Prince Sultan University
Deanship of Educational Services
Department of Mathematics
and General Sciences

COURSE DETAILS:

PHYSICS II	PHY205	FINAL EXAM
Semester:	Spring Semester --Term 172	
Date:	Tuesday, May 15, 2018	
Time Allowed:	3 Hours (8:30 Am – 11:30 Am)	

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section:	Circle your section: 192 (8-9 Sun, Tue, Thu), 186 (9-10 Sun, Tue, Thu), 189 (1-2:15)
Instructor's Name:	Circle the name of your Instructor: Dr. Muaffaq Nofal, Dr. Hazem Abu-Farsakh

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.

GRADING:

	Page 1	Page 2	Page 3	Page 4	Page 5	Page 6	Total
Mark							
Out of	5	5	18	4	4	4	40

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

1- Which of the following statements is true?
a) When an atom loses one or more electrons, it has a negative net charge.
b) The electric force gets stronger as the distance between the charged objects increases
c) Electric field lines never intersect.
d) No electric field exists between the plates of a charged capacitor

2- Suppose a region of space has a uniform electric field, directed towards the right, as shown in the figure. Three points are labeled A, B, and C. Which statement about the electric potential is true?
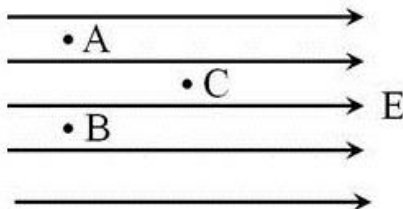

a) The potential at all three points (A, B, and C) is the same because the field is uniform.
b) The potential at point A is the highest, the potential at point B is the second highest, and the potential at point C is the lowest.
c) The potential at points A and B is the same, and the potential at point C is higher than the potential at point A.
d) The potential at points A and B is the same, and the potential at point C is less than the potential at point A.

3- An induced emf is generated in a coil by:
a) Changing the external magnetic field strength inside the coil.
b) Changing the area of the coil.
c) Changing the angle the coil makes with the external magnetic field.
d) All of the above.

4- For which of the four closed surfaces shown is the net electric flux zero?

a) Surface a.

b) Surface b.

c) Surface c.

d) Surface d.
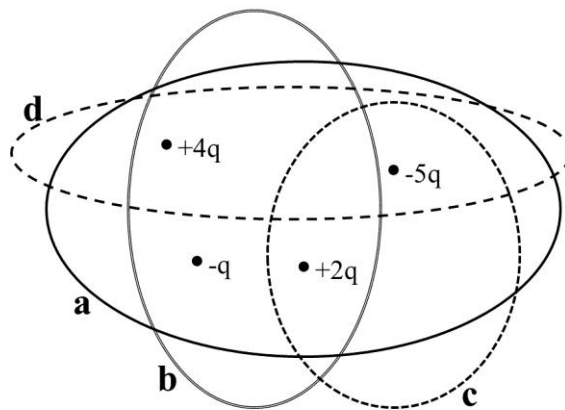
5- Given the plate areas and plate separations of five parallel plate capacitors are
Capacitor 1: area **A**, separation **d**
Capacitor 2: area **A/2**, separation **d**
Capacitor 3: area **A**, separation **d/2**
Capacitor 4: area **A/2**, separation **d/3**
Capacitor 5: area **A**, separation **d/3**
Rank these five capacitors according to their capacitances, least to greatest.

a) 1, 3, 2, 4, 5   b) 2, 1, 4, 3, 5   c) 5, 3, 4, 1, 2   d) 1, 5, 4, 2, 3

6- A resistor is connected to a battery in a simple circuit. How should a second resistor be connected with the first in order to increase the current from the battery?

a) They should be connected in parallel.
b) They should be connected in series with the one with greater resistance first in the circuit.
c) They should be connected in series with the one with less resistance first in the circuit.
d) It is impossible to increase the current by adding a resistor.

