

**Halliday, Resnick, and Walker *Fundamentals of Physics 10e* Problem Answers**  
**Volume 1**

**Chapter 1 Answers**

1	(a) $4.00 \times 10^4 \text{ km}$ ; (b) $5.10 \times 10^8 \text{ km}^2$ ; (c) $1.08 \times 10^{12} \text{ km}^3$
2	0.18 points <sup>2</sup>
3	(a) $10^9 \mu\text{m}$ ; (b) $10^{-4}$ ; (c) $9.1 \times 10^5 \mu\text{m}$
4	(a) 1.9 picas; (b) 23 points
5	(a) 160 rods; (b) 40 chains
6	(a) $8.33 \times 10^{-2}$ , $2.08 \times 10^{-2}$ , $6.94 \times 10^{-3}$ , $3.47 \times 10^{-3}$ ; (b) 0.250, $8.33 \times 10^{-2}$ , $4.17 \times 10^{-2}$ ; (c) 0.333, 0.167; (d) 0.500; (e) 14.0 medios; (f) $4.86 \times 10^{-2} \text{ cahiz}$ ; (g) $3.24 \times 10^4 \text{ cm}^3$
7	$1.1 \times 10^3 \text{ acre-feet}$
8	(a) 60.8 W; (b) 43.3 Z
9	$1.9 \times 10^{22} \text{ cm}^3$
10	15°
11	(a) 1.43; (b) 0.864
12	$3.1 \mu\text{m/s}$
13	(a) 495 s; (b) 141 s; (c) 198 s; (d) -245 s
14	(a) 52.6 min; (b) 4.9%
15	$1.21 \times 10^{12} \mu\text{s}$
16	(a) $3.88 \times 10^8 \text{ rotations}$ ; (b) 1557.806 448 872 75 s; (c) $\pm 3 \times 10^{-11} \text{ s}$
17	C, D, A, B, E; the important criterion is the consistency of the daily variation, not its magnitude
18	2.1 h
19	$5.2 \times 10^6 \text{ m}$

20	(a) $2.69 \times 10^5 \text{ cm}^3$ ; (b) 0.77 y
21	$9.0 \times 10^{49}$ atoms
22	(a) $1.430 \text{ m}^2$ ; (b) 72.84 km
23	(a) $1 \times 10^3 \text{ kg}$ ; (b) 158 kg/s
24	0.260 kg
25	$1.9 \times 10^5 \text{ kg}$
26	(a) $2 \times 10^3 \text{ m}^3$ , $2 \times 10^4 \text{ m}^3$ ; (b) $2 \times 10^6$ bottles, $2 \times 10^7$ bottles; (c) $2 \times 10^6 \text{ kg}$ , $2 \times 10^7 \text{ kg}$
27	(a) $1.18 \times 10^{-29} \text{ m}^3$ ; (b) 0.282 nm
28	1 kilomole
29	$1.75 \times 10^3 \text{ kg}$
30	(a) 4.21 s; (b) 23.2 g; (c) $2.89 \times 10^{-2} \text{ kg/min}$ ; (d) - $6.05 \times 10^{-3} \text{ kg/min}$
31	1.43 kg/min
32	(a) $1.0 \text{ m}^3$ ; (b) $6.0 \times 10^{-4} \text{ m}^3$
33	(a) 293 U.S. bushels; (b) $3.81 \times 10^3$ U.S. bushels
34	403 L
35	(a) 22 pecks; (b) 5.5 Imperial bushels; (c) 200 L
36	(a) 0.900, $7.50 \times 10^{-2}$ , $1.56 \times 10^{-3}$ , $8.32 \times 10^{-6}$ ; (b) 1.00, $8.33 \times 10^{-2}$ , $1.74 \times 10^{-3}$ , $9.24 \times 10^{-6}$ ; (c) 12.0, 1.00, $2.08 \times 10^{-2}$ , $1.11 \times 10^{-4}$ ; (d) 576, 48, 1.00, $5.32 \times 10^{-3}$ ; (e) $1.08 \times 10^5$ , $9.02 \times 10^3$ , 188, 1.00 (f) $1.96 \text{ m}^3$
37	$8 \times 10^2 \text{ km}$
38	(a) 14.5 roods; (b) $1.47 \times 10^4 \text{ m}^2$
39	(a) 18.8 gallons; (b) 22.5 gallons
40	$6.0 \times 10^{26}$ atoms
41	0.3 cord
42	(a) $3.0 \times 10^{-26} \text{ kg}$ ; (b) $5 \times 10^{46}$ molecules
43	3.8 mg/s
44	$1.3 \times 10^9 \text{ kg}$

