges with $v_0 = 5.7 * 10^6 m/s$. What is its acceleration, assume constant?



(01小題)

a=_____m/s²

15: ANS:=1.6E15

Solution:

$$v^2 = v_0^2 + 2as$$

$$a = \frac{v^2 - v_0^2}{2s} = \frac{(5.7 * 10^6 m/s)^2 - (1.5 * 10^5 m/s)^2}{2(0.01m)} = 1.6 * 10^{15} m/s^2$$

Problem 8

Suppose a rocket ship in deep space moves with constant acceleration equal to 9.8m/s^2 , which gives the illusion of normal gravity during the flight. (a) If it starts from rest, how long will it take to acquire a speed one-tenth that of light, which travels to $3 * 10^8\text{m/s}$? (b) how far will it travel in so doing?

(02小題)

(a)_____s

16: ANS:=3.1E6

(b)_____m

17: ANS:=4.59E13

Solution:

$$(a)v = at$$

$$t = \frac{v}{a} = \frac{3 * 10^7\text{m/s}}{9.8\text{m/s}^2} = 3.1 * 10^6\text{s} = 35.4\text{d}$$

$$(b)x = \frac{1}{2}at^2 = \frac{1}{2}(9.8\text{m/s}^2)\left(\frac{3 * 10^7\text{m/s}}{9.8\text{m/s}^2}\right)^2 = 4.59 * 10^{13}\text{m}$$

Problem 9

A bird flies north at 20m/s for 15s . It rests for 5s and then flies south at 25m/s for 10s . For the whole trip, find: (a) the average speed: (b) the average velocity: (c) the average acceleration.

(03小題)

(a) the average speed = ____ m/s

18: ANS: = 18.3

(b) the average velocity = ____ m/s

19: ANS: = 1.67

(c) the average acceleration = ____ m/s^2

20: ANS: = 1.5

Solution:

$$(a) \frac{550\text{m}}{30\text{s}} = 18.3\text{m/s}$$

$$(b) \frac{50\text{m}}{30\text{s}} = 1.67\text{m/s}$$

$$(c) \frac{-45\text{m/s}}{30\text{s}} = 1.5\text{m/s}^2$$

nprob= 10 10

Problem 10

The position of a particle is given by $x = 4 - 5t + 3t^2$ m. What is its (a) instantaneous velocity and (b) acceleration ? (02小題)

(a) its instantaneous velocity = _____ [t]

21: ANS:=-5+6*t

(b) its acceleration=_____ m/s²

22: ANS:=6

Problem 10

Following previous problem, (c) at what time is the particle at rest?
(01小題)

the time=_____s

23: ANS:=0.83

Solution:

$$(a) v = \frac{dx}{dt} = -5 + 6t = -5 + (6)(3) = 13m/s$$

$$a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = 6m/s$$

$$(b) v = 0$$

$$t = \frac{5}{6}s = 0.83s$$

nprob= 11 11

Problem 11

A particle with initial position and velocity x_0 and v_0 is moving in one-dimension. Its linear acceleration as a function of time is given as $a(t) = 4t^2 - 3t + 2$. All physical quantities are in SI units. Find $x(t), v(t)$. (02小題)

$$v(t) = \text{_____} [t, x_0, v_0]$$

24: ANS:= $\frac{4}{3}t^3 - \frac{3}{2}t^2 + 2t + v_0$

$$v(t) = \text{_____} [t, x_0, v_0]$$

25: ANS:= $\frac{1}{3}t^4 - \frac{1}{2}t^3 + 2t + v_0t + x_0$

nprob= 12 12

Problem 12

An object falls from a height of h at rest. The gravitational acceleration is g . (03小題)

(a) the velocity when it touches the ground, $v = \underline{\hspace{2cm}}$ [g, h]

26: ANS: $=\sqrt{2*g*h}$

(b) the time of flight, $t = \underline{\hspace{2cm}}$ [g, h]

27: ANS: $=\sqrt{2*h/g}$

(c) the height of the object when its velocity is half of (a). $h' = \underline{\hspace{2cm}}$ h

28: ANS: $=3/4$