Science Gateway Content Review Topics

Chemistry Topics

*Solutions and Concentrations

- solute, solvent

- unsaturated, saturated, supersaturated

- effect of temperature increase on solid solutes

- effect of temperature increase on gas solutes

- molarity (moles solute/liter of solution)

- percent concentration (grams solute/grams solute + grams solvent) x 100%

*Periodic Table and Trends

- metals, nonmetals, metalloids: location on periodic table and properties of each

- trend of atomic radii (size) across a period and down a group

- trend of reactivity across a period and down a group

- location of radioactive elements

- the 7 diatomic elements

*Acids and Bases

- acidsô have hydrogen capable of releasing as hydrogen ion (H^+)

- basesô have hydroxide ion and capable of releasing hydroxide ion (OH^{1-})

- properties of acids and bases

- tests for an unknown substance and deciding if it is an acid, base, or neutral (litmus and phenolphthalein)

- pH scale for measuring acidity and alkalinity

- range of pH scale for acids, bases, and neutral substances

- within acidic range, which is most acidic; within basic range which is most basic

- acid rainô cause (how it forms) and effects

*Chemical and Physical Properties of Matter

- examples of physical properties as observable or measurable properties

- examples of chemical properties as reactivity or non-reactivity

- identify substances using physical and chemical properties

- comparison of physical and chemical changes

- classify substances as elements, compounds, or mixtures

*Energy

- **l**aw of conservation of energy/mass
- exothermic and endothermic changes
- energy changes in photosynthesis and respiration
- identify energy transformations (ex: From gasoline in a car to car's wheels moving)
- calculate heats of combustion

*Atomic Structure

- location of protons, neutrons, electrons in an atom
- charge and mass of these subatomic particles
- atomic number and atomic mass and mass number
- isotopes
- radioactive elements: location on periodic table
- 3 types of radioactive particles released; use in bombs and power plants
- energy of the future: fusion

*Bonding

- bonding occurs via gaining, losing, or sharing e^-
- covalent bonding: sharing electrons that occurs between two non-metals
- ionic bonding: gaining or losing electrons; occurs between a metal and a non-metal
- how ions form from neutral atoms (cations form from an atom losing electrons; anions form from an atom gaining electrons)
- group 1 ions form 1:1 compounds with group 17 and 2:1 compounds with group 16.
- single, double, triple bonds = # of electron pairs being shared
- writing and naming formulas
- electron dot formulas

intermolecular forces on boiling and melting points

PERIODIC TABLE

KEY

- atomic number - 5
- atomic symbol - B
- name of element - Boron
- atomic weight - 10.811
- electron arrangement - 2, 3

PERIODS	GROUP 1 (Ia)	2 (IIa)	3	4	5	6	7	8	9	10	11	12	13 (IIIa)	14 (IVa)	15 (Va)	16 (VIa)	17 (VIIa)	18 (VIIIa)
1	1 H Hydrogen 1.00797 1																	2 He Helium 4.0026 2
2	3 Li Lithium 6.941 2.1	4 Be Beryllium 9.0122 2.2											5 B Boron 10.811 2.3	6 C Carbon 12.011 2.4	7 N Nitrogen 14.0067 2.5	8 O Oxygen 15.9994 2.6	9 F Fluorine 18.998 2.7	10 Ne Neon 20.183 2.8
3	11 Na Sodium 22.9898 2.8.1	12 Mg Magnesium 24.312 2.8.2											13 Al Aluminum 26.9815 2.8.3	14 Si Silicon 28.086 2.8.4	15 P Phosphorus 30.9738 2.8.5	16 S Sulfur 32.064 2.8.6	17 Cl Chlorine 35.453 2.8.7	18 Ar Argon 39.948 2.8.8
4	19 K Potassium 39.102 2.8.8.1	20 Ca Calcium 40.08 2.8.8.2	21 Sc Scandium 44.956 2.8.9.2	22 Ti Titanium 47.90 2.8.10.2	23 V Vanadium 50.942 2.8.11.2	24 Cr Chromium 51.996 2.8.13.1	25 Mn Manganese 54.9380 2.8.13.2	26 Fe Iron 55.847 2.8.14.2	27 Co Cobalt 58.9332 2.8.15.2	28 Ni Nickel 58.71 2.8.16.2	29 Cu Copper 63.546 2.8.18.1	30 Zn Zinc 65.37 2.8.18.2	31 Ga Gallium 69.72 2.8.18.3	32 Ge Germanium 72.59 2.8.18.4	33 As Arsenic 74.9216 2.8.18.5	34 Se Selenium 78.96 2.8.18.6	35 Br Bromine 79.904 2.8.18.7	36 Kr Krypton 83.80 2.8.18.8
5	37 Rb Rubidium 85.47 2.8.18.8.1	38 Sr Strontium 88.905 2.8.18.8.2	39 Y Yttrium 88.905 2.8.18.9.2	40 Zr Zirconium 91.22 2.8.18.10.2	41 Nb Niobium 92.906 2.8.18.12.1	42 Mo Molybdenum 95.94 2.8.18.13.1	43 Tc Technetium (97) 2.8.18.13.2	44 Ru Ruthenium 101.07 2.8.18.15.1	45 Rh Rhodium 102.905 2.8.18.16.1	46 Pd Palladium 106.4 2.8.18.18.0	47 Ag Silver 107.868 2.8.18.18.1	48 Cd Cadmium 112.40 2.8.18.18.2	49 In Indium 114.82 2.8.18.18.3	50 Sn Tin 118.69 2.8.18.18.4	51 Sb Antimony 121.75 2.8.18.18.5	52 Te Tellurium 127.60 2.8.18.18.6	53 I Iodine 126.9045 2.8.18.18.7	54 Xe Xenon 131.30 2.8.18.18.8
6	55 Cs Cesium 132.905 2.8.18.18.8.1	56 Ba Barium 137.34 2.8.18.18.8.2	57-71 Lanthanide Series*	72 Hf Hafnium 178.49 2.8.18.32.10.2	73 Ta Tantalum 180.948 2.8.18.32.11.2	74 W Tungsten 183.85 2.8.18.32.12.2	75 Re Rhenium 186.2 2.8.18.32.13.2	76 Os Osmium 190.2 2.8.18.32.14.2	77 Ir Iridium 192.2 2.8.18.32.15.2	78 Pt Platinum 195.09 2.8.18.32.16.2	79 Au Gold 196.967 2.8.18.32.18.1	80 Hg Mercury 200.59 2.8.18.32.18.2	81 Tl Thallium 204.37 2.8.18.32.18.3	82 Pb Lead 207.19 2.8.18.32.18.4	83 Bi Bismuth 208.9806 2.8.18.32.18.5	84 Po Polonium (209) 2.8.18.32.18.6	85 At Astatine (210) 2.8.18.32.18.7	86 Rn Radon (222) 2.8.18.32.18.8
7	87 Fr Francium (223) 2.8.18.32.18.8.1	88 Ra Radium (226) 2.8.18.32.18.8.2	89-103 Actinide Series*	104	105													

