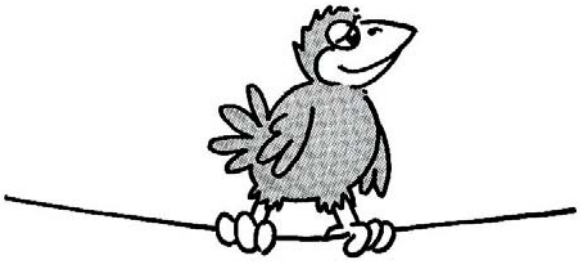
UNL2206, Nature's Threads: Tutorial 1

1) What causes electrical shock – current or voltage?

a) current
b) voltage
c) both
d) neither

2) Will the bird below get a shock sitting on a bare high-voltage power line?



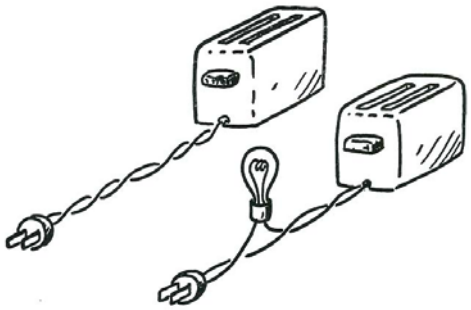
3) The unit of electric current is the ampere, and electric current is often loosely called amperage. Can there exist any situations where there is a lot of amperage without also having a lot of voltage at the same time?

a) Yes
b) No.

4) Is it likely that a situation could exist where there is a lot of voltage without also having a lot of current at the same time?

a) Yes, such situations commonly exist
b) No, such situations are not common.

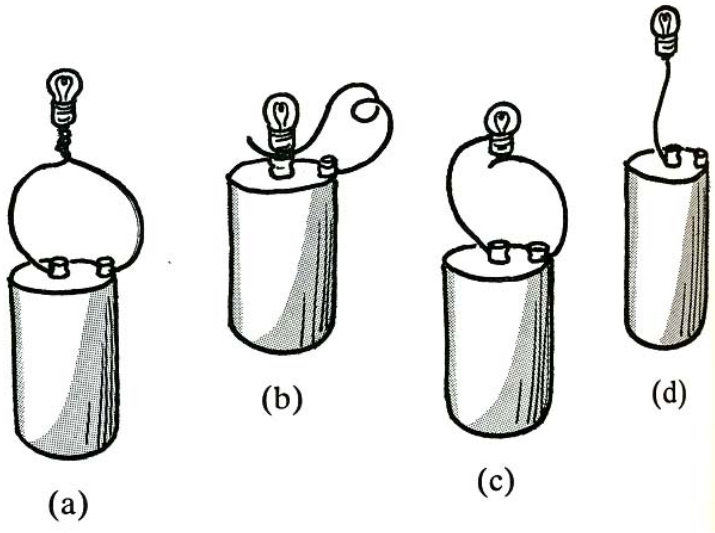
5) A defective toaster may blow your house fuse if it has a short in it. But suppose you add a light bulb to the circuit, as illustrated.



When it is plugged in with the bulb in the circuit it will

a) sometimes blow the fuse
b) never blow the fuse
c) always blow the fuse.

6) A simple electric circuit can be made with a dry cell, a lamp and some wire. In which of the arrangements shown below will the lamp be lit?



7) Your favourite pop band is playing at a concert on an electrically conducting platform (eg., steel) that is electrically insulated (eg. dry wood) from the rest of the concert hall. During the concert, the platform is accidentally connected to a high-voltage ac source; possibly there is a short connecting the platform to the "live" lead of a frayed wire from a guitar amplifier. The band members' hair stand on end. Keeping the electric fluid model in mind, explain why?

(Note: at 220-240V, unless the power supplied is direct current (dc), the surface of the body is unlikely to charge up sufficiently for hair to stand on end; but let us assume that this does happen here.)

At the end of the concert, the band must descend from the platform. Although it would be safer simply to cut off the power, let us assume this cannot be done. Should the band members jump down or simply step off the platform?

8) Estimate the number of electrons annually that pass through to all the homes and offices of a small city of about 100,000 people.

a) None at all
b) About the number of electrons that exist in a pea
c) About the number of electrons that exist in the Earth
d) About the number of electrons that exist in the Sun.

9) If something gets a positive electric charge, then it follows that something else

a) becomes equally positively charged
b) becomes equally negatively charged
c) becomes negatively charged, but not necessarily *equally* negatively charged
d) becomes magnetized.

10) Rub a comb through your hair and try to attract small pieces of paper, aluminum foil, styrofoam and other such things. Try to attract water from a dipping faucet. Instead of a comb, try rubbing a Styrofoam cup against your clothing and so on. Use your imagination!

Come up with a simple explanation of how the “amber effect” works.

11) Before the first moon landing, several NASA scientists were concerned about the possibility that the lunar lander might be engulfed by a layer of dust hovering just above the moon’s surface. Could there be some particular distance from the Moon where electrically charged dust, or even electrons, could hover? Suppose the Moon had a negative charge; then it would exert a repelling force on the negatively charged particles, near it. But the gravitational force of the Moon exerts an attractive force on the dust or electrons. Suppose that an electron is one kilometre above the lunar surface and that the attraction exactly balances the repulsion so that the electron floats. Next, suppose that the same electron was instead at two kilometers above the surface. At this greater distance

a) gravity would be stronger than the electrostatic force, so the electron would fall
b) gravity would be weaker than the electrostatic force, so the electron would be pushed into space
c) gravity would still balance the electrostatic force, so the electron would continue to float.

12) Molecules in a gas resist crowding and get as far apart as possible. Free electrons also resist crowding and get as far apart as possible. When a tank is filled with gas the molecules distribute themselves more or less uniformly throughout the tank’s volume, thereby giving each molecule the maximum possible distance from its nearest neighbours. When a copper ball is charged with electricity, the free electrons will distribute themselves more or less uniformly throughout the ball’s volume for much the same reason.

a) True
b) False