.....Your Ticket to Passing Physical Science - #1

Review – Units Matching

_____ 1.	Time	A)	amperes (A or amps)
_____ 2.	Distance or Height	B)	Hertz (Hz)
_____ 3.	Velocity	C)	Joules (J)
_____ 4.	Acceleration	D)	Joules (J)
_____ 5.	Force	E)	grams/Liter or g/mL or g/cm^3
_____ 6.	Mass	F)	kilograms (kg) or grams (g)
_____ 7.	Kinetic or Potential Energy	G)	liters or milliliters or cm^3
_____ 8.	Work	H)	meters (m)
_____ 9.	Force of Gravity	I)	meters (m)
_____ 10.	Weight	J)	meters/second (m/s)
_____ 11.	Power	K)	meters/second^2 (m/s^2)
_____ 12.	Frequency	L)	Newtons (N)
_____ 13.	Wavelength	M)	Newtons (N)
_____ 14.	Density	N)	Newtons (N)
_____ 15.	Volume	O)	ohms (Ω)
_____ 16.	Voltage	P)	seconds (s), minutes (min), hours (h)
_____ 17.	Current	Q)	volts (V)
_____ 18.	Resistance	R)	watts (W)

5-Minute Lesson - Objective 5.01

Dalton:
1) All matter is made of atoms. (True)
2) Atoms are indivisible and indestructible. (False →Atoms are divisible because they are made of even smaller particles – the proton, neutron, and electron).
3) All atoms of the same element are the identical (False → isotopes of the same element have different numbers of neutrons.). **All atoms of different elements are different** (True → each element has its own number of protons (atomic number)).
4) Atoms combine in whole-number ratios to form compounds →H_2O (2:1 ratio) (True)

Thomson:
- Sent an electric current through a gas in a **cathode ray tube** & **discovered the electron**.
- Came up with the **Plum Pudding Model** = the atom is a ball of positive charge with negative charges floating in it.

Rutherford:
- Shot **alpha particles** at **gold foil**.
  - Most of the particles went straight through →**The atom is mostly empty space.**
  - Some of the particles bounced back → **The atom contains a small, dense, positively-charged nucleus.**

Bohr:
- **Planetary Model** - Electrons circle the nucleus like planets orbit the sun.
- **Electrons occupy energy levels**.

Electron Cloud Model
- Electrons **do NOT travel in orbits** like Bohr thought, but they **do occupy energy levels.** We only know the **probability** of finding an electron in a certain place.

Quiz – Objective 5.01

Identify the scientist or model: Dalton, Bohr, Electron Cloud Model, Rutherford, Thomson

(May be used more than once.)

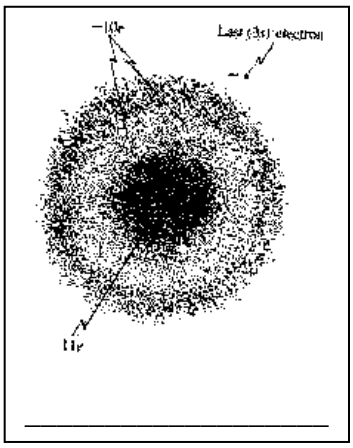
_____ 1. Gold Foil Experiment
_____ 2. Cathode Ray Tube
_____ 3. Planetary Model
_____ 4. Said that atoms combine in whole-number ratios to form molecules
_____ 5. Determined that we cannot know the exact location of electrons
_____ 6. Discovered the electron
_____ 7. Discovered the nucleus
_____ 8. Discovered that atoms are mostly empty space

Which 2 of Dalton's statements are NOT true according to our current understanding of the atom?

_____ 1. Atoms of different elements are always different.
_____ 2. Atoms of the same element are always the same.
_____ 3. All matter is made up of atoms.
_____ 4. Atoms combine in whole number ratios.
_____ 5. Atoms cannot be divided into smaller particles.

Identify the scientist or model: Dalton, Bohr, Electron Cloud Model, Rutherford, Thomson

(May be used more than once.)



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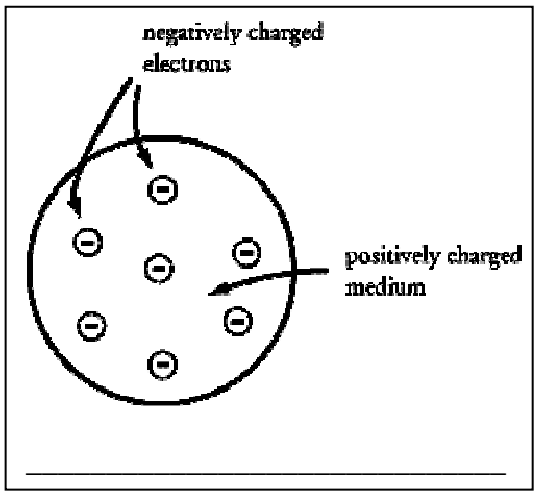

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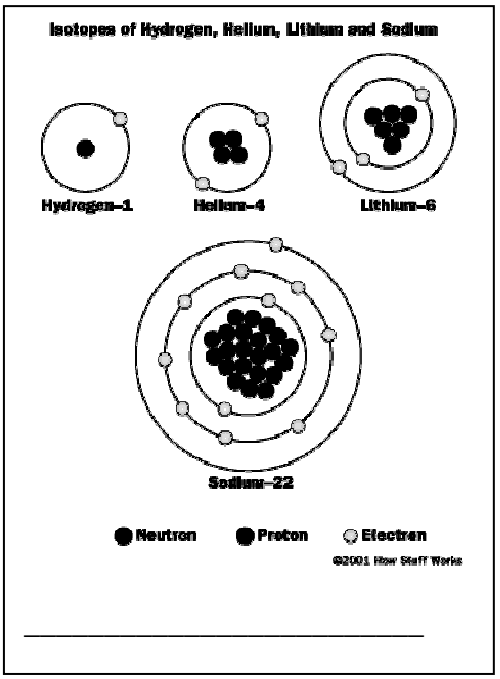

