Prince Sultan University

Department of Mathematics & Physics

PHY 205- General Physics2 - Final Exam

Second Semester, Term 162

Tuesday May/23/2017

Examination Time : 180 minutes

Name . . . . . .

Student I.D. . . . . .

$k = 9\times10^{9}\,\frac{N.m^2}{C^2}$, $\varepsilon_o = 8.85\times10^{-12}\,\frac{C^2}{N.m^2}$, $\mu_0 = 4\pi\times10^{-7}\,\frac{T.m}{A}$

Electron mass $= 9.11\times10^{-31}\,kg$, Electron charge $= -1.6\times10^{-19}\,C$

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. *Your 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 **8 multiple choice** questions, each question worth **1 point**. **Part 2** has **6 multiple choice** questions, each question worth **2 points**. **Part 3** has **five** workout problems each problem worth **4 points.***

Make sure your paper has all the questions and problems.

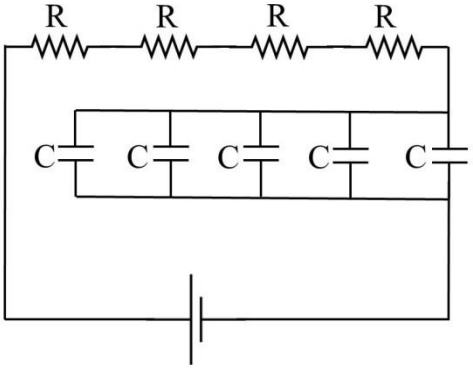
	Possible Score	**Student's Total Score**
Part 1 Questions	**8**	
Part 2 Questions	**12**	
P. # 1	**4**	
P. # 2	**4**	
P. # 3	**4**	
P. # 4	**4**	
P. # 5	**4**	
Total	**40**	**/40**

Part 1: 8 Multiple Choice Questions (1 mark each)

1- Which of the following statements below is false?

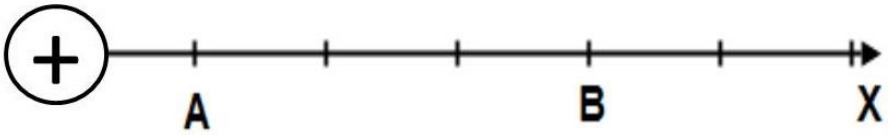
a) Kirchhoff's voltage law states that the algebraic sum of the voltage differences around a closed loop must equal zero.
b) Negative charges move from high electric potential to low electric potential.
c) Using a dielectric material between the plates of a capacitor will always increase its capacitance
d) An emf is induced in a coil in a magnetic field whenever the magnetic flux Φ through the coil changes.

2- An RC circuit consists of four identical resistors (R) and five identical capacitors (C) connected as shown. What is the time constant of the circuit?



a) 4RC b) 5RC c) 20RC d) 9RC

3- In the diagram below, the electric potential at point A due to the shown charge is V. What is the electric potential at point B in terms of V?

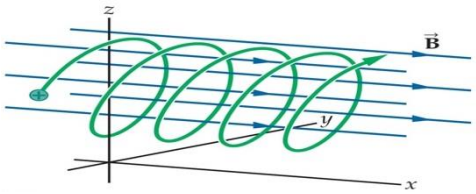


a) V/4 b) V/16 c) V/3 d) 4V

4- Which of the following is the SI unit of the magnetic flux?
a) Tesla b) Gauss c) Weber d) $N.m^2/C$

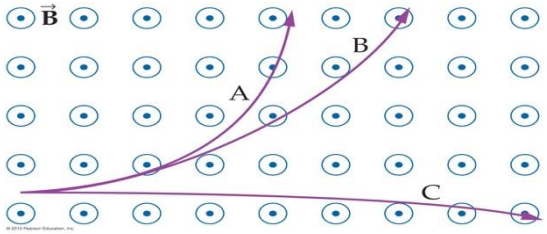
5- For Gauss's law to be valid, the Gaussian surface used must be a
a) A spherical surface. b) A cylindrical surface.
c) An open surface. d) A closed surface.

