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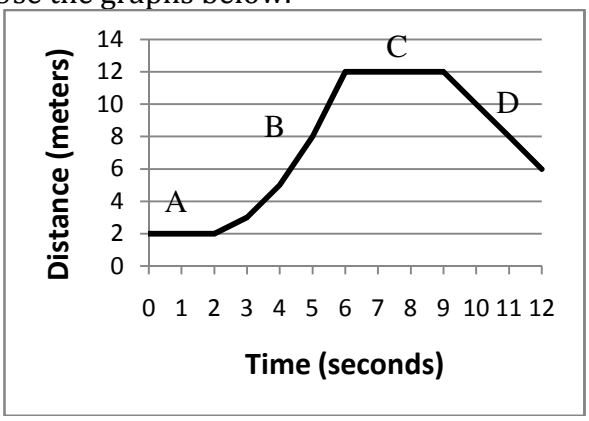
THE CRITICAL PHYSICAL SCIENCE EOC REVIEW

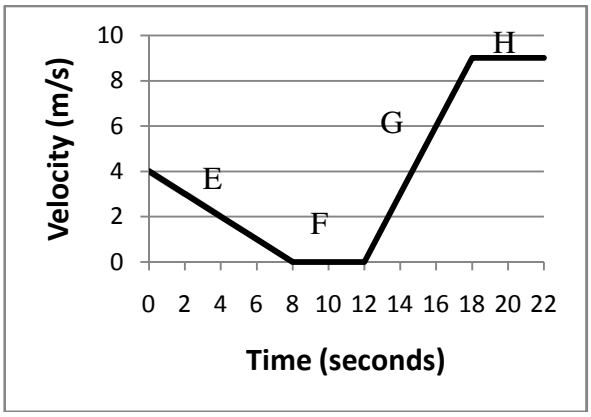
** Show your work on all math problems! **

Velocity and Acceleration

1. A person drives 4 miles east and then 3 miles west.
   a. What is the person's displacement? _____
   b. What is the distance traveled? _____
2. A boat goes downstream at a rate of 10 m/s. If the current is moving at 2 m/s, what is the speed of the boat relative to the river bank? _____
3. How far does an object travel if it is moving at a speed of 4 m/s for 3.2 seconds? _____

4. What is the acceleration of an object if it starts at a speed of 3 m/s and increases to 8 m/s in 20 seconds? _____
5. How long does it take an object to travel 50 km at a rate of 8 km/h? _____
6. What is the final velocity of an object that starts from rest and travels for 5 seconds at an acceleration of 4.3 m/s^2? _____
7. What is the average speed of a car that travels 30 km in the first hour, 2 km in the second hour, and 20 km in the third hour? _____
8. If you calculate the slope on a distance-time graph, you are finding the [velocity or acceleration?] of the object.
9. If you calculate the slope on a velocity-time graph, you are finding the [velocity or acceleration?] of the object.
10. Use the graphs below.





(For a-c) Fill in the blank with the letter of the correct line segment.
If there are 2 blanks, you should identify 2 segments in that graph.

a. Which segment(s) show the object at rest?
   D-t graph: ___ ___ V-t graph: ___
b. Which segment(s) show the object moving at constant velocity?
   D-t graph: ___ V-t graph: ___
c. Which segment(s) show the object accelerating?
   D-t graph: ___ V-t graph: ___ ___

d. What is the velocity of the object during segment D? _____
e. What is the acceleration of the object during segment G? _____
f. What is the average speed of the object in the D-t graph after 12 seconds? _____

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Forces

1. What an object's mass if it accelerates at 5 m/s^2 when a force of 0.5 N is applied? _____

2. A 2-kg object is pulled to the left with a force of 30 N and to the right with a force of 9 N. What is the acceleration of the object? _____

