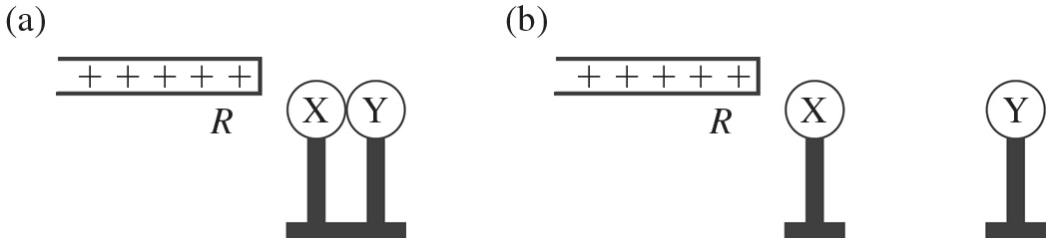
Electrostatic, CRPE, and Circuits Practice Test

Name_____

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

1) If two objects are electrically attracted to each other,
A) one object must be negatively charged and the other object must be positively charged.
B) both objects must be negatively charged.
C) both objects must be positively charged.
D) the objects could be electrically neutral.

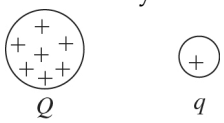
2)



X and Y are two initially uncharged metal spheres on insulating stands, and they are in contact with each other. A positively charged rod *R* is brought close to X as shown in part (a) of the figure. Sphere Y is now moved away from X, as shown in part (b). What are the final charge states of X and Y?
A) X is negative and Y is positive.
B) X is neutral and Y is positive.
C) X is positive and Y is neutral.
D) Both X and Y are negative.
E) Both X and Y are neutral.

3) Two tiny beads are 25 cm apart with no other charges or fields present. Bead A carries 10 μC of charge and bead B carries 1 μC. Which one of the following statements is true about the magnitudes of the electric forces on these beads?
A) The force on B is 10 times the force on A.
B) The force on B is 100 times the force on A.
C) The force on A is exactly equal to the force on B.
D) The force on A is 100 times the force on B.
E) The force on A is 10 times the force on B.

4) In outer space, a positive charge q is released near a positive fixed charge Q, as shown in the figure. As q moves away from Q, what is true about the motion of q? (There may be more than one correct choice.)

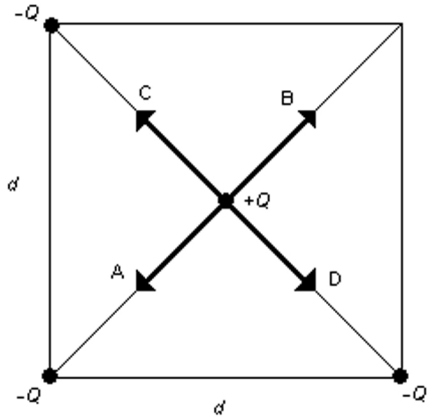


A) It will move with decreasing acceleration.
B) It will move with increasing speed.
C) It will move with constant acceleration.
D) It will move with decreasing speed.
E) It will move with increasing acceleration.

5) Two very small plastic balls of equal mass are released from rest. One of them carries +10 μC of excess charge and the other one carries +1μC of charge. No other charges or fields are present. Which of the following statements are true about them as they move away from each other? (There may be more than one correct choice.)

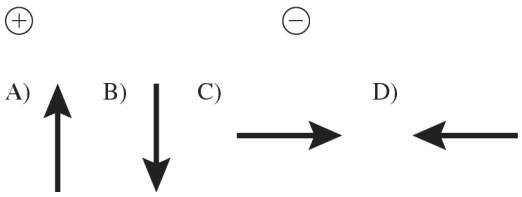
A) The acceleration of the balls keeps increasing.
B) The acceleration of the 10–μC ball is 10 times that of the 1–μC ball.
C) The balls always have accelerations of equal magnitude.
D) The speed of the balls keeps increasing.
E) The acceleration of the 1–μC ball is 10 times that of the 10–μC ball.

6) Four point charges of equal magnitude but with varying signs are arranged on three of the corners and at the center of the square of side d as shown in the figure. Which one of the arrows shown represents the net force acting on the center charge?



A) A B) B C) C D) D

7) Two equal and opposite charges are a small distance apart, forming an electric dipole. A positive charge +q is placed above these charges, as shown in the figure, equidistant from both of them. Which diagram below best gives the direction of the net force the dipole exerts on the charge +q?

