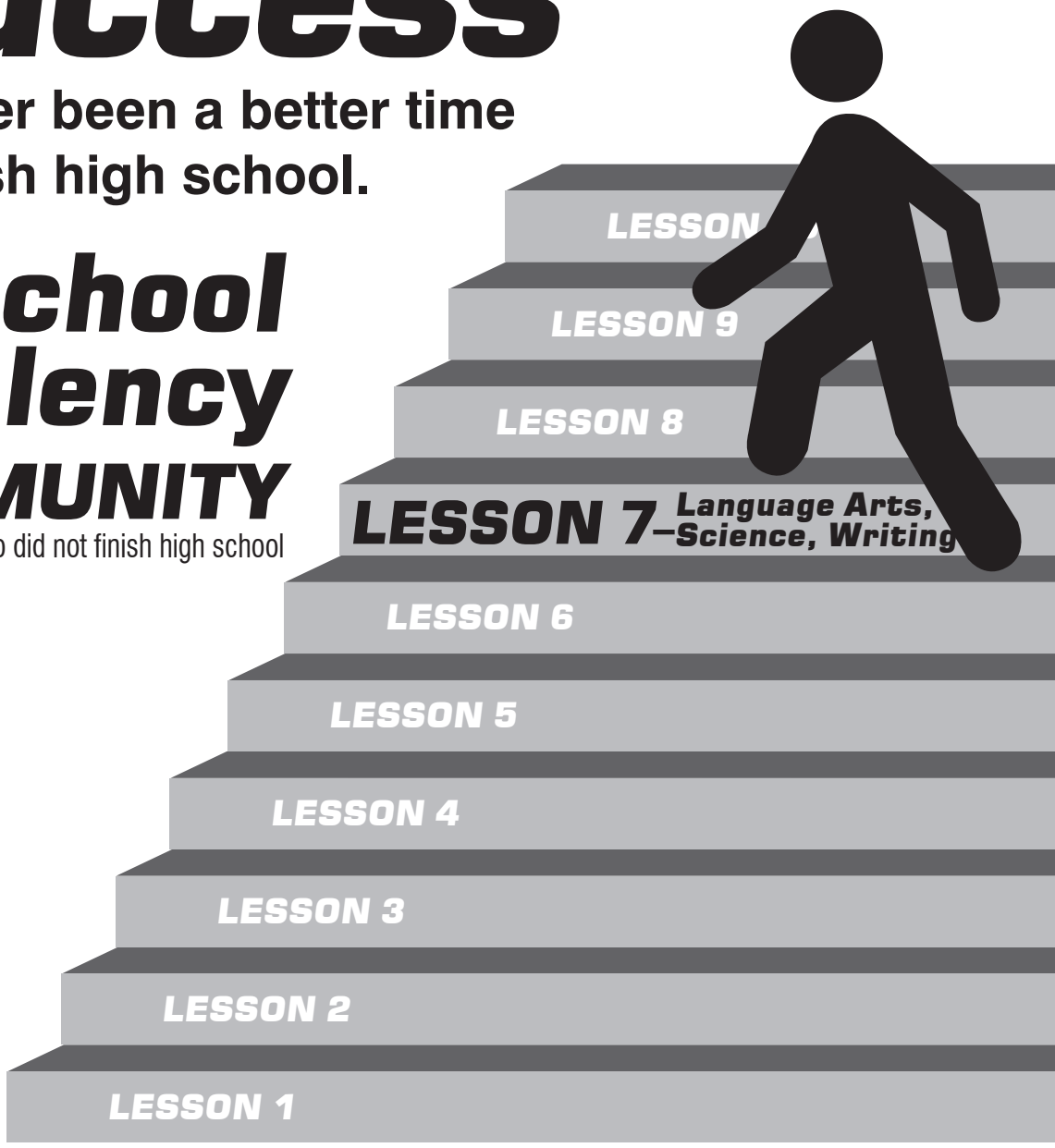
Steps to Success

There's never been a better time to finish high school.

High School Equivalency *in the* COMMUNITY

a 'Mail-In' program for adults who did not finish high school



Seventh Step– KEEP STEPPING!

LESSON 7
Science

Vocabulary to Know

Don't try to memorize these words. As you read the lesson, refer back to them. Write down any questions you may have.

Element–a pure substance that is made of one type of atom and can't be changed by chemical means. Elements have their own formulas which are found in the periodic table.

Atom–An atom is the defining structure of an ***element***, which cannot be broken by any chemical means. A typical atom consists of a nucleus of protons and neutron with electrons.

Molecule–a stable particle made of two or more atoms. A water molecule (H_2O) is made of two hydrogen atoms and one oxygen atom.

Product–a substance that is formed in a chemical reaction.

Reactant–a substance that takes part in a chemical reaction.

Coefficient–a number that multiplies a term in an equation.

- In a chemical equation, the coefficients indicate the number of each type of molecule. For example, $6H_20$ means that there are six water molecules.

Subscript–a number in a chemical formula representing the number of atoms of a particular element in one molecule of the compound.

- *For example*, the subscript "2" in H_2O indicates that there are two hydrogen atoms in a water molecule.

Combination–a chemical reaction in which two or more reactants form a single product.

- Combination reactions are also called synthesis reactions.
- *For example*, hydrogen (H_2) combines with oxygen (O_2) to form water (H_2O).

Compound–a pure substance composed of two or more elements chemically combined.

- A compound can be described by a *chemical formula* such as NaCl or H_2O.

Periodic Table–a table of the chemical elements arranged in order of atomic number, ususally in rows, so that elements with similar atomic structure appear in vertical columns.

> "Science is a way of thinking much more than a body of knowledge."
>
> —Carl Sagan

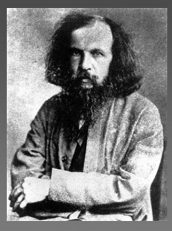
Introduction to the Periodic Table

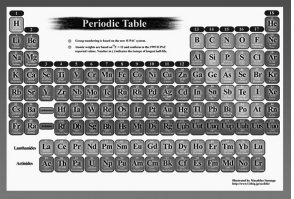
Introduction to the Periodic Table

Atomic Number • Symbol • Atomic Weight

Element • Compound • Mixture

I am Dmitri Mendeleev!