3. What is the weight of a 60 kg object? _____

4. What is the final velocity of a 10 kg object that drops from rest and falls for 30 sec? _____

5. The force that opposes all motion is _____. There are 2 types: static and kinetic.
6. Identify Newton's Law (***1st, 2nd, 3rd***)
    a. When you apply an unbalanced force to an object, it will accelerate. _____
    b. If the forces on an object are balanced, the object will remain at rest or (if it is already in motion) will continue moving at a constant velocity. _____
    c. For every action, there is an equal but opposite reaction. _____
    d. A rocket going up _____
    e. A hockey puck will travel in a straight line at constant speed on ice _____
    f. Kicking a soccer ball can hurt your toe ____
    g. If you drop an object, it will accelerate towards the ground _____
    h. Canoeing _____
7. If you hit a baseball with a bat the action force is _____ and the reaction force is _____.

Kinetic Energy, Gravitational Potential Energy, Work, Power

1. An object that is moving has _____ energy.
2. An object that is held at rest above the ground has _____ energy.
3. A 12 kg object has 500 J of kinetic energy. What is its speed? _____

4. What is the energy of a 5 kg object that is held at a height of 3 m above the ground? _____

5. What is the weight of an object that is held 4.5 m above the ground and has 300 J of energy? _____

6. What is the maximum speed of a 0.9 kg pendulum at the bottom of its swing if it reaches a maximum height of 0.57 m? _____

7. How much work does it take to lift a 3 kg object a distance of 9 meters? _____

8. What is the power of a machine that pushes with a force of 3 N for a distance of 9 m in 8 s? _____

9. A 60 Watt lightbulb does 30 J of work in how much time? _____

10. If a person pushes an object with a force of 30 N, but does not do any work, how far did the object move? _____

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Heat and Temperature

1. Identify the type of heat transfer: ***Conduction, Convection, Radiation***
    a. Heat transfer by the rising of low density (hot) fluids. _____
    b. Heat transfer between two objects that are in contact. _____
    c. Heat transfer by electromagnetic waves. _____
2. You place a block of metal at a temperature of 50°C into a bucket of 18°C water.
    a. Heat will transfer from the [metal or water?] to the [metal or water?].
    b. The final temperature of the metal and water *could be* which of the following temperatures: 16°C, 30°C, or 60°C?
3. No machine can be 100% efficient because some input energy is changed into _____.
4. Fill in the blank with: ***Heat, Temperature***
    a. The transfer of energy from a hot object to a cold object: _____
    b. The average kinetic energy of the particles in an object: _____
5. Which would heat up faster: copper or wood? _____
6. If the specific heat of a substance is high, it takes a lot of energy to heat up that substance. Which would have the highest specific heat: copper or wood? _____
7. If the specific heat of liquid water is 4.18 J/g*°C and the specific heat of ethanol is 2.46 J/g*°C, which increase in temperature faster: water or ethanol?

Light and Sound

1. Wavelength is measured from _____ to _____. The unit of wavelength is _____.
2. The amplitude of a wave is measured from _____ to _____.
3. Use these terms to fill in the blanks: ***longitudinal, transverse***
    a. Sound waves are _____ waves. Light waves are _____ waves.
    b. When the wave energy moves perpendicular to the motion of the particles in the medium, it is a _____ wave.
    c. When the wave energy travels parallel to the motion of the particles in the medium, it is a _____ wave.

4. What is the speed of a 0.4 m wave with a frequency of 30 Hz? _____

5. What is the frequency of a wave with a velocity of 343 m/s and a wavelength of 2.3 m? _____

6. What is the wavelength of a wave that is traveling at 50 m/s and has a frequency of 310 Hz? _____

7. Which electromagnetic wave has the shorter wavelength: infrared rays or radiowaves?
8. Which EM wave has the lower frequency: Red Visible Light or Microwaves?
9. Which EM wave is the most dangerous: x-rays or infrared rays?

