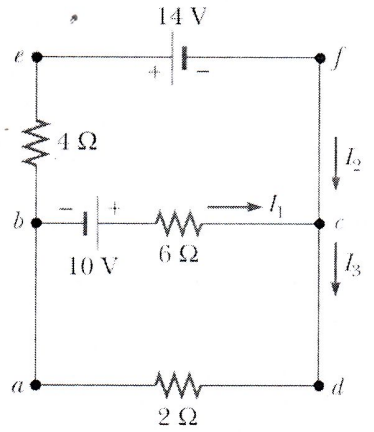
Question (III): answer the following questions: **(30 Marks)**

(1) Find the currents I_1, I_2 and I_3 in the circuit shown below?



(2) Consider three capacitors having capacitance of 3 μF, 6 μF and 12 μF. Find their equivalent capacitance if they are connected: **(a)** in parallel **(b)** in series

(3) The 12-gauge copper wire in a typical residential building has a cross-sectional area of 3.31×10^{-6} m^2. If it carries a current of 10 A, what is the drift speed of the electrons. Assume each copper atom contributes one free electron to the current. [The density of copper is 8.95 g/cm^3]

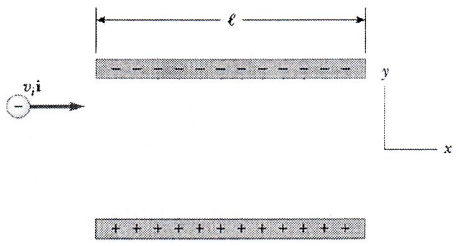
(4) Find the capacitance of a parallel-plate capacitor that has an area A= 2×10^{-4} m^2 and a plate separations ***(i)*** d =1 mm, and ***(ii)*** d = 3 mm

(5) An electron enters the region of a uniform electric field, as shown in the figure below, with v_i= 3×10^6 m/s and E=200 N/C. The horizontal length of the plates is L= 0.1 m.

a) Find the acceleration of the electron while in the electric field

b) Find the time it takes to travel through the region of the electric field

c) What is the vertical displacement y of the electron while it is in the electric field



BEST WISHES,,,

Assiut University **Faculty of Science** **Physics Department**	**Term: 2017 – 2018** **Date**: May 12th, 2018 **Time**: 2 hours

Course Name: 105P **(50%)** **Coordinator:** Dr. Alaa Abd-Elnaiem

Constant: $\varepsilon_0=8.85\times10^{-12}\ C^2/N\,m^2$; $ke=9\times10^9\ Nm^2/C^2$; $e=1.6\times10^{-19}\ C$; $m_e=9.1\times10^{-31}\ kg$; $N_A=6.02\times10^{23}$ *atoms/mole*

Answer all the following questions

Question (I): In the following multiple choice questions, please circle the correct answer, **you must write down the steps to get the correct answer.** **(10 Marks)**

(1) A battery has an *emf* of 12 V and an internal resistance of 0.05 Ω. Its terminals are connected to the load resistance of 3 Ω, then the current through this circuit equal:

7.3 μA	15 mA	3.93 A	20 A

(2) The electron and proton of the hydrogen atom are separated by a distance of approximately 5.3×10^{-11} m, the magnitude of the electric force between the two particles:

8.2×10^{-8} N	3.6×10^{-47} N	8.2×10^{-15} N	3.6×10^{47} N

(3) The magnitude of the electric force on a proton placed in an electric field of 2×10^4 N/C directed along the positive *x*-direction:

3.2×10^{15} N	3.2×10^{-15} N	9.2×10^{-8} N	9.2×10^{8} N

(4) The capacitance of a sphere of radius 150 m:

17 pF	17 nF	17 μF	17 mF

Question (II): Put (√) or (×) for all the following sentences: **(10 Marks)**

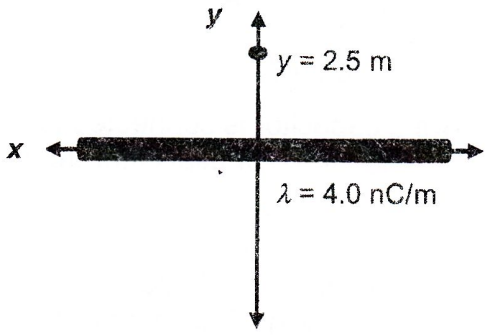
1. Electric charge is conserved and quantized ( ).
2. The electric field lines must begin on a negative charge and terminate on a positive charge ( ).
3. A capacitor basically consists of two conductors separated by any material ( ).
4. The equivalent capacitance for a series combination is always less than any individual capacitance in the combination ( ).
5. The current-potential difference curve for non-Ohmic materials is not linear ( ).
6. The ideal battery is a battery that has no internal resistance ( ).
7. For a series combination of resistors, the potential difference in the two resistors is the same ( ).
8. The Sum of the currents entering any junction in a circuit must equal the sum of the currents leaving that junction ( ).
9. The number of electric field lines drawn is proportional to the magnitude of the charge that created the electric field ( ).
10. From of advantages of using dielectrics in capacitors, decrease the maximum operating voltage of a capacitor ( ).

