

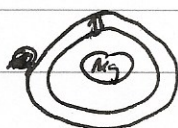
Section A: 1. The two particles of similar mass in a nucleus are protons and neutrons.
 Atomic ~~mass~~^{number} is the number of protons present in a nucleus.
 The ~~mass~~ mass number is the mass of the protons and neutrons in the nucleus.
 An isotope is a variant of an element which has different numbers of neutrons to protons within the nucleus.

2. ~~Mg~~ Mg will have 12 protons and 12 electrons. The electrons will be ordered in the following orbitals $1s^2 2s^2 2p^6 3s^2$ so has a valence of 2 as it has two electrons in the outer orbital ($3s^2$).

Chlorine has 17 protons and 17 electrons. The electrons are in the following orbitals $1s^2 2s^2 2p^6 3s^2 3p^5$ and will have a valence of 1. As there is one remaining electron needed to fill the $3p$ orbital.

$Mg^+ Cl_2^-$ would be the formula

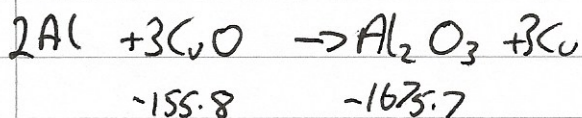
3. s orbitals



p orbitals



4. Heat of formation is the energy required to make a compound. absorb
 Exothermic reactions give off energy (heat) while endothermic reactions ~~take~~^{absorb} energy (heat).



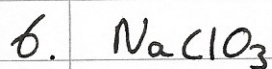
$$\Delta H = -1675.7 + 155.8 = -1519.9 \text{ KJ}$$

5. ~~The lines are due to the movement (stretching or bending) of the bonds between different elements changing dipoles~~

~~The lines are caused when the electrons either move from a lower level orbital to a higher level orbital on heating or the reverse when cooling. This releases radiation electromagnetic radiation.~~

The lines found are due to the movement of the bonds between different elements changing the dipoles.

For methane and ethane I would expect CH stretch and bend



$$106.4$$

$$\text{O} = 16$$

$$\text{Cl} =$$

$$\text{Na} =$$

$$\frac{16 \times 3}{106.4}$$

$$= 0.45 \text{ mdes}$$

$$22.41 \div 100 \times 0.45 = 0.1 \text{ g/L}$$

Section B: 2. Phosphorus comes in 3 forms; white, red and black. They form a tetrahedral structure and are toxic. White phosphorus is a very reactive with oxygen. It will combust spontaneously within air. Red phosphorus is ~~less~~ still reactive but less so than white. Black is the most stable of the three.

Phosphorus has a number of uses within the military and civil spheres. Within industry it has historically been used in the production of matches and is rat poison. It also has uses as an insecticide. The insecticides are very close to a number of different nerve agents which have been used and developed within military and terrorist groups. These include the likes of VX and Sarin, however these have been banned under international law.

The most common uses in the military have been ~~as~~ incendiary and smoke munitions. Although using white phosphorus as an incendiary weapon has been banned under international treaties there are many ~~used~~ countries who are not signatories to them. The use of white phosphorus in smoke grenades etc has reduced and red phosphorus is now the main choice. This is due to the toxicity of white phosphorus, the injuries it can cause and the environmental impact. With red phosphorus many of these concerns are reduced or eliminated.

Phosphorus is good for using in smoke munitions as it is hygroscopic. ~~When it reacts with~~ when it is formed into phosphorus oxide, this means it reacts with water to create other compounds, which in turn react with water. This means that a smoke cloud will react with the water in the air and increase the effectiveness of the smoke screen. The smoke generated is in the visible spectrum ~~but~~ but also gives some screening in the Infrared spectrum which can assist in screening against some surveillance technologies like thermal imagers and also can impact on the ability of some anti-tank missiles to maintain a lock/fix on the target or its link to the operator.

It can also be used in medicine, ~~and~~ in detergents, fertilisers and as a flame retardant when it is within compounds such as phosphates.

2.cont

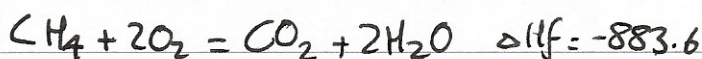
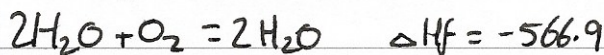
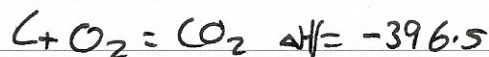
White phosphorus is found as a compound and reactions are needed to remove the phosphorus from them. In order to make red phosphorus white phosphorus is heated and cooled slowly. For black phosphorus it is heated under pressure.

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Section B. 3 (i) the heat of formation is the energy required to make a compound under standard temperature and atmosphere. If the heat of formation is low it is liable to be less stable as less energy is required to break any bonds and return it to the initial elements

ii) CH_4 ΔH_f



ΔH_f

-883

$$-396.5 - 566.9 \Rightarrow -883.6 + \Delta H_f$$

$$-883.6 + 0 \Rightarrow -396.5 - 566.9$$

$$-963.4 + 883.6 = \Delta H_f$$

$$\Delta H_f - 883.6 \Rightarrow -963.4$$

$$\Delta H_f = -963.4 + 883.6$$

$$\Delta H_f = -79.8$$

4

i) ~~say~~ An example would be

The heat of formation is the energy/heat released or absorbed when a compound is formed from its elements. If this value is positive heat is absorbed when it is made so is endothermic. If it is negative ~~the~~ heat is given off and it is exothermic. The less energy required to reverse this process the more likely a compound is likely to experience it and is therefore less stable. A higher ~~ex~~ heat of formation indicates it is less likely to be experience enough stimulus to ~~initiate~~ cause ~~a reverse~~ it to breakdown so is more stable. ^{munition}

An example might be is an ignition train is a fuse. A primary explosive ~~is~~ requires less energy to initiate it than the booster which in turn requires less to initiate it than the main charge. These compounds might be ~~sim~~ lead styphnate ~~as~~ as the primary, PETN as the booster and TNT as the main ~~fill~~ charge fill.