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Electricity & Magnetism

1. A positively-charged object and negatively-charged object [attract or repel?] each other.
2. Two negatively-charged objects will [attract or repel?] each other.
3. Fill in the blank with the correct type of charging: ***Conduction, Friction, Induction***
    a. As you drag your feet across the carpet, your feet pick up electrons. _____
    b. When you hold a charged object close to a neutral object, the neutral object becomes charged. _____
    c. When you touch a charged object to a neutral object and charges flow into the once-neutral object. _____
4. When a switch in a circuit is open, does the lightbulb light up? _____
5. A 20 V battery produces 3 amps of current in a circuit with how much resistance? _____

6. A 50 W machine provides a potential difference of 10 V. What current is produced? ___

7. What is the power of a lightbulb with a resistance of 7Ω and a current of 0.3 A? _____

8. In a [series or parallel?] circuit, there is only one path for current to flow.
9. In a [series or parallel?] circuit, if one lightbulb burns out, the other lightbulbs will continue to shine.
10. For the brightest lightbulbs, would you attach them in series or parallel?
11. If you attached an ammeter anywhere in a [series or parallel?] circuit, you would find that the current was the same throughout the circuit.
12. In a magnet, a north pole would be attracted to a _____ pole and repelled from a ____ pole.
13. In order for a material to be magnetized, its domains must align. To destroy a magnet, you could [heat it or cool it?] or [drop it or cut it in half?].
14. An electromagnet is created when a wire is coiled around a metal core (ex. a nail) and current is sent through the wire. To increase the strength of the electromagnet, [increase or decrease?] the number of coils or [increase or decrease?] the current.
15. Fill in the blanks with: ***Generators, Electric Motors***
    a. _____ create electricity when a coil of wire is turned in a magnetic field.
    b. _____ create moving machine parts by placing a metal inside a coil of current-carrying wire. Changing the current causes the metal to move.

The Atom

1. Fill in the blank with the correct model: ***Bohr, Dalton, Rutherford, Thompson, e- cloud***
    a. _____ said that all matter is made of atoms. Atoms are indivisible (false-subatomic particles). All atoms of the same element are exactly the same (false-isotopes). Atoms of different elements are different. Atoms combine in whole-number ratios.
    b. By shooting alpha particles at gold foil, _____ discovered that the atom is mostly empty space and that it has a small, dense positively charged nucleus.
    c. _____ said that electrons orbit the nucleus like planets orbit the sun.
    d. _____ discovered the electron using a cathode ray tube and inferred the existence of protons. He came up with the plum pudding model to describe how the positive and negative charges were arranged in the atom.
    e. _____ says that while electrons do occupy specific energy levels, their exact location cannot be determined. Only the probability of finding an electron in a certain place is known.

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The Atom (cont'd)

2. Fill in the blanks with the number of electrons that can be held in each energy level:
   1st :_____ 2nd :_____ 3rd :_____ 4th and higher:_____
3. The atomic number is the number of _____.
4. The mass number is the number of _____ and _____.
5. Fill in the table:

	# of protons	# of neutrons	# of electrons
Silicon-29			
$^{70}_{31}Ga^{3+}$			
$^{37}Cl^{1-}$			
Oxygen-18 **ion**			
Potassium-39 **ion**			

6. Isotopes are neutral atoms of the same element and therefore they have the same number of _____ and _____ but a different number of _____.
7. Oxygen-18 and Oxygen-16 are isotopes because they have a different number of _____. The numbers "18" and "16", represent the [atomic number, mass number, or number of neutrons?] of the oxygen atoms above.
8. The number of [protons, neutrons, or electrons?] determines the identity of an element.
9. The number of [protons, neutrons, or electrons?] determines the charge of the element.
10. The number of [protons, neutrons, or electrons?] determines the isotope of the element.
11. An ion will have a different number of _____ compared to _____.

