7.8 Static electricity

Science understanding

Visual/Spatial

The list on the right forms part of the triboelectric series. This lists materials in order of how easily they lose electrons. Materials above cotton tend to lose electrons easily, and may become positively charged. Materials below cotton readily gain electrons and in doing so become negatively charged.

Air
Human hands
Asbestos
Glass
Human hair
Nylon
Wool
Fur
Lead
Silk
Aluminium
Paper
Cotton
Steel
Wood
Hard rubber
Nickel, copper
Silver
Gold
Acetate
Polyester
Styrofoam
Polyethene
Vinyl
Teflon

1 **State** whether air is likely to lose or gain negative charges.

_____

2 A plastic acetate sheet is rubbed against your hair and your hair is attracted to it.

(a) **State** which has become positively charged.

_____

(b) **State** which has become negatively charged.

_____

(c) **Explain** why your hair is attracted to the acetate.

_____

_____

3 When styrofoam is charged with a piece of silk, **identify** which material loses electrons.

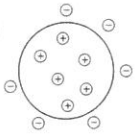
_____

4 On a warm and dry day, the fur of Freddie the mouse is seen to be attracted to Josef's vinyl shoes. **Explain** what is happening in this situation.

_____

_____

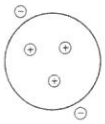
5 Use these diagrams to **state** the number of positive and negative charges in each atom, and **classify** each as having a positive, negative or no overall charge.

(a) 

Positive charges: _____

Negative charges: _____

Overall charge: _____

(b) 

Positive charges: _____

Negative charges: _____

Overall charge: _____

Zapping car doors—page 1

Name:

Skills: interpreting, literacy

Ever been zapped by the car door? Have you noticed that it seems to occur more on hot, dry, windy days?

When you sit in a car in dry weather, the friction between your clothes and the seat's surface, and your feet and the carpet, can cause a build-up of static charge. This happens through 'frictional' or 'contact' charging. One surface ends up with more negative charges than positive. The other surface has fewer negative charges than positives. This is the same thing as rubbing a balloon on your hair: both surfaces become electrically charged, but in this case you are rubbing your body on the car seat.

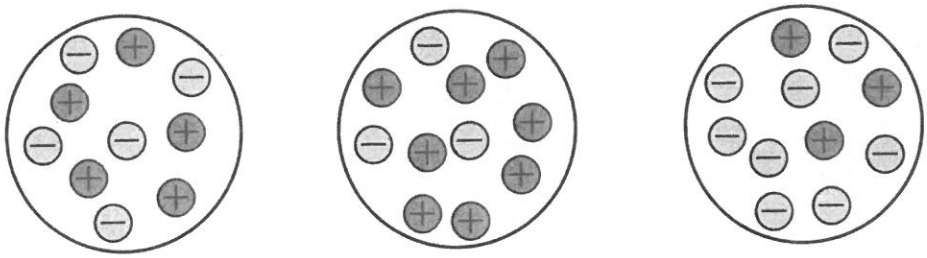
Nothing happens as long as you stay seated. But when you open the car door and step outside, you take a negative charge along with you, while the car seat is left with a positive charge. As you step out of the car, the voltage between your body and the car becomes huge, usually about 10 000 volts—but it may be as high as 20 000 volts. Your shoes insulate you so the charge can't leak out. You reach out to close the car door and ZAP, the charges leap from your fingertip through the air to the car.

You can stop this by:

- changing the surface materials of the car seat
- changing the type of material in your clothing—some materials, however, such as woollen jumpers and pants, certain human-made fabrics and plastic raincoats, make the effect worse.
- always going barefooted, so the charge will leak away when you step outside the car—not good in winter!
- covering your car seats with a conductor such as aluminium foil—this stops the contact-charging effect
- before you get out of the car, touching something metal or glass, which may be enough to take the charges away without the zap.

Questions

1 Label the following diagrams 'positively charged', 'negatively charged' or 'neutral'.



_____ _____ _____

2 Identify the type of weather that increases your chances of getting zapped by static electricity.

_____

_____

3 Explain why there may be a build-up of static electricity when you are in a car.

_____

_____

_____

Zapping car doors—page 2

Name:

4 Explain what happens during the charging process.

5 State the voltage difference between you and the car.

6 Identify one method of reducing the risk of being zapped by the car.

7 Explain why removing your shoes may stop you being zapped.

8 Outline three other situations in which static electricity may be a nuisance.

9 Select one of the situations you outlined in the previous question and propose how the nuisance static electricity may be reduced.

Extension

Fires in some petrol stations have been blamed on this problem. Explain how a fire or explosion could occur because of this static charge.