

## Physics **Physics Second Semester Syllabus**

### **I. Electrostatics (Chapter 20)**

A. Electric Charge B.  
Conservation of Charge  
C. Electric Forces D.  
Coulomb's Law E.  
Charging by Conduction  
F. Charging by Induction  
G. Van de Graaff  
generator

### **II. Electric Current (Chapter 22)**

A. Electric Current B.  
Electric Energy & Power  
C. Electrical energy cost  
D. Voltage Sources E.  
Electric Resistance F.  
Ohm's Law G. Simple  
Electric Circuits

### **III. Electric Circuits (Chapter 23)**

A. Series Circuits B. Parallel  
Circuits C. Pictorial Diagrams D.  
Schematic Diagrams E.  
Combining Resistors F.  
Combining Batteries G.  
Overloading Circuits and Safety

**IV. Magnetism (Chapter 24)** A. Magnetic  
Poles B. Magnetic Fields C. Magnetic  
Domains D. Electric Current & Magnetic  
Fields E. Magnetic Forces F. Meters and  
Motors G. The Earth's Magnetic Field

on-line version of the text book and a  
variety of other resources are available at  
[w.physicspp.com](http://w.physicspp.com) .

use the Online Student Edition, log in  
using: Access Code: **ADF4B3DE54**

### **V. Electromagnetic Induction**

**(Chapter 25)** A. Electromagnetic  
Induction B. Faraday's Law C.  
Generators and Motors D.  
Transformers E. Power  
Transmission F. Induction of  
Electric & Magnetic  
Fields G. Electromagnetic  
Waves

### **VI. Vibrations and Waves (Chapter 14)**

A. Vibration B. Wave  
Description C. Wave  
Motion D. Transverse  
Waves E.  
Longitudinal Waves  
F. Interference G.  
Mechanical Vs. EM

### **VII. Light & Optics (Chapters 16-18)**

A. wave speed B.  
photon energy C.  
EM spectrum D.  
Reflection / mirrors  
E. Refraction /  
lenses

## VIII. Nuclear Physics (Chapter 30)

- A. Atomic structure
- B. Isotopes C.
- Nuclear stability D.

- Nuclear decay E.
- Nuclear Reactions
- F. Fission G.
- Fusion H.  $E = mc^2$

## Physics Final Exam Review Study Guide – 2<sup>nd</sup> Semester

### I. Electrostatics (Chp. 20)

What are the 2 types of charge? What particles contain these charges?

What is the Law of Conservation of Charge?

What are the types of interactions between these charges?

What do you call a substance that does not easily allow charge to pass? ...that does easily allow charge to pass?

What is an electroscope?

What is charging by induction?

What is charging by conduction?

What is neutralization of charge?

What is the equation for finding the force between 2 charged particles? (Coulomb's law)

What is charge polarization?

How much and what type of charge is on a proton? ...on an electron? ...on a neutron?

What is the unit for

charge?

How does a Van de Graaff generator work? What does it do?

## **II. Electric Current (Chp. 22)**

What is current? What is the cause of current?

Which is dangerous, current or voltage?  
Why

What are the different types of sources of voltage?

What is the equation for finding current due to the movement of charge in a certain amount of time? What is the unit for current?

How does a battery work?

What is electrical resistance? What is the unit for electrical resistance?

What is Ohm's Law?

Why is an electric shock harmful to people? How much current is dangerous to people?

What is the difference between AC and DC?

How fast do electrons move in a wire? How fast does an electric signal flow in a wire? Why are these different?

Where do the electrons come from in using AC from an electric outlet? How do they move? What about DC?

What is electric power? What are the equations used for electric power? What is the unit for electric power?

How much does electricity cost? How can you determine the cost of running a light bulb?

What is the unit that the power company uses for selling electrical energy?

### **III. Electric Circuits (Chp. 23)**

What is Ohm's law?

How do you correctly hook up a battery to make a light bulb work?

What is an electric circuit? What is needed to make a simple circuit?

What is an open circuit? What is a closed circuit? What is a short circuit? What is an overloaded circuit?

What is the equation for finding the equivalent (total) resistance of resistors in series?

What is true about the current of resistors in series?

What is true about the voltage of resistors in series?

What is the equation for finding the equivalent (total) resistance of resistors in parallel?