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Graphing Reminders

- identify independent and dependent variables and which goes on x and y axis

- appropriately label x and y axes with measurement AND unit

- choose appropriate scales for x and y axes

- plot points and connect, using best fit

- title graph so that it reflects overall purpose, yet is fairly specific

- use key for graph if needed

Biology Topics

*Energy/Matter Transformations

- Law of Conservation of Matter and Energyô occurs in food chain (includes decomposers)

*Basic Life Functions and Organization

- Homeostasisô balance of life functions, environment, and activities of organism
- Characteristics of living thingsô made of cells highly organized, need energy, grow and develop, life span, reproduce, respond to stimuli adapt to environmental changes
- levels of organization: Cells   tissue   organ   organ system   organism

*Ecology

- relationships of living things to their environment
- population, community, ecosystem, biomes, biosphere
- factorsô abiotic (nonliving components; ex: light) and biotic (living components; ex: predator)
- food chainô producer (plants), consumer (herbivores and carnivores), decomposers
- biological diversityô the number of species in community, greatest at equator
- nicheô position or role of a species in community.

*Cell Theory

- the cell is the basic unit of lifeô all organisms are made of one or more cells
- cells are produced from other cells
- differences between animal and plant cellsô plant cells contain a cell wall and chloroplasts; undergo photosynthesis
- compare a celløs organelles to the operation of a factory
- functionô absorb nutrients, release wastes, convert energy, communicate with other cells
- 2 types of cells: PROKARYOTES (small, simple, no nucleus, single chromosome) and EUKARYOTES (nucleus, typical cell)

- **Cell Organelles**
    - cell & nuclear membrane→ controls in & out, semipermeable
    - nucleus→ control center (the brain)
    - cytoplasm→ gel-like, throughout cell
    - mitochondria→ makes & releases energy for cell, called ATP; place of respiration (power supply)
    - Golgi body→ package & deliver proteins (packing and shipping)
    - endoplasmic reticulum→ transports materials throughout cell (highways)
    - ribosomes→ sight of protein synthesis (protein factories)
    - cell wall→ in plants only; support/ give structure
    - chloroplasts→ in plants only; carries out photosynthesis

*Photosynthesis & Cellular Respiration
- reverse reactions (recycling matter)→ one needs and stores energy, the other releases energy (as ATP)
- animals only go through cellular respiration, but plants photosynthesis AND respire
- **Photosynthesis**
    - endothermic, stores energy, requires light, occurs in chloroplasts of cells
    - makes a high energy molecule called glucose (food) and oxygen from carbon dioxide and water and energy (sunlight)
    - equation:

    $6CO_2 + 6H_2O + \text{energy} \quad C_6H_{12}O_6 + 6O_2$
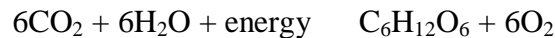
- **Respiration**
    - Exothermic, releases energy (ATP→ adenosine triphosphate), occurs in mitochondria
    - makes energy, carbon dioxide, and water from glucose and oxygen
    - equation:

    $C_6H_{12}O_6 + 6O_2 \quad 6CO_2 + 6H_2O + \text{energy}$

* Genetics/DNA/Heredity

- DNA(deoxyribonucleic acid)ô the õcodeö for making proteins; DNA controls everything; found in the nucleus of cells on chromosomes
- building blocks of DNA are called nucleotides
- DNA = double strand (double helix) in a spiral with nitrogen bases paired up (A with T and C with G)
- bases = adenine (A), thymine (T), cytosine (C), guanine (G)
- DNA is like a recipe containing directions of how to make something (hair color, height, eye color, etc)
- sequence of bases (A, T, C, G) determines traits (genes)
- only identical twins have the same sequence of bases; everyone else has different sequences
- traitsô 1 gene from each parent (dominant and recessive traits)
- genotype and phenotype
- proteins for the cell are made from portions of DNA

Mitosis

- a cell divides giving resulting cells the full number of chromosomes
- one cell produces 2 cells in one division
- occurs in growth
- animal cells pinch in half while plant cells grow a cell wall

Meiosis

- a cell divides giving resulting cell ½ the number of chromosomes
- one cell produces 4 cells in two divisions
- occurs in (reproductive) sex cells so that offspring get half of the needed chromosomes from each parent.