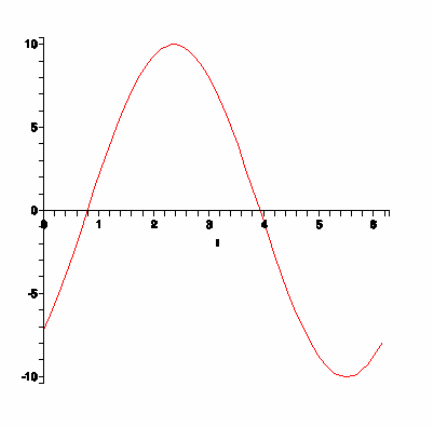
Question No. 1 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question #01	Question 1. A 1.50 V battery of internal resistance 10 Ω is connected in series with a 100 Ω resistor. What voltage does the terminal read on a voltmeter? (A) 1.36 V (B) 1.49 V (C) 1.50 V (D) 1.51 V
Feedback on Each Answer Choice	A. Correct! The terminal voltage is the nominal voltage (1.5 V) minus the current through the internal resistor multiplied by the terminal resistance. See the solution below.
	B. Incorrect. Although the terminal voltage will be reduced, this value will be too low. Do not forget to multiply the current by the resistance when finding the terminal voltage!
	C. Incorrect. The terminal voltage will be different in general from the nominal voltage.
	D. Incorrect. The terminal voltage will be less than the nominal voltage, not greater.
Solution	Write down the equation which relates the nominal voltage/EMF (1.5 V), the internal resistance r, the current I, and the terminal voltage. $V_N - Ir = V_T$ But we know that: $V_T = IR$, Where R is the large resistance in the circuit. So the nominal voltage can be expressed as: $V_N = I(R+r)$. Solve the preceding equation for the current: $I = V_N/(R+r) = 1.5/110\ \Omega = (1.5/1.1) \times 10^{-2}\ A = 1.36 \times 10^{-2}\ A$ Finally, use Ohm's law to find the terminal voltage: $V_T = IR = (1.36 \times 10^{-2}\ A) \times (100) = 1.36\ V$ So the correct response is (A).

Question No. 2 of 10

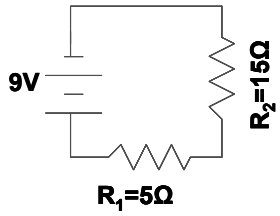
Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #02	Question 2. Suppose the following plot of current (I) in amperes versus time (t) in seconds is given for an AC circuit. What is the rms current?  (A) 7.1 A (B) 10 A (C) 14 A (D) 20 A
Feedback on Each Answer Choice	A. Correct! The peak current is I_0 = 10 A, so the rms current $I_{rms} = I_0/\sqrt{2}$ = 7.1 A. See the solution below.
	B. Incorrect. The peak current is not the rms current.
	C. Incorrect. Do not divide the peak to trough amplitude (20 A) by √2.
	D. Incorrect. The question did not ask for the peak to trough amplitude (20 A).
Solution	The peak (maximum) current of the alternating current is I_0 = 10 A, so the rms current $I_{rms} = I_0/\sqrt{2}$ = 0.707×(10 A) ≈ 7.1 A.

Question No. 3 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #03	Question 3 A 1 Ohm, 10 Ohm, and 1000 Ohm resistor are added in parallel. What is their combined or total resistance? (A) 10,000 Ohms (B) 1011 Ohms (C) 101 Ohms (D) less than 1 Ohm
Feedback on Each Answer Choice	A. Incorrect! Use the formula for parallel resistor combinations.
	B. Incorrect! This would be the value if we were adding them in series. However, this is a parallel combination.
	C. Incorrect! Use the formula for parallel resistor combinations. 1/Rp=1/R1+1/R2….
	D. Correct! Use the formula for parallel resistor combinations. 1/Rp=1/R1+1/R2…. 1/R=1.101= .91 Ohms
Solution	Although it may seem counterintuitive, combining resistors in parallel reduces their overall resistance. In fact, the combined resistance is less than any single one of them. Thus the correct answer is less than 1 Ohm. For a more quantitative explanation, use the formula and calculate the actual combined resistance. $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$ $\frac{1}{R_P} = \frac{1}{1\Omega} + \frac{1}{10\Omega} + \frac{1}{1000\Omega}$ $\frac{1}{R_P} = 1 + .1 + .001 = 1.101$ However, this is 1 divided by the parallel resistance. Take the reciprocal to get the parallel resistance. R_p=.91 Ohms

