KEYS

ABRHS Physics (CP)

Final Outline - 2017

Format: 50-75 multiple choice (conceptual and work out problems)

Make your own Equation Sheet: One side of a piece of regular paper with anything on it. (equations, examples, diagrams) **Hand written by you, no photocopies.** *(Just like the mid year.)*

Momentum:

- Momentum
- Impulse
- Impulse-momentum theorem
- Conservation of momentum
  - Recoil
  - Inelastic
  - Elastic

Energy:

- Work
- Types of energy
- Conservation of energy calculations
- Examples of energy conservation
- Power

Circular Motion:

- Frequency and Period - (Hz, rpm, s, min)
- Directions of acceleration and velocity when traveling in a circle
- Calculations with speed, period and radius
- Calculations with speed, acceleration and radius

Universal Gravitation:

- Universal Gravitation
- Acceleration due to gravity on other planets
- Conceptual understanding of equations
- Orbits

Ohms Law:

- Current
- Calculation of total charge (Coulombs <—> # electrons)
- Voltage (electric potential)
- Resistance
- Electric Potential Energy (kW*hrs)
- Electric Potential Energy vs. Electric Potential (Voltage)
- Electric Power
- Electric Bills
- Ohm's Law

Electric Circuits:

- Ammeters & Voltmeters
- Ohm's Law
- Series Circuits
- Parallel Circuits
- Compound Circuits

ABRHS PHYSICS (CP) NAME: KEY

Final Review - Momentum

Equations and Constants:

$F_{net} = ma$ $p = mv$ $\Delta p = Ft$ $p_i = p_f$ $\Delta p = m(v_f - v_i)$

Concepts: → Impulse = change in momentum!

C 1. A 5 kg ball has a momentum of 50 kg·m/s. What impulse is needed to stop the ball?
a. –5 N·s. b. –10 N·s. c. –50 N·s. d. –250 N·s.

A 2. Which of the following could NOT be units for momentum?
a. N/s. b. kg·m/s. ✓ c. g·m/s. ✓ d. N·s. ✓

3. Which has more momentum, a 100 kg object with a speed of 5 m/s or a 2 kg object with a speed of 250 m/s?
a. The 100 kg object has more momentum. $(100)(5) = 500$ kg·m/s
b. The 2 kg object has more momentum.
C c. They have the same momentum. $(2)(250) = 500$ kg·m/s
d. Not enough information to tell.

4. Which of the following are true statements?
I. Momentum is conserved when two objects explode apart. ✓
E II. Momentum is conserved when two objects collide and stick together. ✓
III. Momentum is conserved when two objects bounce off of each other. ✓
a. I only. b. II only. c. III only. d. I & II only. e. I, II & III.

5. A rubber ball and a lump of putty have equal mass. They are thrown with the same speed against a wall. The
A ball bounces back with nearly the same speed with which it was thrown. The putty sticks to the wall. Which object experiences the greatest change in momentum?
a. the ball → b/c it bounces. b. both experience the same momentum change
c. the putty d. cannot be determined form the information given

6. Which of the following best describes an inelastic collision?
D a. a cannon firing → sticks together
b. two billiard balls colliding
c. a baseball thrown through a window
d. an arrow shot into an apple

→ calculate impulses...

C 7. Which of the following will cause the greatest change in momentum? A force of____acting for____.
a. 6 N, 3 s = 18 Ns b. 3 N, 6 s = 18 Ns c. 5 N, 5 s = 25 Ns d. 4 N, 5 s = 20 Ns

8. A small object collides with a large object. Which object experiences a larger force?
a. the small object
C b. the large object Newton's 3rd Law!
c. they both experience the same force
d. it depends on if the collision is elastic or inelastic

9. A Mack truck and a Volkswagen traveling at the same speed have a head on collision. The vehicle which
A undergoes the greater change in velocity will be the
a. Volkswagen b. Mack truck c. both the same
→ b/c less mass!

10. A Mack truck and a Volkswagen traveling at the same speed have a head on collision. The impact force is greatest on the
C a. Volkswagen b. Mack truck c. is the same for both
Newton's Third Law!