What is true about the current of resistors in parallel?

What is true about the voltage of resistors in parallel?

What is the effect of adding batteries in series?

What is the effect of adding batteries in parallel?

Be able to solve for P,V,I,R anywhere in a circuit!

Be able to draw and read schematic diagrams.

What is the equation to find the power dissipated in a circuit?

What is a circuit breaker or fuse used for?

#### **IV. Magnetism (Chp. 24)**

What is a magnetic pole?

What would happen if you broke a bar magnet into two pieces?

Why does a permanent magnet have a magnetic field?

What is the cause of all magnetism?

What is a magnetic domain?

How can you temporarily make iron act like a magnet?

What do the magnetic field lines around a bar magnet look like?

What are the types of interactions (forces) between magnetic poles?

What is the unit for magnetic field strength?

Why does a wire carrying a current produce a magnetic field?

How can you make an electromagnet?

What happens to the magnetic field if you make a loop in a current-carrying wire?

How do you use the right hand rule for finding the force on a moving charged

particle?

How do you use the wrap around rule for finding the magnetic field around a current carrying wire?

What happens when two current carrying wires are placed near each other?

What is the equation for finding the force on a charged object moving in a magnetic field?

What is the equation for finding the force on a current carrying wire in a magnetic field?

How does a galvanometer work? How is a voltmeter different from an ammeter?

Will a neutron moving through the Earth's magnetic field notice a force due to a magnetic field?

Why does the earth have a magnetic field? What is the direction of Earth's magnetic field lines?

## **V. Electromagnetic Induction (EMI) (Chp. 25)**

What is the link between magnetism and electricity?

What is Faraday's Law?

How does an electromagnet work?

How does an electric motor work?

How does an electric generator work?

Why is AC produced in a generator?

How does a transformer work? Why do transformers work with AC only?

What is a step-up transformer? What is a step-down transformer?

How does the power company send power to its customers? Why do they use AC? Why do they use high voltage?

How are electromagnetic waves related to electromagnetic induction?

## **VI. Waves (Chp. 14-15)**

What is the purpose of a wave?

What is a vibration? What is a wave?

What is the difference between electromagnetic and mechanical waves?

Are light waves mechanical or electromagnetic? Why?

Are sound waves mechanical or electromagnetic? Why?

Know some examples of mechanical waves.

What is the difference between longitudinal and transverse waves?

Are light waves transverse or longitudinal? Why?

Are sound waves transverse or longitudinal? Why?

Be able to recognize electromagnetic waves by their names. (radio, radar, micro, IR, visible, UV, X-ray, gamma, cosmic)

What is the equation for finding the speed of a wave?

What is wavelength, amplitude, frequency, period? What are the units for each

of these?

What is a crest? What is a trough?

What is a compression? What is a rarefaction?

What is the relationship between period and frequency?

What is the unit of measure for period, wavelength, frequency and speed of a wave?

What are constructive and destructive interference?

What is the Doppler Effect? How does it affect sounds? How does it affect light?

What is the range of frequencies that humans can hear?

What is the amplitude of sound in terms of what you can hear?

What is the frequency of sound in terms of what you can hear?

What is infrasonic? What is ultrasonic?

Give an example of the Doppler effect for sound?

What is resonance?

How does constructive and destructive interference affect sound?

How fast do sound waves travel? How does the medium in which sound travels affect the sound waves?

Why does your voice change pitch when you breathe helium?

Why can't sound travel through empty



space?

If lightning strikes 5 miles away, how long would it take to hear it?

What is different in sound problems when there is an echo?

Don't forget how to use the wave equation!

## **VII. Light (Chp. 16-18)**

What is a photon?

What is the equation for finding the energy of an EM wave?

What are some of the uses for different parts of the EM spectrum?

What is the wave equation used for light?

How fast do all EM waves travel?  
Why?

How does the medium in which EM waves travel affect the EM waves?

Why can EM waves travel through empty space?

How does constructive and destructive interference affect light?

What are the different colors in order of wavelength, frequency and energy?

Why does an object appear to look a certain color?

Why do you get hot when wearing a black T-shirt in the summer?

Why do greenhouses get hot

inside?

How long does it take for a laser beam to go and bounce off the moon and make it back?

