HAWAI'I PACIFIC UNIVERSITY

PHYS 2052: FIRST PRACTICE EXAMINATION

Campus/Centre:	( ) Downtown campus ( ) Loa Campus

Examination Day:	TBD	Examination Date:	TBD
Examination Time:	TBD	Duration:	75 min

Course Abbreviation & Number:	PHYS 2052
Course Title:	General Physics II

Name of Student: ____

Student Number: ____

INSTRUCTIONS TO CANDIDATES

1. This examination consists of 5 pages.
2. There are 8 conceptual and 8 quantitative questions in this examination. Answer ALL questions.
3. **All working must be shown.**
4. **Units must be shown.**
5. A list of selected formulae is provided below.

LIST OF SELECTED FORMULAE

E-field

$$E = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$$
$$F = qE$$

Electric potential

$$V = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$$
$$V = \frac{1}{4\pi\epsilon_0}\int_0^Q \frac{dq}{r}$$

Dipoles

$$\vec{\tau} = \vec{p} \times \vec{E}$$
$$U = -\vec{p}\cdot\vec{E}$$

Electric flux

$$\Phi_E = \int \vec{E}\cdot d\vec{A}$$

Gauss's law

$$\oint \vec{E}\cdot d\vec{A} = \frac{q_{\text{enclosed}}}{\epsilon_0}$$

Charge densities

$$\lambda = \frac{dq}{d\ell}$$
$$\sigma = \frac{dq}{dA}$$
$$\rho = \frac{dq}{dV}$$

Potential energy

$$U = qV$$

Spherical integration

$$dV = dr(r d\phi)(r \sin\theta\ d\theta)$$

Cylindrical integration

$$dV = dr(r d\phi)dz$$

Field/potential relations

$$\vec{E} = -\nabla V$$
$$V_b - V_a = -\int_a^b \vec{E}\cdot d\vec{\ell}$$

Capacitors

$$C = \frac{Q}{V}$$
$$U = \frac{1}{2}QV$$

Capacitor array

$$C_{\text{eq}} = \sum C_i \quad \text{(para)}$$
$$\frac{1}{C_{\text{eq}}} = \sum \frac{1}{C_i} \quad \text{(series)}$$

Parallel plate

$$C = \frac{K\epsilon_0 A}{d}$$

Current

$$I = \frac{dq}{dt} = n|q|v_d A$$
$$\vec{J} = nq\vec{v}_d$$

Conductor in equilibrium

$$\vec{E} = 0$$
$$V = \text{const}$$

Resistivity

$$\rho = \frac{E}{J}$$
$$R = \frac{\rho L}{A}$$

Ohm's law

$$V = IR$$

Power

$$P = IV$$

Internal resistance

$$V = \mathcal{E} - Ir$$

Temperature and resistivity

$$\rho(T) = \rho_0[1 + \alpha(T - T_0)]$$

Permittivity of free space

$$\epsilon_0 = 8.854 \times 10^{-12}\ \text{C}^2/\text{Nm}^2$$

Kirchoff's rules

Junction: $\sum I = 0$
Loop: $\sum V = 0$

Resistor array

$$R_{\text{eq}} = \sum R_i \quad \text{(series)}$$
$$\frac{1}{R_{\text{eq}}} = \sum \frac{1}{R_i} \quad \text{(para)}$$

Electron/proton charge

$$e^{\pm} = \pm 1.602 \times 10^{-19}\ \text{C}$$

Electron mass

$$m_e = 9.11 \times 10^{-31}\ \text{Kg}$$

Proton mass

$$m_p = 1.67 \times 10^{-27}\ \text{Kg}$$

Coulomb constant

$$k = 8.99 \times 10^9\ \text{N m}^2/\text{C}^2$$

Newton's 2nd law

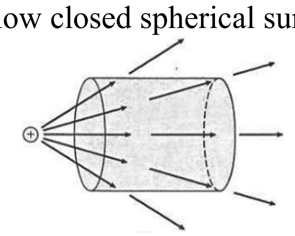
$$\sum \vec{F} = m\vec{a}$$

Course Abbreviation & Number:	PHYS 2052	Semester:	
Course Title:	General Physics II		
Examination Date:	TBD	Duration:	75 min

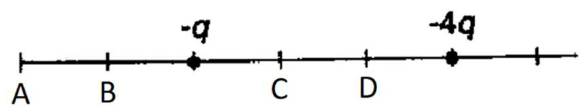
Conceptual Section (Circle the correct answer)

1. The strength of the electrostatic force between two stationary particles is equal to F. What happens to F if the distance between the particles is halved? [2]
   A. It decreases by a factor of 4
   B. It decreases by a factor of 2
   C. It increases by a factor of 2
   D. It increases by a factor of 4

2. Which is true about the net flux through the below closed spherical surface? [2]
   A. The net flux is positive.
   B. The net flux is negative.
   C. The net flux is zero.
   D. Impossible to answer.



3. Two charges –q and –4q are located on a line as shown below. At which point could a positive charge be placed if it is to experience no force? [2]
   A. Point A
   B. Point B
   C. Point C
   D. Point D



4. In a certain region of space, the electric potential is constant. From this fact, what can you conclude about the electric field in this region? [2]
   A. It is constant.
   B. It is positive.
   C. It is negative.
   D. It is zero.

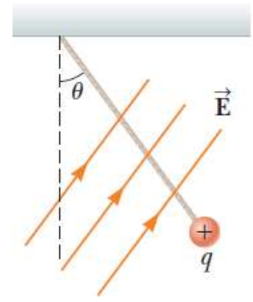
5. A charge of $+4Q$ is injected into the very center of a solid metal sphere of radius R. A few moments later, where will this excess charge reside? [2]
   A. $+2Q$ at the center, and $+2Q$ on the outer surface.
   B. $+Q$ at the center and $+3Q$ on the outer surface.
   C. $+4Q$ at the center.
   D. $+4Q$ on the outer surface.

