Suggested problems
Chapter 22

The quiz questions will be similar to the following text-book problems. Refer to the course website for the latest version of this document. You are encouraged to seek the help of your instructor during his office hours.

2. In Fig. 22-29 the electric field lines on the left have twice the separation of those on the right. (a) If the magnitude of the field at A is 40 N/C, what is the magnitude of the force on a proton at A? (b) What is the magnitude of the field at B?

Answer: (a) \(6.4 \times 10^{-18}\) N; (b) 20 N/C

8. In Fig. 22-31, the four particles are fixed in place and have charges \(q_1 = q_2 = +5e, q_3 = +3e,\) and \(q_4 = -12e.\) Distance \(d = 5.0\) \(\mu\)m. What is the magnitude of the net electric field at point P due to the particles?

Answer: zero

23. Figure 22-42 shows two parallel nonconducting rings with their central axes along a common line. Ring 1 has uniform charge \(q_1\) and radius \(R;\) ring 2 has uniform charge \(q_2\) and the same radius \(R.\) The rings are separated by distance \(d = 3.00R.\) The net electric field at point P on the common line, at distance \(R\) from ring 1, is zero. What is the ratio \(q_1/q_2?\)

Answer: 0.506

52. An electron enters a region of uniform electric field with an initial velocity of 40 km/s in the same direction as the electric field, which has magnitude \(E = 50\) N/C. (a) What is the speed of the electron 1.5 ns after entering this region? (b) How far does the electron travel during the 1.5 ns interval?

Answer: \(5.0 \times 10^{-5}\) m = 50 \(\mu\)m

56. An electric dipole consists of charges +2e and −2e separated by 0.78 nm. It is in an electric field of strength \(3.4 \times 10^6\) N/C. Calculate the magnitude of the torque on the dipole when the dipole moment is (a) parallel to, (b) perpendicular to, and (c) antiparallel to the electric field.

Answer: (a) zero; (b) \(8.5 \times 10^{-22}\) N; (c) zero

73. The electric field in an \(xy\) plane produced by a positively charged particle is \(\vec{E} = 7.2(4.0\hat{i} + 3.0\hat{j})\) N/C at the point (3.0, 3.0) cm and \(\vec{E} = 100\hat{i}\) N/C at the point (2.0, 0) cm. What are the (a) \(x\) and (b) \(y\) coordinates of the particle? (c) What is the charge of the particle?

Answer: (a) \(-1.0\) cm; (b) zero; (c) \(1.0 \times 10^{-11}\) C.

83. An electric dipole with dipole moment \(\vec{p} = (3.00\hat{i} + 4.00\hat{j})(1.24 \times 10^{-30})\) C.m is in an electric field \(\vec{E} = 4000\hat{i}\) N/C. (a) What is the potential energy of the electric dipole? (b) What is the torque acting on it? (c) If an external agent turns the dipole until its electric dipole moment is \(\vec{p} = (-4.00\hat{i} + 3.00\hat{j})(1.24 \times 10^{-30})\) C.m, how much work is done by the agent?

Answer: (a) \(-1.49 \times 10^{-26}\) J; (b) \(-1.98 \times 10^{-26}\) k N.m.; (c) 3.47 \(\times 10^{-26}\) J.