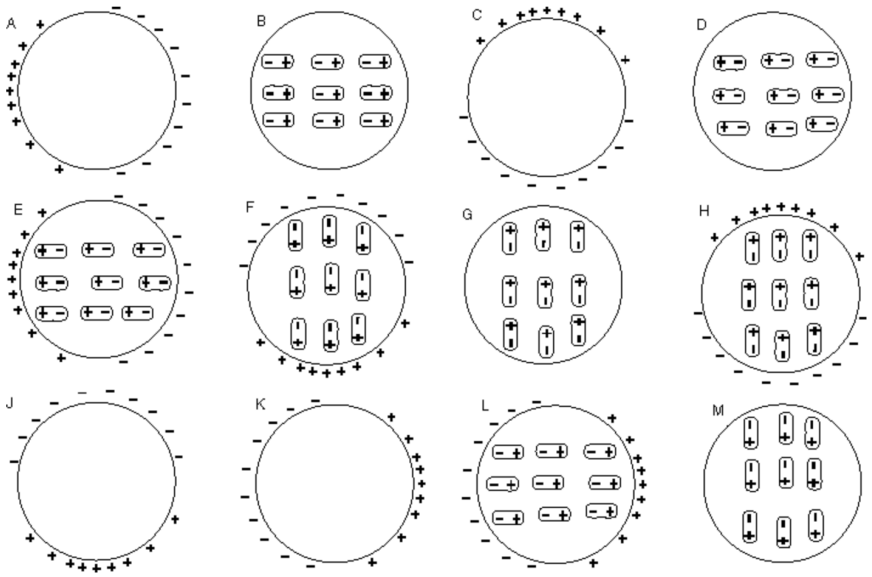
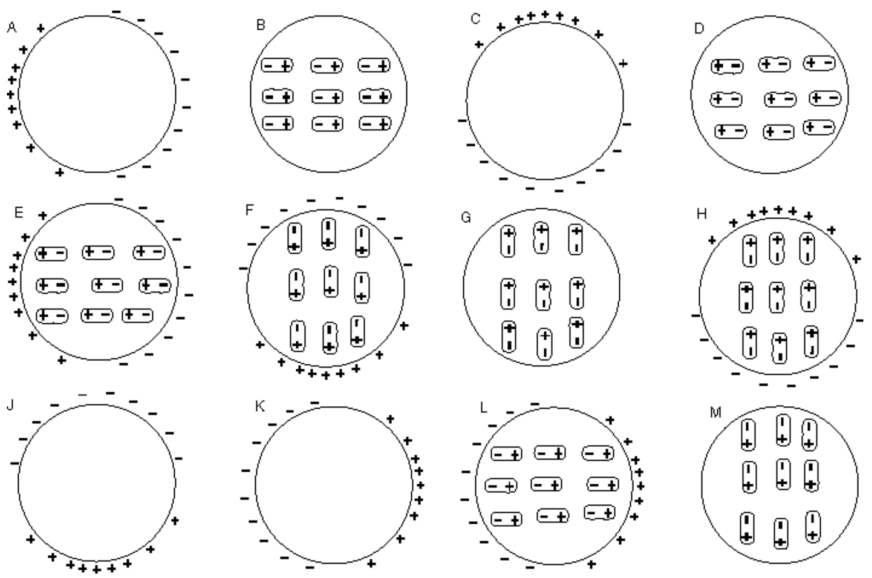
Which of the following diagrams correctly displays the polarization of a metal sphere by an electric field that points to the right, using the conventions discussed in the *Matter and Interactions* textbook?

K ✔



Which of the following diagrams correctly displays the polarization of a plastic sphere by an electric field that points to the left, using the conventions discussed in the *Matter and Interactions* textbook?

D ✔



In a particular metal, the mobility of the mobile electrons is 0.0081 (m/s)/(N/C). At a particular moment, the electric field everywhere inside a cube of this metal is 0.045 N/C in the $+x$ direction.

