Phys 2010 (NSCC), Fall 2005
Answers to Problems

Problem Set #1

1. 2.77×10^4 m

2. $33.0 \frac{\text{kg}}{\text{m}^3}$

3. $91.95 \text{ cm}^3 = 9.195 \times 10^{-5} \text{ m}^3$

4. $x = 49.5$, $\theta = 41.3°$.

5. $x = 2.51$, $y = 3.10$

6. $A = 0.415$, Direction $= \theta = 67.8°$.

7. $A_x = -78.2$, $A_y = 34.8$

8. Sum has magnitude 3.72 and direction $\theta = 44.8°$.

Problem Set #2

1. (a) 180 km (b) $63.5 \frac{\text{km}}{\text{hr}}$

2. 1.32 hr, or 79.3 min

3. $0.75 \frac{\text{m}}{\text{s}^2}$

4. $3.44 \frac{\text{m}}{\text{s}}$

5. 4.5 m

6. (a) $1.25 \frac{\text{m}}{\text{s}^2}$ (b) 8.0 s

7. 200 m

8. 1.1 s

Problem Set #3

1. 2.55 s

2. 31.9 m

3. $18.6 \frac{\text{m}}{\text{s}}$ (That is, intial velocity was $-18.6 \frac{\text{m}}{\text{s}}$.)

4. $48.0 \frac{\text{m}}{\text{s}}$ (That is, velocity was $-48.0 \frac{\text{m}}{\text{s}}$.)

5. $7.79 \frac{\text{m}}{\text{s}^2}$

6. 57.8 m

7. $v_x = +13.0 \frac{\text{m}}{\text{s}}$, $v_y = 6.0 \frac{\text{m}}{\text{s}}$

8. $x = 36$ m, $y = 12$ m

Problem Set #4

1. 3.19 s

2. $36.1 \frac{\text{m}}{\text{s}}$

3. 2.99 s

4. 3.97 m; Yes.

5. $36.0 \frac{\text{m}}{\text{s}}$

6. 4.72 s

7. 7.50×10^3 N; 50.0 m

8. 64 N

Problem Set #5

1. $g_{\text{Titan}} = 1.35 \frac{\text{m}}{\text{s}^2}$

2. 4.4×10^{-9} N

3. $T_1 = 94.4$ N, $T_2 = 35.4$ N.

4. $T_1 = 256$ N, $T_2 = 164$ N, $T_3 = 196$ N.

5. $a = 2.8 \frac{\text{m}}{\text{s}^2}$, $T = 14$ N.

6. $a = 3.6 \frac{\text{m}}{\text{s}^2}$, $F_N = 27.8$ N.

7. $a = 5.9 \frac{\text{m}}{\text{s}^2}$

8. $a = 3.5 \frac{\text{m}}{\text{s}^2}$

Problem Set #6

1. $F_{\text{k}} = 3.44$ N

2. $F_{\text{N}} = 16.1$ N, $\mu_{\text{k}} = 0.21$

3. $a = 0.49 \frac{\text{m}}{\text{s}^2}$

4. $x = 800$ m.

5. $T = 20$ N

6. $F_{\text{k}} = 8.4$ N. $\mu_{\text{k}} = 0.43$

7. $v = 7.85 \frac{\text{m}}{\text{s}}$, $a_{\text{cent}} = 51.3 \frac{\text{m}}{\text{s}^2}$, $F_{\text{cent}} = 103$ N

8. $T = 2.36 \times 10^5$ s $= 2.7$ days.

Problem Set #7

1. $T = 1.8$ s, $v = 0.28 \frac{\text{m}}{\text{s}}$

2. $a_{\text{cent}} = 0.973 \frac{\text{m}}{\text{s}^2}$, 2.4×10^{-3} N. Force comes from static friction.

3. $\mu_{\text{s}} = 0.099$

4. $T = 3.53$ N

5. $W = 1.6 \times 10^3$ J

6. $v = 160 \frac{\text{m}}{\text{s}}$

7. $d = 2.04$ m

8. $h = 0.459$ m

Problem Set #8

1. $v = 2.58 \frac{\text{m}}{\text{s}}$

2. $1.92 \frac{\text{m}}{\text{s}}$

3. $v = 11.6 \frac{\text{m}}{\text{s}}$

4. $W = -1.03 \times 10^4$ J, $F_{\text{av}} = 2.06 \times 10^3$ N.

