Chapter 12 Static Electricity

1. Which atomic particle carries a negative charge?

   A. Electron
   B. Neutron
   C. Nucleus
   D. Proton

2. Which atomic particle carries a positive charge?

   A. Electron
   B. Neutron
   C. Nucleus
   D. Proton

3. What is the neutral particle found inside the core of the atom?

   A. Electron
   B. Neutron
   C. Nucleus
   D. Proton

4. A vinyl plastic strip rubbed with wool repels an ebonite rod rubbed with fur. What is the charge on the ebonite rod?

   A. Neutral or negative
   B. Neutral or positive
   C. Definitely positive
   D. Definitely negative

5. Where is the safest place to be during a lightning storm?

   A. Inside your car
   B. On top of a tall tree
   C. On top of your car
   D. In a boat, on a lake
   E. Under a tall tree

6. Why is it difficult to place a static charge on a hand-held copper rod, by rubbing it with other materials?

   A. Copper has too few electrons in it.
   B. Copper is too good a conductor.
   C. Electrons will not move through the copper.
   D. Copper is too good an insulator.

7. Which material develops a positive charge when it is rubbed with cotton?

   A. Vinyl Plastic
   B. Rubber Balloon
   C. Acetate Plastic
   D. Styrofoam Coffee Cup

8. What happens when a positively charged rod is brought near a conducting metal ball?

   A. Protons on the ball are attracted to the positive rod.
   B. Electrons on the ball move to the side of the ball closest to the positive rod.
   C. Electrons on the ball move to the side of the ball farthest from the positive rod.
   D. Protons on the ball are repelled to the side of the ball farthest from the rod.

9. Static electricity can best be detected with

   A. an ammeter.
   B. an electroscope.
   C. an ohmmeter.
   D. a galvanometer.

10. A small sphere is attracted toward a negatively charged plastic rod. What can you definitely conclude about the charge on the sphere?

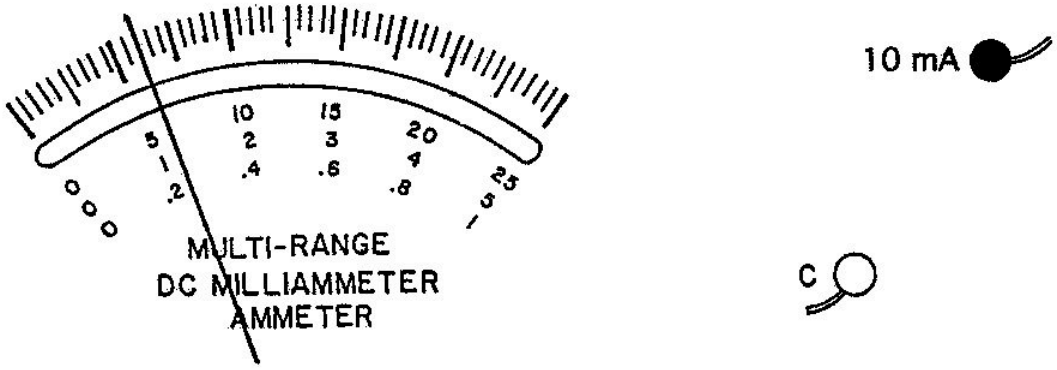
    A. The sphere is negatively charged.
    B. The sphere is either neutral or negatively charged.
    C. The sphere is positively charged.
    D. The sphere is either neutral or positively charged.

Chapter 13 Current Electricity

1. The number of electrically charged particles that pass a point in a circuit in one second is called the
   A. resistance.
   B. voltage.
   C. charge.
   D. current.

2. The amount of energy gained or lost between two points in a circuit by one unit of charge is called the
   A. power.
   B. voltage.
   C. current.
   D. resistance.

3. How is electrical resistance calculated?
   A. Current X Voltage
   B. Current ÷ Voltage
   C. Voltage ÷ Current
   D. Power ÷ Current

