NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NOTES: UNIT 2 (PART 3) THE PERIODIC TABLE

I) The Elements of the Periodic Table

A) So far, you know that;

1) elements are a subset of the term; \*substance(s)

2) elements cannot be \*broken down into simpler substances

3) Every element is represented by a one to three letter symbol.

The first letter is capitalized. Any other letter of the symbol, is written in the small case

The name of an element *tends* to end in the suffix: **-ium** (pronounced **ē**-um) as in *helium*

4) an element is made of atoms which share a common \*atomic number but

that not every atom of an element has the same number of neutrons, which means that there

are often, \*isotopes which exist.

So, you can think of an element as an aggregation of only one type of atom. **The key is that**

**all the atoms have the same # of protons** (same atomic number).

There may be millions of these atoms all bonded to each other ... but because every atom is of

identical atomic number, the whole mass is classified as an element!

atom element

(a group of atoms of the

same atomic number)

Try using the analogy: **atom is to element as a** brick **is to** brick wall**.**

1 atom represents the whole element, like 1 brick

describes the basic properties of a brick wall

**GIMME’ A METAPHOR**

j0233413

Question: How is a string of pearls like atoms and elements?

What assumption do we make about each individual pearl?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Question: Create an analogy in which a lawn is analogized to an element.

What assumption must be made regarding each blade of grass?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B) Depending upon the date of publication of these notes, there are roughly 118 element

represented on the Periodic Table, and they are divided into:

18 vertical columns (called families or groups),

7 horizontal periods and

2 related series.

1) The elements are organized based upon \*increasing atomic number.

2) There are the Main Group elements (Groups 1,2,13-18) and the Transition Metal Elements Groups

C) A somewhat arbitrary means of categorizing the elements is based upon the activity of the

outermost electrons (the most loosely held electrons .... the most energetic electrons) ....

 the \* valence electrons

Val*a*nce curtain ... While not etymologically related, I like to think of being so named, because it is the "outermost" drape ....The furthest from the window (metaphorically, the nucleus)

& the last to be put on (configured) and the first to be taken off.... Works for me!

<http://oxbowherald.com/writing/blog/with-valances-for-windows-all-you-need-is-your-imagination>

1) Based upon the activity of valence electrons, there are **4** broad categories of elements

a) Metals are elements which lose electrons in a chemical reaction, when reacted with

nonmetals. (Metals become oxidized when reacted with nonmetals.)

b) Metalloids (or Semimetals) blend the characteristics of metals and nonmetals & are

elements with properties which fall between the extremes of metallic and

nonmetallic properties. They are associated with the "staircase" of the

periodic table and this staircase separates metals and nonmetals, as well.

c) Nonmetals ***tend*** to gain electrons in a chemical reaction especially when reacted with

a species of lesser electronegativity, like a metal or even another nonmetal.

(Nonmetals tend to become reduced.)

d) Noble Gases often seen as a subset of the nonmetals, these elements tend to neither

gain nor lose electrons under normal Earth-like conditions. That, is,

under normal Earth-like conditions, noble gases don't bond to other

species, and you won’t find them in many compounds. There are a few

exceptions …but not many.

3) Elements tend to interact in such a way as to stabilize their valence electron levels, and

lower their overall energy.

a) For first-year students we could look at these reactions, as an attempt to reach 8

valence electrons. This is called the OCTET RULE. However, it is highly

and not always accurate. Let’s just say that often (but not always,) a atom will

react to that it has 8 valance electrons …

b) Metals tend to Lose Electrons when reacting with nonmetals by Oxidation (LEO) and

the metal atom becomes a positive species.

c) Nonmetals tend to Gain Electrons when reacting with metals by Reduction (GER), and the nonmetal atom becomes a more negative species (due to a gain of electrons)



c) LEO says GER

<http://bananaoilmovies.wordpress.com/2010/11/05/a-farewell/>

**Relative Locations of the 4 Categories of Elements Found on the Periodic Table**

**Non -**

**Metals Noble**

**Gases**

**Metals**

**Metalloids**

**Metals**

II) The major types of elements on the Periodic Table ... *based upon the activity of valence electrons, which*

*is a somewhat arbitrary means of classification… but I feel is as valid as others ….*

A) Organization of the Periodic Table

1) Elements organized by increasing **atomic number** (Periodic Law)

Elements are organized by ***increasing atomic number*** and thus, many of the physical and chemical properties of

the elements tend to **recur in a systematic manner** (as seen in the organization of families and periods).

***Progressing*** from atoms of the smallest atomic number to the largest, certain properties of the elements

approximate those of precursors at regular intervals.

For example, the 3rd element (lithium) is similar in its chemical behavior to the 11th (sodium) as well as to the

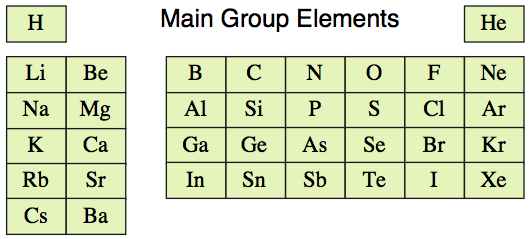
19th (potassium), the 37th (rubidium), the 55th (cesium), and the 87th (francium).

**This regularity in the repetition of properties, establishes the issue of “FAMILY” or GROUP on the**

**periodic table.** This is especially true for the **Main Group** elements.

Main Group Elements: A Main Group Element is any element that belongs to Groups 1, 2, 13 -18.

**The following diagram represents the first 36 Main Group elements**.



<http://www.meta-synthesis.com/webbook/02_mge/hydrides.html>

2) The Periodic Table is most often, divided into 18 groups and 7 periods of approximately 118

*currently* identified elements

a) Depending upon whom you ask, there are 88 to 94 elements recognized as occurring

“naturally” on Earth, *today*. [There *is controversy* over Np (#91), Pu (#92), Tc (#43) & Pm (#61)]

b) 25 (*or so* ... depending on today's date) elements are “synthetic” / human made in high tech

laboratories (see <http://www.lunduniversity.lu.se/o.o.i.s?news_item=6082&id=24890> or <http://tinyurl.com/atomic115>

for Atomic #115’s confirmed discovery in August of 2013)

i) Super colliders: Fermi, CERN, Stanford U. Go to Fermi Lab: <http://www.fnal.gov/>

3) Group (a.k.a. Family): One of 18 \* vertical columns

a) Group members tend to undergo very similar chemical reactions because the members

\* have the same number of valence electrons (There are some exceptions)

b) Some groups or families have been given “trivial” names. You should know them.

