Prince Sultan University

Department of General Sciences.

PHY 205- General Physics2

Final Exam

First Semester, Term 151

Saturday: Jan.2, 2016

Examination Time :2Hours

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:

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

Speed 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- The current in an electron beam in a tube is measured to be 70 μA. How many electrons hit the screen in 5s?

a) 2.2×10^{11} b) 8.8×10^{13} c) 2.2×10^{15} d) 8.8×10^{18}

2-Two point charges of +5.00 μC and −5.00 μCare separated by 10.0 cm. What is the electric potential 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

3-A Gaussian closed surface contains the following point charges: 8 C, 4 C, –2 C, –6 C. The electric flux coming out of the surface is:

a) 16 C/ε_o. b) 6 C/ε_o. c) 4 C/ε_o. d) Zero

4-A proton moves 6 cm perpendicular to an electric field of strength 5.0 N/C with initial velocity of 100 m/s. The work done on the proton is:

a) 0J b) 0.3 J c) 0.033 J. d) 30 J

5-An electron with a speed of 2.0×10^6 m/s moves into a uniform electric field of 500 N/C that is parallel to the electron's motion. How long does it take to bring the electron to rest?

a) $2.3\text{x}10^{-8}$ s b) $3.2\text{x}10^{-8}$ s c) $1.25\text{x}10^{-7}$ s. d) $2.3\text{x}10^{-6}$ s.

6-Two long parallel wires 40 cm apart are carrying currents of 10A and 20A in the opposite direction. What is the magnitude of the magnetic field halfway between the wires?

a) 10 μT b) 25 μT c) 30 μT. d) 40μT

7- An object is placed at radius of curvature of a concave mirror. Where its image will form?

a) 1f b) 1.5f c) 2f. d) Infinity

8- Number 10 copper wire (radius = 1.3 mm) is commonly used for electrical wiring in homes. What is the voltage drop in 40 m of #10 copper wire if it carries a current of 10 A? (The resistivity of copper is $1.7 \times 10^{-8}\Omega\cdot$m.)

a) 1.3 V b) 0.7 V c) 0.5 V d) 0.13 V

9- When an iron piece is freely suspended in an inhomogeneous magnetic field it is strongly attracted towards the stronger part of the magnetic field. Iron is classified as

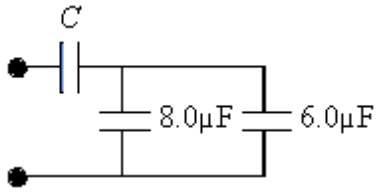
a) Diamagnetic b) Paramagnetic c) ferromagnetic d) None

10- A fully charged capacitor in a RC series circuit practically discharges in time,

(a) t = RC b) t = 2RC c) t = 3RC d) t = 4RC

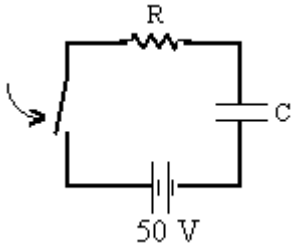
Part 2: 3 Multiple Choice Questions (2 mark each)

1- If $C = 10\mu F$, determine the electrical energy stored by this system of capacitors when 10 V is applied. .



a) 0.1mJ b) 0.3mJ c) 1.4mJ d) 2.4 mJ

2- A series *RC* circuit has a time constant of 1.0 s. The battery has a voltage of 50 V and the maximum current just after closing the switch is 500 mA. The capacitor is initially uncharged. What is the charge on the capacitor 2.0 s after the switch is closed?



a) 0.43C b) 0.66 C c) 0.86 C. d) None

3- Calculate the magnitude of the magnetic field at the common center of two semi circles in figure below, where, I = 50 mA a = 6 cm b = 10 cm.

a) 0. 1 μT b) 0.23 μT c) 0.42 μT d) 0.75 μT

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

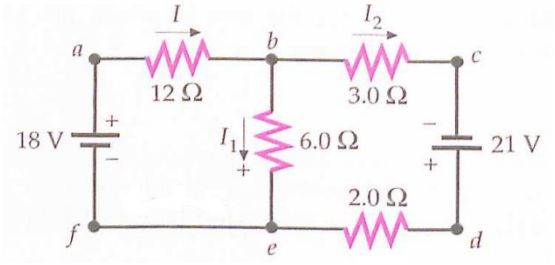
Question 1(6marks):

a) Two charges $q_1 = q_2 = 15\ \mu C$ are 10 cm apart along x-axis. A third charge $q_3 = 25\ \mu C$ stays 8.66 cm above the midpoint of first two charges. What is the mass of the third charge?

b) The nucleolus of a hydrogen atom, a proton sets up an electric field. The average distance between proton and the electron of a hydrogen atom is 5.3×10^{-9} cm. What is the magnitude of the electric field at this distance from the proton?

Question 2.(6 marks):

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



b) What is the power dissipated by 6 Ω resistor?

c) Show that KCL is valid using currents obtained in part (a) in this circuit.

d) Show on the given circuit the real directions of conventional current.

Question 3(6 marks):

The magnetic mass spectrometer separates atoms or molecules of different masses. To separate hydrogen and helium, ionized atoms of both gases were accelerated to final velocity of 10^6 m/s. This beam then sent to a perpendicular magnetic field of 0.25T. Mass of helium is four times 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 helium?

Question 4(6 marks):

Light enters in plastic plate from air at an angle of incidence of 45°. Angle of refraction inside the plastic is found to be 29^{o}

(a) What is the refractive index of the plastic? (Draw Ray diagram).

(b) What is critical angle of this plastic?

(c) A convex lens has focal length 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 an object should be placed in front of the lens? (Measure all distances from the center of the lens).

(d) Describe the nature of the image.

Scrachpaper. Do not Remove.