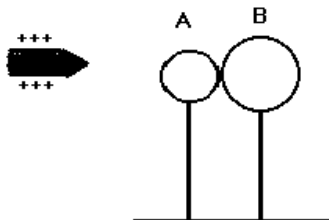


## Unit 2 Conceptual Questions

Please answer questions on Scantron form 882-ES. Otherwise you will receive a zero. Poorly erased responses will not be re-graded. Turn in two days before unit exam. You are encouraged to work together and discuss these questions!!!

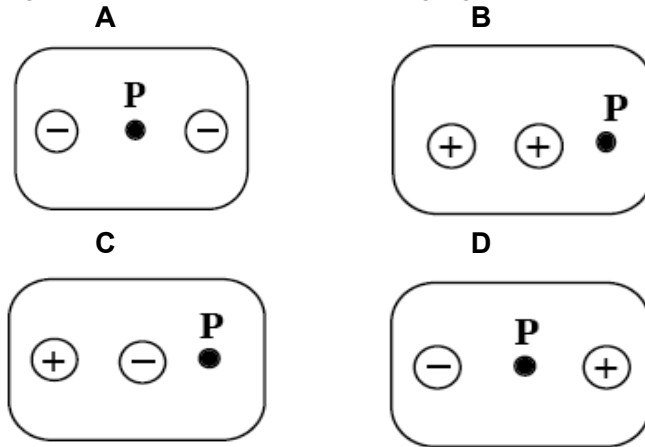
- A  $1.0\mu\text{C}$  charge is placed  $0.50\text{m}$  from a  $250.0\mu\text{C}$  charge of equal mass. Which charge has a larger Coulomb force acting on it?
  - the  $1.0\mu\text{C}$  charge
  - the  $250.0\mu\text{C}$  charge
  - the force is same on both!
- The object that has the larger acceleration in the above question is the
  - $1.0\mu\text{C}$  charge
  - $250.0\mu\text{C}$  charge
  - the accelerations are equal!
- Three isolated charges 1,2, and 3 are located in some region of space. The magnitude and direction of the force that charge 1 exerts on charge 3 depends is independent of
  - the sign of charge 3
  - the sign of charge 1
  - the distance between 1 and 3
  - the distance between 1 and 2
  - the magnitude of the sign of 1
- Two conducting spheres, A and B, on insulating stands are brought into contact. A positively charged rod is brought near sphere A (without touching) as shown in the figure. While the rod is in place, the two spheres are separated. How will the spheres be charged?

- | A           | B        |
|-------------|----------|
| a. positive | positive |
| b. positive | negative |
| c. negative | positive |
| d. negative | negative |
| e. zero     | zero     |