45	(a) yes; (b) 8.6 universe seconds
46	$0.020 \text{ km}^3$
47	$0.12 \text{ AU/min}$
48	$10 \text{ u}$
49	(a) 3.88; (b) 7.65; (c) $156 \text{ ken}^3$ ; (d) $1.19 \times 10^3 \text{ m}^3$
50	$5.95 \text{ km}$
51	(a) 3.9 m, 4.8 m; (b) $3.9 \times 10^3 \text{ mm}$ , $4.8 \times 10^3 \text{ mm}$ ; (c) $2.2 \text{ m}^3$ , $4.2 \text{ m}^3$
52	$\approx 1 \times 10^{36}$
53	(a) $4.9 \times 10^{-6} \text{ pc}$ ; (b) $1.6 \times 10^{-5} \text{ ly}$
54	(a) $11.3 \text{ m}^2/\text{L}$ ; (b) $1.13 \times 10^4 \text{ m}^{-1}$ ; (c) $2.17 \times 10^{-3} \text{ gal/ft}^2$ ; (d) number of gallons to cover a square foot
55	(a) 3 nebuchadnezzars, 1 methuselah; (b) 0.37 standard bottle; (c) 0.26 L
56	4.4
57	10.7 habaneros
58	1.2 m
59	700 to 1500 oysters
60	(a) 2.5 cups, 2 teaspoons; (b) 0.5 quart; (c) 2 teaspoons; (d) 1 teaspoon

## Chapter 2 Answers

1	13 m
2	(a) 1.74 m/s; (b) 2.14 m/s
3	(a) +40 km/h; (b) 40 km/h
4	48 km/h

5	(a) 0; (b) $-2$ m; (c) 0; (d) 12 m; (e) $+12$ m; (f) $+7$ m/s
6	5.554 s
7	60 km
8	(a) 0.50 m/s; (b) 10 s
9	1.4 m
10	(a) method 1; (b) $5.76 \times 10^{-4}$
11	128 km/h
12	(a) 48.0 m; (b) 2.5 m/s; (c) downstream
13	(a) 73 km/h; (b) 68 km/h; (c) 70 km/h; (d) 0
14	5.9 m
15	(a) $-6$ m/s; (b) $-x$ direction; (c) 6 m/s; (d) decreasing; (e) 2 s; (f) no
16	(a) 0; (b) 4.0 m; (c) $-0.82$ s; (d) 0.82 s; (f) $+20t$ ; (g) increase
17	(a) 28.5 cm/s; (b) 18.0 cm/s; (c) 40.5 cm/s; (d) 28.1 cm/s; (e) 30.3 cm/s
18	(a) 54 m; (b) 18 m/s; (c) $-12$ m/s <sup>2</sup> ; (d) 64 m; (e) 4.0 s; (f) 24 m/s; (g) 2.0 s; (h) $-24$ m/s <sup>2</sup> ; (i) 18 m/s
19	$-20$ m/s <sup>2</sup>

20	(a) 1.2 s; (b) 0; (c) positive; (d) negative
21	(a) 1.10 m/s; (b) 6.11 mm/s <sup>2</sup> ; (c) 1.47 m/s; (d) 6.11 mm/s <sup>2</sup>
22	(a) m/s <sup>2</sup> ; (b) m/s <sup>3</sup> ; (c) 1.0 s; (d) 82 m; (e) -80 m; (f) 0; (g) -12 m/s; (h) -36 m/s; (i) -72 m/s; (j) -6 m/s <sup>2</sup> ; (k) -18 m/s <sup>2</sup> ; (l) -30 m/s <sup>2</sup> ; (m) -42 m/s <sup>2</sup>
23	$1.62 \times 10^{15} \text{ m/s}^2$
24	(a) $(2.6 \times 10^4)g$ ; (b) $(1.3 \times 10^2)g$
25	(a) 30 s; (b) 300 m
26	(a) 0.100 m
27	(a) +1.6 m/s; (b) +18 m/s
28	(a) 5.00 s; (b) 61.5 m
29	(a) 10.6 m; (b) 41.5 s
30	(a) 2.5 s
31	(a) $3.1 \times 10^6 \text{ s}$ ; (b) $4.6 \times 10^{13} \text{ m}$
32	21g
33	(a) 3.56 m/s <sup>2</sup> ; (b) 8.43 m/s
34	(a) -50 km/h; (b) -2.0 m/s <sup>2</sup>
35	0.90 m/s <sup>2</sup>
36	(a) 56.6 s; (b) 31.8 m/s
37	(a) 4.0 m/s <sup>2</sup> ; (b) +x

38	(a) 32.9 m/s; (b) 49.1 s; (c) 11.7 m/s
39	(a) $-2.5 \text{ m/s}^2$ ; (b) 1; (d) 0; (e) 2
40	(a) either; (b) neither
41	40 m
42	(a) 15.0 m; (b) 94 km/h
43	(a) $0.994 \text{ m/s}^2$
44	(a) 3.70 m/s; (b) 1.74 m/s; (c) 0.154 m
45	(a) 31 m/s; (b) 6.4 s
46	(a) 183 m/s; (b) no
47	(a) 29.4 m; (b) 2.45 s
48	(a) 1.54 s; (b) 27.1 m/s
49	(a) 5.4 s; (b) 41 m/s
50	9.6 m/s
51	(a) 20 m; (b) 59 m
52	(a) 0.45 s; (b) 38 m/s; (c) 42 m/s
53	4.0 m/s
54	(a) 12.3 m/s
55	(a) $857 \text{ m/s}^2$ ; (b) up
56	3.0 m/s
57	(a) $1.26 \times 10^3 \text{ m/s}^2$ ; (b) up
58	(a) 3.41 s; (b) 57 m
59	(a) 89 cm; (b) 22 cm
60	26 m
61	20.4 m

