2012-2013 Mid-term Review Facts

(Remember – you need to not only know the fact but the concept behind the fact)

Introduction & Nature of Science

1. Metric System uses factors of 10. Meter for length, Gram for mass, Liter for volume
   Kilo - Hecta - Deka - base unit (such as meter) - deci - centi - milli
   If converting within the metric system all you have to do is move the decimal place over
2. **Independent variable** is the one you change, and is graphed on the x axis.
3. **Dependent variable** changes in response to changes in the independent variable, and is graphed on the y axis.
4. **Control** is a test performed with exactly the same conditions (constants), except for the variable being tested. It is used as a comparative tool.
5. **Constant**s are the items that do not change from test to test. (Sometimes called *"controlled variables"* on CAPT – not to be confused with the control test).
6. 3 methods knowledge acquired in science - Observation, measurement and inference. Measurement is the most objective.
7. All matter has mass and volume, and therefore density. The formula for density is **D=m/v**
8. The same substance always has the same density.

Chemistry

9. All matter is made of atoms. Matter is divided into 2 categories: pure **substances** and **mixtures**.
10. Matter exists in **4 states**: solid (definite shape, volume), liquid (volume, takes shape of container), gas (expands to fill the container), plasma; which is determined by temperature.
11. Atoms are composed of **protons** (positively charged particles), **neutrons** (neutral particles), and **electrons** (negatively charged particles).
12. **Elements** are pure substances that contain only one kind of atom.
13. **Compounds** are pure substances that contain two or more kinds of atoms (two or more elements) in a definite ratio (chemically combined, and cannot be separated by physical means). An example is water, H_2O, or table salt, NaCl.
14. **Mixtures** contain two or more substances that may be elements or compounds. A mixture can be the same throughout (**homogeneous**) like salt water; or unevenly mixed (**heterogeneous**) like rocky road ice cream. It can be separated by physical means, such as filtering or evaporating.
15. Atoms with different numbers of protons are different elements.
16. **Atomic number** equals the number of protons in an atom.
17. **Mass number** equals the number of protons plus the number of neutrons in an atom.
18. **Atomic mass** is the average of the atomic masses of all the chemical element's isotopes.
19. For many atoms, the number of **valence electrons** (electrons in the outermost energy level) can be determined by the atom's **group number** on the Periodic Table.
20. The **period number** identifies the atom's number of **energy levels** (location of electrons).
21. **Reactivity** is dependent upon the number of **valence electrons** in an atom.
22. Atoms with the same number of protons, but different numbers of neutrons are **isotopes** of the same element. Carbon 14 dates recent, once living objects. Uranium 238 dates old non-living objects, such as rocks.
23. Attractive forces between atoms are called **bonds**.
    a. When pairs of electrons are shared it is called a **covalent bond**.
    b. Atoms of different elements lose and gain electrons with each other. The resulting **charged atoms** are called **ions**. Atoms that have lost electrons are positively charged, and those that have gained electrons are negatively charged. The attraction between ions with opposite charges is called an **ionic bond**.
24. **Chemical Reactions** occur when atoms change the way they are combined with each other. Atoms break apart from one another and form new combinations with other atoms. Remember that matter cannot be created or destroyed. The same number of atoms of each element exists before and after the reaction. (Balancing equations)

a. Evidence of chemical reaction (**chemical change**) includes production of energy (temp), light, color, and gas or solid formation.

25. **Combustion** occurs in the presence of oxygen and produces carbon dioxide, water and energy. Know how to balance this equation, and the trick!
26. **Rates of chemical reactions** can be controlled by changing concentration, temperature, and using catalysts.
27. The **pH scale** is often used to measure the **acid - base** properties of a solution.

pH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
								|						
strong acid			weak acid					neutral		weak base			strong base		

28. Acid + Base → Salt + Water
29. Metal + Acid → Salt + Hydrogen gas
30. Chemical compounds can be represented by **molecular formula** (CH_4), a **structural formula** , and a **Lewis Dot formula.**

31. Carbon atoms can form covalent bonds to one another creating chains, rings and branching molecules; such as **hydrocarbons** for fuel (methane, pentane, etc.), **polymers** and the large molecules of life.
32. There are 3 types of **hydrocarbons**: **alkanes** (single covalent bonds $\mathbf{C_nH_{(2n+2)}}$), **alkenes** (which contain at least one double covalent bond $\mathbf{C_nH_{(2n)}}$), and **alkynes** (which contain triple covalent bond $\mathbf{C_nH_{(2n-2)}}$). All are named using the prefix for the number of carbon atoms in the chain (such as meth for one, etc.).
33. Hydrocarbon branches are named by adding **–yl**, to the chemical prefix for the number of carbon atoms.
34. Simple chemical **monomers** (like ethene) can be combined to create linear, branched and/or cross-linked polymers like **polyethylene**.
35. The chemical structure of polymers affects their physical properties (strength=high density which is no side-branching, flexibility=low density which is side branching)
36. **Radioactive decay** is the breakdown of unstable **parent isotopes** to their stable **daughter element**. The rate of decay is measured in **half lives** - the time it takes for half the parent atoms in a sample to decay to the daughter element.