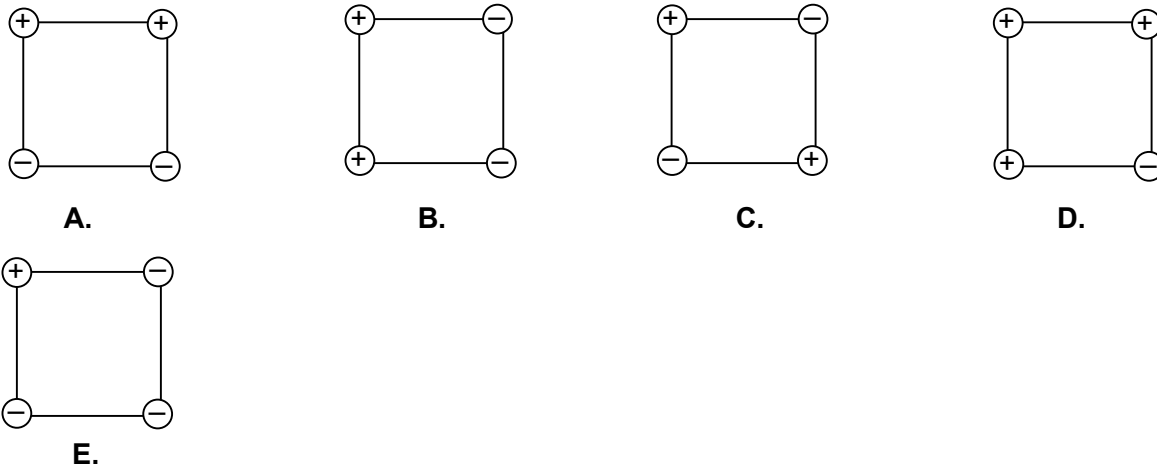


- A charge  $Q$  is placed on a conducting shell. The field inside the shell is
  - zero
  - $kQ/r$
  - $kq/r^2$
  - not enough information given
- A charge  $Q$  is placed inside conducting shell. The charge on the inner and outer surfaces of the shell are
  - zero, zero
  - $Q, -Q$
  - $-Q, Q$ , respectively.
- A uniform electric field points to the left of this page. A proton and an electron have velocities that point to the right. What happens to their speeds in this field?
  - The electron slows down but the proton speeds up.
  - The electron and the proton speeds up.
  - The electron speeds up but the proton slows down.
  - The electron and the proton slow down.

8. Shown below are four arrangements of two electric charges. In each figure, a point labeled **P** is also identified. All of the charges are the same size, 20 C, but they can be either positive or negative. The charges and point P all lie on a straight line. The distances between adjacent items, either between two charges or between a charge and point P, are all 5 cm. There are no other charges in this region. For this problem, we are going to place a +5 C charge at point P. In which case is the strength of the force on the 5C charge greatest?

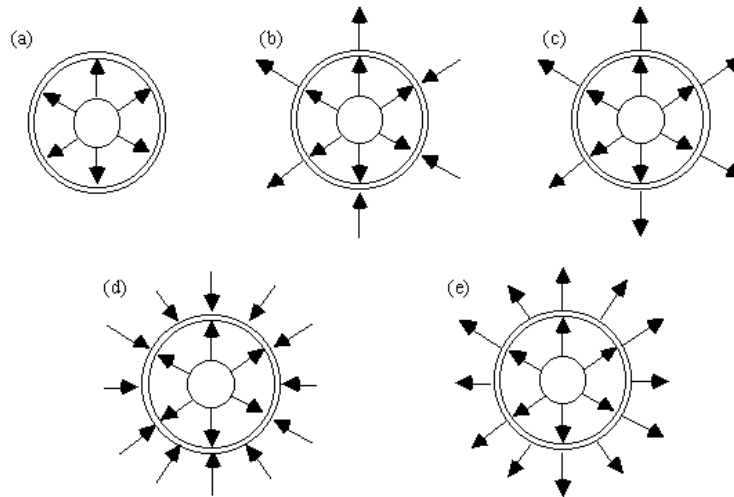


9. Consider the following charge distributions. The magnitudes of the charges at the corners of the square are equal. In which of the following cases is the electric field at the center of the square zero.



10. The electric field vector on the outside surface of a positively charged conductor points
- tangent to its surface
  - inward and perpendicular to its surface
  - at 45 degrees to the surface
  - outward and perpendicular to its surface
11. An electron is moving to the right in an electric field that points to the left. The work done by the field after the electron travels a certain distance to the right is,
- greater than zero
  - equal to zero
  - less than zero
12. The change in potential energy of the electron above is
- greater than zero
  - equal to zero
  - less than zero
13. The electron above undergoes a change in electrical potential that is
- greater than zero
  - equal to zero
  - less than zero

14. Which one of the following figures shows a qualitatively accurate sketch of the electric field lines in and around this system?

