Halliday, Resnick, and Walker, *Fundamentals of Physics 10e* Question Answers
Volume 2

Chapter 21 Answers

1	3, 1, 2, 4 (zero)
2	(a) 3, 1, 2; (b) all tie
3	*a* and *b*
4	(a) between; (b) positively charged; (c) unstable
5	$2kq^2/r^2$, up the page
6	(a) neutral; (b) negatively
7	*b* and *c* tie, then *a* (zero)
8	*a* and *d* tie, then *b* and *c* tie
9	(a) same; (b) less than; (c) cancel; (d) add; (e) adding components; (f) positive direction of *y*; (g) negative direction of *y*; (h) positive direction of *x*; (i) negative direction of *x*
10	$6kq^2/d^2$, leftward
11	(a)+4*e*; (b) -2*e* upward; (c) -3*e* upward; (d) -12*e* upward
12	(a) 1–3, positive direction of *x*; 4, negative direction of *x*; (b) 1 and 2 tie, then 3 and 4 tie

Chapter 22 Answers

1	*a*, *b*, *c*
2	$q/4\pi\varepsilon_0 d^2$, leftward
3	(a) yes; (b) toward; (c) no (the field vectors are not along the same line); (d) cancel; (e) add; (f) adding components; (g) toward negative *y*
4	2, 4, 3, 1 (zero)

5	(a) to their left; (b) no
6	(a) 3, then 1 and 2 tie (zero); (b) all tie; (c) 1 and 2 tie, then 3
7	(a) 4, 3, 1, 2; (b) 3, then 1 and 4 tie, then 2
8	(a) positive; (b) same
9	*a, b, c*
10	(a) rightward; (b) $+q_1$ and $-q_3$, increase; $+q_2$, decrease; *n*, same
11	*e, b*, then *a* and *c* tie, then *d* (zero)
12	*b*
13	*a, b, c*
14	all tie

Chapter 23 Answers

1	(a) 8 N·m^2/C; (b) 0
2	all tie
3	all tie
4	(a) all tie; (b) *a* uniform, *b* variable, *c* uniform, *d* variable
5	all tie
6	either 2σ, σ, 3σ or 3σ, σ, 2σ
7	*a, c*, then *b* and *d* tie (zero)
8	(a) *a, b, c, d*; (b) *a* and *b* tie, then *c, d*
9	(a) 2, 1, 3; (b) all tie ($+4q$)
10	(a) all tie ($E = 0$); (b) all tie
11	(a) impossible; (b) $-3q_0$; (c) impossible
12	(a) all tie (zero); (b) all tie

Chapter 24 Answers

1	$-4q/4\pi\varepsilon_0 d$
2	(a) 1, then 2 and 3 tie; (b) 3

3	(a) 1 and 2; (b) none; (c) no; (d) 1 and 2, yes; 3 and 4, no
4	(a) 2, 4, and then a tie of 1, 3, and 5 (where $E = 0$); (b) negative x direction; (c) positive x direction
5	(a) higher; (b) positive; (c) negative; (d) all tie
6	b, then a, c, and d tie
7	(a) 0; (b) 0; (c) 0; (d) all three quantities still 0
8	(a) positive; (b) positive; (c) negative; (d) all tie
9	(a) 3 and 4 tie, then 1 and 2 tie; (b) 1 and 2, increase; 3 and 4, decrease
10	(a) $Q/4\pi\varepsilon_0 R$; (b) $Q/4\pi\varepsilon_0 R$; (c) $Q/4\pi\varepsilon_0 R$; (d) a, b, c
11	a, b, c
12	(a) B; (b) A; (c) A; (d) alpha particle, then electron and proton tie

Chapter 25 Answers

1	a, 2; b, 1; c, 3
2	(a) $C/3$; (b) $3C$; (c) parallel
3	(a) no; (b) yes; (c) all tie
4	(a) 2; (b) 3; (c) 1

5	(a) same; (b) same; (c) more; (d) more
6	(a) less; (b) less; (c) less; (d) less
7	a, series; b, parallel; c, parallel
8	(a) $V/3$; (b) $CV/3$; (c) $CV/3$ (not CV)
9	(a) increase; (b) same; (c) increase; (d) increase; (e) increase; (f) increase;
10	(a) increase; (b) increase; (c) decrease; (d) decrease; (e) same, increase, increase, increase
11	parallel, C_1 alone, C_2 alone, series