How long does it take for light to reach us from the sun? (Its only a mere 93,000,000 miles away!)

What is reflection?

What is refraction?

How does a flat mirror reflect light?

How does a curved mirror reflect light?

How does a flat piece of glass refract light?

How does a curved lens refract light?

## **VIII. Nuclear Physics**

What are the basic subatomic particles?

What are their charges, masses in AMU and kg.

What is mass defect? How do you calculate it?

What does  $E=mc^2$  mean?

What is meant by the term nuclear reaction?

What are the 3 types of nuclear decay? Order them from strong to weak

What is fission?

What is fusion?

What is meant by the term half-life?

What happens to a Plutonium-244 nucleus that undergoes 5 alpha decays?

What is the mass leftover when a 1 kg mass of material undergoes 5 half lives?

If the half life was 10 years, how long until there is less than 1g of the material left?

### **Physics Second Semester Review Problems**

1. Calculate the amount of electrostatic force between a proton and an electron that are a distance of  $2.4 \times 10^{-10} \text{m}$  apart.

2. If two charged objects are moved twice as far apart as before, then what happens to the amount of electrostatic force?

3. Describe the ways in which you can charge an object.

4. What does it mean for an object to be neutral?

5. What does it mean to ground a charged object?

6. Why does a sock stick to a shirt after being removed from the clothes dryer?

7. Why does a charged balloon stick to a wall?

8. Why does your hair stand up when touching a Van de Graaff generator?

9. 25C of charge moves through a section of wire in 5 seconds. Calculate the current in the wire.

10. Calculate the work done in moving 5C of charge through a 12V car battery.

11. A toaster is plugged into a 120V outlet and draws 7A of current. Calculate the resistance & power used by the toaster.

12. A 100W light bulb is left on for 1 hour. Calculate how much electric charge moves in the bulb in this time. Calculate how much

it costs to keep the bulb on for this time.

13. How do the length, thickness, temperature and type of material affect the resistance of a conductor?

14. Why are some materials good insulators rather than conductors?

15. A 6V battery is connected to a  $3\Omega$  light bulb, calculate the current & power through the bulb.

16. A 6V battery is connected to a  $2\Omega$  light bulb in series with a  $4\Omega$  bulb; calculate the equivalent resistance of the circuit.

calculate the current through each bulb, calculate the voltage across each bulb, calculate the power used by each bulb, what

happens to the  $2\Omega$  bulb if the  $4\Omega$  bulb burns out?

17. A 6V battery is connected to a  $2\Omega$  light bulb in parallel with a  $3\Omega$  bulb; calculate the equivalent resistance of the circuit, calculate

the current through each bulb, calculate the power used by each bulb. What is the voltage across each bulb? What happens to the

$2\Omega$  bulb if the  $3\Omega$  bulb burns out?

18. A battery is connected to two lightbulbs. Which will produce more power; a series or parallel circuit of these bulbs?

19. What is a circuit breaker?

20. Calculate the amount of force that acts on a proton that moves at  $6 \times 10^6$ m/s through a magnetic field of 15T?

21. Is it possible to have a magnet with only 1 magnetic pole? Explain why or why not.

22. If a proton were to move from the right side of the page towards the left and passes through a magnetic field which points down

the page, then what will be the direction of the magnetic force that acts on the proton?

23. A 10cm wire carries a current of 10A and is in a magnetic field of 10T. Calculate the amount of force exerted on the wire.

24. If a wire carries a current across the page from right to left and it passes through a magnetic field which is directed up the page,

then what is the direction of the magnetic force that acts on the wire?

25. Give an example of electromagnetic induction.

26. What is an electric motor? What is an electric generator?

27. A transformer has 20 loops of wire on the primary and 80 loops on the secondary. If the secondary voltage is measured to be

200V, then calculate the amount of primary voltage.

28. Why is electrical energy transmitted long distances to homes at high voltage (AC)?

29. What is the standard voltage used in homes in the United States?

30. If 60 ocean waves lap up on shore in 2minutes, then what is the frequency of the waves?

31. A wave moves at a speed of 60m/s and the wavelength is 700cm. Calculate the frequency & period of this wave.

32. While watching a thunderstorm, you see lightning and count 8 seconds until you hear the thunder. How far away did the

lightning strike?