Specifics of this work will be seen again, throughout the year, but get familiarized

with the family names and traits, now….

|  |  |  |
| --- | --- | --- |
| Group | Trivial Name | Comments |
| 1 | alkali metals | The most reactive of the metals. They are the most easily oxidized metals.Fr is the most active of the group. Atoms of these metals have only 1 valence electron …They produce +1 ions.  They are not found naturally in the crust of the earth, as a metal. They are found only as +1 ion species in compounds, such as NaCl, or KNO3.  Hydrogen **is not** considered to be an alkali metal. It is often placed in group 1, because it has only 1 valence e-, ***but*** H is often, separated from the rest of the table |
| 2 | alkaline earth metals | These the second most active (reactive) family of metals. They are easily oxidized but less so than the alkali metals. These metals are not found naturally in the crust of the Earth, as metals. Atoms have 2 valence electrons and form +2 ions. |
| 3-11 | transition metals | These are some of the most commonly recognized metals. These metals are more difficult to oxidize and are better for the purposes of engineering, because of it.  The cations of the transition metals, (particularly Period 4 cations) often produce colored aqueous solutions. The color changes based upon the oxidation state of the metal cation. |
| 15 | pnictogens | A rarely used family name, meaning “choking gas formers” |
| 16 | chalcogens | Pronounced: *Kalk*-o-gens: A seldom-used family name, meaning “ore-formers” |
| 17 | halogens | The most active nonmetals, in that they are the most easily reduced of the nonmetals, as a rule. (They gain electrons easily) These are very important chemicals. When reacted with metals, the halogens tend to become -1 ions. These metal and halogen compounds are often called “halides” … e.g. NaCl, sodium chloride is a halide. KBr, potassium bromideis a halide as well. |
| 18 | noble gases | Before 1961 or so these were referred to as the **inert gases**, for it was believed that they would not bond with any element. Since this time, a few compounds in which the noble gas is the oxidized species have been made under relatively extreme conditions, with oxygen, and fluorine.  For the most part, noble gases do not bond, and are not found in compounds, on Earth, under  normal circumstances. With the exception of Helium, the noble gases have a stable octet (8 valence e-), making them very unreactive.  Helium has only 2 valence electrons – but they complete and maximize the first principal energy level, providing an amazing chemical stability. Helium is often separated from the rest of the noble gas family, because the atoms have only 2 valence electrons. |

c) The elements of the two series (Lanthanide Series and Actinide Series) are often seen as

**extensions of Group 3**, but there is some argument over this. Suffice it to write at this point,

that the members of the Actinide (Actinoid) series and the Lanthanide (Lanthanoid) series

have been displaced because of variations in their chemistries from the rest of the Group 3

metals, and for an interesting quirk in their quantum configuration**∞**. ….By removing them

we also create a much neater Periodic Table.

**∞**essentially, the last configured e- are buried in an inner “f”-sublevel

4) Period: One of 7 \* horizontal rows

a) In essence, the period is equivalent to the valence principal energy level

1

2

3

4

5

6

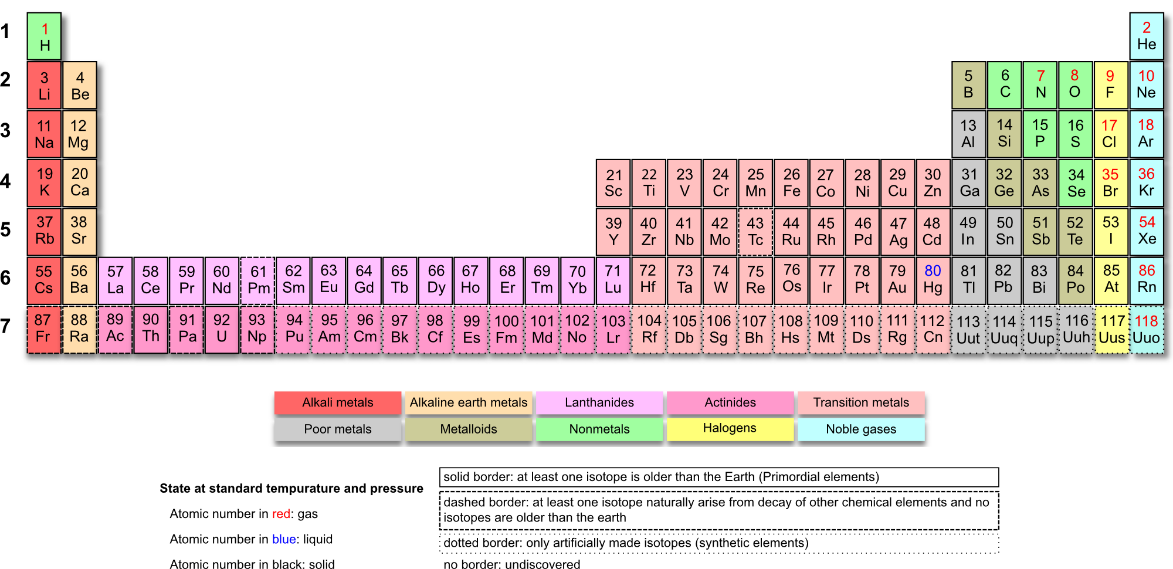
7

6

7

**Here is a “long form” of the periodic table, in which the Lanthanoid and Actinoid series are both included.**

citation: <http://www.sciencegeek.net/tables/LongTable.svg>



**B) METALS:**

1) **Chemical definition** of metal: \* metal atoms lose electrons (are oxidized) in a chemical

reaction. They become more positive in oxidation state (or more positive in charge).