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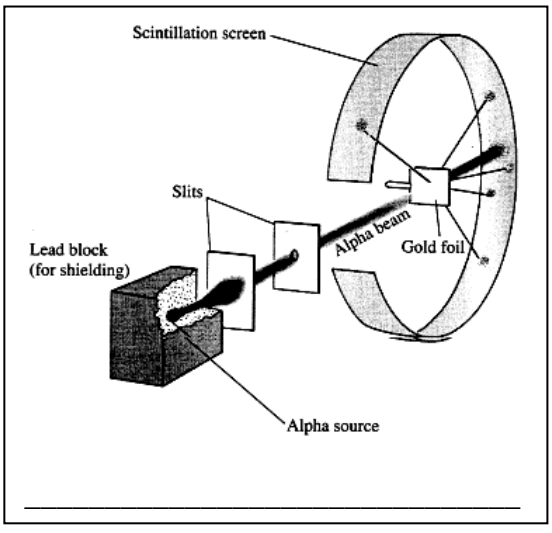

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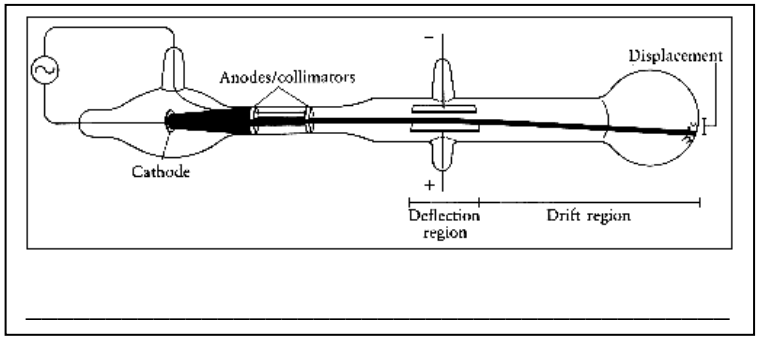

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7-Minute Lesson – Objective 5.02

Subatomic Particle	Charge	Location
Proton	Positive (+)	Nucleus
Neutron	Neutral (no charge)	Nucleus
Electron	Negative (-)	Energy Levels (outside nucleus)

*Most of the mass of the atom is found in the nucleus (protons and neutrons). Electrons are tiny!!!

Atomic Number: # of protons
Mass Number: # of protons + neutrons

How many protons, neutrons, and electrons?

Mass Number → 31 / Atomic Number → 15 **P** 3- ← Charge

15 protons - from atomic number
16 neutrons - mass number minus atomic number
18 electrons - 3- charge means gained 3 electrons. Take the # of protons (15) and add 3.

Ca-39 ← Mass Number

20 protons - from atomic number on periodic table
19 neutrons - mass number minus atomic number
20 electrons – no charge (same as # of protons)

20
Ca
Calcium
40.08

Isotopes – same element, different number of neutrons (different mass).
Ex. Carbon-12 and Carbon-14
(both have 6 protons, but one has 6 neutrons and the other has 8 neutrons)

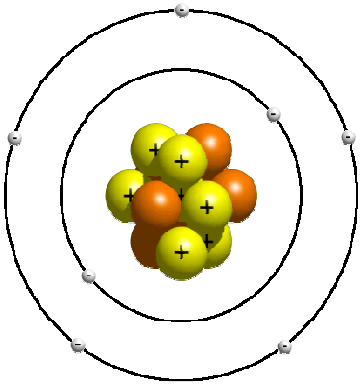
Which isotope is more common: Chlorine-35 or Chlorine-37?
(answer: chlorine-35 because the average atomic mass is closer to 35 than to 37)

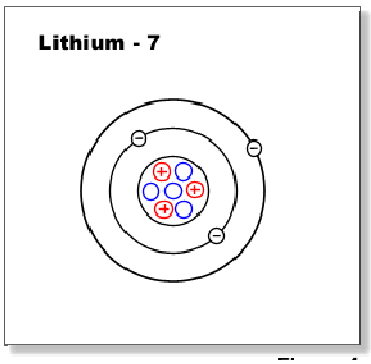
17
Cl
Chlorine
35.45 ← **Average Atomic Mass**

Bohr models

- Protons and neutrons in the nucleus
- Electrons in energy levels →

Energy Level	Max # of e-
1	2
2	8
3	18
4	32





Quiz – Objective 5.02

1) Fill in the table:

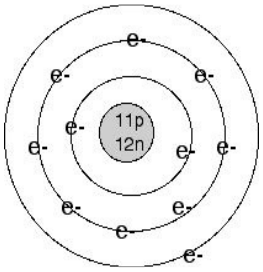
	Protons	Neutrons	Electrons
$^{39}_{19}K^{1+}$			
Sr-88			
$^{15}_{7}N^{3-}$			

2) Circle the two that are isotopes:

$^{14}_{5}X$ $^{14}_{7}X$ $^{15}_{7}X$ $^{15}_{6}X$

3) Which element is shown in the Bohr Model?

