Algebra-based physics-2: electricity, magnetism, and modern physics (phys135b-01): unit 2

Jordan Hanson

February 5, 2018

Whittier College Department of Physics and Astronomy

UNIT 1 REVIEW

Reading: Chapters 18 and 19

1. Charge, mass, the Coulomb force, and the gravitational force
2. Force fields
3. Electric potential and capacitance

UNIT 1 REVIEW PROBLEMS

Charged black holes: Suppose two black holes with the same mass are pulled towards each other by gravity. Each, however, has a slight positive charge. If the Coulomb force balances with gravity, what is the charge of the black holes? Each black hole has a mass of 6×10^{30} kg, $G = 7 \times 10^{-11}$ m^3 s^{-2} kg^{-1}, and $\epsilon_0 = 9 \times 10^{-12}$ N^{-1} m^{-2} C^2.

- A: 5×10^{40} C
- B: 5×10^{30} C
- C: 5×10^{20} C
- D: 5×10^{10} C

Is this number surprisingly small, or surprisingly large?

SUMMARY

UNIT 2 SUMMARY

Reading: Chapters 20 and 21

1. Current, Ohm's Law, resistors and conductors
2. DC circuits I
3. Nerve signals
4. DC circuits II

JITT - READING QUIZ RESULTS

CURRENT

Notions of current:

- $I = \frac{\Delta Q}{\Delta t}$ - The derivative of charge
- The *movement* of electrons
- The *flow* of charge
- Number of Coulombs per second (1 Amp = C/s)

There is an interesting problem with the notion of current as movement of charges.

Speed of typical electronic signals: $\approx 10^{8}$ m/s

Typical speed of actual charges pas $\approx 10^{-4}$ m/s

Since there is a 12 order of magnitude range, it's probably a good idea to ponder...

The answer lies in the fact that we are no longer dealing with contact forces, but long-range interactions like the Coulomb force.

CURRENT

CONCLUSION

UNIT 2 SUMMARY

Reading: Chapters 20 and 21

1. Current, Ohm's Law, resistors and conductors
2. DC circuits I
3. Nerve signals
4. DC circuits II

ANSWERS

ANSWERS