**Physics**

***Final Review Packet***

Please note that the following chapters are meant to direct your studying.

**We did not cover every topic** in each of the listed section of the Physics Classroom.

**Unit 1 – Wave Motion**

 **Physics Classroom:** Waves + Sound Waves & Music

 **Key Vocab Words:**

 wave, transverse wave, longitudinal wave, trough, crest, wavelength, frequency, principle of superposition,
 interference, destructive interference, node, constructive interference, antinode, reflection, refraction,
 diffraction, pitch, Doppler shift, resonance

 **Problems:**

1. Identify the following images as one of the following: reflection, interference, diffraction or refraction.In addition, describe what each term means. **a) interference c) refraction**   
  **b) reflection d) diffraction**  
2. If sound travels at 5600 m/s through a steel rod, what is the wavelength, given a wave frequency of 2480 Hz? 2.26m
3. The speed of a wave depends upon (i.e., is causally affected by)… a
	1. the properties of the medium through which the wave travels.
	2. the wavelength of the wave.
	3. the frequency of the wave.
	4. both the wavelength and the frequency of the wave.
4. Look at the image in problem 1, letter d.
 a) What do the light bands represent? crests
 b) What do the dark bands represent? troughs
 c) What do the gray fuzzy lines represent? Nodal lines (regions of destructive interference)
5. What is the Doppler shift? Provide an example of a time when you experienced this phenomenon. See PCR
6. Ella Fitzgerald has the ability to break glass when she sings. Why does the glass shatter? resonance
7. **TRUE or FALSE –** In order for John to hear Jill, air molecules must move from the lips of Jill to the ears of John.
8. A sound wave is different than a light wave in that a sound wave is… b
	1. produced by an oscillating object and a light wave is not.
	2. not capable of traveling through a vacuum.
	3. not capable of diffracting and light wave is.
	4. Capable of existing with a variety of frequencies and a light wave has a single frequency.
9. Label the following diagram. Include these terms: amplitude, wavelength (all 3 ways to indicate wavelength), crest, trough. see PCR

**Unit 2 – Optics**

 **Physics Classroom:** Light Waves & Color + Reflection…+ Refraction…

 **Key Vocab Words:**

light, electromagnetic spectrum, primary color, secondary color, dye, pigment, primary pigment, secondary pigment,
 polarized, reflection, refraction, angle of refraction, angle of incidence, plane (flat) mirrors, concave converging
 mirrors, convex diverging mirrors, convex converging lens, concave diverging lens, real, virtual, inverted, upright.

 **Problems:**

1. Fill in the diagrams for the mixing of light and the mixing of pigments: See PCR
**Light Pigment**
2. How do you create cyan light? blue + green

1. Consider the visible light spectrum (ROYGBIV)...
	1. Which color has the greatest frequency? violet
	2. Which color has the greatest wavelength red
2. The diagrams depict a sheet of paper being illuminated with white light (ROYGBIV). The papers are impregnated with a chemical capable of absorbing one or more of the colors of white light. In each case, determine which color(s) of light are reflected by the paper and what color the paper will appear to an observer. See PCR

 
3. In the diagrams below, several sheets of paper are illuminated by different primary colors of light (R for red, B for blue, and G for green). Indicate what primary colors of light will be reflected and the appearance of the sheet of paper. (Note the similarity between this problem and the above problem.) See PCR

 

1. Answer the following questions as they pertain to mirrors:
 a) Describe the physical properties of the image seen in a plane mirror. Virtual, same size, same distance
 b) Describe the physical properties of a virtual image. Upright, can’t show up on screen
 c) An object produces a virtual image in a concave mirror. Where is the object located? Behind (in) mirror
 e) Describe the image seen in a convex (diverging) mirror. Small, closer than object, virtual

1. An object 2.4-cm high is placed 12.0 cm from a concave converging mirror with a focal point of 3.0 cm.
 a) Draw a ray diagram. Use a ruler to mark

 f and 2f at equal spacing. Object

 b) Where will the image be located? 4cm
2. An object that is 4.0 cm high is placed 14.0 cm from a convex converging lens that has a focal length of 9.0 cm.
 a) Draw a ray diagram. Use a ruler to mark
 f and 2f at equal spacing.

 b) Where will the image be located?
25.2 cm

**Unit 3 – Electrostatics**

 **Physics Classroom:** Static Electricity

 **Key Vocab Words:**

 electrostatics, neutral, insulator, conductor, electroscope, charging by friction, charging by conduction,
 charging by induction, grounding, electric field, electric field lines

