Science Committee

ORGANISING THE ELEMENT - C2

NOBLE GASES

Helium
- *Airships and balloons*
- *Less dense than air,*
- *make them float*
- *Has a boiling*
- *temperature of -*
- *269°C, used to cool*
- *metals down to low temperatures to lose resistance and become superconductors used in MRI*

Neon
- *Advertising signs, shop signs*
- *Glows a red/orange colour when electricity passes through when in a vacuum discharge tube*

Argon
- *Provide inert unreactive atmosphere around hot metal when welding*
- *Incandescent light bulbs*
- *Does not react with tungsten filament in light bulbs*
- *Generates ultraviolet light when electricity passes through*
- *Fill the space between double glazed windows*

Krypton
- *Fill energy saving fluorescent lights*
- *React with fluoride to create krypton fluoride, used in lasers manufacturing circuit boards and semiconductors*
- *Krypton lasers used by surgeons for eye treatment and to remove birthmarks*

ALKALI METALS

Lithium
- *Heat resistive glasses and ceramics, Lithium batteries*
- *Used to deoxidise copper and alloys*
- *Lithium salts used as mood-stabilizing drug*
- *Lithium-6 is a main source of tritium production*
- *Lightest metal to be discovered*
- *Used as colourants in red fireworks*

Sodium
- *Liquid sodium used as coolers in nuclear reactors*
- *Used as luster in metals*
- *Used in streetlights for bright yellow glow*
- *Sodium hydroxide used as oven cleaner*
- *Salt in food made of sodium chloride*

Potassium
- *Potassium chloride used in fertilisers, prevent hyper/hypokalemia in plants*
- *Potassium chlorate, Potassium nitrate used as explosives and fireworks*
- *Potassium nitrate used in food preservative*
- *Maintains blood pressure and acidity in human body*
- *95% of cells made of potassium*
- *Potassium hydroxide for detergents*

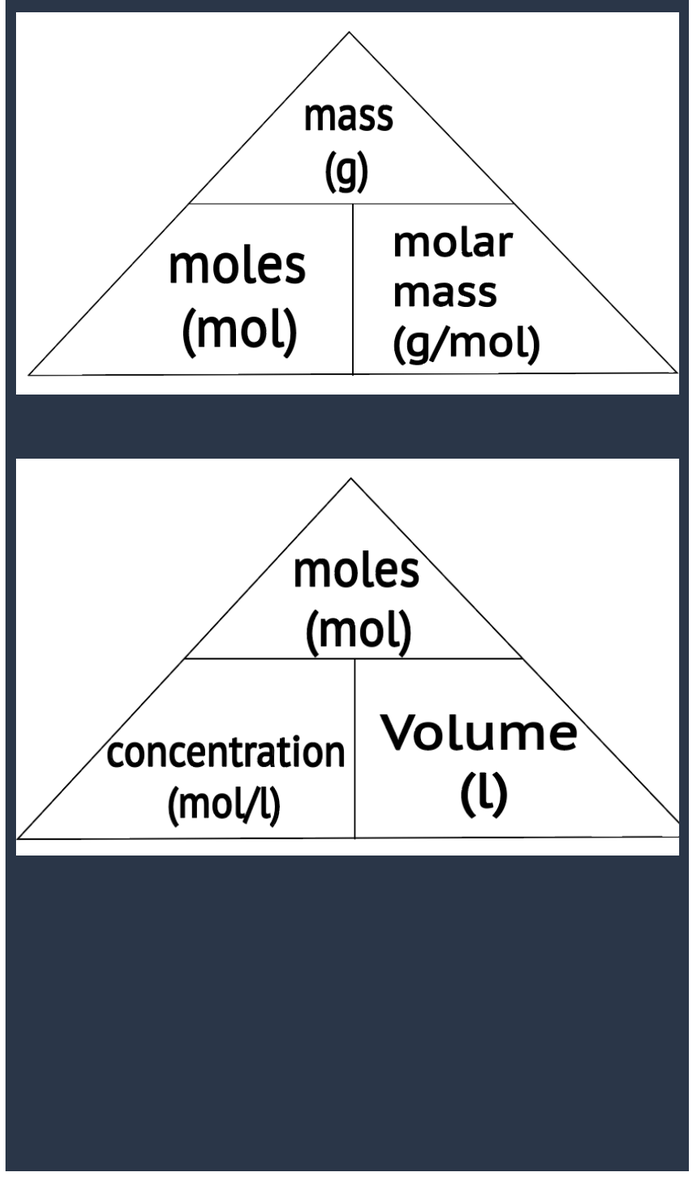
Rubidium
- *Manufacture atomic clocks, electronic tubes, photocells*
- *Component in engines of spaceships*
- *Rubidium vapour for laser cooling*
- *Thermoelectric generators*
- *Rubidium carbonate used in making optical glasses*

