***Physics: Principle and Applications*, 7e (Giancoli)**
Chapter 19   DC Circuits

19.1   Conceptual Questions

1) When two or more different capacitors are connected in series across a potential source, which of the following statements must be true? (There could be more than one correct choice.)
A) The total voltage across the combination is the algebraic sum of the voltages across the individual capacitors.
B) Each capacitor carries the same amount of charge.
C) The equivalent capacitance of the combination is less than the capacitance of any of the capacitors.
D) The potential difference across each capacitor is the same.
E) The capacitor with the largest capacitance has the most charge.
Answer: A, B, C
Var: 1

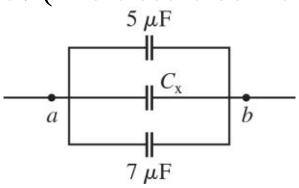
2) Three identical capacitors are connected in series across a potential source (battery). If a charge of Q flows into this combination of capacitors, how much charge does each capacitor carry?
A) $3Q$
B) Q
C) $Q/3$
D) $Q/9$
Answer: B
Var: 1

3) Three identical capacitors are connected in parallel to a potential source (battery). If a charge of Q flows into this combination, how much charge does each capacitor carry?
A) $3Q$
B) Q
C) $Q/3$
D) $Q/9$
Answer: C
Var: 1

4) When two or more different capacitors are connected in parallel across a potential source (battery), which of the following statements must be true? (There could be more than one correct choice.)
A) The potential difference across each capacitor is the same.
B) Each capacitor carries the same amount of charge.
C) The equivalent capacitance of the combination is less than the capacitance of any one of the capacitors.
D) The capacitor with the largest capacitance has the largest potential difference across it.
E) The capacitor with the largest capacitance has the most charge.
Answer: A, E
Var: 1

5) A 5-μF, a 7-μF, and an unknown capacitor C_X are connected in series between points *a* and *b*. What do you know about the equivalent capacitance C_{ab} between *a* and *b*? (There could be more than one correct choice.)
A) $C_{ab} > 12$ μF
B) 5 μF < C_{ab} < 7 μF
C) 5 μF < C_{ab} < 12 μF
D) $C_{ab} < 5$ μF
E) $C_{ab} < C_X$
Answer: D, E
Var: 1

6) A 5-μF, a 7-μF, and an unknown capacitor C_X are connected in parallel between points *a* and *b* as shown in the figure. What do you know about the equivalent capacitance C_{ab} between *a* and *b*? (There could be more than one correct choice.)



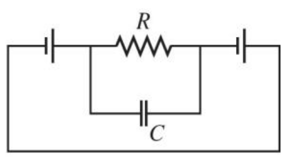
A) $C_{ab} > 12$ μF
B) $C_{ab} > C_X$
C) 5 μF < C_{ab} < 12 μF
D) $C_{ab} < 5$ μF
E) $C_{ab} < C_X$
Answer: A, B
Var: 1

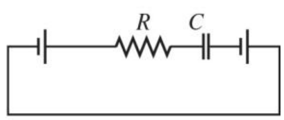
7) Suppose you have two capacitors and want to use them to store the *maximum* amount of energy by connecting them across a voltage source. You should connect them
A) in series across the source.
B) in parallel across the source.
C) It doesn't matter because the stored energy is the same either way.
Answer: B
Var: 1

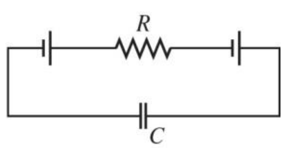
8) Four unequal resistors are connected in series with each other. Which one of the following statements is correct about this combination?
A) The equivalent resistance is equal to that of any one of the resistors.
B) The equivalent resistance is equal to average of the four resistances.
C) The equivalent resistance is less than that of the smallest resistor.
D) The equivalent resistance is less than that of the largest resistor.
E) The equivalent resistance is more than the largest resistance.
Answer: E
Var: 1

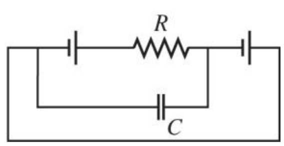
9) Four unequal resistors are connected in a parallel with each other. Which one of the following statements is correct about this combination?
A) The equivalent resistance is less than that of the smallest resistor.
B) The equivalent resistance is equal to the average of the four resistances.
C) The equivalent resistance is midway between the largest and smallest resistance.
D) The equivalent resistance is more than the largest resistance.
E) None of the other choices is correct.
Answer: A
Var: 1

10) You buy a AA battery in the store, and it is marked 1.5 V. If this marking is strictly accurate, while this battery is fresh
A) its terminal voltage will be more than 1.5 V when it is used in a circuit.
B) its terminal voltage will be less than 1.5 V when it is used in a circuit.
C) its terminal voltage will be 1.5 V when it is used in a circuit.
Answer: B
Var: 1

11) Draw a circuit with two batteries, a resistor between them, and a capacitor in parallel with the resistor. The batteries are connected negative pole to positive pole.
A)


B)


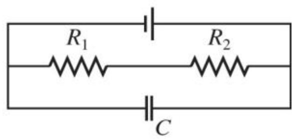
C)


D)


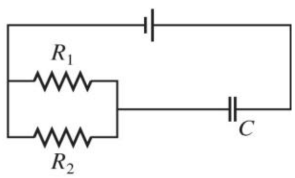
Answer: A
Var: 1

12) Draw a circuit consisting of a battery connected to two resistors, R_1 and R_2, in series with each other and a capacitor C connected across the resistors.

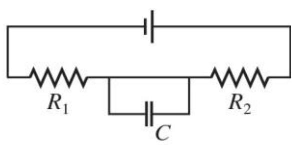
A)



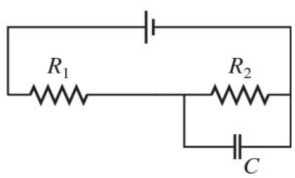
B)



C)



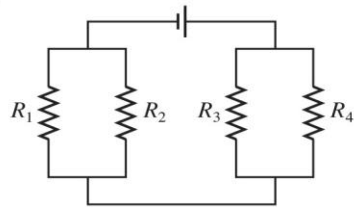
D)



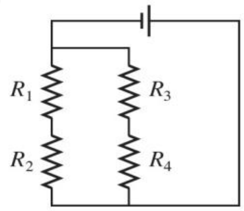
Answer: A
Var: 1

13) Draw a circuit with a battery connected to four resistors, R_1, R_2, R_3, and R_4, as follows. Resistors R_1 and R_2 are connected in parallel with each other, resistors R_3 and R_4 are connected in parallel with each other, and both parallel sets of resistors are connected in series with each other across the battery.

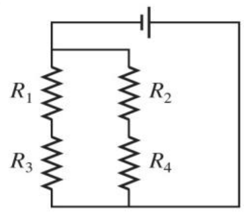
A)



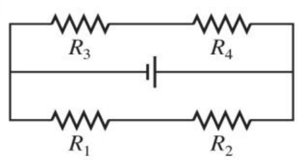
B)



C)



D)



Answer: A
Var: 1

14) When unequal resistors are connected in parallel in a circuit,
A) the same current always runs through each resistor.
B) the potential drop is always the same across each resistor.
C) the largest resistance has the largest current through it.
D) the power generated in each resistor is the same.
Answer: B
Var: 1

15) When unequal resistors are connected in series across an ideal battery,
A) the same power is dissipated in each one.
B) the potential difference across each is the same.
C) the current flowing in each is the same.
D) the equivalent resistance of the circuit is less than that of the smallest resistor.
E) the equivalent resistance of the circuit is equal to the average of all the resistances.
Answer: C
Var: 1

16) You obtain a 100-W light bulb and a 50-W light bulb. Instead of connecting them in the normal way, you devise a circuit that places them in series across normal household voltage. If each one is an incandescent bulb of fixed resistance, which statement about these bulbs is correct?
A) Both bulbs glow with the same brightness, but less than their normal brightness.
B) Both bulbs glow with the same brightness, but more than their normal brightness.
C) The 100-W bulb glows brighter than the 50-W bulb.
D) The 50-W bulb glows more brightly than the 100-W bulb.
Answer: D
Var: 1

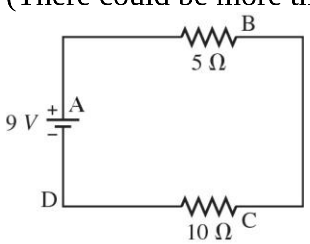
17) As more resistors are added in series to a constant voltage source, the power supplied by the source
A) increases.
B) decreases.
C) does not change.
D) increases for a time and then starts to decrease.
Answer: B
Var: 1

18) As more resistors are added in parallel across a constant voltage source, the power supplied by the source
A) increases.
B) decreases.
C) does not change.
D) increases for a time and then starts to decrease.
Answer: A
Var: 1

19) When different resistors are connected in parallel across an ideal battery, we can be certain that
A) the same current flows in each one.
B) the potential difference across each is the same.
C) the power dissipated in each is the same.
D) their equivalent resistance is greater than the resistance of any one of the individual resistances.
E) their equivalent resistance is equal to the average of the individual resistances.
Answer: B
Var: 1

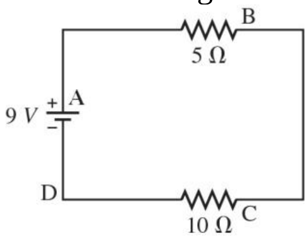
20) The lamps in a string of decorative lights are connected in parallel across a constant-voltage power source. What happens if one lamp burns out? (Assume negligible resistance in the wires leading to the lamps.)
A) The brightness of the lamps will not change appreciably.
B) The other lamps get brighter equally.
C) The other lamps get brighter, but some get brighter than others.
D) The other lamps get dimmer equally.
E) The other lamps get dimmer, but some get dimmer than others.
Answer: A
Var: 1

21) A 9-V battery is hooked up to two resistors in series using wires of negligible resistance. 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. Which statements about this circuit are true? (There could be more than one correct choice.)



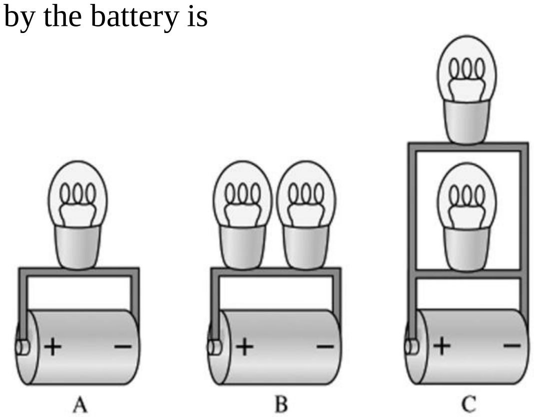
A) The current is exactly the same at points A, B, C, and D.
B) The current at A is greater than the current at B, which is equal to the current at C, which is greater than the current at D.
C) The current at A is greater than the current at B, which is greater than the current at C, which is greater than the current at D.
D) The potential at B is equal to the potential at C.
E) The potential at D is equal to the potential at C.
Answer: A, D
Var: 1

22) 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?



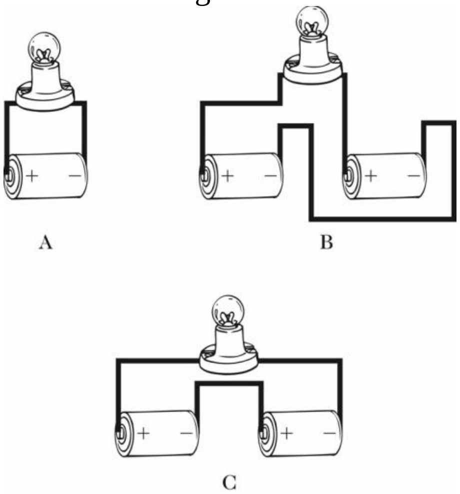
A) the 10-Ω resistor
B) the 5-Ω resistor
C) Energy is being dissipated by both resistors at the same rate.
Answer: A
Var: 1

23) Identical light bulbs can be attached to identical ideal batteries in three different ways (A, B, or C), as shown in the figure. The ranking (from lowest to highest) of the *total* power produced by the battery is



A) B, A, C
B) A, B, C
C) C, B, A
D) A, C, B
E) C, A, B
Answer: A
Var: 1

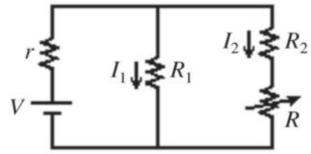
24) Identical ideal batteries are connected in different arrangements to the same light bulb, as shown in the figure. For which arrangement will the bulb shine the *brightest*?