a) Magnesium-11
b) Magnesium-23
c) Sodium-23
d) Sodium-12

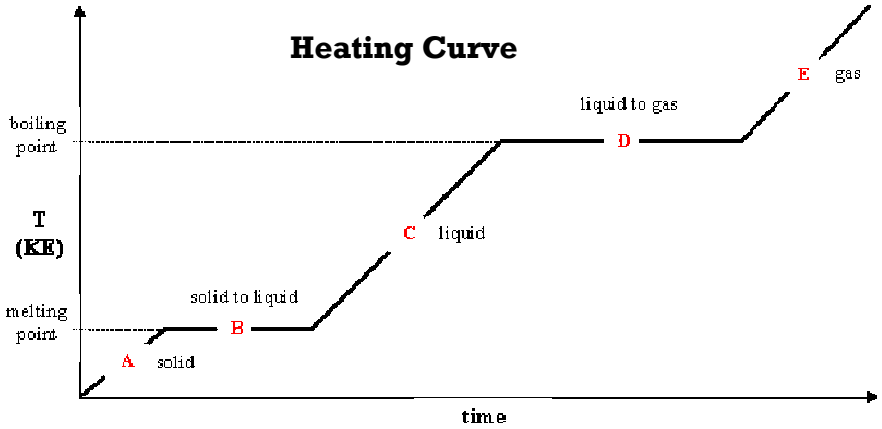


5-Minute Lesson – Objective 5.03

Physical properties – state (solid, liquid, gas), density, color, hardness, electrical conductivity
Physical changes – changes in shape (cutting), phase changes (melting, etc.), dissolving

	Melting Point	Boiling Point
Substance A	10°C	250 °C
Substance B	-40 °C	80 °C

- At -20 °C, Substance A is a **solid** (-20 °C is colder than its melting point).
- At -20 °C, Substance B is a **liquid** (between the melting point and the boiling point).
- At 90 °C, Substance A is a **liquid** (between the melting point and the boiling point).
- At 90 °C, Substance B is a **gas** (90 °C is higher than the boiling point).



*Temperature does not change during phase changes (melting point, boiling point)

Density

- $d = \frac{m}{v}$ mass – grams; volume – mL or L or cm^3; density – g/mL or g/cm^3 or g/L

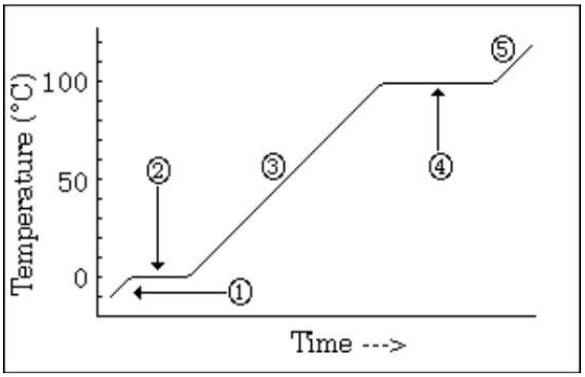
.....Your Ticket to Passing Physical Science - #5

Quiz – Objective 5.03

	Melting Point	Boiling Point	Density
Zinc	420°C	907 °C	7.14 g/cm^3
Mercury	-39 °C	357 °C	13.6 g/cm^3

1) Zinc is a [solid, liquid, or gas?] at 300 °C.
2) Zinc is a [solid, liquid, or gas?] at 500 °C.
3) Mercury is a [solid, liquid, or gas?] at 300 °C.
4) Mercury is a [solid, liquid, or gas?] at 500 °C.
5) If an unknown substance has a mass of 20 g and a volume of 1.47 cm^3, is it zinc or mercury?
6) What is the volume of a substance with a density of 12 g/mL and a mass of 6 g? _____

7) **Use the Heating Curve.**
   What phase(s) would you see at:
   Point 1. _____
   Point 2. _____
   Point 3. _____
   Point 4. _____
   Point 5. _____
8) What is the melting point of this substance? _____
9) What is the boiling point of this substance? _____
10) Is this substance water: Yes/No?



5-Minute Lesson – Objective 6.01

Periodic Table: Columns = Groups or Families Rows = Periods

	Family Name	# of Valence e-	Charge
Group 1	Alkali Metals	1	1+
Group 2	Alkaline Earth Metals	2	2+
Group 3-12	Transition Metals	3-12	1+, 2+, or 3+ (generally)
Group 13	Boron Family	3	3+
Group 14	Carbon Family	4	4+
Group 15	Nitrogen Family	5	3-
Group 16	Oxygen Family	6	2-
Group 17	Halogens	7	1-
Group 18	Noble Gases	8 *Except: He (2)	0

Metals – left side of zig-zag line, shiny, ductile, malleable, lose electrons, high melting point and boiling point, usually solids at room temperature, excellent conductor of electricity
Nonmetals – right side of zig-zag line, dull, brittle, gain electrons, low melting point and boiling point, usually liquids or gases at room temperature, poor conductor
Metalloids – having a side on the zig-zag line, have characteristics of both metals and nonmetals, semiconductors

Exceptions: H is on the left, but is a nonmetal; Al is on the zig-zag line, but is a metal.

Atomic size (or atomic radius) increases as you move down a column.
Atomic size (or atomic radius) decreases as you move from left to right across a row.

- **Francium** is the largest atom; **Helium** is the smallest atom.