Final Review - Momentum

11. A bug and a car have a collision on the highway. As a result, the bug is smeared all over the headlight of the car, which did not notice the collision. State whether each of the following statements is true or false. (All the statements refer to magnitudes -- don't worry about directions.)

T	F	The changes in momentum of the bug and car were the same.
T	F	The final momentum of the bug is the same as the car.
T	F	The impulses on the bug and car were the same during the collision.
T	F	The acceleration of the bug and car were the same. > different masses !
T	F	The changes in velocity of the bug and car were the same.
T	F	The forces on the bug and car were the same during the collision.

Problems:

1. Beth (65 kg) is sitting on a lab cart (25 kg) at rest. If she jumps off with a speed of 2 m/s, what is the resultant velocity of the lab cart?

$p_i = p_f$ $(65)(0) + (25)(0) = (65)(2) + (25)v$

$0 = 130 + 25v$

$\boxed{v = -5.2 \text{ m/s}}$ (- b/c it goes backwards)

2. A 2 kg cart moving at 2 m/s collides with a 3 kg cart at rest. Calculate the final velocity of the carts if the collision is inelastic.

$p_i = p_f$ $(2)(2) + (3)(0) = (2)v + (3)v$

$\longrightarrow 4 = 5v$ $\boxed{v = 0.8 \text{ m/s}}$

inelastic → they stick together!
∴ they have the same speed!

3. During a class Egg Drop Competition, a 0.12 kg egg drop device hits the ground with a speed of 5 m/s and comes to rest in 0.1 s.
   a. What is the change in momentum of the device?

   $v_i = 5 \text{ m/s}$ $\Delta p = p_f - p_i = (.12)(0) - (.12)(5)$

   $v_f = 0 \text{ m/s}$ $\boxed{= -0.6 \text{ kg}\cdot\text{m/s}}$

   b. What force acts on the device?

   $J = Ft$ & $J = \Delta p$ ∴ $-0.6 = F(0.1)$

   $\boxed{F = -6 \text{ N}}$

ABRHS PHYSICS (CP) NAME: KEY

Final Exam
Energy Review

Chapter 8

Equations:

$W = Fdcos(\theta)$ $KE = \frac{1}{2}mv^2$ $W = \Delta KE$ $PE = mgh$ $P = \frac{W}{t}$

Constants:

g = (-) 10 m/s²

Concepts:

D 1. Which of the following are units of power?
 a. N b. J c. kg d. W

A 2. All of the following represent energy except
 a. W/t b. Fd c. mgh d. 1/2 mv²

A 3. If you push an object twice as far while applying the same force you do
 a. twice as much work
 b. four times as much work
 c. the same amount of work

W = Fd

B 4. A job is done slowly while an identical job is done quickly. Both jobs require the same amount of work, but different amounts of
 a. energy b. power c. both of these d. none of these

D 5. The law of conservation of energy means that
 a. energy cannot be created or destroyed
 b. energy can change forms
 c. the total amount of energy cannot change
 d. all of the above

B 6. Exert a force of 5 N for a distance of 4 meters in 2 seconds and you deliver a power of
 a. 2.5 W b. 10 W c. 20 W d. 40 W

$W = Fd = 5 \cdot 4 = 20\text{ J}$

$P = \frac{\text{Energy}}{\text{time}} = \frac{20}{2}$

C 7. Exert 100 J in 50 seconds and your power output is
 a. 1/4 W b. 1/2 W c. 2 W d. 4 W e. more than 4 W

$\frac{100}{50}$

B 8. An object is raised above the ground gaining a certain amount of potential energy. If the same object is raised twice as high, it gains
 a. four times as much potential energy
 b. twice as much potential energy
 c. the same amount of potential energy

PE = mgh

C 9. A 1000 kg car and a 2000 kg car are both lifted the same distance in a garage. Lifting up the more massive car requires
 a. less work b. the same work c. twice as much work d. four times as much work

↳ b/c 2X mass

A 10. An object that has kinetic energy must be
 a. moving b. up in the air c. at rest d. attached to a spring

D 11. An object that has potential energy must have this energy because of its
 a. speed b. momentum c. acceleration d. position

↳ height!

