1 Q0 One mole of a monatomic ideal gas is taken from an initial state
21 Q0 (i) to a final state (f) as shown in figure 1. The curved
   Q0 line is an isotherm. Calculate the increase in entropy
   Q0 of the gas for this process.
   Q0
   A1   36.5 J/K.
   A2   1.25 J/K.
   A3   25.0 J/K.
   A4   22.5 J/K.
   A5   11.2 J/K.
   Q0
   Q0 One mole of a diatomic ideal gas is taken through the cycle
   Q0 shown in Figure 2. Process b->c is adiabatic, Pa = 0.3 atm,
   Q0 Pb = 3.0 atm, Vb = 1.0*10**(-3) m**3, and Vc = 4.0*Vb.
   Q0 What is the efficiency of the cycle?
   Q0
   A1   53%.
   A2   34%.
   A3   28%.
   A4   74%.
   A5   12%.
   Q0
 3 Q0 You mix two samples of water, A and B. Sample A is 100 g
   Q0 at 20 degree-C and sample B is also 100 g but at 80 degree-C.
21 Q0 Calculate the change in the entropy of sample B.
   Q0
   A1   - 8.9 cal/K.
   A2   8.9 cal/K.
   A3   - 9.7 cal/K.
   A4   9.7 cal/K
   A5   zero.
   Q0
4 Q0 What mass of water at 0 degrees-C can a freezer make into ice
21 Q0 cubes in one hour, if the coefficient of performance of the
   Q0 refrigerator is 3.0 and the power input is 0.2 Kilowatt?
   Q0
   A1   6.5 kg.
   A2   9.2 kg.
   A3   1.9 kg.
   A4   0.4 kg.
   A5   3.0 kg.
   Q0
5 Q0 Which of the following statements is correct?
21 Q0
   A1 For an adiabatic process the change in entropy is zero if it
   A1 is done reversibly.
   A2 For an adiabatic process the change in entropy is negative if
   A2 it is done irreversibly.
   A3 For an isothermal expansion the change in entropy of an ideal
   A3 gas is zero.
   A4 A Carnot engine does not reject any heat as waste.
   A5 The efficiency of a Carnot engine is 100%.
   Q0
6 Q0 In figure 3, Q = 60 micro-C, q = 20 micro-C, a = 3.0 m,
22 Q0 and b = 4.0 m. Calculate the total electric force
   Q0 on q. [i and j are the unit vectors in the positive direction
   Q0 of x-axis and y-axis, respectively].

```
   Q0
   A1    0.69 i (N).
   A2   -0.69 i (N).
   A3   -0.34 i (N).
   A4    0.34 i (N).
   A5    1.12 j (N).
   Q0
7  Q0 In figure 4, a 0.3 g metallic ball hangs from an insulating
23 Q0 string in a vertical electric field of 4000 N/C directed
   Q0 upward as shown. If the tension in the string is 0.005 N,
   Q0 then the charge on the ball is:
   Q0
   A1 -0.52 micro-C
   A2  0.52 micro-C
   A3 -0.73 micro-C
   A4  0.73 micro-C
   A5 -1.3  micro-C
   Q0
8  Q0 In figure 5, four charges are placed on the circumference of a
23 Q0 circle of diameter 2 m. If an electron is placed at the center
   Q0 of the circle, then the electron will
   Q0 [Take Q = 60 micro-C, q = 20 micro-C]
   Q0
   A1   stay at the center.
   A2   move to the right.
   A3   move to the left.
   A4   move upward.
   A5   move downward.
   Q0
9  Q0 A particle of mass 5.0 g and charge 40 mC moves in a region of
 23Q0 space where the electric field is uniform and given by
   Q0 E = -5.5 i (N/C). If the velocity of the particle at t = 0 is
   Q0 given by v = 50 j (m/s), find the speed of the particle at
   Q0 t = 2 s. [i, and j are the unit vectors in the directions of x,
   Q0 and y respectively].
   Q0
   A1  101  m/s.
   A2  65   m/s.
   A3  34   m/s.
   A4  150  m/s.
   A5  85   m/s.
   Q0
10 Q0 At which point can the electric field due to the two charges
23 Q0 shown in figure 6 be zero?
   Q0
   A1  point E.
   A2  point A.
   A3  point B.
   A4  point C.
   A5  point D.
   Q0
11 Q0 A point charge, q1 = -2.0*10**(-6) C, is placed inside a cube
24 Q0 of side 5.0 cm, and another point charge q2 = 3.0*10**(-6) C
   Q0 is placed outside the cube. Find the net electric flux
   Q0 through the surfaces of the cube.
   Q0
   A1   -2.3*10**5 N m**2/C
```

