Physics Semester 2 Final Review

KEY

Springs and Pendulums

Waves

Define/describe the following terms and include units where applicable:

1. Transverse wave oscillations ⊥ to energy
2. Longitudinal wave oscillations // to energy
3. Crest top of wave
4. Trough bottom of wave
5. Amplitude distance from middle to peak
6. Wavelength distance between repeating parts
7. Frequency oscillations per second
8. Period seconds per 1 oscillation
9. Doppler Effect wave source is moving which changes frequency
10. Constructive Interference two crests or two troughs overlap + amplitudes add
11. Destructive Interference a crest + trough overlap + amplitudes subtract
12. The period of an ocean wave is 10 seconds. What is the wave's frequency?

$f = \frac{1}{10} = 0.1\ Hz$

13. An ocean wave has a frequency of 0.05 Hz and a wavelength of 10 meters. What is the wave's speed?

$v = \lambda f$

$= 0.5\ m/s$

14. A sound wave has a frequency of 261.6 Hz. What is the wavelength of this sound traveling in air at 343 m/s?

$343 = \lambda \cdot 261.6$

$\lambda = 1.31\ m$

15. To play "Mary had a Little Lamb," you need the notes at the frequencies of 440 Hz, 523 Hz, and 587 Hz.
    a. Calculate the wavelengths of these notes.

$\lambda = 0.78\ m$ (1st harmonic)

$0.66\ m$

$0.58\ m$

    b. Draw a picture the resonance of a musical note in an open straw AND a closed straw.

    c. Calculate the length of straw you need to cut for open pipes of all three notes.

open: $L = \frac{1}{2}\lambda$

$.39\ m$

$.33\ m$

$.29\ m$

Light and Color

16. What is the speed of all electromagnetic waves? How does this compare to the speed of sound?

$3 \times 10^8\ m/s$ light is much faster!

17. An FM radio station broadcasts its signal at a frequency of 9.15×10^7 Hz. Determine the wavelength of the signal in the air.

$v = \lambda f$

$\lambda = 3.28\ m$

18. What is the difference between color by addition and color by subtraction? Give an example of each.

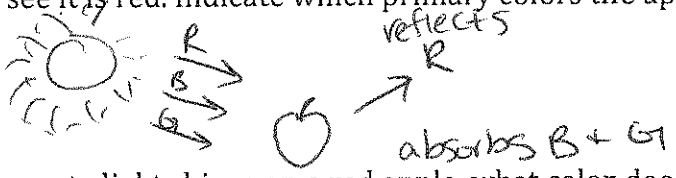
adding λ → more colors reflected (white) light

Subtracting λ - more λ absorbed to see fewer colors reflected (black)

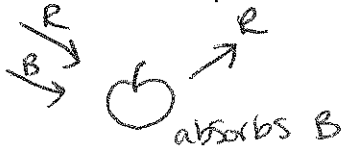
19. Which color of light has the highest frequency?

Violet

20. Draw a diagram of light coming from the sun and reflecting off of an apple into your eye so that you see it is red. Indicate which primary colors the apple absorbs/reflects.



21. If magenta light shines on a red apple, what color does it appear? What color(s) does the apple absorb/reflect?



appears red

Mirrors and Lenses/Reflection and Refraction

22. How does the angle of incidence compare to the angle of reflection?

same

23. How does the angle of incidence compare to the angle of refraction?

$n_1 \sin\theta = n_2 \sin\theta$

24. When light travels from air to a medium that has a higher index, what happens to its speed? Its direction?

it slows down & bends toward normal

25. What is total internal reflection?

going from more dense → less dense medium

when θ_i is greater than the critical angle

26. A ray of light travels from air (n=1.00) into water (n = 1.33). The angle of incidence of the light is 50°. What is the angle of refraction?