 NAME: ____________

Final Exam
Energy Review

A 12. Someone can lift containers a height of 1 meter or roll them up a 2 meter long ramp (to the same height.) With the ramp, the force needed is about
same work
a. half as much b. the same c. twice as much

E 13. When a car brakes to a stop, its kinetic energy is changed to
a. stopping energy b. potential energy c. energy of motion d. energy of rest e. heat

C 14. Which requires more work: lifting a 500 N sack to a height of 2 m or lifting a 250 N sack a height of 4 m?
a. lifting the 500 N sack b. lifting the 250 N sack c. they are the same

D 15. A TV is pushed 2 m by a force of 20 N. How much work is done on the TV?
a. 2 J b. 10 J c. 20 J d. 40 J e. 80 J

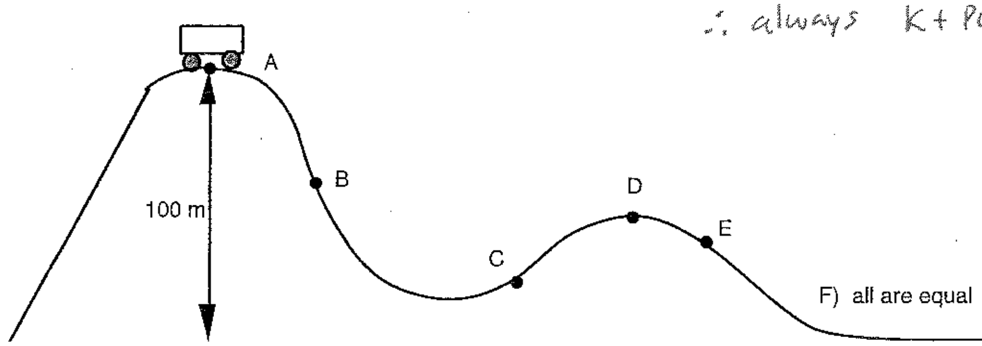
B 16. It takes 40 J to push a big box 4 m across the floor. How much force was needed? $40 = F\ 4$
a. 4 N b. 10 N c. 40 N d. 160 N

D 17. A 2 kg mass is held 4 m above the ground. How much potential energy does it have? $2(10)(4)$
a. 20 J b. 40 J c. 60 J d. 80 J

B 18. A 2 kg mass has 40 J of potential energy. How far above the ground is it? $40 = 2(10)h$
a. 1 m b. 2 m c. 3 m d. 4 m

The picture below is for questions 19 to 22.
A roller coaster is lifted to the top of the first hill, point A, 100 m high, where it has a total of 15,000 J of energy. It then goes through a frictionless track.

$\therefore$ always $K + PE = 15{,}000$



A 19. If it has 10,000 J of potential energy at point B, how much kinetic energy does it have at point B?
a. 5,000 J b. 10,000 J c. 15,000 J d. 25,000 J

F 20. At which point would it have the most total energy?
a. A b. B c. C d. D e. E f. all the same

C 21. At which point would it have the least potential energy?
a. A b. B c. C d. D e. E f. all the same
↳ b/c lowest point (of the choices)

A 22. At point E, if the coaster has a kinetic energy of 11,000 J, what is its potential energy?
a. 4,000 J b. 11,000 J c. 15,000 J d. 26,000 J

ABRHS PHYSICS (CP) NAME: KEY

Final Exam
Energy Review

Problems:

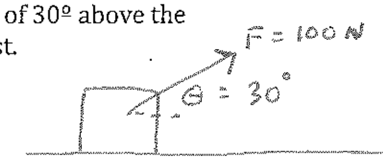
1. A 1.5 kg ball is dropped from the top of a 25 m tall building.
   a. How much PE does it have at the top?

   $PE = mgh$ $\quad PE = (1.5)(10)(25)$ $\quad \boxed{PE = 375\ J}$

   b. How fast is it moving when it hits the ground?

   PE turns into KE so $\quad K = \frac{1}{2}mv^2$ $\quad 375 = \frac{1}{2}(1.5)v^2$ $\quad v^2 = 500$ $\quad \boxed{v = 22.4\ m/s}$

2. You pull a 12 kg box 4 meters across the floor with a force of 100 N at an angle of 30º above the horizontal. There is also a frictional force of –35 N. The box was initially at rest.



   a. How much work did you do on the box?