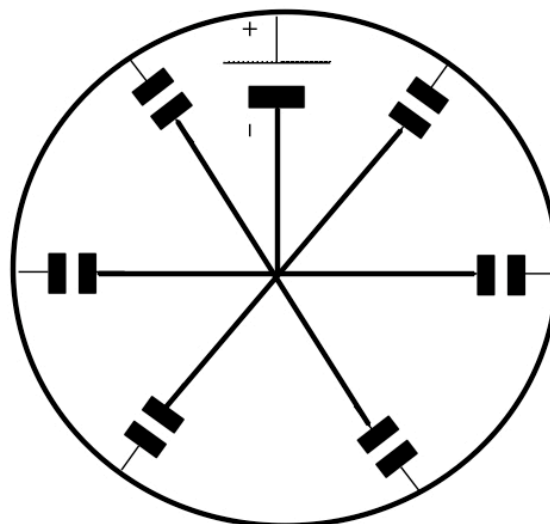


15. Two spherical conductors have a total charge  $Q$ . The radii of the spheres are  $c$  and  $d$ , where  $c > d$ . Which sphere has the higher potential?
- The sphere of radius  $c$
  - The sphere of radius  $d$
  - Both have the same potential
16. Two spherical conductors of radii  $c$  and  $d$  (where  $c > d$ ) and charge  $Q_C$  and  $Q_D$  are connected together with a wire. Which of the following is not true regarding the spheres when they reach equilibrium? Assume the separation of the spheres is large.
- The electrical potential of each sphere is the same.
  - The charge gained or lost by sphere  $c$  equal the charge lost or gained by sphere  $d$ .
  - The electric field at the surface of each sphere is the same.
  - None of the above
17. Which one of the following statements concerning electrostatic situations is false?
- $\mathbf{E}$  is zero everywhere inside a conductor.
  - Equipotential surfaces are always perpendicular to  $\mathbf{E}$ .
  - It takes zero work to move a charge along an equipotential surface.
  - If  $V$  is constant throughout a *region of space* then  $E$  must be zero in that region.
  - No force component acts along the path of a charge as it is moved along an equipotential surface.
18. When two capacitors are connected in series, the charge on the capacitors
- is larger on the larger capacitor.
  - is smaller on the larger capacitor.
  - is the same on both capacitors.
19. When two capacitors are connected in parallel, the charge on the capacitors
- is larger on the larger capacitor.
  - is smaller on the larger capacitor.
  - is the same on both capacitors.
20. A parallel plate capacitor,  $C$ , is connected to a battery. If the potential difference of the battery is  $V$ , what is the sum total of the charge on the plates?
- 0
  - $CV/2$
  - $2CV$

21. A dielectric is inserted into a parallel plate capacitor that is connected to a battery. Which of the following is not true regarding the insertion of the dielectric?
- The charge on the capacitor increases.
  - Its capacitance increases.
  - The electric field between the plates increases.
  - The energy stored by the capacitor increases.

22. Six equivalent capacitors  $C$  are connected in a circuit as shown below. What is the equivalent capacitance of this circuit?

- $C/3$
- $C/6$
- $2C$
- $3C$
- $6C$



23. Suppose a potential difference is applied to a conductor that obeys Ohm's Law. Now suppose we double the potential difference across the conductor. Which of the following statements is true about the conductor?
- Its resistance doubles.
  - The current through it doubles.
  - The resistance drops by a factor of two.
  - The power dissipated by the conductor doubles.

24. Two cylindrical copper wires have the same mass. Wire A is three times as long as wire B. Their resistances are related by

- $R_A = 27R_B$
- $R_A = 9R_B$
- $R_A = 3R_B$
- $R_A = R_B$

25. Two resistors dissipate the same amount of power. The potential drop across resistor A is twice that across resistor B. If the resistance of B is  $R$ , what is the resistance of A?

