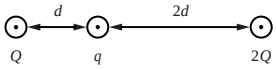
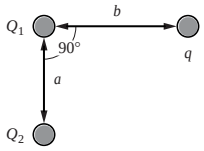
PHY 114 B – Practice questions for 1st hour exam January 30, 2003

1. In the figure, if $Q = 30\ \mu C$, $q = 5.0\ \mu C$, and $d = 30$ cm, what is the magnitude of the electrostatic force on q?



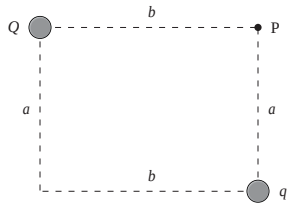
a. 15 N
b. 23 N
c. zero
d. 7.5 N
e. 38 N

2. If $a = 3.0$ mm, $b = 4.0$ mm, $Q_1 = 40$ nC, $Q_2 = 80$ nC, and $q = 12$ nC in the figure, what is the magnitude of the total electric force on q?



a. 0.78 N
b. 0.68 N
c. 0.58 N
d. 0.88 N
e. 0.62 N

3. If a = 60 cm, b = 80 cm, Q = –4.0 nC, and q = 1.5 nC, what is the magnitude of the electric field at point P shown?

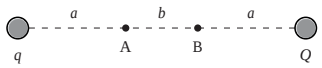


a. 68 N/C
b. 72 N/C
c. 77 N/C
d. 82 N/C
e. 120 N/C

4. A solid nonconducting sphere (radius = 12 cm) has a charge of uniform density (30 nC/m^3) distributed throughout its volume. Determine the magnitude of the electric field 15 cm from the center of the sphere.

a. 22 N/C
b. 49 N/C
c. 31 N/C
d. 87 N/C
e. 26 N/C

5. If a = 30 cm, b = 20 cm, q = +2.0 nC, and Q = –3.0 nC in the figure, what is the potential difference $V_A - V_B$?

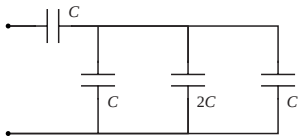


a. +60 V
b. +72 V
c. +84 V
d. +96 V
e. +48 V

6. Two identical particles, each with a mass of 2.0 mg and a charge of 25 nC, are released simultaneously from rest when the two are 4.0 cm apart. What is the speed of either particle at the instant when the two are separated by 10 cm?

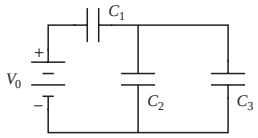
a. 7.3 m/s
b. 9.8 m/s
c. 9.2 m/s
d. 6.5 m/s
e. 4.6 m/s

7. If C = 15 mF, determine the equivalent capacitance for the combination shown.



a. 20 mF
b. 16 mF
c. 12 mF
d. 24 mF
e. 75 mF

8. In the figure, if C_1 = 15 μF, C_2 = 10 μF, C_3 = 20 μF, and V_0 = 18 V, determine the energy stored in C_2.



a. 0.72 mJ
b. 0.32 mJ
c. 0.50 mJ
d. 0.18 mJ
e. 1.60 mJ

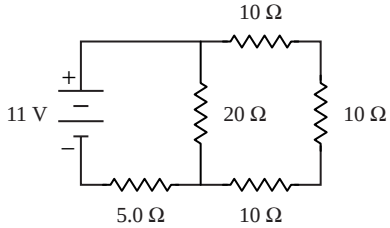
9. An electric heater is constructed by applying a potential difference of 110 V across a wire with a resistance of 5.0 Ω. What is the power rating of the heater?

a. 2.0 kW
b. 2.4 kW
c. 1.7 kW
d. 1.5 kW
e. 60 kW

10. How many electrons pass through a 20-Ω resistor in 10 min if there is a potential drop of 30 volts across it?

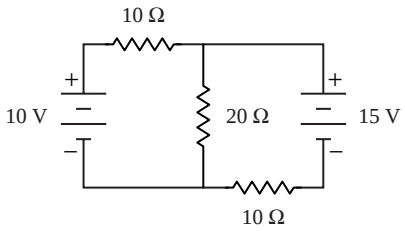
a. 5.6×10^{21}
b. 7.5×10^{21}
c. 9.4×10^{21}
d. 1.1×10^{21}
e. 3.8×10^{21}

11. What is the magnitude of the potential difference across the 20-Ω resistor shown in the figure?



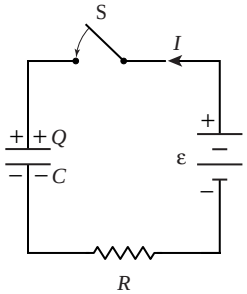
a. 3.2 V
b. 7.8 V
c. 11 V
d. 5.0 V
e. 8.6 V

12. What is the magnitude of the current in the 20-Ω resistor shown?



a. 0.75 A
b. 0.00 A
c. 0.25 A
d. 0.50 A
e. 1.00 A

13. In the figure, at $t = 0$ the switch S is closed with the capacitor uncharged. If $C = 50\ \mu$F, $\varepsilon = 20$ V, and $R = 4.0$ kΩ, what is the charge on the capacitor when $I = 2.0$ mA?



a. 360 μC
b. 480 μC
c. 240 μC
d. 600 μC
e. 400 μC