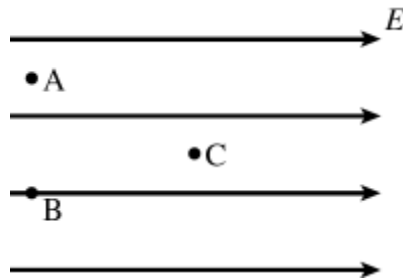


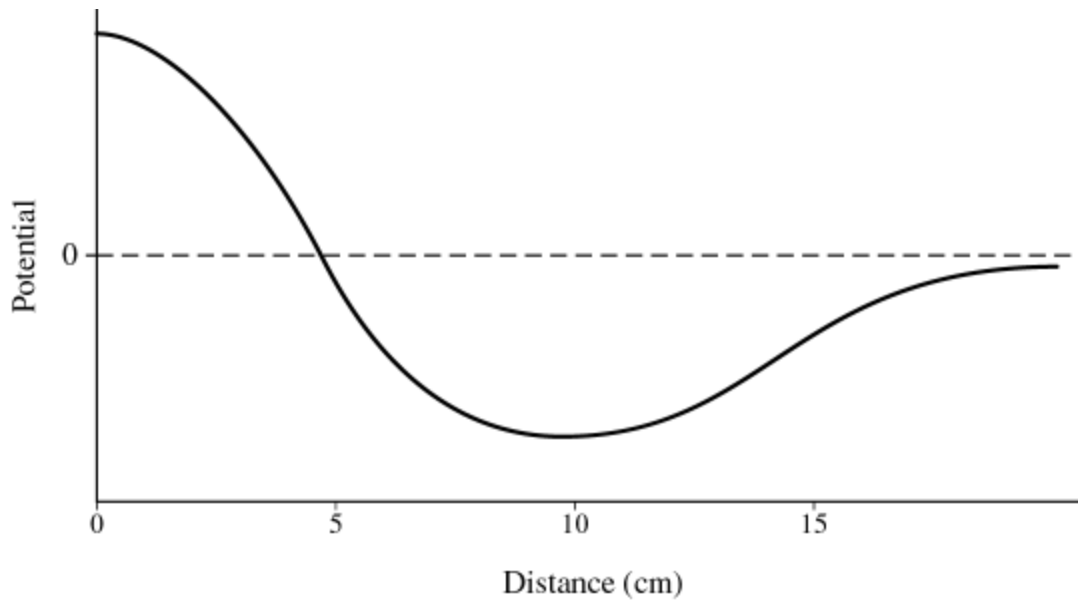
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) If the voltage at a point in space is zero, then the electric field must be _____
 A) zero.
 B) positive.
 C) uniform.
 D) negative.
 E) impossible to determine based on the information given.
- 2) Suppose a region of space has a uniform electric field, directed towards the right, as shown below. Which statement is true? _____

