Solutions PHYS-205A (Final Exam) Spring 2021

Problem 1

No. Acceleration is change in velocity with time. Velocity being zero at one instant is not sufficient to make it zero.

Problem 2

$$\frac{d\vec{P}}{dt} = \vec{F}$$

The resultant force acting on the falling body in this case is gravity. The $\frac{d\vec{P}}{dt}$ is not equal to zero. Thus, $\vec{P}$ is not conserved.

Problem 3

$$[r] = M\frac{L}{T^2}L = ML^2T^{-2}$$

$$[K] = M\frac{L^2}{T^2} = ML^2T^{-2}$$

They are same.

Problem 4

Kinetic energy involves speed, not velocity. Thus, escape velocity does not depend on launch angle.

Problem 5

$\Delta x = ?$ $\quad \Delta y = -0.25\,m$ $\quad v_{iy} = 0$

$\Delta t = \boxed{0.23\,s}$ $\quad \Delta t = \boxed{0.23\,s}$ $\quad v_{fy} =$

$v_{ix} = 750\,\frac{m}{s}$ $\quad a = -9.8\,\frac{m}{s^2}$

$$\Delta y = v_{iy}\Delta t + \frac{1}{2} a \Delta t^2$$

$$-0.25 = 0 + \frac{1}{2}(-9.8)\,\Delta t^2$$

$$\Delta t = 0.23\,s.$$

$$\Delta x = v_{ix}\Delta t$$

$$= (750)(0.23)$$

$$= 170\,m.$$

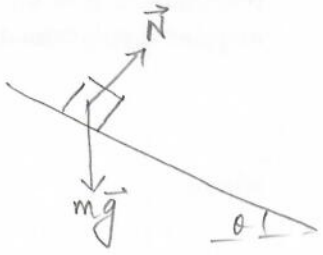
Problem 6

$$\omega = 2\pi \frac{30\ rev}{60\ s} = \pi\ \frac{rad}{s}$$

$$a = \omega^2 R$$

$$= (\pi)^2\, 2.0 = 2.0 \times 10^1\ \frac{m}{s^2}$$

Problem 7



$$\Delta K = W_g + \underbrace{W_N}_{=0}$$

$$= mg\,d\,\cos(90-\theta)$$

$$= (25.0)(9.8)(10.0)\sin(30)$$

$$= 1225\,J = 1200\,J.$$

Problem 8

$v_i = 0$ $\quad \Delta x =$

$v_f = 24.0 \frac{m}{s}$ $\quad \Delta t = 8.00\ s$

$a =$

$$\frac{\Delta x}{\Delta t} = \frac{v_i + v_f}{2}$$

$$\frac{\Delta x}{8.00} = \frac{0 + 24.0}{2}$$

$$\Delta x = 96.0\ m$$

$$\Delta\theta = \frac{\Delta x}{R} = \frac{96.0\ m}{0.300\ m} = 320\ rad.$$

Problem 9

$$I = m_1(a^2+b^2) + m_2(2a)^2 + m_3(a^2+b^2) + m_4 0^2 + m_0 a^2$$

$$= (m_1 + 4m_2 + m_3 + m_0)a^2 + (m_1 + m_3)b^2$$

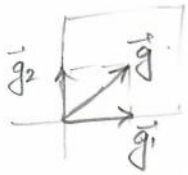
$$= (1.0 + 4(2.0) + 3.0 + 5.0)(10.0\ cm)^2 + (1.0 + 3.0)(20.0\ cm)^2$$

$$= 1700\ kg\ cm^2 + 1600\ kg\ cm^2 = 3300\ kg\ cm^2 = 0.33\ kg\ m^2$$

Problem 10

$$\vec{g} = \vec{g}_1 + \vec{g}_2$$

$$= \frac{GM}{L^2}\hat{i} + \frac{GM}{L^2}\hat{j}$$



magnitude: $|\vec{g}| = \sqrt{2}\frac{GM}{L^2}$

direction: towards center of square.