Q2: Write a solution then select the correct answer for only 5 Problems: (20 Points, 4 for each)

1- A straight wire carries a current of 40 A in a uniform magnetic field (magnitude = 80 mT). If the force per unit length on this wire is 2.0 N/m, determine the angle between the wire and the magnetic field.

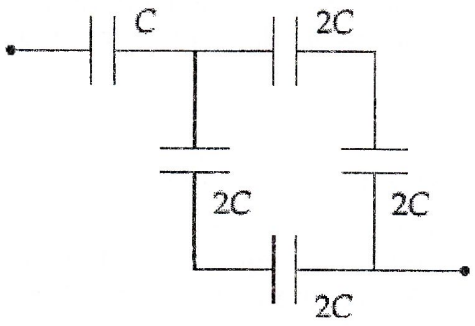
a) either 39° or 141°	**b)** either 25° or 155°	**c)** either 70° or 110°	**d)** either 42° or 138°

2- Charge of uniform linear density (4.0 nC/m) is distributed along the entire *x* axis. Determine the magnitude of the electric field on the *y* axis at .



a) 36 N/C	**b)** 29 N/C	**c)** 43 N/C	**d)** 50 N/C

3- Determine the equivalent capacitance of the combination shown when C = 24 μF.



a) 20 μF	**b)** 16 μF	**c)** 36 μF	**d)** 45 μF

Q3: Solve only 2 of the following 3 problem: - **(14 Points, 7 for each)**

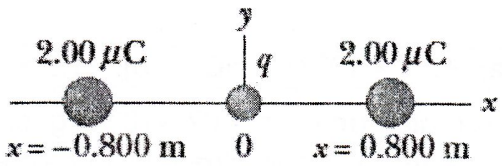
1. Given two 2.00m C charges, as shown in Figure below, and a positive test charge q =1.28x10^{-18} C at the origin,

(a) What is the net force exerted by the two 2.00 mC charges on the test charge q? **(2 point)**

(b) What is the electric field at the origin due to the two 2.00mC charges? **(1 point)**

(c)What is the electric potential at the origin due to the two 2.00mC charges? **(2 points)**

(d) What is the potential energy of the test charge q at the origin? **(2 point)**



4- A 9.5-cm radius hemispherical closed surface (half of a spherical surface) contains a net charge of 3.3×10^{-7} C (inside it). The flux through the rounded portion of the surface is 4.9×10^{4} N·m^2/C. What is the flux through the flat portion?

a) $+3.7 \times 10^{4}$ N·m^2/C	**b)** -1.2×10^{4} N·m^2/C	**c)** $+1.2 \times 10^{4}$ N·m^2/C	**d)** -3.7×10^{4} N·m^2/C

5- A proton (mass = 1.67×10^{-27} kg, charge = 1.60×10^{-19} C) moves from point **A** to point **B** under the influence of an electrostatic force only. At point **A** the proton moves with a speed of 50 km/s. At point **B** the speed of the proton is 80 km/s. Determine the potential difference $V_B - V_A$.

a) –20 V	**b)** +20 V	**c)** +27 V	**d)** –27 V

6- A wire (mass = 50 g, length = 40 cm) is suspended horizontally by two vertical wires which conduct a current I = 8.0 A, as shown in the figure. The magnetic field in the region is into the paper and has a magnitude of 60 mT. What is the tension force in either vertical wire?

a) 0.15 N	**b)** 0.68 N	**c)** 0.10 N	**d)** 0.34 N

2. A parallel-plate capacitor has plates of dimensions 2.0 cm×3.0 cm separated by a 1.0-mm thickness of paper ($\kappa = 3.7$, $E_{max} = 16 \times 10^6$ V/m)

(a) Find its capacitance **(2 points)**

(b) What is the maximum charge that can be placed on the capacitor? **(3 points)**

(c) What is the maximum energy that can be stored in the capacitor? **(2 points)**

3. A coil consists of 200 turns of wire. Each turn is a square of side 18 cm, and a uniform magnetic field directed perpendicular to the plane of the coil is turned on. If the field changes linearly from 0 to 0.50 T in 0.80 s.