   $W = Fd\cos\theta = (100)(4)(\cos 30)$ $\quad \boxed{W = 346\ J}$

   b. How much work did friction do on the box?

   $W = Fd = (-35)(4) =$ $\quad \boxed{W = -140\ J}$ No "cosθ" b/c friction is parallel to distance...

   c. What was the total work done on the box?

   Add them up! $\quad 346 - 140 =$ $\boxed{206\ J}$

   d. How much kinetic energy did the box gain?

   $\boxed{206\ J}$

   e. What is the final speed of the box?

   $\therefore K = \frac{1}{2}mv^2$ $\quad 206 = \frac{1}{2}(12)v^2$ $\quad v^2 = 34.3$ $\quad \boxed{v = 5.86\ m/s}$

3. Some students did a lab with a 0.65 kg ball. They tossed it up and down over a motion detector and recorded the initial height and velocity of the ball as shown in the table. Fill in the rest of the table.

(mass = 0.65 kg)	Height (m)	Velocity (m/s)	PE (J)	KE (J)	TE (J)
Initial Data	0.15	2.70	(.65)(10)(.15) 0.975 J	$\frac{1}{2}(.65)(2.7)^2$ 2.37 J	3.34
Maximum Height	0.515	0	3.34	0	3.34
Random Position	0.429	-1.3	2.79	$\frac{1}{2}(.65)(-1.3)^2$ 0.549	3.34

↓ b/c constant!

$PE = mgh$ $\quad K = \frac{1}{2}mv^2$ $\quad T = K + PE$

$3.34 = (.65)(10)h$

$h = .515$

$3.34 - 0.549$

 NAME: KEY

Final Review - Circular Motion

Equations and Constants:

$$F_c = \frac{mv^2}{r} \qquad a_c = \frac{v^2}{r} \qquad v = \frac{2\pi r}{T} \qquad f = \frac{1}{T}$$

Concepts:

1. If the frequency of a rotating object increases, the period of rotation
   a. Increases
   b. Decreases
   c. May increase or decrease
   d. Remains the same

B

2. A bicycle wheel turns at a rate of 60 rpm. This is equal to
   a. 60 Hz b. 0.02 Hz c. 1 Hz d. 6 Hz

C

3. You are driving home from school and you notice that when you take a sharp right turn your body leans to the left. This is caused by
   a. Centripetal force.
   b. Centrifugal force.
   c. Inertia.
   d. Conservation of momentum.

X skip it.

Questions 4 to 7 refer to the following:
A small ball is tied to the end of a string and swung in a horizontal circle.

4. The direction of the force on the ball is
   a. Toward the center.
   b. Tangent to the path.
   c. Away from the center.

A

5. The direction of the acceleration of the ball is
   a. Toward the center.
   b. Tangent to the path.
   c. Away from the center.

A

6. If the string suddenly snapped, the ball would fly off
   a. Toward the center.
   b. Tangent to the path.
   c. Away from the center.
   d. And continue and a circular path.

B

7. The small ball on a string is now swung in a vertical circle. Where along the path is the string most likely to break?
   a. At the top of the path. → b/c tension is greatest here
   b. At the bottom of the path.
   c. Somewhere in the middle, but definitely not at the top or the bottom of the path.
   d. The ball is equally likely to break at any point along the path.

B

8. If you double the radius of the circular path, and keep the speed the same, the centripetal force
   a. Decreases by a factor of two.
   b. Decreases by a factor of four.
   c. Increases by a factor of two.
   d. Increases by a factor of four.

A $F_c = \frac{mv^2}{r}$

 NAME: ____________

Final Review - Circular Motion

Problems:

1. A little boy is on a Merry-go-Round that is rotating with a constant rate of 10 rpm. He is sitting 5 meters from the center of the ride.
   a. How many seconds does it take to rotate once?

      $f = 10\,rpm \quad \therefore T = \frac{1}{f} = \frac{1}{10} \quad T = .1\,min \rightarrow$ Then $(.1)(60)$ $\boxed{T = 6 \text{ seconds}}$

   b. What is his linear speed?

      $V = \frac{2\pi r}{T} \quad V = \frac{2\pi(5)}{6} \quad \boxed{V = 5.24\,m/s}$

   c. What is the magnitude and direction of his acceleration?

