```
1  Q0 Two positively charged particles q1 and q2 (with q2>q1)
22 Q0 are fixed in place on the x-axis at the positions shown
   Q0 in figure 1. A third charge q3 is to be placed
   Q0 somewhere on the x-axis such that the net electrostatic
   Q0 force on q3 is zero. Which one of the following
   Q0 statements is TRUE?
   Q0
   A1 q3 should be placed at a point between q1 and q2 but
   A1 closer to q1
   A2 q3 should be placed at the mid point between q1 and q2.
   A3 q3 should be placed at a point between q1 and q2 but
   A3 closer to q2.
   A4 q3 should be placed to the left of q1.
   A5 q3 should be placed to the right of q2.
   Q0
2  Q0 Two 1.0 g spheres are charged equally and placed 2.0 cm apart.
22 Q0 When released, each one begins to accelerate at 225 m/s**2.
   Q0 What is the magnitude of the charge on each sphere?
   Q0
   A1  1.0*10**(-7)  C.
   A2  2.0*10**(-7)  C.
   A3  3.0*10**(-7)  C.
   A4  0.5*10**(-14) C.
   A5  8.0*10**(-9)  C.
   Q0
3  Q0 Three charges +2.00*10**(-8) C, +2.00*10**(-8) C, and
23 Q0 -4.00*10**(-8) C are respectively arranged at the
   Q0 corners F, G, and H of a right-angle triangle as shown
   Q0 in figure 2.  Find the magnitude and direction of the
   Q0 resultant electric field at point P due to the three charges.
   Q0
   A1  2.88*10**3 N/C  towards H.
   A2  5.37*10**3 N/C  towards H.
   A3  5.37*10**3 N/C  away from H.
   A4  1.09*10**5 N/C  towards F.
   A5  2.88*10**3 N/C  away from H.
   Q0
4  Q0 In figure 9, a small ball of mass m=2.0 g is hanging from
23 Q0 a fixed point by a non-conducting string of length 1.00 m.
   Q0 The ball carries a charge q=25.0*10**(-9) C. The mass of
   Q0 the string is negligible. An electric field E with magnitude
   Q0 E=2.0*10**5 N/C, in the positive x-direction, causes the
   Q0 ball to be in an equilibrium position with an angle Theta.
   Q0 Find the angle Theta. [Take g = 9.80 m/s**2].
   Q0
   A1 14.3 degrees.
   A2 10.0 degrees.
   A3  7.1 degrees.
   A4  0.2 degrees.
   A5 75.7 degrees.
   Q0
5  Q0 A uniform electric field is set up between two large
23 Q0 charged plates, see Figure 3. An electron is released
   Q0 from the negatively charged plate, and at the same time,
   Q0 a proton is released from the positively charged plate.
   Q0 They cross each other at a distance of 5.00*10(-6) m
   Q0 from the positively charged plate. If only the field due
   Q0 to the charged plates is considered, find the distance
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   Q0 between the two plates. [Take the ratio
   Q0 mass of the electron : mass of the proton = 1 : 1833]
   Q0
   A1 9.19 mm.
   A2 11.3 mm.
   A3 2.34 mm.
   A4 7.77 mm.
   A5 14.6 mm.
   Q0
6  Q0 A very long uniform line of charge having a linear charge
24 Q0 density of 6.8 micro-C/m lies along x-axis. A second line
   Q0 of charge has a linear charge density of -3.40 micro-C/m
   Q0 and is parallel to x-axis at y = 0.5 m. What is the net
   Q0 electric field at point where y= 0.25 m on y-axis?
   Q0