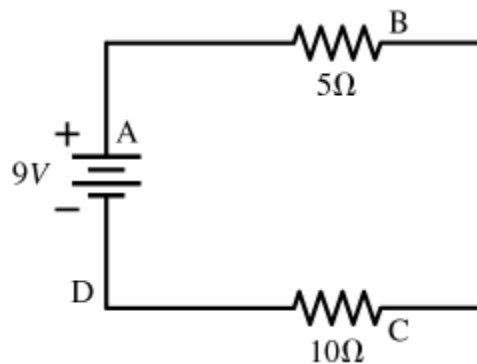


- A) The voltage at points A and B are equal, and the voltage at point C is higher than the voltage at point A.
 B) The voltage at point A is the highest, the voltage at point B is the second highest, and the voltage at point C is the lowest.
 C) The voltage at all three locations is the same.
 D) The voltage at points A and B are equal, and the voltage at point C is lower than the voltage at point A.
 E) None of the above
- 3) Two conducting spheres initially have a charge $+Q$ uniformly distributed on each of their surfaces. Sphere #1 has a larger radius than sphere #2. The two spheres are brought together such that they touch for a few seconds, and then they are separated. After they are separated, which sphere has a higher charge? _____
 A) Sphere #1
 B) Sphere #2
 C) The charge of each sphere is still equal.
- 4) A resistor is made out of a long wire having a length L . Each end of the wire is attached to a terminal of a battery having a constant voltage V_0 . A current I flows through the wire. If the wire were cut in half, making two wires of length $L/2$, and both wires were attached to the battery (the end of both wires attached to one terminal, and the other ends attached to the other terminal), what would be the total current flowing through the two wires? _____
