Prince Sultan University

Department of Mathematics & Physics

PHY 205- General Physics2

Final Exam

First Semester, Term 141

Saturday Jan.10/2014

Examination Time : 2 Hours

Name .....

Student I.D. ..... **Class Time**----------

Important Instructions:

1. *You can use a scientific calculator that does not have programming or graphing capabilities.*
2. *You may **NOT** borrow a **calculator** from anyone.*
3. *Do not use **RED pen**.*
4. *This is a closed books and notes exam. Do **NOT** use notes or textbooks.*
5. *There should be **NO** talking during the examination.*
6. *You will be **expelled** immediately from the exam if your mobile phone is seen or heard.*
7. *Any signs of **cheating** may cause you being expelled from the exam.*
8. *This examination has **3 parts**. **Part 1** has 10 **multiple choice** questions, each question worth **1 point**. **Part 2** has 3 **multiple choice** questions, each question worth **2 points**. **Part 3** has **four** workout problems each problem worth 6 **points.***

Make sure your paper has all the questions and problems.

	Possible Score	**Student's Total Score**
Part 1 Questions	**10**	
Part 2 Questions	**6**	
P. # 1	**6**	
P. # 2	**6**	
P. # 3	**6**	
P. # 4	**6**	
Total	**40**	**/40**

GIVEN DATA (Do not Remove)

CONSTANTS:

$$k = 9\times10^{9}\ \frac{N.m^2}{C^2}\ ,\quad \varepsilon_o = 8.85\times10^{-12}\ \frac{C^2}{N.m^2}\ ,\quad \mu_o = 4\pi\times10^{-7}\ \frac{T.m}{A}$$

Velocity of light = c= 3 x 10^8 m/s

Proton mass = 1.67x10^{-27} kg, *Proton charge = 1.6x10^{-19} C*

Electron mass = 9.1x10^{-31} kg, *Electron charge = 1.6x10^{-19}C*

1 eV = *1.6x10^{-19}*J 1nm = 1nano meter = 10^{-9} m

Dielectric constant of Air & Vacuum = 1

Refractive index of air = 1

$q(t) = q_o(1 - e^{-t/RC})$; $I(t) = I_o e^{-t/RC}$

Magnetic field of a curved conductor at center of curvature 'R'

$$B = (\mu o\ I\ \varphi) / (4\ \pi\ R)$$

Good Luck

Part 1: 10 Multiple Choice Questions (1 mark each)

1- A metallic object holds a charge of -3.8×10^{-6} C. What excess number of electrons does this represent?

a) 4.2×10^{14} b) 6.1×10^{13} c) 2.4×10^{13} d) 1.6×10^{14}

2- If the distance between two point charges is tripled, the mutual force between them will be changed by what factor?

a) 9 b) 3 c) 1/3 d) 1/9

3- Two point charges are separated by 10.0 cm and have charges of +2.00 μC and –2.00 μC, respectively. What is the electric field at a point midway between the two charges?

a) 28.8×10^6 N/C b) 14.4×10^6 N/C c) 7.19×10^6 N/C d) Zero

4-A closed surface contains the following point charges: 8 C, 4 C, –2 C, –4 C. The electric flux coming out of the surface is:

a) 16 C/ε_o. b) 6 C/ε_o. c) 1 C/ε_o. d) Zero

5-A proton ($+1.6 \times 10^{-19}$ C) moves 10 cm along the direction of an electric field of strength 3.0 N/C. The electrical potential difference between the proton's initial and ending points is:

a) 4.8×10^{-19} V b) 0.33 V c) 0.033 V. d) 30 V

6- Electrons in an x-ray machine are accelerated from rest through a potential difference of 50 k V. What is the kinetic energy of each of these electrons in eV?

a) 50 eV b) 80 eV c) 330 eV. d) 50×10^3 eV

7- A high-voltage power line 20 m above the ground carries a current of 2000 A. What is the magnetic field due to the current directly under the power line?

a) 20 μT b)35 μT c) 2 μT. d) 20 mT

8- An object is placed at '2f 'in front of a convex lens. Where its image will form?

a) f b) 1.5f c) 2f. d) Infinite

9-According to Lenz's law the direction of an induced current in a conductor will be that which tends to produce which of the following effects?

a) Increases the effect which produces it b) produce the greatest voltage
b) oppose the effect which produces it d) None of these