Caesium
- *Caesium-134 used in nuclear power*
- *Used in photoelectric cells due to quick electron emission, night vision equipment*
- *Removes air traces from vacuums*
- *Caesium-137 used in brachytherapy to treat cancer using radiation*
- *Used in military aircraft*
- *Caesium vapour used in magnetometer*
- *Used as catalyst for hydrogenation of organic compounds*
- *Used in propulsion systems*
- *Caesium hydroxide is the strongest base to be discovered*
- *Most electropositive element*

Francium
- *Has lowest electromagnetivity among all known elements*
- *Produced by bombardment of thorium with protons or bombardment of radium with neutrons*
- *Rare element*
- *Doesn't have much use, since the half-life in only 22 minutes*

CHALLENGING STOICHIOMETRY QUESTIONS

SCAN ME



ISOTOPES

ISOTOPES DEFINITION:

Isotopes of an element share the same number of protons but have different numbers of neutrons. As they have the same electrons shell, they all have the same chemical properties.

Although chemically all the isotopes are indistinguishable, but some isotopes have the ability to circumvent this rule by transforming into another element entirely.

One of the most important factor that cause the decay of nucleus is the ratio of protons to neutrons a particular nucleus has.

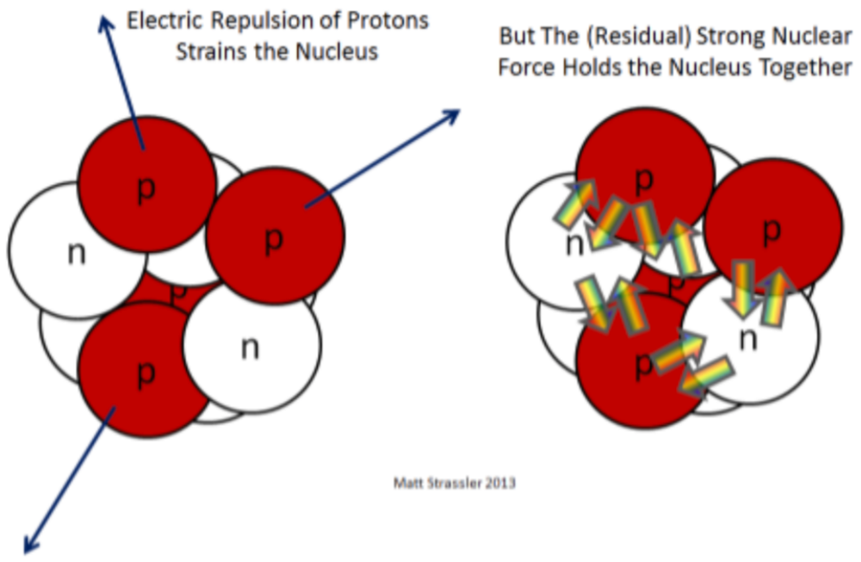
If a nucleus has too many neutrons (the definition of "too many" depends on how heavy the nucleus is), there is a chance that it will decay towards stability. The same is true for an nucleus contain too many protons.

EXTENSION:

Lighter isotopes form during the big bang. Others result from processes that happen within stars or as a result of chance collisions between highly energetic nuclei - known as cosmic rays - within our atmosphere.