      $a_c = \frac{V^2}{r} \quad a_c = \frac{(5.24)^2}{5} \quad \boxed{a_c = 5.48\,m/s^2, \text{ to center}}$

   d. If he were to sit 3 meters from the center, what would be his linear speed?

      $V = \frac{2\pi r}{T} \quad V = \frac{2\pi(3)}{6} \quad \boxed{V = 3.14\,m/s}$

   e. If he were to sit 3 meters from the center, what would be his frequency?

      Same! still $\boxed{10\,rpm}$ { or if you like $f = \frac{1}{T} = \frac{1}{6}$ $\boxed{f = 0.167\,Hz}$

      either answer is fine.

   f. If he were to sit 3 meters from the center, what would be his acceleration?

      $a_c = \frac{V^2}{3} = \frac{(3.14)^2}{3} \quad \boxed{a_c = 3.29\,m/s^2}$

2. A 1500 kg car is driving in a circle with a radius of 20 meters with a constant speed of 5 m/s.
   a. What is the period of this motion?

      $V = \frac{2\pi r}{T} \quad 5 = \frac{2\pi(20)}{T} \quad \boxed{T = 25.1\text{ sec.}}$

      remember Hz = rps

   b. What is the frequency of this motion?

      $f = \frac{1}{T} \quad f = \frac{1}{25.1} \quad \boxed{f = 0.04\,Hz}$

   c. What is the centripetal force on the car?

      $F_c = \frac{mv^2}{r} \quad F_c = \frac{(1500)(5)^2}{20} \quad \boxed{F_c = 1875\,N}$

   d. Where does the centripetal force come from?

      Friction between tires & road

   e. If the car were to have the same mass, but twice the velocity, how much centripetal force would it experience?

      $F_c = \frac{mv^2}{r} \quad F_c = \frac{(1500)(10)^2}{(20)} \quad \boxed{F_c = 7500\,N}$

Hey! Could do

$F_c = \frac{mv^2}{r} = 1875$ (befor)

So $F_c = \frac{(m)(2v)^2}{r} = 4\frac{mv^2}{r}$
$= 4(1875) = 7500$

 NAME: KEY

Final Review - Gravity

Equations and Constants:

$$F_g = \frac{Gm_1m_2}{d^2} \qquad g = \frac{GM_{planet}}{r_{planet}^2} \qquad G = 6.67 \times 10^{-11}\ Nm^2/kg^2$$

$m_{earth} = 6 \times 10^{24}$ kg $\qquad r_{earth} = 6.4 \times 10^6$ m

Concepts:

1. The earth exerts a gravitational force of 7000 N on a satellite. What force does the satellite exert on the earth?
   a. 700 N
   b. 7000 N
   c. more than 7000 N
   d. The answer cannot be calculated with the given information.

   B N3L!

2. According to the Law of Universal Gravitation, the force ↑ as the mass increases and the force ↓ as the distance increases.
   a. Increases, increases
   b. Decreases, increases
   c. Increases, decreases
   d. Decreases, decreases

   C

3. Why don't two people feel the gravitational force between them?
   a. The action reaction forces cancel each other out.
   b. They do feel the force.
   c. The force too small to be noticeable.
   d. Gravity is only a property of planets and moons, not people.

   C

4. Which of the following statements is true?
   a. Your mass depends on where you are in the universe but your weight is constant. X
   b. Both your mass and your weight depend on where you are in the universe. X
   c. Both your mass and your weight are constant everywhere in the universe. X
   d. Your weight depends on where you are in the universe and your mass is constant.

   D

remember weight is the force of gravity

Problems:

5. A small satellite has a mass of 500 kg on the surface of the earth. The satellite is then put in orbit around the earth.
   a. What is the weight of the satellite on the surface of the earth?

      $w = mg \qquad w = (500)(10) = \boxed{5000\ N}$

      could also do $F_g = G\frac{(500)(6\times10^{24})}{(6.4\times10^6)^2} = 4887\ N$ *

   b. What is the mass of the satellite in its orbit?

