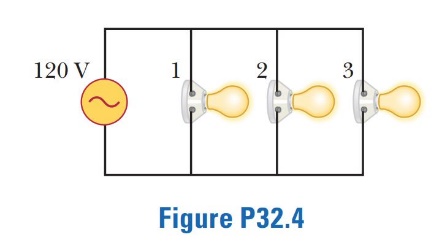
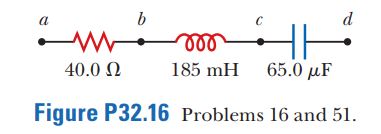
**Chapter 32**

1. Figure P32.4 shows three lightbulbs connected to a 120-V AC (rms) household supply voltage. Bulbs 1 and 2 have a power rating of 150 W, and bulb 3 has a 100-W rating. Find (a) the rms current in each bulb and (b) the resistance of each bulb. (c) What is the total resistance of the combination of the three lightbulbs?

**SOLUTION:**

2. An AC source with Δ*V* max = 150 V and *f* = 50.0 Hz is connected between points *a* and *d* in Figure P32.16. Calculate the maximum voltages between (a) points *a* and *b*, (b) points *b* and *c*, (c) points *c* and *d*, and (d) points *b* and *d.*

**SOLUTION:**

3. A series *RLC* circuit has components with the following values: *L =* 20.0 mH, *C* = 100 nF, *R* = 20.0 Ω, and Δ*V* max = 100 V, with Δ*ν* = Δ*V*max sin *ωt.* Find (a) the resonant frequency of the circuit, (b) the amplitude of the current at the resonant frequency, (c) the *Q* of the circuit, and (d) the amplitude of the voltage across the inductor at resonance.

**SOLUTION:**

**Solution for Chapter 32**

Diagram of a diagram showing a light bulb and a circle

Description automatically generated1. Figure P32.4 shows three lightbulbs connected to a 120-V AC (rms) household supply voltage. Bulbs 1 and 2 have a power rating of 150 W, and bulb 3 has a 100-W rating. Find (a) the rms current in each bulb and (b) the resistance of each bulb. (c) What is the total resistance of the combination of the three lightbulbs?

**Ans:**

All lamps are connected in parallel with the voltage source, so   
 for each lamp.

Also, the current is  and the resistance is .

(a) For the 150-W bulbs,



For the 100-W bulb,

The rms current in each 150-W bulb is 1.25 A. The rms current in the 100-W bulb is 0.833 A.

