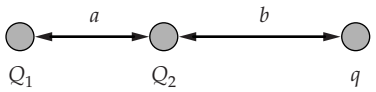
Name: _____

Please mark your answers here and in the scantron.

1. If a = 3.0 mm, b = 4.0 mm, Q_1 = –60 nC, Q_2 = 80 nC, and q = 30 nC in the figure, what is the magnitude of the total electric force on q?



a. 1.4 N
b. 1.0 N <=
c. 1.7 N
d. 2.0 N
e. 0.50 N

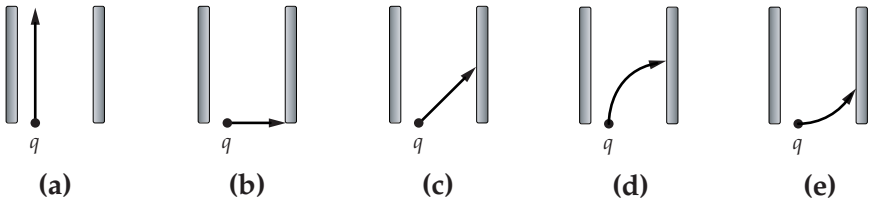
2. A particle (m = 50 g, q = 5.0 μC) is released from rest when it is 50 cm from a second particle (Q = –20 μC). Determine the magnitude of the initial acceleration of the 50-g particle.

a. 54 m/s^2
b. 90 m/s^2
c. 72 m/s^2 <=
d. 65 m/s^2
e. 36 m/s^2

3. A uniformly charged rod (length = 2.0 m, charge per unit length = 3.0 nC/m) is bent to form a semicircle. What is the magnitude of the electric field at the center of the circle?

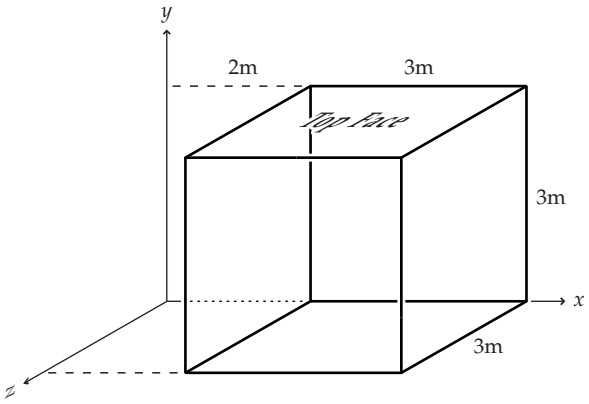
a. 64 N/C
b. 133 N/C
c. 48 N/C
d. 85 N/C <=
e. 34 N/C

4. A positively charged particle is moving in the +y-direction when it enters a region with a uniform electric field pointing in the +x-direction. Which of the diagrams below shows its path while it is in the region where the electric field exists. The region with the field is the region between the plates bounding each figure. The field lines always point to the right. The x-direction is to the right; the y-direction is up. <=



(a) **(b)** **(c)** **(d)** **(e)**

5. The electric field in the region of space shown is given by $E = (8\mathbf{i} + 2y\mathbf{j})$ N/C where y is in m. What is the magnitude of the electric flux through the top face of the cube shown?



a. 90 N · m^2/C
b. 6.0 N · m^2/C
c. 54 N · m^2/C <=
d. 12 N · m^2/C
e. 126 N · m^2/C

6. Points A [at (2, 3) m] and B [at (5, 7) m] are in a region where the electric field is uniform and given by $\mathbf{E} = (4\mathbf{i} + 3\mathbf{j})$ N/C. What is the potential difference $V_A - V_B$?

a. 33 V
b. 27 V
c. 30 V
d. 24 V <=
e. 11 V

7. Three identical point charges (+2.0 nC) are placed at the corners of an equilateral triangle with sides of 2.0-m length. If the electric potential is taken to be zero at infinity, what is the potential at the midpoint of any one of the sides of the triangle?