33. Calculate the photon energy of an electromagnetic wave that has a wavelength of 1.3m.

34. What is the difference between electromagnetic and mechanical waves?

35. Why can't sound travel through empty space?

36. What is the source of all mechanical waves?

37. What is the source of all electromagnetic waves?

38. What are the two types of wave interference? Describe how they happen.

39. List the electromagnetic spectrum and state an application of each type of wave.

40. What can happen to light as it interacts with matter?

41. How does light bounce off a surface?

42. What happens when light moves from a medium to a different medium?

43. How is the law of conservation of charge important? How is the law of conservation of energy important?

44. What isotope remains after the alpha decay of uranium-235? What isotope remains after the beta decay of Boron-12?

45. If a 1kg sample of radioactive material undergoes 4 decays, then what amount of the original material remains?

46. If a sample of radioactive material has a half life of 12,500 years and undergoes 4 decays, then how long would it take for all the

decays to  
occur?

47. What happens to a nucleus that undergoes gamma decay?

48. Write a nuclear reaction that shows nuclear fission. Write a nuclear reaction that shows nuclear fusion.

49. How does the Sun produce its energy?

50. Make sure you have all the metric prefixes and standard units on your cheat sheet!

**Equations:**

$$F = k \cdot Q_1 \cdot Q_2 / d^2$$

$$d^2 = k \cdot Q_1 \cdot Q_2 / F$$

$$k \cdot Q_2 / d = \sqrt{F \cdot Q_1}$$

$$F$$

$$I = Q_t / t = I \cdot t = Q_t$$

$$I = V / R \quad V = I \cdot R \quad R = V / I$$

$$R_{eq} = R_1 + R_2 + \dots + R_N \quad 1/R_{eq} = 1/R_1 + 1/R_2 + \dots + 1/R_N$$

$$P = I \cdot V \quad I = P / V \quad V = P / I$$

$$P = W_t / t \quad W = P \cdot t = W_t$$

$$V = W_Q / Q \quad W = Q \cdot V \quad Q = W_V$$

$$F = Q \cdot v \cdot B \quad Q = F_{B \cdot v} \quad B = F_{Q \cdot v} \quad V = F_{Q \cdot B}$$

$$F = B \cdot I \cdot L \quad B = F_{I \cdot L} \quad I = F_{B \cdot L} \quad L = F_{B \cdot I}$$

$$N_p N_s = V_p V_s = I_s I_p$$

$$f = \# \text{ cycles}$$

$$t_{\#} = f \cdot t \quad T = 1/f \quad f = 1/T$$

$$v = f \cdot \lambda \quad f = v/\lambda \quad \lambda = v/f$$

$$E = h \cdot f = E_h$$

$$v = \Delta x / \Delta t \quad \Delta x = v \cdot \Delta t \quad \Delta t = \Delta x / v$$

$$n = c_v / v = c_n$$

$$n_1 \cdot \sin \theta_i = n_2 \cdot \sin \theta_r \quad \theta_r = \sin^{-1} (n_1/n_2 \cdot \sin \theta_i) \quad \theta_i = \theta_r$$

$$E = m \cdot c^2 \quad m = E/c^2$$

## Other Data & Information:

Accepted Known  
Values:

1 proton has  $+1.6 \times 10^{-19}$  Coulomb of charge

1 electron has  $-1.6 \times 10^{-19}$  Coulomb of charge

Earth is about 93,000,000 miles from Sun

magnetic field of the Earth is about  $6 \times 10^{-5}$  T

gravity on Earth is about 9.8 (or 10)  $\text{m/s}^2$

Earth has a mass of about  $6 \times 10^{24}$  kg

mass of electron =  $9.11 \times 10^{-31}$  kg

mass of a proton =  $1.672 \times 10^{-27}$  kg

mass of a neutron =  $1.674 \times 10^{-27}$  kg

the speed of light in empty space is about  $3 \times 10^8$   $\text{m/s} = c$

the speed of sound in air is about 340  $\text{m/s}$

Physical  
Constants

$h = 6.63 \times 10^{-34}$  J s  $k = 9 \times 10^9$   $\text{Nm}^2/\text{C}^2$

1 mile = 5280 ft = 1609 m



1 in = 2.54  
cm