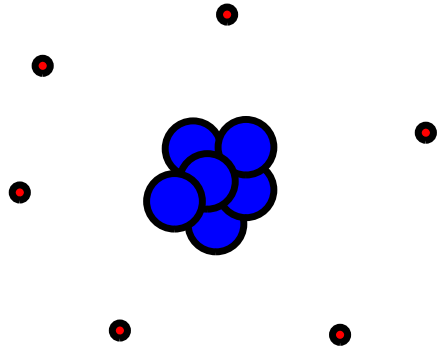
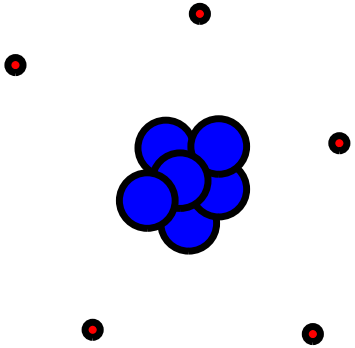
Static Electricity

Static: **Not moving**

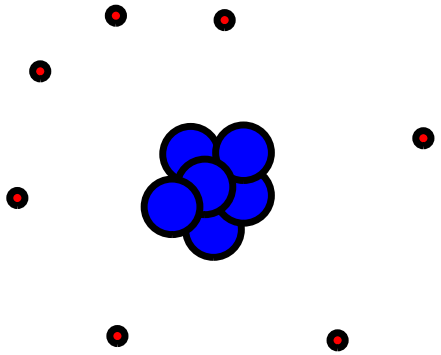
Neutral Atom



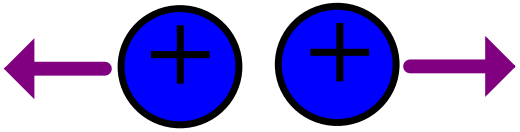
Positive Charge

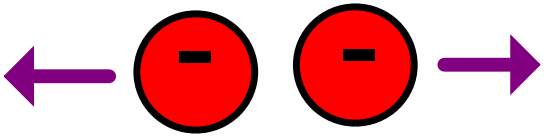


Negative Charge

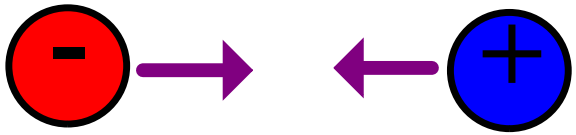


Like charges repel.





Unlike charges attract.