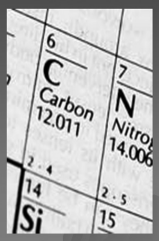




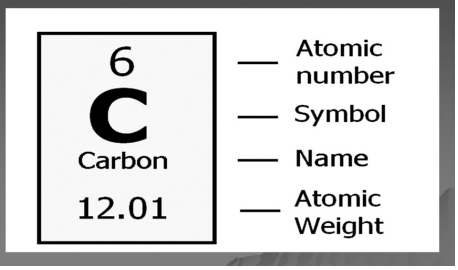
I made the PERIODIC TABLE !

What is the PERIODIC TABLE?

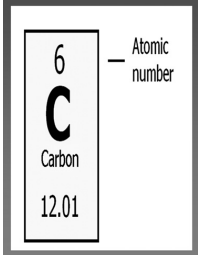
- Shows all known elements in the universe.
- Organizes the elements by chemical properties.



How do you read the PERIODIC TABLE?



What is the ATOMIC NUMBER?



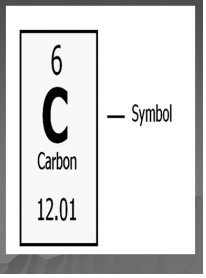
- The number of protons found in the nucleus of an atom

Or

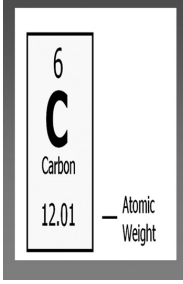
- The number of electrons surrounding the nucleus of an atom.

What is the SYMBOL?

- An abbreviation of the element name.



What is the ATOMIC WEIGHT?

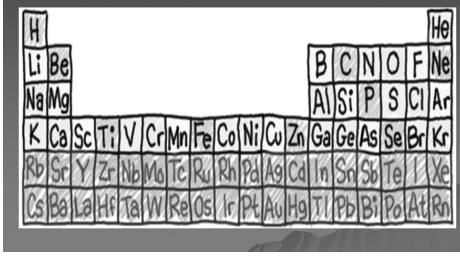


- The number of protons and neutrons in the nucleus of an atom.

How do I find the number of protons, electrons, and neutrons in an element using the periodic table?

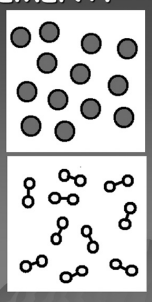
- # of PROTONS = ATOMIC NUMBER
- # of ELECTRONS = ATOMIC NUMBER
- # of NEUTRONS = ATOMIC WEIGHT _ ATOMIC NUMBER

Elements, Compounds, and Mixtures

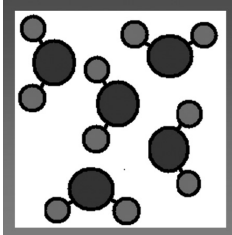


What is an ELEMENT?

- A substance composed of a single kind of atom.
- Cannot be broken down into another substance by chemical or physical means.



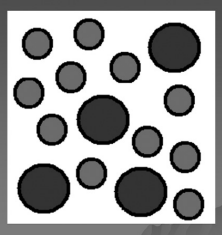
What is a COMPOUND?



- A substance in which two or more different elements are CHEMICALLY bonded together.

What is a MIXTURE?

- Two or more substances that are mixed together but are NOT chemically bonded.