10-Helium atom contains 2 paired electrons in its valence shell. Atomic number of helium is 2. Helium gas is classified as,

a) Diamagnetic b) Paramagnetic c) ferromagnetic d) None

Part 2: 3 Multiple Choice Questions (2 mark each)

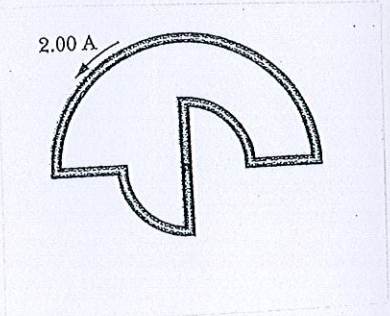
1- A parallel-plate capacitor has dimensions 4.0 cm × 5.0 cm. The plates are separated by a 1.0-mm thickness of paper (dielectric constant $\kappa = 3.7$). What is the charge that can be stored on this capacitor, when connected to a 1.5 V battery?

a) 20×10^{-12} C b) 4.8×10^{-11} C c) 4.8×10^{-12} C d) 0.98×10^{-10} C

2- A series RC circuit has 200 μ F capacitor and 400 ohm resistor connected with a battery of 6V. Switch is closed at time t = 0 and capacitor starts charging. At what time charge on capacitor will be 80% of the maximum value?

a) 80 ms b) 100 ms c) 129 ms . d) None

3- A Closed loop carrying a current of 2 A. The loop is made up of a half circle of radius 4 m, two quarter circles of radius 2m, and three straight wires. What is the magnitude of net magnetic field at the common center of the circular sections?

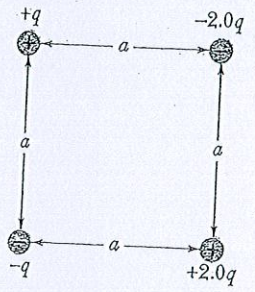


a) 1.57 nT b) 157 nT c) 50 nT d) 100 nT

Part 3: Solve the following four problems in the space provided in between showing all your steps (6 marks each)

Question 1(6 marks):

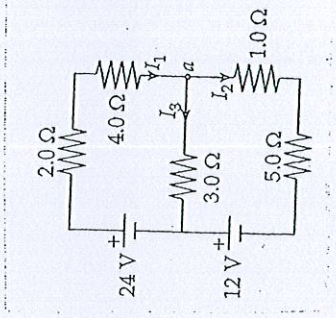
a) What is the magnitude and direction of the electric field at the center of the square, a = 5 cm; q = 10^{-8} C.



b) Calculate electric potential at the center of the square in part (a).

Question 2. (6 marks):

a) In this given network, calculate unknown currents I_1, I_2, I_3.

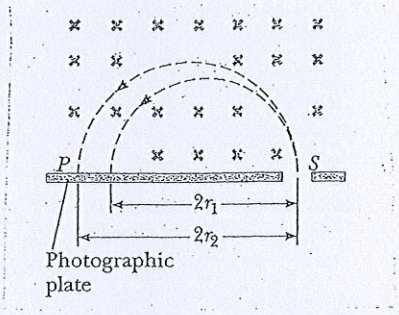


b) What is the power dissipated by 5 Ω resistor?

c) Show that KCL is valid using currents in this circuit.

Question 3 (6 marks):

The magnetic mass spectrometer separates atoms or molecules of different masses. To separate hydrogen and heavy hydrogen (deuterium) both particles were accelerated to final velocity of 10^6 m/s. This beam then sent to a perpendicular magnetic field of 0.1 T. Mass of deuterium is double of the mass of proton.



(a) What voltage is required to accelerate protons to 10^6 m/s?

(b) What will be the radius of proton in the magnetic field?

(c) What is the distance of separation of hydrogen and deuterium?

Question 4 (6 marks):

Light enters diamond from air at an angle of incidence of 48.0°. Angle of refraction inside the diamond is found to be 18°

What is the refractive index of diamond?

b) What is critical angle of diamond?

c) A concave mirror has radius of curvature of 20 cm. It is required in an experiment to form an image to be double of the size of the real 2 cm long object. Where real object should be placed in front of the concave mirror? (Measure all distances from the pole of the mirror)

d) Describe the nature of image.

Scrach paper. Do not Remove.