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...culty of Science
...hysics Dept.
Physics 110

Home Work # 2 Display Date: 05/2/1439H Chapters Covered: Ch.
Student Name: Anmar Bukhora ID: 1-24-7011 Section:

Q.1 A robotic vehicle, or rover, is exploring the surface of Mars. The stationary Mars lander is ... coordinates, and the surrounding Martian surface lies in the -plane. The rover, which we represe... has - and -coordinates that vary with time:

$x = 2.0\text{ m} - (0.25\text{ m/s}^2)t^2$

$y = (1.0\text{ m/s})t - (0.025\text{ m/s}^3)t^3$

Find the rover's displacement and average velocity vectors for the interval $= 0.0$ s to $= 2.0$ s.

$\vec{r} = x\hat{i} + y\hat{j}$

$= [2-(0,25)t^2]\hat{i} + [1(t)+(0,0025)t^3]\hat{j}$

$t=0 \rightarrow \vec{r}_0 = (2)\hat{i} + 0\hat{j}$

$t=2 \; \vec{r}_2 = (1)\hat{i} + (2,2)\hat{j}$

$\Delta\vec{r} = \vec{r}_2 - \vec{r}_0 = (1)\hat{i} + (2,2)\hat{j} - (2)\hat{i}$

$\Delta\vec{r} = (-1)\hat{i} + (2,2)\hat{j}$

$v_{av} = \frac{\Delta\vec{r}}{\Delta t} = \frac{(-1)\hat{i}+(2,2)\hat{j}}{2-0} = (-0,5)\hat{i} + (1,1)\hat{j}$

Q.2 A motorcycle stunt rider rides off the edge of a cliff. Just at the edge his velocity ... magnitude 9.0 m/s. Find the motorcycle's distance from the edge of the cliff 0.50 s after it ... the cliff.

$x = v_{0x}t = (9\,m/s)(0{,}5s) = 4{,}5\,m$

$y = -\frac{1}{2}gt^2 = -\frac{1}{2}(9{,}8\,m/s^2)(0{,}5s)^2 = -1{,}2\,m$

$r = \sqrt{x^2+y^2} = \sqrt{(4,5)^2+(-1,2)^2} = 4{,}7\,m$

Q.3 Passengers on a carnival ride move at constant speed in a horizontal circle of r... complete circle in 4.0 s. What is their acceleration?

$v = \frac{2\pi R}{T} = \frac{2\pi(5)}{4} = 7{,}9\;m/s$

$a_{rad} = \frac{v^2}{R} = \frac{(7,9)^2}{5} = 12\,m/s^2$

Home Work # 5	Display Date: **27/3/1439H**	Chapter Covered: **Ch.8**
Student Name:	ID:	Section:

Q.1 You throw a ball with a mass of 0.40 kg against a brick wall. It is moving horizontally to the left at 30 m/s when it hits the wall; it rebounds horizontally to the right at 20 m/s. Find the impulse of the net force on the ball during its collision with the wall.

$P_1 = mv = (.4)(-30) = 12$ kg m/s

$P_2 = mv_2 = (.4)(+20) = +8$ kg·m/s

$J = \Delta P = \boxed{20\ N.s}$

$F_{av} = J/\Delta t = \frac{20\ N.s}{.01\ s} = 2000\ N$

Q.2 Two gliders with different masses move toward each other on a frictionless air track. After they collide, glider *B* has a final velocity of +2.0 m/s. What is the final velocity of glider *A*?