 **Problems:**

1. Describe the steps one would take to charge an object by each of the following ways: friction, conduction, and induction. See PCR
2. **TRUE or FALSE** – An object that is positively charged contains all protons and no electrons.
3. **TRUE or FALSE** – An object that is negatively charged could contain only electrons with no accompanying protons.
4. **TRUE or FALSE** – An object that is electrically neutral contains only neutrons.
5. A physics student is investigating the charge on several objects and makes findings below. The student knows that object **A is negatively charged and object B is electrically neutral.** What can be concluded about the charge on objects C, D, E and F? (C=negative; D=negative; E=positive; F=positive)

|  |  |  |  |
| --- | --- | --- | --- |
| **Object C** | **Object D** | **Object E** | **Object F** |
| attracts B | repels C | attracts D repels F | attracts A |

1. A rubber balloon possesses a positive charge. If brought near and touched to the door of a wooden cabinet it sticks to the door. This does not occur with an uncharged balloon. Explain what happens to allow the balloon to stick. The door becomes polarized (electrons drawn toward the balloon) then the balloon and door are attracted to each other.

**Unit 4 – Electric Circuits**

 **Physics Classroom:** Current Electricity

 **Key Vocab Words:**

electric current, conventional current, electric circuit, resistance, voltage, series circuit, equivalent resistance,
 parallel circuit, ammeter, voltmeter, kilo-watt hour

 **Problems:**

1. Which of the following will cause the current through an electrical circuit to decrease? a, d
a. decrease the voltage b. decrease the resistance c. increase the voltage d. increase the resistance
2. A circuit is wired with a power supply, a resistor and an ammeter (for measuring current). The ammeter reads a current of 24 mA (milliAmps). Determine the new current if the voltage of the power supply was…
	1. Increased by a factor of 2 and the resistance was held constant. 48mA
	2. Increased by a factor of 2 and the resistance was increased by a factor of 2. 24mA
	3. Increased by a factor of 3 and the resistance was decreased by a factor of 2. 144mA
3. Two 15.0- resistors and two 20.0- resistors (for a total of 4 resistors) are connected in series and placed across a 35.0-V battery.
 a) What is the equivalent resistance of the circuit? 70 ohms
 b) What is the value of the current in the circuit? 0.50A
 c) What is the potential drop (**voltage**) across each resistor? 7.5V in each 15ohm and 10V in each 20ohm
 d) Calculate the power of each resistor. 3.75W for 15ohm and 5W for 20ohm
 e) Calculate the total power in the circuit. 17.5W
 f) Assuming that the above resistors are light bulbs of given resistance, what will happen if one is unscrewed?
 all go out

1. A coffee pot, rated at 950 W, is plugged into a 120-V source and left on for 4 hours
 a) How much energy (in kWh) does the coffee pot use? (1000 W = 1 kW). 3.8kWh
 b) If it costs $0.14 for every kilowatt-hour, how much does it cost to run the coffee pot? $0.532

**Unit 5 – Motion in 1D**

 **Physics Classroom:** 1D Kinematics

 **Key Vocab Words:**

motion diagram, scalar, vector, displacement, distance, average velocity, average speed, instantaneous velocity,
 average acceleration, acceleration due to gravity (free fall)

 **Problems:**

1. An airplane flying at a velocity of 165 m/s accelerates at a rate of 7.0 m/s2 for 5.0 seconds. What is the final velocity of the plane? 200m/s
2. A motorcycle starts from rest and accelerates uniformly for 5.0 seconds. During this time, it travels a distance of 140 meters. At what rate was it accelerating? 11.2 m/s/s
3. A wrecking ball is hanging at rest from a crane when suddenly the cable breaks. The time that it takes to fall to the ground is 2.4 s. How far has the ball traveled during this time? 28.2m
4. A ball is thrown upward with an initial velocity of 12.0 m/s. How much time does it take to reach its maximum height? 1.22s

1. Looking at the graph to the right…
 a) Identify the position at 6 seconds. 1m
 b) Describe the motion of the object.
moving north, gaining speed

2

3

4

5

6

0

1

2

4

6

8

10

12

14

16

18

20

position

(m)

North

South

time (s)

4

6

8

10

12

0

2

4

8

12

16

20

velocity

(m/s)

2

6

10

14

18

1. Looking at the graph to the right…
 a) Describe the motion of the object.

moving in the positive direction, slowing down
2. Draw a position vs. time, a velocity vs. time and an acceleration vs. time graph for the following scenarios:
 a) An object that is speeding up while moving toward the origin (assume constant acceleration).
 b) An object moving at a constant velocity.
 c) An object standing still. SEE the WS with 21 graphs
 d) An object that is slowing down while moving away from the origin (assume constant acceleration).
3. Using the position vs. time graph, answer the following questions and construct a velocity vs. time and an acceleration vs. time graph.