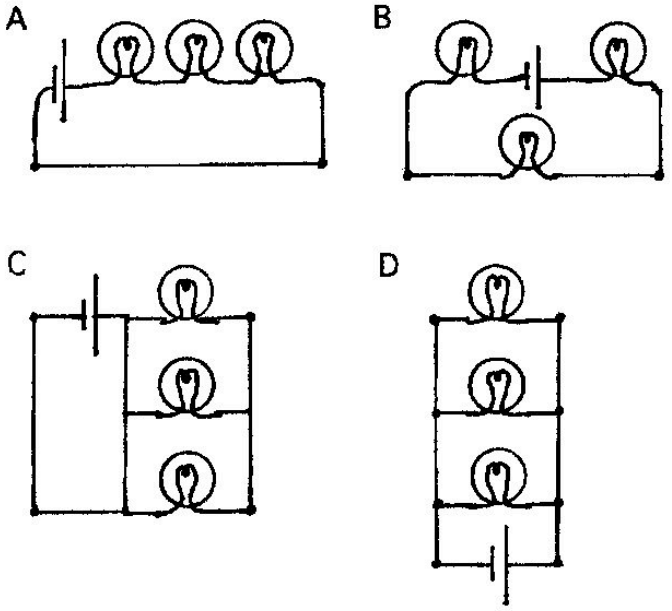


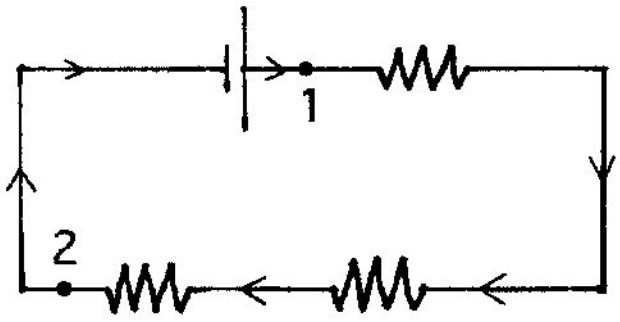
4. What is the current reading on the above ammeter, in milliamperes?
   A. 0.24 mA
   B. 2.4 mA
   C. 24 mA
   D. 0.22 mA
   E. 22 mA

5. If you connect four 1.5 V dry cells in series, what will the voltage of the battery be?
   A. 1.5V
   B. 3.0 V
   C. 4.5V
   D. 6.0 V

6. If you connect four 1.5 V dry cells in parallel, what will the voltage of the battery be?
   A. 1.5V
   B. 3.0 V
   C. 4.5 V
   D. 6.0 V

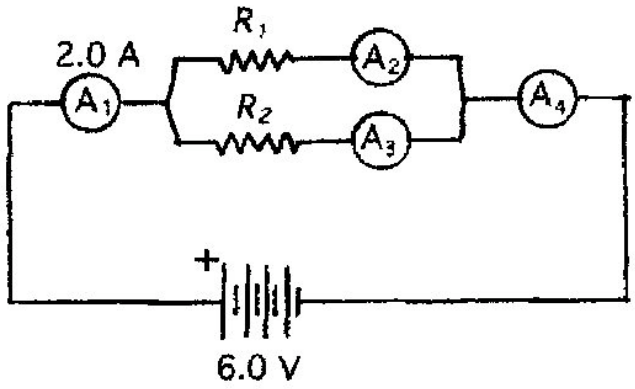
7. You have three light bulbs, each of which requires 1.5 V to operate at full brightness. Which circuit diagram shows the correct way to do this, when you have only one 1.5 V dry cell to use as a source?





8. What can truthfully be said about the current at points **1** and **2**?
   A. Current is greatest at **1** and least at **2**.
   B. Current is greatest at **2** and least at **1**.
   C. Current is the same at **1** as it is at **2**.
   D. There is no current at either **1** or **2**.

(9-13)



9. If the current in ammeter A_1 is 2.0 A, what is the current in ammeter A_4?

A. 4.0 A B. 2.0 A C. 1.0 A D. 3.0A

10. If R_1 and R_2 are identical resistors, what is the current in ammeter A_2?

A. 4.0 A B. 2.0 A C. 1.0 A D. 3.0 A

11. What is the potential difference between the ends of either resistor?

A. 6.0 V B. 6.0 A C. 3.0 V D. 1.0A

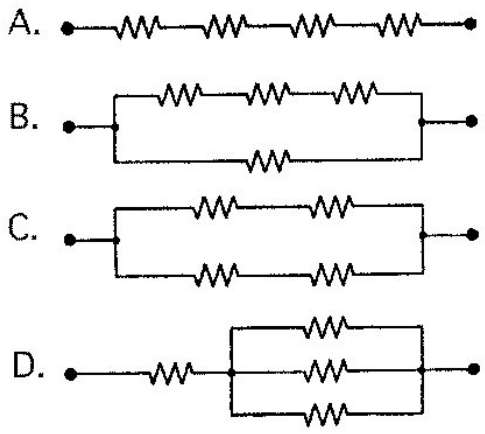
12. What single resistance could be used in place of the parallel combination of R_1 and R_2?