Quiz – Objective 6.01

1) What family are the following elements in?
   a. Bromine: _____
   b. Lithium: _____
   c. Strontium: _____
2) Is it a metal, nonmetal or metalloid?
   a. Calcium: _____
   b. Gallium: _____
   c. Sulfur: _____
   d. Hydrogen: _____
   e. Aluminum: _____
   f. Solid at room temperature, high melting point, shiny, conducts electricity: ____
   g. Gas, gains electrons, right side of the zig-zag line: _____
3) Which has a larger atomic size?
   a. Magnesium or Cesium?
   b. Potassium or Calcium?
4) Which has a smaller atomic radius?
   a. Phosphorus or Fluorine?
   b. Sodium or Aluminum?
5) Fill in the table:

Element	# Valence e-	Charge
Calcium		
Phosphorus		
Chlorine		
Helium		

5-Minute Lesson – Objective 6.02

Ionic Compounds – made from a **metal** (or polyatomic ion) & a **nonmetal** (or polyatomic ion)
- Electrons are **transferred** from the metal to the nonmetal.
- Cation = positive ion (metal); Anion = negative ion (nonmetal)

Covalent Compounds – made from a **nonmetal** & a **nonmetal**
- Electrons are **shared**.

Naming Compounds

Ionic: no prefixes, change the ending to –ide unless ends with polyatomic ion.

$CaCl_2$	calcium chloride
$Ca_3(PO_4)_2$	calcium phosphate

Covalent: use prefixes (no mono- for 1st element); change ending to –ide

N_3O_4	trinitrogen tetroxide
NO_2	nitrogen dioxide
NO	nitrogen monoxide

1-mono
2-di
3-tri
4-tetra
5-penta
6-hexa
7-hepta
8-octa
9-nona
10-deca

Writing Formulas from Names

Ionic: criss-cross & reduce to find subscripts; use parentheses for polyatomic ions

Potassium oxide	$K^{1+}\ O^{2-}$	→ K_2O
Magnesium phosphate	$Mg^{2+}\ PO_4^{3-}$	→ $Mg_3(PO_4)_2$

Covalent: prefixes tell you the subscripts

Disulfur trioxide	S_2O_3

Quiz – Objective 6.02

1) Is the compound ionic or covalent?
   a. SBr_2: _____
   b. $SrCl_2$: _____
   c. $CaCO_3$: _____
2) Name the following compounds:
   a. BaF_2: _____
   b. S_3O_5: _____
   c. Na_2CrO_4: _____
   d. H_2O: _____
   e. NH_4OH: _____
3) Write the formulas for the following compounds:
   a. Dinitrogen tetrasulfide: _____
   b. Carbon monoxide: _____
   c. Lithium oxide: _____
   d. Magnesium sulfide: _____
   e. Potassium sulfate: _____
   f. Calcium hydroxide: _____

5-Minute Lesson – Objective 6.03

Chemical Reactions: Reactants →Products

Balance Equations: Place coefficients (large numbers) in front of the compounds to make sure that you have the same number of each element on the left and on the right side.

Example: Which set of coefficients would balance the equation?

____N_2 + ____ H_2 → ____ NH_3

a) 1, 1, 2
b) 1, 3, 2
c) 2, 3, 1

Correct Answer: b (2 nitrogens on the left and right; 6 hydrogens on the left and right)

Types of Chemical Reactions:

Synthesis:	A + B → C	(One product)
Decomposition:	C → A + B	(One reactant breaks down into multiple products)
Single Replacement:	A + BC → AC + B	(A lone element kicks out an element in a compound)
Double Replacement:	AC + BD →AD + BC	(Two compounds as reactants; switch partners)

Quiz – Objective 6.03

Balance the equation and write the reaction type (Synthesis, Decomposition, SingleR, DoubleR).

1) _____ Zn + _____ HCl → _____ $ZnCl_2$ + _____ H_2 Type: _____

2) _____$Ca_3(PO_4)_2$ + _____ NaBr → _____Na_3PO_4 + _____ $CaBr_2$ Type: _____

3) _____H_2O → _____H_2 +_____O_2 Type: _____

10-Minute Lesson – Objectives 6.04 and 6.05

4 Indications that a Chemical Reaction has taken place:

1) Formation of a Gas
2) Formation of a Precipitate (a solid when 2 liquids react)
3) Release or absorption of heat or light (energy)
4) Drastic color change

Types of Physical Changes: Phase Changes (Melting, etc.), Dissolving, Change in shape (cutting)

Exothermic Reactions – Reactions that release energy (feel hot)
Endothermic Reactions – Reactions that absorb energy (feel cold)

Solution Terms

Solute – the substance that dissolves (ex. salt)
Solvent – the substance that the solute is dissolved into (ex. water)

To speed up dissolving:

- Stir it, Heat it up, increase the surface area (crush it)
- The higher the concentration of a solution, the longer it takes to add more solute.