A) A
B) B
C) C
Answer: C
Var: 1

25) A resistor is made out of a wire having a length L. When the ends of the wire are attached across the terminals of an ideal battery having a constant voltage V_0 across its terminals, 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 across the terminals of the battery (the right ends of both wires attached to one terminal, and the left ends attached to the other terminal), how much current would the battery put out?
A) $4I$
B) $2I$
C) I
D) $I/2$
E) $I/4$
Answer: A
Var: 1

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

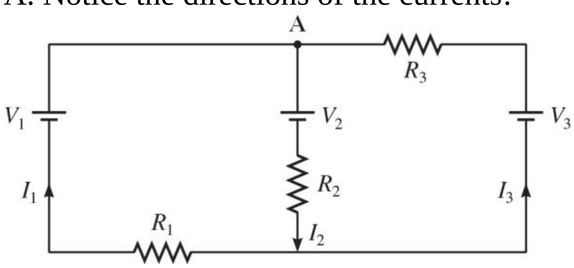


A) I_1 remains unchanged and I_2 increases.
B) I_1 decreases and I_2 decreases.
C) I_1 decreases and I_2 increases.
D) I_1 increases and I_2 decreases.
E) I_1 increases and I_2 increases.
Answer: C
Var: 1

27) Kirchhoff's junction rule is a statement of
A) the law of conservation of momentum.
B) the law of conservation of charge.
C) the law of conservation of energy.
D) the law of conservation of angular momentum.
E) Newton's second law.
Answer: B
Var: 1

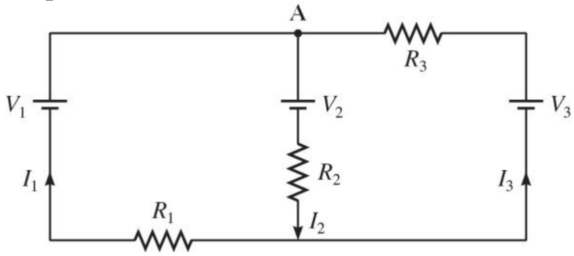
28) Kirchhoff's loop rule is a statement of
A) the law of conservation of momentum.
B) the law of conservation of charge.
C) the law of conservation of energy.
D) the law of conservation of angular momentum.
E) Newton's second law.
Answer: C
Var: 1

29) For the circuit shown in the figure, write the Kirchhoff current equation for the node labeled A. Notice the directions of the currents!



Answer: $I_1 - I_2 + I_3 = 0$
Var: 1

30) For the circuit shown in the figure, write the Kirchhoff loop equation for the entire *outside* loop. Notice the directions of the currents!



Answer: $V_1 + I_3R_3 - V_3 - I_1R_1 = 0$

Var: 1

31) A resistor, an uncharged capacitor, a dc voltage source, and an open switch are all connected in series. The switch is closed at time $t = 0$ s. Which one of the following is a correct statement about this circuit?

A) The charge on the capacitor after four time constants is about 98% of the maximum value.
B) The charge on the capacitor after one time constant is 50% of its maximum value.
C) The charge on the capacitor after one time constant is $1/e$ of its maximum value.
D) The voltage on the capacitor after one time constant is $1/e$ of the maximum value.
E) The voltage on this capacitor after one time constant is 100% of its maximum value.

Answer: A

Var: 1

32) A capacitor C is connected in series with a resistor R across a battery and an open switch. If a second capacitor of capacitance $2C$ is connected in parallel with the first one, the time constant of the new RC circuit will be

A) the same as before.
B) twice as large as before.
C) three times a large as before.
D) one-half as large as before.
E) one-fourth as large as before.

Answer: C

Var: 1

33) A capacitor C is connected in series with a resistor R across a battery and an open switch. If a second capacitor of capacitance $2C$ is connected in series with the first one, the time constant of the new RC circuit will be

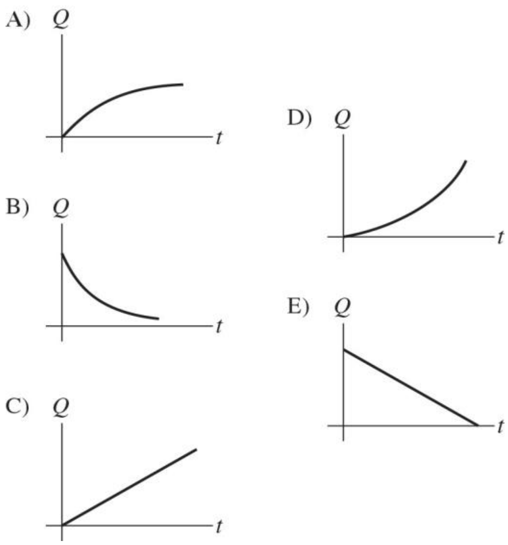
A) the same as before.
B) larger than before.
C) smaller than before.
D) variable.

Answer: C

Var: 1

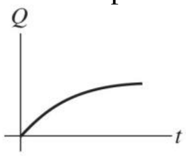
34) A resistor, an uncharged capacitor, a dc voltage source, and an open switch are all connected in series. The switch is closed at time $t = 0$ s. Which one of the following is a correct statement about the circuit?
A) The capacitor charges to its maximum value in one time constant.
B) The capacitor charges to its maximum value in two time constants.
C) The potential difference across the resistor is always equal to the potential difference across the capacitor.
D) Current flows through the circuit even after the capacitor is essentially fully charged.
E) Once the capacitor is essentially fully charged, there is no current in the circuit.
Answer: E
Var: 1

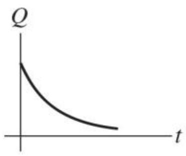
35) A charged capacitor is connected in series with a resistor and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the charge Q on the capacitor as a function of time t?

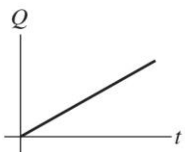


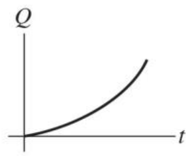
Answer: B
Var: 1

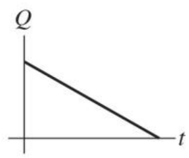
36) An uncharged capacitor is connected in series with a resistor, a dc battery, and an open switch. At time t = 0 s, the switch is closed. Which of the graphs below best describes the charge Q on the capacitor as a function of time t?

A) 

B) 

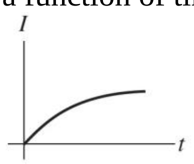
C) 

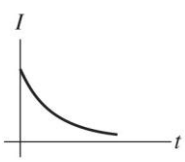
D) 

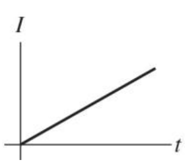
E) 

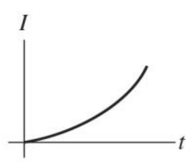
Answer: A
Var: 1

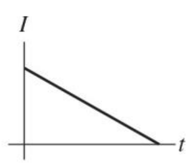
37) A charged capacitor is connected in series with a resistor and an open switch. At time t = 0 s, the switch is closed. Which of the graphs below best describes the current I through the resistor as a function of time t?

A) 

B) 

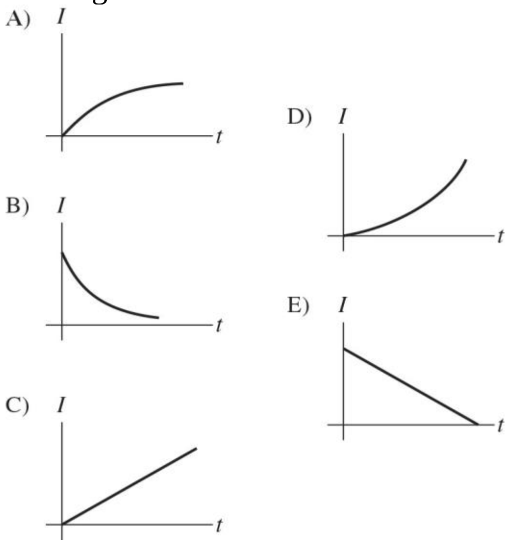
C) 

D) 

E) 

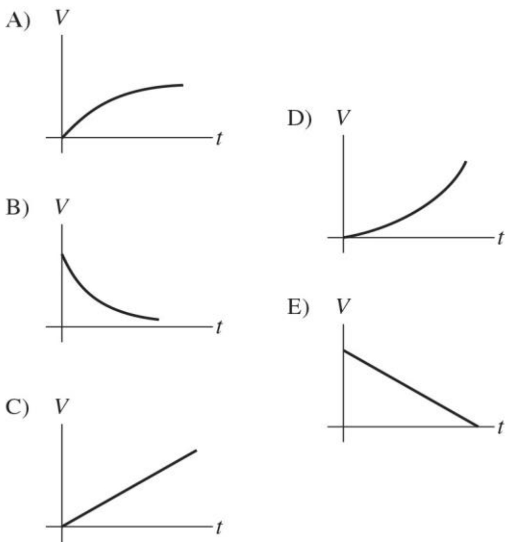
Answer: B
Var: 1

38) An uncharged capacitor is connected in series with a resistor, a dc battery, and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the current I through the resistor as a function of time t?



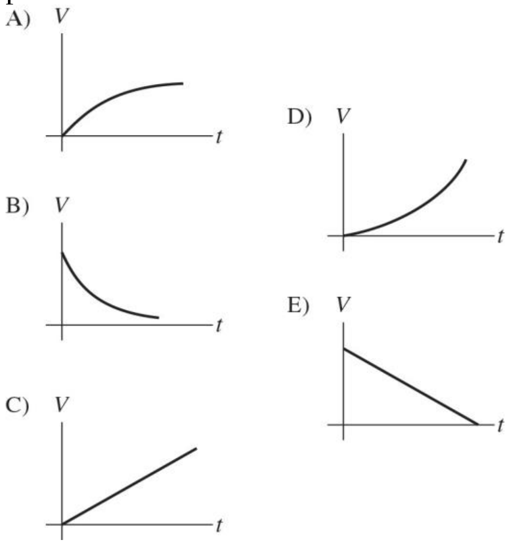
Answer: B
Var: 1

39) A charged capacitor is connected in series with a resistor and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the potential difference V across the resistor as a function of time t?



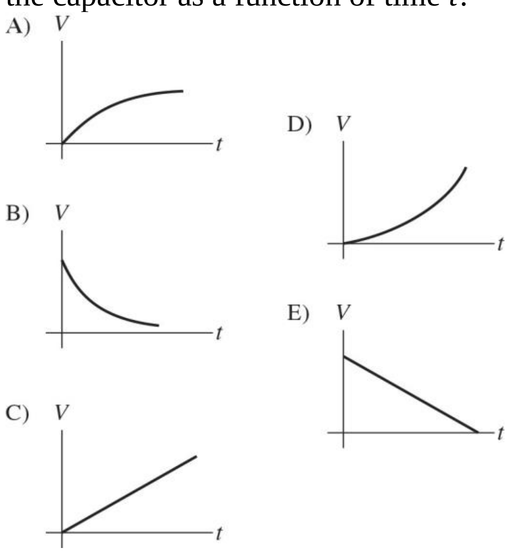
Answer: B
Var: 1

40) An uncharged capacitor is connected in series with a resistor, a dc battery, and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the potential difference V across the resistor as a function of time t?



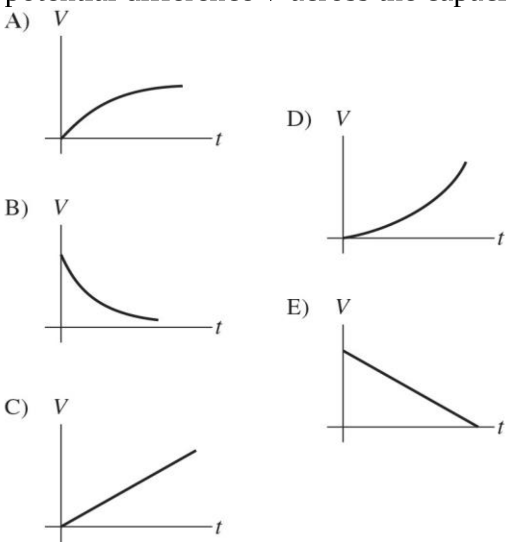
Answer: B
Var: 1

41) A charged capacitor is connected in series with a resistor and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the potential difference V across the capacitor as a function of time t?