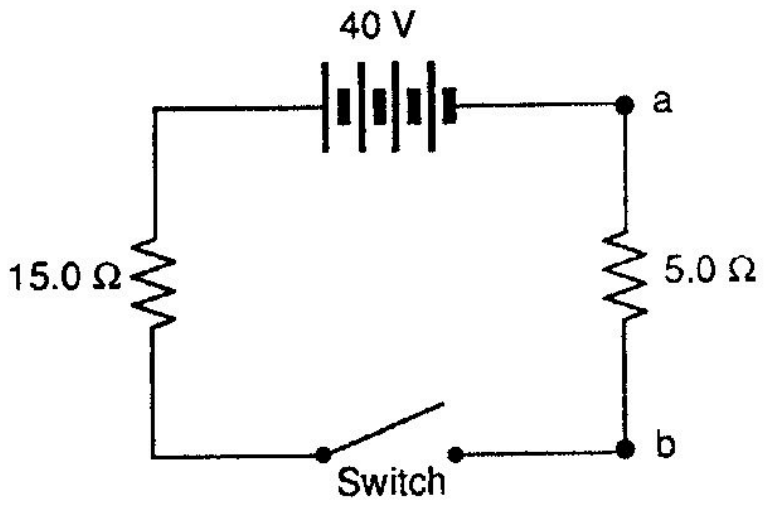
A. 6.0 Ω B. 3.0 Ω C. 2.0 Ω D. 1.0Ω

13. What is the resistance of each of the resistors R_1 and R_2 by itself?

A. 6.0 Ω B. 3.0 Ω C. 2.0 Ω D.1.0 Ω

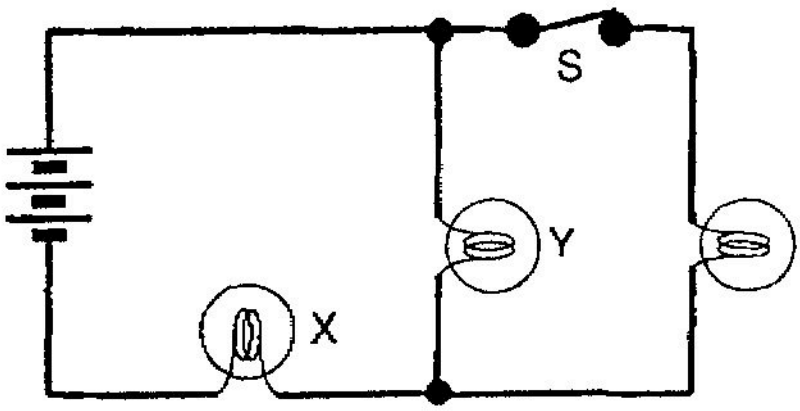
14. Four identical resistors, each of value R, are arranged in four combinations, as shown below. Which one of these resistor arrangements will result in the smallest equivalent resistance?





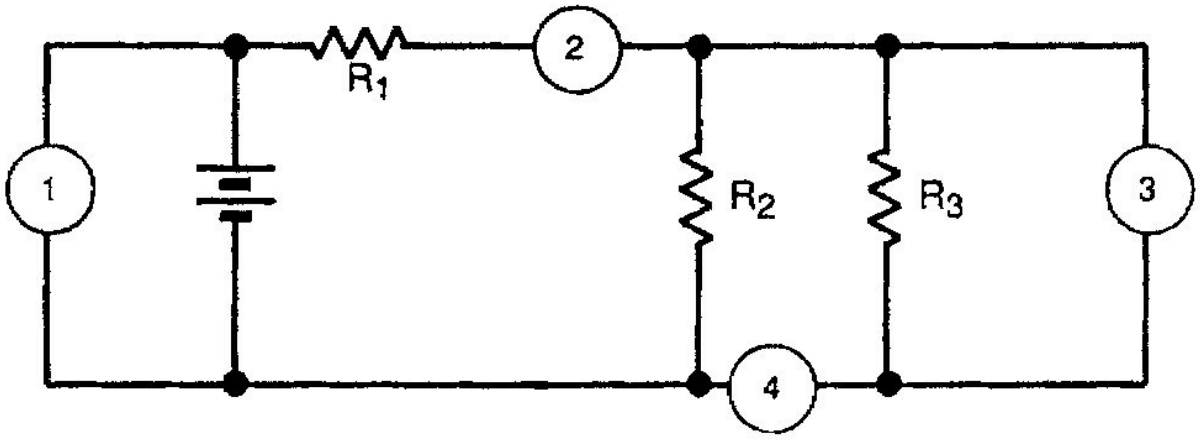
15. The switch in the above diagram is open. What is the potential difference, V_{ab}, across the 5.0 Ω resistor?

A. 0 V
B. 10 V
C. 30 V
D. 40 V



16. In the above circuit, what is the effect on bulbs **X** and **Y** after switch **S** is opened?

	Bulb X	**Bulb Y**
A	dimmer	dimmer
B	dimmer	brighter
C	brighter	dimmer
D	brighter	brighter



17. For the above circuit, in order to determine the power dissipated in resistor R_3, where should a **voltmeter** and an **ammeter** be placed?