   A1 7.3*10**5 N/C along +y-axis.
   A2 4.8*10**6 N/C along +y-axis.
   A3 4.8*10**4 N/C along -y-axis.
   A4 3.4*10**6 N/C along +y-axis.
   A5 7.3*10**2 N/C along -y-axis.
   Q0
7  Q0 Which of the following statements are CORRECT:
24 Q0
   Q0 (1) The electric flux through a Gaussian surface depends on
   Q0     the shape of the surface.
   Q0 (2) The electric flux through a closed surface depends on
   Q0     the net charge enclosed by the surface.
   Q0 (3) The electric field inside a uniformly charged solid
   Q0     conducting sphere in electrostatic equilibrium is zero.
   Q0 (4) The electric potential inside a uniformly charged solid
   Q0     conducting sphere in electrostatic equilibrium is zero.
   Q0
   A1 2 and 3 only.
   A2 1 and 2 only.
   A3 1, 2, 3, and 4.
   A4 3 and 4 only.
   A5 4 only.
   Q0
8  Q0 The net electric flux passing through a closed surface
24 Q0 is -4.00*10**2 N*m**2/C. What is net electric charge
   Q0 contained inside the surface if the surface is a cylinder
   Q0 of height 3.52 cm and radius 1.12 cm.
   Q0
   A1  -3.54*10**(-9) C.
   A2  -1.00*10**(-2) C.
   A3   3.54*10**(-9) C.
   A4   1.00*10**(-2) C.
   A5   zero.
   Q0
9  Q0 A positive point charge q sits at the center of a hollow
   Q0 spherical shell. The shell, with radius R and negligible
24 Q0 thickness, has net charge -2q. The electric field strength
   Q0 outside the spherical shell (at r>R) will be:
   Q0
   A1   k*q/r**2    radially inwards.
   A2   k*q/r**2    radially outwards.
   A3   3*k*q/r**2  radially inwards.
   A4   3*k*q/r**2  radially outwards.
```

```
   A5   zero.
   Q0
10 Q0 A charged, isolated, large non-conducting plate is placed
24 Q0 on the XY-plane. At 1.5 m from the plate, on Z-axis, the
   Q0 electric field measured was 10**4 N/C and directed into
   Q0 the plate. What is the charge density on the plate?
   Q0
   A1   -1.8*10**(-7)   C/m**2.
   A2    1.8*10**(-7)   C/m**2.
   A3   -3.2*10**(-7)   C/m**2.
   A4    3.2*10**(-7)   C/m**2.
   A5    zero.
   Q0
11 Q0 Two oppositely charged parallel plates, 0.02 m apart, produce
   Q0 a uniform electric field between the plates. The potential
   Q0 energy U(J) of an electron in the field varies with
25 Q0 displacement x(m) from one of the plates as shown in figure 5.
   Q0 What is the magnitude of the force on the electron?
   Q0
   A1   7.5*10**(-15) N.
   A2   3.0*10**(-18) N.
   A3   6.0*10**(-20) N.
   A4   1.5*10**(-15) N.
   A5   zero.
   Q0
12 Q0 A point charge Q, at the center of a circle, is surrounded
   Q0 by six charges each of magnitude q at a distance r as shown
   Q0 in figure 4. How much work is done by an external agent to
25 Q0 remove the charge Q from the center to infinity?
   Q0 [Consider the electrostatic potential at infinity = 0 ]
   Q0
   A1  zero.
   A2  k*6*Q*q/r**2.
   A3  k*6*q/r.
   A4  k*6*q/r**2.
   A5  k*3*Q*q/r.
   Q0
13 Q0 Two protons, P, are fixed 6.0 m apart, as shown in
25 Q0 figure 7. An electron, e, is released from point A. Find
   Q0 its speed at point O, midway between the protons.
