

**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	$q/4\pi\epsilon_0 d^2$ , 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) $8 \text{ N}\cdot\text{m}^2/\text{C}$ ; (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 $2\sigma, \sigma, 3\sigma$ or $3\sigma, \sigma, 2\sigma$
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	$-4q/4\pi\epsilon_0 d$
2	(a) 1, then 2 and 3 tie; (b) 3