Answer: B
Var: 1

42) An uncharged capacitor is connected in series with a resistor, a dc battery, and an open switch. At time $t = 0$ s, the switch is closed. Which of the graphs below best describes the potential difference V across the capacitor as a function of time t?



Answer: A
Var: 1

43) An ideal ammeter should
A) have a high coil resistance.
B) introduce a very small series resistance into the circuit whose current is to be measured.
C) introduce a very large series resistance into the circuit whose current is to be measured.
D) consist of a galvanometer in series with a large resistor.
Answer: B
Var: 1

44) A galvanometer can be converted to an ammeter by the addition of a
A) small resistance in parallel.
B) large resistance in parallel.
C) small resistance in series.
D) large resistance in series.
Answer: A
Var: 1

45) Decreasing the resistance of an ammeter's shunt resistance
A) allows it to measure a larger current at full scale deflection.
B) allows it to measure a smaller current at full scale deflection.
C) enables more current to pass directly through the galvanometer.
D) converts it to a voltmeter.
Answer: A
Var: 1

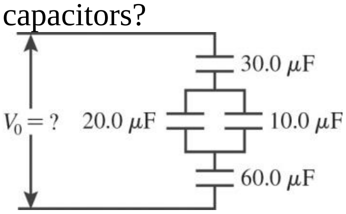
46) In order to construct a voltmeter from a galvanometer, one normally would
A) use a very small shunt resistor.
B) use a very large shunt resistor.
C) use a very small series resistor.
D) use a very large series resistor.
Answer: D
Var: 1

19.2   Problems

1) A 4.0-μF capacitor and an 8.0-μF capacitor are connected together. What is the equivalent capacitance of the combination if they are connected (a) in series or (b) in parallel?
Answer: (a) 2.7 μF   (b) 12.0 μF
Var: 1

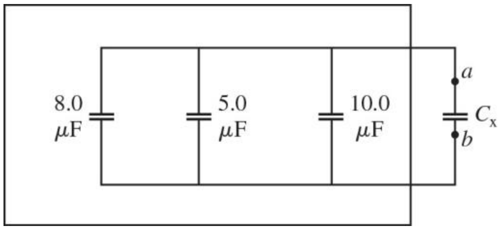
2) You have three capacitors with capacitances of 4.00 μF, 7.00 μF, and 9.00 μF. What is the equivalent capacitance if they are connected (a) in series and (b) in parallel?
Answer: (a) 1.98 μF   (b) 20.00 μF
Var: 1

3) A network of capacitors is connected across a potential difference V_0 as shown in the figure.
(a) What should V_0 be so that the 60.0-μF capacitor will have 18.0 μC of charge on each of its plates?
(b) Under the conditions of part (a), how much total energy is stored in this network of capacitors?



Answer: (a) 1.50 V   (b) 13.5 μJ
Var: 1

4) A network of capacitors is mostly inside a sealed box, but one capacitor C_X is sticking out, as shown in the figure. When you connect a multimeter across points *a* and *b*, it reads 27.0 μF. What is C_X?

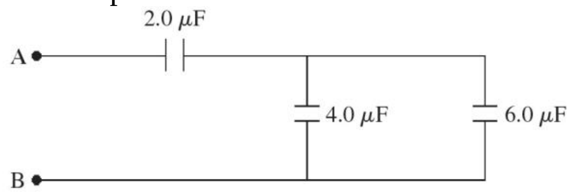


A) 27.0 μF
B) 23.0 μF
C) 4.0 μF
D) 2.4 μF
E) 2.2 μF
Answer: C
Var: 1

5) A 5.0-μF capacitor and a 7.0-μF capacitor are connected in series across an 8.0-V potential source. What is the potential difference across the 5.0-μF capacitor?
A) 0 V
B) 8.0 V
C) 2.7 V
D) 3.6 V
E) 4.7 V
Answer: E
Var: 5

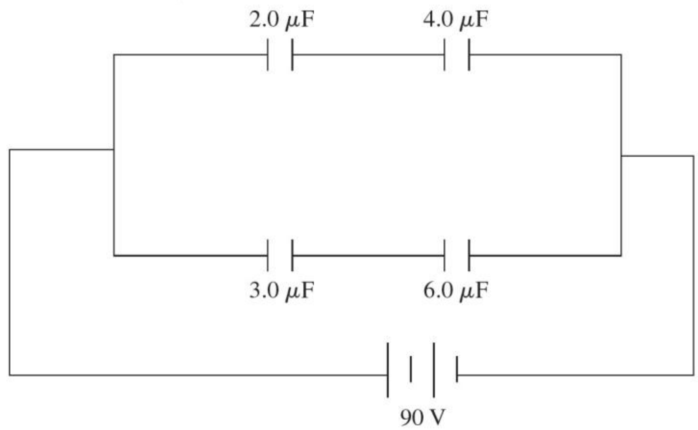
6) A 2.0-μF capacitor and a 4.0-μF capacitor are connected in series across an 8.0-V potential source. What is the charge on the 2.0-μF capacitor?
A) 2.0 μC
B) 4.0 μC
C) 12 μC
D) 11 μC
E) 25 μC
Answer: D
Var: 5

7) Three capacitors are connected as shown in the figure. What is the equivalent capacitance between points A and B?



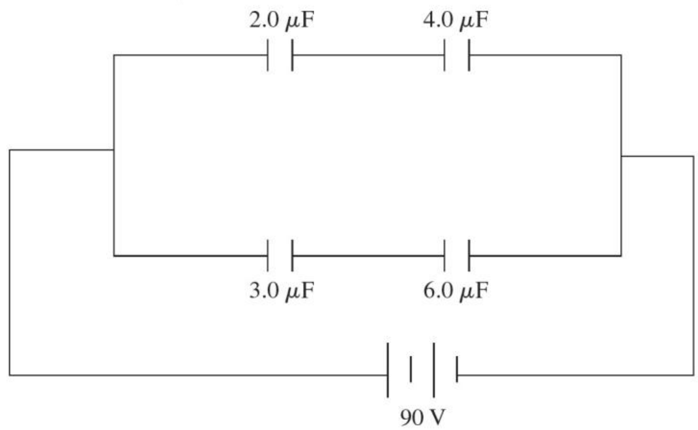
A) 12 μF
B) 4.0 μC
C) 7.1 μF
D) 1.7 μF
E) 8.0 μF
Answer: D
Var: 1

8) A system of four capacitors is connected across a 90-V voltage source as shown in the figure. What is the equivalent capacitance of this system?



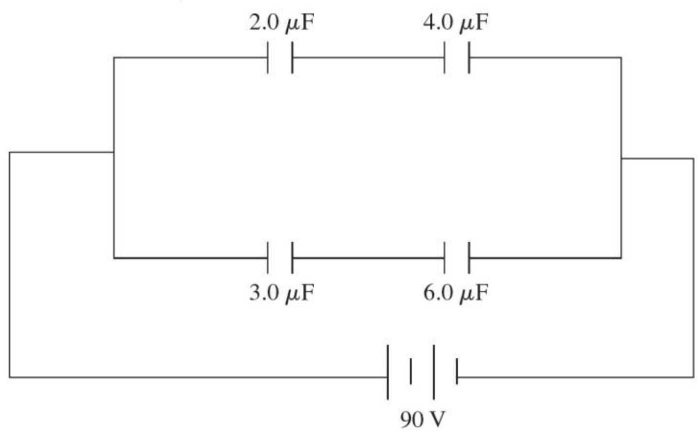
A) 1.5 μF
B) 15 μF
C) 3.6 μF
D) 3.3 μF
Answer: D
Var: 1

9) A system of four capacitors is connected across a 90-V voltage source as shown in the figure.
(a) What is the charge on the 4.0-μF capacitor?
(b) What is the charge on the 2.0-μF capacitor?



Answer: (a) 120 μC (b) 120 μC
Var: 1

10) A system of four capacitors is connected across a 90-V voltage source as shown in the figure.
(a) What is the potential difference across the plates of the 6.0-μF capacitor?
(b) What is the charge on the 3.0-μF capacitor?



Answer: (a) 30 V (b) 180 μC
Var: 1

11) A 5.0-μF, a 14-μF, and a 21-μF capacitor are connected in parallel. How much capacitance would a single capacitor need to have to replace the three capacitors?
A) 40 μF
B) 21 μF
C) 5.0 μF
D) 14 μF
Answer: A
Var: 50+

12) A 5.0-μF, a 14-μF, and a 21-μF capacitor are connected in series. How much capacitance would a single capacitor need to have to replace the three capacitors?
A) 40 μF
B) 3.6 μF
C) 2.0 μF
D) 3.1 μF
Answer: D
Var: 1

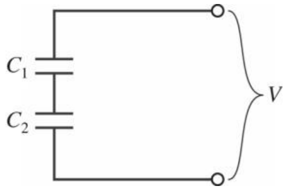
13) A 5.0-μF and a 12.0-μF capacitor are connected in series, and the series arrangement is connected in parallel to a 29.0-μF capacitor. How much capacitance would a single capacitor need to replace this combination of three capacitors?
A) 33 μF
B) 13 μF
C) 16 μF
D) 38 μF
Answer: A
Var: 50+

14) Four 16-μF capacitors are connected in combination. What is the equivalent capacitance of this combination if they are connected
(a) in series?
(b) in parallel?
(c) such that two of them are in parallel with each other and that combination is in series with the remaining two capacitors?
Answer: (a) 4.0 μF (b) 64 μF (c) 6.4 μF
Var: 1

15) Three capacitors of capacitance 5.00 μF, 10.0 μF, and 50.0 μF are connected in series across a 12.0-V potential difference (a battery).
(a) How much charge is stored in the 5.00-μF capacitor?
(b) What is the potential difference across the 10.0-μF capacitor?
Answer: (a) 37.5 μC (b) 3.75 V
Var: 1

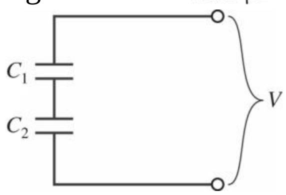
16) A 1.0-μF capacitor and a 2.0-μF capacitor are connected together, and then that combination is connected across a 3.0-V potential source (a battery). What is the potential difference across the 2.0-μF capacitor if the capacitors are connected (a) in series or (b) in parallel?
Answer: (a) 1.0 V (b) 3.0 V
Var: 1

17) Two capacitors are connected as shown in the figure, with C_1 = 4.0 μF and C_2 = 7.0 μF. If a voltage source V = 90 V is applied across the combination, find the potential difference across C_1.



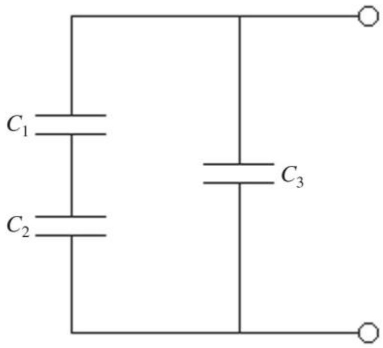
A) 57 V
B) 36 V
C) 60 V
D) 9.0 V
Answer: A
Var: 1

18) A potential difference of V = 100 V is applied across two capacitors in series, as shown in the figure. If C_1 = 10.0 μF and the voltage drop across it is 75 V, what is the capacitance of C_2?



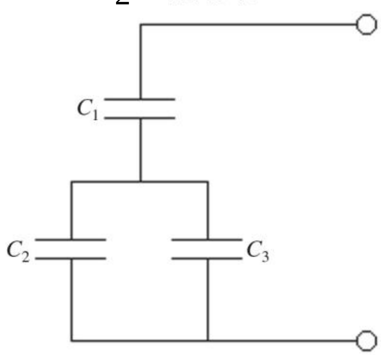
A) 30 μF
B) 2.5 μF
C) 7.5 μF
D) 3.3 μF
Answer: A
Var: 10

19) Three capacitors of equal capacitance are arranged as shown in the figure, with a voltage source across the combination. If the voltage drop across C_1 *is* 10.0 V, what is the voltage drop across C_3?