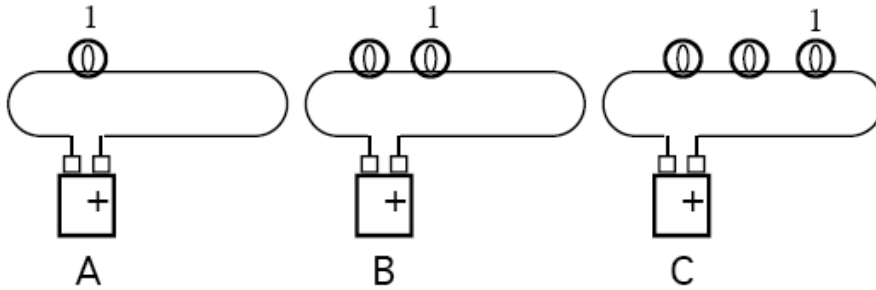
- $R$
- $2R$
- $R/2$
- $4R$
- $R/4$

In questions 26-28:

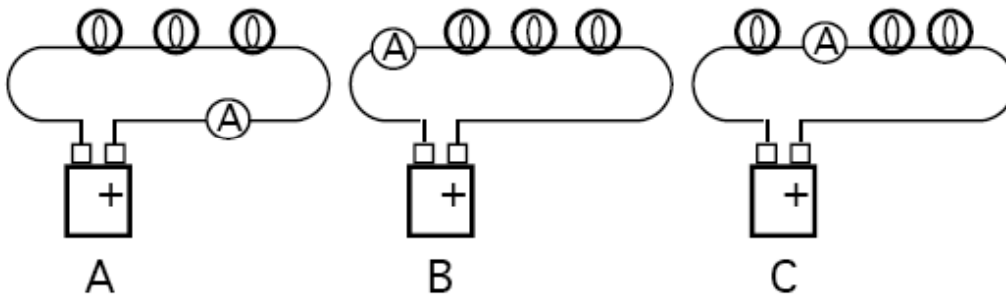
- a) bulbs are identical
- b) treat the bulbs as ohmic resistors
- c) treat the wires as zero resistance connectors
- d) batteries are ideal (no internal resistance)

**Note: More than one answer is possible in 26-28.**

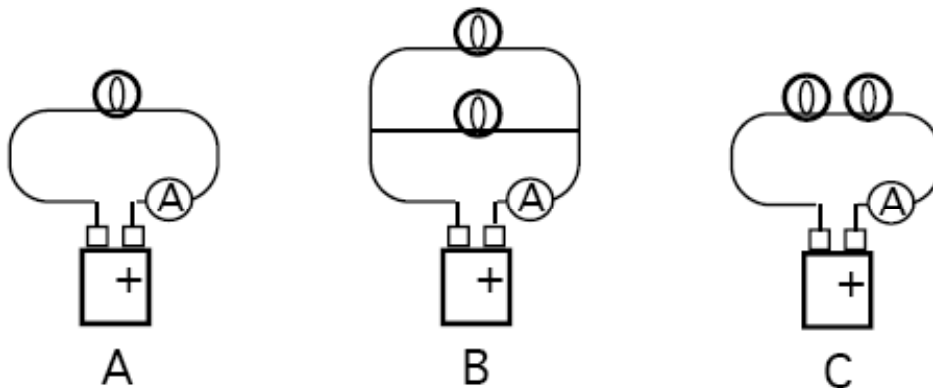
26. In which case is the bulb labeled "1" brightest?



27. In which case is current through the ammeter greatest?



28. In which case is the current through the ammeter greatest?



29. True or False: The equivalent resistance of a network of three parallel resistors is always less than that of the smallest resistance in the network.

30. Which has a larger resistance?

- a. a 100W lamp
- b. a 60W lamp

Refer to the circuit shown on the right. Positive terminal of battery is shown.