2) oxidation / oxidized: the loss of an electron

a) mnemonic: LEO

b) eg.) Fe0 loses 3 electrons & turns into Fe+3 \* Fe0 → Fe+3 & 3 e-

c) Very often the metal cations are water soluble, thus their chemistry is quite

different from the metal atom.

d) at least 75% of all elements are metallic

e) **Physical** Characteristics of Metals

Lustrous \* shiny / reflective of light

Tenacious \* resists being pulled apart

Ductile \* can be drawn (pulled) into a wire

Malleable \* can be bent / pounded into a foil or sheet

Good conductors of thermal energy and electricity

Most metals are solid (crystalline) at STP: (Hg(l)) is the exception

Other **physical** traits of metals concern their various: melting points, boiling points, densities, & colors

and these vary widely from element to element.

 Check out: How It's Made: Horseshoes <http://www.youtube.com/watch?v=QCxoRl5bILg'> or <http://tinyurl.com/mqf4lqm>

Watch for references to: metal, malleability, electromagnetic spectrum, alloy **C) METALLOIDS**

1) **Definition**: The elements which essentially, ***blend*** the physical and chemical

Chemical Application:

Where will I find metalloids (semimetals) in my world?

properties that fall between the extremes of the properties

associated with metals and nonmetals.

Most metalloids are brittle, somewhat shiny solids that exhibit

properties between those of the metals and nonmetals.

e.g.) semi-conductor: a substance that conducts electricity better than non- conducting

nonmetals but not as well as conductive metals, compared to the

semiconductor in the pure state, or when "doped" with another

material. see: <http://www.alcwin.org/Chemical_Terms_Description-549-S.htm>

At high temperatures, they conduct electricity as if they were

metals, but at lower temperatures (such as room temperature

[20°C - 25°C], they act as insulators, stopping electric currents

from flowing see: <http://school.discoveryeducation.com/teachersguides/pdf/physicalscience/ds/metalloids.pdf>

Essentially, metalloids have electron configurations intermediate between the

nearly empty outer electron shells of the typical metals and the nearly filled

electron shells of the nonmetals. Thus, they have enough empty electron orbitals

into which electrons can be moved to conduct electric current. <http://www.britannica.com/EBchecked/topic/377645/metalloid>

2) Many identify metalloids by referring you to the staircase:

B, Si, Ge, As, Sb, Te, (maybe astatine …chemists are arguing about it…)

**B**

**Si**

**Ge** **As**

**Sb** **Te**

\**At*

Chemical Issue: (say it with an echo...)

As with astatine, there is some debate about aluminum. In Europe (especially Great Britain), aluminum is often

considered to be a metalloid, but many have a problem with this based upon the definition of metalloid. Aluminum

forms **ionic bonds** with oxygen, **but** it makes **covalent bonds** with iodine … However, aluminum is squarely a metal

to my mind, for it does not meet the (somewhat complex) aspects of the definition of the term "metalloid", really.

And, this is just one of the many areas over which chemists argue. Some also question the metalloid classification of

the king of semi-conducting material, silicon(!) And, some wish to include bismuth (as it fits the attributes, better than

Sb!! …but is not next to the staircase) The *Journal of Chemical Education* (Dec 2001) has an excellent article on this

issue.

**D) NONMETALS:**

**= nonmetals**

= nonmetals which are diatomic (7-H Club)

1) **Chemical Def:**  \* When reacted with a metal, the nonmetal atom will tend to

gain electrons (become reduced)

2) reduction / reduced (GER):

3) Physical Characteristics: (They are *NOT* metals) … at STP the solid nonmetals are **brittle**.

a) So what about the other physical characteristics?

**Time for: DiGaetano’s Rule #1 …You can know what something is, by what it isn’t**

**E) NOBLE GASES**

1)  **Chemical Def:** As a general rule under normal, earthlike, conditions, noble gases \* do not

become oxidized, NOR reduced. They do not “make” (are not found in) compounds

**2) Note: Not all gases are NOBLE GASES** **HeO**

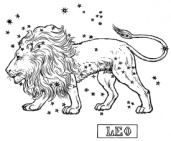
F) We know of two complimentary reactions occurring between many of the elements of the PT

Reduction Oxidation

occur simultaneously

(analogy: playing a game of catch)

REDOX Reactions

 mnemonics

 LEO says GER

&/or try

OIL RIG

1) Oxidation is the loss of an electron. The original species becomes a \*MORE POSITIVE

SPECIES.

Fe0 → Fe+3 + 3 e-

Oxidized to a positive ion due to a loss of 3 electrons

Cl-1 → Cl+5 + 6 e-

Mg0 → Mg+2 + 2e-

2) Reduction is the gain of an electron. The original species becomes a \* MORE NEGATIVE

SPECIES.

Mg+2 + 2e- → Mg0 notice that the produce is more negative than the reactant

P0 + 3 e- → P-3

a) It is called reduction, because the charge becomes more negative due to a gain of

negative charge (electrons)

G) **SPECIAL NAMES OF CERTAIN GROUPS / FAMILIES (In-Depth)**

**1) ALKALI METALS:** (Group 1)

|  |
| --- |
| **Li** |
| **Na** |
| **K** |
| **Rb** |
| **Cs** |
| **Fr** |

a) \* The most active metals known. Metallic activity increases as we move from top

to bottom of the group.

i) ***active*** metal = \* readily oxidized due to relatively lower ionization energies

ii) Francium (Fr) \* the most active of all of the metals

b) cannot be found as atoms (metallic or elemental form) in the crust of the earth. The

cations of these metals can be found in compounds only. The pure metals become

oxidized very easily and exothermically when reacted with water to produce H2(g)

**2) ALKALINE-EARTH METALS:** (Group 2)

|  |
| --- |
| **Be** |
| **Mg** |
| **Ca** |
| **Sr** |
| **Ba** |
| **Ra** |

a) they are also ***active metals***, but less so than Group 1 metals

b) cannot be found as atoms (free elements) in the crust of the earth

c) they react easily with water to produced H2(g)

**3) TRANSITION METALS** Groups 3-11 (most well-known metals)

a) When dissolved in water, the cations of many compounds with transition metal

cations (especially those of Period 4), produce colored aqueous solutions

e.g.) Cu2+(aq) = a green/blue/teal Cr6+(aq) of (CrO4)2- = yellow

Cr7+(aq) = of (Cr2O7)2- = orange, Mn7+(aq) of (MnO4)2- = deep violet /purple,

Ni2+(aq) = light green, Co2+(aq) = light pink

b) have multiple oxidation states & they don't always follow the rules

of the other metals. Iron is one of the more abundant transition metals in the crust.