time (s)

10

15

20

25

30

0

5

5

10

15

20

25

30

35

40

45

50

position

(m)

North

South

**1**

**2**

**3**

**4**

velocity

(m/s)

time (s)

0

North

South

acceleration

(m/s2)

time (s)

0

North

South

1. Describe motion for each section (1, 2, 3, and 4).
2. What is the object’s average velocity from **15-25** **s**?
3. What is the object’s average velocity from **25-35 s**?
4. What is the object’s average velocity from **35-50 s**?
5. Draw the corresponding velocity vs. time graph.
6. Draw the corresponding acceleration vs. time graph .

time (s)

4

6

8

10

12

0

2

4

8

12

16

20

velocity

(m/s)

2

6

10

14

18

9. Use the velocity vs. time graph below to
answer the questions that follow.

 a) What is the object’s acceleration from
 0-8 seconds? -0.5m/s/s
 b) What is the object’s acceleration from
 8-10 seconds? 0.0m/s/s

**Unit 6 – Newton’s Laws**

 **Physics Classroom:** Newton’s Laws

 **Key Vocab Words:**

force, free-body diagram, net force, Newton’s first law, Newton’s second law, inertia, Newton’s third law

 **Problems:**

1. If the forces acting upon an object are balanced, then the object… c
	1. must not be moving.
	2. must be moving with a constant velocity.
	3. must not be accelerating.
	4. none of these
2. If a bug and a truck windshield collide head-on, explain which one experiences a greater impact force. same
3. You are a passenger in a car that is moving rapidly down a straight road. As the driver makes a sharp left turn, you are pressed against the right side of the car. Explain why this happens. You want to keep moving straight
4. The block is initially moving at a speed of 5 m/s to the right. If no net force acts on it, what will be its subsequent motion?
 a) The block moves to the right and slows down.
 b) The block moves to the right at the same speed.
 c) The block moves to the right and speeds up.
 d) Its subsequent motion cannot be determined without more information.
5. The block, initially moving to the right at 5 m/s, is acted upon by a net force to the left. How will it continue to move?
 a) The block moves to the right at the same speed.
 b) The block moves to the right and slows down.
 c) The block moves to the right and speeds up.
 d) The block moves to the left and slows down.
6. If a person gets a bookshelf sliding, and wants to keep it sliding at a constant velocity, they must:
 a) Stop pushing and let inertia keep the shelves sliding.
 b) Apply a force smaller than the kinetic friction.
 c) Apply a force equal to the kinetic friction.
 d) Apply a force greater than the kinetic friction.
7. Draw free-body diagrams for the following problems. Be sure to draw all the forces with arrows that are of appropriate length to reflect the given descriptions.
 a) Object slides across a horizontal surface at constant speed without friction. Fn up; equal Fg down
 b) A sky diver falls downward through the air at constant velocity (air resistance is important). Fd up = Fg down
 c) An object is suspended from the ceiling. Ft up = Fg down
 d) An object slides a horizontal surface at constant velocity. Friction is present. Fn up=Fg down; Fa = Ff
 e) An wagon accelerates from rest because of an applied force. Friction is present. Fn up=Fg down; Fa > Ff
8. What is the gravitational force exerted by a large body, such as Earth called? What is the formula that links this answer to the mass of an object? WEIGHT! Fg=mg
9. A 520-kg wrecking ball is suspended from a cable.
 a) Draw a free-body diagram of this situation.
 b) What the mass of the ball? 520kg
 c) What is the tension exerted on the ball? 5096N
10. A 920-kg car is towed into the body shop with a force of 300 N. The friction between the car tires and the road surface is 115 N. What is the acceleration of the car? 0.201m/s/s

**Unit 7 – Motion in 2D**

 **Physics Classroom:** Vectors – Motion & Force in 2 Dimensions

 **Key Vocab Words:**

projectile, trajectory, uniform circular motion, centripetal acceleration, centripetal force

 **Problems:**

1. A ball rolls with a speed of 2 m/s across a table top that is 1 meter above the floor. Upon reaching the edge of the table, it follows a parabolic path to its landing spot on the floor. How far along the floor is this spot from the table? (This problem continues on the next page) = 0.904m

|  |  |
| --- | --- |
| Horizontal | Vertical**a = k = ag (free fall)** |
| **vix=**2m/s | **viy=0m/s** |
| **vfx** =2m/s | **vfy**  |
| **Δx (range)** | **Δy (height)** |
| **ax=0** | **ay=-9.8m/s/s** |
| **t** | **t** |