 A) $I/2$ B) $4I$ C) I D) $2I$
- 5) A straight bar magnet is initially 4 cm long, with the north pole on the right and the south pole on the left. If you cut the magnet in half, the right half will _____
 A) only contain a north pole.
 B) still contain a north pole on the right and a new south pole on the left.
 C) only contain a south pole.

6) The potential as a function of distance is shown in the plot below. Which statement is true? 6) _____



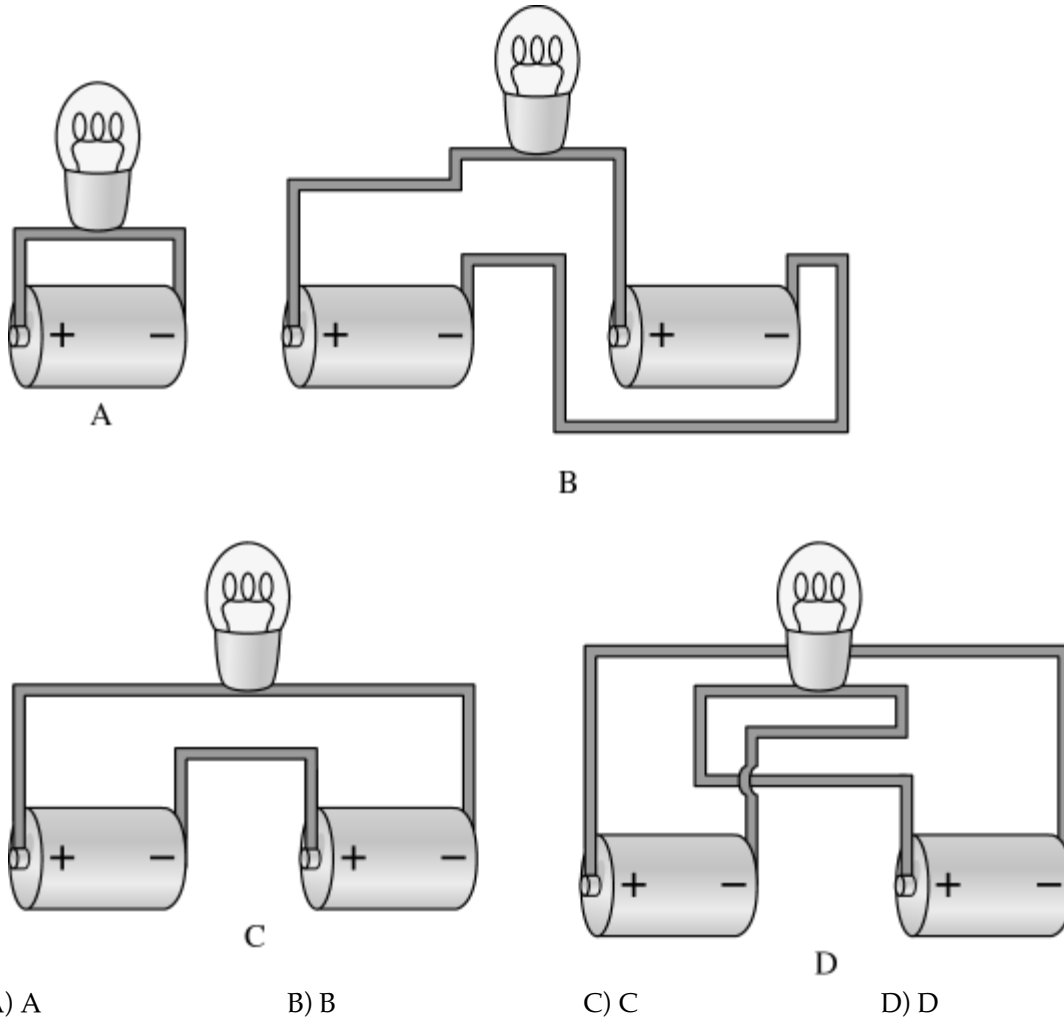
- A) The electric field is zero at $x=0$, its magnitude is at a maximum at $x=15$ cm, and the field is directed to the left there.
 - B) The electric field is zero at $x=0$, its magnitude is at a maximum at $x=5$ cm, and the field is directed to the right there.
 - C) The electric field is zero at $x=10$ cm, its magnitude is at a maximum at $x=5$ cm, and the field is directed to the left there.
 - D) The electric field is zero at $x=5$ cm, its magnitude is at a maximum at $x=0$, and the field is directed to the right there.
- 7) A 9 Volt battery is hooked up to two resistors in series. One has a resistance of 5 Ohms, and the other has a resistance of 10 Ohms. Several locations along the circuit are marked with letters, as shown below. Which statement is true? 7) _____