**4) HALOGENS** (salt-formers)

|  |
| --- |
| **F** |
| **Cl** |
| **Br** |
| **I** |
| *At\** |

a) Group 17 ... very active **NON**metals

b) an active nonmetal \* readily reduced ; highly electronegative species

c) Fluorine (F) \* the most active of all of the nonmetals

**5) NOBLE GASES**

|  |
| --- |
| **He** |
|  |
| **Ne** |
| **Ar** |
| **Kr** |
| **Xe** |
| **Rn** |

a) Group 18 (**including helium**)

b) Very unreactive: tend to be found as monatomic (lone) species.

Under normal, earth-like conditions, they are not found ***in compounds*** because they

tend NOT to make bonds... They are considered to be unusually chemically stable

i) 1963: exceptions: Under extreme pressure and very low temperature, scientists

have been able to create compounds of F and O, only with the noble gases

Kr, Xe, & Rn (no known compounds of He, Ne, & Ar exist on Earth. (Some

experts suspect that no compounds of He and Ne exist even in the depths of space)

*FYI: Group 15 is also known as the Nitrogen Family or the* ***PNICTOGENS*** *(choking-gas formers)*

*Group 16 is also known as the Oxygen Family**or the* ***CHALCOGENS*** *(pronounced Kalkogens … ore -formers)*

*A family is named, also after the first element of the family: e.g. Group 13 = Boron Family*

![MC900434713[1]](data:None;base64,)

Checkout Tom Lehrer’s Song of the Elements (music: I am the very model of a modern Major General from

The Pirates of Penzance by Gilbert and Sullivan) <http://www.privatehand.com/flash/elements.html>

Practice 1:

\_\_\_1) Which of these describes the chemical activity of a metal? A metal tends to;

1) gain an electron when reacted with a nonmetal

2) share an electron, when reacted with a nonmetal

3) bond easily to other metals by either gaining or losing electrons

4) lose an electron, when reacted with a nonmental

\_\_\_2) Which element is best described by the terms: NONMETAL and HALOGEN?

1) carbon (C) 2) Nitrogen (N) 3) Oxygen (O) 4) Fluorine (F)

\_\_\_3) Which element is best described by the term; TRANSITION METAL?

1) potassium (K) 2) calcium (Ca) 3) iron (Fe) 4) bromine (Br)

\_\_\_\_4) Which of the following elements is MOST LIKELY to be reduced, when reacted with sodium (Na),

in a chemical reaction?

Think: What is the question really asking? What of the 4 types of elements is reduced????

Once you know the answer to that question ….the rest is pretty straight up….

1) oxygen (O) 2) helium (He) 3) neon (Ne) 4) potassium (K)

\_\_\_5) Which formula indicates that the substance can be **decomposed** into simpler substances?

a) S8(s) b) NH3(g) c) Hg(l) d) O2(s)

Explain your reasoning: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6-10) Based upon the diagram identifying the types of elements, or any other reference, in what category

of element would most chemists place the following?

6) Oxygen \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 9) Germanium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7) Copper \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 10) Uranium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8) Neon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ANSWERS TO PRACTICE 1

1) 4

2) 4

3) 3

4)

5) b It is a compound (two or more different capital letters with a “g” for gas) . Compounds can be broken down into simpler substances. The others are elements and elements cannot be broken down into simpler substances.

6) nonmetal 7) metal 8) noble gas 9) semimetal or metalloid 10) metal

H) Allotropy (Allotropes) Greek: *allos* = other & *tropos* = manner (NEW CONCEPT)

Substances made from **atoms of the** **same element**, existing in the ***same phase*** but with different

physical and chemical properties \* caused by differences in structure, **due to differences in bonding**.

Allotropy is a specific form (a subset) of polymorphism.

1) Allotropy is a specific form of polymorphism, which is the existence of a substance in more than

one form. Different crystal structures are known as polymorphs. The term polymorphism is applied

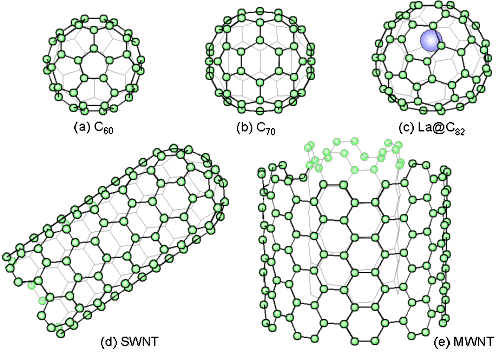
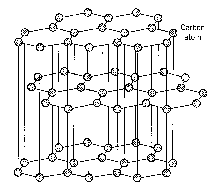
to *compounds* as well as to *elements*...while the term **allotropy applies to elements specifically**.

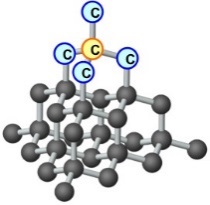
see: <http://www.bbc.co.uk/dna/h2g2/A5759517>

O = O O

O O

2) example: O2(g) (oxygen) vs. O3(g) (ozone)

 3) example: Diamond, Graphite, Buckminsterfullerene (fullerenes)



Sheets of graphite: one on top of the other

See: <http://www.sciencedaily.com/releases/2006/05/060508171127.htm>

See:  [http://www.understandingnano.com/nanotubes-carbon.html](%20http:/www.understandingnano.com/nanotubes-carbon.html)

http://www.photon.t.u-tokyo.ac.jp/~maruyama/fticr/fullerene.gif

Reading: The chemical and physical properties of allotropes are different from each other. For instance, diamond is an allotrope of the element carbon. Graphite is a second allotrope of carbon.