→ conservation of momentum

before $v_{A1} = 2$ m/s $v_{B1} = -2$ m/s, $m_A = .5$ kg $m_B = .3$ kg

after $v_{A2} = ?$ $v_{B2} = 20$ m/s

$P_1 = m_A v_{A1x} + m_B v_{B1}$

$= (.5)(2) + (.3)(-2)$ after

$\boxed{= .4\ kg \cdot m/s}$ $\boxed{P_1 = P_2}$

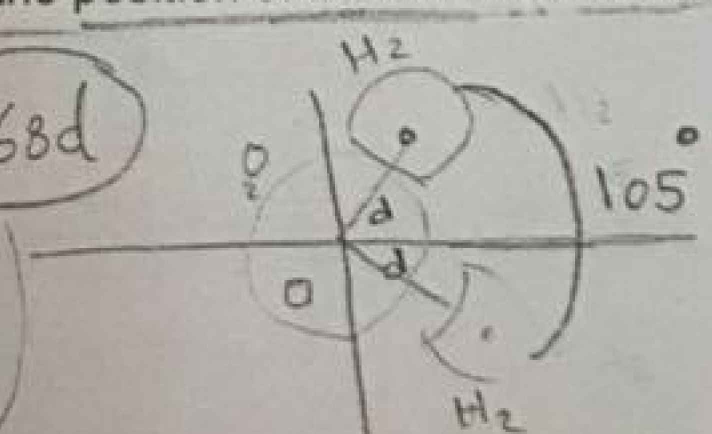
$P_2 = m_A v_{A2} + m_B v_{B2}$ before

$v_{A2} = \frac{P_1 - m_B v_{B2}}{m_A} = \boxed{-.40\ m/s}$

Q.3 A simple model of a water molecule. The oxygen–hydrogen separation is $d = 9.57\times10^{-11}$ m. Each hydrogen atom has mass 1.0 u, and the oxygen atom has mass 16.0 u. Find the position of the center of mass.

$$X_{cm} = \left[\frac{(1u)(d\cos(\frac{105}{2}) + (1u)(d\cos(\frac{105}{2}) + (16)(0)}{1.u + 1.u + 16u}\right] = .068d$$

$$y_{cm} = \left[\frac{(1u)(d\sin(\frac{105}{2}) + (1u)(d\sin(\frac{105}{2}) + (16u)(0)}{1.u + 1.u + 16u}\right] = 0$$



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sub $d = 9.57\times10^{-11}$

$X_{cm} = (.068)(9.57)\times10^{-11} = 6.5\times10^{-12}$ m

Q1)

$\omega = \boxed{10}\ kJ$
$= 10 \times 10^3\ J$
$v_1 = \boxed{2}\ m/s$
$h = \boxed{20cm}$
$v = ?$

$\omega = K_E + U_g$
$\omega = \frac{1}{2} \cancel{m} v^2 + \cancel{m} gh$

$10000 = \frac{1}{2} (v_2 - 2)^2 + 9.8 * 20$

$= -138\ m/s$

Q2) $\omega = \boxed{600}\ N$
$x = 1cm \rightarrow \frac{1}{100} = \boxed{0.01}$
$k = ?$
$\omega = ?$

$k = \frac{F}{x} \Rightarrow \frac{600}{0.01} = 60$
$\omega = \frac{1}{2} kx^2$
$\omega = \frac{1}{2}(6000)(0.01)^2 = 3$

Q3) $m = 12kg$
$d_1 = 2.5\ m$
$\varphi = 30°$
$d_2 = 2.6m$
$F_K?$

$F = mg \sin\varphi$
$F = 12 \times 9.8 \sin 30$
$= 58.8N \Rightarrow F = mg \sin\varphi$

$F_K = 58.8N \rightarrow$ Constanspeed

Home Work # 3 | Display Date: 26/2/1439H | Chapters Covered: Ch.4 & Ch.5

Student Name: | ID: | Section:

Q.1 A 2.49×10^4 N Rolls-Royce Phantom traveling in the +x-direction makes an emergency stop; the x-component of the net force acting on it is -1.83×10^4 N. What is its acceleration?

F=ma a⇒Fm

$m = 2.49 \times 10^4 = 2540.8 kg$

$a = \frac{-1.83 \times 10^4}{2540.8}$

$= -7.2 m/s^2$

Q.2 An elevator and its load have a combined mass of 800 kg. The elevator is initially moving downward at 10.0 m/s; it slows to a stop with constant acceleration in a distance of 25.0 m. What is the tension *T* in the supporting cable while the elevator is being brought to rest?

$v = \frac{d}{t} \Rightarrow t = \frac{25}{10} \Rightarrow t = 2.5 s$

$-v = at$

$\frac{-(-10)}{2.5} = 4 m/s$

$t = (800)(9.8) - 800(4) = 11040 N$

Q.3 You want to move a 500-N crate across a level floor. To start the crate moving, you have to pull with 230-N horizontal force. Once the crate starts to move, you can keep it moving at constant velocity with o[nly] 200 N. What are the coefficients of static and kinetic friction?