In order to form other heavier nucleus, the light nuclei have had to smash with enough energy to allow the strong force - a glue-like bond that forms when protons and neutrons get close enough to touch - to overcome the electromagnetic force – which pushes protons apart. If the strong force wins out, the colliding nuclei bond together, or fuse, to form a heavier nucleus.

Sun will be a good example of the application of isotopes. One of its main sources of power is a series of fusion reactions and beta decay processes that transform hydrogen into helium.



APPLICATION:

The special characteristics of isotopes make it useful in many area of application. For instance, medicine, archaeology, agriculture, power generation and mining.

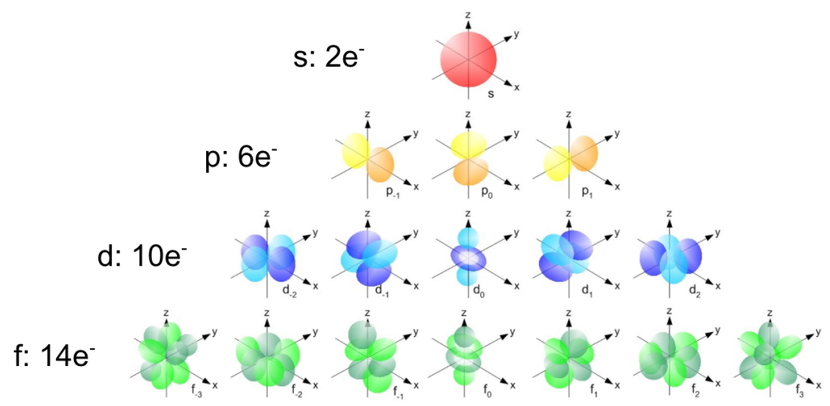
- ***PET scan** is the use of byproduct of the radioactive decay of certain isotopes (often called **medical isotopes**). We produce these medical isotopes using our knowledge of how nuclear reactions proceed, with the help of **nuclear reactors or accelerators called cyclotrons**.*
- *The use of **carbon 14 to trace back the age of an object**. Under normal circumstances, carbon-14 is produced in our atmosphere via cosmic ray reactions with nitrogen-14. It has a **half-life of roughly 5,700 years**, which means that half of a quantity of carbon-14 will have decayed away in that time period. As biological organism lives, it will intake approximately one carbon-14 isotope for every trillion stable carbon-12 isotopes and the carbon-12 to carbon-14 ratio stays about the same while the organism lives. Once it dies, new intake of carbon stops. This means the ratio of carbon-14 to carbon-12 changes in the remains of this organism over time. The scientist will extract the carbon 14 isotopes using a method called **accelerator mass spectrometry (AMS)**. This methods will sort out the isotopes by weight. AMS makes use of the fact that accelerated particles with the **same charge but different masses follow separate paths through magnetic fields**. By making use of these separate paths, scientists can determine isotope ratios with incredible accuracy.*
- *In industry, radioactive isotopes of various kinds are used for **measuring the thickness of metal or plastic sheets**; their precise thickness is indicated by the strength of the radiations that penetrate the material being inspected. They also may be employed in place of large X-ray machines to examine manufactured metal parts for structural defects. Other significant applications include the use of radioactive isotopes as **compact sources of electrical power**—e.g., plutonium-238 in spacecraft. In such cases, the heat produced in the decay of the **radioactive isotope is converted into electricity** by means of **thermoelectric junction circuits** or related devices.*
- *In medicine, for example, cobalt-60 is extensively employed as a radiation source to **arrest the development of cancer**. Other radioactive isotopes are used as **tracers for diagnostic purposes** as well as in research on metabolic processes. When a radioactive isotope is added in small amounts to comparatively large quantities of the stable element, it behaves exactly the same as the ordinary isotope chemically; it can, however, be **traced with a Geiger counter** or other detection device. Iodine-131 has proved effective in treating hyperthyroidism. Another medically important radioactive isotope is carbon-14, which is used in a breath test to detect the ulcer-causing bacteria Helicobacter Pylori.*

ELECTRON ORBITALS:

How to fill out?

How to write out:

Li: $1s^2 2s^1$
K: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
Fe: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$



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SCAN ME