Chapter 26 Answers

1	tie of A, B, and C, then tie of $A + B$ and $B + C$, then $A + B + C$
2	b, a, c
3	(a) top-bottom, front-back, left-right; (b) top-bottom, front-back, left-right; (c) top-bottom, front-back, left-right; (d) top-bottom, front-back, left-right
4	a, b, and c all tie, then d (zero)
5	a, b, and c all tie, then d
6	(a) all tie; (b) B, C, A; (c) B, C, A
7	(a) B, A, C; (b) B, A, C
8	(a) 1 and 2 tie, then 3; (b) 1 and 2 tie, then 3; (c) 1 and 2 tie, then 3

9	(a) C, B, A;
	(b) all tie;
	(c) A, B, C;
	(d) all tie
10	C, A, B
11	(a) a and c tie, then b (zero); (b) a, b, c; (c) a and b tie, then c

Chapter 27 Answers

1	(a) equal;
	(b) more
2	(a) no;
	(b) yes;
	(c) all tie
3	parallel, R_2, R_1, series
4	(a) b and d tie, then a tie of a, c, and e;
	(b) b, d, then a tie of a, c, and e;
	(c) positive x direction
5	(a) series;
	(b) parallel;
	(c) parallel
6	2.0 A
7	(a) less;
	(b) less;
	(c) more
8	(a) $3R$; (b) $R/3$; (c) same
9	(a) parallel; (b) series
10	60 μC
11	(a) same;
	(b) same;
	(c) less;
	(d) more
12	1, c; 2, a; 3, d; 4, b
13	(a) all tie;
	(b) 1, 3, 2

Chapter 28 Answers

1	(a) no because $\vec{v}$ and $\vec{F}_B$ must be perpendicular;
	(b) yes;
	(c) no because $\vec{B}$ and $\vec{F}_B$ must be perpendicular

2	(a) 3 and 4 tie, then 1 and 2 tie (zero); (b) 4 (making the reasonable assumption that the rightward current is due to leftward motion of electrons in the wire)
3	(a) $+z$ and $-z$ tie, then $+y$ and $-y$ tie, then $+x$ and $-x$ tie (zero); (b) $+y$
4	into page: a, d, e; out of page: b, c, f (the particle is negatively charged)
5	(a) $\vec{F}_E$; (b) $\vec{F}_B$
6	2, 5, 6, 9, 10
7	(a) $\vec{B}_1$; (b) $\vec{B}_1$ into page, $\vec{B}_2$ out of page; (c) less
8	(a) upper plate; (b) lower plate; (c) out of the page
9	(a) positive; (b) 2 → 1 and 2 → 4 tie, then 2 → 3 (which is zero)
10	$1i$, $2e$, $3c$, $4a$, $5g$, $6j$, $7d$, $8b$, $9h$, $10f$, $11k$
11	(a) negative; (b) equal; (c) equal; (d) half-circle
12	(a) all tie; (b) all tie; (c) 3, 2, 1

Chapter 29 Answers

1	c, a, b
2	1, then 3 and 4 tie, then 2 (zero)
3	c, d, then a and b tie (zero)
4	(a) into; (b) greater
5	a, c, b
6	(a) c, a, d, b; (b) a, c, b, d; (c) a and c tie, then b and d tie; (d) greater
7	c and d tie, then b, a
8	b, d, c, a (zero)
9	b, a, d, c (zero)
10	d, then a and e tie, then b, c
11	(a) 1, 3, 2; (b) less

Chapter 30 Answers

1	out
2	1 and 3 tie (clockwise), then 2 and 5 tie (zero), then 4 and 6 tie (counterclockwise)
3	(a) all tie (zero); (b) 2, then 1 and 3 tie (zero)
4	(a) into; (b) counterclockwise; (c) larger
5	d and c tie, then b, a
6	(a) 2, 1, 3; (b) 2, 1, 3; (c) 1 counterclockwise; 2 clockwise; 3 counterclockwise
7	(a) more; (b) same; (c) same; (d) same (zero)
8	2 a, 4 b, 1 c, 3 d
9	(a) all tie (zero); (b) 1 and 2 tie, then 3; (c) all tie (zero)
10	c, b, a
11	b
12	(a) and (b): (1) and (2) tie, then (3) and (4) tie

Chapter 31 Answers

1	b, a, c
2	(a) less; (b) greater
3	(a) $T/4$; (b) $T/4$; (c) $T/2$; (d) $T/2$
4	with n zero or a positive integer, (a) $0 \pm n2\pi$, (c) $\pi/2 \pm n2\pi$, (e) $\pi \pm n2\pi$, (g) $3\pi/2 \pm n2\pi$
5	c, b, a
6	(a) 3, 1, 2; (b) 2, then 1 and 3 tie
7	a inductor; b resistor; c capacitor