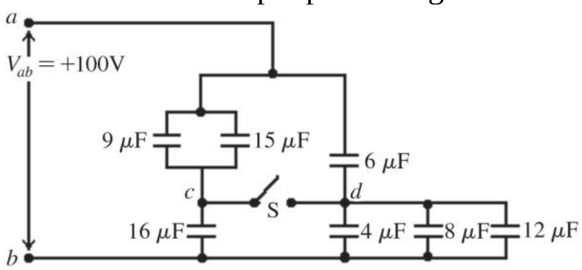
A) 20 V
B) 10.0 V
C) 40 V
D) 30 V
Answer: A
Var: 10

20) Three capacitors are arranged as shown in the figure, with a voltage source connected across the combination. C_1 has a capacitance of 9.0 pF, C_2 has a capacitance of 18.0 pF, and C_3 has a capacitance of 27.0 pF. Find the potential drop across the entire arrangement if the potential drop across C_2 is 257.0 V.



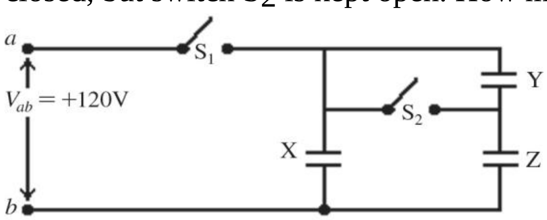
A) 1500 V
B) 1000 V
C) 470 V
D) 430 V
Answer: A
Var: 50+

21) The capacitive network shown in the figure is assembled with initially uncharged capacitors. Assume that all the quantities in the figure are accurate to two significant figures. The switch S in the network is kept open throughout. What is the total energy stored in the seven capacitors?



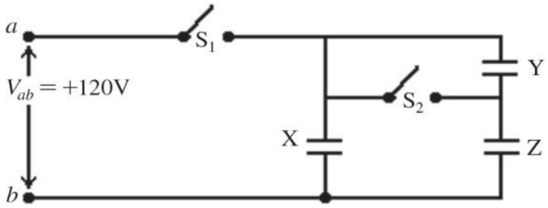
A) 48 mJ
B) 72 mJ
C) 96 mJ
D) 120 mJ
E) 144 mJ
Answer: B
Var: 1

22) The network shown is assembled with uncharged capacitors X , Y, and Z, with $C_X = 4.0\ \mu F$, $C_Y = 3.0\ \mu F$ and $C_Z = 5.0\ \mu F$. The switches S_1 and S_2 are initially open, and a potential difference V_{ab} = 120 V is applied between points *a* and *b*. After the network is assembled, switch S_1 is then closed, but switch S_2 is kept open. How much energy is finally stored in capacitor X?



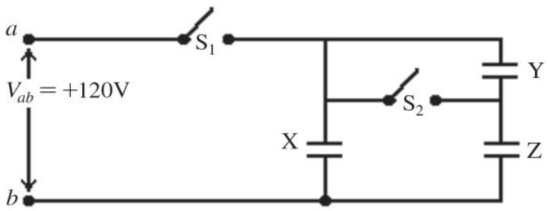
A) 29 mJ
B) 0.48 mJ
C) 0.24 mJ
D) 58 mJ
E) 0.96 mJ
Answer: A
Var: 50+

23) The network shown is assembled with uncharged capacitors X , Y, and Z, with $C_X = 8.- \mu F$, $C_Y = 9.- \mu F$ and $C_Z = 1.0 \mu F$. The switches S_1 and S_2 are initially open, and a potential difference V_{ab} = 120 V is applied between points *a* and *b*. After the network is assembled, switch S_1 is then closed, but switch S_2 is kept open. How much charge is finally stored in capacitor Y?



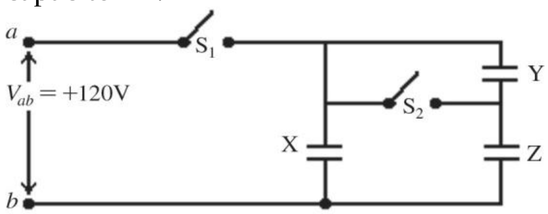
A) 110 µC
B) 54 µC
C) 81 µC
D) 140 µC
E) 160 µC
Answer: A
Var: 50+

24) The network shown is assembled with uncharged capacitors X , Y, and Z, with $C_X = 3.0 \mu F$, $C_Y = 5.0 \mu F$ and $C_Z = 1.0 \mu F$. The switches S_1 and S_2 are initially open, and a potential difference V_{ab} = 120 V is applied between points *a* and *b*. After the network is assembled, switch S_1 is then closed, but switch S_2 is kept open. What is the final potential difference across capacitor Z?



A) 100 V
B) 600 V
C) 55 V
D) 38 V
E) 29 V
Answer: A
Var: 50+

25) The network shown is assembled with uncharged capacitors X , Y, and Z, with C_X = 4.0 μF, C_Y = 6.0 μF, and C_Z = 5.0 μF. The switches S_1 and S_2 are initially open, and a potential difference V_{ab} = 120 V is applied between points *a* and *b*. After the network is assembled, switch S_1 is then closed, but switch S_2 is kept open. What is the final potential difference across capacitor X?



A) 120 V
B) 82 V
C) 75 V
D) 67 V
E) 60 V
Answer: A
Var: 1

26) A group of 1.0-μF, 2.0-μF, and 3.0-μF capacitors is connected in parallel across a 24-V potential difference (a battery). How much energy is stored in this three-capacitor combination when the capacitors are fully charged?
A) 1.7 mJ
B) 2.1 mJ
C) 4.8 mJ
D) 7.1 mJ
Answer: A
Var: 1

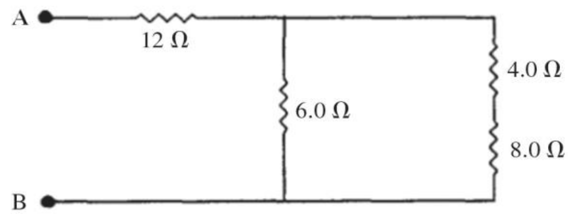
27) A 9.00-μF and a 12.0-μF capacitor are connected together, and this combination is connected across a 25.0-V potential difference. How much electric energy is stored in the combination if they are connected (a) in parallel or (b) in series?
Answer: (a) 6.56 mJ (b) 1.61 mJ
Var: 1

28) What different resistances can be obtained by using two 2.0-Ω resistors and one 4.0-Ω resistor? You must use all three of them in each possible combination.
Answer: 0.80 Ω, 1.5 Ω, 2.0 Ω, 3.3 Ω, 5.0 Ω, 8.0 Ω
Var: 1

29) Two resistors in series are equivalent to 9.0 Ω, and in parallel they are equivalent to 2.0 Ω. What are the resistances of these two resistors?
Answer: 3.0 Ω and 6.0 Ω
Var: 1

30) What resistance must be connected in parallel with a 633-Ω resistor to produce an equivalent resistance of 205 Ω?
Answer: 303 Ω
Var: 1

31) What is the equivalent resistance between points A and B of the network shown in the figure?



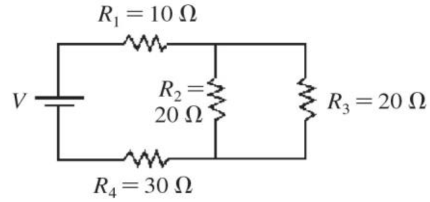
Answer: 16 Ω
Var: 1

32) A combination of a 2.0-Ω resistor in series with 4.0-Ω resistor is connected in parallel with a 3.0-Ω resistor. What is the equivalent resistance of this system?
A) 2.0 Ω
B) 3.0 Ω
C) 4.0 Ω
D) 9.0 Ω
Answer: A
Var: 1

33) Two 4.0-Ω resistors are connected in parallel, and this combination is connected in series with 3.0 Ω. What is the equivalent resistance of this system?
A) 1.2 Ω
B) 5.0 Ω
C) 7.0 Ω
D) 11 Ω
Answer: B
Var: 1

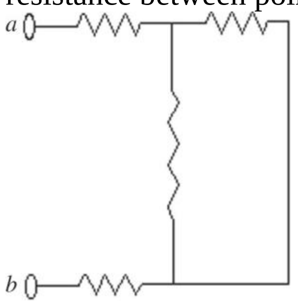
34) A 2.0-Ω resistor is in series with a parallel combination of 4.0-Ω, 6.0-Ω, and 12-Ω resistors. What is the equivalent resistance of this system?
A) 24 Ω
B) 4.0 Ω
C) 1.8 Ω
D) 2.7 Ω
Answer: B
Var: 1

35) What is the equivalent resistance in the circuit shown in the figure?



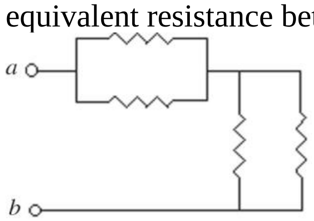
A) 80 Ω
B) 55 Ω
C) 50 Ω
D) 35 Ω
Answer: C
Var: 1

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



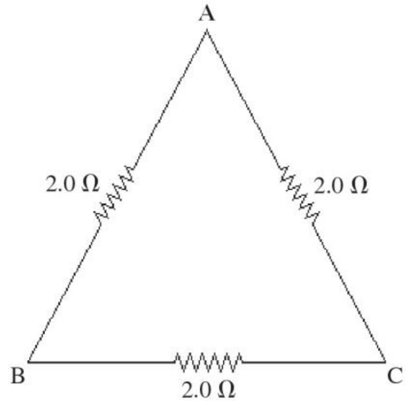
A) 450.0 Ω
B) 720.0 Ω
C) 540.0 Ω
D) 180.0 Ω
Answer: A
Var: 41

37) The resistors in the circuit shown in the figure each have a resistance of $700\ \Omega$. What is the equivalent resistance between points *a* and *b* of this combination?



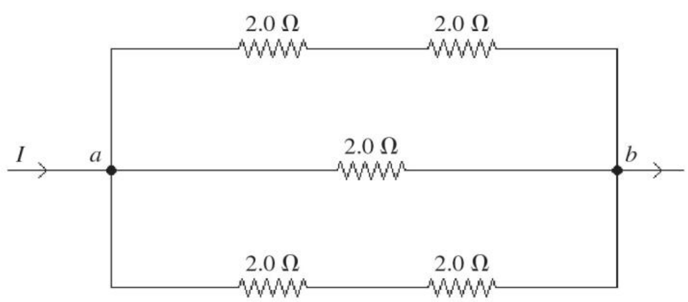
A) 700 Ω
B) 2800 Ω
C) 175 Ω
D) 1400 Ω
Answer: A
Var: 9

38) Three 2.0-Ω resistors are connected to form the sides of an equilateral triangle ABC as shown in the figure. What is the equivalent resistance between any two points, AB, BC, or AC, of this circuit?



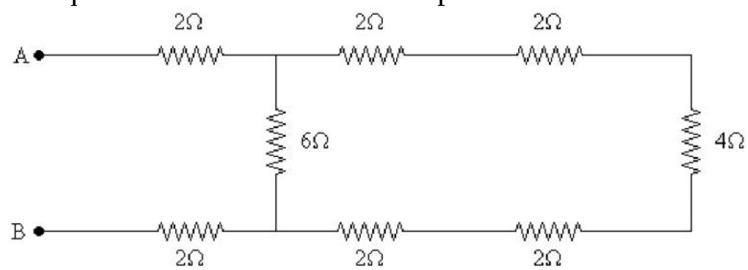
A) 2.0 Ω
B) 6.0 Ω
C) 4.3 Ω
D) 3.3 Ω
E) 1.3 Ω
Answer: E
Var: 1

39) Five 2.0-Ω resistors are connected as shown in the figure. What is the equivalent resistance of this combination between points *a* and *b*?