6- For a charged particle moving in a uniform magnetic field to follow the shown path, the velocity of this charged particle must be



a) Parallel to the magnetic field
b) Antiparallel to the magnetic field
c) Perpendicular to the magnetic field
d) At an angle with the magnetic field

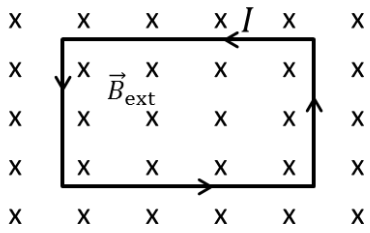
7- If the particles A, B & C have identical ***masses*** and ***magnitude of charges***, rank the particles in order of ***increasing speed***.



a) $V_A < V_B < V_C$
b) $V_C < V_B < V_A$
c) $V_A < V_C < V_B$
d) $V_C < V_A < V_B$

8- A rectangular current loop is placed in a uniform magnetic field. A current flows in the wire loop, as shown. What does the loop do?

a) Rotates
b) Moves to the right
c) Moves out of the page
d) Remains motionless

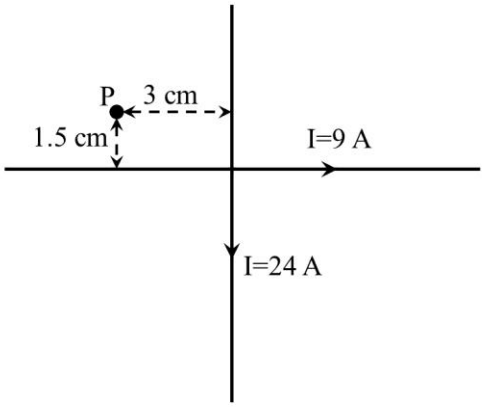


Part 2: 6 Multiple Choice Questions (2 mark each)

1- The energy stored in a 4 μf capacitor is 1.62×10^{-4}J. How much charge is stored on each plate of the capacitor?

a) 36 μC b) 18 μC c) 72 μC d) 12.96 μC

2- Two long wires carry currents of 9A and 24 A in the directions shown in the figure. The wires are isolated and not in electrical contact. What is magnitude of the net magnetic field produced at point P shown in the figure?



a) 4×10^{-5} T b) 28×10^{-5} T c) 16×10^{-5} T d) 20×10^{-5} T

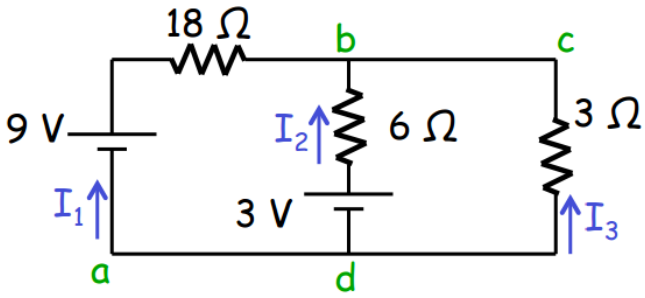
3- The Kirchhoff's loop rule applied to loop abcda in the shown figure will give:

a) $9 - 18I_1 - 3I_3 = 0$

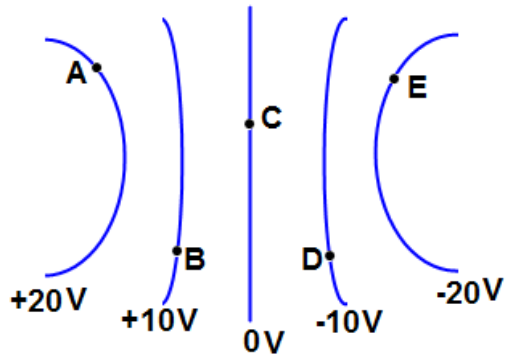
b) $9 + 18I_1 - 3I_3 = 0$

c) $9 + 18I_1 + 3I_3 = 0$

d) $9 - 18I_1 + 3I_3 = 0$



4- A non-uniform electric field is represented by the shown equipotential lines. How much work is done by the electric field when a positive charge of magnitude 2.5 μC moves from point B to point E?



a) 25 μJ b) 75 μJ c) 12 μJ d) 50 μJ

5-A solenoid that is 60 cm long and consisting of 9000 turns is required to produce a magnetic field of 0.2 T inside it. What is the required current?

a) 10.6 A
b) 17.7 A
c) 13.1 A
d) 29.5 A

6- A step down transformer produces a voltage of 3 V across the secondary coil when the voltage across the primary coil is 120 V. What voltage appears across the primary coil of this transformer if 60 V is applied to the secondary coil?