- A) The current at A is equal to the current at B, which is equal to the current at C, which is equal to the current at D.
- B) The current at A is greater than the current at B, which is greater than the current at C, which is greater than the current at D.
- C) The current at A is greater than the current at B, which is equal to the current at C, which is greater than the current at D.

8) Identical batteries are connected in different arrangements to the same light bulb, as shown below. For which arrangement will the bulb shine the brightest?

8) _____



9) Consider a solenoid of length L , N windings, and radius b (L is much longer than b). A current I is flowing through the wire. If the radius of the solenoid were doubled (becoming $2b$), and all other quantities remained the same, the magnetic field

9) _____

- A) would become one half as strong.
- B) would remain the same.
- C) would become twice as strong.

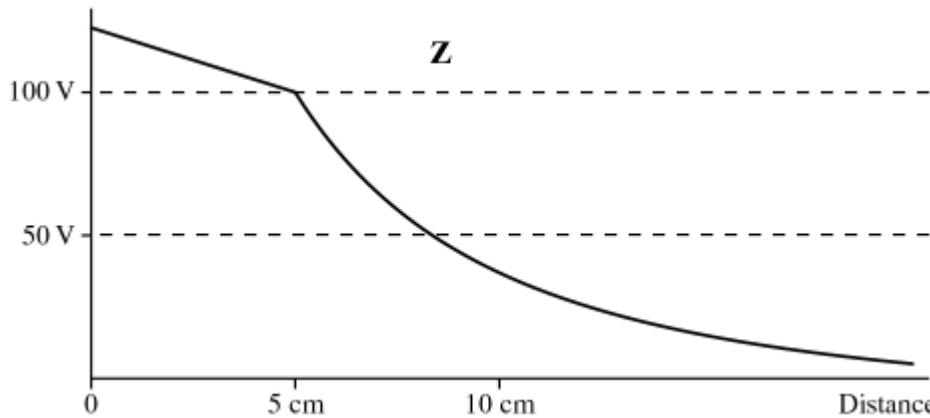
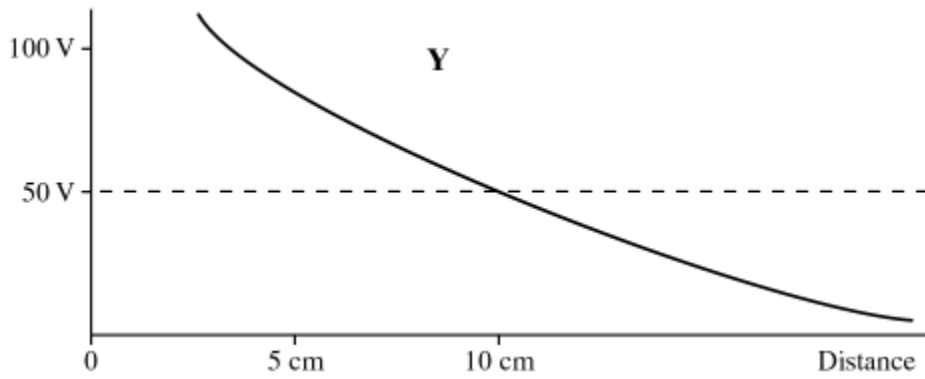
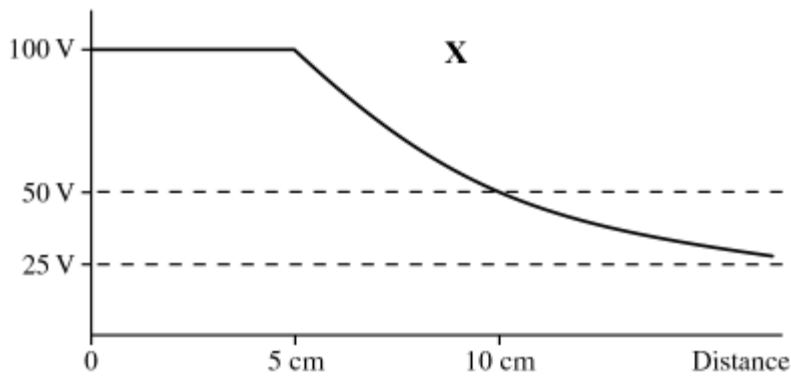
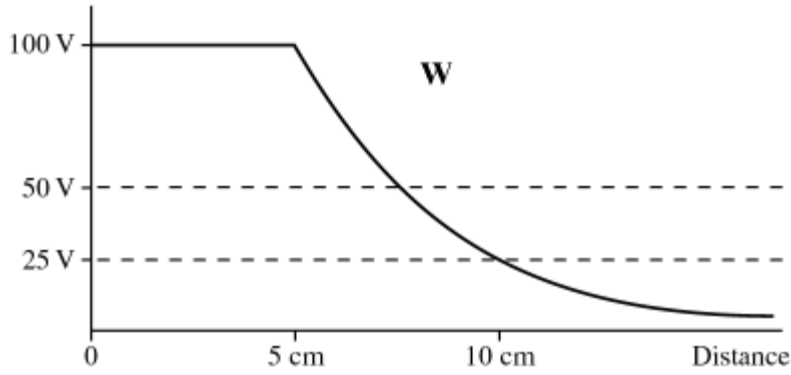
10) A very short solenoid contains $N=20$ circular loops of wire. The radius of the loop is $R=0.5$ meters, and the length of the solenoid is $d=0.02$ meters. Approximately what is the magnetic field in the center of the solenoid?

10) _____

- A) $\mu_0 N I / (2pR)$
- B) $\mu_0 N I / d$
- C) $\mu_0 N I / (2R)$
- D) $\mu_0 N I / (2dR)$

11) A metallic sphere of radius 5 cm is charged such that the potential of its surface is 100 V (relative to infinity). Which of the following plots correctly shows the potential as a function of distance from the center of the sphere?