What is the average drift speed of the mobile electrons in the metal at this moment?

v_{drift} = _____ m/s

$V_{avg} = \mu E$

$= 0.0003645 \frac{m}{s}$

An electric field is applied to a solution containing potassium ions. As a result, the ions move through the solution with an average drift speed of 1.6e-07 m/s. The mobility of potassium ions in solution is 7.62e-08 (m/s)/(N/C).

What is the magnitude of the electric field in the solution?

$E =$ [ ] N/C

$V_{avg} = \mu E$

$E = \frac{V_{avg}}{\mu}$

$= 2.100\ N/C$

Neutral block

Charged sphere

You place a neutral block of copper near a small glass sphere which has a charge of 5e-08 coulombs uniformly distributed over its surface.

A) How long do you have to wait to make sure that the mobile electron sea inside the copper block has reached equilibrium?

- ○ About 1 second
- ◉ Less than a nanosecond (1e-9 s)
- ○ Several hours
- ○ About 10 minutes

✔

B) In equilibrium, what is the drift speed of the mobile electrons inside the copper?

- ○ About 1e-5 m/s
- ○ About 1e5 m/s
- ◉ 0 m/s

✔

C) In the equation $v = uE$, what is the meaning of the symbol u?

- ◉ The mobility of an electron inside the metal, in (m/s)/(N/C)
- ○ The time it takes a block of metal to reach equilibrium in seconds.
- ○ The density of mobile electrons inside the metal, in (electrons/m^3)

✔

D) This part of the question focuses on reasoning. Use these premises:

The definition of equilibrium (part B, above), and
The relationship between drift speed and electric field in a conductor (part C)

to reason about which situations are *possible* inside a copper block at equilibrium.

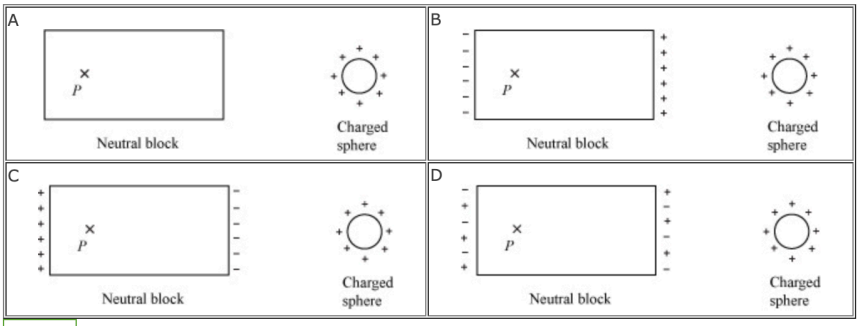
Hint: Some of the situations are possible, some are ruled out by one premise, and some are ruled out by two premises. If a situation is ruled out by two premises, check both boxes.

Case	Drift speed v	Net electric field E_{net}	At equilibrium: Possible or not?
1	v = 0	$E_{net} = 0$	☐ Not possible by definition of equilibrium ☐ Not possible because v = uE ☑ Possible ✔
2	v = 0	$E_{net} > 0$	☐ Possible ☐ Not possible by definition of equilibrium ☑ Not possible because v = uE ✔
3	v > 0	$E_{net} = 0$	☑ Not possible by definition of equilibrium ☑ Not possible because v = uE ☐ Possible ✔
4	v > 0	$E_{net} > 0$	☐ Not possible because v = uE ☑ Not possible by definition of equilibrium ☐ Possible ✔

E) Now that you have considered each case above, in equilibrium which one is the only possible situation?

- 1
- 4
- 2
- 3

F) Which of the following schematic diagrams best represents the charge distribution on the neutral copper block at equilibrium?



- B
- D
- C
- A

G) At location *P* inside the copper block the electric field due to the charged sphere is < -470, 0, 0 > N/C. At equilibrium, which of the following statements must be true, based on the reasoning in part D?

- The electric field at *P* due only to charges on the surface of the copper block is < 0, 0, 0 > N/C.
- It is not possible to determine the electric field at *P* due only to charges on the surface of the copper block.
- Because the net field at *P* is 0, the electric field at *P* due only to charges on the surface of the polarized copper block must be < 470, 0, 0 > N/C