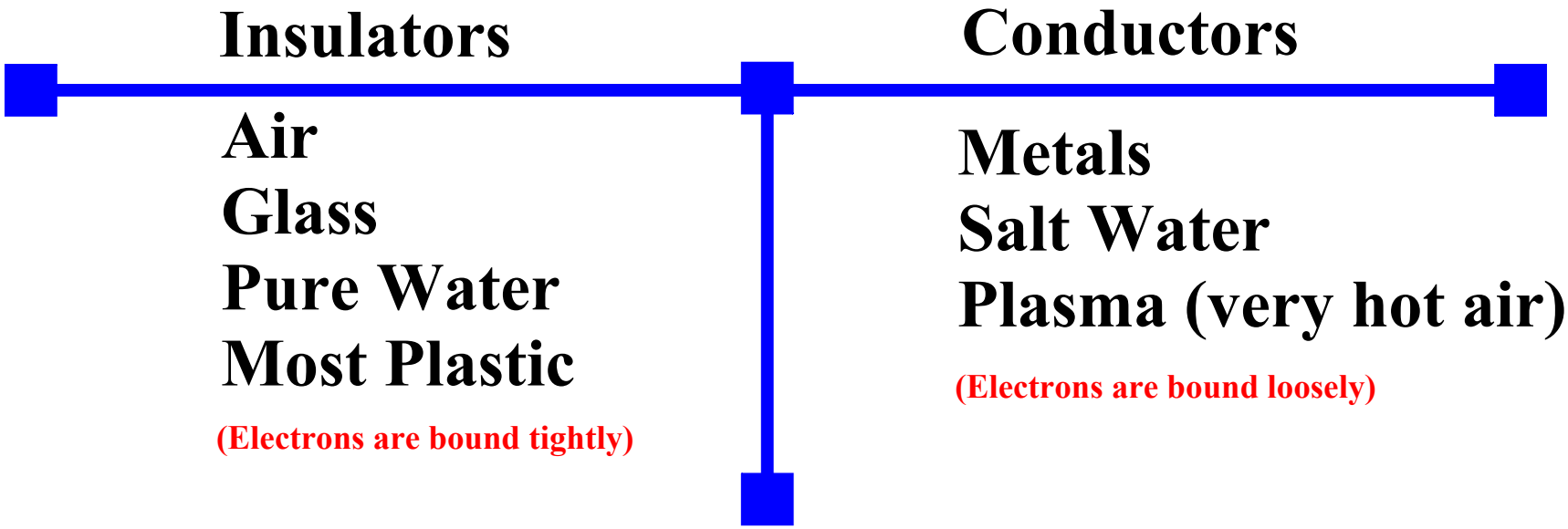
Charge on a single electron

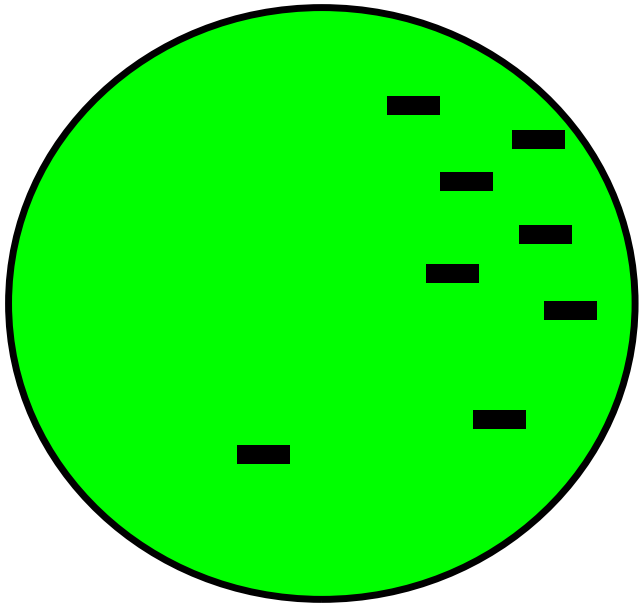
$$e = -1.602 \times 10^{-19} C.$$

C. = Coulomb

Insulator: A material in which charges can not move easily.

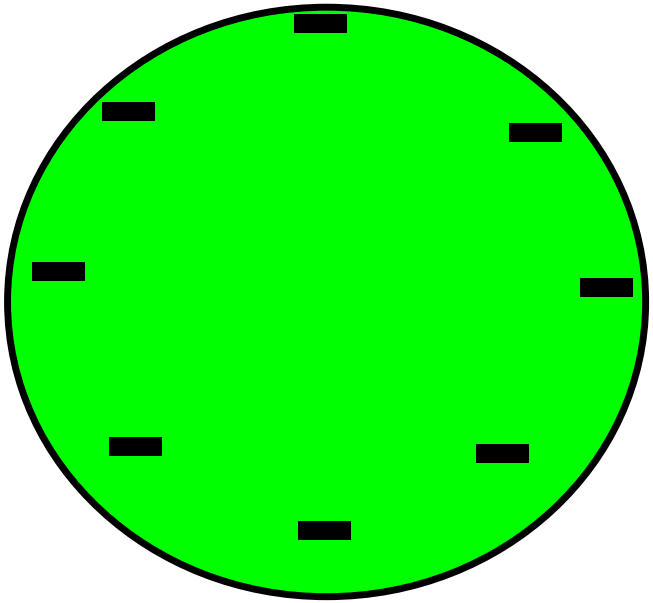
Conductor: A material in which charges can move easily.





Insulator

Charges can't move easily, so they stay clumped together.



Conductor

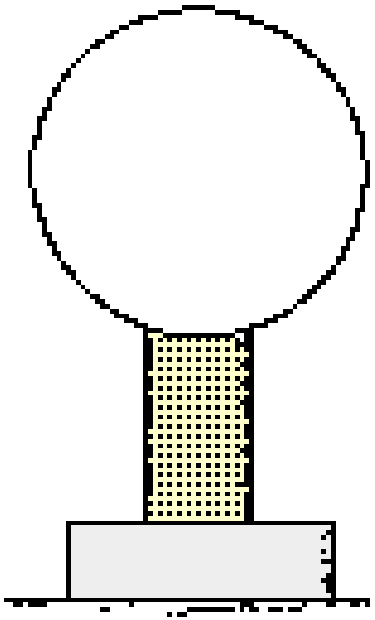
Charges can move easily, so they move as far from each other as possible and end up spread out on the outside surface.