A2   +3.4*10**5 N m**2/C
A3   1.1*10**7 N m**2/C
A4   -1.1*10**5 N m**2/C
A5   2.3*10**5 N m**2/C
Q0
12 Q0 Figure 7 shows portions of two large, parallel, nonconducting
24 Q0 sheets, A and B. The surface charge densities are:
Q0 sigma 1 = -4.5 micro-C/m**2 and sigma 2 = -6.5 micro-C/m**2.
Q0 Find the electric field at any point between the two sheets.
Q0
A1 1.1*10**5 N/C towards B.
A2 1.4*10**5 N/C towards A.
A3 1.4*10**5 N/C towards B.
A4 1.1*10**5 N/C towards A.
A5 zero.
Q0
13 Q0 A hollow metallic sphere, of radius 2.0 cm, is filled
24 Q0 with a non-conducting material which carries a charge of
Q0 5.0 pico-C distributed uniformly throughout its volume.
24 Q0 What is the magnitude of the electric field 1.5 cm from
Q0 the center of the sphere?
Q0
A1 84 N/C.
A2 68 N/C.
A3 17 N/C.
A4 90 N/C.
A5 zero.
Q0
14 Q0 A total charge of 5.00*10**(-6) C is uniformly distributed
24 Q0 inside an irregularly-shaped insulator. The volume of the
Q0 insulator is 3.0 m**3. Now, imagine a cube of volume 0.50 m**3
Q0 inside the insulator. What is the total electric flux
Q0 through the surfaces of the cube?
Q0
A1 9.4*10**4 N*m**2/C.
A2 Zero.
A3 2.5*10**3 N*m**2/C.
A4 4.5*10**5 N*m**2/C.
A5 8.1*10**5 N*m**2/C.
Q0
15 Q0 A 40 N/C uniform electric field points perpendicularly toward
24 Q0 a large neutral conducting sheet, as shown in figure 8. The
Q0 surface charge densities (in C/m**2) on the right, sigma-R
Q0 and left, sigma-L, respectively are:
Q0
A1 - 3.5*10**(-10) ; +3.5*10**(-10).
A2 + 3.5*10**(-10) ; -3.5*10**(-10).
A3 - 7.0*10**(-10) ; +7.0*10**(-10).
A4 + 7.0*10**(-10) ; -7.0*10**(-10).
A5 zero ;   zero.
Q0
16 Q0 Find the electrostatic potential at x = 0 for the following
25 Q0 distribution of charges:-2q at x= 10 cm and -2q at x= -10 cm.
Q0 [Take q = 1.0*10**(-9) C, and the electrostatic potential at
Q0 infinity = 0]
Q0
A1 -360 V.

```
   A2   180 V.
   A3   360 V.
   A4   zero.
   A5  -180 V.
   Q0
17 Q0 Three point charges are initially infinitely far apart.
24 Q0 Two of the point charges are identical and have charge Q. If
   Q0 zero net work is required to assemble the three charges at
   Q0 the corners of an equilateral triangle of side d, then the
   Q0 value of the third charge is
   Q0
   A1   - Q/2.
   A2   - 2*Q.
   A3   - Q/3.
   A4     Q/2.
   A5     Q/3.
   Q0
18 Q0 Consider two concentric conducting shells of radii (a) and
25 Q0 (b), b > a. The smaller (inner) shell has a positive charge
   Q0 (q) and the larger (outer) shell has a charge (Q). If the
   Q0 potential of the inner shell is zero, what is the value of Q?
   Q0
   A1   Q = -b*q/a.
   A2   Q = -a*q/b.
   A3   Q =  b*q/a.
   A4   Q =  a*q/b.
   A5   Q = - q.
   Q0
19 Q0 In figure 9, two equal positive charges, each of magnitude
25 Q0 5.0*10**(-5) C, are fixed at point A and B separated by a
   Q0 distance of 6 m. An equal and opposite charge moves towards
   Q0 them along the line CO. At point C, 4.0 m from O, the
   Q0 kinetic energy of the moving charge is 4.0 J. What is the
   Q0 kinetic energy of this charge when it passes point O?
   Q0
   A1   10.0  J.
   A2   4.3   J.
   A3   2.2   J.
   A4   12.5  J.
   A5   19.0  J.
   Q0
20 Q0 The potential of a charge distribution is given by:
25 Q0          V(x,y) = A [y*(x**2)- x*(y**2)],
   Q0 where A is in appropriate units. The electric field will
   Q0 be zero at the point:
   Q0
   A1   x = 0, and y = 0.
   A2   x = 1, and y = 0.
   A3   x = 0, and y = 1.
   A4   x = 1, and y = 1.
   A5   x = 1, and y = -1.
```

