Answer Key

ÇANKAYA UNIVERSITY
MATHEMATICS AND COMPUTER SCIENCE DEPARTMENT

PHYS 122 General Physics II
Second Midterm Examination
26.04.2011

NAME, SURNAME :
NUMBER :
DEPARTMENT :
SECTION :
SIGNATURE :

Questions	Grade	Out of
1		25
2		25
3		25
4		25
TOTAL		100

TOTAL NUMBER OF QUESTIONS : 4

IMPORTANT :

1) Write your name and department.
2) Check that there are 4 questions.
3)Show all your work. Correct answers without the intermediate steps may not get credit.

I)(25Pts.)
Show that, according to the free-electron model of electrical conduction in metals and classical physics, the resistivity of metals should be proportional with $\sqrt{T}$, where T is the temperature in kelvins.
Explain clearly your answer.

$\rho = \frac{m}{e^2 n \tau}$, $\rho \simeq \tau^{-1} \simeq v_{eff}$

$v_{eff} \simeq \sqrt{T}$, $\rho \simeq \sqrt{T}$

II)(25 Pts.)
a) Calculate the current through each ideal battery in Figure 1.Assume that $R_1 = 1.0\,\Omega$, $R_2 = 2.0\,\Omega$,$E_1 = 2.0\,V$, and $E_2 = E_3 = 4.0V$.
b) Calculate $V_a - V_b$.
Explain clearly your answer.

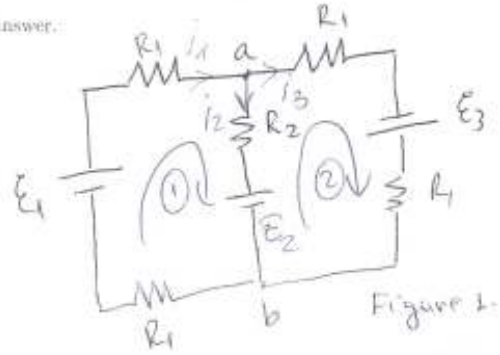

Figure 1.

a)

junction a:)

$i_1 = i_2 + i_3$

loop 1:)

$\xi_1 - i_1 R_1 - i_2 R_2 - \xi_2 = 0$

loop 2:)

$\xi_2 + i_2 R_2 - i_3 R_1 + \xi_3 - i_3 R_1 = 0$

$i_1 = \frac{2}{3}\,A$, $i_2 = -\frac{1}{3}\,A$, $i_3 = \frac{7}{3}\,A$, i_2 has opposite direction

b) $V_a + i_2 R_2 - \xi_2 = V_b$

$V_a - V_b = 4 - 2 \cdot \frac{1}{3} = \frac{2}{3}\,V$

III)(25 Pts.)
An electron is accelerated from rest by a potential difference of V_0 . It then enters a uniform magnetic of magnitude B_0 with its velocity perpendicular to the field.Calculate:
a) the speed of the electron
b) the radius and its path in the magnetic field.
Explain clearly your answer.

$$\frac{1}{2} m_e v^2 = |e| V_0$$

a) $$v = \sqrt{\frac{2|e|V_0}{m_e}}$$

b) $$|e| v B_0 = \frac{m_e v^2}{r}$$

$$r = \frac{|e| B_0}{m_e \sqrt{\frac{2|e|V_0}{m_e}}} = \frac{|e| B_0}{\sqrt{2 m_e |e| V_0}}$$

IV)(25Pts.)
A solenoid has length L=1.23 m and inner diameter d=3.55 cm, and it carries a current i=5.57 A. It consists of five close-packed layers,each with 850 turns along length L.What is **B** at its center?
Explain clearly your answer.

$B = \mu_0 i n$

$B = \left(4\pi \times 10^{-7} \frac{T \cdot m}{A}\right) 15.57 A \, \frac{5 \times 850 \text{ turns}}{1.23 m}$

$B = 2.42 \times 10^{-2} T = 24.2 mT$