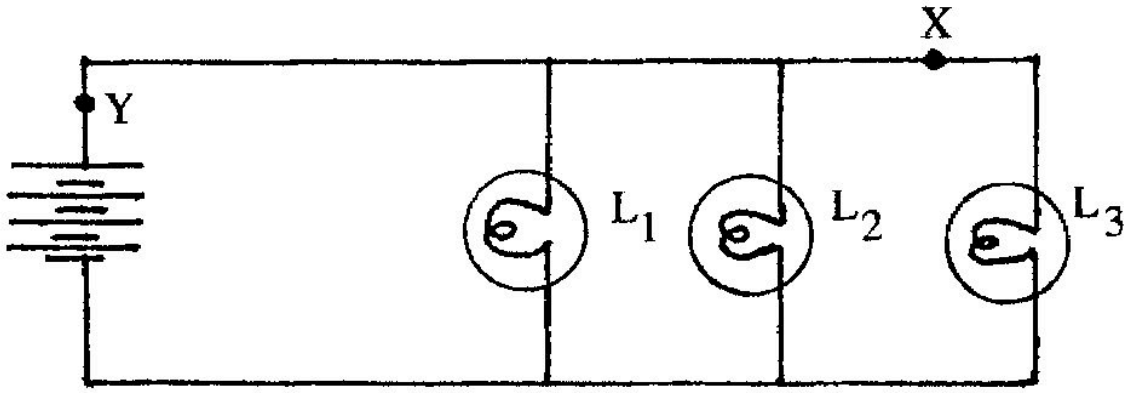
	voltmeter	**ammeter**
A	1	2
B	1	4
C	3	2
D	3	4

18. A piece of nichrome wire 9.0 m long has a resistance R. The wire is cut into nine pieces of equal length. These nine shorter pieces are then joined at their ends so that there is a parallel arrangement of nine, one-metre lengths of nichrome wire. What is the resistance of the parallel arrangement?

A. R
B. 9R
C. 81R
D. R / 9
E. R / 81

19. A 6.0 V battery is connected to a resistor, and the current is measured to be 2.5 mA. The 6.0 V battery is removed, and replaced with a 12.0 V battery. What will this do to the resistance of the resistor, if heating effects are negligible?

A. The resistance will remain the same.
B. The resistance will be reduced by one half.
C. The resistance will double.
D. The resistance will be four times as great.



(20-22) Three identical lamps are connected in parallel with a battery, as in the above figure. The wire is cut at **X**.

20. After the wire is cut at **X**,

A. the other two lamps will be much brighter.
B. the other two lamps will have about the same brightness.
C. the other two lamps will be much dimmer.
D. the other two lamps will go out.

21. After the wire at **X** is cut, the current at **Y** will

A. increase by about one third.
B. decrease by about one third.
C. fall to zero.
D. stay about the same as it was.

22. After the wire at **X** is cut,

A. the voltages across $\mathbf{L_1}$ and $\mathbf{L_2}$ will stay the same as before.
B. the voltages across $\mathbf{L_1}$ and $\mathbf{L_2}$ will increase.
C. the voltages across $\mathbf{L_1}$ and $\mathbf{L_2}$ will decrease.
D. there will be no voltage across $\mathbf{L_1}$ and $\mathbf{L_2}$.

Chapter 14 Circuit Theory

1. The kilowatt·hour is used to measure
   A. power.
   B. energy.
   C. voltage.
   D. current.

2. The amount of energy an appliance uses in one second is its
   A. energy.
   B. power.
   C. efficiency.
   D. resistance.
   E. voltage.

3. What is the power rating of an appliance that draws 15 A on a 120 V circuit?
   A. 1800 W
   B. 8 W
   C. 105 W
   D. 0.125 W

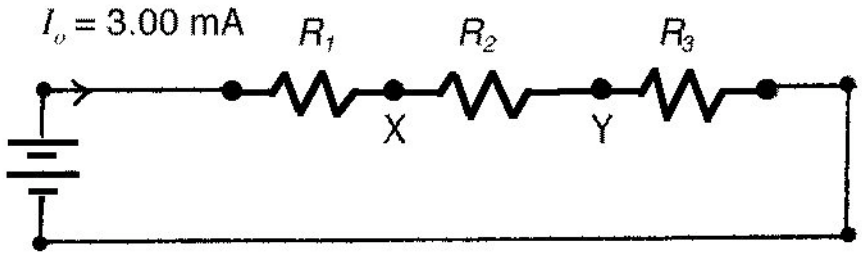
4. A 1440 W kettle is plugged into a 120 V wall outlet. How much current will it draw?
   A. 172800 A
   B. 0.083 A
   C. 1320 A
   D. 12 A
   E. 10 A