7- In the shown figure, the magnet induces a current to flow in the coil in the direction indicated. What can you say about the magnet?

a) The magnet is not moving.
b) The magnet is moving into the page.
c) The magnet is moving away from the coil.
d) The magnet is moving towards the coil
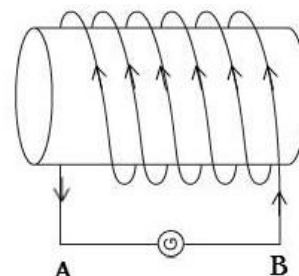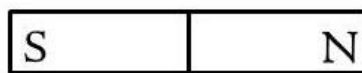
8- If the magnification of the image of an object placed in front of a certain mirror is M=+1, then
a) The mirror is concave and the object is placed at its center of curvature.
b) The mirror is convex and the object is placed at its center of curvature.
c) The mirror is plane mirror and the object is placed anywhere.
d) All of the above cases give this value of magnification.

9- What is the value of the angle θ in the following diagram?

a) 30º

b) 60º

c) 90º

d) 45º
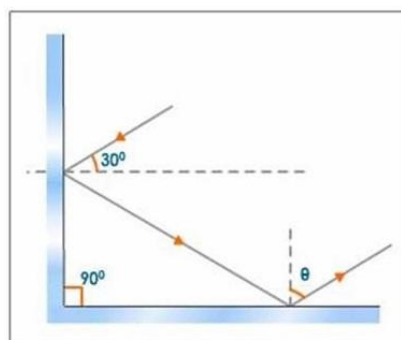
10- A ray of light, which is traveling in air, is incident on a glass plate at 45º angle. The angle of refraction of the light ray in the glass is:
a) less than 45º
b) Greater than 45º
c) Equal to 45º
d) Could be any of the above; it all depends on the index of refraction of glass.

Part 2: 9 Multiple Choice Questions (2 mark each)

1- A negative charge of -20 μC is placed on the x-axis at x=6 cm and an unknown charge Q is placed on the x-axis at x=-12 cm. What is the value of the unknown charge Q if the net electric field produced at the origin is zero?

a) -5 μC   b) 5 μC   c) -80 μC   d) 80 μC

2- A parallel plate capacitor of plate area 70 cm^2 carries a charge of 40 nC when charged at 200 volt. The space between the plates is filled with dielectric material of dielectric constant 3.5. What is the plate separation (d) of this capacitor?
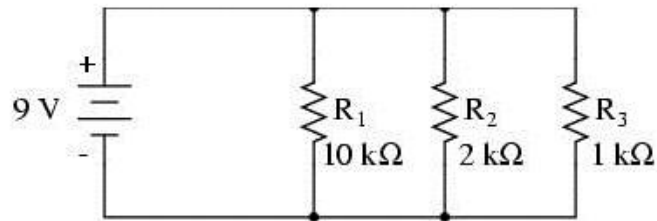
a) 0.91 mm   b) 3.22 mm   c) 1.1 mm   d) 0.31 mm

3- A 5 μf capacitor initially uncharged is connected in series to a resistor through a battery of electromotive force 12 volts. What is the charge on the capacitor after two time constants?
a) 1.62 μC   b) 103.8 μC   c) 0.81 μC   d) 51.2 μC

4- In the shown figure, how much current flows in the battery?

a) 0.692 mA
b) 5.625 mA
c) 14.4 mA
d) 3.4 mA

9 V   R$_1$ 10 kΩ   R$_2$ 2 kΩ   R$_3$ 1 kΩ

5- A step-down ideal transformer is used to reduce a primary voltage of 220 volt to 55 volt. If the current in the primary coil is 2.75 A, What is the resistance of the secondary coil?
a) 0.2 Ω   b) 5 Ω   c) 80 Ω   d) 0.0125 Ω

6- An alternating current (ac) that varies sinusoidally with time with maximum value 4 A is passing through a 12 Ω resistor. What is the power consumed in this resistor?
a) 96 Watt   b) 192 Watt   c) 2.83 Watt   d) 8 Watt

7- The critical angle when light passes through corn oil into water is 64.8°. If the refractive index of water is 1.33, what is the refractive index of corn oil?
a) 1.47   b) 0.68   c) 1.2   d) 1.51

8- A 40 cm tall object is placed in front of a certain lens. A real 10 cm tall image is formed. What is the magnification of this image?
a) 0.25   b) -0.25   c) 4   d) -4