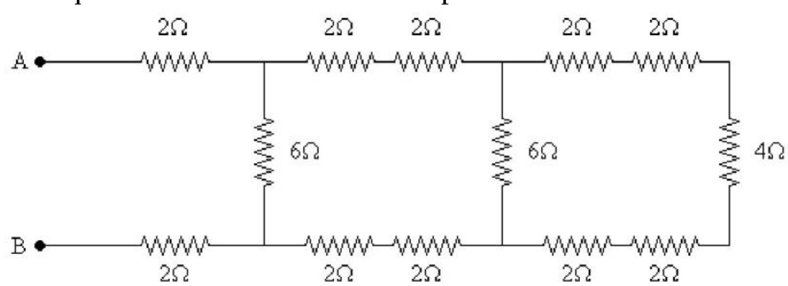
A) 1.0 Ω
B) 10.0 Ω
C) 2.0 Ω
D) 6.0 Ω
E) 0.40 Ω
Answer: A
Var: 1

40) 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?



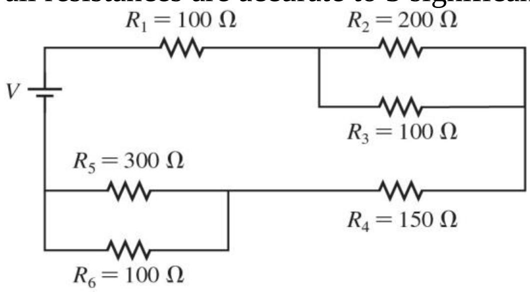
A) 4 Ω
B) 6 Ω
C) 8 Ω
D) 10 Ω
E) 12 Ω
Answer: C
Var: 1

41) 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?



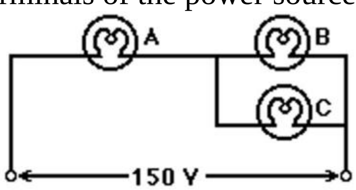
A) 4 Ω
B) 6 Ω
C) 8 Ω
D) 10 Ω
E) 12 Ω
Answer: C
Var: 1

42) 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) 950 Ω
B) 450 Ω
C) 392 Ω
D) 257 Ω
Answer: C
Var: 1

43) Three light bulbs, A, B, and C, have electrical ratings as follows:
Bulb A: 96.0 W, 1.70 A
Bulb B: 80.0 V, 205 W
Bulb C: 120 V, 0.400 A
These three bulbs are connected in a circuit across a 150-V voltage power source, as shown in the figure. Assume that the filament resistances of the light bulbs are constant and independent of operating conditions. What is the equivalent resistance of this combination of bulbs between the terminals of the power source?



A) 61.5 Ω
B) 15.3 Ω
C) 74.0 Ω
D) 86.2 Ω
E) 364 Ω
Answer: A
Var: 1

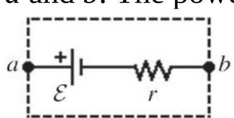
44) A heating element having a resistance (at its operating temperature) of 148 Ω is connected to a battery having an emf of 523 V and unknown internal resistance.It is found that heat energy is being generated in the resistance of the heating element at a rate of 66.0 W. What is the rate at which heat energy is being generated in the internal resistance of the battery?
Answer: 283 W
Var: 50+

45) When an external resistor of resistance R_1 = 14 Ω is connected across the terminals of a battery, a current of 6.0 A flows through the resistor. When a different external resistor of resistance R_2 = 64.4 Ω is connected instead, the current is 2.0 A. Calculate (a) the emf of the battery and (b) the internal resistance of the battery.
Answer: (a) 150 V (b) 11 Ω
Var: 1

46) A battery you buy at the store has an internal emf of 3.0 V. If it has an internal resistance of14.0 Ω, what current will this battery put out if it is short-circuited?
A) 0.21 A
B) 42 A
C) 4.7 A
D) 130 A
Answer: A
Var: 50+

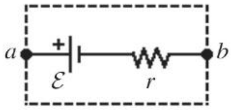
47) A 7.0-Ω resistor is connected across the terminals of a battery having an internal emf of 10 V. If 0.50-A current flows, what is the internal resistance of the battery?
A) 13 Ω
B) 20 Ω
C) 10.8 Ω
D) 27.0 Ω
Answer: A
Var: 7

48) A battery has an emf ε = 78.0 V and an internal resistance r = 4.0 Ω, as shown in the figure. A current of 4.7 A is drawn from the battery when a resistor R is connected across the terminals a and b. The power dissipated by the resistor R is closest to



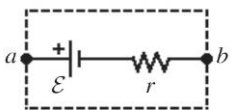
A) 280 W.
B) 340 W.
C) 320 W.
D) 300 W.
E) 370 W.
Answer: A
Var: 50+

49) A battery has an emf ε = 43.0 V and an internal resistance r = 8.0 Ω, as shown in the figure. When the terminal voltage V_{ab} is equal to 34.0 V, the current through the battery, including its direction, is closest to



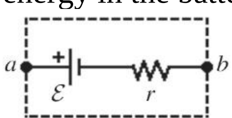
A) 1.1 A, from *b* to *a*.
B) 4.2 A, from *b* to *a*.
C) 1.1 A, from *a* to *b*.
D) 4.2 A, from *a* to *b*.
E) 5.4 A, from *b* to *a*.
Answer: A
Var: 50+

50) A battery has an emf ε = 12 V and an internal resistance r = 2.0 Ω, as shown in the figure. When a current of 6.0 A is drawn from the battery, the terminal voltage of the battery V_{ab} is closest to



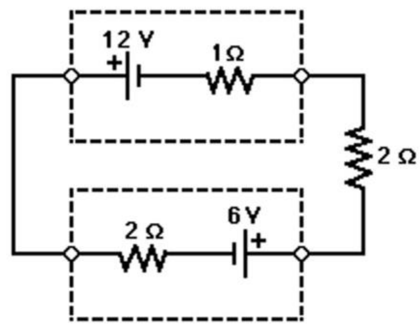
A) 0 V.
B) +12 V.
C) +24 V.
D) 2.0 V.
E) 10 V.
Answer: A
Var: 1

51) A battery has an emf ε = 12 V and an internal resistance r = 2.0 Ω, as shown in the figure. When a 3.0-Ω cable is connected across the battery terminals *a* and *b*, the rate at which chemical energy in the battery is depleted is closest to



A) 24 W.
B) 27 W.
C) 29 W.
D) 32 W.
E) 34 W.
Answer: C
Var: 1

52) A circuit contains two batteries and a 2.0-Ω resistor as shown in the figure. The emfs and internal resistances of these batteries are indicated in the figure, and all numbers are accurate to two significant figures. What are the terminal voltages of (a) the 6.0-V battery and (b) the 12-V battery?

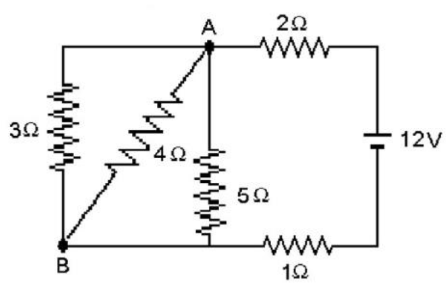


Answer: (a) -1.2 V (the terminal polarity is opposite from the polarity of the internal emf) (b) 8.4 V
Var: 1

53) 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?
Answer: (a) 0.40 A (b) 4.0 A
Var: 1

54) 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?
Answer: (a) 0.83 A (b) 0.53 A
Var: 1

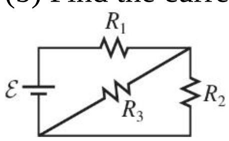
55) For the circuit shown in the figure, the battery is ideal and all quantities are accurate to two significant figures. Find the current through (a) the 1.0-Ω resistor, (b) the 3.0-Ω resistor, and (c) the 4.0-Ω resistor.



Answer: (a) 2.8 A (b) 1.2 A (c) 0.90 A
Var: 1

56) Two 100-W light bulbs of fixed resistance are to be connected to an ideal 120-V source. What are the current, potential difference, and dissipated power for each bulb when they are connected
(a) in parallel (the normal arrangement)?
(b) in series?
Answer: (a) 0.83 A in each; 120 V for each; 100 W in each (200 W total)
(b) 0.42 A in each; 60 V for each; 25 W in each (50 W total)
Var: 1

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



Answer: (a) 9.6 Ω (b) I_1 = 0.63 A, I_2 = 0.45 A, I_3 = 0.18 A
Var: 1

58) A 22-A current flows into a parallel combination of 4.0-Ω, 6.0-Ω, and 12-Ω resistors. What current flows through the 12-Ω resistor?
A) 18 A
B) 11 A
C) 7.3 A
D) 3.7 A
Answer: D
Var: 1

59) A 6.0-Ω and a 12-Ω resistor are connected in parallel across an ideal 36-V battery. What power is dissipated by the 6.0-Ω resistor?
A) 220 W
B) 48 W
C) 490 W
D) 24 W
Answer: A
Var: 1

60) The following three appliances are connected in parallel across an ideal 120-V dc power source: 1200-W toaster, 650-W coffee pot, and 600-W microwave. If all were operated at the same time what total current would they draw from the source?
A) 4.0 A
B) 5.0 A
C) 10 A
D) 20 A
Answer: D
Var: 1

61) A certain 20-A circuit breaker trips when the current in it equals 20 A. What is the maximum number of 100-W light bulbs you can connect in parallel in an ideal 120-V dc circuit without tripping this circuit breaker?
A) 11
B) 17
C) 23
D) 27
Answer: C
Var: 1

62) A15-Ω resistor is connected in parallel with a 30-Ω resistor. If this combination is now connected in series with an ideal 9.0-V battery and a 20-Ω resistor, what is the current through the 15-Ω resistor?
A) 0.10 A
B) 0.13 A
C) 0.20 A
D) 0.26 A
Answer: C
Var: 1

63) Three resistors of resistances 4.0 Ω, 6.0 Ω, and 10 Ω are connected in parallel. If this combination is now connected in series with an ideal 12-V battery and a 2.0-Ω resistor, what is the current through the 10-Ω resistor?
A) 0.59 A
B) 2.7 A
C) 11 A
D) 16 A
Answer: A
Var: 1

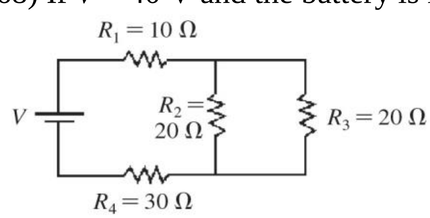
64) Two resistors having resistances of 5.0 Ω and 9.0 Ω are connected in parallel. A 4.0-Ω resistor is then connected in series with the parallel combination. An ideal 6.0-V battery is then connected across the series-parallel combination. What is the current through the 9.0-Ω resistor?
A) 0.35 A
B) 0.53 A
C) 0.83 A
D) 0.30 A
E) 0.67 A
Answer: D
Var: 1

65) 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) 2.7 W
B) 5.3 W
C) 6.0 W
D) 12 W
Answer: B
Var: 1

66) Four resistors having resistances of 20 Ω, 40 Ω, 60 Ω, and 80 Ω are connected in series across an ideal dc voltage source. If the current through this circuit is 0.50 A, what is the voltage of the voltage source?
A) 20 V
B) 40 V
C) 60 V
D) 80 V
E) 100 V
Answer: E
Var: 1

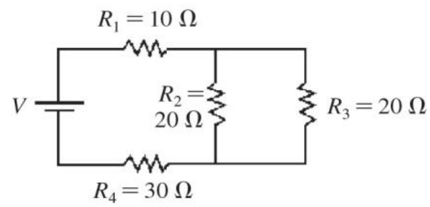
67) Four resistors having resistances of 20 Ω, 40 Ω, 60 Ω, and 80 Ω are connected in series across an ideal 50-V dc source. What is the current through each resistor?
A) 0.25 A
B) 0.50 A
C) 0.75 A
D) 2.0 A
E) 4.0 A
Answer: A
Var: 1

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



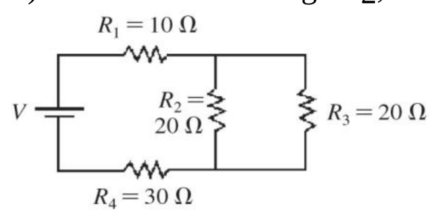
A) 6.7 V
B) 8.0 V
C) 10 V
D) 20 V
Answer: B
Var: 1

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



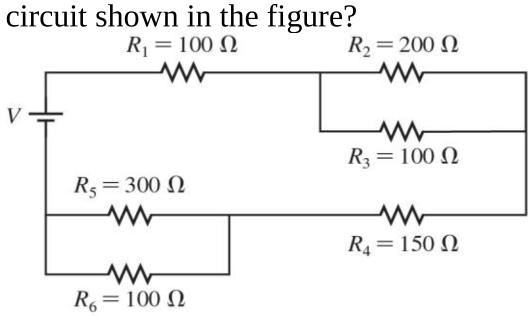
A) 0.050 A
B) 0.20 A
C) 1.0 A
D) 4.0 A
Answer: B
Var: 1

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



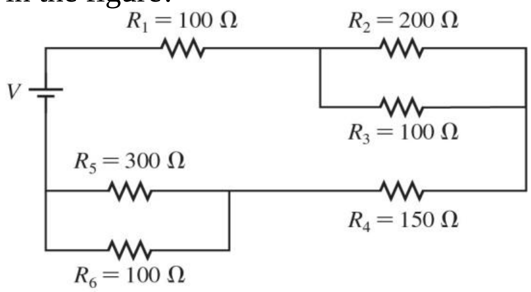
A) 150 V
B) 75 V
C) 60 V
D) 30 V
Answer: A
Var: 1

71) If emf of the ideal battery is V = 100 V, what is the potential difference across R_5 for the circuit shown in the figure?