8	(a) 1 and 4;
	(b) 2 and 3
9	(a) positive;
	(b) decreased (to decrease X_L and get closer to resonance);
	(c) decreased (to increase X_C and get closer to resonance)
10	(a) less;
	(b) equal;
	(c) greater
11	(a) rightward, increase (X_L increases, closer to resonance);
	(b) rightward, increase (X_C decreases, closer to resonance);
	(c) rightward, increase (ω_d/ω increases, closer to resonance)
12	(a) lead;
	(b) capacitive;
	(c) less
13	(a) inductor; (b) decrease

Chapter 32 Answers

1	1 a, 2 b, 3 c and d
2	(a) rightward;
	(b) leftward;
	(c) into
3	a, decreasing; b, decreasing
4	b
5	supplied
6	(a) increase;
	(b) increase
7	(a) a and b tie, then c, d;
	(b) none (because plate lacks circular symmetry, $\vec{B}$ not tangent to any circular loop);
	(c) none
8	(a) all down;
	(b) 1 up, 2 down, 3 zero
9	(a) 1 up, 2 up, 3 down;
	(b) 1 down, 2 up, 3 zero
10	(a) 1 down, 2 down, 3 up;
	(b) 1 up, 2 down, 3 zero
11	(a) 1, 3, 2;
	(b) 2
12	(a) a, c, f; (b) gh bar

Chapter 33 Answers

1	(a) positive direction of z; (b) x
2	c
3	(a) same; (b) increase; (c) decrease
4	into
5	(a) and (b) $A = 1$, $n = 4$, $\theta = 30°$
6	20° and 90°
7	a, b, c
8	b 30°; c 60°; d 60°; e 30°; f 60°
9	B
10	n_3, n_2, n_1
11	none
12	d, b, a, c

Chapter 34 Answers

1	(a) a; (b) c
2	(a) I_1 and I_4; (b) I_2 and I_3; (c) I_3; (d) I_3; (e) I_2
3	(a) a and c; (b) three times; (c) you
4	(a) from infinity to the focal point; (b) decrease continuously
5	convex
6	1 concave, 2 convex, 3 plane
7	(a) all but variation 2; (b) 1, 3, 4: right, inverted; 5, 6: left, same
8	1 converging, 2 diverging
9	d (infinite), tie of a and b, then c
10	(a) I_2 and I_3; (b) I_1 and I_4; (c) I_1; (d) I_1; (e) I_4
11	(a) x; (b) no; (c) no; (d) the direction you are facing

Chapter 35 Answers

1	(a) decrease; (b) decrease; (c) decrease; (d) blue
2	(a) increase; (b) 1λ
3	(a) $2d$; (b) (odd number)$\lambda/2$; (c) $\lambda/4$
4	a, c, b
5	(a) intermediate closer to maximum, $m = 2$; (b) minimum, $m = 3$; (c) intermediate closer to maximum, $m = 2$; (d) maximum, $m = 1$
6	b, 3 and 5; c, 1 and 4; d, 2
7	(a) maximum; (b) minimum; (c) alternates
8	(a) 300 nm; (b) exactly out of phase
9	(a) peak; (b) valley
10	(a) 0.5 wavelength; (b) 1 wavelength
11	c, d
12	(a) no; (b) $2(0) = 0$; (c) $2L$
13	c

Chapter 36 Answers

1	(a) $m = 5$ minimum; (b) (approximately) maximum between the $m = 4$ and $m = 5$ minima
2	4
3	(a) A, B, C; (b) A, B, C
4	(a) A, B, C; (b) A, B, C
5	(a) 1 and 3 tie, then 2 and 4 tie; (b) 1 and 2 tie, then 3 and 4 tie

6	(a) contract; (b) contract
7	(a) larger; (b) red
8	(a) increase; (b) first order
9	(a) decrease; (b) same; (c) remain in place
10	(a) decrease; (b) decrease; (c) shift to right
11	(a) A; (b) left; (c) left; (d) right
12	(a) less; (b) greater; (c) greater
13	(a) 1 and 2 tie, then 3; (b) yes; (c) no
14	the next three orders, $m = 1, 2,$ and 3, for which $\sin\theta < 1.0$ (higher numbered orders would require $\sin\theta > 1.0$)

