Phys 2B Summer 2022

Quiz 2 Practice

<u>Question 1:</u>

Which of the following statements is/are true?

    I. Conductors in equilibrium must have zero net charge.

    II. Conductors in equilibrium must have $E = 0$ internally.

    III. Conductors in equilibrium must have $V = 0$ internally.

(a) I only

(b) II only

(c) III only

(d) II and III, but not I

(e) All of I, II, and III

Question 2:

Two protons are separated by a distance of 2.0 meters. What is the electric potential (voltage) at a point halfway between them?

(a) 0

(b) 0.72 nV

(c) 1.4 nV

(d) 2.9 nV

(e) 5.8 nV

Question 3:

A charge $q_1 = +2.0\,\text{C}$ is at the origin and a second charge $q_2 = -3.7\,\text{C}$ is at $x = 1.0\,\text{m}$. At which value of x between the two charges is the net electric potential equal to 0?

(a) $x \approx 0.15\,\text{m}$

(b) $x \approx 0.22\,\text{m}$

(c) $x \approx 0.29\,\text{m}$

(d) $x \approx 0.35\,\text{m}$

(e) $x \approx 0.41\,\text{m}$

Question 4:

The potential in a certain region is given by $V(x) = (1.40\,\text{V/m}^2)x^2$. What is the electric field inside this region at $x = 15.0\,\text{m}$?

(a) $(-42.0\,\text{V/m})\hat{x}$

(b) $(-21.0\,\text{V/m})\hat{x}$

(c) $(+21.0\,\text{V/m})\hat{x}$

(d) $(+42.0\,\text{V/m})\hat{x}$

(e) $(+315\,\text{V/m})\hat{x}$

Question 5:

A uniformly charged ring has radius $R = 20\,\text{cm}$ and total charge $Q = 8.0\,\text{nC}$. How much energy is required to bring a proton from rest, infinitely far away from the ring, to the center of the ring (still at rest)?

(a) 0

(b) $2.9 \times 10^{-17}\,\text{J}$

(c) $5.8 \times 10^{-17}\,\text{J}$

(d) $2.9 \times 10^{-16}\,\text{J}$

(e) $3.6 \times 10^{-16}\,\text{J}$

Question 6:

A parallel-plate capacitor is attached to a battery, and the battery is allowed to charge the capacitor fully. The circuit consists purely of the battery and the single capacitor. After the capacitor is fully charged, its plates are pulled farther apart without otherwise altering the system (the capacitor is still attached to the battery). Which of the following remain(s) the same before and after separating the plates?

    I. The voltage difference between the capacitor's plates.

   II. The charge stored on the capacitor's plates.

  III. The energy stored by the capacitor.

(a) I only

(b) II only

(c) III only

(d) I and III, but not II

(e) All of I, II, and III

Question 7:

An insulator with dielectric breakdown field strength of 120 MV/m is to be used to keep a power line from discharging into the environment. If the power line carries a 500 kV current and the environment is at 0 V, roughly how thick must the layer of insulating material be to remain insulating? Approximate the electric field as constant.

(a) 0.25 mm

(b) 0.94 mm

(c) 1.9 mm

(d) 4.2 mm

(e) 9.8 mm

Question 8:

A 12 nF capacitor is fully charged by a 9.0 V battery. It is then disconnected from the battery, and connected to a 9.0 nF capacitor, which is initially uncharged. What will be the final charge on the 12 nF capacitor, once it is done transferring charge to the 9.0 nF capacitor?

(a) 33 nC

(b) 62 nC

(c) 71 nC

(d) 88 nC

(e) 108 nC

What is the equivalent capacitance of the entire capacitor network shown below?

(a) 0.94 μF

(b) 1.2 μF

(c) 2.8 μF

(d) 9.5 μF
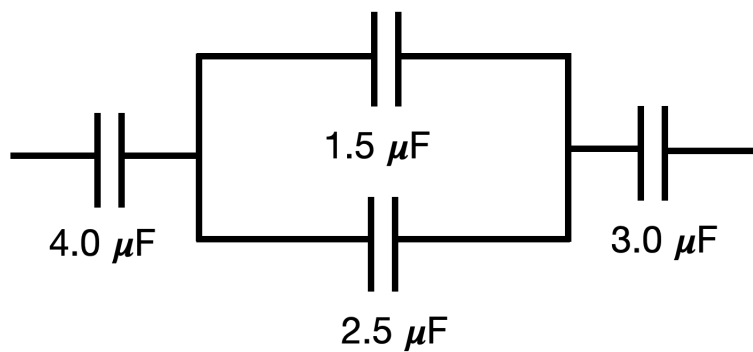
(e) 11 μF

Question 10:

A typical microwave oven runs at $1000\,\text{W}$ and $110\,\text{V}$. How many electrons pass through such a microwave oven in $35\,\text{s}$ of operation?

(a) 1.9×10^{12} electrons

(b) 4.8×10^{15} electrons

(c) 6.7×10^{17} electrons

(d) 3.2×10^{19} electrons

(e) 2.0×10^{21} electrons