6. The plates of a parallel-plate capacitor have a constant amount of charge on each plate as they are pushed together, without touching. How is the voltage across the plates affected? [2]
   A. The voltage across the plates decreases.
   B. The voltage across the plates becomes zero.
   C. The voltage across the plates increases.
   D. The voltage across the plates remains constant.

7. A wire of resistance 0.010 Ω. What will the resistance be if it is now stretched to twice its length without changing the volume of the wire? [2]
   A. 0.005 Ω
   B. 0.010 Ω
   C. 0.020 Ω
   D. 0.040 Ω

8. You are given a copper bar of dimensions 3 cm × 5 cm × 8 cm and asked to attach leads to it. If you want to achieve the largest resistance, you attach the leads to the opposite faces that measure [2]
   A. 5 cm × 8 cm.
   B. 3 cm × 8 cm.
   C. 3 cm × 5 cm.
   D. Any pair of faces will make the same resistance.

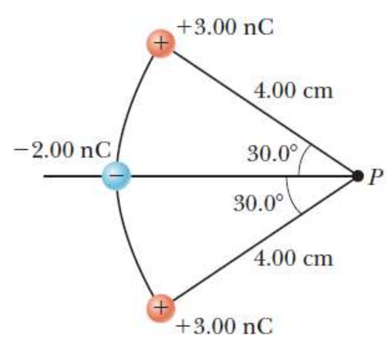
Quantitative Section



1. A charged ball of mass 1.00 g is suspended on a string in the presence of a uniform electric field. When $\vec{E} = (3.00\hat{\imath} + 5.00\hat{\jmath}) \times 10^5$ N/C, the ball is in equilibrium at an angle $\theta = 37.0°$.
   (a) Draw a free body diagram of the left charge (include vectors, coordinates, and components of vectors not parallel to axes). [2]

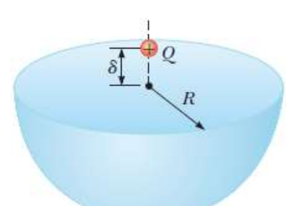
   (b) Determine the charge on the ball. [4]

   (c) Determine the tension in the string. [3]



2. Three point charges are located on a circular arc as shown in the figure.
   (a) What is the total electric field at *P*, the center of the arc? [4]

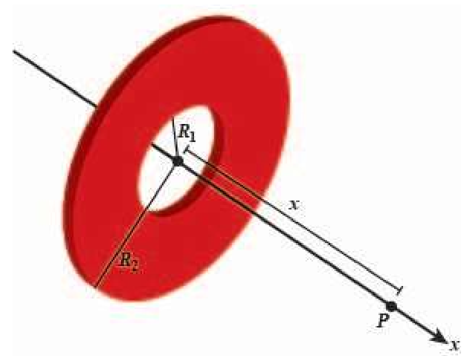
   (b) Find the magnitude of electric force exerted on a 25.00 nC point charge placed at *P*. [2]



3. A particle with charge Q is located a small distance δ immediately above the center of hemisphere's flat face of radius R. Answer the following questions when the particle is still immediately above the flat surface as we let $\delta \to 0$.
   (a) What is the electric flux through the curved surface? [3]

   (b) What is the electric flux through the flat face? [2]

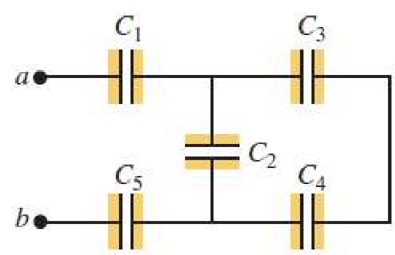
4. A uniformly charged disk has a large hole through the center. The disk has a uniform surface charge density σ, an inner radius of R_1, and an outer radius of R_2.



   (a) Find the electric potential at a point P a distance x from the center of the disk along the perpendicular central axis of the disk. [5]

   (b) Find the x component (the central axis is the x-axis) of the electric field at a point P. [3]

5. The figure shows a system of five capacitors, where the potential difference across is 50.0 V. The capacitor values are $C_1 = 3.00\ \mu F$, $C_2 = 2.80\ \mu F$, $C_3 = 8.40\ \mu F$, $C_4 = 6.80\ \mu F$, and $C_5 = 6.50\ \mu F$.



   (a) Find the equivalent capacitance of this system between electrodes a and b. [3]

   (b) How much charge is stored by this combination of capacitors? [3]

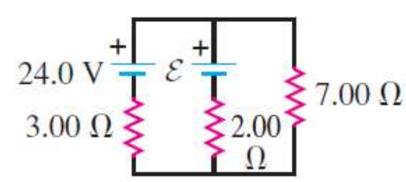
   (c) How much energy is stored in C_5? [2]

Course Abbreviation & Number:	PHYS 2052	Semester:	
Course Title:	General Physics II		
Examination Date:	TBD	Duration:	75 min

6. An 18 gauge copper wire (diameter 1.02 mm) carries a current with a current density of 3.30×10^{6} A/m^2. The density of free electrons for copper is 8.5×10^{28} electrons per cubic meter.

   (a) Calculate the current in the wire. [2]

   (b) Calculate the magnitude of the drift velocity of electrons in the wire. [2]



7. A simple circuit is shown in the diagram to the right.

   (a) What must Ɛ be in order for the current through the 7.00 Ω resistor to be 1.80 A in the downward direction? [4]

   (b) At this value of Ɛ, what is the current through the 2.00 Ω resistor? [2]

   (c) At this value of Ɛ, what is the current through the 3.00 Ω resistor? [2]

END OF EXAMINATION