Question No. 4 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

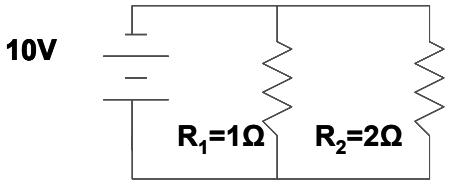
Question #04	Question 4. What is the power dissipated by the following circuit?  (A) 0.45 W (B) 4 W (C) 6 W (D) 16 W
Feedback on Each Answer Choice	A. Incorrect. Consider the equations for power and current in terms of V and R.
	B. Correct! First, simplify the circuit. Find the effective resistance of the series combination, then use $I = V^2/R$. See the solution below.
	C. Incorrect. $P \neq V^2/R_2$.
	D. Incorrect. $P \neq V^2/R_1$.
Solution	First, simplify the circuit. Since it's a series circuit, simply add the resistors to get the total resistance. $R_S=R_1+R_2+\ldots$ R_s= 20Ω Next, use Ohm's law to find the current through the circuit. Since it's a series circuit, this current would be the same throughout. $V = IR$ $I = V/R$ Next, use the equation for the power, and substitute the value of current found previously. $P = IV = V^2/R$. $V = 9^2/20 \approx 4$ W Thus, the correct answer is (B).

Question No. 5 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question #05

Question 5. Find the power dissipated by the circuit shown.



(A) 33 W
(B) 50 W
(C) 100 W
(D) 150 W

Feedback on Each Answer Choice

A. Incorrect.
First find the total resistance of the whole circuit. This is a parallel circuit, not a series circuit.

B. Incorrect.
$P \neq V^2/R_2$.

C. Incorrect.
$P \neq V^2/R_1$.

D. Correct!
First find the total resistance of the whole circuit. Then use Ohm's law, P=V2/R to find the power. The voltage is 10V from the battery, and the resistance is the total resistance found by combining the resistors in parallel. To get this parallel resistance, the shortcut formula of product divided by sum could be used.

Solution

First find the total resistance of the whole circuit.

$$\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_2}$$

$$\frac{1}{R_P}=\frac{1}{1\Omega}+\frac{1}{2\Omega}$$

$$\frac{1}{R_P}=\frac{2}{2\Omega}+\frac{1}{2\Omega}=\frac{3}{2\Omega}$$

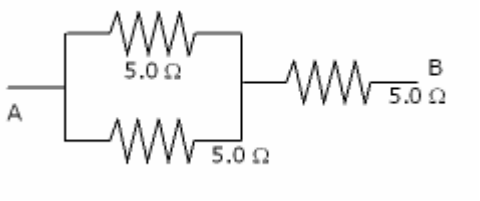
$$R_P=\frac{2}{3}\Omega=.67\Omega$$

Next, use the formula for power, $P = V^2/R$, to find the total power dissipated by the circuit.

$P = V^2/R_P$
P = 100/.67 W
P = 150 W

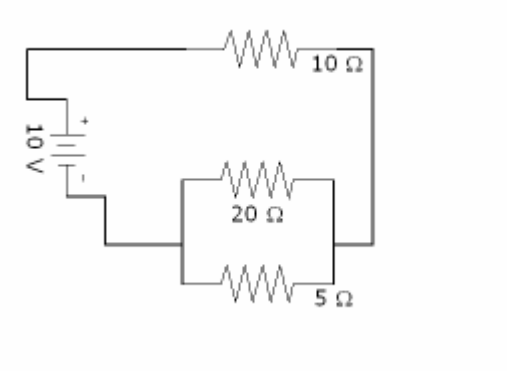
The power dissipated in each of the two branches could also be found using $P = V^2/R$, since the voltage drop across both resistors is the same. Then add the results to obtain the total power of 150 W, which gives the same result.

Question No. 6 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #06	Question 6. What is the resistance encountered from point A to point B?  (A) 3.3 Ω (B) 7.5 Ω (C) 10.0 Ω (D) 15.0 Ω
Feedback on Each Answer Choice	A. Incorrect. Add the resistors in parallel, then in series, not the other way around.
	B. Correct! Add the first two resistors in parallel. Then add this effective resistance in series with 5.0 Ω.
	C. Incorrect. Consider the rules for adding resistances in series and in parallel.
	D. Incorrect. Do not just multiply 5.0 by 3 since there are 3 resistors.
Solution	First, use the shortcut rule for adding the first two resistors in parallel: $R_1=\frac{5\times5}{5+5}\ \Omega=\frac{25}{10}\ \Omega=2.5\ \Omega$ Next, add this effective resistance to the 5.0 Ohm resistor that is in series: $R=(2.5+5.0)\ R=7.5\ \Omega.$ In effect, these three resistors are a combination of series and parallel connections. Thus the correct answer is (B).