Solubility Curves

- For Solids: As the temperature increases, you can dissolve more in the solution

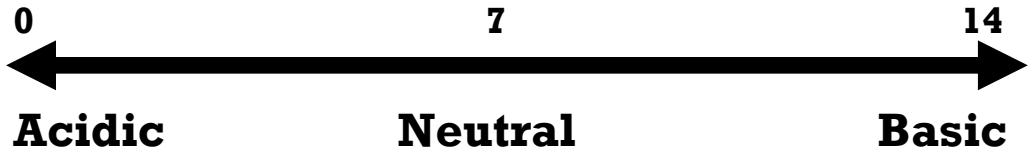
Saturated – solution holds the maximum amount of solute (on the line)
Unsaturated – solution holds less than the maximum amount (less than the line)
Supersaturated – solution holds more than the maximum amount (higher than the line)

Acids and Bases

Acids – Ex. HCl, H_2SO_4; releases **H+** when dissolved in water, sour, corrosive, turns pH paper **red**

Bases – Ex. NaOH, $Mg(OH)_2$; releases **OH-** when dissolved in water, bitter, corrosive, slippery, turns pH paper **blue**; turns phenolphthalein **bright pink**

Neutral – Ex. Water



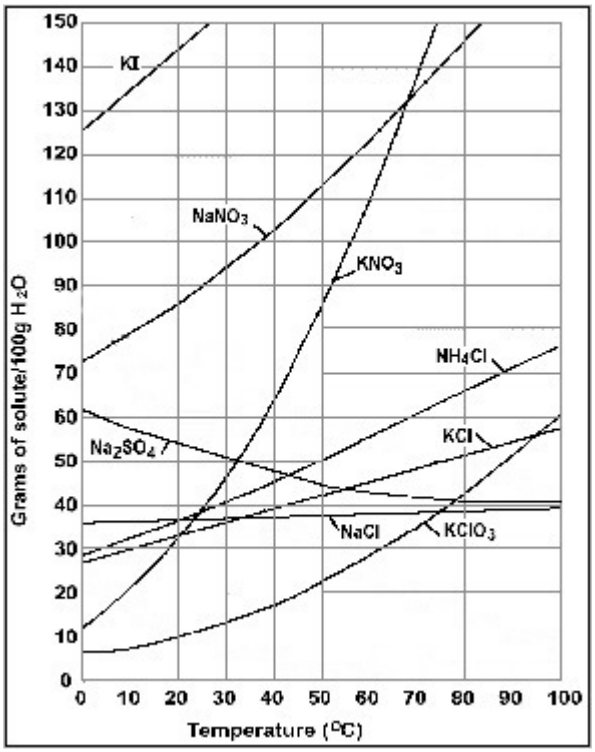
Neutralization Reaction: Acid + Base → Salt + Water
$HCl + NaOH \rightarrow NaCl + H_2O$

Electrical Conductivity

Ionic Compounds & Acids conduct electricity when dissolved. Covalent compounds do not!

Quiz – Objectives 6.04 and 6.05

1) Is this a <u>chemical</u> reaction or a <u>physical</u> change?
   a. Burning Wood: _____
   b. Boiling: _____
   c. Rusting: _____
   d. Dissolving: _____
   e. Putting zinc in hydrochloric acid and producing hydrogen: _____
2) In a carbonated soda, which is the **solute** and which is the **solvent**?
   a. Carbon dioxide: _____
   b. Water: _____
3) Is this exothermic or endothermic?
   a. Burning candle: _____
   b. Baking a cake: _____
   c. Freezing: _____
   d. Melting: _____
4) Will it conduct electricity when dissolved?
   a. SO_3: _____
   b. NaCl: _____
5) Acid or Base?
   a. $Ca(OH)_2$: _____
   b. HBr: _____
   c. H_2SO_4: _____
   d. Turns pH paper red: _____
   e. Bitter: _____
   f. pH > 7: _____
6) Use the Solubility Curves on the right →
   a. As temperature increase, the amount of $KClO_3$ that can be dissolved [<u>increases or decreases?</u>].
   b. At 50°C, is the solution saturated, unsaturated or supersaturated?
      i. 113 g $NaNO_3$: _____
      ii. 120 g $NaNO_3$: _____
      iii. 100 g $NaNO_3$: _____



2-Minute Lesson – Objective 6.06

<u>Nuclear Reactions</u>

	What is given off by nucleus	Charge
Alpha Decay	$^{4}_{2}He$	2+
Beta Decay	$^{0}_{-1}e$	1-
Gamma Decay	Gamma Ray (energy)	0

<u>Fission</u> – Large nucleus **splits** into 2 smaller nuclei
<u>Fusion</u> – 2 small nuclei **fuse** together to form one larger nucleus.

Quiz – Objective 6.06

1. Identify the reaction as alpha decay, beta decay, gamma decay, fission, or fusion.

$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{56}Ba + {}^{93}_{36}Kr + 3\,{}^{1}_{0}n$ _____

$^{2}H + {}^{3}H \rightarrow {}^{4}He$ _____

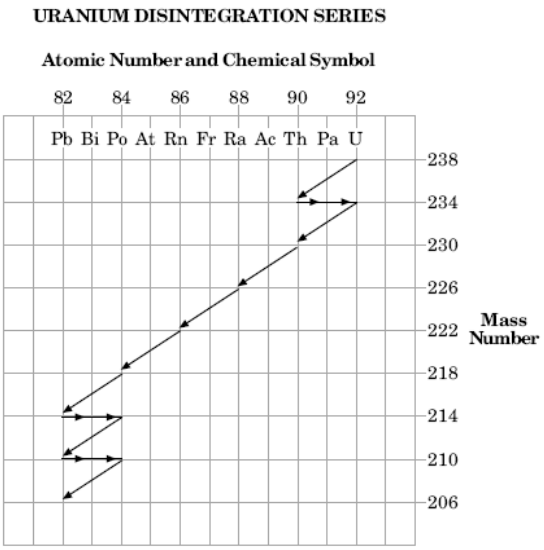
$^{238}_{92}U^{*} \rightarrow \gamma + {}^{238}_{92}U$ _____