      $\boxed{500\ kg}$

   c. Is the weight of the satellite in its orbit more than, less than or the same as the weight of the satellite on the surface of the earth?

      weight is less b/c it is farther from the center of the earth

* this is more accurate than the 5000 b/c "10" is rounded off.

Final Review - Gravity

6. The gravitational force between two spheres in outer space is 1000 N.
   a. How large would the force be if one sphere ~~had twice~~ the mass?
   $\frac{(2)(1)}{(1)^2} = \times 2 = \boxed{2000 N}$
   b. How large would the force be if both spheres had twice the mass?
   $\frac{(2)(2)}{(1)^2} = \times 4 = \boxed{4000 N}$
   c. How large would the force be if the spheres were half the distance apart?
   $\frac{(1)(1)}{(1/2)^2} = \frac{1}{1/4} = \times 4 = \boxed{4000 N}$
   d. How large would the force be if you doubled both masses and the distance between the masses?
   $\frac{(2)(2)}{(2)^2} = \frac{4}{4} = \times 1 = \boxed{1000 N}$

7. Calculate the force of attraction between a 300 kg mass and 500 kg mass that are 20 cm apart.
   $F_G = G\frac{(300)(500)}{(.2)^2}$ ↳ $= .2$ m
   $\boxed{F_g = 2.5 \times 10^{-4} N \quad (\text{or } 0.00025 N)}$

8. The force between two 1000 kg spheres is 0.03 N. How far apart are the spheres?
   $0.03 = G\frac{(1000)(1000)}{d^2}$
   $d^2 = .00222$ $\boxed{d = 0.047 m}$

9. Imagine an astronaut of mass 75 kg is on the planet Venus. What is the acceleration due to gravity on Venus? ($M_{Venus} = 4.9 \times 10^{24}$ kg $R_{Venus} = 6 \times 10^6$ m $D_{Venus\text{-}sun} = 1.1 \times 10^{11}$ m)
   $g = G\frac{M}{R^2}$
   $g = G\frac{(4.9 \times 10^{24})}{(6 \times 10^6)^2}$
   $\boxed{g = 9.08 \ m/s^2}$

ABRHS PHYSICS (CP)   NAME: KEY

Final Exam
Ohm's Law Review

Chapters 32, 33

Equations: $V = \frac{PE}{Q}$ $\quad I = \frac{Q}{t}$ $\quad V = IR$ $\quad P = IV$ $\quad P = \frac{PE}{t}$ $\quad Q = ne$

Constants: e = 1.6 x 10^{-19} C   1 kW = 1000 W

Concepts:

C 1. Energy per charge is called
a. current. b. electric potential energy. c. voltage. d. resistance.

D 2. A battery does 18 J of work on 3 C of charge. What is its voltage?
a. 48 V. b. 18 V. c. 9 V. d. 6 V. e. 3 V.

$P = IV$
$60 = I(120)$
$I = 0.5$
$\therefore V = IR$
$120 = (.5)R$

A 3. An ordinary light bulb is marked "60 W" and "120 V." What is its resistance?
a. 240 Ω. b. 180 Ω. c. 120 Ω. d. 60 Ω. e. 15 Ω.

4. Current is a measure of:
a. force that moves a charge past a point.
B b. amount of charge that moves past a point per unit time.
c. speed with which a charge moves past a point.
d. resistance to the movement of a charge past a point.
c. energy used to move a charge past a point.

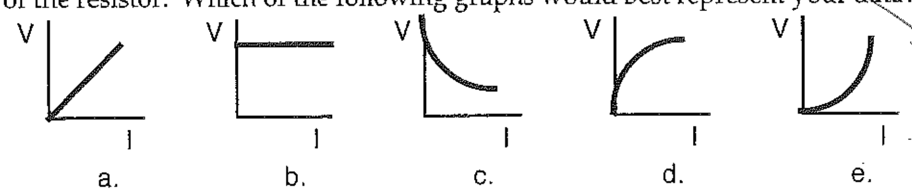
= 60 s $\frac{90}{60}$

B 5. If 90 C of charge move through a light bulb in one minute, what is its current?
a. 90 A. b. 1.5 A. c. 60 A. d. 2/3 A. e. 0 A.