Biogeochemical Cycles

37. Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.
38. **Water cycle** = **Hydrologic cycle**; evaporation – condensation – precipitation – runoff – percolation – transpiration. Sun is the energy source to drive the cycle.
39. **Carbon cycle =** movement of carbon between the biosphere, atmosphere, oceans, and geosphere. Plants absorb CO_2 from the atmosphere during **photosynthesis**, and release CO_2 back in to the atmosphere during **respiration**. Dissolved CO_2 in the oceans is used by marine biota in photosynthesis and is released to the atmosphere. Two other important processes are fossil fuel burning and changing land use (agriculture, deforestation, etc.).

Global Warming

40. Earth receives incoming solar radiation. The atmosphere reflects some of it and some passes through to heat the Earth. That which is not absorbed is re-radiated by the Earth at a longer wavelength (**infrared**).
41. **Greenhouse gases** (water vapor, carbon dioxide, methane, nitrous oxide, HFC's) absorb out-going (re-emitted) radiation, heating the Earth's atmosphere. This is known as the "**greenhouse effect**".
42. Energy production (by automobiles, for electricity, for heat) is the biggest producer of the greenhouse gas, carbon dioxide.
43. Earth's average surface temperature increased approximately 1°F in the 20th century due to pollution, and is expected to change 1-4.5°F in the next 50 years; leading to melting of the polar ice caps and glaciers, rising sea levels, changes in weather patterns, and heating of the oceans.

44. Dark colors such as black are good **absorbers** and **radiators** of energy, whereas light colors such as silver are good **reflectors** of energy.
45. Energy from the Sun is received as light energy. This energy is the source of the Earth's energy, and it powers the water cycle, weather, and all living things through a series of **energy transformations**.

Ozone Depletion

46. **Ozone** molecule consists of 3 oxygen atoms.
47. **Bad ozone** exists in lower atmosphere as pollutant, and is the main component of **smog**.
48. **Good ozone** is in the upper atmosphere (stratosphere) and absorbs much of the ultraviolet radiation (UVC and UVB) from the Sun.
49. Good ozone (in the **Ozone Layer**) is depleted by **CFC**'s, causing a hole in the ozone over Antarctica.
50. Depletion of the Ozone Layer causes higher levels of UV radiation to reach Earth's surface.
51. The **Montreal Protocol** is an international agreement that was developed to reverse the process of ozone depletion by banning the use and production of CFC's.

Natural Resources

52. **Natural resources** are naturally occurring substances that are considered valuable and useful.
53. **Renewable resources** can be replaced in a relatively short period of time without depleting the resource. Examples: animals, insects, reptiles, plants, trees, water, grass, solar and wind energy.
54. **Non-renewable resources** cannot be replaced in a short period of time, once removed it will take a very, very long time, if ever, to replace them. Examples: fossil fuels, oil, coal, copper, diamonds, natural gas, iron ore, minerals, gold, silver, platinum, rocks.
55. Only 3% of the world's water is freshwater (not saltwater). Only 1% is **potable**. Coastal areas are very susceptible to pollution in American because roughly 50% of the US population lives within 50 miles of the coastline. The Clean Water Act (1972) and the Safe Drinking Water Act (1974) have been effective in improving the quality of America's waterways.
56. **Carrying capacity** is the number of individuals that an ecosystem can support. If a population exceeds the carrying capacity, environmental factors will act to reduce the population of that species.

Energy Resources

57. **Fossil fuels** are non-renewable resources with distinct advantages for energy production, such as high efficiency, ease of handling, availability, and existing technology. However supply is dwindling and they are not a "clean" energy source. The burning of fossil fuels contributes to CO_2 in the atmosphere – a key component of global warming. Industrialization is directly related to fossil fuel consumption.
58. **Petroleum** is a mixture of many carbon compounds that are separated by boiling point in a refinery by the process of **fractional distillation.**
59. Most oil is burned as fuel. The remainder is used to produce useful products.
60. **Biofuels** such as ethanol made from corn or sugar contain produce less energy per liter/gram then gasoline (fossil fuels) because there are fewer covalent bonds to break. They still release CO_2 to the atmosphere, but there is no net gain.
61. **Biomass** is a renewable natural resource that has been used as fuel for thousands of years (wood, peat, etc.)
62. **Alternative energy sources** include wind power, solar, nuclear fission, hydroelectric, geothermal. All have positive and negative aspects.
63. **The Sun** is the ultimate source of most energy resources on Earth.

Acid Rain

64. **Acid Precipitation** is caused by the burning of fossil fuels which produce sulfur dioxide and nitrous oxides. These smokestack pollutants combine with moisture (water) in the atmosphere, and decrease the pH of precipitation (usually rain). Weather patterns move the acidified moisture eastwards in the U.S., causing harm to forests, animal life, fish populations and buildings in NY State and New England especially.
65. The **Acid Rain Lab** demonstrated the impact of acidified water on various rock types. **Carbonate rocks** such as limestone and marble were adversely affected by acid rain, dissolving more quickly over time.