$^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th$ _____

$^{238}_{92}U \rightarrow {}^{0}_{-1}e^{-} + {}^{238}_{93}Np$ _____

2. Complete the nuclear reactions: $^{15}_{7}N \rightarrow {}^{4}_{2}He +$ _____

$^{15}_{7}N \rightarrow$ _____ $+ {}^{0}_{-1}e$



3. Use the Uranium Disintegration Series

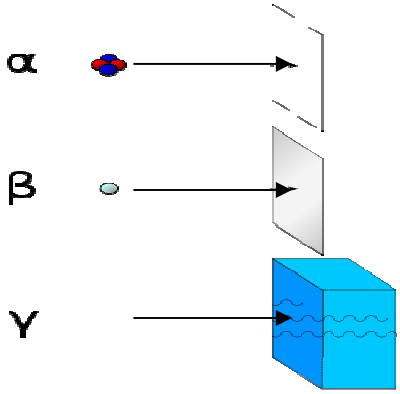
a) How many alpha decays? ____

b) How many beta decays? ____

c) When U-234 decays, it undergoes [alpha or beta?] decay.

4. Which way would the path of the particle bend? UP or DOWN?

NEGATIVELY-CHARGED PLATE



UP or DOWN or would not bend?

UP or DOWN or would not bend?

UP or DOWN or would not bend?

POSITIVELY-CHARGED PLATE

5-Minute Lesson – Objective 2.01 – CONCEPT review

Frame of Reference – what you compare the motion of an object to; how fast an object is moving depends on what you compare it to (All motion is relative!)
Distance- Total path traveled
Displacement- An object's change in position (straight-line distance from start to endpoint).

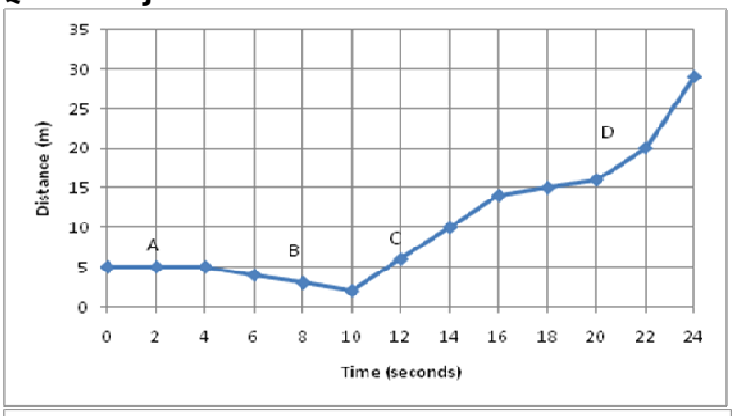
Speed – distance traveled per time (30 m/s)
Velocity – speed with direction (30 m/s, north)
Average Speed = **total** distance traveled / **total** time

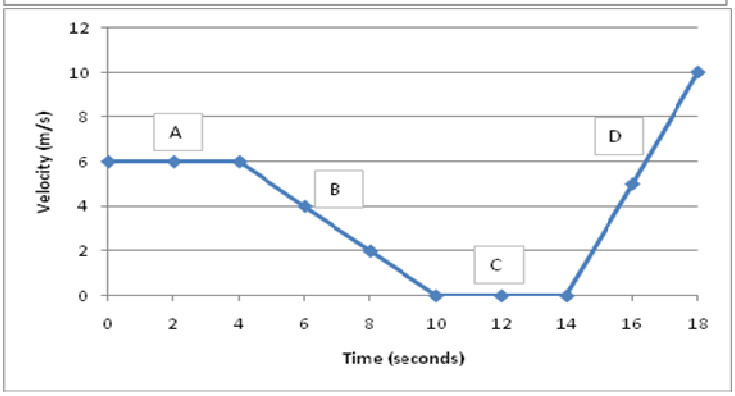
Acceleration-Change in velocity over time (speeding up, slowing down, changing direction)-m/s^2

Slope of a distance-time graph: velocity (speed)
- Therefore, positive slope means positive velocity (moving forward).
- Zero slope means zero velocity (not moving)
- Changing slope (curve) means changing velocity (acceleration).

Slope of a velocity-time graph: acceleration
- Positive slope means positive acceleration (speeding up)
- Negative slope means negative acceleration (slowing down)
- Zero slope means zero acceleration (moving at constant speed)
- An object that is not moving has a velocity of 0.

Quiz – Objective 2.01





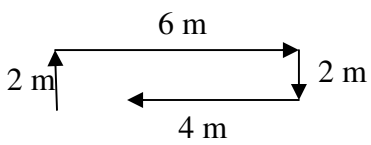
Use the Distance-time Graph:
1. Is the object at rest, moving at constant velocity, or accelerating?
Segment A: _____
Segment B: _____
Segment C: _____
Segment D: _____

2. What is the object's distance at 22 seconds? _____

Use the Velocity-time Graph:
3. Is the object at rest, moving at constant velocity, or accelerating?
Segment A: _____
Segment B: _____
Segment C: _____
Segment D: _____

4. What is the object's velocity at 16 seconds? _____

Use the diagram to the right.
5. What is the object's distance? _____
6. What is the object's displacement? _____



5-Minute Lesson – Objective 2.02 (CONCEPT review)

- Acceleration due to Gravity (g): All objects on Earth accelerate towards the ground at an acceleration of 9.8 m/s/s.
- Weight (F_g) = the force of gravity acting on an object
- Net Force: overall force acting on an object
- Friction Force – a force that opposes the motion of an object
- Newton's 3 Laws of Motion
    - 1st Law (Law of Inertia) – An object at rest will stay at rest. An object in motion will stay in motion at constant velocity (same speed, straight line).
        - Inertia: resistance to a change in motion; the more mass an object has, the more inertia (resistance) it has.
    - 2nd Law ($F_{net} = ma$) – If a net force is acting on an object, the object will accelerate.
        - The greater the force applied, the greater the acceleration.
        - The more mass an object has, the harder it is to accelerate.
    - 3rd Law ($F_{A \text{ on } B} = -F_{B \text{ on } A}$) – For every action there is an equal but opposite reaction.