|  |  |
| --- | --- |
| Diamond | Graphite |
| Diamonds are hard / rigid | Graphite is soft / flexible (mixed with clay, it is the "lead" of a pencil). |
| Diamond is an excellent electrical insulator | graphiteGraphite is a fairly good conductor of electricity, for a nonmetal |
| http://bookbuilder.cast.org/bookresources/11968/46242_1.jpgDiamond is the ultimate abrasive | Graphite is a very good lubricant! |
| Diamond is transparent | Graphite is opaque. |
| Diamond crystallizes in the isometric system | Graphite crystallizes in the hexagonal system. |

**All diamonds at or near the surface of the Earth are currently undergoing a transformation into graphite**. This, fortunately, for the jewelry lover, is **extremely** slow. <http://mineral.galleries.com/minerals/elements/diamond/diamond.htm> Whereas graphite is in the form of sheets, a diamond is basically a huge "super-molecule" or network solid, composed of carbon atoms bonded together by covalent bonds. The size of this "super-molecule" corresponds to the size of the diamond is: e.g. a diamond of 1 carat, for instance, contains about 10,000,000,000,000,000,000,000 or 1 x **1022** carbon atoms (that’s 10 [billion](http://www.answers.com/topic/billion) billion atoms). <http://www.unc.edu/~rowlett/units/large.html>

(As an aside... while not helping with the idea of allotropy, diamond and graphite have one similar property.) Both are made of carbon (although the atoms are bonded differently) ... but under the correct conditions, each *combust, in oxygen, to produce carbon dioxide.*  In fact, Lavoisier (who named the element, carbon), bought a small diamond and proceeded to combust it, using a magnifying glass. He then went on to prove chemically, that carbon dioxide was produced. <http://www.vectorsite.net/tpchem_02.html>, also see: <http://www.chemicool.com/elements/carbon.html>

The metal tin (Sn), was recognized as an element by Lavoisier. <http://lycoskids.infoplease.com/ce6/sci/A0848797.html> Tin also exhibits [allotropy](http://lycoskids.infoplease.com/ce6/sci/A0803422.html). Above 13.2°C tin metal is a lustrous, silver-white, highly crystalline metal with a tetragonal structure similar to the other Group 14 elements. However, a brittle form with orthorhombic structure may exist above 161°C. Below 13.2°C, some pure tin tends to become a gray, loose powder, a change commonly designated **“tin pest”, “tin leprosy” or “tin disease.”** It is not a chemical change, but a physical change as the tin atoms rearrange themselves into a less cohesive form, at cold temperatures. It has been connected to (possibly inappropriately) to the disasters of Napoleon in Russia and Scott’s loss of fuel and food and ultimately, death trying for the South Pole.

Tin metal is very soft (only slightly harder than lead) and malleable; it can be rolled, pressed, or hammered into extremely thin sheets (as in, "tin foil"). When iron or steel is dipped into molten tin, a layer of tin is deposited on the surface. The tin serves to prevent rusting, (it resists oxidation, the loss of electrons) since it is barely affected by moisture. A tin coating is used to protect copper (as in some expensive cookware) and other metals. This **process** of protecting copper and iron with a coating of zinc is called **"galvanizing"** (Have you ever heard of a galvanized roofing nail … or have you ever heard the saying to: *galvanize yourself against trouble* is to act so as to **protect** yourself?)

PRACTICE 2:

1) Identify one physical property which differentiates the allotropes of tin. \* color / tenacity or lack of…

2) At 298 K, oxygen (O2) and ozone (O3) have different properties because their

(1) atoms have different atomic numbers (3) molecules have different molecular structures

(2) atoms have different atomic masses (4) molecules have different average kinetic energies

3) Which statement correctly describes diamond and graphite, which are different forms of solid carbon?

(1) They differ in their molecular structure, only.

(2) They differ in their properties, only.

(3) They differ in their molecular structures and properties.

(4) They do not differ in their molecular structure or properties.

4) When reading about allotropes, a student should expect there to be differences in

(1) just their chemical properties

(2) just their physical properties

(3) neither their chemical nor physical properties

(4) both their chemical and physical properties

5) Identify one CHEMICAL property of any allotrope of tin \* resists oxidation (corrosion, loss of e-)

6) Identify one PHYSICAL property of graphite which differentiates graphite from its allotrope, diamond

\* hardness, conductivity, color (transparency)

7) At surface conditions, which is actually a more stable substance, diamond or the graphite of your pencil?

8) Which natural substance is the hardest known to humans? \* diamond

9) Robert Falcon Scott tried to be the first to reach the South Pole, in 1911. His team deposited stores of fuel

and food along the way, to be collected upon the way back. He had sealed all his canisters of food and

kerosene with seams of tin. He did get to the South Pole, in January 1912, but he was beaten there, by Roald

Amundsen, by one month. Scott and the three remaining explorers made a mad dash to get back to One Ton

Depot, but the last living team member (Scott), died in March of 1912, due to exposure, cold and starvation,

11 miles from the settlement. Often, they found their stores empty or the kerosene had seeped into their food,

making it inedible.

In your estimation, based upon the reading, what could have theoretically occurred to the tins of supplies,

and why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Answers: 1) color / tenacity or lack of 2) 3 3) 3 4) 4 5) resists oxidation (corrosion, loss of e-) 6) hardness, conductivity, color (transparency) 7) graphite 8) diamond

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

I) **A FEW MISCELLANEOUS RELATIONSHIPS**

**1) Phases at STP: Liquids: (only 2) \* (di)bromine (Br2(l)) and mercury (Hg(l))**

**Gases: all noble gases, \* H2(g), N2(g), O2(g), F2(g), Cl2(g)**

**Solids: \*** all other elements not listed as liquid or gaseous state

**2 Diatomic Elements (7-H Club)**: Elements which exist in their pure form in pairs.

The diatomics are **molecular elements.** All diatomic elements are NONmetals – but not all

nonmetals are diatomic.

|  |  |
| --- | --- |
| 5 Atoms of Neon | 5 molecules of Fluorine (a total of \_\_\_\_ atoms) |

H

7N

O

F

Cl

Br

I

17

**3) Radioactive Elements** (Covered in the last unit, in June):

a) Every isotope of the elements with atomic number 84 or greater are all radioactive.

b) Radioactivity: The disintegration of a nucleus via the release of energy and/or matter.

i) very often, radioactive materials can be used to increase the density of soft

tissues and contrast these tissues, with the surrounding tissues (as in barium

sulfate for gastro-intestinal scans)

ii) very often when a nucleus disintegrates, it turns into a different elemental

species, called a “daughter nucleus”.