11) _____



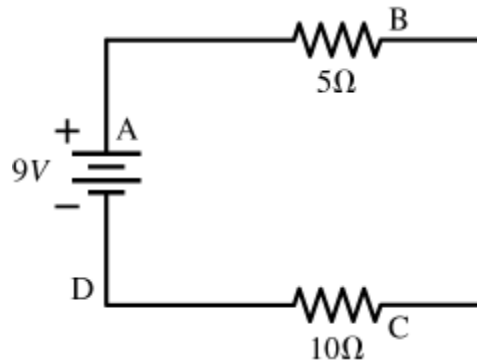
A) Plot W

B) Plot X

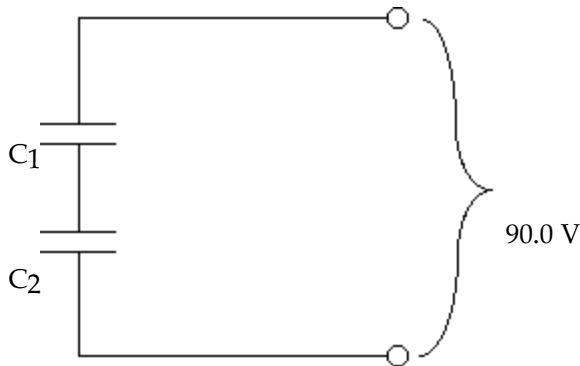
C) Plot Y

D) Plot Z

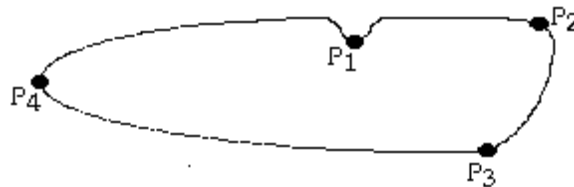
- 12) A 9 Volt battery is hooked up to two resistors in series. One has a resistance of 5 Ohms, and the other has a resistance of 10 Ohms. Several locations along the circuit are marked with letters, as shown below. Through which resistor is energy being dissipated at the higher rate? 12) _____



- A) The 5 Ohm resistor.
 B) Energy is being dissipated by both resistors at the same rate.
 C) The 10 Ohm resistor.
- 13) Two capacitors, one a $4.0 \mu\text{F}$ capacitor, C_1 , and the other a $6.0 \mu\text{F}$ capacitor, C_2 , are connected in series. If a 90.0 V voltage source is applied to the capacitors, as shown, find the voltage drop across the $4.0 \mu\text{F}$ capacitor. 13) _____

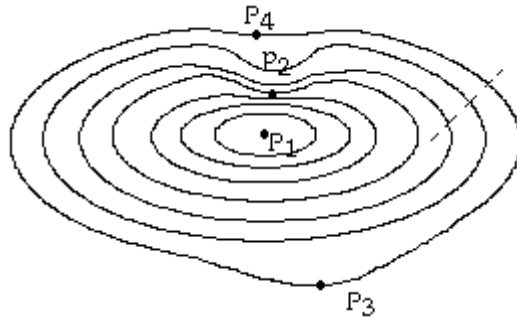


- A) 54 V B) 36 V C) 9.0 V D) 60 V
- 14) A charged conductor is shaped as shown. Of the labeled points, at which would the electric field strength probably be strongest? 14) _____



- A) P_2 B) P_3 C) P_1 D) All the same

- 15) An electric charge distribution causes the equipotential lines that are shown in the figure. Of the four labeled points, which is at the point where the electric field is stronger than the field strength at the others? 15) _____



- A) P₄ B) P₁ C) P₂ D) P₃

- 16) A 7.0 pF capacitor consists of two parallel plates that have surface charge densities of $\pm 3.0 \text{ nC/mm}^2$. If the potential between the plates is 21.0 kV, find the surface area of one of the plates. 16) _____

- A) 0.020 mm² B) 0.010 mm² C) 25 mm² D) 49 mm²

- 17) A 3.0 μF and a 13.0 μF capacitor are connected in series, and the series arrangement is connected in parallel to a 25.0 μF capacitor. How much capacitance would a single capacitor need to replace the three capacitors? 17) _____

- A) 27 μF B) 24 μF C) 16 μF D) 12 μF

- 18) A uniform electric field has the strength of 6.0 N/C. What is the electric energy density of the field? (The value of ϵ_0 is $8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$.) 18) _____

- A) $2.7 \times 10^{-11} \text{ J/m}^3$ B) $2.0 \times 10^{12} \text{ J/m}^3$
 C) $1.6 \times 10^{-10} \text{ J/m}^3$ D) $4.1 \times 10^{12} \text{ J/m}^3$

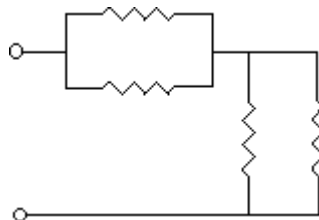
- 19) Two parallel circular plates with radius 8.0 mm carrying equal-magnitude surface charge densities of $\pm 3.0 \mu\text{C/m}^2$ are separated by a distance of 2.0 mm. How much stored energy do the plates have? 19) _____

- A) 21 nJ B) 640 nJ C) 65 nJ D) 200 nJ

- 20) A 2.0 μF capacitor is charged until it acquires a potential difference of 100.0 V across its plates, then the emf source is removed. If the capacitor is then discharged through a 100.0 k Ω resistance of a circuit, what is the voltage across the capacitor 9.0 ms later? 20) _____

