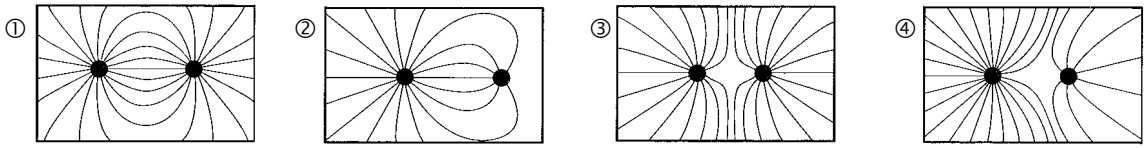
Go to

https://www.leifiphysik.de/elektrizitaetslehre/ladungen-elektrisches-feld/versuche/elektrisches-feld-und-potential-simulation

and choose «Ladungen». Place a couple of charges into the field. Then choose «Feldlinien» and look at the diagrams. This may help you solve the problems.

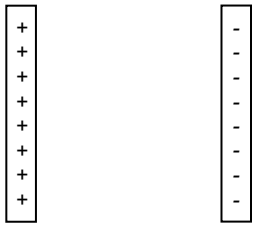
1. Four electric field line patterns are shown below. The charge on the left is positive in all cases.
a) Is the charge on the right positive or negative?
b) Is the charge on the right smaller, larger, or the same, compared to the one on the left?
c) Show the direction of the field lines by adding arrows to the lines in the drawing.



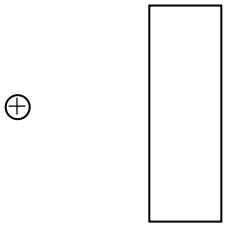
2. Sketch the field line patterns. In some cases charges will be separated by electrostatic induction. Draw the charge distribution in the picture.

a) b) c)

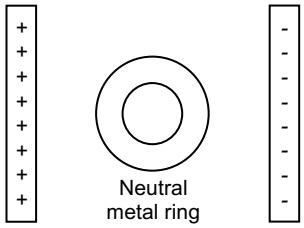
d)



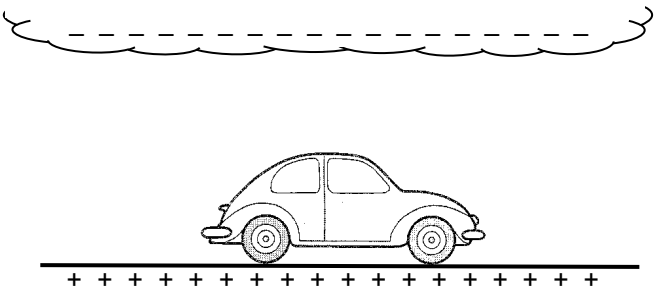
e)



f)



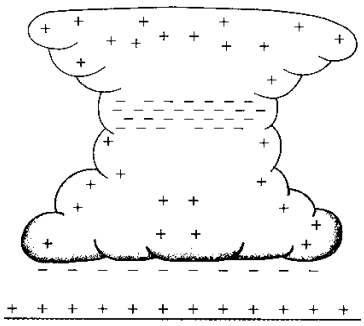
3. A car is parked in the electric field of a thundercloud.
a) Draw the charge distribution which occurs in the car body into the picture.
b) Sketch the electric field line pattern outside the car.
c) What does the electric field inside the car look like? Give reasons for your answer.



4. A uniform electric field exerts a force of 0.568 mN on a small electrically charged ball (Q = 1.49 nC, m = 2.73 g).
a) Calculate the electric field strength.
b) Determine the acceleration of the little ball.

5. Two small metal spheres which carry charges of $Q_1 = 3.24 \cdot 10^{-8}$ C and $Q_2 = -2.16 \cdot 10^{-8}$ C are spaced 80.0 cm apart.
Determine the amount and direction of the electric field strength at the point which is located exactly in the middle between the two spheres.

6. A thundercloud with an area of 5.6 km^2 is at a height of 401 m above the surface of the earth. The magnitude of the electric field is 18 $\frac{kN}{C}$. (Imagine the cloud and the ground to be the plates of a plate capacitor.) A raindrop of charge $+3.00 \cdot 10^{-8}$ C is hovering between the cloud and the ground.



a) Calculate the electric force acting on the raindrop.
b) Determine the raindrop's weight.
c) What is the mass of the raindrop?
d) What electric field strength is needed for the raindrop to accelerate upwards with 1.07 $\frac{m}{s^2}$? (ignore air resistance)

solutions:

1. a) ①: negative, ②: negative, ③: positive, ④: positive
b) ①: equal, ②: smaller, ③: equal, ④: smaller

4. a) $3.81 \cdot 10^5 \frac{N}{C}$ b) $0.208 \frac{m}{s^2}$

5. a) $3.03 \cdot 10^3 \frac{N}{C}$

6. a) $5.4 \cdot 10^{-4}$ N b) $5.4 \cdot 10^{-4}$ N c) 55 mg d) $2.0 \cdot 10^4 \frac{N}{C}$