a) 1.5 V
b) 2400 V
c) 1200 V
d) 15 V

Part 3: Solve the following five problems in the space provided in between showing all your steps (4 marks each)

Question 1(4 marks):

A charge of **- 40 μC** is located on the y axis at **y = –20 cm**, and a second charge of **20μC** is placed on the y axis at **y = 30 cm**. Use these informations to answer the below questions:

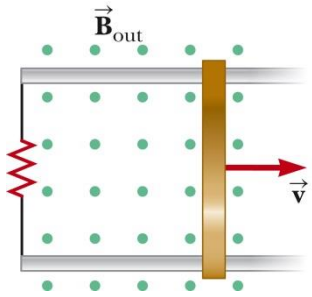
a) (1mark) The magnitude and direction of the electric force on the positive charge.

b) (2 marks) The net electric field at the origin.

c) (1 mark) The net electric potential at the origin.

Question 2(4 marks):

In the figure below, the resistance of the resistor is $R = 5\ \Omega$, the length of the rod is $l = 20$ cm, and the strength of the external magnetic field is 2 T. The rod is moved at a constant velocity such that the mechanical power delivered to the rod is 20 W. Find:



a) The speed of the rod

b) The magnitude of the current induced in the circuit

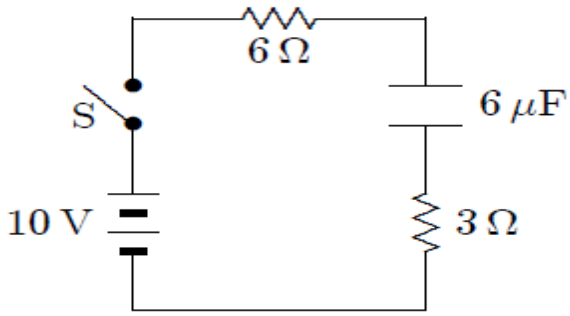
c) The direction of the current induced in the circuit

d) The change of the magnetic flux in the loop as the rod moves for 0.2 seconds.

Question 3 (4 marks):

In the circuit shown, the capacitor is initially uncharged. At time t = 0, switch S is closed. Calculate:

a) (1 mark) the time constant of the circuit.

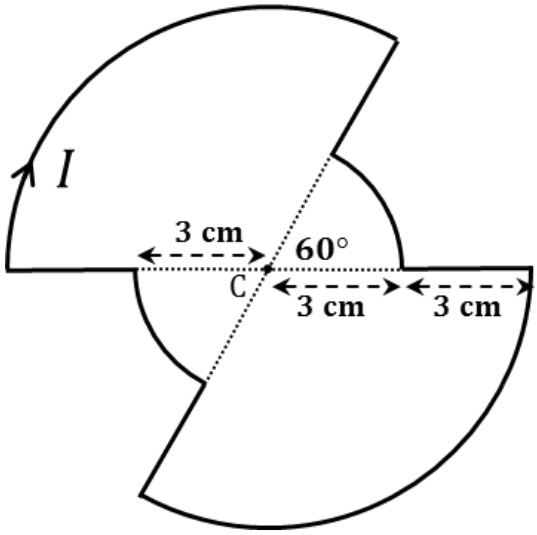


b) (1 mark) the current in the circuit when t = 13 μs.

c) (2 marks) the charge of the capacitor at the moment when the current is 0.8 A?

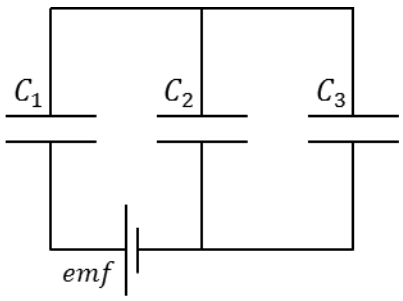
Question 4 (4 marks):

Consider the loop shown in the figure. If the current is $I = 4\ A$, find the magnitude and direction of the magnetic field at the center of the loop (point C).



Question 5 (4 marks):

In the figure, $emf = 30\ V, C_1 = 30\ \mu F, C_2 = 40\ \mu F, C_3 = 20\ \mu F$. Calculate:



a) (1 mark) The equivalent capacitance

b) (3 marks) The potential difference across each capacitor and the charge on it.

Scratch paper