Nuclear Reactions

1. An alpha particle is just a _____ nucleus. This nucleus consists of ____ protons and ____ neutrons and therefore has a charge of _____.
2. A Beta particle is a/an _____. It has a charge of _____.
3. Gamma radiation is a form of _____ radiation. It has a charge of _____.
4. Write a nuclear equation showing $^{207}_{82}Pb$ undergoing nuclear decay:
   a. Alpha Decay: _____
   b. Beta Decay: _____
5. [Fission or Fusion?] occurs when a neutron is absorbed by a Uranium nucleus causing it to split into two smaller nuclei: Krypton and Barium.
6. [Fission or Fusion?] occurs when two small nuclei (often hydrogen isotopes) are combined to form one larger nucleus.
7. [Fission or Fusion?] occurs on the sun and stars & cannot be controlled on Earth (yet).
8. [Fission or Fusion?] can be controlled in nuclear reactors & used by people for energy.
9. Nuclear reactors produce useful energy, but they also produce a lot of radioactive waste which must be stored in _____ to prevent radiation exposure.

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Periodic Table

1. Name the Groups/Families:

Group 1	
Group 2	
Groups 3-12	
Group 17	
Group 18	

2. Valence electrons are the electrons in the [outermost or innermost?] energy level.
3. The octet rule states that elements are most stable if they have _____ valence electrons.
4. How many valence electrons do these elements have?
   a) Mg: _____ b) C: _____ c) Cl: _____ d) Ar: _____ e) He: _____
5. What is the oxidation number of each of these elements?
   a) K: _____ b) S: _____ c) Al: _____ d) Ne: _____ e) P: _____ f) He: _____

6. Fill in the blank with: ***Metals, Nonmetals, Metalloids***
   a. _____ are found on the left side of the periodic table.
   b. _____ are found along the zig-zag line.
   c. _____ are found on the right side of the periodic table.
   d. _____ lose their electrons when forming compounds, are excellent conductors of heat and electricity, are malleable and ductile, mostly solids, and have luster.
   e. _____ gain electrons when forming compounds, are poor conductors of heat and electricity, are brittle and dull, and are mostly gases at room temperature.
   f. _____ have characteristics of metals and nonmetals & can be used as semiconductors.

7. [Helium or Francium?] has the largest atomic radius?
8. [Helium or Francium?] has the smallest atomic radius?
9. Atomic radius [increases or decreases?] as you move from left to right across the periodic table.
10. Atomic radius [increases or decreases?] as you move from top to bottom on the periodic table.
11. Which has the largest atomic radius: K, Ca, P, or S?
12. Which has the smallest atomic radius: P, O, Sn, or Si?
13. What family would element X be in if it has 7 valence electrons & a charge of -1? _____
14. What period would element X be in if its electrons occupy 4 energy levels? Period # ____

Ionic, Covalent, Metallic Bonding

1. Fill in the blanks with: ***Ionic, Covalent, Metallic***
   a. _____ bonding occurs when the valence e- of two metals are released into a sea of e-.
   b. _____ bonding occurs when electrons are shared between two nonmetals.
   c. _____ bonding occurs when electrons are transferred from a metal to a nonmetal.

2. Draw the electron dot diagrams for: Mg: _____, N: _____, Cl: _____, He: _____

3. Name these compounds:
   a. S_3O_2: _____
   b. $Ca_3(PO_4)_2$: _____
   c. Al_2O_3: _____
   d. NaOH: _____
4. Write the formula from the name.
   a. Dihydrogen monoxide: _____
   b. Calcium chlorate: _____
   c. Gallium chloride: _____
   d. Magnesium sulfide: _____
   e. Trinitrogen pentachloride: _____

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Chemical Reactions

1. Balance the equation and give the type of reaction (synthesis, decomposition, single replacement, double replacement).
   a. ___ Zn + ___ HCl → ___ $ZnCl_2$ + ___ H_2 Type: _____

   b. ___ Fe + ___ S_8 → ___ FeS Type: _____

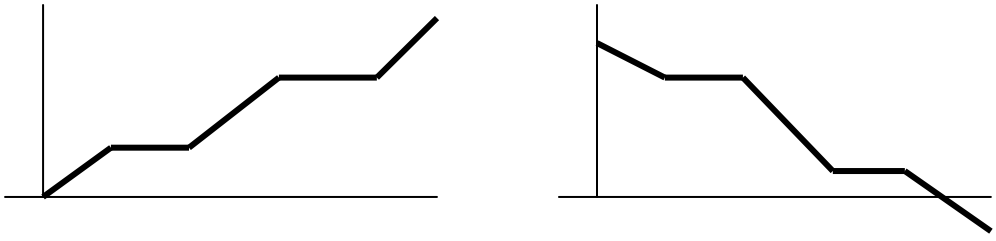
   c. ___ $Pb(NO_3)_2$ + ___ KI → ___PbI_2 + ___KNO_3 Type: _____

