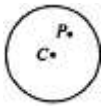
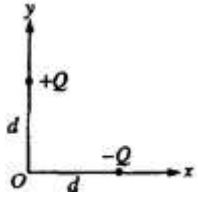
AP2 EXAM #4 2014: Ch11-15 & 18-22 Multiple Guess Section

2. The *hollow* metal sphere shown below right holds a net positive electric charge. Point ***C*** is the center of the sphere and point ***P*** is *any other* point inside the sphere. Which of the following is true of the electric field at these points?



(A) It is zero at both points. (B) It is zero at C, but at P it is not zero and is directed inward.
(C) It is zero at C, but at P it is not zero and is directed outward.
(D) It is zero at P, but at C it is not zero. (E) It is not zero at either point.

Use the following info for Questions #3 & 4: Two charges ***–Q*** and ***+Q*** are just chilling on the ***x–*** and ***y–***axes, respectively, each at a distance ***d*** from the origin ***O***, as shown below right.



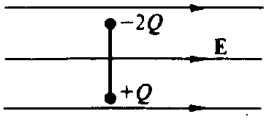
3. What is the direction of the electric field at the origin ***O*** ?

a. → b. ← c. ↖ d. ↘ e. ↙

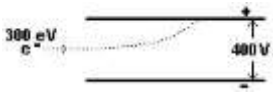
4. What is the magnitude of the electric field at the origin ***O***?

(A) $\frac{kQ}{2d^2}$ (B) $\frac{kQ}{\sqrt{2}d^2}$ (C) $\frac{kQ}{d^2}$ (D) $\frac{\sqrt{2}kQ}{d^2}$ (E) $\frac{2kQ}{d^2}$

7. A rigid insulated baton with two unequal charges attached to the ends is placed in a uniform electric field ***E*** as shown below right. The rod experiences a

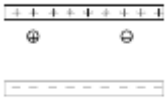


(A) net force to the left and a clockwise rotation
(B) net force to the left and a counterclockwise rotation
(C) net force to the right and a clockwise rotation
(D) net force to the right and a counterclockwise rotation
(E) rotation, but no net force



9. As demonstrated by Millikan, a 300 *eV* electron is aimed midway between two parallel metal plates connected to a battery of terminal voltage of 400 V. The electron is deflected upwards and strikes the upper plate as shown. What is the kinetic energy of the electron just before striking the metal plate?

(A) 300 eV (B) 400 eV (C) 500 eV (D) 700 eV (E) 740 eV



11. A single electron and a single proton are placed between two oppositely charged parallel plates. Both are closer to the positive plate than the negative plate, as shown above. Which of the following statements is true?

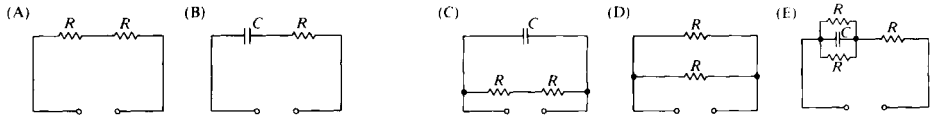
I. The force on the proton is greater than the force on the electron.

II. The potential energy of the proton is greater than that of the electron.

III. The potential energy of the proton and the electron is the same.

(A) I only (B) II only (C) III only (D) I & II only (E) I & III only

Use the following info for Questions #13 & 14: The five partial circuits below are composed of resistors ***R***, all of equal resistance, and capacitors ***C,*** all of equal capacitance. A battery that can be used to complete any of the circuits is available.

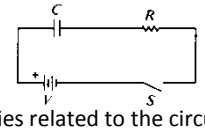


13. Into which circuit should the battery be connected to obtain the greatest steady power dissipation?

(A) A (B) B (C) C (D) D (E) E

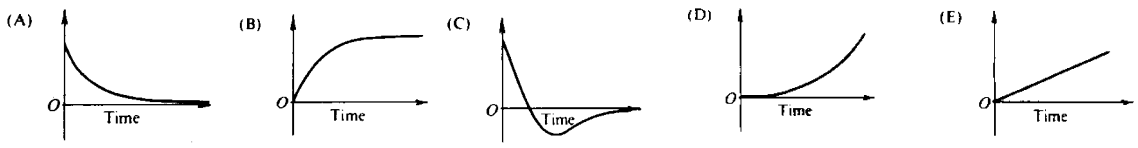
14. Which circuit will retain stored energy if the battery is connected to it and then disconnected?