**4) Transuranium Elements (synthetic):** (Trans = beyond: Transuranium element = *beyond* uranium)

a) These elements do NOT occur naturally on Earth (although there is some

disagreement about neptunium, & plutonium). They are created in the laboratory by

various **nuclear** bombardments / reactions. They are synthetic AND radioactive

(because they represent atomic numbers in the radioactive range (see above)

b) All of the isotopes of each transuranium element are radioactive … (but not every

radioactive element is a transuranium element.) Be aware of this distinction!

5) **The inner transition metals**: Essentially the elements of the Lanthanoid and Actinoid series

a) elements of these series are alternately called lanthan*ides* and actin*ides* &/or the

inner transition metals are the "f" block elements

b) Our version of the periodic table, has the elements separated from the main elements because the elements are more chemically similar to each other, than in the classic

definition of "family".

c) Their electron configurations are very difficult to prove, since the f and d sublevels

are so close to each other in energy.

d) But, their chemistries are more related to their neighbors, than their group because it

seems that their valence number is relatively stable. Electrons are configured into the

f-sublevel, thus leaving the valence sublevels of s and/or p constant.

e) The inner-transition elements also include most of the “rare-earths” (but not all of

them). They are sort of a subset of the inner-transition metals.

6) **The Rare-Earth Elements (metals)**: Rare-Earths actually are **NOT all that rare** ...

a) but the ores (mixtures) in which they occur, have such small amounts that the metals

are difficult to purify and collect in large quantities.

e.g) Lutetium is the 60th most abundant element, in the crust of the Earth, and that

means lutetium, is far more common than either silver or gold.

The scarcest naturally occurring element (thulium) is as common as bismuth,

and ***more common*** than arsenic, cadmium, mercury and selenium.

<http://www.scribd.com/doc/68112125/96/f-Block-Inner-Transition-Metals-Lanthanoids-and-Actinoids>

b) The rare earths are all chemically similar metals and include 14 lanthanides of the

Lanthanide series, Scandium and Yttrium. (Promethium is often considered to be "synthetic" and

not included in the list, because it does not occur in the mined minerals / ores containing the rare-earths.)

c) They are used in cell phone batteries, guided missile systems, magnets needed in

satellites, computer batteries, hard drives, and are important four our emerging green

technologies associated with fluorescent light bulbs, wind turbines, generator magnets

d) China supplies 95% to 97% of world's known quantities of rare-earth metals due

to large deposits. There is however, research that the mud of the Pacific Ocean is also

rich in deposits (Science News 13 Aug 2011 p. 14)

Because rare earth elements are an important strategic resource in which China has a considerable advantage due to the massive reserves in the country, a great deal of money has gone toward researching rare earths. In order to close its technology gap with the West, China has also drawn on the research of others. Nearly 50 % of the graduate students who [study](http://fmso.leavenworth.army.mil/documents/rareearth.pdf) at the U.S. Department of Energy’s Ames National Laboratory are from China. Each time a visiting student returns, he or she is replaced by another Chinese visiting student. FORBES Magazine 21 June 2012 at <http://www.forbes.com/sites/jackperkowski/2012/06/21/behind-chinas-rare-earth-controversy/>

…In the United States, California's Mountain Pass mine, reopened in 2010 and it is expected to start producing light rare-earth elements this year. The mine was once the world's biggest producers of rare earths, but shut down in 2002 because of environmental problems and falling prices. Another mine is proposed in Wyoming, by Canadian company Rare Element Resources, but it faces opposition from local residents.

One of the larger rare-earth gambles is at Alaska's Bokan Mountain. Once mined for uranium, the granite peak on Prince of Wales Island contains rich veins of the harder-to-find heavy rare-earth elements. The project has strong support from Alaska's legislature and from nearby communities. A Canadian company plans to extract the ore and transform it into oxides with a custom-built processing plant. Therein lies the challenge…. <http://news.yahoo.com/radioactive-mountain-key-us-rare-earth-woes-172406798.html>

1) Of what importance could there be for lawyers and diplomats to have a chemistry background? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2) What are the economic challenges associated with mining / refining for rare earth metals? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7) Abundance in the Universe, by mass (an adaptation of an idea taken from a chart from <http://www.webelements.com/>

**Only 0.04% of the matter in the universe, is something other than hydrogen and helium!!!**

Hydrogen

Helium

Carbon Oxygen

J) Elements can bond with each other, to make structures (molecules, ionic compounds) beyond that

of the atom…. **New and Important Vocabulary:**

Molecule: generally, any substance which is neutral in overall charge, \*made from

nonmetal atoms, chemically united with covalent bonds (a sharing of

electrons between two “bound atoms”) May be molecular elements or

molecular compounds.

Ionic Compound a compound (thus neutral in overall charge), held together by \* ionic

bonds between a metal ion and nonmetal ion OR most compounds with a

charged species bonded to another charged species, like a polyatomic ion.

Noto Bene: **The term *ION* ≠ *IONIC***

So… what is the difference? \*An ion is a noun … it is a species in which the #p ≠ #e-

The term *ionic* is more of an adjective, which describes a type of bond or a type of compound

with an ionic bond, which exists between ions.

PRACTICE 3: Use the following choices, your Periodic Table, AND the table of polyatomic ion. Identify each of the following compounds as either;

a) A Molecule (a multi-atomic element or compound, made of nonmetals, but has NO polyatomic ions)

b) Ionic Compound (made of metal and nonmetal species **OR** the compound contains a polyatomic ion)

When asked "Rationale", consider using ideas such as: *made from 2 nonmetal atoms*; *made from metal ion and nonmetal ion; has a polyatomic ion*... or some sort of variation on any of the three. Complete sentences are unnecessary.