5. 0.168 J

6. $P = 8.00$ W

7. $W = 2.06 \times 10^4$ J

8. 686 W

Problem Set #9

1. $J = 6.3 \frac{\text{kg}\cdot\text{m}}{\text{s}}$, $F_{\text{av}} = 3.15 \times 10^3$ N

2. $v = 65.2 \frac{\text{m}}{\text{s}}$

3. $t = 62.1$ s

4. $v = 2.2 \frac{\text{m}}{\text{s}}$; details of collision don't matter.

5. $v = 1.8 \frac{\text{m}}{\text{s}}$, 2.2×10^4 J of KE lost.

6. $v_1' = +8.57 \frac{\text{cm}}{\text{s}}$, $v_2' = 28.6 \frac{\text{cm}}{\text{s}}$

7. $v = 1.53 \frac{\text{m}}{\text{s}}$

8. $v = 528 \frac{\text{m}}{\text{s}}$

Problem Set #10

1. $\theta = 25.6$ rad $= 1.47 \times 10^3$ deg $= 4.07$ rev

2. (a) 123 m, (b) 2.15 m, (c) 773 m

3. $4.19 \times 10^{-2} \frac{\text{rad}}{\text{s}^2}$

4. $\theta = 3.20$ rad $= 183$ deg

5. $a_T = 0.34 \frac{\text{m}}{\text{s}^2}$

6. $v_T = 1.02 \frac{\text{m}}{\text{s}}$

7. $v_{CM} = 0.30 \frac{\text{m}}{\text{s}}$

8. $\tau_{\text{net}} = +32.4 \text{ N}\cdot\text{m}$

Problem Set #11

1. $T = 385$ N

2. $T_1 = 26.7$ N, $T_2 = 53.3$ N

3. $T_1 = 40.0$ N, $T_2 = 47.7$ N, $T_3 = 62.2$ N

4. $x = 4.25$ N

5. $R = 9.07$ cm

6. $I = 1.17 \text{ kg}\cdot\text{m}^2$

7. $\tau = 9.25 \times 10^{-2} \text{ N}\cdot\text{m}$

8. $T = 177$ N

Problem Set #12

1. KE $= 276$ J

2. (a) $\text{KE}_{\text{trans}} = 500$ J, (b) $\text{KE}_{\text{rot}} = 250$ J, (c) $\text{KE}_{\text{tot}} = 750$ J.

3. $a = \frac{5}{7} g \sin\theta$

4. $\omega_f = 50.0\,\frac{\text{rad}}{\text{s}} = 8.00\,\frac{\text{rev}}{\text{s}}$.
5. $\omega_f = 3.58\,\frac{\text{rad}}{\text{s}} = 0.569\,\frac{\text{rev}}{\text{s}}$.
6. $\Delta\text{KE} = +539$ J.
7. (a) $F_x = +24.0$ N. (b) $a_x = 60\,\frac{\text{m}}{\text{s}^2}$
8. (a) $k = 575\,\frac{\text{N}}{\text{m}}$. (b) $W = 46.0$ J.

Problem Set #13

1. $k = 3.95\,\frac{\text{N}}{\text{m}}$
2. $k = 2.51\,\frac{\text{N}}{\text{m}}$, $T = 0.627$ s
3. $E_{\text{tot}} = 0.153$ J
4. $v_{\max} = 0.783\,\frac{\text{m}}{\text{s}}$, $a_{\max} = 17.5\,\frac{\text{m}}{\text{s}^2}$
5. $l = 59.6$ m
6. $T = 37.5$ s.
7. $T = 2.32$ s
8. $v = 3.9\,\frac{\text{m}}{\text{s}}$

Problem Set #14

1. $\lambda = 5.7$ mm
2. $T = 1.14 \times 10^{-8}$ s, $\lambda = 3.4$ m
3. $F = 30.0$ N
4. $v = 25.8\,\frac{\text{m}}{\text{s}}$
5. $I = 7.96 \times 10^{-2}\,\frac{\text{W}}{\text{m}^2}$
6. $\beta = 109$ dB
7. $f_o = 363$ Hz
8. $f_o = 294$ Hz