Charging by contact

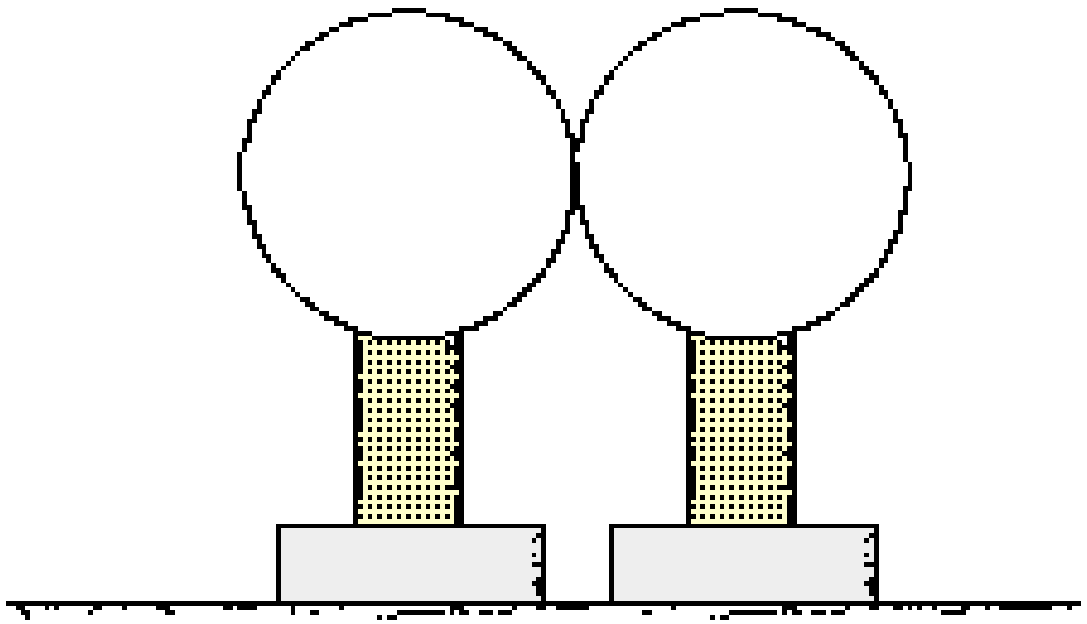
Friction can rub electrons off of one material and deposit them on another material.

Charge Polarization

Charging by induction

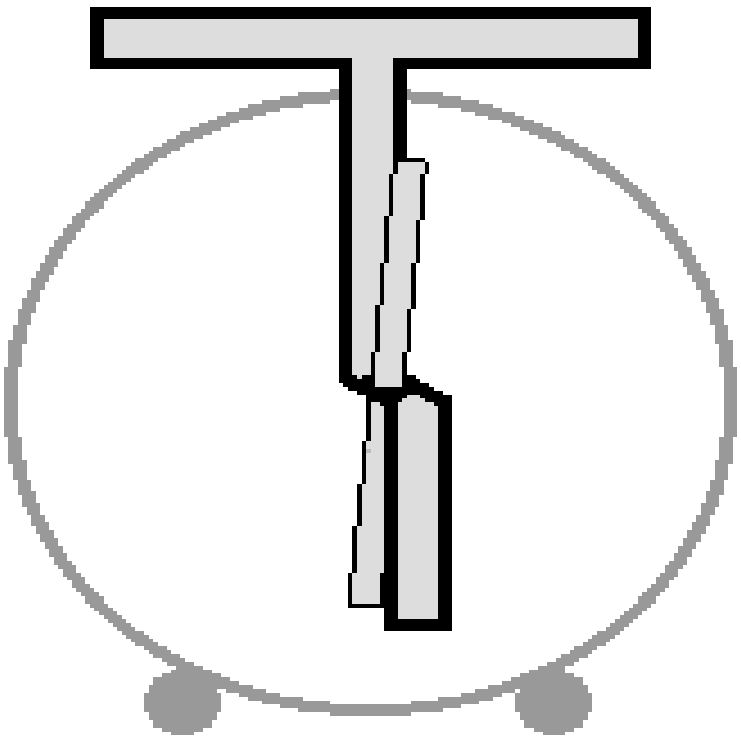


A negatively charged object is brought near to a neutral, conducting sphere. Electrons in the sphere are forced from the left side of the sphere to the right side.