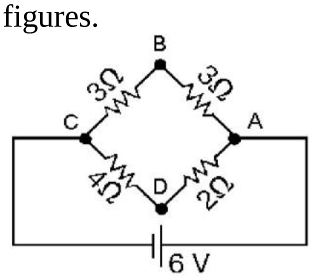
A) 19 V
B) 40 V
C) 75 V
D) 77 V
Answer: A
Var: 1

72) If emf of the ideal battery is $V = 4.0$ V, what is the current through R_6 for the circuit shown in the figure?



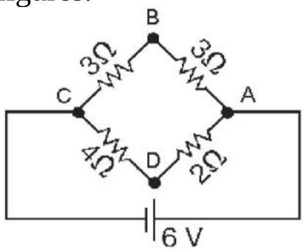
A) 0.0077 A
B) 0.017 A
C) 0.040 A
D) 4.0 A
Answer: A
Var: 1

73) 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.



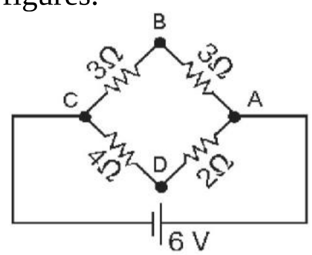
A) 6.0 V
B) 4.0 V
C) 3.0 V
D) 2.0 V
Answer: A
Var: 1

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



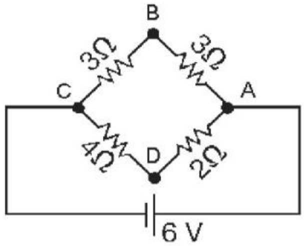
A) 6.0 V
B) 4.0 V
C) 3.0 V
D) 2.0 V
Answer: C
Var: 1

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



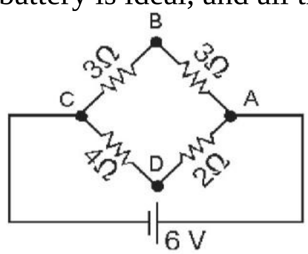
A) 6.0 V
B) 4.0 V
C) 3.0 V
D) 2.0 V
Answer: B
Var: 1

76) What current flows from the battery in the circuit shown in the figure? The battery is ideal, and all the numbers are accurate to two significant figures.



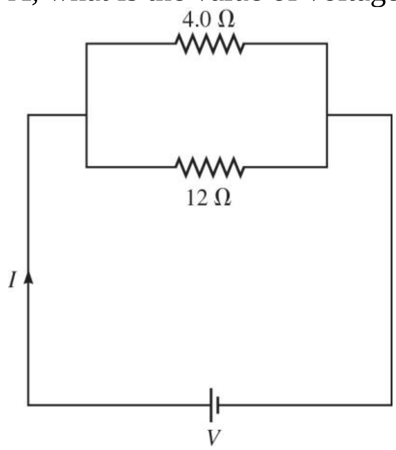
A) 0.35 A
B) 2.0 A
C) 2.5 A
D) 3.0 A
Answer: B
Var: 1

77) 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.



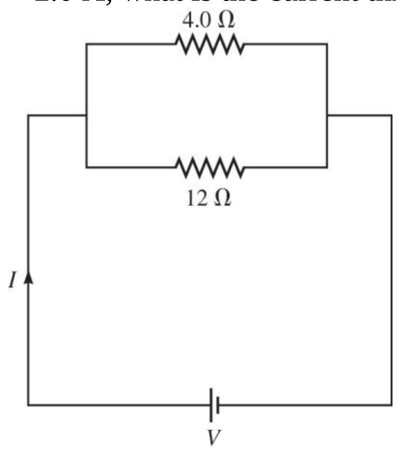
A) 0.35 V
B) 2.0 V
C) 2.5 V
D) 3.0 V
Answer: D
Var: 1

78) A 4.0-Ω resistor is connected to a 12-Ω resistor and this combination is connected to an ideal dc power supply with voltage V as shown in the figure. If the total current in this circuit is I = 2.0 A, what is the value of voltage V?



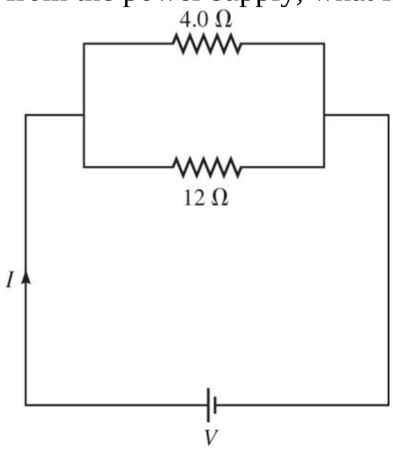
A) 2.0 V
B) 3.0 V
C) 6.0 V
D) 1.5 V
E) 8.0 V
Answer: C
Var: 1

79) A 4.0-Ω resistor is connected with a 12-Ω resistor and both of these are connected across an ideal dc power supply with voltage V as shown in the figure. If the total current in this circuit is I = 2.0 A, what is the current through the 4.0-Ω resistor?



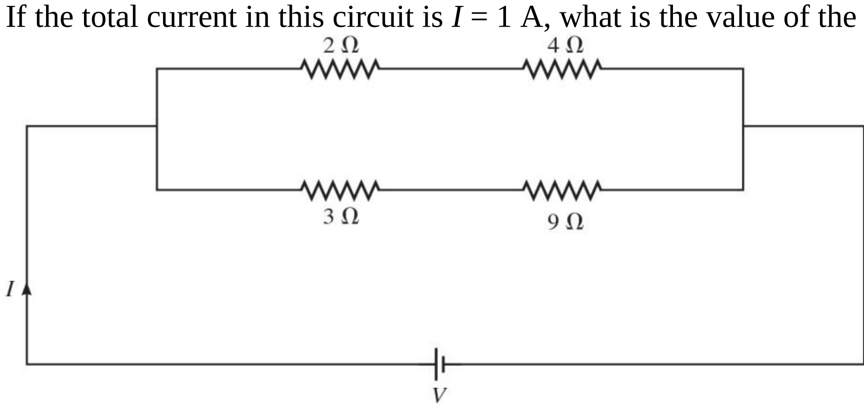
A) 2.0 A
B) 2.5 A
C) 0.5 A
D) 3.0 A
E) 1.5 A
Answer: E
Var: 1

80) A 4.0-Ω resistor is connected with a 12-Ω resistor and this combination is connected across an ideal dc power supply with V = 6.0 V, as shown in the figure. When a total current I flows from the power supply, what is the current through the 12-Ω resistor?



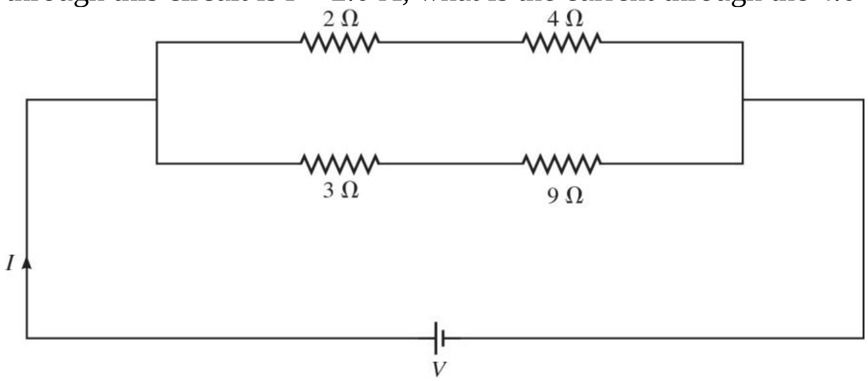
A) 1.5 A
B) 2.0 A
C) 2.5 A
D) 3.0 A
E) 0.50 A
Answer: E
Var: 1

81) 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) 2 V
B) 4 V
C) 6 V
D) 8 V
E) 10 V
Answer: B
Var: 1

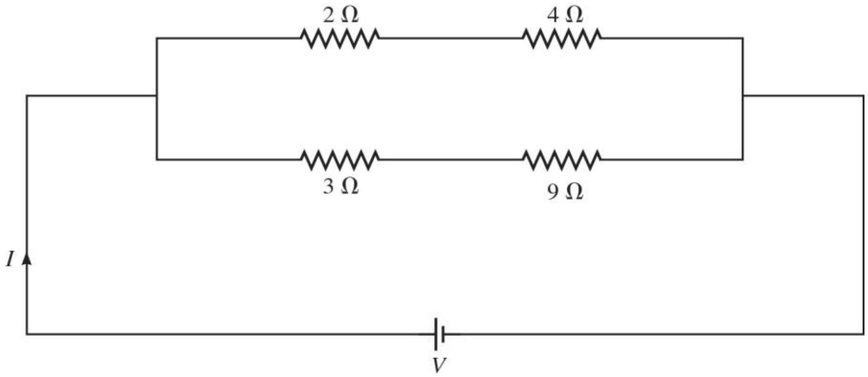
82) Four resistors are connected across an ideal dc battery with voltage V as shown in the figure. Assume that all quantities shown are accurate to two significant figures. If the total current through this circuit is I = 2.0 A, what is the current through the 4.0-Ω resistor?



A) 1.0 A
B) 2.0 A
C) 3.0 A
D) 1.3 A
E) 2.4 A
Answer: D
Var: 1

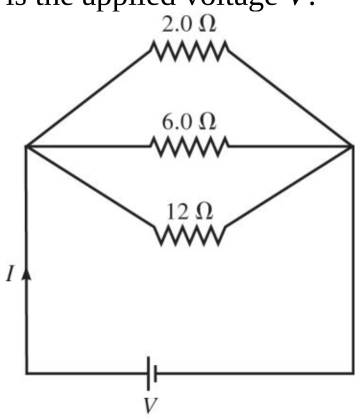
83) An ideal 100-V dc battery is applied across a series combination of four resistors having resistances of 20 Ω, 40 Ω, 60 Ω, and 80 Ω. What is the potential difference across the 40-Ω resistor?
A) 20 V
B) 40 V
C) 60 V
D) 80 V
E) 100 V
Answer: A
Var: 1

84) Four resistors are connected across an ideal dc source of $V = 8.0$ V, as shown in the figure. Assume all resistances shown are accurate to two significant figures. What is the current through the 9.0-Ω resistor?



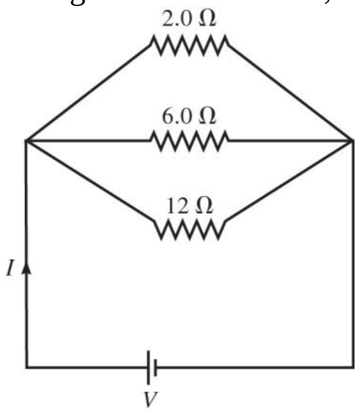
A) 1.0 A
B) 0.67 A
C) 0.50 A
D) 0.90 A
E) 2.0 A
Answer: B
Var: 1

85) Three resistors with resistances of 2.0 Ω, 6.0 Ω, and 12 Ω are connected across an ideal dc voltage source V as shown in the figure. If the total current through the circuit is $I = 2.0$ A, what is the applied voltage V?