6. Which of the following would have the least resistance, assuming they are all made of the same material?
D a. a long, skinny wire. b. a long, fat wire.
c. a short, skinny wire. d. a short, fat wire.

7. Imagine you did a lab investigating how the current through a resistor depends on the voltage of the resistor. Which of the following graphs would best represent your data?

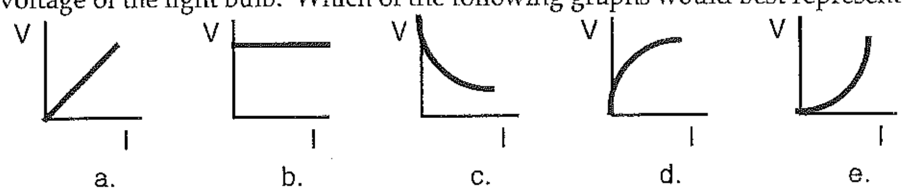
A



linear!
(∴ slope = resistance)

8. Imagine you did a lab investigating how the current through a light bulb depends on the voltage of the light bulb. Which of the following graphs would best represent your data?

E



R ↑ w/ current
so

9. Most batteries are marked "1.5 V." This means
a. There is 1.5 V of energy in the battery.
D b. Every electron that leaves the battery gets 1.5 J of energy.
c. There is 1.5 J of energy in the battery.
d. Each Coulomb of charge that leaves the battery is given 1.5 J of energy.
e. None of those are correct.

remember
Voltage = $\frac{\text{Energy}}{\text{charge}}$

Final Exam
Ohm's Law Review

Problems:

1. For each of the terms listed, give the variable (the letter in the equations) and the units (what the thing is measured in.)

Term	*Variable*	*Unit*
Power	P	W
Resistance	R	Ω
Current	I	A

Term	*Variable*	*Unit*
Voltage	V	V
Charge	Q	C
Energy	PE	J → kW·hr !!

2. How many electrons pass through a resistor in 1 hour if the there is a current of 0.5 A passing through the bulb? 1 hour = 60·60 = 3600 s.

$I = \frac{Q}{t}$ $.5 = \frac{Q}{3600}$ $\underline{Q = 1800\ C}$ → $Q = ne$

$1800 = n(1.6 \times 10^{-19})$

$\boxed{n = 1.13 \times 10^{22} \text{ electrons}}$

3. A 75 W light bulb is connected to a 120 V outlet.
   a. What is the current in the light bulb?

   $P = IV$ $75 = I(120)$ $\boxed{I = 0.625\ A}$

   b. What is the resistance of the light bulb?

   $V = IR$ $120 = (.625)R$ $\boxed{R = 192\ \Omega}$

   c. Why does the light bulb light up?

   The filament gets so hot (a few thousand degrees) that it glows – it's "white hot"

Oops! R = 6 Ω

* 4. 300 C of charge pass through a resistor in 2 minutes. → = 120 seconds
   a. What is the current passing through the resistor?

   $I = \frac{Q}{t}$ $I = \frac{300}{120}$ $\boxed{I = 2.5\ A}$

   b. What is the voltage across the resistor?

   $V = IR$ $V = (2.5)(6)$ $\boxed{V = 15\ V}$

   c. How much power is being dissipated in the resistor?

   $P = IV$ $P = (2.5)(15)$ $\boxed{P = 37.5\ W}$

ABRHS PHYSICS (CP) NAME: KEY

Final Exam
Circuits Review

Chapters 34, 35

Equations:

$$I = \frac{Q}{t} \qquad V = IR \qquad P = VI \qquad R_{series} = R_1 + R_2 + R_3 + \ldots$$

$$\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Concepts:

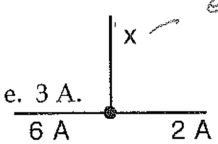
B 1. When building a simple circuit, the ammeter is placed in __S__ and the voltmeter is placed in __P__
a. series, series b. series, parallel
c. parallel, parallel d. parallel, series

A 2. In a simple circuit, potential energy is __lost__ at the resistors and takes the form of __heat__
a. lost, heat b. created, heat
c. lost, potential energy d. created, potential energy

A 3. Two resistors connected in series must have the same
a. current. b. voltage. c. resistance. d. power. e. energy.