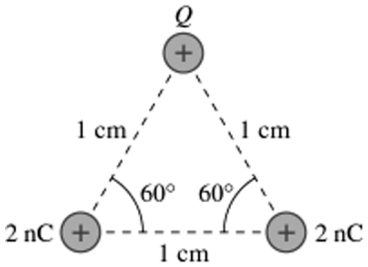


A) C B)

8) Two equally charged tiny spheres of mass 1.0 g are placed 2.0 cm apart. When released, they begin to accelerate away from each other at 414 m/s^2. What is the magnitude of the charge on each sphere, assuming only that the electric force is present? ($k = 9.0 \times 10^9\ N \cdot m^2/C^2$)

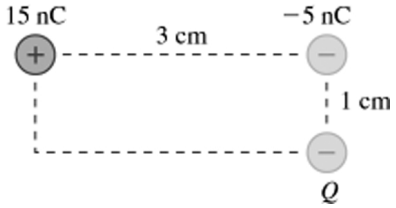
A) 95 nC B) 140 nC C) 75 nC D) 120 nC

9) As shown in the figure, three charges are at the vertices of an equilateral triangle. The charge Q is 6.7 nC, and all the other quantities are accurate to two significant figures. What is the magnitude of the net electric force on the charge Q due to the other two charges? ($k = 1/4\pi\varepsilon_0 = 9.0 \times 10^9$ N • m^2/C^2)



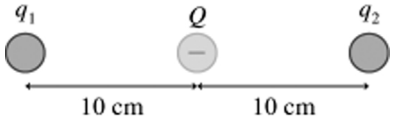
A) 1.4×10^{-3} N B) 1.2×10^{-3} N C) 2.1×10^{-3} N D) 1.0×10^{-3} N

10) As shown in the figure, three charges are at corners of a rectangle. The charge in the bottom right corner is Q = – 90 nC, and all the other quantities are accurate to two significant figures. What is the magnitude of the net electrical force on Q due to the other two charges? ($k = 1/4\pi\varepsilon_0 = 9.0 \times 10^9$ N • m^2/C^2)



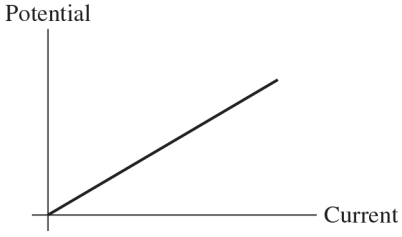
A) 2.8×10^{-2} N B) 7.1×10^{-2} N C) 5.3×10^{-2} N D) 3.8×10^{-2} N

11) As shown in the figure, the charge Q is midway between two other charges. If Q = –7.5 nC, what must be the charge $q1$ so that charge $q2$ remains stationary as Q and $q1$ are held in place?



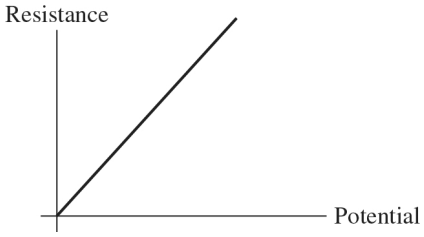
A) 7.5 nC B) 30 nC C) 15 nC D) 60 nC

12) For the graph shown in the figure, what physical quantity does the slope of the graph represent for ohmic material?



A) 1/(resistance) B) 1/(resistivity) C) resistivity D) resistance

13) For the graph shown in the figure, what physical quantity does the slope of the graph represent for ohmic material?



A) 1/(current)
B) current
C) power
D) resistivity
E) 1/(resistivity)

14) Copper wire #1 has a length L and a radius b. Copper wire #2 has a length $2L$ and a radius $2b$. Which statement about the resistance across the ends of the wires is true?
A) The resistance of wire #1 is half that of wire #2.
B) The resistance of wire #1 is twice as high as that of wire #2.
C) The resistance of wire #1 is equal to that of wire #2.
D) The resistance of wire #1 is four times higher than that of wire #2.

15) The length of a certain wire is kept same while its radius is doubled. What is the new resistivity of this wire?
A) It is increased by a factor of 2.
B) It is increased by a factor of 4.
C) It does not change.
D) It is reduced by a factor of 2.

16) A wire of resistivity ϱ must be replaced in a circuit by a wire of the same material but four times as long. If, however, the total resistance is to remain as before, the diameter of the new wire must
A) be one–fourth the original diameter.
B) be one–half the original diameter.
C) be two times the original diameter.
D) be the same as the original diameter.

