1. A 12V battery is attached to the ends of a metal rod that has an internal resistance of 606 Ω, a mass of 3 kg and a specific heat of 0.25 J/kg•K. If a current is run through the rod for 10 seconds, what is the temperature change in the rod?

   A) 3.2 K

   B) 24 K

   C) 32 K

   D) 96 K

   E) 144 K

2. A falling 2 kg mass, is kept at a constant velocity and used to power a light bulb. If the light bulb requires a current of 0.5 A to run and has an internal resistance of 60 Ω. How fast must the mass fall to power the bulb?

   A) 0.75 m/s

   B) 1.5 m/s

   C) 2 m/s

   D) 3 m/s

   E) 6 m/s

3. An electric motor with a 100V battery and an internal resistance of 40Ω. The motor is used to lift a 5kg object. What is the maximum velocity at which the motor can lift the object?

   A) 2.5 m/s

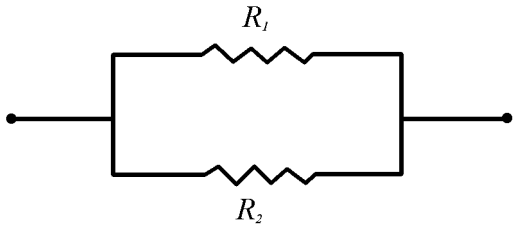
   B) 5 m/s

   C) 10 m/s

   D) 12.5 m/s

   E) 25 m/s

4. Base your answer to the following question on the diagram below which shows two resistors connected in parallel. A voltage V is applied to the pair.



   What is the ratio of the power dissipated by R_1 to the power dissipated by R_2 when $R_1 = 1.5R_2$?

   A) $\frac{4}{9}$

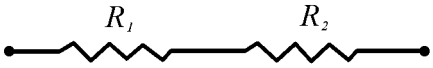
   B) $\frac{2}{3}$

   C) 1

   D) $\frac{3}{2}$

   E) $\frac{9}{4}$

5. Base your answer to the following question on the diagram below which shows two resistors connected in series. A voltage V is applied to the pair.



   What is the ratio of the power dissipated by R_1 to the power dissipated by R_2 when $R_1 = 1.5R_2$?

   A) $\frac{4}{9}$

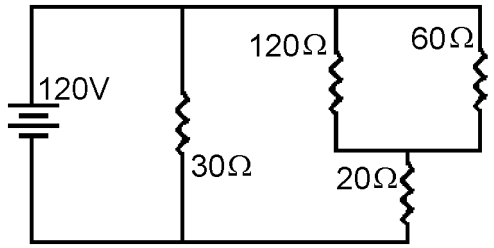
   B) $\frac{2}{3}$

   C) 1

   D) $\frac{3}{2}$

   E) $\frac{9}{4}$

6. Base your answer to the following question on the circuit shown below.



The power dissipated by the 20 Ω resistor is most nearly

A) 40 W

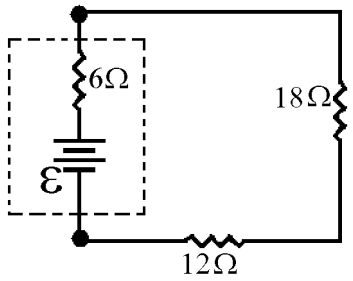
B) 80 W

C) 120 W

D) 480 W

E) 720 W

7. Base your answer to the following question on the circuit diagram below which shows a battery with an internal resistance of 6.0 Þ connected to a 12-Þ and 18-ohm resistor in series. The current in the 12-Þ resistor is 0.2 A.



What is the total power dissipated by the external resistors in this circuit?

A) 1.0 W

B) 1.2 W

C) 1.44 W

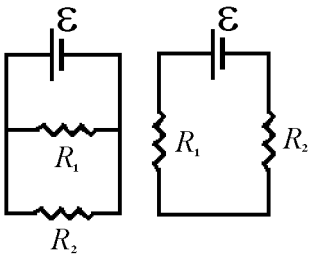
D) 1.728 W

E) 2.0 W

8. Base your answer to the following question on the diagram below which shows two different resistors, R_1 and R_2, in two different connections to the same source of emf ε that has no internal resistance.