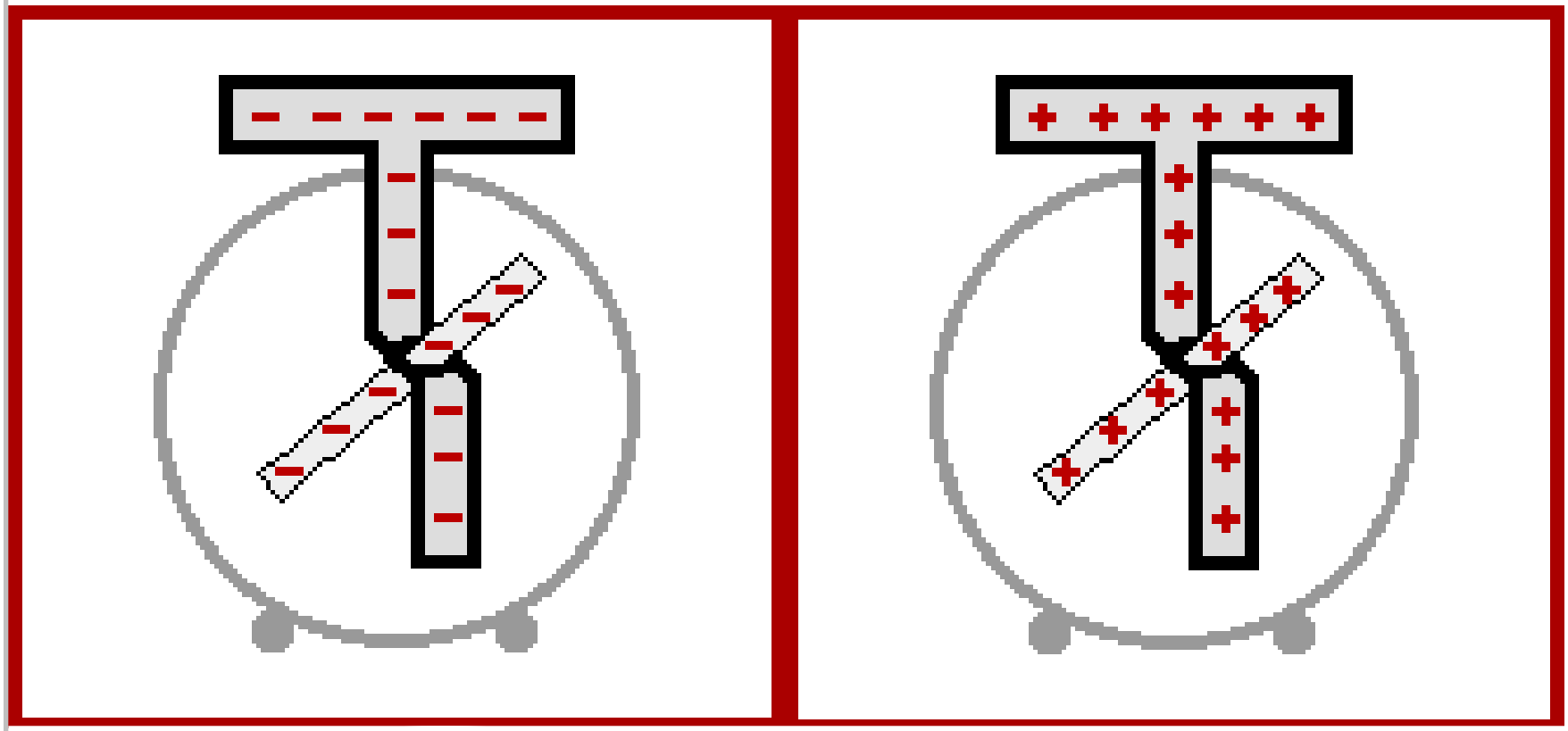


Two neutral conducting spheres are touching one another, thus allowing for the free movement of electrons between them.

Induced Charge



The electroscope is neutral as evidenced by the needle in a relaxed position.



Electrons move in a conductor.

Protons don't move.

Coulomb's Law

$$F = k \frac{q_a q_b}{d^2}$$

F = the force between two charged objects

$k = 9.0 \times 10^9 \text{ N m}^2/\text{C}^2$

q_a and q_b = Charges on objects "a" and "b"

d = distance between the objects

Very similar to Universal Law of Gravitation

$$F = G \frac{m_1 m_2}{d^2}$$

If an astronaut took one gram of electrons from the earth to the moon, what would be the force between the earth and the moon as a result of the difference in charge?

Mass of an electron = 9.1×10^{-28} g

So in one gram there are 1.1×10^{27} electrons.

The charge of a single electron is $e = -1.602 \times 10^{-19}$ C.

So the charge on a gram of electrons is -1.76×10^{8} C.