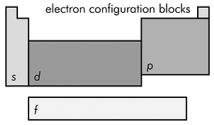
The Periodic Table of the Elements

by Robert Campion version 1.4

group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
period 1	1.00794 1312.0 2.20 1 +1 −1 **H** Hydrogen $1s^1$																	4.002602 2372.3 2 **He** Helium $1s^2$
2	6.941 520.2 0.98 3 +1 −1 **Li** Lithium $1s^2\ 2s^1$	9.012182 899.5 1.57 4 +2 **Be** Beryllium $1s^2\ 2s^2$											10.811 800.6 2.04 5 +3 +2 +1 −1 **B** Boron $1s^2\ 2s^2\ 2p^1$	12.0107 1086.5 2.55 6 +4 +3 +2 +1 −1 −2 −3 −4 **C** Carbon $1s^2\ 2s^2\ 2p^2$	14.0067 1402.3 3.04 7 +5 +4 +3 +2 +1 −1 −2 −3 **N** Nitrogen $1s^2\ 2s^2\ 2p^3$	15.9994 1313.9 3.44 8 +2 −1 −2 **O** Oxygen $1s^2\ 2s^2\ 2p^4$	18.998403 1681.0 3.98 9 −1 **F** Fluorine $1s^2\ 2s^2\ 2p^5$	20.1797 2080.7 10 **Ne** Neon $1s^2\ 2s^2\ 2p^6$
3	22.98976 495.8 0.93 11 +1 −1 **Na** Sodium $[Ne]\ 3s^1$	24.3050 737.7 1.31 12 +2 +1 **Mg** Magnesium $[Ne]\ 3s^2$											26.98153 577.5 1.61 13 +3 +1 **Al** Aluminium $[Ne]\ 3s^2\ 3p^1$	28.0855 786.5 1.90 14 +4 +3 +2 +1 −1 −2 −3 −4 **Si** Silicon $[Ne]\ 3s^2\ 3p^2$	30.97696 1011.8 2.19 15 +5 +4 +3 +2 +1 −1 −2 −3 **P** Phosphorus $[Ne]\ 3s^2\ 3p^3$	32.065 999.6 2.58 16 +6 +5 +4 +3 +2 +1 −1 −2 **S** Sulfer $[Ne]\ 3s^2\ 3p^4$	35.453 1251.2 3.16 17 +7 +6 +5 +4 +3 +2 +1 −1 **Cl** Chlorine $[Ne]\ 3s^2\ 3p^5$	39.948 1520.6 18 **Ar** Argon $[Ne]\ 3s^2\ 3p^6$
4	39.0983 418.8 0.82 19 +1 **K** Potassium $[Ar]\ 4s^1$	40.078 589.8 1.00 20 +2 **Ca** Calcium $[Ar]\ 4s^2$	44.95591 633.1 1.36 21 +3 +2 +1 **Sc** Scandium $[Ar]\ 3d^1\ 4s^2$	47.867 658.8 1.54 22 +4 +3 +2 +1 −1 −2 **Ti** Titanium $[Ar]\ 3d^2\ 4s^2$	50.9415 650.9 1.63 23 +5 +4 +3 +2 +1 −1 −3 **V** Vanadium $[Ar]\ 3d^3\ 4s^2$	51.9962 652.9 1.66 24 +6 +5 +4 +3 +2 +1 −1 −2 **Cr** Chromium $[Ar]\ 3d^5\ 4s^1$	54.93804 717.3 1.55 25 +7 +6 +5 +4 +3 +2 +1 −1 −2 −3 **Mn** Manganese $[Ar]\ 3d^5\ 4s^2$	55.845 762.5 1.83 26 +6 +5 +4 **+3** **+2** +1 −1 −2 **Fe** Iron $[Ar]\ 3d^6\ 4s^2$	58.93319 760.4 1.91 27 +5 +4 +3 +2 +1 −1 −2 −3 **Co** Cobalt $[Ar]\ 3d^7\ 4s^2$	58.6934 737.1 1.88 28 +4 +3 +2 +1 −1 −2 **Ni** Nickel $[Ar]\ 3d^8\ 4s^2$	63.546 745.5 1.90 29 +2 +1 **Cu** Copper $[Ar]\ 3d^{10}\ 4s^1$	65.38 906.4 1.65 30 +2 **Zn** Zinc $[Ar]\ 3d^{10}\ 4s^2$	69.723 578.8 1.81 31 +3 +2 +1 **Ga** Gallium $[Ar]\ 3d^{10}\ 4s^2\ 4p^1$	72.64 762.0 2.01 32 +4 +3 +2 +1 −1 −2 −3 −4 **Ge** Germanium $[Ar]\ 3d^{10}\ 4s^2\ 4p^2$	74.92160 947.0 2.18 33 +5 +3 +2 +1 −1 −2 −3 **As** Arsenic $[Ar]\ 3d^{10}\ 4s^2\ 4p^3$	78.96 941.0 2.55 34 +6 +5 +4 +3 +2 +1 −1 −2 **Se** Selenium $[Ar]\ 3d^{10}\ 4s^2\ 4p^4$	79.904 1139.9 2.96 35 +7 +5 +4 +3 +2 +1 −1 **Br** Bromine $[Ar]\ 3d^{10}\ 4s^2\ 4p^5$	83.798 1350.8 3.00 36 +2 **Kr** Krypton $[Ar]\ 3d^{10}\ 4s^2\ 4p^6$
5	85.4678 403.0 0.82 37 +1 **Rb** Rubidium $[Kr]\ 5s^1$	87.62 549.5 0.95 38 +2 **Sr** Strontium $[Kr]\ 5s^2$	88.90585 600.0 1.22 39 +3 +2 +1 **Y** Yttrium $[Kr]\ 4d^1\ 5s^2$	91.224 640.1 1.33 40 +4 +3 +2 +1 −1 −2 **Zr** Zirconium $[Kr]\ 4d^2\ 5s^2$	92.90638 652.1 1.60 41 +5 +4 +3 +2 +1 −1 −3 **Nb** Niobium $[Kr]\ 4d^4\ 5s^1$	95.96 684.3 2.16 42 +6 +5 +4 +3 +2 +1 −1 −2 **Mo** Molybdenum $[Kr]\ 4d^5\ 5s^1$	(98) 702.0 1.90 43 +7 +6 +5 +4 +3 +2 +1 −1 −3 **Tc** Technetium $[Kr]\ 4d^5\ 5s^2$	101.07 710.2 2.20 44 +8 +6 +5 +4 +3 +2 +1 −2 **Ru** Ruthenium $[Kr]\ 4d^7\ 5s^1$	102.9055 719.7 2.28 45 +6 +5 +4 +3 +2 +1 −1 −3 **Rh** Rhodium $[Kr]\ 4d^8\ 5s^1$	106.42 804.4 2.20 46 +4 +2 **Pd** Palladium $[Kr]\ 4d^{10}$	107.8682 731.0 1.93 47 +3 +2 +1 **Ag** Silver $[Kr]\ 4d^{10}\ 5s^1$	112.441 867.8 1.69 48 +2 **Cd** Cadmium $[Kr]\ 4d^{10}\ 5s^2$	114.818 558.3 1.78 49 +3 +2 +1 **In** Indium $[Kr]\ 4d^{10}\ 5s^2\ 5p^1$	118.710 708.6 1.96 50 +4 +2 **Sn** Tin $[Kr]\ 4d^{10}\ 5s^2\ 5p^2$	121.760 834.0 2.05 51 +5 +3 −3 **Sb** Antimony $[Kr]\ 4d^{10}\ 5s^2\ 5p^3$	127.60 869.3 2.10 52 +6 +4 +2 −2 **Te** Tellurium $[Kr]\ 4d^{10}\ 5s^2\ 5p^4$	126.9044 1008.4 2.66 53 +7 +5 +1 −1 **I** Iodine $[Kr]\ 4d^{10}\ 5s^2\ 5p^5$	131.293 1170.4 2.60 54 +8 +6 +4 +2 **Xe** Xenon $[Kr]\ 4d^{10}\ 5s^2\ 5p^6$
6	132.9054 375.7 0.79 55 +1 **Cs** Cæsium $[Xe]\ 6s^1$	137.327 502.9 0.89 56 +2 **Ba** Barium $[Xe]\ 6s^2$	174.9668 523.5 1.27 71 +3 **Lu** Lutetium $[Xe]\ 4f^{14}\ 5d^1\ 6s^2$	178.49 658.5 1.30 72 +4 +3 +2 +1 −1 −2 **Hf** Hafnium $[Xe]\ 4f^{14}\ 5d^2\ 6s^2$	180.9478 761.0 1.50 73 +5 +4 +3 +2 +1 −1 −3 **Ta** Tantalum $[Xe]\ 4f^{14}\ 5d^3\ 6s^2$	183.84 770.0 2.36 74 +6 +5 +4 +3 +2 +1 −1 −2 **W** Tungsten $[Xe]\ 4f^{14}\ 5d^4\ 6s^2$	186.207 760.0 1.90 75 +7 +6 +5 +4 +3 +2 +1 −1 −3 **Re** Rhenium $[Xe]\ 4f^{14}\ 5d^5\ 6s^2$	190.23 840.0 2.20 76 +8 +6 +4 +3 +2 +1 −2 **Os** Osmium $[Xe]\ 4f^{14}\ 5d^6\ 6s^2$	192.217 880.0 2.20 77 +6 +4 +3 +2 +1 −1 −3 **Ir** Iridium $[Xe]\ 4f^{14}\ 5d^7\ 6s^2$	195.084 870.0 2.28 78 +6 +4 +2 +1 −1 −3 **Pt** Platinum $[Xe]\ 4f^{14}\ 5d^9\ 6s^1$	196.9665 890.1 2.54 79 +5 +3 +2 +1 −1 **Au** Gold $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^1$	200.59 1007.1 2.00 80 +2 +1 **Hg** Mercury $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2$	204.3833 589.4 1.62 81 +3 +1 **Tl** Thallium $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^1$	207.2 715.6 2.33 82 +4 +2 **Pb** Lead $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^2$	208.9804 703.0 2.02 83 +5 +3 +2 +1 −3 **Bi** Bismuth $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^3$	(210) 812.1 2.00 84 +6 +4 +2 −2 **Po** Polonium $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^4$	(210) 890.0 2.20 85 +7 +5 +3 +1 −1 **At** Astatine $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^5$	(220) 1037.0 86 **Rn** Radon $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^6$
7	(223) 380.0 0.70 87 +1 **Fr** Francium $[Rn]\ 7s^1$	(226) 509.3 0.90 88 +2 **Ra** Radium $[Rn]\ 7s^2$	(262) 470.0 103 +3 **Lr** Lawrencium $[Rn]\ 5f^{14}\ 7s^2\ 7p^1$	(261) 580.0 104 +4 **Rf** Rutherfordium $[Rn]\ 5f^{14}\ 6d^2\ 7s^2$	(262) 105 +5 **Db** Dubnium	(266) 106 +6 **Sg** Seaborgium	(264) 107 +7 **Bh** Bohrium	(277) 108 +8 **Hs** Hassium	(268) 109 **Mt** Meitnerium	(271) 110 **Ds** Darmstadium	(272) 111 **Rg** Roentgenium	(285) 112 **Cn** Copernicium	(284) 113 **Uut** Ununtrium	(289) 114 **Uuq** Ununquadium	(288) 115 **Uup** Ununpentium	(292) 116 **Uuh** Ununhexium	117 **Uus** Ununseptium	(294) 118 **Uuo** Ununoctium