   Q0
   A1   11.6 m/s.
   A2   24.0 m/s.
   A3   121  m/s.
   A4   2.4  m/s.
   A5   0.1  m/s.
   Q0
14 Q0 Figure 6 shows three points X, Y and Z forming an equilateral
   Q0 triangle of side S in a uniform electric field of strength E.
25 Q0 A unit positive test charge is moved from X to Y, then from
   Q0 Y to Z, and from Z back to X. Which one of the following
   Q0 correctly gives the work done by an external agent in
   Q0 moving the charge along the various parts of the path?
   Q0
   A1    0, -E*S*Sin(60 degrees)  , + E*S*Sin(60 degrees).
   A2    0, -E*S*Cos(60 degrees)  , + E*S*Cos(60 degrees).
   A3  E*S, -E*S*Sin(60 degrees)  , + E*S*Cos(60 degrees).
   A4    0, -E*S*Cos(60 degrees)  , + E*S*Sin(60 degrees).
```

```
   A5 -E*S, -E*S*tan(60 degrees)  , + E*S*Sin(60 degrees).
   Q0
15 Q0 Over a certain region of space, the electric potential
25 Q0 is give by:
   Q0             V(x,y) = x**2 +y**2 +2*x*y.
   Q0 Find the angle that the electric field vector makes with
   Q0 Z-axis at the point P(1.0,2.0,0.0)
   Q0
   A1    90 degrees.
   A2     0 degrees.
   A3    45 degrees.
   A4    75 degrees.
   A5    60 degrees.
   Q0
16 Q0 Consider two separate capacitors: c1=30 micro-F carries a
   Q0 charge of q1=6.0*10**2 micro-C and c2=50 micro-F, carries
26 Q0 a charge of q2=1.0*10**3 micro-C. If the opposite polarity
   Q0 terminals of the two capacitors are connected together as
   Q0 shown in figure 10, find the new voltage across c1.
   Q0
   A1    5.0 Volts.
   A2    10  Volts.
   A3    15  Volts.
   A4    3.8 Volts.
   A5    2.2 Volts.
   Q0
17 Q0 A 25 micro-F parallel plates capacitor is constructed using
   Q0 Pyrex glass as a dielectric. If the thickness of the Pyrex
26 Q0 glass sheet is doubled, calculate the new capacitance of the
   Q0 capacitor. (Dielectric constant of Pyrex Glass = 5.6)
   Q0
   A1    12.5  micro-F.
   A2    30.2  micro-F.
   A3    100   micro-F.
   A4    50.0  micro-F.
   A5    6.25  micro-F.
   Q0
18 Q0 Three capacitors C1=5 micro-F, C2=10 micro-F and C3= 3 micro-F
26 Q0 are connected to a 20 V battery as shown in Figure 8.  Find
   Q0 the stored electric energy in C2.
   Q0
   A1    2.2*10**(-4) J.
   A2    0.3*10**(-4) J.
   A3    4.0*10**(-6) J.
   A4    1.3*10**(-4) J.
   A5    1.0*10**(-5) J.
   Q0
19 Q0 A 500 W electric heater is designed to operate from a 120-V
27 Q0 power supply. The line voltage decreases and the heater takes
   Q0 only 459 W. Find the voltage drop in the line voltage
   Q0 (Assuming the resistance is constant).
   Q0
   A1    5   Volts.
   A2    10  Volts.
   A3    15  Volts.
   A4    3   Volts.
   A5    2   Volts.
   Q0
```

```
20 Q0 What diameter must a copper wire have if its resistance is
   Q0 to be the same as that of an equal length of an aluminum wire
27 Q0 with 3.26 mm diameter?
   Q0 [Resistivity of aluminum = 2.75*10**(-8) Ohm.m;
   Q0  Resistivity of copper   = 1.69*10**(-8) Ohm.m;
   Q0
   A1    2.6 mm.
   A2    8.3 mm.
   A3     10 mm.
   A4    4.0 mm.
   A5    3.3 mm.
```