\_\_\_1) N2O5 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_2) KCl Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_3) NaClO

\_\_\_4) O2 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_5) O3

\_\_\_6) Li2CO3 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_7) NH3

\_\_\_8) CH2FCl

\_\_\_9) Mg3(PO4)2 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_10) Fe2O3 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_11) H2O Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_12) ICl

\_\_\_13) Br2 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_14) CaO

\_\_\_15) BaSO4

\_\_\_16) Cl2

\_\_\_17) LiF

\_\_\_18) HCl

\_\_\_19) N2

\_\_\_20) TiO2 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_21) MnO

\_\_\_22) Mg(OH)2

\_\_\_23) AgCl Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_24) H2

\_\_\_25) CCl4 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_26) MgF2

\_\_\_27) CuCl2

\_\_\_28) Ni2O3

\_\_\_29) PbO

\_\_\_30) PbO2

\_\_\_31) NaOH

\_\_\_32) C6H12O6 Rationale: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_33) NH4Cl (***tricky***)

\_\_\_34) NH4NO3 (tricky ...for basically the same reason as #33)

Answers: 1) a 2) b 3) b 4) a 5) a 6) b 7) a

8) a 9) b 10) b 11) a 12) a 13) a 14) b 15) b

16) a 17) b 18) a 19) a 20) b 21) b 22) b 23) b

24) a 25) a 26) b 27) b 28) b 29) b 30) b 31) b

32) a 33) b has a PAI 34) b

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NOW, TRY THESE....

DIRECTIONS: Use your copy of the Periodic Table to identify each of the following elements as a **metal, metalloid, nonmetal or noble gas**

1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_tungsten

2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_silicon

3) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_helium

4) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_neon

5) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_iodine

6) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ potassium

7) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_hydrogen

8) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_rhodium

9) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_carbon

10)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_germanium

DIRECTIONS: Use your notes and periodic table. Select the most correct response to each question.

\_\_\_11) 1.00 gram of gold metal may be converted into a thin foil with an area of 1 m2. This ability to be

converted to a foil most directly demonstrates:

a) ductility b) tenacity c) electrical conductivity d) malleability

\_\_\_12) Which of the following is most likely the best conductor of an electrical current at STP?

a) sulfur b) tungsten c) iodine d) bromine

\_\_\_13) Given the chemical reaction equation: 2 Mg(s) + O2(g) → 2 MgO(s) + kJ

*metal* atoms of the reactant, Mg(s), are most probably:

a) converted into energy b) reduced c) oxidized d) converted to an anion

\_\_\_14) In the compound MgO(s), the Mg of the compound most probably exists as a(n)

a) cation b) anion c) negative ion d) metal atom

Ans: 1) metal 2) metalloid 3) noble gas 4) noble gas 5) nonmetal 6) metal 7) nonmetal 8) metal 9) nonmetal

10) metalloid 11) d definition 12) b good electrical conductivity is a physical property of metals 13) c in a chemical reaction, metal atoms lose electrons (become oxidized) 14) a in a comp. metal elements are probably "+" ions (cations)

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PRACTICE 4: For questions 1 - 8, one or more of the responses given are correct. Using your notes and understanding of the periodic table, decide which of the responses is (are) correct. Then choose:

1) when only I were correct

2) when only II were correct

3) when only I and II were correct

4) when only II and III were correct

5) when I, II, and III were each correct

\_\_\_\_\_ 1) The element **uranium** (atomic number 92) may be described as :

I) a metal II) radioactive III) synthetic

\_\_\_\_\_ 2) Helium, neon, and argon, are **each**

I) capable of being oxidized during a chemical reaction

II) pretty unreactive and not found in compounds

III) members of the noble gas family of elements

\_\_\_\_\_ 3) Sodium, Calcium and Iron are each

I) oxidized in chemical reactions II) metals III) found in period 4 of the Periodic Table

\_\_\_\_\_ 4) Group 2 elements may be described as

I) having at least 1 metal and at least 1 nonmetal

II) being made of atoms that are readily oxidized

III) members of the alkali metal family

\_\_\_\_\_ 5) The elements represented by atomic numbers 24, 25, 26 and 27 are all

I) solid at STP II) transition elements III) metals

\_\_\_\_\_ 6) The elements iodine , bromine, and chlorine are all

I) diatomic molecules II) halogens III) gases at STP

\_\_\_\_\_ 7) The atoms of the elements; phosphorous, sulfur and carbon

I) tend to be reduced in reactions II) are halogens III) are metalloids

\_\_\_\_\_ 8) The term STP translates into values equal to

I) 273 K and 1 atm II) 0˚C and 101.3 kPa III) 273 K and 101.3kPa

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For questions 9 - 22 use the following incomplete section of the Periodic Table at STP, which represents

Periods 3, 4 and 5. Please note the following:

**• Using only the numbers 1, 2, 3, 4, 5 choose the letter which best completes the statements 9 - 22.**

**• The elements K, Al, Sb and Kr are given only to help focus you.**

**• Letters (1) - (5)** **may be used once, more than once or not at all.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 |  | 13 | 14 | 15 | 16 | 17 | 18 |
| period  3 |  | **(2)** |  | Al |  |  |  |  |  |
| period  4 | K |  |  |  |  | **(3)** |  | **(4)** | Kr |
| period  5 | **(1)** |  |  |  |  | Sb |  |  | **(5)** |

\_\_\_\_\_ 9 Of the choices, this element is best classified as a metalloid.

\_\_\_\_\_ 10 Of the choices, this element is the most **active** metal.

\_\_\_\_\_ 11 Of the choices, this element is diatomic (a member of the 7-H Club) at STP.

\_\_\_\_\_ 12 Of the choices, this element is classified as an alkaline-earth element.

\_\_\_\_\_ 13 Of the choices, this element is a liquid at STP.

\_\_\_\_\_ 14 Of the choices, this element is a gas at STP.

\_\_\_\_\_ 15 Of the choices, this element is most likely to be reduced in a chemical reaction.

\_\_\_\_\_ 16 Of the choices, this element is probably the most brittle. (hint: solid nonmetals and metalloids are brittle)

\_\_\_&\_\_\_ 17 Of the choices, these 2 elements would be the better conductors of electricity.