1. Two balls, one 1.0 kg, the other 3.0 kg, are rolled off the edge of a table at the same speed.
 a) Which ball, if either, travels farther out from the table? same
 b) Which ball, if either hits the ground first? same
2. Which position should the airplane drop its cargo to hit the target? Draw the path the cargo would take as it moves toward the ground.

a. A b. B c. C

1. The following diagram represents an overhead view of a ball attached to a string that is being spun in a horizontal circle.
 a) Indicate the direction of the force acting on the ball. inward
 b) Indicate the direction of the velocity of the ball. tangent
 c) Indicate the direction of the acceleration of the ball. inward
 d) If the ball was suddenly released at the point shown (the black dot), indicate which way the ball would travel.
2. While traveling at 13 m/s, a car hits a dip in the road of radius 24 m.
 a) Draw the free-body diagram for the driver.
 b) What is your centripetal acceleration? 7.04m/s/s
 c) What is the magnitude of the normal force
 acting on you if you are 60 kg? 1010.5N

**Unit 8 – Work & Energy**

 **Physics Classroom:** Work, Energy & Power

 **Key Vocab Words:**

energy, kinetic energy, work, gravitational potential energy, law of conservation of energy

 **Problems:**

1. A student lifts a box of books that weighs 185 N. The box is lifted 0.800 m. How much work does the student do on the box?
2. Differentiate the following terms: positive work, negative work, no work.
3. In which situation is a person doing work on an object?
 a) A school crossing guard raises a stop sign that weighs 10 N.
 b) A student walks 1 m/s while wearing a backpack that weighs 15 N.
 c) A man exerts a 350 N force on a rope attached to a house.
 d) A worker holds a box 1 m off the floor.
4. Define each of the following scenarios as positive work, negative work or no work.
 a) Lifting a bag of groceries.
 b) A hockey puck pushed across the ice.
 c) Lowering a crate of books to the floor.
 d) Sliding a box across the floor.
5. A 950-kg car moves with a speed of 37 m/s. What is its kinetic energy?
6. An 875-kg compact car speeds up from 22.0 m/s to 44.0 m/s while passing another car.
 a) What were its initial and final energies?
 b) How much work was done on the car to increase its speed?
7. A 90-kg rock climber climbs 45 m up to the top of a quarry. What is the change in the climber’s gravitational potential energy relative to the ground?
8. The chain on a roller coaster applies a force of 4000N while pulling an 800 kg roller coaster car up a hill that is 400 m long. Refer to the diagram of the roller coaster below.

 a) Identify each letter on the diagram as Work, KE, GPE and/or Heat.

 90 m

**A**

**B**

**C**

**D**

**E**

**STOP**

 b) How much work did the chain do to pull the car to the top of the ride?
 c) What is the gravitational potential energy at the top of the ride?
 d) What is the kinetic energy at the bottom of the first hill?
 e) How fast is the roller coaster car going at the bottom of the first hill?
 f) If the next hill has a height of 90 m determine the following: GPE, KE and speed.
 g) If a force of 8000 N is applied to stop the car at the end of the ride, what is the stopping distance?

## Physics Formulas

**Constants** ag = 9.8 m/s2 vlight = 3.00 x 108 m/s

**Basic Motion Definitions Motion with Constant Acceleration**

 s = d
 t Δx = vit + ½ at2

 v = Δx vf = vi + at
 t Δx = ½ (vf + vi) t

 a = Δv vf2 = vi2 + 2aΔx

 Δt

**Forces and Newton’s Laws Circular Motion**

 net F = ma v = d = 2Пr = 2Пrf
 Fg = mag t T

 Fƒ = μFN ac = v2  r

**Momentum** net Fc = mac = m v2
 p = mv r

**Work & Energy Wave Motion**

KE = ½ mv2 v = λf
 GPE = magh

 W = Fx f = 1 or T = 1
 W = ΔKE = ΔGPE T f

# Electric Circuits

OHMS’ LAW V = IR

 SERIES I total = I 1 = I 2 = I 3 PARALLEL I total = I 1 + I2 + I 3
 1 = 1 + 1 + 1

 R total = R 1 + R2 + R 3  R total R 1 R 2 R 3

 V total = V 1 + V 2 + V 3  V total = V 1 = V 2 = V 3

 POWER P = IV = I2R = V2  ENERGY E = Pt = IVt = I2Rt = V2t

 R R

# Lenses & Mirrors

 1 = 1 + 1 hi = – di

 f do di ho do