5. A 1000 W kettle is used for one-half of an hour, non-stop. If electrical energy costs 7 ¢ per kWh, how much will it cost to operate the kettle as described?
   A. 3.5 ¢
   B. 7.0 ¢
   C. 35 ¢
   D. 70 ¢
   E. $35.00

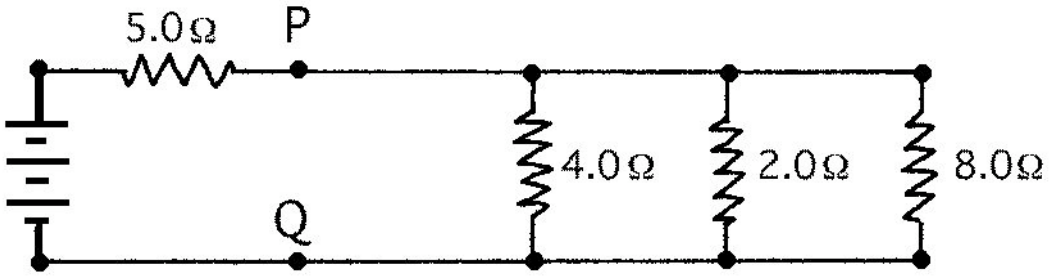
6. A 100 W light bulb is used in a 120 V circuit. What is the resistance of the light bulb filament?

   A. 0.83 Ω
   B. 1.2 Ω
   C. 144 Ω
   D. 12 kΩ

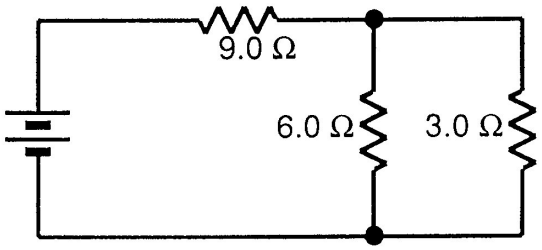
7. In a household circuit operating on 120 V, there are four 60.0 W bulbs that are turned on at present. What is the equivalent resistance of this circuit?
   A. 60 Ω
   B. 240 Ω
   C. 0.50 Ω
   D. 2.0 Ω



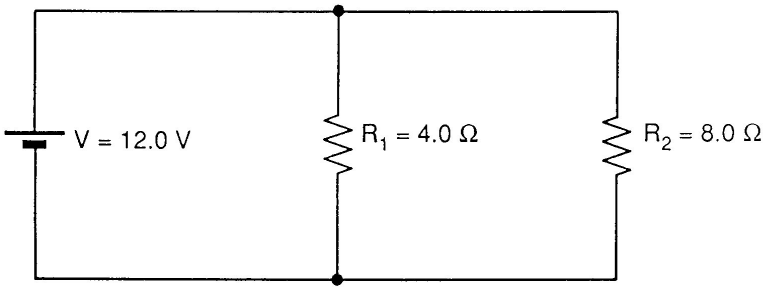
8. The three resistors in the diagram above are in series, and they have identical resistances. If the current from the battery (I_0) is 3.00 mA, currents at X and Y will be
   A. 1.50 mA and 0.75 mA.
   B. 1.50 mA and 1.00 mA.
   C. 3.00 mA and 3.00 mA.
   D. 1.00 mA and 1.00 mA.



9. Which action would cause the greatest *increase* in current through the 5 Ω resistor in the above figure?
   A. Add another 8.0 Ω resistor between P and Q.
   B. Remove the 8.0 Ω resistor.
   C. Add another 2.0 Ω resistor between P and Q.
   D. Remove the 2.0 Ω resistor.

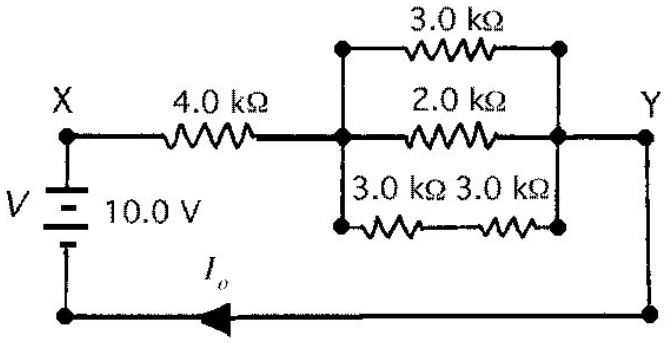


10. In the above circuit, the current through the 3.0 Ω resistor is 1.0 A. What is the current through the 9.0 Ω resistor?
    A. 1.0 A B. 1.5 A C. 2.0 A D. 3.0 A



11. The above circuit shows two different resistors connected in parallel across a 12.0 V battery. What is the power dissipated by resistor R_2?
    A. 18 W B. 54 W C. 81 W D. 160 W

