

Conceptual Physics Review (Chapters 32 & 33.1 to 33.3)

(Also unit conversions, measurement, and sig figs)

Chapter 32

- Describe the electrical forces between objects.
- Explain how an object becomes charged, both by giving examples and by discussing what is happening at the atomic level.
- Describe Coulomb's law and be able to apply it.
- Compare and contrast Newton's law of gravitation with Coulomb's law.
- Distinguish between a conductor and an insulator.
- Describe how an insulator can be charged by friction and by contact.
- Describe how a conductor can experience a redistribution of charge without contact.
- Describe how an insulator can experience a redistribution of charge without contact.
- Define electric dipole and give an example.

The summary on page 514 of your textbook is excellent for electrostatics!!!!

Chapter 33

- Define electric field, and state how it is similar to and how it is different from a magnetic field and a gravitational field.
- Be able to draw electric field lines pointing in the appropriate direction, given the source of the field.
- Define electric shielding.

Homework Assignments

- Review *all* written assignments out of your textbook, including Appendix F problems.
- Review *all* reading quizzes.
- Review *all* worksheets.

Unit Conversions

Know all metric prefixes from the blue handout and be able to show your work converting between different metric units. Study and review all worksheets on this topic!!!

Measurement and significant figures

- Distinguish between precision and accuracy for data.
- Define precision for an instrument.
- Describe what is meant by uncertainty in measurement and explain how many digits a measurement should include.
- Be able to count how many significant figures a particular measurement has.
- Know the rules for how many sig figs the answer to a multiplication or division problem should have.
- Know the rules for how many sig figs the answer to an addition or subtraction problem should have.

Sample Calculations

1. For each of the following pairs, circle the quantity that is greater.

- a) 1 nm 1 mm b) 1 Gm 1 pm
c) 1 kHz 1 MHz d) 1 m 1 Mm
e) 1 g 1 cg f) 1 μm 1 km

2. For each of the following conversions, SHOW your steps, including conversion factors WITH UNITS.

- a) $470 \text{ nm} = \underline{\hspace{2cm}} \text{ pm}$
b) $4.9 \text{ Gm} = \underline{\hspace{2cm}} \text{ km}$
c) $2.4 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$
d) $5.5 \times 10^{14} \text{ Hz} = \underline{\hspace{2cm}} \text{ MHz}$
e) $720 \text{ }\mu\text{m} = \underline{\hspace{2cm}} \text{ m}$
f) $3.0 \times 10^8 \text{ m/sec} = \underline{\hspace{2cm}} \text{ km/hr}$

3. Fill in the blanks.

- a) $1 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$ b) $1 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$
c) $4 \text{ g} = \underline{\hspace{2cm}} \text{ kg}$ d) $4 \text{ kg} = \underline{\hspace{2cm}} \text{ g}$
e) $1 \text{ Mm} = \underline{\hspace{2cm}} \text{ m}$ f) $1 \text{ m} = \underline{\hspace{2cm}} \text{ Gm}$

4. How many significant figures does each of the following measurements have? If it's ambiguous, explain why, and give examples of how the measurement could be rewritten to eliminate the ambiguity.

- a) 0.0002020 g b) 4.000 m c) 40.0 cm
d) 5000 miles e) 3.42 inches f) 2.5 seconds

5. For each problem, calculate the solution and leave your answer with the correct number of significant figures.

- a) $3.4 \text{ cm} \times 5239 \text{ cm} =$
b) $5280 \text{ ft} / 3.0 =$
c) $4001.6 \text{ miles} / 2.5 \text{ hours} =$

6. For each problem, calculate the solution and leave your answer with the correct number of significant figures. Some problems might require unit conversions before you can perform the calculation!!

a) $4.25 \text{ m} + 2.1 \text{ m} =$

b) $52.4 \text{ ft} - 0.5 \text{ ft} =$

c) $1248.72 \text{ m} + 36 \text{ mm} =$

Use Coulomb's law to answer the following questions. $F = k \frac{q_1 q_2}{d^2}$, $k = 9.0 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$

- 7.
- What *kind* of force exists between two *oppositely* charged particles some distance apart?
 - If the distance between the two particles is reduced to one-third of what it originally was, how does the new force compare to the original force? Answer quantitatively if possible.
 - Instead of reducing the distance, the distance between the particles is increased to five times what it originally was. How does the new force compare to the original force?
 - The particles are placed back at their original distance, but the magnitude of the charge of each particle is doubled. How does the new force compare to the original force?
8. Two oppositely charged pennies are brought into contact with each other.
- Is it relatively easy to bring the pennies into contact or is there any force acting in opposition to the contact? Explain.
 - If the charges on the pennies are equal in magnitude before they are brought into contact, explain what will happen when they touch.
 - What was the net charge on the pair of pennies before contact? After contact?
9. What is the electrostatic force between two balloons, each having a charge of + 50.0 nC, when they are 50.0 cm apart? Calculate the force, including units, and state whether it is attractive or repulsive.

10. What is the electrostatic force between two protons (charge of a proton = 1.602×10^{-19} C) that are 750.0 nm apart? Be sure to give both the magnitude of the force (with units) and the direction (attractive or repulsive).

11. Sketch the electric field lines around each charge configuration shown below.