62	(a) 350 ms; (b) 82 ms
63	2.34 m
64	(a) $8.0 \text{ m/s}^2$ ; (b) 20 m/s
65	(a) 2.25 m/s; (b) 3.90 m/s
66	(a) 0.13 m; (b) 0.50 m
67	0.56 m/s
68	5.0 m/s
69	100 m
70	15.6 m/s
71	(a) 2.00 s; (b) 12 cm; (c) $-9.00 \text{ cm/s}^2$ ; (d) right; (e) left; (f) 3.46 s
72	(a) 15.7 m/s; (b) 12.5 m; (c) 82.3 m
73	(a) 82 m; (b) 19 m/s
74	1.3 s
75	(a) 0.74 s; (b) $6.2 \text{ m/s}^2$
76	(a) $D_{23}/v_p$ ; (b) $t_r + v_p/2a + (D_{12} - d)/v_p$
77	(a) $3.1 \text{ m/s}^2$ ; (b) 45 m; (c) 13 s
78	yes, 0, 10 m/s
79	17 m/s
80	(a) $5.0 \text{ m/s}^2$ ; (b) 4.0 s; (c) 6.0 s; (d) 90 m
81	+47 m/s
82	39 m/s
83	(a) 1.23 cm; (b) 4 times; (c) 9 times; (d) 16 times; (e) 25 times
84	(a) 25g; (b) 400 m

85	25 km/h
86	(a) 18 m/s; (b) 83 m
87	1.2 h
88	(a) 5.00 m/s; (b) 1.67 m/s <sup>2</sup> ; (c) 7.50 m
89	$4H$
90	(a) 15 m; (b) 2.0 m/s; (c) $-2.0 \text{ m/s}^2$ ; (d) 3.5 m/s; (e) 0
91	(a) 3.2 s; (b) 1.3 s
92	(a) 60.6 s; (b) 36.3 m/s
93	(a) 8.85 m/s; (b) 1.00 m
94	34 m
95	(a) $2.0 \text{ m/s}^2$ ; (b) 12 m/s; (c) 45 m
96	(a) 38.1 m; (b) 9.02 m/s; (c) down; (d) 14.5 m/s; (e) up
97	(a) 48.5 m/s; (b) 4.95 s; (c) 34.3 m/s; (d) 3.50 s
98	1.5 s
99	22.0 m/s
100	(a) 17 s; (b) 290 m
101	(a) $v = (v_0^2 + 2gh)^{0.5}$ ; (b) $t = [(v_0^2 + 2gh)^{0.5} - v_0]/g$ ; (c) same as (a); (d) $t = [(v_0^2 + 2gh)^{0.5} + v_0]/g$ , greater
102	8.4 m
103	414 ms
104	(a) 80 m/s; (b) 110 m/s; (c) $20 \text{ m/s}^2$
105	90 m



106	(a) 3.0 s; (b) 9.0 m
107	0.556 s
108	$2.78 \text{ m/s}^2$
109	(a) $0.28 \text{ m/s}^2$ ; (b) $0.28 \text{ m/s}^2$
110	94 m
111	(a) 10.2 s; (b) 10.0 m
112	3.75 ms
113	(a) 5.44 s; (b) 53.3 m/s; (c) 5.80 m
114	(a) $9.08 \text{ m/s}^2$ ; (b) 0.926g; (c) 6.12 s; (d) $15.3T_r$ ; (e) braking; (f) 5.56 m
115	2.3 cm/min
116	217 m/s
117	0.15 m/s
118	(a) 3.5; (b) $(5.0 \text{ m})/v_s$
119	(a) 1.0 cm/s; (b) 1.6 cm/s, 1.1 cm/s, 0; (c) $-0.79 \text{ cm/s}^2$ ; (d) 0, $-0.87 \text{ cm/s}^2$ , $-1.2 \text{ cm/s}^2$

### Chapter 3 Answers

1	(a) -2.5 m; (b) -6.9 m
2	(a) 13 m; (b) 7.5 m
3	(a) 47.2 m; (b) $122^\circ$
4	(a) 0.349 rad; (b) 0.873 rad; (c) 1.75 rad; (d) $18.9^\circ$ ; (e) $120^\circ$ ; (f) $441^\circ$
5	(a) 156 km; (b) $39.8^\circ$ west of due north
6	(a) 4.28 m; (b) 11.7 m