$F_s = M_t N$

$230 = \mu s (500)$

$M_s = 0.46$

$F_k = \mu k F N$

$= \frac{200}{500} = 0.40$

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Home Work # 6 | Display Date: **1/4/1439H** | Chapter Covered: **Ch.9 & Ch.10**

Student Name: | ID: | Section:

Q.1 An athlete whirls a discus in a circle of radius 80.0 cm. At a certain instant, the athlete is rotating at 10.0 rad/s and the angular speed is increasing at 50.0 rad/s². For this instant, find the tangential and centripetal components of the acceleration of the discus and the magnitude of the acceleration.

$r = .80\ m$

$\omega = 10\ rad/s$

$\alpha = 50\ rad/s^2$

$a_{tan} = r\alpha = (.8)(50) = 40\ m/s^2$

$a_{rad} = \omega^2 r = (10)(.8) = 80\ m/s^2$

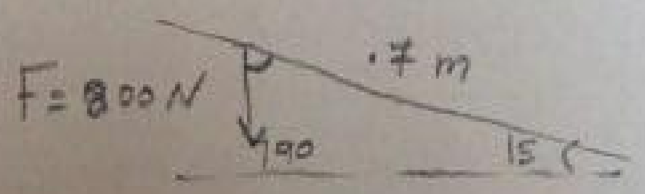
Q.2 You are designing an airplane propeller that is to turn at 2400 rpm. The forward airspeed of the plane is to be 75.0 m/s, and the speed of the propeller tips through the air must not exceed 270 m/s.
a) What is the maximum possible propeller radius?
b) With this radius, what is the radial acceleration of the propeller tip?

$\omega = \left(2400\ \frac{rev}{min}\right)\left(\frac{2\pi\ rad}{1\ rev}\right)\left(\frac{1\ min}{60 s}\right) = 251\ rad/s$

$v_{tip}^2 = v_{plane}^2 + v_{tan}^2 = v_{plane}^2 + r^2\omega^2$

$r^2 = \frac{v_{tip}^2 - v_{plane}^2}{\omega^2}$ $\quad r = \sqrt{\frac{(270)^2 - (75)^2}{251\ rad/s}} = 1.03$

Q.3 A plumber slips a piece of scrap pipe over his wrench handle. He stands on the end of the cheater, applying his 800-N weight at a point 0.70 m from the center of the fitting. The wrench handle and cheater make an angle of 15° with the horizontal. Find the magnitude and direction of the torque he applies about the center of the fitting.



$\theta = 90 + 15 = 105$ $\quad 180 - 105 = 75$

$\tau = F \cdot r \sin\theta$

$= (800)(.7)\sin(75)$

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Home Work # 1 | Display Date: 28/5/1439H | Chapters Covered: Ch.1 & Ch.2
Student Name: | ID: | Section:

Q.1 The world land speed record of 763.0 mi/h. Express this speed in meters per second.

1 mi = 1610 m

1 hr = 3600 sec

$763 \times \frac{1610}{3600}$

Q.2 Given the two displacements $\vec{D} = 6\hat{\imath} + 3\hat{\jmath} - \hat{k}$ m and $\vec{E} = 4\hat{\imath} - 5\hat{\jmath} + 8\hat{k}$ m. Find the magnitude of the displacement $2\vec{D} - \vec{E}$.

2D = 12i + 6j − 2k

(−) E = 4i − 5j + 8k

8i + 11j − 10k

Q.3 The velocity of a car at any time t is given by this equation $v = 60\ m/s + 0.5\ m/s^3\ t^2$.

a) Find the change in velocity of the car in the time interval $t_1 = 1$ s to $t_2 = 3$ s.

b) Find the average acceleration in this time interval.

$\Delta V = V_2 - V_1$

(a) $V_1 = 60,5$

$V_2 = 64,5$

$64,5 - 60,5$

$= 4$ m/s

(b) $a_{ave} = \frac{V_2 - V_1}{t_2 - t}$

$\frac{64,5 - 60,5}{3 - 1} = 2$ m/s²