As a result, the charge on the earth would be 1.76×10^{8} C.
and the charge on the moon would be -1.76×10^{8} C.

$$F = k \frac{q_a q_b}{d^2}$$

$$k = 9.0 \times 10^9 \text{ N m}^2/\text{C}^2$$

$$q_a \text{ and } q_b = +/- 1.76 \times 10^8 \text{ C.}$$

$$d = 3.8 \times 10^8 \text{ m}$$

$$F = -1.9 \times 10^9 \text{ N}$$

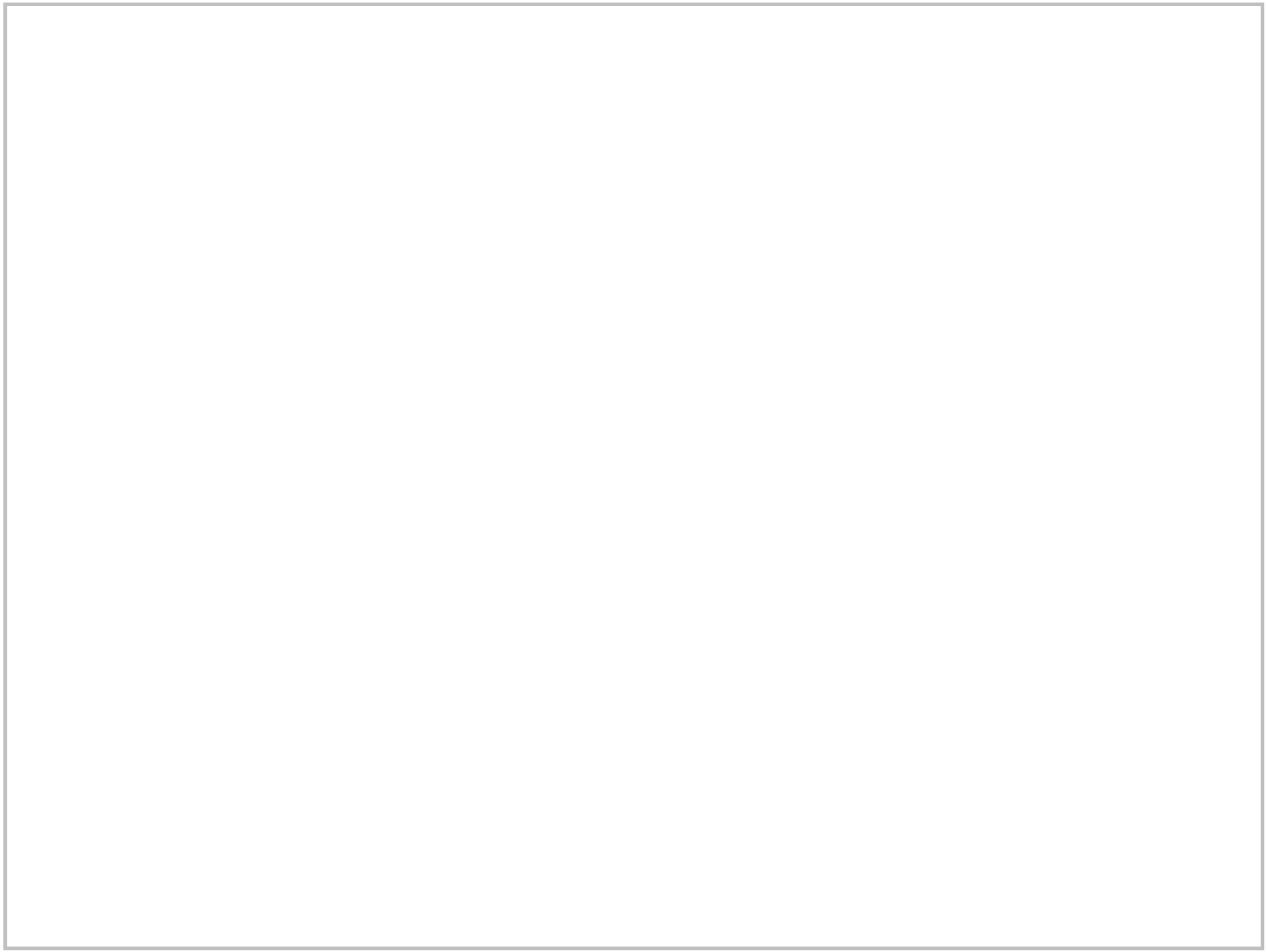
The minus sign means the earth and moon are being pulled towards each other. A plus sign would mean they are being repelled.

Homework

Honors
p 478

#23, 24,
28, 31

College Prep
p 515 Review 3-24
Every 3rd question.



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