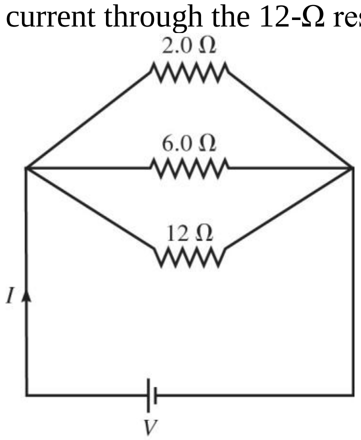
A) 6.0 V
B) 3.0 V
C) 2.0 V
D) 2.7 V
E) 1.5 V
Answer: D
Var: 1

86) Three resistors with resistances of 2.0 Ω, 6.0 Ω, and 12 Ω are connected across an ideal dc voltage source V = 2.0 V, as shown in the figure. What is the total current I in this circuit?



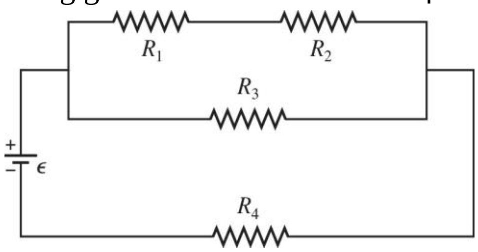
A) 0.70 A
B) 1.5 A
C) 2.0 A
D) 3.0 A
E) 6.0 A
Answer: B
Var: 1

87) Three resistors with resistances of 2.0 Ω, 6.0 Ω, and 12 Ω are connected across an ideal dc voltage source V, as shown in the figure. If the total current in the circuit is I = 5.0 A, what is the current through the 12-Ω resistor?



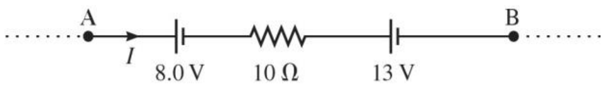
A) 1.7 A
B) 2.5 A
C) 0.56 A
D) 5.0 A
E) 0.75 A
Answer: C
Var: 1

88) For the circuit shown in the figure, the ideal battery has an emf ε = 80 V. The four resistors have resistances of $R_1 = 14\,\Omega$, $R_2 = 21\,\Omega$, $R_3 = 21\,\Omega$, and $R_4 = 14\,\Omega$. Calculate the rate at which heat is being generated in the resistor R_4.



Answer: 120 W
Var: 50+

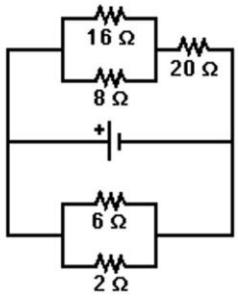
89) A portion of a circuit is shown in the figure, and the batteries are ideal. What is the potential difference $V_A - V_B$ if $I = 5.0$ A?



A) 63 V
B) 35 V
C) 55 V
D) 45 V
E) 71 V
Answer: D
Var: 1

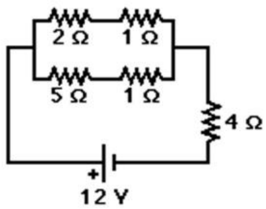
90) An ideal 10.0-V dc is connected across a 590.0-Ω, resistor in series with an 840.0-Ω resistor. What is the potential drop across the 590.0 Ω resistor?
A) 4.1 V
B) 5.9 V
C) 14 V
D) 7.0 V
Answer: A
Var: 50+

91) 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.



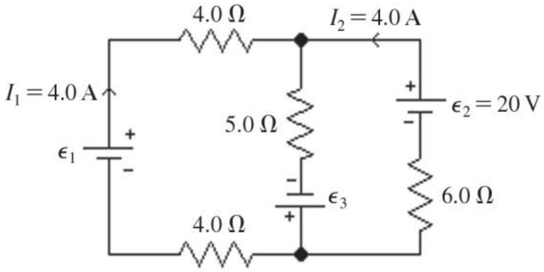
A) 2.25 A
B) 0.75 A
C) 4.5 A
D) 9.5 A
E) 6.4 A
Answer: D
Var: 1

92) For the circuit shown in the figure, what is the power dissipated in the 2.0-Ω resistor? All the numbers shown are accurate to three significant figures.



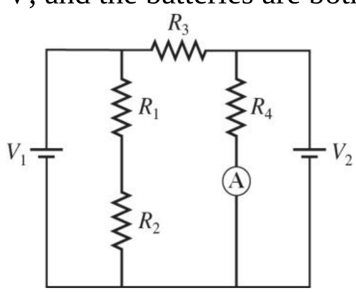
A) 5.33 W
B) 8.00 W
C) 6.67 W
D) 2.67 W
E) 3.56 W
Answer: E
Var: 1

93) For the circuit shown in the figure, calculate the emf's ε_1 and ε_3, assuming that the batteries are ideal. Note that two currents are shown.



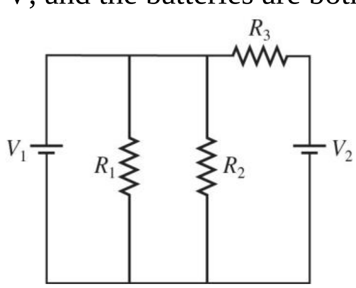
Answer: ε_1 = 28 V, ε_3 = 44 V
Var: 1

94) In the circuit shown in the figure, $R_1 = R_2 = 90.0\ \Omega$, $R_3 = R_4 = 20.0\ \Omega$, $V_1 = 7.0$ V, $V_2 = 8.0$ V, and the batteries are both ideal. What current does the ammeter read?



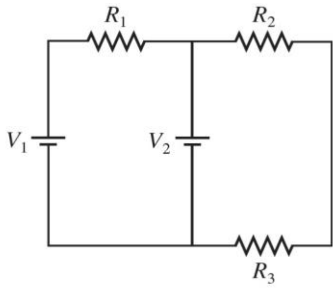
A) 0.40 A
B) 0.050 A
C) 0.83 A
D) 0.056 A
Answer: A
Var: 50+

95) In the circuit shown in the figure, $R_1 = 60\ \Omega$, $R_2 = 120\ \Omega$, $R_3 = 180\ \Omega$, $V_1 = 3.0$ V, $V_2 = 6.0$ V, and the batteries are both ideal. What is the current through R_1?



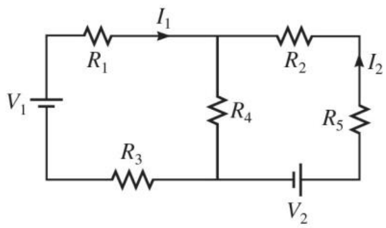
A) 0.050 A
B) 0.030 A
C) 0.00 A
D) 2.68 A
Answer: A
Var: 1

96) In the circuit shown in the figure, R_1 = 10 Ω, R_2 = 12 Ω, R_3 = 20 Ω, V_1 = 1.0 V, V_2 = 7.0 V, and the batteries are both ideal. What is the current through R_1?



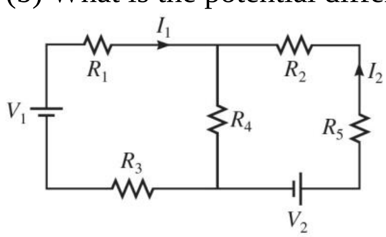
A) 0.60 A
B) 0.80 A
C) 0.18 A
D) 0.13 A
Answer: A
Var: 1

97) For the circuit shown in the figure, R_1 = 18 Ω, R_2 = 44 Ω, R_3 = 33 Ω, R_4 = 14 Ω, R_5 = 12 Ω, V_1 = 18 V, V_2 = 12 V, and the batteries are ideal. Determine I_1 and I_2.



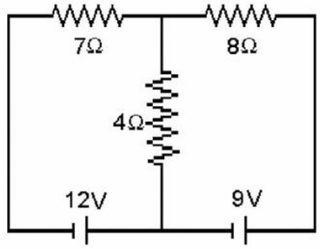
Answer: I_1 = 0.25 A, I_2 = 0.12 A
Var: 1

98) For the circuit shown in the figure, R_1 = 50 Ω, R_2 = 20 Ω, R_3 = 35 Ω, R_4 = 10 Ω, R_5 = 68 Ω, I_1 = 0.111 A, I_2 = 0.142 A, and the batteries are ideal.
(a) Determine V_1 and V_2.
(b) What is the potential difference across R_4?



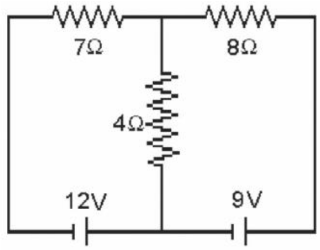
Answer: (a) V_1 = 12 V, V_2 = 15 V (b) 2.5 V
Var: 1

99) Determine the current in the 7.0-Ω resistor for the circuit shown in the figure. Assume that the batteries are ideal and that all numbers are accurate to two significant figures.



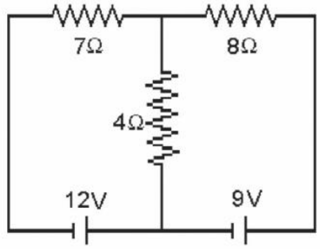
A) 0.28 A
B) 1.3 A
C) 1.6 A
D) 2.1 A
Answer: C
Var: 1

100) Determine the current in the 8.0-Ω resistor for the circuit shown in the figure. Assume that the batteries are ideal and that all numbers are accurate to two significant figures.



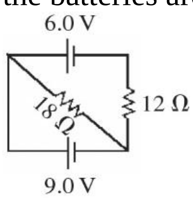
A) 0.28 A
B) 1.3 A
C) 1.6 A
D) 2.1 A
Answer: B
Var: 1

101) Determine the current in the 4.0-Ω resistor for the circuit shown in the figure. Assume that the batteries are ideal and that all numbers are accurate to two significant figures.



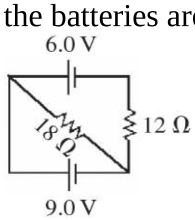
A) 0.28 A
B) 1.3 A
C) 1.6 A
D) 2.1 A
Answer: A
Var: 1

102) Determine the current in the 12-Ω resistor for the circuit shown in the figure assuming that the batteries are ideal.



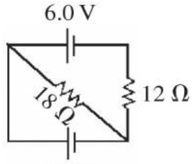
A) 0.25 A
B) 0.50 A
C) 0.75 A
D) 1.0 A
Answer: A
Var: 1

103) Determine the current in the 18-Ω resistor for the circuit shown in the figure assuming that the batteries are ideal.



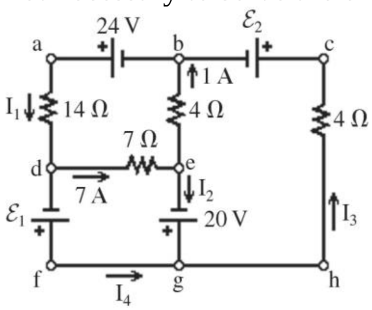
A) 0.25 A
B) 0.50 A
C) 0.75 A
D) 1.0 A
Answer: B
Var: 1

104) For the circuit shown in the figure, both batteries are ideal. What current flows in the solid wire connecting the upper left and lower left corners of the circuit?



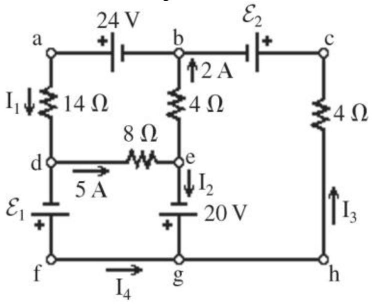
A) 0.25 A
B) 0.50 A
C) 0.75 A
D) 1.0 A
Answer: C
Var: 1

105) A multiloop circuit is shown in the figure. Find the current I_1 if the batteries are ideal. (It is not necessary to solve the entire circuit.)



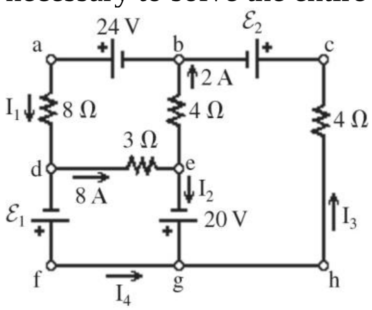
A) -2 A
B) 2 A
C) 6 A
D) -5 A
E) 0 A
Answer: A
Var: 1

106) A multiloop circuit is shown in the figure. Find the current I_2 if the batteries are ideal. (It is not necessary to solve the entire circuit.)