atomic mass (or most stable mass number) — 1st ionization energy (kJ/mol) — chemical symbol — name — electron configuration — atomic number — electronegativity — oxidation states (most common are bold)

alkali metals · alkaline metals · other metals · transition metals · lanthanoids · actinoids · metalloids · nonmetals · halogens · noble gases · unknown elements · radioactive elements have masses in parenthesis



notes
- as of yet, elements 113-118 have no official name designated by the IUPAC.
- 1 kJ/mol ≈ 96.485 eV.
- all elements are implied to have an oxidation state of zero.

138.9054 538.1 1.10 57 +3 +2 **La** Lanthanum $[Xe]\ 5d^1\ 6s^2$	140.116 534.4 1.12 58 +4 +3 +2 **Ce** Cerium $[Xe]\ 4f^1\ 5d^1\ 6s^2$	140.9076 527.0 1.13 59 +5 +4 +3 +2 **Pr** Praseodymium $[Xe]\ 4f^3\ 6s^2$	144.242 533.1 1.14 60 +3 +2 **Nd** Neodynium $[Xe]\ 4f^4\ 6s^2$	(145) 540.0 61 +3 **Pm** Promethium $[Xe]\ 4f^5\ 6s^2$	150.36 544.5 1.17 62 +3 +2 **Sm** Samarium $[Xe]\ 4f^6\ 6s^2$	151.964 547.1 63 +3 +2 **Eu** Europium $[Xe]\ 4f^7\ 6s^2$	157.25 593.4 1.20 64 +3 +2 +1 **Gd** Gadolinium $[Xe]\ 4f^7\ 5d^1\ 6s^2$	158.9253 565.8 65 +4 +3 +1 **Tb** Terbium $[Xe]\ 4f^9\ 6s^2$	162.500 573.0 1.22 66 +3 +2 **Dy** Dysprosium $[Xe]\ 4f^{10}\ 6s^2$	164.9303 581.0 1.23 67 +3 **Ho** Holmium $[Xe]\ 4f^{11}\ 6s^2$	167.259 589.3 1.24 68 +3 **Er** Erbium $[Xe]\ 4f^{12}\ 6s^2$	168.9342 596.7 1.25 69 +3 +2 **Tm** Thulium $[Xe]\ 4f^{13}\ 6s^2$	173.054 603.4 70 +3 +2 **Yb** Ytterbium $[Xe]\ 4f^{14}\ 6s^2$
(227) 499.0 1.10 89 +3 **Ac** Actinium $[Rn]\ 6d^1\ 7s^2$	232.0380 587.0 1.30 90 +4 +3 +2 **Th** Thorium $[Rn]\ 6d^2\ 7s^2$	231.0358 568.0 1.50 91 +5 +4 +3 +2 **Pa** Protactinium $[Rn]\ 5f^2\ 6d^1\ 7s^2$	238.0289 597.6 1.38 92 +6 +5 +4 +3 **U** Uranium $[Rn]\ 5f^3\ 6d^1\ 7s^2$	(237) 604.5 1.36 93 +7 +6 +5 +4 +3 **Np** Neptunium $[Rn]\ 5f^4\ 6d^1\ 7s^2$	(244) 584.7 1.28 94 +7 +6 +5 +4 +3 **Pu** Plutonium $[Rn]\ 5f^6\ 7s^2$	(243) 578.0 1.30 95 +6 +5 +4 +3 +2 **Am** Americium $[Rn]\ 5f^7\ 7s^2$	(247) 581.0 1.30 96 +4 +3 **Cm** Curium $[Rn]\ 5f^7\ 6d^1\ 7s^2$	(247) 601.0 1.30 97 +4 +3 **Bk** Berkelium $[Rn]\ 5f^9\ 7s^2$	(251) 608.0 1.30 98 +4 +3 **Cf** Californium $[Rn]\ 5f^{10}\ 7s^2$	(252) 619.0 1.30 99 +3 +2 **Es** Einsteinium $[Rn]\ 5f^{11}\ 6s^2$	(257) 627.0 1.30 100 +3 +2 **Fm** Fermium $[Rn]\ 5f^{12}\ 7s^2$	(258) 635.0 1.30 101 +3 +2 **Md** Mendelevium $[Rn]\ 5f^{13}\ 7s^2$	(259) 642.0 1.30 102 +3 +2 **No** Nobelium $[Rn]\ 5f^{14}\ 6s^2$

LESSON 7
Science

ASSIGNMENT 1

DIRECTIONS

Use the Periodic Table to answer the following questions.

