

HAWAII PACIFIC UNIVERSITY



PHYS 2052: FIRST PRACTICE EXAMINATION

Campus/Centre:	<input type="checkbox"/> Downtown campus <input type="checkbox"/> Loa Campus
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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

<p>E-field</p> $E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$ $F = qE$	<p>Electric potential</p> $V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$ $V = \frac{1}{4\pi\epsilon_0} \int_0^Q \frac{dq}{r}$	<p>Dipoles</p> $\vec{\tau} = \vec{p} \times \vec{E}$ $U = -\vec{p} \cdot \vec{E}$	<p>Electric flux</p> $\Phi_E = \int \vec{E} \cdot d\vec{A}$
<p>Charge densities</p> $\lambda = \frac{dq}{d\ell}$ $\sigma = \frac{dq}{dA}$ $\rho = \frac{dq}{dV}$	<p>Spherical integration</p> $dV = dr(r d\phi)(r \sin \theta d\theta)$	<p>Potential energy</p> $U = qV$	<p>Gauss's law</p> $\oint \vec{E} \cdot d\vec{A} = \frac{q_{\text{enclosed}}}{\epsilon_0}$
<p>Parallel plate</p> $C = \frac{k\epsilon_0 A}{d}$	<p>Capacitor array</p> $C_{\text{eq}} = \sum C_i \text{ (para)}$ $\frac{1}{C_{\text{eq}}} = \sum \frac{1}{C_i} \text{ (series)}$	<p>Field/potential relations</p> $\vec{E} = -\nabla V$ $V_b - V_a = - \int_a^b \vec{E} \cdot d\vec{\ell}$	<p>Capacitors</p> $C = \frac{Q}{V}$ $U = \frac{1}{2} QV$
<p>Resistivity</p> $\rho = \frac{E}{J}$ $R = \frac{\rho L}{A}$	<p>Ohm's law</p> $V = IR$	<p>Current</p> $I = \frac{dq}{dt} = n q v_d A$ $\vec{J} = nq\vec{v}_d$	<p>Conductor in equilibrium</p> $\vec{E} = 0$ $V = \text{const}$
	<p>Power</p> $P = IV$	<p>Internal resistance</p> $V = \mathcal{E} - Ir$	<p>Temperature and resistivity</p> $\rho(T) = \rho_0 [1 + \alpha(T - T_0)]$
	<p>Permittivity</p> $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2/\text{Nm}^2$		

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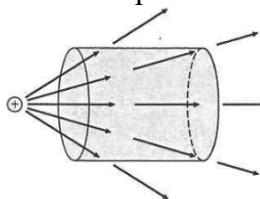
Conceptual Section (Circle the correct answer)

1. The strength of the electrostatic force between these 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 0.010Ω . What will the resistance be if it is now stretched to twice its length without changing the volume of the wire? [2]

- A. 0.005Ω
- B. 0.010Ω
- C. 0.020Ω
- D. 0.040Ω

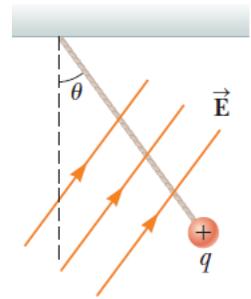
8. You are given a copper bar of dimensions $3 \text{ cm} \times 5 \text{ cm} \times 8 \text{ cm}$ and asked to attach leads to it. If you want to achieve the largest resistance, you attach the leads to the opposite faces that measure [2]

- A. $5 \text{ cm} \times 8 \text{ cm}$.
- B. $3 \text{ cm} \times 8 \text{ cm}$.
- C. $3 \text{ cm} \times 5 \text{ cm}$.
- D. Any pair of faces will make the same resistance.

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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 $\vec{E} = (3.00\hat{i} + 5.00\hat{j}) \times 10^5 \text{ N/C}$, the ball is in equilibrium at an angle $\theta = 37.0^\circ$.

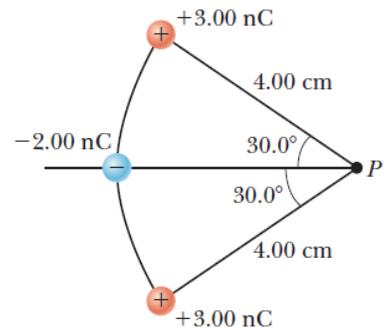


(a) Draw a free body diagram of the left charge (include vectors, coordinates, and components of vectors not parallel to axes). [2]

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

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

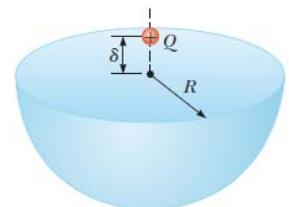
2. Three point charges are located on a circular arc as shown in the figure.



(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 $\delta \rightarrow 0$.



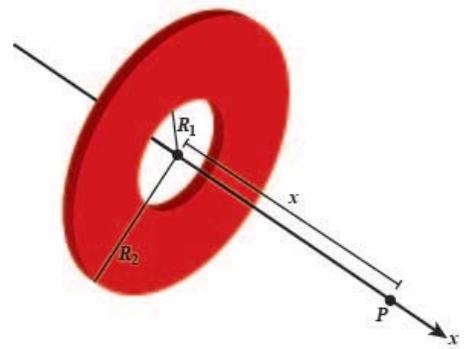
(a) What is the electric flux through the curved surface? [3]

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

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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 .

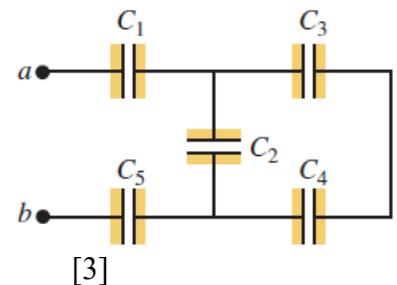
- (a) Find the electric potential at a point P a distance x from the center of the disk along the perpendicular central axis of the disk. [5]



- (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 $C_1 = 3.00 \mu\text{F}$, $C_2 = 2.80 \mu\text{F}$, $C_3 = 8.40 \mu\text{F}$, $C_4 = 6.80 \mu\text{F}$, and $C_5 = 6.50 \mu\text{F}$.

- (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]

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6. The radius of 22 gauge Nichrome wire is 0.32 mm. The resistivity of Nichrome is $1.00 \times 10^{-6} \Omega\text{m}$ at 0°C .
- (a) Calculate the resistance per unit length of this wire at 0°C . [2]
- (b) If Nichrome wire of length 20 m kept at a constant 0°C temperature is connected at both ends to a 9 V battery, then how much power is dissipated through the wire? [2]
7. A 12.0V battery has an internal resistance of 0.24Ω and a charge of 50.0 Ah. The battery is charged by passing a 10 A current through it for 5.0 h.
- (a) What is the terminal voltage during charging? [2]
- (b) What total electrical energy is supplied to the battery during charging? [2]
- (c) What electrical energy is dissipated in the internal resistance during charging? [2]
8. A 1.50 m cylindrical rod of diameter 0.500 cm is connected to a power supply that maintains a constant potential difference of 15.0 V across its ends, while an ammeter measures the current through it. You observe that at room temperature 20.0°C the ammeter reads 18.5 A, while at a temperature of 92.0°C it reads 17.2 A. You can ignore any thermal expansion of the rod.
- (a) Find the resistivity at 20.0°C . [3]
- (b) Find the temperature coefficient of resistivity at 20.0°C for the material of the rod. [3]

END OF EXAMINATION