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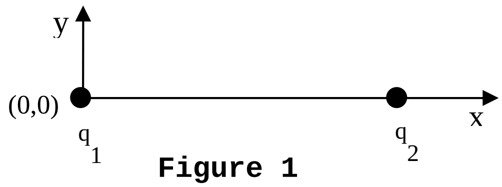


Figure 1

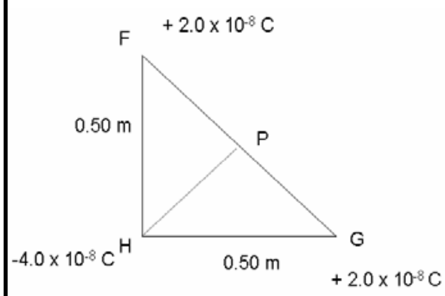


Figure 2

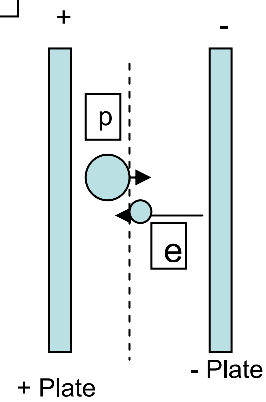


Figure 3

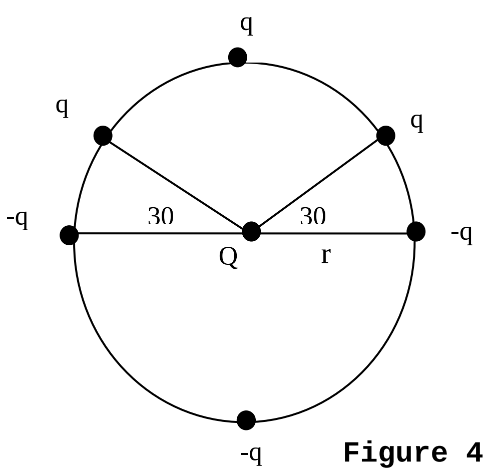


Figure 4

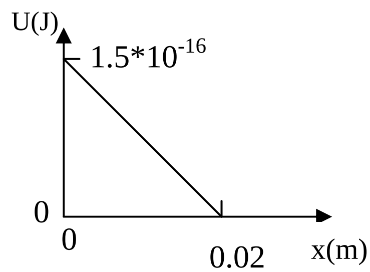
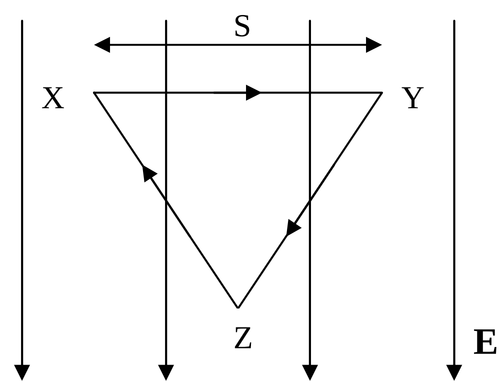


Figure 5



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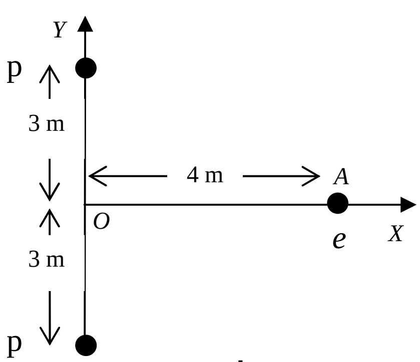

Figure 7

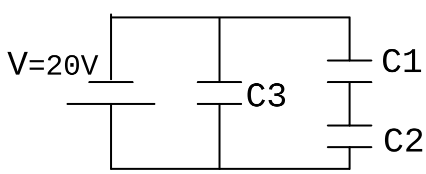

Figure 8

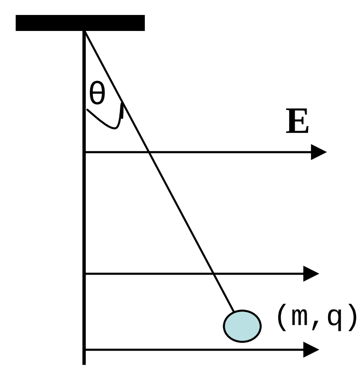

Figure 9

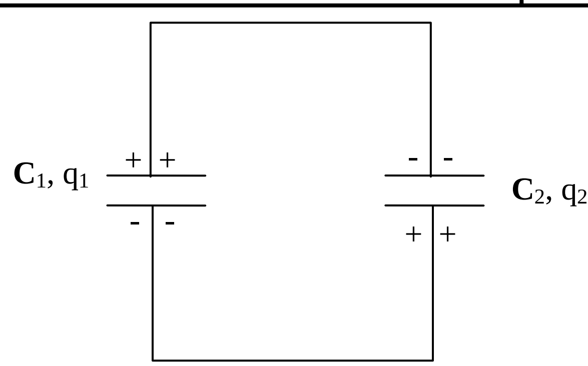

Figure 10