(12-15)



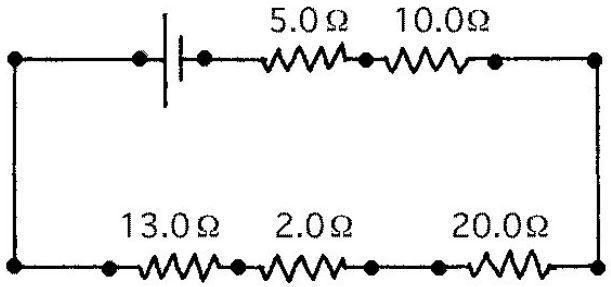
12 What is the equivalent resistance of the circuit between points X and Y?
    A. 1.0 kΩ B. 5.0 kΩ C. 11.0 kΩ D. 15.0 kΩ

13. What is the current, I_0, through the battery?
    A. 0.67 mA B. 2.0 mA C. 2.5 mA D. 10.0 mA

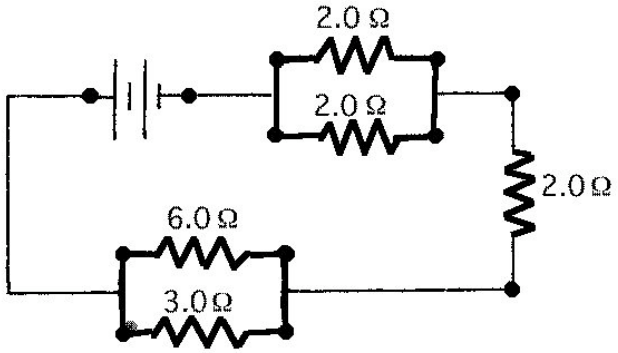
14. What is the potential difference between the ends of the 4.0 kΩ resistor?
    A. 10.0 V B. 4.0 V C. 8.0 V D. 2.0 V E. 6.0 V

15. What is the current in the 2.0 kΩ resistor?
    A. 1.0 mA B. 2.0 mA C. 4.0 mA D. 5.0 mA E. 0.50 mA

Short Answer Questions



1. What is the equivalent resistance of the above circuit?



2. What is the equivalent resistance of the above circuit?

3. What is the current in a circuit if 12 C of charge pass a point in the circuit in 1.5 s?

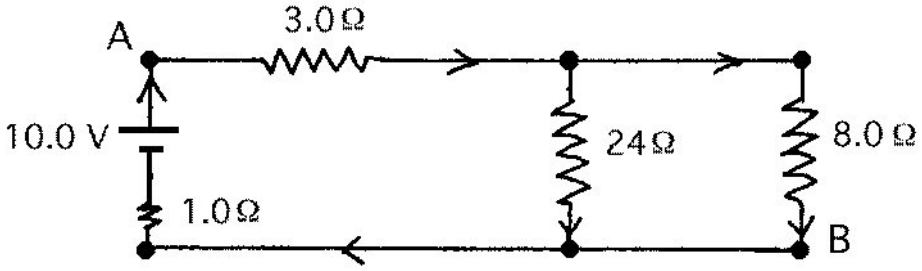
4. What is the voltage between the ends of a resistor, if 360 J of energy is expended as heat for every 6.0 C of charge that pass through the resistor?

5. What is the resistance of a resistor if a current of 1.50 mA exists in the resistor when a potential difference of 45.0 V is applied to the ends of the resistor?

6. Three resistors are connected in series with a 24.0 V battery. The resistors are 2.0 Ω, 4.0 Ω and 6.0 Ω. What is the potential difference across the 4.0 Ω resistor?

7. Three resistors are in parallel, and a current of 36.0 A enters the parallel network. If the resistors have resistances of 2.0 Ω, 3.0 Ω, and 6.0 Ω, what current exists in the 3.0 Ω resistor?

8. An old dry cell has an emf of 1.50 V. When it is connected to a 5.00 Ω resistor, the terminal voltage is 1.20 V. What is the internal resistance of the dry cell?

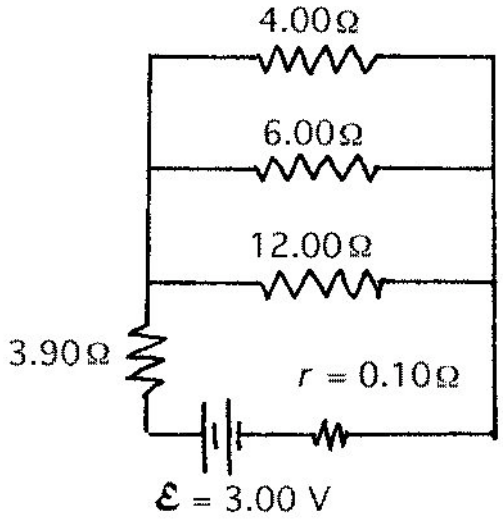


9. (a) What is the equivalent resistance of the above circuit?