Quiz – Objective 2.02

1) The [mass or weight?] of a book would be the same on Earth as on the moon.
2) If a box is pushed towards the right, the direction of the friction force acting on the box is [up, down, left or right?].
3) What is the net force acting on a box that is being pulled to the right with a 50 N force and to the left with a 10 N force? _____ to the _____
4) If the mass of your object doubled but the force you applied to the object stayed the same, the object would accelerate [faster or slower?].
5) Which law (1st, 2nd, or 3rd)?
    _____a. If you hit a baseball, it will accelerate.
    _____b. When you hit a baseball with a bat, the baseball also exerts a force on the bat, causing it to recoil.
    _____c. When you turn a corner in a car, your body wants to keep going straight.
    _____d. When you push backwards on the water with a paddle, the canoe moves forward.
    _____e. If you slam your brakes in a car, a canoe on the top of the car slides forward.

5-Minute Lesson – Objective 3.01 and 3.02 (CONCEPT review)

Kinetic Energy – Energy of motion (any moving object has kinetic energy) - Joules
Potential Energy – Stored energy (an object that is held at rest above the ground has PE) – Joules
- Types of PE: gravitational, elastic, chemical

Law of Conservation of Energy – Energy is neither created nor destroyed; it just changes form.
- Ex. When an object falls, all of the potential energy that it started with, changes into kinetic energy as it falls and speeds up.

Work – to do work, you must apply a force to an object and move the object a certain distance
Power – the amount of work done per second

Quiz – Objective 3.01 and 3.02

1) The faster an object is moving, the greater its [kinetic or potential?] energy.
2) The higher above the ground an object is, the greater its [kinetic or potential?] energy.
3) You push against a table, but it does not move. How much work do you do? _____
4) If a roller coaster has 50,000 J of potential energy at the top of the first hill, how much kinetic energy does it have at the lowest point? _____

5-Minute Lesson – Objective 3.03 (CONCEPT review)

Temperature – the average kinetic energy of the particles in a substance.

- The faster the particles that make up an object are moving, the higher the object's temperature.

Heat – the transfer of thermal energy from an object at a high temperature to an object at low temperature.

3 Types of Heat Transfer

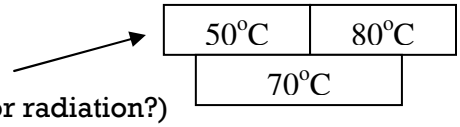
1) Conduction – heat transfer between objects that are touching
2) Convection – heat transfer by the rising of low density (hot) liquid/gas and the sinking of high density (cold) liquid/gas.
3) Radiation – heat transfer by electromagnetic radiation (ex. ultraviolet radiation)

Specific Heat – the amount of heat needed to increase the temperature of a substance

- The larger the specific heat, the longer it takes to heat up and cool down.

No machine is 100% efficient – some usable energy is always lost because friction changes it into heat

Quiz – Objective 3.03



1) Draw 3 arrows to show the direction of heat transfer.
2) What type of heat transfer (conduction, convection, or radiation?)
   a. Your microwave heats your food. _____
   b. A fireplace heats the entire house. _____
   c. Water boiling. _____
   d. You put a pan on the stove to cook food. _____
   e. The sun heats the Earth. _____
3) Which will heat up faster, **iron** (specific heat = 0.449 J/g*°C) or **copper** (specific heat = 0.385 J/g*°C)? _____

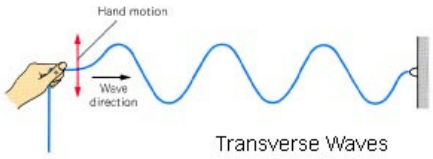
5-Minute Lesson – Objective 3.04 (CONCEPT review)

Mechanical Waves – waves that require matter to travel through, ex. sound, water, earthquakes

- Electromagnetic (light) waves can travel through empty space (are NOT mechanical waves)

Transverse waves

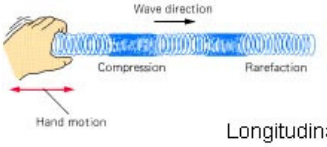
- crest (highest point), trough (lowest point)
- amplitude (rest to crest)
- wavelength (crest to crest)
- ex. light wave



Transverse Waves

Longitudinal (compressional) waves

- compression (maximum density)
- rarefaction (minimum density)
- ex. sound wave, slinky



Longitudinal Waves

Frequency - # cycles/second

Period - # seconds/cycle

Sound waves

- Higher Amplitude → More Energy (louder)
- Higher Frequency → higher pitch
- Speed of sound is fastest in solids and slowest in a gas (ex. air)

Electromagnetic waves (radiation)

- Higher frequency → shorter wavelength → higher energy
- Lower frequency → longer wavelength → lower energy
- Speed is fastest in a vacuum (no particles – 3×10^8 m/s) and slowest in a solid.
- Visible light – the wavelength (or frequency) determines the color of the light