Physics 102
Formula Sheet for 2nd Major Exam
Second Semester 2003-2004 (Term 032)

$Q = mc\Delta T$, $Q = mL$

$Q = nc_p\Delta T$, $Q = nc_v\Delta T$

$W = Q_h - Q_c$

$\varepsilon = \frac{W}{Q_h} = 1 - \frac{Q_c}{Q_h}$

$K = \frac{Q_c}{W}$

$\frac{Q_c}{Q_h} = \frac{T_c}{T_h}$, $\Delta S = \int \frac{dQ}{T}$

$F = k\frac{q_1 q_2}{r^2}$, $\Phi = \int_{Surface} \vec{E}.d\vec{A}$

$E = \sigma/2\varepsilon_o$, $E = \sigma/\varepsilon_o$

$E = k\frac{q}{r^2}$, $E = k\frac{q}{R^3}r$, $E = \frac{2k\lambda}{r}$

$\Phi_c = \oint \vec{E}.d\vec{A} = \frac{q_{in}}{\varepsilon_0}$

$E_x = -\frac{\partial V}{\partial x}$, $E_y = -\frac{\partial V}{\partial y}$, $E_z = -\frac{\partial V}{\partial z}$

$\Delta V = V_B - V_A = -\int_A^B \vec{E}.d\vec{S} = \frac{\Delta U}{q_0}$

$V = k\frac{q}{r}$

$U = k\frac{q_1 q_2}{r_{12}}$

$PV^{\gamma} = \text{constant}$; $TV^{\gamma-1} = \text{constant}$

$C_V = \frac{3}{2}R$ for monatomic gases,

$= \frac{5}{2}R$ for diatomic gases.

$v = v_o + at$

$x - x_o = v_o t + \frac{1}{2}a t^2$

$v^2 = v_o^2 + 2a(x - x_o)$

Constants:

Pi = π

$k = 9.0 \times 10^9$ N.m²/C²

$\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N.m^2$

$e = -1.6 \times 10^{-19}$ C

$m_e = 9.11 \times 10^{-31}$ kg

$m_p = 1.67 \times 10^{-27}$ kg

$k_B = 1.38 \times 10^{-23}$ J/K

$N_A = 6.022 \times 10^{23}$ molecules/mole

$R = 8.314$ J/mol. K

1 atm = 1.013×10^5 N/m^2

$g = 9.8$ m/s^2

micro = 10^{-6}

nano = 10^{-9}

pico = 10^{-12}

Sigma = σ

a*b**c = ab^c

Sqrt(a) = $\sqrt{a}$

1 calorie = 4.186 Joule

for water: $L_f = 80$ cal/g

$L_v = 540$ cal/g

c = 1 cal/g.K

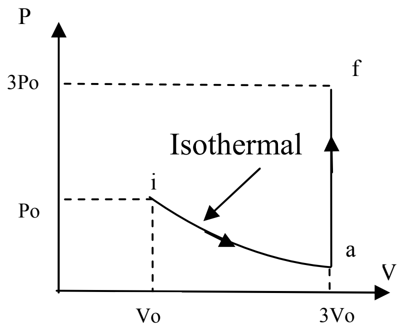

Figure 1

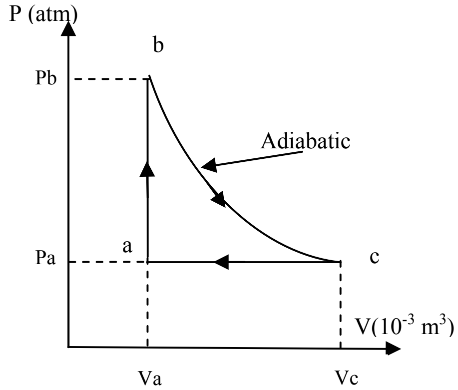

Figure 2

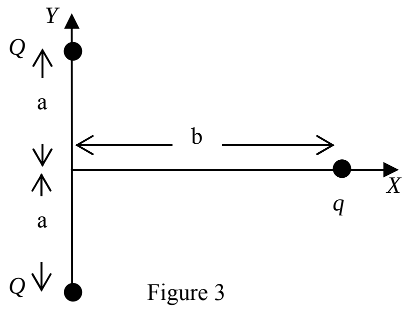

Figure 3

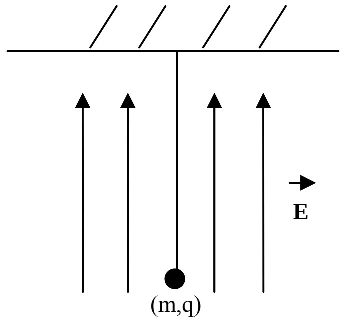

Figure 4

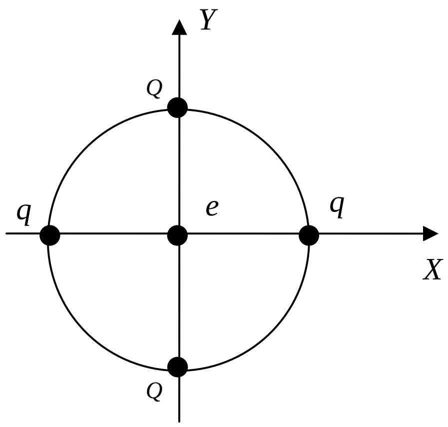

Figure 5

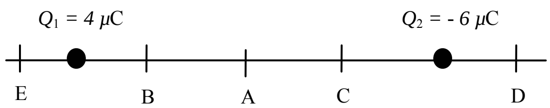

Figure 6

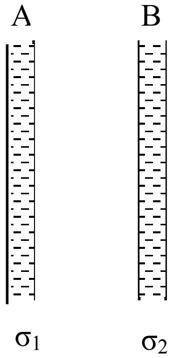

Figure 7

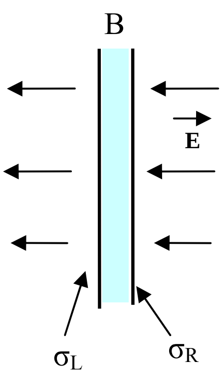

Figure 8

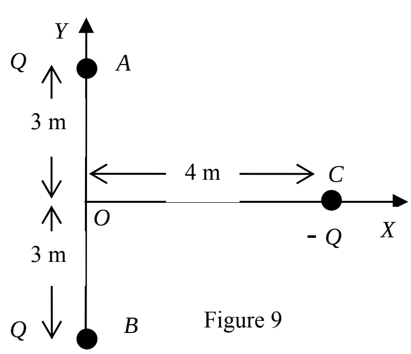

Figure 9