17) The length of a certain wire is doubled and at the same time its radius is reduced by a factor of 2. What is the new resistance of this wire?
A) It it 8 times as large.
B) It is ½ as large.
C) It is 2 times as large.
D) It is 4 times as large.

18) When the current through a resistor is increased by a factor of 4, the power dissipated by the resistor
A) increases by a factor of 16.
B) decreases by a factor of 16.
C) increases by a factor of 4.
D) decreases by a factor of 4.

19) Consider two copper wires with circular cross–sections and equal lengths. One wire has 3 times the diameter of the other. How do the resistances of these two wires compare?
A) The thicker wire has 3 times the resistance of the thinner wire.
B) The thicker wire has $\sqrt{3}$ times the resistance of the thinner wire.
C) The thicker wire has 1/9 the resistance of the thinner wire.
D) The thicker wire has 1/3 the resistance of the thinner wire.

20) A certain metal wire has a cross-sectional area of 1.0 cm^2 and a resistivity of $1.7 \times 10^{-8}\ \Omega \cdot m$. How long would it have to be to have a resistance of 1.0 Ω?

A) 5.9 km B) 5.9×10^6 m C) 5.9 m D) 590 m

21) A 1.0-m length of nichrome wire has a radius of 0.50 mm and a resistivity of $1.0 \times 10^{-6}\ \Omega \cdot m$. When this wire carries a current of 0.50 A, what is the voltage across its ends?

A) 1.6 V B) 0.0030 V C) 0.64 V D) 0.32 V

22) When a 1.0-m length of metal wire is connected to a 1.5-V battery, a current of 8.0 mA flows through it. What is the diameter of the wire? The resistivity of the metal is $2.24 \times 10^{-8}\ \Omega \cdot m$.

A) 2.2 μm B) 24 μm C) 6.0 μm D) 12 μm

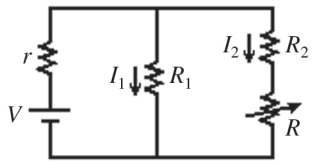
23) A light bulb operating at a dc voltage of 120 V has a resistance of 200 Ω. How much power is dissipated in this bulb?

A) 72 W B) 14 mW C) 60 W D) 7.2 W

24) As more resistors are added in parallel across a constant voltage source, the power supplied by the source

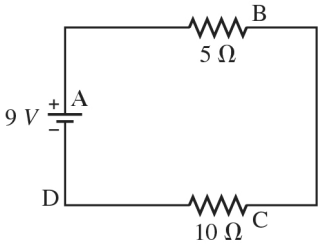
A) does not change.
B) increases.
C) increases for a time and then starts to decrease.
D) decreases.

25) In the circuit shown in the figure, the resistor *R* has a variable resistance. As *R* is decreased, what happens to the currents?



A) I_1 decreases and I_2 increases.
B) I_1 decreases and I_2 decreases.
C) I_1 increases and I_2 increases.
D) I_1 increases and I_2 decreases.
E) I_1 remains unchanged and I_2 increases.

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

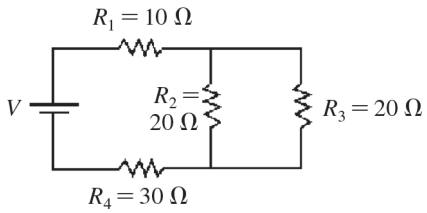


A) Energy is being dissipated by both resistors at the same rate.
B) the 5–Ω resistor
C) the 10–Ω resistor

27) When different resistors are connected in parallel across an ideal battery, we can be certain that
A) their equivalent resistance is equal to the average of the individual resistances.
B) their equivalent resistance is greater than the resistance of any one of the individual resistances.
C) the potential difference across each is the same.
D) the same current flows in each one.
E) the power dissipated in each is the same.

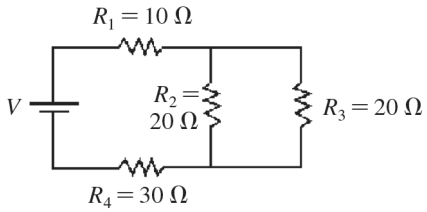
28) Two resistors having resistances of 5.0 Ω and 9.0 Ω are connected in parallel. A 4.0–Ω resistor is then connected in series with the parallel combination. An ideal 6.0–V battery is then connected across the series–parallel combination. What is the current through the 9.0–Ω resistor?
A) 0.53 A B) 0.83 A C) 0.35 A D) 0.30 A E) 0.67 A

29) If $V = 20$ V and the battery is ideal, what is the current through R_3 in the figure?