Quiz – Objective 3.04

1) A sound that is very loud (has a lot of energy) will have a very high [frequency, amplitude, or wavelength?].
2) A low pitch sound has a very low [frequency, amplitude, or wavelength?].
3) For electromagnetic waves, a high energy wave has a high [frequency or wavelength?] and a short [frequency or wavelength?].
4) Which type of electromagnetic wave has the higher energy: radio wave or gamma ray?
5) Which type of electromagnetic wave has the higher energy: red light or violet light?
6) Which type of electromagnetic wave has a shorter wavelength: microwave or infrared?
7) Which type of electromagnetic wave has a higher frequency: ultraviolet or violet light?
8) Which type of electromagnetic wave has the smaller frequency: x-rays or gamma rays?
9) The color of visible light is determined by the [wavelength, amplitude, or speed] of the wave.
10) Which travels faster: light or sound?
11) Light travels fastest through a [vacuum, gas, liquid, or solid?].
12) Sound travels fastest through a [vacuum, gas, liquid, or solid?].

5-Minute Lesson – Objective 4.01 and 4.02 (CONCEPT review)

Static electricity – the build-up of excess (stationary) charges

- Like charges repel and opposite charges attract
- On drier days it is easier for objects to become charged (charges build up in one place rather than escaping onto water molecules in the air).

Types of charging:

1) Friction – charging by rubbing
2) Conduction – charging by touching
3) Induction – charging by holding a charged object close to a neutral object

Current Electricity – moving charges (open circuit – OFF)

Series Circuit – only one path for current to flow; same current throughout; all lightbulbs have to share the voltage of the battery; dimmer bulbs than parallel; if one goes out, they all go out.

Parallel Circuit – multiple paths, current splits to go through separate paths & recombines when returns to battery (current is different in different places); draws more current out of the battery than series circuits; each lightbulb gets entire voltage of battery; brighter than series; if one goes out, the rest stay on.

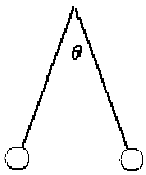
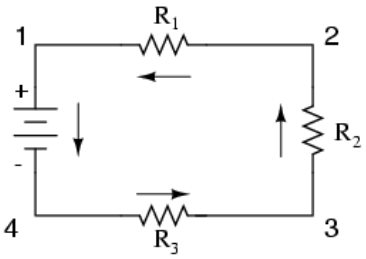


Figure A



Quiz – Objective 4.01 and 4.02

1) These pith balls have the [same or opposite?] charge.
2) Figure A is a [series or parallel?] circuit:
   a. If R3 went out, which bulbs would light? _____
   b. Would the current be the same at point 2 compared to point 3? _____
3) Figure B is a [series or parallel?] circuit:
   a. If R1 went out, which bulbs would light? _____
   b. Would the current be the same at point 1 and point 4?
4) Lightbulbs in [series or parallel?] are brighter than those in [series or parallel?].
5) The higher the voltage in a circuit, the [higher or lower?] the current.
6) The higher the resistance in a circuit, the [higher or lower?] the current.

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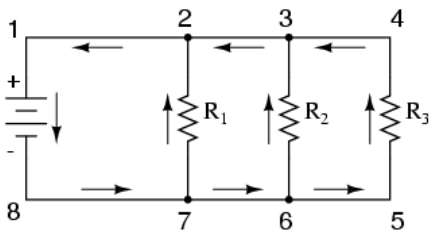
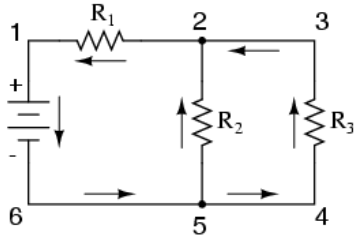
Figure B



7) In this complex circuit:
   a. If R1 went out, which bulbs would light? _____
   b. If R2 went out, which bulbs would light? _____
   c. If R3 went out, which bulbs would light? _____

Series-parallel



5-Minute Lesson – Objective 4.03 (CONCEPT review)

Magnets (have a N and S pole)

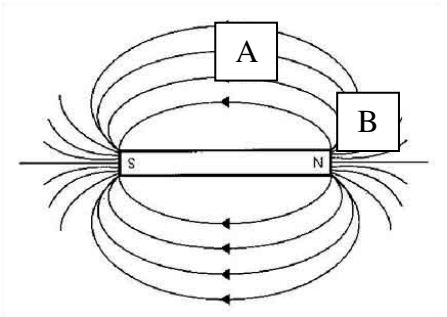
- Magnetic domains – if the domains (mini-magnets) inside a material are aligned, the material is magnetized.
  - To demagnetize: drop it, hammer it, heat it (so the domains are not aligned)
- Opposite poles attract, like poles repel
- Magnetic field is strongest near the poles.

Electromagnets – a wire that a current is traveling through will have a magnetic field around it.

- If you coil a wire into a solenoid & put a piece of iron inside, the iron will become magnetized.
- Generators – changes mechanical energy into electrical energy
  - When you rotate a coil of wire in a magnetic field, electrical current will start the flow through the wire.
- Electric Motors – changes electrical energy into mechanical energy
  - A coil of wire with current moving through it will rotate when placed in a magnetic field.

Quiz – Objective 4.03

1) Which location would have the strongest magnetic field: A or B?



2) In an electromagnet, the strength of the magnet will increase if you:
   a. [increase or decrease?] the number of coils.
   b. [increase or decrease?] the voltage of the battery.
   c. [increase or decrease?] the current going through the wire.
3) The poles will switch on an electromagnet if you [change the voltage of the battery, decrease the number of coils, or change the direction of the current?].
4) Do the field lines show that these poles are attracting or repelling each other?