a. 16 V
b. 10 V
c. 70 V
d. 46 V <=
e. 44 V

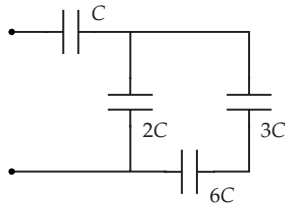
8. Identical point charges (+50 μC) are placed at the corners of a square with sides of 2.0-m length. How much external energy is required to bring a fifth identical charge from infinity to the geometric center of the square?

a. 41 J
b. 16 J
c. 64 J <=
d. 10 J
e. 80 J

9. A charge is placed on a spherical conductor of radius r_1. This sphere is then connected to a distant sphere of radius r_2 (not equal to r_1) by a conducting wire. After the charges on the spheres are in equilibrium,

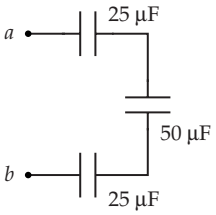
a. the electric fields at the surfaces of the two spheres are equal.
b. the amount of charge on each sphere is $q/2$.
c. both spheres are at the same potential. <=
d. the potentials are in the ratio $\frac{V_2}{V_1} = \frac{q_2}{q_1}$.
e. the potentials are in the ratio $\frac{V_2}{V_1} = \frac{r_2}{r_1}$.

10. Determine the equivalent capacitance of the combination shown when C = 45 μF.



a. 28 μF
b. 36 μF <=
c. 52 μF
d. 44 μF
e. 23 μF

11. How much energy is stored in the 50-μF capacitor when $V_a - V_b = 22$V?



a. 0.78 mJ
b. 0.58 mJ
c. 0.68 mJ
d. 0.48 mJ <=
e. 0.22 mJ

12. A rod of 2.0-m length and a square (2.0 mm × 2.0 mm) cross section is made of a material with a resistivity of $6.0 \times 10^{-8}\ \Omega \cdot$ m. If a potential difference of 0.50 V is placed across the ends of the rod, at what rate is heat generated in the rod?

a. 3.0 W
b. 5.3 W
c. 8.3 W <=
d. 1.3 W
e. 17 W

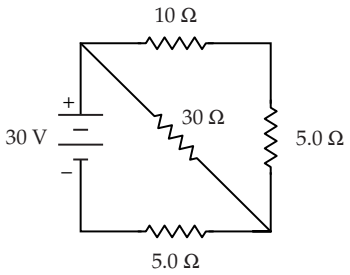
13. A conductor of radius r, length ℓ and resistivity ρ has resistance R. It is melted down and formed into a new conductor, also cylindrical, with one fourth the length of the original conductor. The resistance of the new conductor is

a. $\frac{1}{16}R$ <=
b. $\frac{1}{4}R$
c. R
d. $4R$
e. $16R$

14. A small bulb is rated at 7.5 W when operated at 125 V. The tungsten filament has a temperature coefficient of resistivity $\alpha = 4.5 \times 10^{-3}/°C$. When the filament is hot and glowing, its temperature is seven times room temperature (20 °C). What is the resistance of the filament (in ohms) at room temperature?

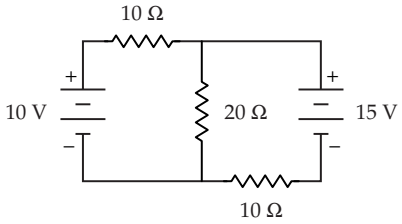
a. 1280.
b. 1350. <=
c. 1911.
d. 4530.
e. 5630.

15. At what rate is thermal energy generated in the 30-Ω resistor?



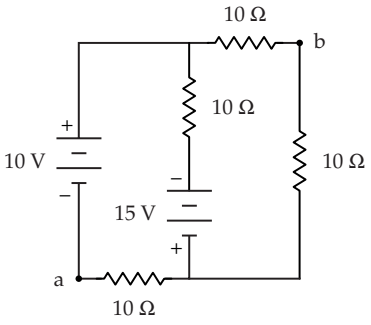
a. 20 W
b. 27 W
c. 60 W
d. 13 W <=
e. 30 W

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



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

17. Determine the potential difference $V_a - V_b$ shown in the circuit below.



a. –5.0 V <=
b. +5.0 V
c. –10 V
d. +10 V
e. 0 V