1. **What is the atomic number of:**
   Calcium _____
   Iron _____
   Gold _____
   Uranium _____

2. **What is the Atomic mass of:**
   Calcium _____
   Iron _____
   Uranium _____
   Copper _____

3. **How many protons do the following have?**
   Calcium _____
   Gold _____
   Copper _____
   Iron _____

4. **How many electrons do the following have?**
   Gold _____
   Iron _____
   Copper _____
   Uranium _____

5. **Does mercury have more protons and electrons than tin?** _____

6. **Is mercury a heavier element than tin?**
   _____

7. **Does potassium have more electrons than neon?** _____

8. **Does hydrogen have more electrons than Uranium?** _____

9. **Which has more protons—sulfur or iodine?**
   _____

10. **Write the symbols or the names for each of these elements:**
    Chlorine _____
    Copper _____
    Potassium _____
    Silver _____
    Na _____
    Sn _____
    Zn _____
    Helium _____
    Iron _____
    P _____
    Ne _____
    Mercury _____

LESSON 7
Science

ASSIGNMENT 2

Chemistry is the study of matter. Scientists define *matter* as anything that has mass and takes up space. Matter is made up of extremely tiny particles called ***atoms*** and ***molecules***. Atoms and molecules make up the three common states of matter on Earth—solids, liquids, and gases. Being a solid, liquid, or gas is a property of a substance.

Matter can go through a *physical change*. When atoms and molecules speed up or slow down the substance can change from liquid to gas or to a solid—this is a physical change. When a substance is dissolved by water or some other solvent, a new substance has not really been formed. The ions or molecules can still come back together to form the original substance.

In a *chemical change*, the atoms in the reactants rearrange themselves and bond together differently to form one or more new products with different characteristics than the reactants. When a new substance is formed, the change is called a chemical change.

You may not have realized it but chemistry takes place in your kitchen whenever you bake. Mix some flour, milk, butter, sugar, baking powder, and an egg in a bowl; add some heat from the oven, and the transformation from a soupy mix to a cake is chemistry at work. A chemical reaction has occurred!

Matter can neither be created nor destroyed. When elements or compounds enter into a chemical reaction, the numbers of their atoms always remains the same. The resulting product may look different, but the same numbers and kinds of atoms are still there. This is the ***law of conservation of matter*** (*matter is neither created nor destroyed during chemical reactions*). Think about the unbaked cake verses the baked cake. You can also relate this to money. You exchange coins for currency. You may walk into a bank with 20 quarters, 30 dimes, 25 nickels, and 75 pennies and walk out with a ten dollar bill. You haven't lost nor gained money. It is the same amount, but it looks different.

When elements are combined to create a chemical reaction, ***chemical equations*** are created. John Dalton's ***atomic theory*** said that chemical reactions basically involve the rearrangement of atoms. Even though the atoms are rearranged both sides of the chemical equation will have the same amount of atoms. These equations have to be balanced. The same value (amount) has to be on both sides of the equation. Chemical equations need to follow these principles in order to be correct.

When taking the High School Equivalency Exam you will have to identify these balanced equations. Here is an example of *how to balance an equation*.

How to balance an equation.

1. **Write down your given equation.**

   For this example, you will use:

   $$\underbrace{C_3H_8 + O_2}_{\textit{reactants}} \rightarrow \underbrace{H_2O + CO_2}_{\textit{products}}$$

   $$C_3H_8 + O_2 \rightarrow H_2O + CO_2$$

   subscript

2. **Write down the number of atoms that you have on each side of the equation.**

   Look at the subscripts next to each atom to find the number of atoms in the equation.

   - Left side: 3 carbon, 8 hydrogen and 2 oxygen
   - Right side: 1 carbon, 2 hydrogen and 3 oxygen

3. **Always leave hydrogen and oxygen for last.**

   This means that you will need to balance the carbon atoms first.

4. **Add a *coefficient* to the single carbon atom on the right of the equation to balance it with the 3 carbon atoms on the left of the equation.**

   $$C_3H_8 + O_2 \rightarrow H_2O + 3CO_2$$

   - The ***coefficient*** 3 in front of carbon on the right side indicates 3 carbon atoms just as the subscript 3 on the left side indicates 3 carbon atoms.
   - In a chemical equation, you can change coefficients, but you should never alter the subscripts.

5. **Balance the hydrogen atoms next.**

   You have 8 on the left side. So you'll need 8 on the right side.

   $$C_3H_8 + O_2 \rightarrow 4H_2O + 3CO_2$$

   - On the right side, you now added a 4 as the coefficient because the subscript showed that you already had 2 hydrogen atoms.
   - When you multiply the coefficient 4 times by the subscript 2, you end up with 8.

6. **Balance the oxygen atoms.**
   - Because you've added coefficients to the molecules on the right side of the equation, the number of oxygen atoms has changed. You now have 4 oxygen atoms in the water molecule and 6 oxygen atoms in the carbon dioxide molecule. That makes a total of 10 oxygen atoms.
   - Add a coefficient of 5 to the oxygen molecule on the left side of the equation. You now have 10 oxygen molecules on each side.

     $$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$$

   - The carbon, hydrogen, and oxygen atoms are balanced. Your equation is complete.

DIRECTIONS

Balance the following chemical equations.

1. $Fe + O_2 \rightarrow Fe_3O_4$
2. $Sr + O_2 \rightarrow SrO$
3. $Sn + NaOH \rightarrow Na_2SnO_2 + H_2$
4. $K + Br_2 \rightarrow KBr$
5. $C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$
6. $Sb + I_2 \rightarrow SbI_3$
7. $COCl_2 + H_2O \rightarrow HCl + CO_2$
8. $CS_2 + O_2 \rightarrow CO_2 + SO_2$

9. $H_2SO_4 = NaCN \rightarrow HCN + Na_2SO_4$

10. $KClO_3 \rightarrow KCl + O_2$

11. $H_2 + F_2 \rightarrow HF$

12. $BaCl_2 + KIO_3 \rightarrow Ba(IO_3)_2 + KCl$

13. $Mg + HCl \rightarrow MgCl_2 + H_2$

DIRECTIONS
Answer the following questions.

14. Which of the following is true for balancing equations?

A. There must be an equal number of atoms of each element on both sides of the equation.
B. The number of products should be equal to number of reactants.
C. The properties of the products should be the same as the properties of the reactants.
D. There must be an equal number of compounds on both sides of the equation.