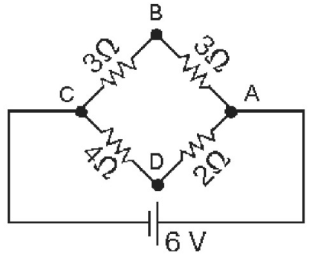
A) 0.050 A B) 0.20 A C) 4.0 A D) 1.0 A

30) If 1.5 A flows through R_2, what is the emf V of the ideal battery in the figure?



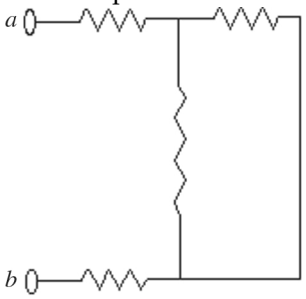
A) 30 V B) 150 V C) 60 V D) 75 V

31) What is the potential drop from point A to point B for the circuit shown in the figure? The battery is ideal, and all the numbers are accurate to two significant figures.



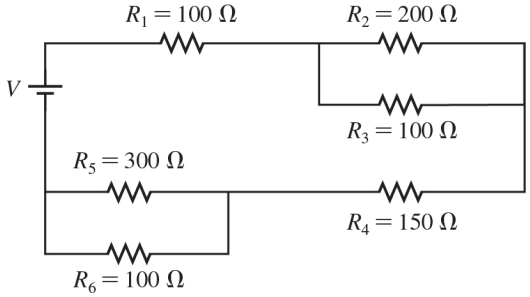
A) 2.5 V B) 3.0 V C) 0.35 V D) 2.0 V

32) Each of the resistors shown in the figure has a resistance of 180.0 Ω. What is the equivalent resistance between points *a* and *b* of this combination?



A) 720.0 Ω B) 180.0 Ω C) 540.0 Ω D) 450.0 Ω

33) What is the equivalent resistance of the circuit shown in the figure? The battery is ideal and all resistances are accurate to 3 significant figures.



A) 392 Ω B) 950 Ω C) 450 Ω D) 257 Ω

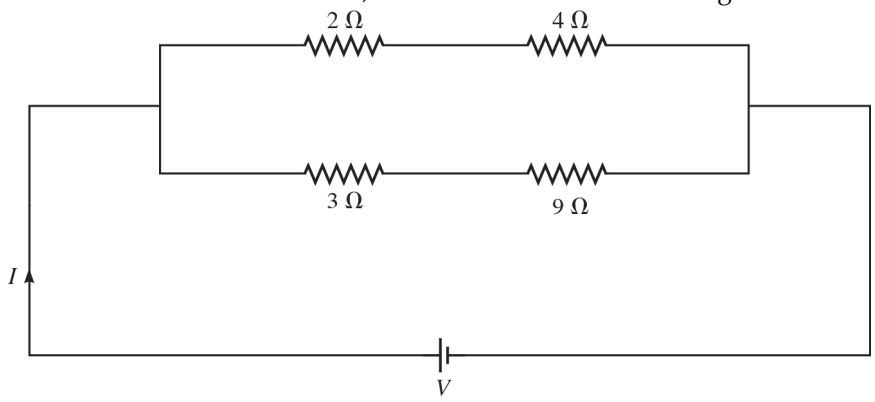
34) An ideal 10.0–V dc is connected across a 590.0–Ω, resistor in series with an 840.0–Ω resistor. What is the potential drop across the 590.0 Ω resistor?

A) 4.1 V B) 7.0 V C) 5.9 V D) 14 V

35) A 3.0–Ω resistor is connected in parallel with a 6.0–Ω resistor. This combination is then connected in series with a 4.0–Ω resistor. The resistors are connected across an ideal 12–volt battery. How much power is dissipated in the 3.0–Ω resistor?

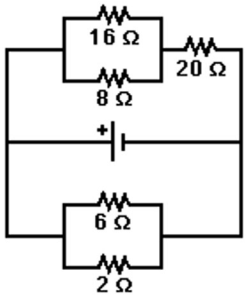
A) 6.0 W B) 5.3 W C) 2.7 W D) 12 W

36) Four resistors are connected across an ideal dc battery with voltage V, as shown in the figure. If the total current in this circuit is $I = 1$ A, what is the value of the voltage V?