Question No. 7 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question #07	Question 7. What is the current through the 10 Ω resistor shown in the figure shown?  (A) 0.33 A (B) 0.67 A (C) 0.71 A (D) 1.0 A
Feedback on Each Answer Choice	A. Incorrect. You cannot ignore the effect of the 5 Ω resistor.
	B. Incorrect. You cannot ignore the effect of the 20 Ω resistor.
	C. Correct! Find the effective resistance of all the resistors combined. Then divide the voltage of the battery by the effective resistance to find the current through the first resistor.
	D. Incorrect. Do not divide the voltage by 10 Ω; consider the effect of the other resistors as well.
Solution	First, find the effective resistance of the entire circuit. The 20 Ω and 5 Ω resistors in parallel combine as a 4 W resistor. The 10 Ω and the effective 4 Ω resistor combine as a 14 Ω resistor. The current through the first resistor is given by I = (10 V)/(14 Ω) = 0.71 A. Thus (C) is the correct answer choice.

Question No. 8 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #08	Question 8 If a 10 microFarad, a 20 microFarad, and a 30 microFarad capacitor are all connected in parallel, what is their combined capacitance? (A) 60 microFarads (B) 6000 microFarads (C) 5.5 microFarads (D) 6 microFarads
Feedback on Each Answer Choice	A. Correct! Use the formula for combining capacitors in parallel. This is very similar to adding resistors in series, simply add them together.
	B. Incorrect! This is the product of all the capacitance values. However, for this problem, we should use the formula that relates capacitors in parallel. This would be the sum of the capacitances.
	C. Incorrect! This would be the answer if they were added in series. However, for this problem they are in parallel.
	D. Incorrect! Use the formula for adding capacitors in parallel. Cp=C1+C2+C3+…
Solution	Adding capacitors is the reverse of adding resistors. Thus adding capacitors in parallel actually increases the capacitance. $C_P = C_1 + C_2 + C_3 \ldots$ $C_P = 10\,\mu F + 20\,\mu F + 30\,\mu F = 60\,\mu F$ Since all of the answers are in microfarads, there is no need to convert into Farads. Note that combining capacitors in parallel increases their overall capacitance. This should seem reasonable since each capacitor is connected separately to the voltage source. Each capacitor is allowed to charge up fully. Together, they have more capacitance and more charge storage.

Question No. 9 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #09	Question 9. The various appliances in your house are wired in what manner? (A) Series (B) Parallel (C) High current appliances are in series (D) High current appliances are in parallel
Feedback on Each Answer Choice	A. Incorrect! If you add or turn on more and more devices, does this affect the voltage to each of them? No. If one lightbulb burns out, or is turned off, do all the other item go off? No. Then they aren't wired in series.
	B. Correct! Each item in your house gets the same voltage. Additionally, plugging in more items doesn't vary the voltage they get. Even if some items are turned off, the rest still function.
	C. Incorrect! Consider the following question. If one lightbulb burns out, or is turned off, do all the other items go off?
	D. Incorrect! Consider the following question. If you add or turn on more and more devices, does this affect the voltage to each of them?
Solution	Consider the properties of the circuits in your house. No matter how many, or which appliances you plug in, they all work on the save voltage. Usually 120V. If one appliance is unplugged, turned off, or has a burned out bulb, the rest still work. These observation lead to the conclusion that they must be wired in parallel. You may notice that you have a variety of circuits in your house. The kitchen may be on one circuit, the bathroom on another, etc. However all of these individual circuits are wired in parallel to each other. Therefore, you house is basically a collection of devices wired in parallel. Each of these collections is in turn wired in parallel to other groups. This way, if you overload the kitchen circuit, a fuse or circuit breaker won't disable the entire house, only the section with too much current.

Question No. 10 of 10

Instruction: (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

Question #10	Question 10. If an AC circuit has a peak voltage of 10 V and a rms current of 14 A, what is the average power dissipated in the circuit? (A) 70 W (B) 100 W (C) 140 W (D) 200 W
Feedback on Each Answer Choice	A. Incorrect. Do not use $P_{av} = ½\ I_0V_0$, since the current value given is an rms value and not a peak value.
	B. Correct! Use $P_{av} = V_{rms}I_{rms} = (V_0/\sqrt{2})\times I_{rms}$. See the solution below.
	C. Incorrect. Do not just multiply the peak voltage and the rms current together.
	D. Incorrect. Do not multiply the product of the values given by √2.
Solution	Use $P_{av} = V_{rms}I_{rms} = (V_0/\sqrt{2})\times I_{rms} = (10/\sqrt{2})\times 14\text{ W} \approx 7.1\times 14\text{ W} \approx 100\text{ W}$.