15. Which is the next logical step in balancing the given equation?

$$N_2 + O_2 \rightarrow NO_2$$

A. Place the coefficient 2 in front of oxygen and nitrogen dioxide.
B. Place the coefficient 3 in front of oxygen and nitrogen dioxide.
C. The equation is already balanced.
D. Change the subscript of the nitrogen molecule 1.

16. In this equation, what should be the coefficients of the reactants and products?

$$I_2 + O_2 \rightarrow I_4O_9$$

A. The coefficient of iodine is 2, oxygen is 9, and the product is 2
B. The coefficient of iodine I 0, oxygen is 4, and the product i2
C. The coefficient of iodine is 4, oxygen is 9, and the product is 2
D. The coefficient of iodine is 2, oxygen is 9, and the product is 1.

17. What is the basic unit of all matter?

A. Neutron
B. Atom
C. Electron
D. Proton
E. Nucleus

18. Water is a colorless and odorless liquid. It can exist in solid, liquid, and gas states. It boils at 100 degrees C and melts at 0 degrees C. Which option best describes this information?

A. These are the physical properties of water.
B. These are the chemical properties of water.
C. These are the physical changes water undergoes.
D. These are the chemical changes water undergoes.
E. These are the molecular changes water undergoes.

19. Which of the following is an indication that a substance has undergone a chemical change?

A. No new product has been formed.
B. The color of the substance has not changed.
C. The original constitute has not changed.
D. The molecular structure has changed.

20. Which process is a physical change?

A. Iron rusting
B. Milk turning to curd
C. Water boiling
D. Paper burning
E. Hard water staining pipes

21. Which is a chemical change?

A. Water boiling
B. Wood burning
C. Glass breaking
D. Ice melting
E. Molding iron

22. The general chemical equation for cellular respiration is shown below.

$$C_6H_{12}O_6 + 60_2 \rightarrow 6OH_2O + 6C0_2 + \text{energy}$$

Which statement describes the process in the equation?

A. Glucose and oxygen combine to produce energy.
B. Glucose and oxygen combine to produce water carbon dioxide.
C. Glucose is broken down in the presence of oxygen to release energy.
D. Glucose is broken down into water and carbon dioxide to store energy.

Vocabulary to Know

Nonfiction–Writing that is based on facts, real events, and real people

ASSIGNMENT 3

DIRECTIONS

Read the passage and answer the questions that follow.

Structure and Properties of Matter

Everything in our physical world is made of matter. Whether it is a synthetic or natural object, a bowl of cereal, a bike pump or a torrent of hail, it has essential physical properties that define its character as matter.

When we use matter or react to it, we think about it in all sorts of different ways. If we are playing basketball, we think about where the ball is going to go in physical space and how we can control it. If we are making a sandwich, we think about different combinations of flavors and how to make the sandwich taste as good as possible by combining those flavors. If we are deciding what to in the morning, we think about the visual qualities of different clothes, imagining what the most appealing combination might be.

As scientists, we can think about matter in two categorical ways. We can think about its physical properties, and we can think about its chemical properties.

Physical properties have to do with the matter itself; chemical properties have to do with how the matter exists in relation to the matter around it.

In the case of, say, a basketball, as scientists, we might think about properties like its appearance (round, knobby texture, orange color), buoyancy (Does it float? Yes.), or conductivity (no, it can't carry an electrical current). Other physical properties, some immediately observable and some only discernible under testing,

are boiling point, density, ductility, hardness, magnetism, malleability, mass, melting point, and odor.

These include physical properties we can test using just our five senses and properties we test more rigorously using scientific tools. We can change some of the physical properties of matter, while others are fixed, unless we alter them with the interference of other substances. For instance, we can take a big block of cheddar cheese and chop it into tiny pieces, even put it in a blender, and turn it into a cheese puree. That changes the cheese's texture, but not its color. Also, the cheese still has the same level of facility in carrying in carrying electrical current. You won't be able to stretch the cheese like a rubber balloon or use it to scratch glass, like a diamond. The blended cheese will still have the same mass as the original block of cheddar. Put it on some nachos and have a snack.

Another category is matter's chemical properties. Chemical properties are defined by one kind of matter's reaction to other conditions, or types of matter on a chemical level. The product of a chemical reaction is irreversible. When wood burns in a fire, for instance, it changes from wood into ash and smoke. That ash and smoke will never be wood again.

You can usually tell when a chemical change is taking place because there will be a telltale signal. If a substance is changing color, giving off heart, foaming, fizzing, or bubbling, or producing sound or new light, it's probably undergoing some kind of chemical reaction!

Next time you're watching fireworks, take a second to appreciate how many chemical changes and reactions are taking place moment by moment, one right after the other-sometimes right on top of one another. While we can appreciate that chemical changes are always happening all around us, it's fascinating to see a display of chemical change that's designed to express itself so dramatically!

Fireworks are a unique art form based on manipulating the changing chemical properties in reactive matter. Chemists who design fireworks have the fun job of creating exciting-looking-and—sounding chemical reactions between substances. Their first priority is safety, of course. Firework specialists, or pyrotechnicians, are responsible for unleashing those reactions in a carefully choreographed sequence, specially designed to make the show as tense and exciting as possible.

One thing all matter has in common is that its basic building block is the atom. Raisins are made up of atoms. Glass windows and chandeliers are made of atoms. Your parents are made up of atoms. Leonardo Da Vinci's painting the Mona Lisa is made up of atoms. The air we breathe is made of atoms.

Atoms are so tiny that we can't see them—even with the aid of powerful microscopes. Different fundamental types of matter—we call them elements, and they're all listed on the Periodic Table of the Elements—are made up of atoms with different but discrete chemical structures. There are about one hundred elements, and together those elements compose everything in the known physical universe.

Atoms are made up of even smaller component structures. Again, there's no way for us to observe these structures physically. That's what sets them apart from the physical properties of matter, which, as we know, are discernible to our five senses. But those physical properties all answer to their basic chemical makeup. The buoyancy of raisins in a bowl of cereal isn't just a random trait. It's because the type of atoms in a raisin is constructed to behave in certain ways in relation to the atoms around it.

On the Periodic Table of the Elements, scientists have, over time, placed different essential atomic types of matter into different groups, based on their atomic or chemical makeup.