For each question(s) pick your answer from the following list.

I. It is greater for the parallel connection.
II. It is greater for the series connection.
III. It is the same for both connections.
IV. It is different for each connection, but one must know the values of R_1 and R_2, to know which is greater.
V. It is different for each connection, but one must know the value of ε to know which is greater.



How does the power dissipated by the resistors for these two cases compare?

A) I

B) II

C) III

D) IV

E) V

9. A resistor dissipates a power P when a current I passes through it. If the current is doubled, the power dissipated would be

A) $\frac{1}{4}P$

B) $\frac{1}{2}P$

C) P

D) $2P$

E) $4P$

10. A cylindrical resistor of constant resistivity dissipates a power P when attached to a battery with potential V. If the potential is doubled the power dissipated would be

A) $\frac{1}{4}P$

B) $\frac{1}{2}P$

C) P

D) $2P$

E) $4P$

11. A cylindrical resistor of constant resistivity dissipates a power P when attached to a battery with potential V. If a second identical resistor were added in parallel to the first, the total power dissipated would be

A) $\frac{1}{4}P$

B) $\frac{1}{2}P$

C) P

D) $2P$

E) $4P$

12. A resistor dissipates a power P when a current I passes through it. If a second identical resistor were added in parallel to the first, and the total current remained constant, the total power dissipated would be

A) $\frac{1}{4}P$

B) $\frac{1}{2}P$

C) P

D) $2P$

E) $4P$

Base your answers to questions **13** and **14** on the following statement. When connected in parallel one light bulb dissipates 40 watts and a second light bulb dissipates 60 watts?

13. What is the ratio of the resistance of the 40 watt bulb to the resistance of the 60 watt bulb?

A) $\frac{4}{9}$

B) $\frac{2}{3}$

C) $\frac{4}{3}$

D) $\frac{3}{2}$

E) $\frac{9}{4}$

14. What is the ratio of the current in the 40 watt bulb to the current in the 60 watt bulb.

A) $\frac{4}{9}$

B) $\frac{2}{3}$

C) $\frac{3}{4}$

D) $\frac{3}{2}$

E) $\frac{9}{4}$

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15. Several identical resistors are connected in parallel to a 120 V battery. In this situation each light bulb dissipates 40 W of power. If the maximum current in the circuit cannot exceed 9 A, what is the maximum number of light bulbs that can be attached?

A) 3

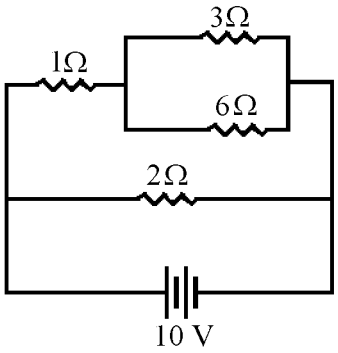
B) 6

C) 9

D) 12

E) 27

16. Base your answer to the following question on the circuit diagram below which shows four resistors attached to a 10 V battery.



What is the equivalent resistance of the circuit?

A) $\frac{1}{2}\,\Omega$

B) $\frac{2}{3}\,\Omega$

C) $\frac{6}{5}\,\Omega$

D) $\frac{3}{2}\,\Omega$

E) $2\,\Omega$

17. An immersion heater of resistance R converts electrical energy into thermal energy that is transferred to the liquid in which the heater is immersed. If the voltage applied to the heater is V, the thermal energy transferred to the liquid in time t is

A) $\frac{Vt}{R}$

B) $\frac{V^2t}{R}$

C) $\frac{V}{Rt}$

D) $\frac{V^2}{Rt}$

E) $\frac{V}{R^2\mathrm{t}}$

18. An immersion heater converts electrical energy into thermal energy that is transferred to the liquid in which the heater is immersed. When current I is run through a certain immersion heater for time t it delivers an amount of energy E. The resistance of the heater is