$1 \sin(50) = 1.33 \sin\theta$

$\theta = 35°$

27. Explain the difference between being nearsighted and farsighted.

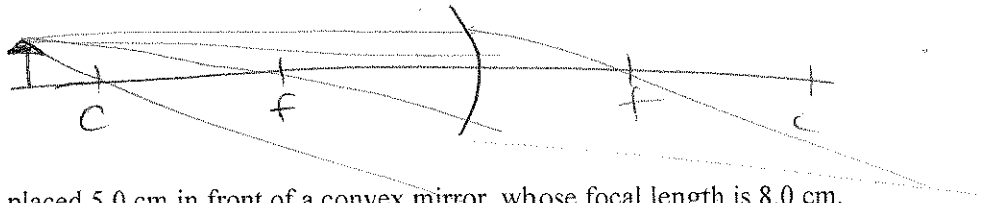
nearsighted - eye is too long, image formed in front of retina, corrected by diverging (concave lens)

farsighted - opposite

Ray Diagrams—you should be able to draw all types of ray diagrams for convex and concave mirrors and lenses.

28. A person is standing beyond c of a concave mirror. Draw a ray diagram showing their image. Make sure it is clear if the image is larger, smaller, right side up, or inverted.

See notes!



29. A pencil is placed 5.0 cm in front of a convex mirror, whose focal length is 8.0 cm.
    a. Calculate where the image will be located (also state in front or behind).
    b. Calculate the magnification of the pencil (also state smaller or larger).

$\frac{1}{8} = \frac{1}{5} + \frac{1}{d_i}$ $\quad d_i = -13.3$ cm

← behind mirror

$m = 2.66$

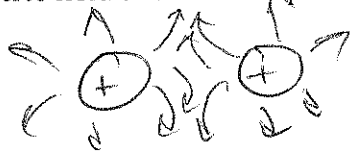
30. An object is placed 25.0 cm from a convex lens, which has a focal length of 15.0 cm. Draw a ray diagram and the image. Then, use the lens equation to solve.

$\frac{1}{15} = \frac{1}{25} + \frac{1}{d_i}$

$d_i = 37.5$ cm

Electricity

31. Draw the electric field around two protons.



32. Which subatomic particle(s) can transfer from one material to another, making an object charged?

only electrons

33. A negatively charged rod attracts a neutral balloon. The balloon sticks, then falls off the rod. Describe what is happening in terms of electrons.

negative charge attracts protons in balloon → localized positive charge → electrons transfer, both are negative → like charges repel

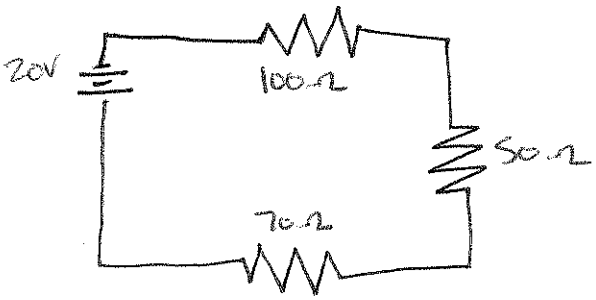
34. A ball has a charge of 2 C. A second ball, located 0.64 m away has a charge of -1.3 C. What is the electric force between the balls?

$\frac{(9\times10^9)(2)(-1.3)}{.64^2}$ $\quad -5.7\times10^{10}$ N

35. What is the electric field strength at a point if a charge of -4.5×10^{-7} C that experiences a force of +2.8 N?

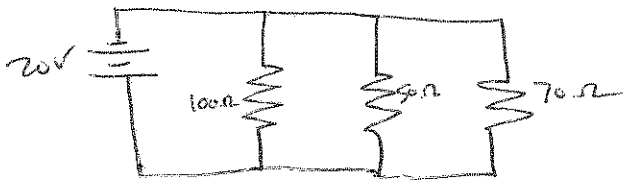
$E = \frac{F}{q} = \frac{2.8}{-4.5\times10^{-7}\text{ C}}$ $\quad -6.2\times10^6$ N/C

36. A 100 Ω resistor, a 50Ω resistor, and a 70Ω resistor are connected in series with a 20 V battery.
    a. Draw a circuit diagram
    b. Find the equivalent resistance and the overall current in the circuit
    c. Find the potential difference and the current through each resistor.