Chapter 37 Answers

1	c
2	(a) negative; (b) positive
3	b
4	(a) C_1; (b) C_1
5	(a) C_1'; (b) C_1'
6	(a) Sam; (b) neither
7	(a) 4 s; (b) 3 s; (c) 5 s; (d) 4 s; (e) 10 s
8	(a) 3, then 1 and 2 tie; (b) 2, then 1 and 3 tie; (c) 2, 1, 3; (d) 2, 1, 3

9	(a) a tie of 3, 4, and 6, then a tie of 1, 2, and 5;
	(b) 1, then a tie of 2 and 3, then 4, then a tie of 5 and 6;
	(c) 1, 2, 3, 4, 5, 6;
	(d) 2 and 4;
	(e) 1, 2, 5
10	*b, a, c, d*
11	(a) 3, tie of 1 and 2, then 4;
	(b) 4, tie of 1 and 2, then 3;
	(c) 1, 4, 2, 3

Chapter 38 Answers

1	(a) greater;
	(b) less
2	only b
3	potassium
4	3, 2, 1
5	only e
6	downward
7	none
8	3, 2, 1
9	(a) decreases by a factor of $1/2^{0.5}$;
	(b) decreases by a factor of 1/2
10	(a) decreasing;
	(b) increasing;
	(c) same;
	(d) same
11	amplitude of reflected wave is less than that of incident wave
12	electron
13	electron, neutron, alpha particle
14	2, 1, 3
15	all tie
16	3, 2, 1

Chapter 39 Answers

1	a, c, b
2	less
3	(a) 18;
	(b) 17

4	(a) $(1/L)^{0.5} \sin(\pi x/2L)$; (b) $(4/L)^{0.5} \sin(2\pi x/L)$; (c) $(2/L)^{0.5} \cos(\pi x/L)$
5	equal
6	(a) 1/4; (b) same factor
7	c
8	(a) 3; (b) 4
9	(a) decrease; (b) increase
10	(a) greater; (b) less; (c) less
11	$n = 1, n = 2, n = 3$
12	(a) wider; (b) deeper
13	(a) $n = 3$; (b) $n = 1$; (c) $n = 5$
14	12 eV (4 → 2 in A matches 1 → 2 in C); 9 eV (5 → 4 in A matches 1 → 2 in D); 24 eV (5 → 1 in A matches 1 → 3 in D); 15 eV (4 → 1 in A matches 1 → 2 in E)
15	b, c, and d

Chapter 40 Answers

1	(a) 2; (b) 8; (c) 5; (d) 50
2	0, 2, and 3
3	all true
4	$6p$
5	same number (10)
6	(a) bromine; (b) rubidium; (c) hydrogen
7	2, -1, 0, and 1
8	(a) 1, 2, 3; (b) $-z$ direction
9	(a) 2; (b) 3
10	(a) rubidium; (b) krypton

11	(a) n;
	(b) n and ℓ
12	a and b
13	In addition to the quantized energy, a helium atom has kinetic energy; its total energy can equal 20.66 eV
14	(a) unchanged;
	(b) decrease;
	(c) decrease

Chapter 41 Answers

1	b, c, d (the latter due to thermal expansion)
2	4
3	8
4	(a) 3, then a tie of 1 and 2 (zero); (b) 3, 2, 1; (c) 1, 2, 3
5	below
6	$4s^2$ and $4p^2$
7	increase
8	(a) right to left;
	(b) back bias
9	much less than
10	(a) anywhere in the lattice;
	(b) in any silicon-silicon bond;
	(c) in a silicon ion core, at a lattice site
11	b and d

Chapter 42 Answers

1	(a) ^{196}Pt;
	(b) no
2	less
3	yes
4	above
5	(a) less; (b) greater)
6	A and C tie, then B
7	^{240}U
8	7 h
9	no effect
10	2, 3, 1
11	yes
12	(a) d; (b) g

13	(a) all except ^{198}Au; (b) ^{132}Sn and ^{208}Pb
14	(a) increase; (b) same
15	d

Chapter 43 Answers

1	(a) 101; (b) 42
2	decreased
3	^{239}Np
4	more neutrons than protons
5	^{140}I, ^{105}Mo, ^{152}Nd, ^{123}In, ^{115}Pd
6	greater
7	increased
8	20
9	less than
10	larger
11	still equal to 1
12	(a) ^{93}Sr; (b) ^{140}I; (c) ^{155}Nd

Chapter 44 Answers

1	b, c, d
2	the π^+ pion whose track terminates at point 2
3	(a) 1; (b) positively charged
4	baryon number
5	a, b, c, d
6	(a)-(c) yes; (d) no
7	d
8	3, 2, 1
9	c
10	c, f
11	(a) lepton; (b) antiparticle; (c) fermion; (d) yes