   (b) What current exists at A?

   (c) What is the potential difference between the ends of the 8.0 Ω resistor?

   (d) What current exists at B?



10. (a) What is the voltage across the 6.0 Ω resistor?

    (b) What current exists in the 12.0 Ω resistor?

Chapter 15 Special Relativity

1. (a) According to occupants of a space bus travelling at 0.87 c, a certain event takes 10 s to occur. To a 'fixed' observer outside the space bus, how long will the event take to occur?

   (b) The occupants of the space bus, which is travelling in the X-dimension, say the bus is 20 m long. To a 'fixed' observer watching the space bus go by in the X-dimension, what is the apparent length of the bus in the X-dimension?

2. What does Einstein's Special Theory of Relativity say about the speed of light?

3. What happens to the magnitude of the momentum of a proton if it is accelerated to a speed approaching the speed of light?

4. (a) If a 1 g mass were converted entirely into energy ($E = mc^2$), how much energy would be released?

   (b) If you could store all this energy and use it later at will, how many years supply would you have, assuming your daily needs are 20 kWh?

Key to Physics One Test Items

Chapter 1 Distance, Time and Speed

1. (a) 55.2 m
   (b) 31.5 mL
   (c) 105 cm^2
   (d) 4.5 x 10^2 g/mL
2. 65.5 Hz
3. 0.0166 s
4. (a) 147 mm/h
   (b) 3.52 m/day
5. 18 s
6. 2.0 km/h
7. 3.75 x 10^3 km
8. (a) 5.0 s
   (b) To get to Wendy's?
9. (a) The graph is parabolic.
   (b) $\ell \cong 9.5$ cm
   (c) $\ell \cong 38$ cm
   (d) 4 times

Chapter 2 Acceleration

1. (a) 3.0 m/s
   (b) 2.0 m/s^2
   (c) $v_f = 3.0 \text{ m/s} + (2.0 \text{ m/s}^2)t$
2. (a) 35.0 m/s
   (b) -10.0 m/s^2
   (c) 101 m
   (d) $v_f = 45.0 \text{ m/s} - (10.0 \text{ m/s}^2)t$
3. (a) 5.00 m/s^2
   (b) 5.00 s
4. 368 m
5. 11 s
6. 6.2 cm/s
7. -22.5 m/s^2
8. 6.41 s (Use quadratic equation.)

Chapter 3 Forces

1. (a) 0.45 cm/N
   (b) $y = (0.45 \text{ cm/N})F_g$
   (c) 18.0 cm
   (d) 14.0 N
2. Both fall with the same rate of acceleration. There is no air friction because there is no air on the moon due to its low *g.*
3. (a) 0.042 (b) $F_f = 0.042\ F_g$
4. 0.048
5. The same. Friction force is independent of area of contact.
6. 2.0 x 10^{20} N

Chapters 1-4 (Chapter 4 is Newton's Laws of Motion)

1. C
2. C
3. B
4. A
5. A
6. C
7. B
8. C
9. A
10. C
11. C
12. C
13. C
14. D
15. D
16. A
17. A
18. A
19. B
20. D
21. C

Open-ended Questions

1. See text.
2. -22.5 m/s^2
3. 0.0020
4. (a) 0.30 m/s^2
   (b) 2.50 N
   (c) 5.00 kg
   d) $F = (5.00 \text{ kg})a$
5. 7.4 x 10^2 N
6. 9.0 x 10^2 N
7. Increase, because as fuel is expelled the mass of the rocket decreases, and $a = F/m$. Also, *g* decreases with altitude.
8. 9.9 x 10^{-2} m/s.

Chapter 5 Vectors

1. (a) D_R **= 130 m** from the starting point to the finishing point.
   (b) 270 m
2. 205 N
3. 566 km/h
4. (a) 4.9 m/s (b) 14.0° W of the vertical
5. 193 N
6. They drop simultaneously. Both experience the same vertical acceleration.