LESSON 7
Reasoning through Language Arts

Those basic materials can combine in practically infinite ways. It's exciting to think about the creative and organic possibilities that matter holds for the future.

1. **What two categorical ways of thinking about matter are discussed in the passage?**
   A. solid and liquid
   B. natural and unnatural
   C. physical and chemical
   D. beneficial and harmful

2. **What is compared and contrasted with the physical properties of matter in the passage?**
   A. a painting by Leonardo Da Vinci
   B. the Periodic Table of Elements
   C. the appearance of a basketball
   D. the chemical properties of matter

3. **If a substance is producing sound or new light, it is probably undergoing a chemical reaction. The explosion of fireworks produces sound and light.**

   Based on this information, what is a likely conclusion?
   A. The explosion of fireworks is an example of a chemical reaction.
   B. The explosion of fireworks is an example of a physical reaction.
   C. Chopping a big block of cheese into pieces is an example of a chemical reaction.
   D. Chopping a big block of cheese into pieces creates light.

4. **A glass bowl falls on the floor and breaks into little pieces. What kind of change has taken place?**
   A. a physical change
   B. a chemical change
   C. a psychological change
   D. a biological change

5. **What is the passage mostly about?**
   A. fireworks
   B. matter
   C. scientists
   D. magnetism

6. **Read this sentence:** "In the case of, say, a basketball, as scientists, we might think about ***properties*** like its appearance (round, knobby texture, orange color), buoyancy (Does it float? Yes.), or conductivity (No. It can't carry an electrical current)." **What does the word "*properties*" mean above?**
   A. problems or difficulties
   B. increases or expansions
   C. qualities or characteristics
   D. changes or transformations

7. **Choose the answer that best completes the sentence below.**

   Matter can be thought of in two categorical ways, _____, physical and chemical.
   A. instead
   B. namely
   C. earlier
   D. later on

DIRECTIONS

Use a separate sheet of paper to answer questions 8, 9, and 10.

8. **What is an example of a physical property?**

9. **What is an example of a chemical change?**

10. **Which is easier to observe, the physical or chemical properties of an object?**

    Support your answer with *evidence* from the passage.

LESSON 7
Reasoning through Language Arts

ASSIGNMENT 4

DIRECTIONS
Read the passage and answer the questions that follow.

Gains of the Great Depression

The following essay is a writer's final draft of an informative essay.

During the Great Depression, millions of people lost jobs, and families struggled to find financial footholds. It lasted for ten years, leaving very strong memories of dramatically dark times. Throughout those years, people found new ways to cope with the struggles, and interestingly enough, new emotions and belief in the ideals of America. Everybody kept hope for the future and growing more unified and patriotic as a country.

One important effect of the Great Depression was how it made people and families resourceful. That quality is largely a part of the memoir Digging In, where a man who lived during the Depression talked about his family's frugalness, and how they had to "cut back on everything possible" in order to save money. Some of the things they had to cut back on included city water, selling their car, and discontinuing purchases of toothpaste, toilet paper, and snacks, just to name a few. They also "took care of what [they] had", and listed all the ways they used a cotton cloth, which included using it as a dish cloth, bandage, quilt piece and more. These qualities of being frugal and resourceful weren't bad; they taught people to not be wasteful and to not spend money on things that aren't necessary. Being resourceful became a part of life during the Depression as a way to help families stay financially afloat.

More significantly the Great Depression, in a broad sense, brought a sense of patriotism and more unity as a country. Former President Franklin D. Roosevelt enriched his second inaugural

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address with these ideals. He said that the greatest change he had witnessed was the "change in the moral climate of America" and that they were on the road of progress. Another quote of his was "in seeking for economic and political progress as a nation, we all go up, or else we all go down, as one people." What Roosevelt was implying was if the people wanted their country to go in the right direction, they all had to work together. Working together wouldn't be hard, due to the entire country's new sense of belief in their country, also known as patriotism. The United States' stronger sense of unity that came about during the depression helped citizens work through the hard times.

Most importantly, the Depression oddly enough brought a sense of hope. In some cases, farmers had to keep hope for the future and that it would bring rain for their crops so they could get money, as a farmer had in a poem called "Debts." In an article about "The New Deal," on explanation was given about how Roosevelt gave the country hope by creating many reforms that were aimed to "relieve poverty, reduce unemployment, and speed economic recovery." This hope for the future gave people something worth living for during times when suicide didn't seem like a bad idea. Indeed, this sense of hope was a very

important effect that the Great Depression had on the people who lived through it.

Even though the Depression devastatingly affected tens of millions of people, the way it changed people's outlooks was inspiring. Instead of tossing a cotton bag in the garbage, people learned to be resourceful and used them as towels and dish cloths. A stronger sense of pride in their country helped them work through the hardships together, with patriotism and unity. Above all else, without hope for the future, people would've given up on trying to fix their severely wounded economy. These enhanced senses of resourcefulness, unity, along with patriotism and hope were all ways that the Great Depression affected Americans.

1. **Which sentence would *best* replace the last sentence in paragraph 1?**
   A. Everyone learned the value of being resourceful, while also keeping hope for the future and growing more unified and patriotic as a country.
   B. The Great Depression will always be remembered as a truly tough time for the American people.
   C. Thus, Americans actually fared far better in the wake of the Great Depression.

2. **Select the error (if any) in the sentence below.**

   These qualities of <u>being frugal</u> and resourceful weren't <u>bad, they</u> taught people not to be wasteful <u>and not</u> to spend money on things <u>that aren't</u> necessary. (<u>No change</u>)

DIRECTIONS

Read paragraphs 1 and 2 of the essay and answer the question.

3. **In Sentence 3 of Paragraph 2, to whom does *they* refer?**
   A. The American people
   B. Writers in the Depression Era
   C. The author's family
   D. Citizens of the author's hometown

4. **Select the sentence that should be revised for a more clear development of the paragraph's main idea.**

   More significantly the Great Depression, in a broad sense, brought a sense of patriotism and more unity as a country. **(a)**Former President Franklin D. Roosevelt enriched his second inaugural address with these ideals. He said that the greatest change he had witnessed was the "change in the moral climate of America" and that they were on the road of progress. Another quote of his was "in seeking for economic and political progress as a nation, we all go up, or else we all go down, as one people." **(b)**What Roosevelt was implying was if the people wanted their country to go in the right direction, they all had to work together. **(c)**Hard work and cooperation are consistent themes in American success stories. **(d)**The United States' stronger sense of unity that came about during the depression helped citizens work through the hard times.