A) $\frac{E}{tI}$

B) $\frac{E}{tI^2}$

C) $\frac{EI}{t}$

D) $\frac{EI^2}{t}$

E) EIt

19. A light bulb has a resistance of 150 Ω and is powered by a 200 V power supply. The power of the bulb is most nearly

A) 134 W

B) 186 W

C) 267 W

D) 456 W

E) 799 W

20. A 10 kΩ resistor has a current of 4 A through it. The energy dissipated in this resistor in one minute is equal to

A) 40 kJ

B) 160 kJ

C) 240 kJ

D) 2400 kJ

E) 9600 kJ

21. How much energy is dissipated in one minute by a 5 kΩ resistor that carries a current of 1 A?

A) 5 kJ

B) 10 kJ

C) 30 kJ

D) 100 kJ

E) 300 kJ

22. A 500 Ω resistor dissipates 600 kJ of heat energy in 30 s. The current through the resistor is most nearly

A) 1 A

B) 4 A

C) 6 A

D) 10 A

E) 20 A

23. A 120 W light bulb draws 0.5 A of current. The voltage it operates at is

A) 30 V

B) 60 V

C) 240 V

D) 480 V

E) 800 V

24. A light bulb operating at a voltage of 100 V dissipates 50 J of energy every second. The current the light bulb draws is

A) 0.25 A

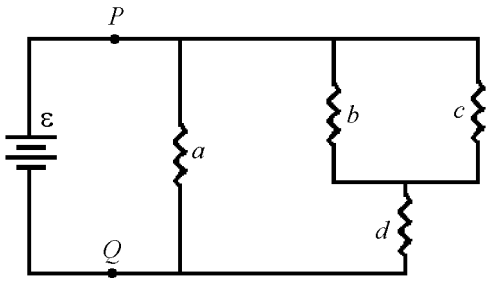
B) 0.5 A

C) 2 A

D) 4 A

E) 5 A

25. Base your answer to the following question on the circuit diagram shown below.



What is the energy dissipated by resistor *a* in 10 seconds if the current through the resistor is 4A and the resistance is 15 Þ?

A) 120 J

B) 240 J

C) 1.2 kJ

D) 2.4 kJ

E) 3.6 kJ

26. Amps•Volts can be used to measure

A) work

B) resistance

C) energy

D) power

E) electric charge

27. Which quantities are needed to calculate the amount of energy supplied to an operating toaster?

I. resistance
II. applied voltage
III. operating time

A) II only

B) I and II only

C) I and III only

D) II and III only

E) I, II, and III

28. Base your answer to the following question on the following situation. A certain toaster draws 3 A of current while in household operation at 120 V.

If all the energy the toaster dissipates is used to heat the toast, how much heat is applied to the toast in 5 minutes?

A) 10.8 kJ

B) 108 kJ

C) 1.08 MJ

D) 10.8 MJ

E) 108 MJ

29. Two lamps are connected in parallel. When the lamps are operated at their rated voltage, the wattage of the combination is

A) equal to the sum of the two wattages

B) greater than the wattage of either but less than the sum of the two wattages

C) less than the wattage of one but more than the wattage of the other

D) less than the wattage of either

E) less than the square of the sum of the two wattages but greater than the sum

30. A 120 V line is protected by a 15 A fuse. What is the maximum number of 500 W, 120 V lamps that could be operated in parallel on this line?

A) 1

B) 2

C) 3

D) 4

E) 5

31. A perfectly efficient engine generates a power output of P when put in a circuit with a resistor R and a voltage source V. The current in this circuit is I. How much heat is lost in the resistor in t seconds?

A) $IV - P$

B) $(IV - P)t$

C) I^2R

D) I^2R/t

E) $(I^2R - P)t$

32. What is the power dissipated by a circuit that consists of three 2 Þ resistors connected in parallel with a 12 V battery?

A) 18 W

B) 72 W

C) 144 W

D) 216 W

E) 486 W

33. Which of the following is a unit for energy?

A) W•A/C

B) $Þ^2$•A

C) A•V

D) V^2•Þ

E) W•s

Answer Key
Capacitor Circuits MC Questions [Mar 28, 2011]

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

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