- A) 4.4 V B) -4.6 V C) 96 V D) 100 V

- 21) The resistors in the circuit shown each have a resistance of 500 Ω . What is the equivalent resistance of the circuit? 21) _____



- A) 2000 Ω B) 500 Ω C) 1000 Ω D) 125 Ω

- 22) A 9.0 V battery is connected to two resistors in series. If the resistors have resistances of 410.0 Ω and 280.0 Ω , what is the voltage drop across the 280.0 Ω resistor? 22) _____
A) 5.4 V B) 3.7 V C) 13 V D) 6.2 V
- 23) A 3.0 μF capacitor is initially uncharged and connected in series with a 7.0 k Ω resistor. A 17.0 V battery is then inserted in the circuit and the capacitor begins to charge. How much energy does the capacitor have stored 19.0 ms after the battery has been added? 23) _____
A) 15 μJ B) 17,000 kJ C) 330 nJ D) 150,000 nJ
- 24) A 1.0 μF capacitor is connected in series to a resistor. If an emf source is connected in series to this arrangement, and if the voltage drop across the capacitor is one-half the applied emf 10.0 ms after the emf source has been connected, what is the resistance of the circuit? 24) _____
A) 0.14 k Ω B) 14 k Ω C) 0.069 k Ω D) 6.9 k Ω
- 25) A 2.0 μF capacitor has a potential difference of 5.0 V applied across its plates. If the potential difference across its plates is increased to 8.0 V, how much additional energy does the capacitor store? 25) _____
A) 18 μJ B) 39 μJ C) 9.0 μJ D) 78 μJ
- 26) A 13 μF capacitor is connected in series with a 21 k Ω resistor. A 9 V battery is added in series with the capacitor and resistor when a switch is closed. What is the voltage between the plates of the capacitor 15 ms after closing the switch? 26) _____
A) 0.48 V B) 1.9 V C) 0.95 V D) 19 V
- 27) A rechargeable battery that is completely drained of electrical energy can be completely charged by applying 1.0 mA of current for 1.0 h. If the battery acquires an emf of 2.0 V in the process of being charged, how much energy is the battery capable of storing? 27) _____
A) 2.0 mJ B) 0.60 μJ C) 7.2 J D) 2.0 kJ
- 28) A long, straight wire with 3.0 A current flowing through it has magnetic field strength 1.0 T at its surface. If the wire has a radius R , where within the wire is the field strength 39.0% of 1.0 T? 28) _____
A) 0.39 R B) 0.03 R C) 0.61 R D) 0.06 R
- 29) A wire is formed into a circle with radius 5.00 mm. A current flows through the wire and causes a magnetic field of magnitude B at the center of the loop. If the wire is heated and expands by 6.00%, what does the magnitude of the magnetic field become at the center of the loop? 29) _____
A) 1.06 B B) $B/1.06$ C) 6.66 B D) B
- 30) A very long wire generates a magnetic field of 0.0040×10^{-4} T at a distance of 2.0 mm. What is the magnitude of the current? 30) _____
A) 13,000 mA B) 2.0 mA C) 4.0 mA D) 4000 mA
- 31) A solenoid of length 12 cm consists of a wire wrapped tightly around a wooden core. The magnetic field strength is 4.0 T inside the solenoid. If the solenoid is stretched to 30 cm by applying a force to it, what does the magnetic field become? 31) _____
A) 10.0 T B) 4.0 T C) 20 T D) 1.6 T

Answer Key

Testname: PH2200-EX3-F05.TST

- 1) E
- 2) D
- 3) A
- 4) B
- 5) B
- 6) B
- 7) A
- 8) C
- 9) B
- 10) C
- 11) B
- 12) C
- 13) A
- 14) A
- 15) C
- 16) D
- 17) A
- 18) C
- 19) D
- 20) C
- 21) B
- 22) B
- 23) D
- 24) B
- 25) B
- 26) A
- 27) C
- 28) A
- 29) B
- 30) C
- 31) D