31. All lamps (circles) are identical. Which lamp(s) burn(s) brighter?  
 a. A                      b. B                      c. C                      d. C and D  
 e. A and B

32. The larger current is through lamp  
 a. A                      b. B  
 c. current is same through A and B

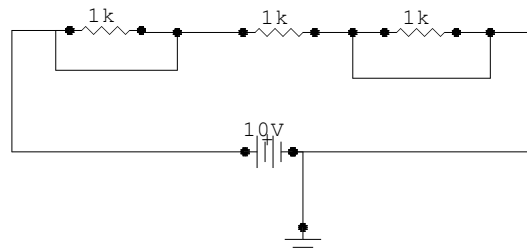
33. If lamp A only is unscrewed, which lamp(s) will go out?  
 a. B                      b. C                      c. B and C                      d. neither B or C

34. In the circuit shown, the larger current is through lamp  
 a. C                      b. D                      c. current is same through C and D

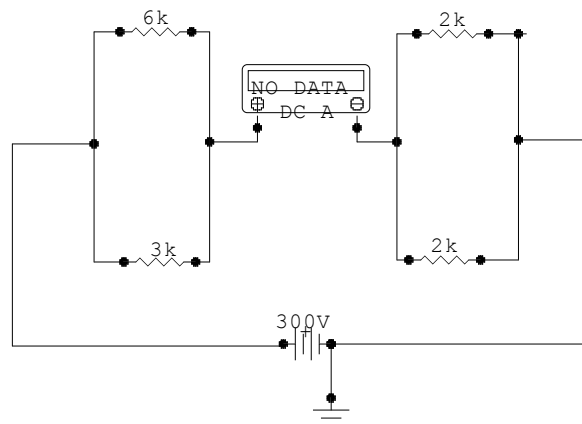
35. If a wire were connected from point 1 to point 2 in the circuit, which lamps would burn?  
 a. A                      b. B                      c. A and B                      d. all                      e. C and D

36. A 40W bulb and a 100W bulb are connected in series. Which will glow more brightly?  
 a. the 40W bulb                      b. the 100W bulb                      c. both glow equally bright

37. Consider the circuit shown below. What is the current delivered by the battery?  
 a. 0 A  
 b. 0.010A  
 c. 0.020A  
 d. 0.030A  
 e. 0.040A

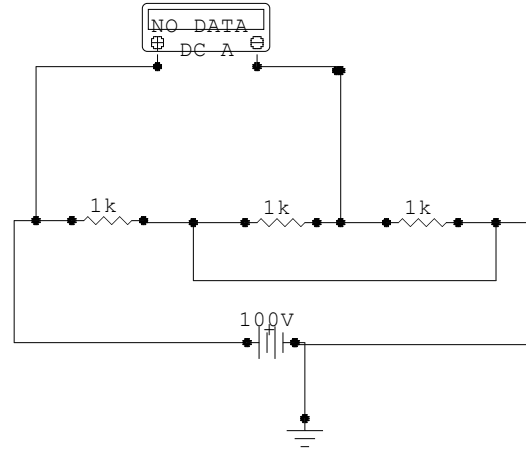


38. Consider the circuit shown on the right. Note the ammeter in the diagram. What value does it read?  
 a. 0 A  
 b. 0.10A  
 c. 0.20A  
 d. 0.30A  
 e. 0.40A

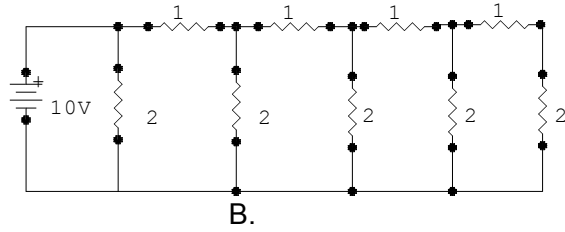
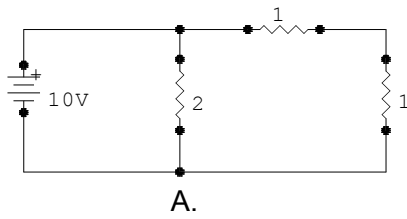


39. Consider the circuit shown on the right. Note that there is an ammeter in the diagram. What is the total current delivered by the battery?

- A. 0A
- B. 0.10A
- C. 0.20A
- D. 0.30A
- E. 0.40A



40. Which of the circuits below draws the most current from the battery? All resistor values are in ohms.



C. Both circuits produce the same current.