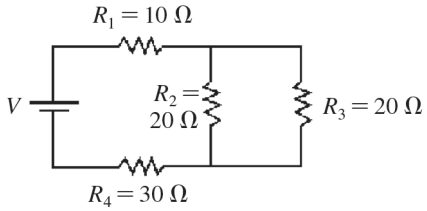
A) 4 V B) 10 V C) 2 V D) 8 V E) 6 V

37) For the circuit shown in the figure, the current in the 8.0–Ω resistor is 0.50A. What is the current in the 2.0–Ω resistor? All the numbers shown are accurate to two significant figures.



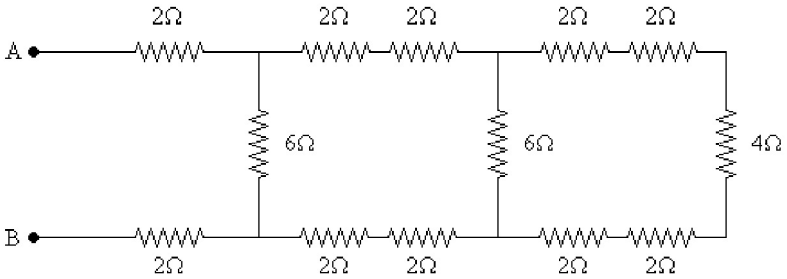
A) 6.4 A B) 4.5 A C) 9.5 A D) 2.25 A E) 0.75 A

38) If $V = 40$ V and the battery is ideal, what is the potential difference across R_1 in the figure?



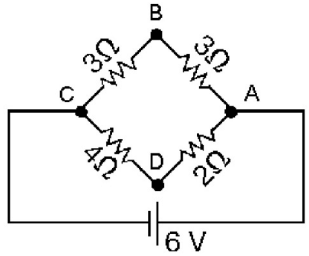
A) 8.0 V B) 20 V C) 10 V D) 6.7 V

39) A number of resistors are connected across points A and B as shown in the figure. What is the equivalent resistance between points A and B?



A) 10 Ω B) 12 Ω C) 4 Ω D) 8 Ω E) 6 Ω

40) What is the magnitude of the potential difference between points A and C for the circuit shown in the figure? The battery is ideal, and all the numbers are accurate to two significant figures.



A) 6.0 V B) 4.0 V C) 3.0 V D) 2.0 V

41) Four resistors having resistances of 20 Ω, 40 Ω, 60 Ω, and 80 Ω are connected in series across an ideal 50–V dc source. What is the current through each resistor?

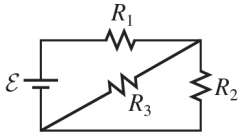
A) 2.0 A B) 4.0 A C) 0.25 A D) 0.50 A E) 0.75 A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

42) Three resistors of 12 Ω, 12 Ω, and 6.0 Ω are connected together, and an ideal 12–V battery is connected across the combination. What is the current from the battery if they are connected (a) in series or (b) in parallel?

43) Two resistors with resistances of 5.0 Ω and 9.0 Ω are connected in parallel. A 4.0–Ω resistor is then connected in series with this parallel combination. An ideal 6.0–V battery is then connected across the series–parallel combination. What is the current through (a) the 4.0–Ω resistor and (b) the 5.0–Ω resistor?

44) For the circuit shown in the figure, $R_1 = 5.6\ \Omega$, $R_2 = 5.6\ \Omega$, $R_3 = 14\ \Omega$, and $\varepsilon = 6.0$ V, and the battery is ideal.
(a) What is the equivalent resistance across the battery?
(b) Find the current through each resistor.



1) D
2) A
3) C
4) A, B
5) C, D
6) A
7) A
8) B
9) C
10) D
11) B
12) D
13) A
14) B
15) C
16) C
17) A
18) A
19) C
20) A
21) C
22) D
23) A
24) B
25) A
26) C
27) C
28) D
29) B
30) B
31) B
32) D
33) A
34) A
35) B
36) A
37) C
38) A
39) D
40) A
41) C
42) (a) 0.40 A (b) 4.0 A
43) (a) 0.83 A (b) 0.53 A
44) (a) 9.6 Ω (b) $I_1 = 0.63$ A, $I_2 = 0.45$ A, $I_3 = 0.18$ A