	V	I	R
1	9.1	0.091	100Ω
2	4.5	0.091	50Ω
3	6.4	0.091	70Ω
Batt	20V	0.091	220

37. A 100 Ω resistor, a 50Ω resistor, and a 70Ω resistor are connected in parallel with a 20 V battery.
    a. Draw a circuit diagram
    b. Find the equivalent resistance and the overall current in the circuit
    c. Find the potential difference and the current through each resistor.



	V	I	R
1	20	0.2	100
2	20	0.4	50
3	20	0.3	70
Batt	20	0.9	22.6

Magnetism

38. What are the two poles of a magnet called? Which is attracted to which?

N & S opposites attract N → S

39. How are electricity and magnetism related?

when one moves, it creates the other

40. What happens when you break a magnet in half?

You get two magnets!

41. What is an electromagnet?

a coiled wire around a post that creates a magnet

42. Why does moving a magnet back and forth in a coil of wire produce an alternating current (not direct current)?

Because when you move the magnet in opposite directions, it causes the electrons to move in opposite directions

43. Describe how an electric motor works. How does this compare to a generator?

a current runs through a loop over a magnet - the circuit alternates being open & closed, so the loop spins. In a generator, you spin the loop over a magnet to create electricity

44. What is the current running through a 0.62 cm wire that experience 0.13 N of force in a magnetic field of 0.44 T?

$F = ILB$

$.13 = I \cdot .62 \cdot .44$

$I = 48$ A

Physics Semester 2 Final Review

Springs and Pendulums

1. *What does the period of a simple pendulum depend on (2 things)?*

   length ; gravity

2. *What fundamental characteristic of all matter does a pendulum not depend on?*

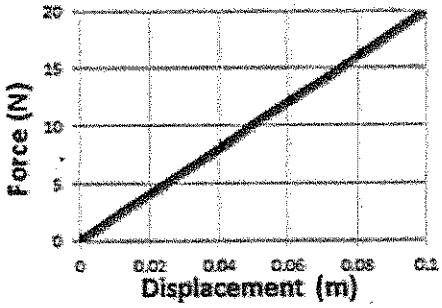
   mass

3. *A spring is stretched by 0.15 m from its equilibrium position by a 300 N force.*
   a) *What is the spring constant?*

   $F = k\Delta x \quad k = \frac{F}{\Delta x} \quad \frac{300}{.15} = 2000\frac{N}{m}$

   b) *What is the potential energy stored in the spring?*

   $U_{sp} = \frac{1}{2}k\Delta x^2 = \frac{1}{2}(2000)(.15)^2 = 22.5\,J$



4. *What is the spring constant for the graph to the right ?*

   $\frac{\Delta F}{\Delta x} = k \quad \frac{20}{.1} = 200\frac{N}{m}$

EQUATIONS:

$T_p = 2\pi\sqrt{l/g}$

$|F_s| = k|x|$

$U_s = \frac{1}{2} k x^2$

$T = 1/f$

$v = f\lambda$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$m = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$

$n_i \sin\theta_i = n_r \sin\theta_r$

$n = \frac{c}{v}$

$k = 9.0 * \frac{10^9 NC^2}{m^2};$

$F = \frac{kq_1q_2}{r^2},$

$E = \frac{F}{q},$

$V = \frac{W}{q},$

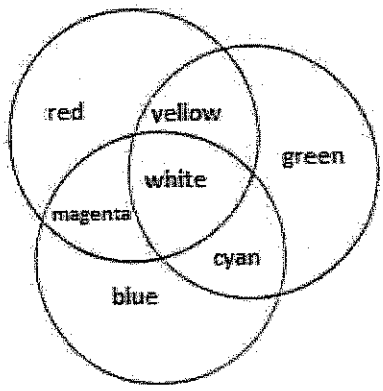
$V = IR,$

$R_{series} = R_1 + R_2 \ldots$

$\frac{1}{R_{paralell}} = \frac{1}{R_1} + \frac{1}{R_2} \ldots$

$P = I\,V$

Charge of an elementary charge = 1.60×10^{-19} C



$F_{wire} = I\,L\,B\,(\sin\theta)$

$F_{charge} = q\,v\,B\,(\sin\theta)$

Ray Diagrams:

1. Draw ray parallel, then through f
2. Draw ray through f, then parallel
3. Draw ray through c