\_\_\_&\_\_\_ 18 Of the choices, these two would have melting points below standard temperature.

\_\_\_\_19 Of the choices, which would undergo chemical reactions most similar to those of the element calcium ?

\_\_\_\_\_ 20 Of the choices, which element has the ability to be oxidized or reduced depending upon the reaction ?

\_\_\_\_\_ 21 Of the choices, this element is LEAST likely to be oxidized or reduced in a chemical reaction.

\_\_\_\_\_&\_\_\_\_\_ 22 Of the choices, which 2 elements are probably malleable ?

Answers: 1) 3 2) 4 3) 3 4) 2 5) 5 6) 3 7) 1 8) 5 9) c 10) 1 11) 4 12) 2 13) 4

14) 5 15) 4 16) 3 17) 1 & 2 18) 4 & 5 19) 2 20) 3 21) 5 22) 1 & 2

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PRACTICE

1) Which list of elements contains two metalloids? 9) The elements in the Periodic Table are arranged

(1) Si, Ge, Po, Pb (3) Si, P, S, Cl in order of increasing

(2) As, Bi, Br, Kr (4) Po, Sb, I, Xe (1) atomic number (3) mass number

(2) atomic radius (4) neutron number

2) Which element is a solid at STP?

The element in Period 4 and Group 1 of the Periodic Table would be classified as a

(1) metal (3) nonmetal

(2) metalloid (4) noble gas

(1) H2 (2) I2 (3) N2 (4) O2 10)

Which element is a noble gas?

(1) krypton (3) antimony

(2) chlorine (4) manganese

3)

11)

An atom of argon rarely bonds to an atom

of another element because an argon atom has

(1) 8 valence electrons (3) 3 electron shells

(2) 2 electrons in the (4) 22 neutrons

first shell

11)

At STP the element oxygen can exist as either

O2 or O3 gas molecules. These two forms of the

element have:

(1) the same chemical and physical properties

(2) the same chemical properties, but different

physical properties.

(3) different chemical properties, but the same

physical properties

(4) different chemical and physical properties

4)



12)

Which element has chemical properties that are most similar to those of the element sodium?

(1) Mg (2) K (3) Se (4) Cl

5)

About what is this question really asking?

Which list of elements contains a metal, a metalloid, and a nonmetal?

(1) Zn, Ga, Ge (3) Cd, Sb, I

(2) Si, Ge, Sn (4) F, Cl, Br

6)

About what is this question really asking?

Which element is malleable and conducts electricity?

(1) iron (3) sulfur

(2) iodine (4) phosphorus

13)

At STP, solid carbon can exist as graphite or as

diamond. These two forms of carbon have

(1) the same properties and the same crystal

structures.

(2) the same properties and different crystal

structures.

(3) different properties and the same crystal

structures.

(4) different properties and different crystal

structures.

7)

What concept is this question testing?

Which terms are used to identify pure substances?

(1) an element and a mixture

(2) an element and a compound

(3) a solution and a mixture

(4) a solution and a compound

14)

Think! The question is asking... which has a melting point greater than 0 C ... Any Tables that might help????

At standard pressure, which element has a

melting point higher than standard temperature?

(1) F2 (2) Br2 (3) Fe (4) Hg

15)

At STP, an element that is a brittle solid and a poor conductor of heat and electricity could have an atomic number of

(1) 12 (2) 13 (3) 16 (4) 17

8)

Answers: 1) 1 2) 2 3) 1 4) 4 look up allotropy 5) 2 same family or group 6) 3 7) 4 look up allotropy 8) 3 must be a ***solid*** nonmetal 9) 1 10) 1 11) 1 12) 3 13) 1 14) 2 15) 3

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16) Below is a portion of the poem, *The Valediction Forbidding Mourning* by the Reverend John Donne.

\*breach = break...

also, for the proper meter, pronounce *expansion* as "ex-pan-shē-un"

Our two souls therefore, which are one

Though I must go, endure not yet

A breach\*, but an expansion

*Like gold to airy thinness beat*.

If they be two, they are two so

As stiff twin compasses are two

Thy soul the fixed foot, makes no show

To move, but doth if th’ other do.

Based upon interpreting the poem, the physical property of gold metal to which Donne alludes

is \* malleability (the ability of a metal to be pounded into a foil)

17) Why would it be correct to write that S6(s) [hexasulfur] and S8(s) [cyclo-octasulfur] are BOTH examples

of elemental sulfur?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18) O2(g) [dioxygen gas] is an example of *elemental* oxygen and SO3(g) [sulfur trioxide] is NOT a form of

oxygen (It contains oxygen atoms, but is not oxygen alone). SO3(g) is better classified as a *compound*.

Ca(s) [calcium metal in the solid phase] is an example of an element BUT CaCl2(s) [calcium chloride] is a

compound

Br2(l) [dibromine liquid] is an example of an element, BUT NaBr(s) [solid sodium bromide] is a compound.

Given the above examples, differentiate between an element and a compound. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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19) Using the periodic table, and your grasp of the basic ideas, identify the following elements as

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**metal, metalloid, nonmetal or noble gas.**

a) This category of element tends to lose electrons to other elements, in a chemical reaction.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) This members of this category of element are NOT found in chemical compounds, under normal

circumstances, here on Earth \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) The element, sodium (atomic number 11), should be classified as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) The element, uranium (atomic number 92), should be classified as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) The element sulfur (atomic number 16) should be classified as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

f) The element xenon (atomic number 54) should be classified as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20) Helium is a noble gas. Oxygen is a nonmetal. Should you expect to find the compound HeO(g) in

the atmosphere of the Earth?

\_\_\_\_\_\_\_\_ Defend your reasoning. Be sure to quote from the reading. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Answers:

16) Malleability

17) Even though each has multiple atoms, the atoms are all of sulfur (16 protons) and any sample of matter made up of only species with 16 protons,

must be classified as elemental sulfur.

18) tomorrow... be sure to have written something down though...push, push, push your boundaries!!!

19) a) metal (metallic) element b) noble gas element c) metal

20) No, because ....helium is a noble gas and noble gases do not make bonds with other elements (or make compounds) readily, easily……

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