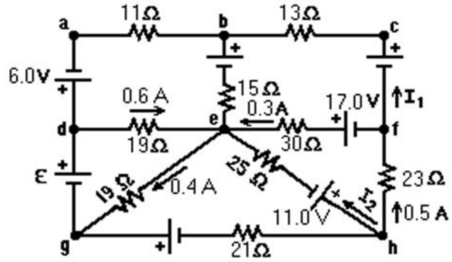
A) -3 A
B) 3 A
C) 7 A
D) -7 A
E) 0 A
Answer: A
Var: 1

107) A multiloop circuit is shown in the figure. Find the emf ε_1 if the batteries are ideal. (It is not necessary to solve the entire circuit.)



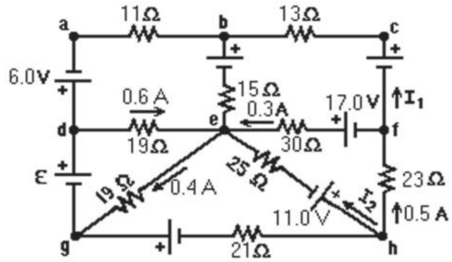
A) -4 V
B) 4 V
C) 44 V
D) 52 V
E) -52 V
Answer: A
Var: 1

108) A multiloop circuit is shown in the figure, but some quantities are not labeled. Find the emf ε if the batteries are ideal. (It is not necessary to solve the entire circuit.)



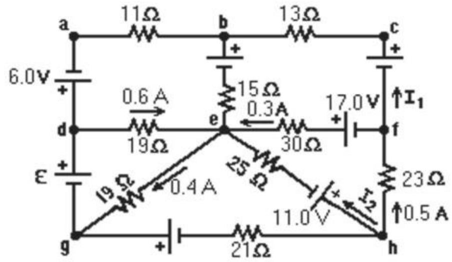
A) +3 V
B) +19 V
C) -3 V
D) -10 V
E) -19 V
Answer: B
Var: 1

109) A multiloop circuit is shown in the figure, but some quantities are not labeled. Find the current I_1 if the batteries are ideal. (It is not necessary to solve the entire circuit.)



A) 0 A
B) +0.2 A
C) +0.4 A
D) -0.2 A
E) -0.4 A
Answer: B
Var: 1

110) A multiloop circuit is shown in the figure, but some quantities are not labeled. Find the current I_2 if the batteries are ideal. (It is not necessary to solve the entire circuit.)



A) +0.1 A
B) +0.3 A
C) +0.5 A
D) -0.1 A
E) -0.3 A
Answer: E
Var: 1

111) A 8.0-μF uncharged capacitor is connected in series with a 6.0-kΩ resistor, an ideal 20-V dc source, and an open switch. If the switch is closed at time t = 0.0 s, what is the charge on the capacitor at t = 9.0 ms?
A) 0 C
B) 37% of the minimum charge
C) 17% of the maximum charge
D) 68% of the minimum charge
E) 96% of the maximum charge
Answer: C
Var: 5

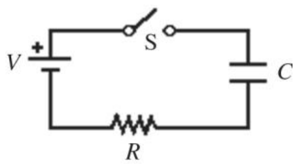
112) A 2.0-μF capacitor that is initially uncharged is charged through a 50-kΩ resistor. How long does it take for the capacitor to reach 90% of its full charge?
A) 0.90 s
B) 0.23 s
C) 2.2 s
D) 2.3 s
Answer: B
Var: 1

113) A fully charged 37-μF capacitor is discharged through a 1.0-kΩ resistor. If the voltage across the capacitor is reduced to 7.6 volts after just 20 ms, what was the original potential across the capacitor?
A) 16 V
B) 13 V
C) 11 V
D) 9.0 V
E) 8.0 V
Answer: B
Var: 1

114) When an initially uncharged capacitor is charged through a 25-kΩ resistor by a 75-V dc ideal power source, it takes 0.23 ms for the capacitor to reach 50% of its maximum charge? What is the capacitance of this capacitor?
Answer: 13 nF
Var: 1

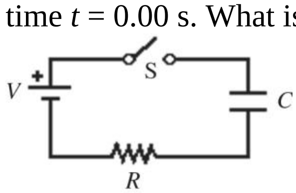
115) A 2.0-μF capacitor is charged to 12 V and then discharged through a 4.0-MΩ resistor. How long will it take for the voltage across the capacitor to drop to 3.0 V?
A) 8.0 s
B) 11 s
C) 22 s
D) 24 s
Answer: B
Var: 1

116) For the circuit shown in the figure, V = 60 V, C = 20 μF, R = 0.10 MΩ, and the battery is ideal. Initially the switch S is open and the capacitor is uncharged. The switch is then closed at time t = 0.00 s. What is the charge on the capacitor 8.0 s after closing the switch?



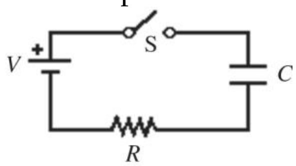
A) 1200 μC
B) 940 μC
C) 1400 μC
D) 1600 μC
E) 1900 μC
Answer: A
Var: 50+

117) For the circuit shown in the figure, V = 20 V, C = 10 μF, R = 0.80 MΩ, and the battery is ideal. Initially the switch S is open and the capacitor is uncharged. The switch is then closed at time t = 0.00 s. What is the potential difference across the resistor 20 s after closing the switch?



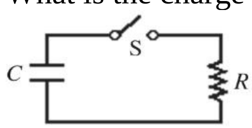
A) 1.6 V
B) 2.0 V
C) 2.3 V
D) 2.6 V
E) 3.0 V
Answer: A
Var: 50+

118) For the circuit shown in the figure, $V = 60$ V, $C = 40$ µF, $R = 0.90$ MΩ, and the battery is ideal. Initially the switch S is open and the capacitor is uncharged. The switch is then closed at time $t = 0.00$ s. At a given instant after closing the switch, the potential difference across the capacitor is twice the potential difference across the resistor. At that instant, what is the charge on the capacitor?



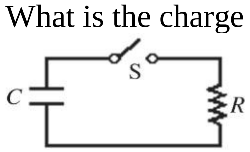
A) 1600 µC
B) 1400 µC
C) 1200 µC
D) 890 µC
E) 600 µC
Answer: A
Var: 50+

119) For the circuit shown in the figure, $C = 12$ µF and $R = 8.5$ MΩ. Initially the switch S is open with the capacitor charged to a voltage of 80 V. The switch is then closed at time $t = 0.00$ s. What is the charge on the capacitor, when the current in the circuit is 3.3 µA?



A) 350 µC
B) 340 µC
C) 480 µC
D) 620 µC
E) 700 µC
Answer: B
Var: 1

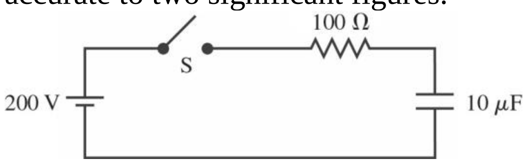
120) For the circuit shown in the figure, $C = 13$ µF and $R = 7.6$ MΩ. Initially the switch S is open with the capacitor charged to a voltage of 80 V. The switch is then closed at time $t = 0.00$ s. What is the charge on the capacitor 40 s after closing the switch?



A) 3300 µC
B) 3100 µC
C) 2900 µC
D) 2700 µC
E) 2500 µC
Answer: A
Var: 50+

121) A 1.0-μF capacitor is charged until it acquires a potential difference of 900.0 V across its plates, and then the emf source is removed. If the capacitor is then discharged through a 500.0-kΩ resistance, what is the voltage drop across the capacitor 9.0 ms after beginning the discharge?
A) 880 V
B) 920 V
C) 16 V
D) -16 V
Answer: A
Var: 50+

122) The capacitor shown in the circuit in the figure is initially uncharged when the switch S is suddenly closed, and the battery is ideal. After one time constant has gone by, find (a) the current through the resistor and (b) the charge on the capacitor. Assume that the numbers shown are all accurate to two significant figures.



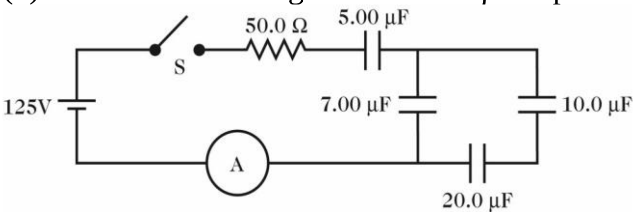
Answer: (a) 0.74 A (b) 1.3 mC
Var: 1

123) A circuit contains a 2.0-MΩ resistor in series with an uncharged capacitor. When this combination is connected across an ideal battery, the capacitor reaches 25% of its maximum charge in 1.5 s. What is its capacitance?
Answer: 2.6 μF
Var: 1

124) A series circuit consists of a 2.5-μF capacitor, a 7.6-MΩ resistor, and an ideal 6.0-V dc power source.
(a) What is the time constant for charging the capacitor?
(b) What is the potential difference across the capacitor 25 s after charging begins?
Answer: (a) 19 s (b) 4.4 V
Var: 1

125) A resistor with a resistance of 360 Ω is in a series circuit with a capacitor of capacitance 7.3 × 10^{-6} F. What capacitance must be placed in parallel with the original capacitance to change the capacitive time constant of the combination to three times its original value?
Answer: 15 × 10^{-6} F
Var: 1

126) In the circuit shown in the figure, all the capacitors are initially uncharged when the switch S is suddenly closed, and the battery is ideal. Find (a) the maximum reading of the ammeter and (b) the maximum charge on the 5.00-μF capacitor.



Answer: (a) 2.50 A (b) 458 μC
Var: 1

127) A galvanometer has an internal resistance of 100 Ω and deflects full-scale at 2.00 mA. What size resistor should be added to it to convert it to a milliammeter capable of reading up to 4.00 mA?
A) 50.0 Ω in series
B) 50.0 Ω in parallel
C) 100 Ω in series
D) 100 Ω in parallel
Answer: D
Var: 1

128) A galvanometer has a coil with a resistance of 24.0 Ω, and a current of 180 μA causes full-scale deflection. If the galvanometer is to be used to construct an ammeter that deflects full scale for 10.0 A, what shunt resistor is required?
A) 234 μΩ
B) 342 μΩ
C) 432 μΩ
D) 423 μΩ
Answer: C
Var: 1

129) A galvanometer that gives a full-scale deflection when 150 μA runs through it is used to make an ammeter that reads a maximum of 1.00 A. To do this, a 3.3-mΩ shunt was required. What is the resistance of just the galvanometer?
Answer: 22 Ω
Var: 1

130) A galvanometer has an internal resistance of 100 Ω and deflects full-scale at 2.00 mA. What size resistor should be added to it to convert it to a millivoltmeter capable of reading up to 400 mV?
A) 50.0 Ω in series
B) 50.0 Ω in parallel
C) 100 Ω in series
D) 100 Ω in parallel
Answer: C
Var: 1

131) A galvanometer with a coil resistance of 40.0 Ω deflects full scale for a current of 2.0 mA. What series resistance should be used with this galvanometer in order to construct a voltmeter that deflects full scale for 50 V?
A) 25 kΩ
B) 27 kΩ
C) 29 kΩ
D) 31 kΩ
Answer: A
Var: 1

132) A galvanometer with a coil resistance of 80 Ω deflects full-scale for a current of 2.0 mA. What series resistance is required to convert it to a voltmeter reading full scale for 200 V.
A) 100 mΩ
B) 0.80 mΩ
C) 13 MΩ
D) 250 kΩ
E) 100 kΩ
Answer: E
Var: 1

133) You have available a galvanometer that gives a full-scale deflection for a 333-μA current and has a coil resistance of 33 Ω.
(a) What shunt resistance is needed to convert this galvanometer to a 5.0-A ammeter?
(b) What series resistance is needed to convert this galvanometer to a 5.0-V voltmeter?
Answer: (a) 2.2 mΩ (b) 15 kΩ
Var: 1