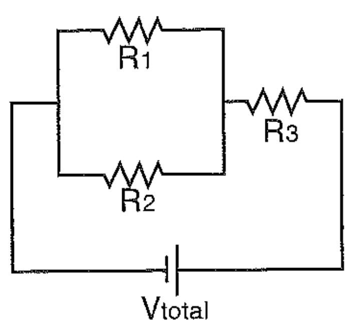
B 4. Two resistors connected in parallel must have the same
a. current. b. voltage. c. resistance. d. power. e. energy.

B 5. Three wires come together and the currents in two of them are shown to the right. Which of the following could be the current in the third wire?
a. 6 A. b. 8 A. c. 12 A. d. 2 A.. e. 3 A.



either 4 A or 8 A

junction rule!



loop rule!

C 6. In the circuit above, which of the following statements about voltages must be true?

I. $V_1 + V_3 = V_{total}$ ✓
II. $V_2 + V_3 = V_{total}$ ✓
III. $V1 + V2 + V_3 = V_{total}$ ✗

a. I only. b. II only. c. I & II only. d. all of them. e. none of them.

C 7. In the circuit above, the total current coming out of the power supply must be equal to
a. the current in R_1. b. the current in R_2.
c. the current in R_3. d. the sum of the currents in R_1, R_2 and R_3.

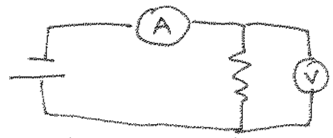
D 8. Connecting resistors in series always __↑__ the total resistance while connecting resistors in parallel always __↓__ the total resistance.
a. increases, increases b. decreases, decreases
c. decreases, increases d. increases, decreases

NAME: ____________________

Final Exam
Circuits Review

Problems:

1. A simple circuit contains a single 20 Ω resistor. The circuit voltage is set to 40 V.
   a. Sketch the circuit and include the placement of the ammeter and voltmeter.



   b. Calculate the current in the circuit.

$V = IR$ $\quad 40 = I(20)$ $\quad \boxed{I = 2A}$

   c. How much charge flows through the resistor in 5 minutes? → $5 \cdot 60 = 300$ seconds.

$I = \frac{Q}{t}$ $\quad 2 = \frac{Q}{300}$ $\quad \boxed{Q = 600\ C}$

   d. What is the power generated by this circuit?

$P = IV$ $\quad P = (2)(40) =$ $\quad \boxed{P = 80\,W}$

   e. How much electrical energy is "lost" in 5 minutes?

$V = \frac{PE}{Q}$ $\quad$ [Q is from part c]

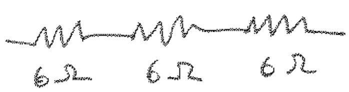
$40 = \frac{PE}{600}$ $\quad \boxed{PE = 24{,}000\ J}$

   f. What form does this "lost" energy take?

thermal energy (it gets hot.)

2. Imagine you have three identical 6 Ω resistors. There are only 4 ways they could be connected. Draw them and determine the total resistance of each.

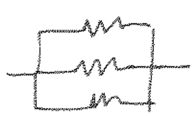
① all series



→ $R_T = R_1 + R_2 + R_3$

$\boxed{R_T = 18\,\Omega}$

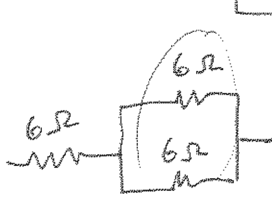
② all parallel



→ $\frac{1}{R_T} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$

$\frac{1}{R_T} = \frac{1}{2}$ → $\boxed{R_T = 2\,\Omega}$

③



$\frac{1}{R_T} = \frac{1}{6} + \frac{1}{6}$

$\frac{1}{R_T} = \frac{1}{3}$

$\underline{R_T = 3\,\Omega}$ then $6\,\Omega + 3\,\Omega = \boxed{9\,\Omega}$

④

$R_T = 6 + 6$

$\underline{R_T = 12\,\Omega}$ then $\frac{1}{R_T} = \frac{1}{12} + \frac{1}{6} = \frac{3}{12}$

$\frac{1}{R_T} = \frac{1}{4}$ $\quad \boxed{R_T = 4\,\Omega}$