(a) Find the magnitude of the induced emf in the coil when the field is changing? **(4 points)**

(b) What is the magnitude of the induced current in the coil while the field is changing? **(3 points)**

Exam ends.....All the best..... Prof. El-ameer Sayed, Dr. Ahmed Tamer, Dr. Samar Moustafa, Dr. Mohamed Abdelkareem

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(b) What is the maximum charge that can be placed on the capacitor? **(3 points)**

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Exam ends.....All the best..... Prof. El-ameer Sayed, Dr. Ahmed Tamer, Dr. Samar Moustafa, Dr. Mohamed Abdelkareem

5. A rock is thrown downward from a height above the ground with an initial speed of 10 m/s. It strikes the ground 5 s later. The height of the rock above the ground:

a) 125.5 m

b) 100.2 m

c) 150.3 m

d) 172.5 m

6. If A = [15, 80°] and B = [20, 60°], the *x*-component of A + B is:

a) -12.6

b) 7.4

c) 12.6

d) -7.4

7. A vector, B, when added to the vector C = 3i + 4j yields a resultant vector which is in the positive y direction and has a magnitude equal to that of C. The magnitude of B is:

a) 6.32

b) 3.16

c) 9.56

d) 18.22

8. The initial velocity of a particle is $9.0\hat{j}$ m/s and moves in the *xy* plane with a constant acceleration of $(2\hat{i} - 4\hat{j})$. At the instant the *x* coordinate of the particle is 25 m, the *x*-component of final speed of the particle is:

a) 10 m/s

b) 16 m/s

c) 20 m/s

d) 14 m/s

Assuit University Faculty of Science Department of Physics		Second Semester 2017 - 2018 Date: 12 / 5 / 2018 Time: 2 hours
Course Title: General Physics (1) – Code: P100 – Final Exam (50%)		

Part I- Choose the correct answer: **(22 Marks)**

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1. **The quantity with the same units as force times distance, Fd, with dimension is ML^2T^{-2}:**

a) mv^2

b) mvr

c) rmv^2

d) ma

2. **A plate of aluminum (2m x 2m) has a mass of 648 kg. The thickness of the plate is:**

(The density of aluminum is 2.70×10^3 kg/m^3):

a) 300 cm

b) 6.0 cm

c) 20 cm

d) 60 cm

3. **The position of a particle moving along the x axis is: $x = (10t^2 + 5t)$, where t is in s. The initial velocity and the initial position, respectively, are:**

a) 5 m/s and -2.5 m

b) -10 m/s and -5 m

c) 5 m/s and 0.0 m

d) 10 m/s and -5 m

4. **A particle moving with a constant acceleration of 0.08 m/s^2 has a velocity of 0.2 m/s when its position is 0.1 m. The position of the particle after 5 s is:**

a) -4.2 m

b) –2.1 m

c) 4.2 m

d) 2.1 m

9. A projectile is thrown from the top of a building with an initial velocity of 30 m/s in the horizontal direction. If the top of the building is 35 m above the ground. The speed of the projectile just before it strikes the ground is:

a) 10.3 m/s

b) 20.2 m/s

c) 30.7 m/s

d) 39.8 m/s

10. The speed of a particle moving in a circle 2 m in radius increases at the constant rate of 4.4 m/s^2. At an instant when the magnitude of the total acceleration is 6 m/s^2, the speed of the particle is:

a) 3.22 m/s

b) 3.99 m/s

c) 3.52 m/s

d) 2.86 m/s

11. A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are:

a) Both tangents to the circular path

b) Both perpendiculars to the circular path

c) Opposite to each other

d) Perpendicular to each other

/22

Part II- Solve only Four (4) out the following five (5) problems: (28 Marks)

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1) **Suppose the acceleration of a particle moving with a uniform speed v in a circular orbit of radius r is proportional to some power of r as r^a ånd some power of v as v^b. Determine the value of a & b and write final relation.**

2) **A stone thrown from the top of a building is given an initial velocity of 20 m/s straight upward. The building is 50 m high, and the stone just misses the edge of the roof on its way down. Find:**

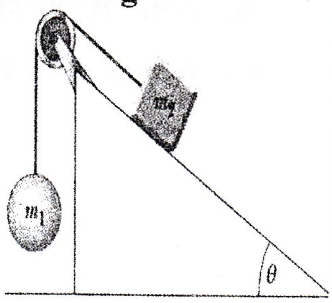
I. **The time at which the stone reaches its maximum height.**

II. **The maximum height.**

III. **The velocity of the stone just before it hits ground and the total time the stone in air.**

3) **A person begins a trip by first walking 25 km southeast from his car. He stops and sets up his tent for the night. On the second day, he walks 40 km in a direction 60° north of east. Determine the resultant displacement and its direction.**

5) Two unequal masses are attached by a light weight string that passes over a friction less pulley of negligible mass. The vertical one with a mass of m_1= 10 kg and the block of mass "m_2 = 5 kg" lies on a friction less incline of $\theta = 45^{\circ}$. Find the magnitude of the acceleration of the two masses and the tension in the string.



/28

4) A stone is thrown from the top of a building upward at an angle of 30° to the horizontal with an initial speed of 20 m/s. If the height of the building is 45 m.

i. How long does it take the stone to reach the ground?

ii. What is the speed of the stone just before it strikes the ground.

iii. Where does the stone strike the ground?