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(8664) G. C. W. asks: An electric company charges for current 10 cents per kilowatt-hour. How many kilowatt-hours are required to run ten 110-volt 16 candle power lamps 10 hours? Also, how many for a 5 horse power motor, 110 volts, and a 220-volt motor for the same time? A. A 16 candle power lamp at 110 volts may be assumed to take one-half an ampere, and thus use watts per hour. Ten lamps will use 550 watts, and in 10 hours will use 5,500 watts, or 5.5 kilowatt hours, which at 10 cents per kilowatt hour will cost 55 cents. An electrical herse power is 746 watts: 5 herse power for one hour will use 3,730 watts, and in ten hours will use 37,300 watts, or 37.3 kilowatt hours. This at ten cents per kilowatt hour will cost \$3.73. It is common to reckon 11-3 horse power per kilowatt hour. If reckoned thus, the bill would be \$3.75 The voltage does not affect the horse power. If the current were supplied at 220 volts, the amperes would be halved, but the watts would be the same, and the bill calculated would be the same. The real bill as found from a meter might be very different from this. The motor does not run at best efficiency unless it runs at full lead. If it is not using 5 horse power, it takes more than the proportionate part of 5 horse power to drive it: how much, it is not possible to say in general terms.

(8665) E. A. asks: During a rainstorm a click, and sometimes a very brief ring of a telephone bell is frequently audible. and is always coincident with a heavy stroke of lightning. It seems very evident that the click of the bell is due to the lightning being coincident with it, but how does the lightning cause the bell to click? A. The ringing of the telephone bell when a discharge of lightning occurs in its vicinity is explained by in duction. The electric discharge affects the wire in the same manner as the discharge of a battery current through the wire would do. The magnet attracts the armature, and the bell rings. It is a frequent occurrence with both telegraph and telephone lines.

(8666) J. D. A. writes: On several occasions I have read in the answers to questions of your valuable paper, that lightning is due to atmospheric disturbances. I have also noticed that this theory is advanced in most of the electrical books that have come to my hands. Though it is undeniable that there must be some disturbance, yet such theory does not seem to me entirely satisfactory, for it is open to the question, What is the nature of such disturbance? I am of the opinion (and the more I study the subject the more I adhere to it) that lightning is caused by the heat thrown off in the sudden condensation of the water vapors suspended in the atmosphere; the condensation being caused by the atmospheric pressure, and taking place whenever said pressure becomes greater than the expansive force of said vapors. Is not this pessible? I would like to know your opinion on this theory, either through the columns of your paper or otherwise. A. While the condensation of water vapor in the air may be concerned in the production of electrification of the water drops in the air, it is not easy to see how the pressure of the air can be any different from the pressure of the vapor of vater in the same place in the air unless law of Newton is untrue, that action and re action are equal. The production of a flash of lightning is not yet accounted for by any theory, and we shall have to wait for more knowledge than we have to explain this phenomenon.

(8667) S. M. D. asks: Is there any limit to the distance that a certain amount of electricity will travel over wire, that is, will a weak battery send electricity as far as a strong battery? A. There is a limit of distance to which a small amount of electric current can affect an instrument so that it can be perceived. This is at a less distance than a strong current can affect the same instru-In this sense a weak current cannot travel as far as a strong one over a wire. A weak battery cannot produce the same effect through a mile of wire as a strong battery can; but if we had more delicate instruments we might still detect the weak current much farther than we can at present. It is not so much the defect of the current as of the instruments for observing it.



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