   d. ___ H_2O → ___ H_2 + ___ O_2 Type: _____

2. We balance equations because of the law of conservation of [energy, mass, or friction?]
3. What are the 4 indicators that tell you that a chemical reaction has taken place?
   a. _____ c. _____
   b. _____ d. _____
4. In an endothermic reaction, energy is [released or absorbed?] and therefore feels [hot or cold?] to the touch.
5. In an exothermic reaction, energy is [released or absorbed?] and therefore feels [hot or cold?] to the touch.
6. Identify as ***Endothermic or Exothermic***:
   a. A campfire: ____ c. A+ B → C + D + energy: _____
   b. Baking bread: _____ d. A+ B + energy → C + D: _____

Physical Properties of Matter

1. Phase changes (ex. melting, boiling, etc.) are [physical or chemical?] changes.
2. What is the density of a 60 g object that has a volume of 4 cm^3? _____
3. What is the volume of 22 g of a liquid that has a density of 58 g/mL? _____
4. Label the heating and cooling curves: ***solid, liquid, gas, melting point, boiling point***



5. You are heating water on the stove and it begins to boil. While it is boiling, the temperature [increases, decreases, or stays the same?].

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Solutions & Acids/Bases

1. In a salt water solution, salt is the [solute or solvent?] and water is the [solute or solvent?].
2. If you stir, heat, or crush the solute (increase the surface area), the rate of dissolving will [increase or decrease?].
3. As you try to add more solute to a solution that is already highly concentrated, the rate of dissolving will [increase or decrease?].
4. Solubility curves:
    a. As temperature increases, the solubility of most salts [increases or decreases?].

    b. Fill in the blank with: ***supersaturated, unsaturated, and saturated***
        i. A/An _____ solution is one that is holding its maximum amount of solute at that temperature.
        ii. A/An _____ solution is holding less than the maximum amount of solute that the solution could hold at that temperature.
        iii. A/an _____ solution was heated to a higher temp, more solute was added, and then it was cooled carefully. This solution holds more than its usual maximum amount of solute.

5. Fill in the blank with: ***Nonpolar Covalent (NP), Polar Covalent (P), Ionic (I)***
    a. Nonpolar covalent compounds dissolve _____ compounds.
    b. Polar Covalent compounds will dissolve _____ or _____ compounds.

6. Label as: ***Nonpolar (NP), Polar (P), or Ionic (I)***
    a. Oil: ____
    b. Water: ____
    c. Salt: ____
    d. Alcohol: ____
7. Does oil dissolve in water? ____ Does a salt dissolve in alcohol? _____
8. When dissolved, [ionic or covalent?] compounds will conduct electricity.

9. Fill in the blank with: ***Acid, Base***
    a. A/An _____ tastes sour, is found in citrus fruits, & its formula starts with an "H".
    b. A/An _____ tastes bitter, feels slippery, & is found in many household cleaners.
    c. A/An _____ gives off hydroxide ions (OH-) when dissolved in water.
    d. A/An _____ gives off H ions (H^+) forming hydronium ions [H_3O+] in water.
    e. A/An _____ turns pH or litmus paper red.
    f. A/An _____ turns pH or litmus paper blue.
    g. A/An _____ turns phenolphthalein pink.
    h. On the pH scale, a/an _____ is from 0 to 6.9.
    i. On the pH scale, a/an _____ is from 7.1 to 14.

10. In the neutralization reaction below, identify the: ***acid, base, salt, water***

    $Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$

    _____ _____ _____ _____

11. What type of reaction is a neutralization reaction: synthesis, decomposition, single replacement, or double replacement?