Chapter 6 Mechanical Energy

1. 1.8×10^3 J
2. 9.6×10^2 J
3. (a) 100.0 N (b) 10.0 m
   (c) 1.0×10^3 J
4. (a) 2.0 m (b) 200 N
5. 1.05×10^3 W
6. (a) 15 (b) 1800 J
7. 44 m/s
8. 2.7×10^6 J or 2.7 MJ
9. 5.6×10^3 W
10. 67%

Chapter 7 Thermal Energy

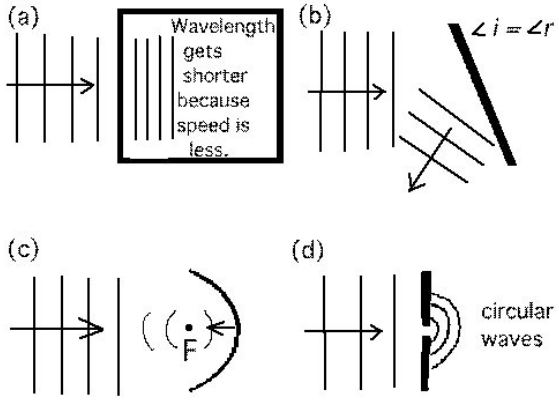
1. B
2. C
3. B
4. A
5. **A**
6. D
7. A
8. B

Word Problems

1. 1.0×10^6 J , or 1.0 MJ
2. 482 J/kg/C°
3. 72%
4. 18.6°C
5. (a) 0.10 C°/s (b) 84 W

Chapter 8 Waves

1.



2. 0.00067 s or 6.7×10^{-4} s
3. 50. Hz
4. 0.645 m
5. 7.1×10^{14} Hz
6. See text.

Chapter 9 Sound

1. B
2. B
3. A
4. B
5. C
6. C
7. D

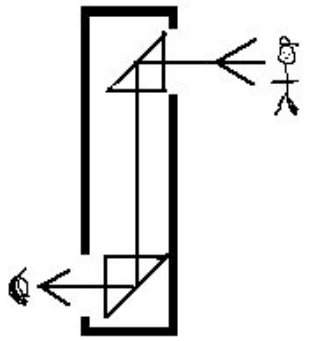
Open-ended Questions

1. See text.
2. Light travels about a million times faster than sound, so the flash is seen practically instantaneously, but sound from the thunder takes more time:
   $t = d/v$ = 3500 m/350 m/s = 10 s.
3. The sonic boom can do damage to windows, eardrums, etc., so planes are required to stay under the speed of sound when flying over occupied areas.

Chapter 10 Light

1. (a) The slope is 1.56, = index of refraction, n, since n = sin *i* /sin *r.*
   (b) approximately 40°
2. 4.9×10^{14} Hz
3. (a) 45.6° (b) 2.14×10^8 m/s

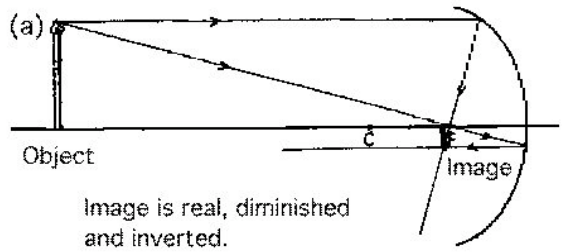
4.

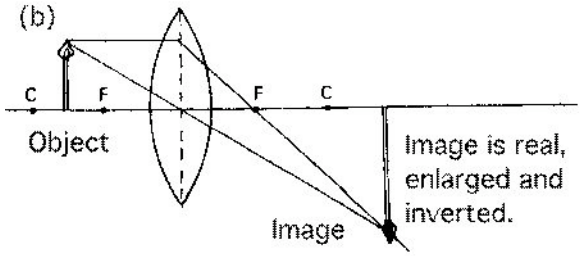


(5-12) See text.
(Note: In #7, the angle is 45°.)

Chapter 11 Optics

1.





2. 60.0 cm
3. 70. mm
4. You need 4X the area to compensate for
1/4 the time, so increase the aperture by 2 stops to f/8.
5. See text.

Chapter 12 Static Electricity

1. A
2. D
3. B
4. D
5. A
6. B
7. C
8. B
9. B
10. D

Chapter 13 Current Electricity

1. D
2. B
3. C
4. B
5. D
6. A
7. D
8. C
9. B
10. C
11. A
12. B
13. A
14. B
15. A
16. B
17. D
18. E
19. A
20. B
21. B
22. A

Chapter 14 Circuit Theory

1. B
2. B
3. A
4. D
5. A
6. C
7. A
8. C
9. C
10. B
11. A
12. B
13. B
14. C
15. A

Short-Answer Questions

1. 50.0 Ω
2. 5.0 Ω
3. 8.0 A
4. 60 V
5. 30 kΩ
6. 8.0 V
7. 12 A
8. 1.25 Ω
9. (a) 10.0 Ω
   (b) 1.0 A
   (c) 6.0 V
   (d) 0.75 A
10. (a) 1.0 V
    (b) 0.083 A

Chapter 15 Special Relativity

1. (a) 20 s
   (b) 9.8 m
2. See text.
3. $\boldsymbol{p} \rightarrow \infty$
4. (a) 9×10^{13} J (b) 3×10^{10} a