9- An object is placed in front of a diverging lens of radius of curvature 150 cm. A virtual image is formed 25 cm away from the lens. How far is the object from the lens?
a) 18.75 cm   b) 37.5 cm   c) -18.75 cm   d) -37.5 cm

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

Problem1 (4 marks): In shown figure, two currents $I_1 = 11$ A, $I_2 = 8$ A, a=30 cm, b= 40 cm.
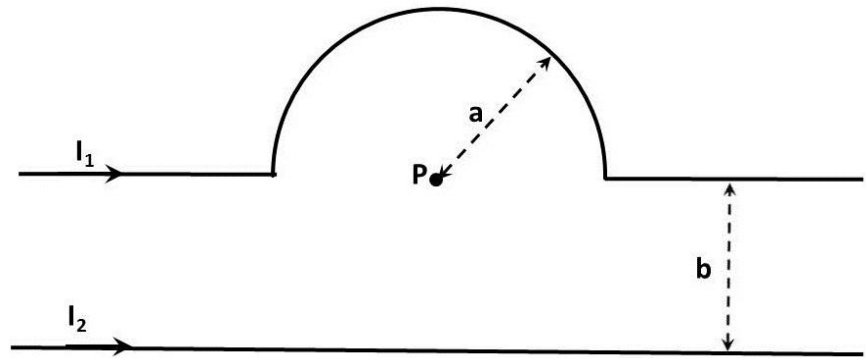

a) (3 marks) What is the magnitude and direction of the net magnetic field produced at the center of the semicircle (point P)?

b) (1 mark) What will be the magnitude and direction of the force acting on an electron that passes through point P at a speed of 4×10^4 m/s towards the top of the page?

Problem2 (4 marks): A conducting rod of length 1.2 m moves on two horizontal frictionless rails making a rectangular loop of increasing area when the rod moves to the right with a velocity of 2 m/s. One end of the rectangular loop contains a resistor of 5 Ω. This system is in a perpendicular magnetic field of 2.5 T going out of the paper as shown.

a)(1 mark) Calculate the induced emf in the circuit.
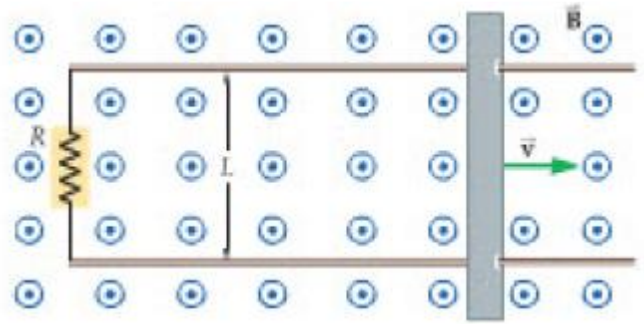
b)(1 mark) Calculate the change in flux in 0.7 seconds.

c)(1 mark) Calculate the applied force required to maintain the constant velocity of the bar.

d)(1 mark) How much electric power is generated by the motion of the rod?

Problem3 (4 marks):

An object is placed in front of a certain mirror of focal length 5 cm. If the magnification of the resulting image was M = - 0.2,

a) (0.5 mark) What is the type of the used mirror?

b) (0.5 mark) Is the formed image real or virtual?

c) (1 mark) How far is the object from the mirror?

d) (1 mark) How far is the image from the mirror?

e) (1 mark) How tall is the image if the object is 15 cm tall?

CONSTANTS:

$$k = 9 \times 10^9 \frac{N.m^2}{C^2} \; , \qquad \varepsilon_o = 8.85 \times 10^{-12} \frac{C^2}{N.m^2} \; , \quad \mu_0 = 4\pi \times 10^{-7} \frac{T.m}{A}$$

Electron mass $= 9.11 \times 10^{-31} kg$, Electron charge $= -1.6 \times 10^{-19} C$

Proton mass $= 1.67 \times 10^{-27} kg$, Proton charge $= 1.6 \times 10^{-19} C$

$$m(mili) = 10^{-3} \; , \; \mu(micro) = 10^{-6} \; , \; n(nano) = 10^{-9} \; , \; p(pico) = 10^{-12}$$