(A) A (B) B (C) C (D) D (E) E



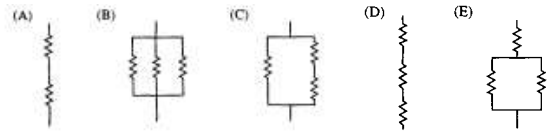
Use the circuit shown to the right for Questions #17 - 19:

Assume the capacitor ***C*** is initially uncharged. The following graphs may represent different quantities related to the circuit as functions of time ***t*** after the switch ***S*** is closed



17. Which graph best represents the voltage versus time across the resistor ***R***?
(A) A (B) B (C) C (D) D (E) E

25 Which of the following combinations of 4Ω resistors would dissipate 24 W when connected to a 12 Volt battery?

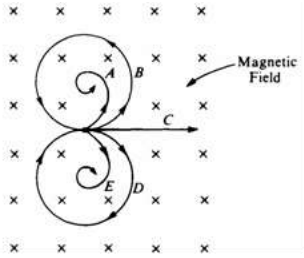


30. A charged particle with constant speed enters a uniform magnetic field pointing perpendicular to the particle velocity. The particle will:
A) Speed up B) Slow down C) Experience no change in velocity D) Follow a parabolic arc E) Follow a circular arc

31. A proton of mass ***M*** and kinetic energy ***K*** passes undeflected through a region with electric and magnetic fields perpendicular to each other. The electric field has magnitude ***E***. The magnitude of the magnetic field ***B*** is

$$A)\ \sqrt{\frac{ME^2}{K}} \qquad B)\ \sqrt{\frac{ME}{2K}} \qquad C)\ \sqrt{\frac{2ME^2}{K}} \qquad D)\ \sqrt{\frac{ME^2}{2K}} \qquad E)\ \sqrt{\frac{ME^2}{K^2}}$$

34. [MULTIPLE SELECTION QUESTION] Which of the paths shown to the right represents the path of an electron traveling without any loss of energy through a uniform magnetic field directed into the page?
(A) A (B) B (C) C (D) D (E) E



Use the following info for Questions #35 & 36: A magnetic field of 0.1T forces a proton beam of 1.5 mA to move in a circle of radius 0.1 m. The plane of the circle is perpendicular to the magnetic field.

35. Of the following, which is the best estimate of the work done by the magnetic field on the protons during one complete orbit of the circle?
(A) 0 J (B) 10^{-22} J (C) 10^{-5} J (D) 10^{2} J (E) 10^{20} J

36. Of the following, which is the best estimate of the speed of a proton in the beam as it moves in the circle?
(A) 10^{-2} m/s (B) 10^{3} m/s (C) 10^{6} m/s (D) 10^{8} m/s (E) 10^{15} m/s

FR:

4. (10pts: ***B***) In a small linear accelerator I built out of spare dishwasher parts in my basement during one of my attempts to rule the world, protons are accelerated from rest through some potential difference to a speed of 31,000 m/s. The resulting stream of protons produces a current of 2×10^{-4} A.

(A) Calculate that potential difference I used to accelerate my protons.

(B) As a test, I aimed the proton beam at a neighbor's cat. Calculate the amount of thermal energy produced in the cat.

Later, as another cool test, I aim the proton beam into a large magnetic field, ***B***, that causes the beam to follow an upward circular path.

(C) Calculate the magnitude of the magnetic field that causes a circular path of protons with radius 10-cm.

(D) What is the direction of ***B*** is the proton beam is aimed to the right and the circular path arcs upward.