5. **Choose the 2 sentences that do not support the author's argument.**
   A. The Great Depression was a tragedy in every way.
   B. The Great depression was hard on the majority of American families, but was not without its positive effects.
   C. The sale of American flags and other patriotic items sharply declined following the Great Depression.
   D. The New Deal instilled hope for a positive future in the wake of the Great Depression.

ASSIGNMENT 5

DIRECTIONS

Please read the following *New York Times* excerpt and answer the questions.

The Great Depression

A Short History of the Great Depression

By Nick Taylor—author of "American-Made" (2008), a history of the Works Progress Administration.

The Great Depression was a worldwide economic crisis that in the United States was marked by widespread unemployment, near halts in industrial production and construction, and an 89 percent decline in stock prices. It was preceded by the so-called New Era, a time of low unemployment when general prosperity masked vast disparities in income.

The start of the Depression is usually pegged to the stock market crash of "Black Tuesday," Oct. 29, 1929, when the Dow Jones Industrial Average fell almost 23 percent and the market lost between $8 billion and $9 billion in value. But it was just one in a series of losses during a time of extreme market volatility that exposed those who had bought stocks "on margin"—with borrowed money.

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The stock market continued to decline despite brief rallies. Unemployment rose and wages fell for those who continued to work. The use of credit for the purchase of homes, cars, furniture and household appliances resulted in foreclosures and repossessions. As consumers lost buying power industrial production fell, businesses failed, and more workers lost their jobs. Farmers were caught in a depression of their own that had extended through much of the 1920s. This was caused by the collapse of food prices with the loss of export markets after World War I and years of drought that were marked by huge dust storms that blackened skies at noon and scoured the land of topsoil. As city dwellers lost their homes, farmers also lost their land and equipment to foreclosure.

President Herbert Hoover, a Republican and former Commerce secretary, believed the government should monitor the economy and encourage counter-cyclical spending to ease downturns, but not directly intervene. As the jobless population grew, he resisted calls from Congress, governors, and mayors to combat unemployment by financing public service jobs.

LESSON 7
Writing

He encouraged the creation of such jobs, but said it was up to state and local governments to pay for them. He also believed that relieving the suffering of the unemployed was solely up to local governments and private charities.

By 1932 the unemployment rate had soared past 20 percent. Thousands of banks and businesses had failed. Millions were homeless. Men (and women) returned home from fruitless job hunts to find their dwellings padlocked and their possessions and families turned into the street. Many drifted from town to town looking for non-existent jobs. Many more lived at the edges of cities in makeshift shantytowns their residents derisively called Hoovervilles. People foraged in dumps and garbage cans for food.

The presidential campaign of 1932 was run against the backdrop of the Depression. Franklin Delano Roosevelt won the Democratic nomination and campaigned on a platform of attention to "the forgotten man at the bottom of the economic pyramid." Hoover continued to insist it was not the government's job to address the growing social crisis. Roosevelt won in a landslide. He took office on March 4, 1933, with the declaration that "the only thing we have to fear is fear itself."

It was preceded by the so-called ***New Era***, a time of low unemployment when general prosperity masked vast disparities in income."

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1. **Based on the sentence above, the *New Era* was most likely a time when...**
   A. Everyone had more money.
   B. People didn't have jobs.
   C. The poor made a lot less then the rich.
   D. People were very sad.

2. **When did the Great Depression begin?**
   A. The early 1920s
   B. The New Era
   C. Black Tuesday
   D. During WWI

3. **Based on the following excerpt, please choose the best definition of a *shantytown*.**

   Millions were homeless. Men (and women) returned home from fruitless job hunts to find their dwellings padlocked and their possessions and families turned into the street. Many drifted from town to town looking for non-existent jobs. Many more lived at the edges of cities in makeshift ***shantytowns*** their residents derisively called Hoovervilles. People foraged in dumps and garbage cans for food.

   A. The areas where President Hoover lived
   B. Deprived areas people turned into a place to live
   C. Suburban Neighborhood
   D. Big garbage dumps

LESSON 7
Writing

DIRECTIONS
Use a separate sheet of paper if necessary to complete 4-6.

4. **Summarize in 2-3 sentences what happened to people working in America when the stock market crashed (causing the worth of businesses and investments to dramatically decrease.)**

5. **Who did President Herbert Hoover believe was responsible for helping the unemployed? Please support your answer with at least one piece of supporting textual evidence.**

6. **Why did the unemployed living in "makeshift shantotowns" call their living areas "Hoovervilles?" Please support your answer with at least one piece of supporting textual evidence.**

ASSIGNMENT 6

DIRECTIONS
Read the following excerpt from BBC News from February 2014 and answer the questions.

Hollywood Star Shirley Temple Dies

With her adorable charm and blonde curls, she was one of the most popular stars of the 1930s, in hit movies like *Bright Eyes* and *Stand Up and Cheer*…

Born in 1928, Temple soon became a major star after getting her first film role at the age of three.

Her singing, dancing and acting won over fans worldwide. She was given a special juvenile Oscar in 1935, when she was just six years old. To this day, she is still the youngest person to receive an Academy Award.

LESSON 7
Writing

With the nickname "America's little darling," she was ranked as Hollywood's biggest draw for four years running from 1935 to '38 in an annual poll of US cinema owners.

Her rendition of the song *"On the Good Ship Lollipop"* in the film *Bright Eyes* was among her most famous performances.

She was such a hit that US president Franklin Delano Roosevelt dubbed her "Little Miss Miracle" for raising morale during the Great Depression and she was credited with helping save 20th Century Fox from bankruptcy…

Actress Whoopi Goldberg wrote on Twitter: "The Good Ship Lollypop has sailed today with Shirley Temple aboard," and described the star as a true one of a kind.

Joan Rivers tweeted: "Rest in peace, Shirley Temple Black. I know that you're sailing up and away on the Good Ship."

Film critic Leonard Maltin wrote: "One of the most talented and brightest stars in the world has gone to the sky. A genuine phenomenon."

Adapted from: www.edcite.com

1. **Shirley Temple became famous during...**
   A. The New Era
   B. WWI
   C. WWII
   D. The Great Depression

2. **Which of the following did Shirley Temple NOT do?**
   A. Raise the country's morale during tough times
   B. Save 20th Century Fox from bankruptcy
   C. End the economic struggle for the country

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