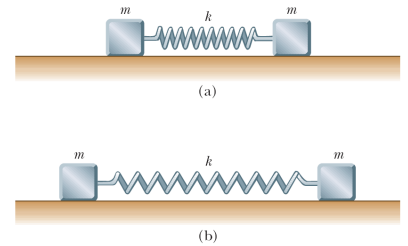


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- 1 Two identical metallic blocks resting on a frictionless horizontal surface are connected by a light metallic spring having the spring constant 100 N/m and an unstretched length of 0.300 m as shown in Figure P19.57a. A total charge of Q is slowly placed on the system, causing the spring to stretch to an equilibrium length of 0.400 m as shown. Determine the value of Q , assuming that all the charge resides on the blocks and modeling the blocks as point charges.



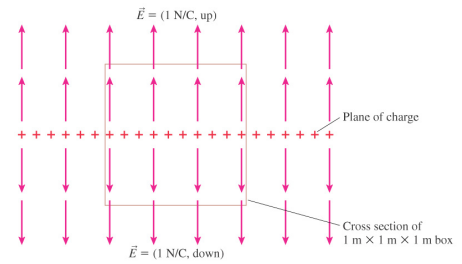
- 2 Two small spheres of mass m are suspended from strings of length ℓ that are connected at a common point. One sphere has charge Q , and the other has charge $2Q$. The strings make angles θ_1 and θ_2 with the vertical.
- (a) How are θ_1 and θ_2 related?
- (b) Assume that θ_1 and θ_2 are small. Show that the distance r between the spheres is given

$$\text{by } r \approx \left(\frac{4k_e Q^2 \ell}{mg} \right)^{1/3}$$

- 3 Find the electric field at the point 20 cm above the centre of the square made of 4 charged rods of $L=20\text{cm}$ and $Q=1\text{mC}$ each. (use the opposite page to present your solution with full diagram)
- 4 A vertical electric field of magnitude $2.00 \times 10^4 \text{ N/C}$ exists above the Earth's surface on a day when a thunderstorm is brewing. A car covers a rectangle measuring 6.00 m by 3.00 m on the roadway below it, which is built on dry fill. The roadway slopes downward at 10.0° . Determine the electric flux through the bottom of the car.
- 5 At some moment of time the following charges are placed (fixed) at given coordinates $Q(1,1,1)$; $-2Q(1,2,3)$; $-Q(0,0,2)$; $+2Q(1,0,2)$.
Find the total flux through the surface of the sphere centered at $(0,0,0)$ and having radius of
- a) 1
b) $3^{1/3}$
c) $4^{1/3}$
d) 4

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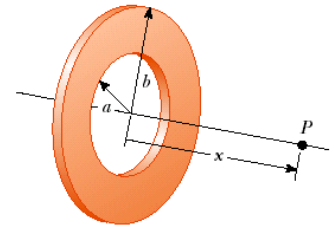
6 i) The total electric flux through this box is: 6



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ii) Find the flux through the circular disk of radius 5 cm which is placed at distance 5 m from the single point charge $Q=2\text{mC}$. The point charge is on the axis perpendicular to the disk and passing through its centre.

7 Calculate the electric potential at point P on the axis of the annulus shown on the right which has a uniform charge density σ .

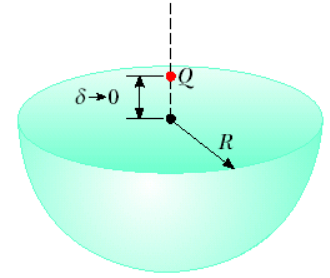


8A) Obtain the expression for the electric potential at distance r from the centre of the charged cylindrical conductor of radius R and infinite length.

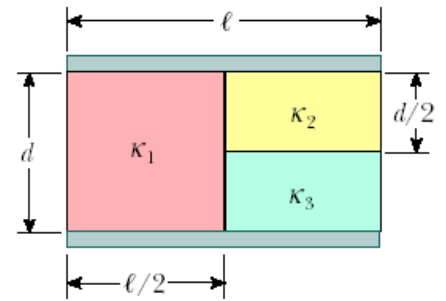
8B) Use the result of the Part A to get the expression for the infinite cylindrical capacitor of inner radius a and out radius b

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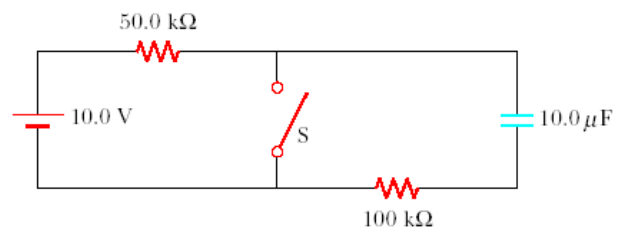
- 9 A point charge Q is located just above the center of the flat face of a hemisphere of radius R as shown in Figure P24.15. What is the electric flux (a) through the curved surface and (b) through the flat face?



- 10 A parallel-plate capacitor is constructed by filling the space between two square plates with blocks of three dielectric materials, as in Figure. You may assume that $\ell \gg d$. (a) Find an expression for the capacitance of the device in terms of the plate area A and d , κ_1 , κ_2 , and κ_3 . (b) Calculate the capacitance using the values $A = 1.00 \text{ cm}^2$, $d = 2.00 \text{ mm}$, $\kappa_1 = 4.90$, $\kappa_2 = 5.60$, and $\kappa_3 = 2.10$.



- 11 In the circuit below, the switch S has been open for a long time. It is then suddenly closed. Determine the time constant (a) before the switch is closed and (b) after the switch is closed. (c) Let the switch be closed at $t = 0$. Determine the current in the switch as a function of time.

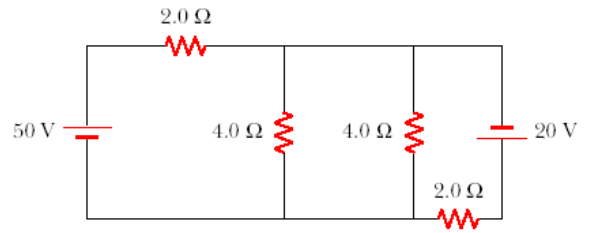


ASSIGNMENT 5
Assigned March 13 Due: March 30, 6:00 PM

PHY1124B Winter 2017
Dr. Andrzej Czajkowski

STUDENT LAST NAME: _____ STUDENTNUMBER: _____

12 Calculate the power delivered to each resistor shown below



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