(b) The resistance in bulbs 1 and 2 is



and the resistance in bulb 3 is

(c) The bulbs are in parallel, so



![A diagram of a problem

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFJhamFrYXIgUmFqdQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzQzAACSkgACAAAAAzQzAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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zXkfjHxP4b8VeFm1aG3Wz19bhERd5Mu0d8jAxj9a9yrLXwzoS3v2xdGsBc7t3mi2Tdn1zjr70UK8YT553b73/P1CtRlKHJCyWulv62PNfGvjDULHwdo2gtI0OoahZRNd3EpxsQjBBPqSDn2z610Xw9uvCukaV/Zei6nFeXmwz3LojAyEDk8joOgFdbfaHpOpzCbUtLsryVV2h7i3SRgPTJHTmm2nh/RrCYy2OkWFtIVKl4bZEJU9RkDpVyxFOVJwSab1079PkiI4epGqpNppJL/P5sp2+v2HiTwre32kyNJB5cse5kKnIXng/WvMvANrLe/CXxRb26l5HLbVHUkIDj9K9htdNsbG0a1srK3trdiS0MMSohz1yAMc0ljplhpcbR6bZW1mjncy28Sxhj6kACojXjTjOMVva3yLlRlOUJSe17/NHz7eXukz/CrStOtfLbWFvmLoqfvMHd398qP/1V9B6bHLFpVpHcf61IUV8/3gozVaLw7osF8b2HSbKO6LbvOW3UNn1zjrWlVYnExrK0V1b+8jD4d0ndvpYr6iQNLuieAIXz/wB8mvMPhp4Ws/E/wf0ODV7q6uLAM0jWIZFicrKxAYhQxGecbsV6ldWlvfWz297BFcQSDDxSoGVh7g8GoNN0fTNHhaLSNOtLCNjkpawLEp/BQK4lo2/T8Lna9kcVqmnwXXxpsrOYyG0uNElaa28xvLkKyKBlc47/AKCnabbib4nX2g6gjNpWm6ZAdNtJnLo6nIeQ7id7AgLk5x+Ndk+i6XJqi6lJptm9+owt00CmUD0D4z+tPvNNstQKG9tIZ2jzsaRASmeuD1H4ULRL5/r+Vwet/l+n+R4/4hvbub4d+P7CSWSXTNP1GOGxldixVd6F4wx6hTwPTp2rpvEcP/CP+KvCEnhzdFc3979nu4UckXMGzLu4z8xXAO48+9d2um2KWK2aWdutqpBWARAICDkfL068/Wo7bRtNsrprm0sLaGdl2GVIgG2/3c9h7dKFpb5fgv1B63+f4/5HmNxqeoaPpfxRv9Gz9tgvVaNlGSn7lAWx7DJ/Cuk0TQWkXQdUttcgSHyfm8iFlbUFePpIxkO88bs4yCD711NnomlafNPNYaZZ2stx/rnhgVGl/wB4gc/jTLLw/o+nSF9P0uztmbOTFAq9euMDjPf1oWi+S/BW/Eb1+9/j/keULaJ/wrDxxeGWdrnTdTvRZTGZi9tsYFdjZyOfz6V0M8f9m+L/AAHPaSSLNqSTR3r+YSbkeRvy/wDeIbkZ6dq7NfC+gJZz2qaHpq21w2+aEWkYSVvVlxgn3NObw5ojvau+j2DNZjFsxtUJgHonHy/hRHS3y/BWf3ilrf5/jt9xweoT32j+NDf30Catol5qsccV9bSFbiwmyIxE6/xR7h0HqT1xXp1URomlrefal0+2E/mGXzBEMl/73+979auSRpNE0cqK6MMMrDII9CKFpG39dAesrnnXgmKW60Hx1BZn9/JrV+keD/EVAH61gQxS6P8AAXStY0ma5TWrVYEhxK2TJ5wQwlM4I6grj36816xp+h6TpMkj6VpdlZPKcyNbW6Rl/rtAzSro2mJefa1sLYXG8yeYIhkOerf73v1oWlv+3fw/zHfX5v8AEqeJbqztfCN9ca1cz2NqluTPNbOVkjGOdpHOewxXHWF28HxY0ZLa3j020v8ASJpGtUkBMgDKUaQD5d3J6E9+TXol1awXtrJbXkMc8EqlJIpVDK4PUEHqKoReGNCg+y+To9ihs23W5W3QGI4xlTjg8D8hQtJX/rZr9RfZt/XT/I4bRNItNQ17x7a33mXFvb3S+RFLKzCEtACWXJ4Oe/btisxNZ1K8+HPw/hu7ycWuqXcVvqN0JCHdOcIXHI3EAE5yfxr0+Pw7osLXLQ6RYRtdjFyUtkBmH+3x83406PQdIh0ptMi0qyjsG+9aJboIj/wADH6ULRJf4fw/zG9W/n+P+RxZs7HTfjppdvYokCnQ5v3KHCj94vRegzg9OuK63xJ9kk02K1vNRXT/ALTdQxxSE4LOHDBF5HJ2kD061Knh3RkuLeddKs/OtiTDKYFLRk4yQcZB4HPtVm9sLTUrY2+oWsN1CSCY5ow65HQ4PcUdEv63uLq3/W1jjU+1aZ8YLTTtJnuZNPn0ySa/glneVI2DYjcbidrE5Hvj2o8KEH4teOgDzmx/9EmuytdPtLFHWztooRIcvsQDeemT6n61XtPD+jWF615Y6TY210/3p4bZEdvqwGTQtPuf53/4APW/yLVve2t28yWtzDO0D+XMscgYxt/dbHQ+xqaq1pp1lYyXEllaQ273MhlnaKMKZX/vNjqfc1ZoAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAP/2Q==)2. An AC source with Δ*V* max = 150 V and *f* = 50.0 Hz is connected between points *a* and *d* in Figure P32.16. Calculate the maximum voltages between (a) points *a* and *b*, (b) points *b* and *c*, (c) points *c* and *d*, and (d) points *b* and *d.*

**Ans:**

We first determine the reactances of the circuit. The capacitive reactance is



the inductive reactance is,

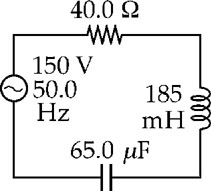


and the impedance Z of the circuit is



The current in the circuit is then





**ANS. FIG. P32.16**

(a) The maximum voltage between points *a* and *b* is the potential drop across the resistor:



(b) The maximum voltage between points *b* and *c* is the potential drop across the coil:



(c) The maximum voltage between points *c* and *d* is the potential drop across the capacitor:



(d) The potential drop between points *b* and *d* is



3. A series *RLC* circuit has components with the following values: *L =* 20.0 mH, *C* = 100 nF, *R* = 20.0 Ω, and Δ*V* max = 100 V, with Δ*ν* = Δ*V*max sin *ωt.* Find (a) the resonant frequency of the circuit, (b) the amplitude of the current at the resonant frequency, (c) the *Q* of the circuit, and (d) the amplitude of the voltage across the inductor at resonance.

**Ans:**

We are given *L* = 0.020 0 H, *C* = 100 × 10–9 F, *R* = 20.0 Ω, and 

(a) The resonant frequency for a series *RLC* circuit is

(b) At resonance,



(c) From Equation 32.43,



(d) At resonance, the amplitude of the voltage across the inductor is

