

George Goddard

1

The nucleus contains two particles of a similar mass. These are protons which have a positive charge and neutrons which don't have a charge.

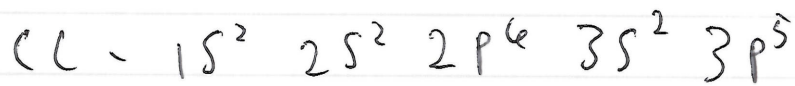
The atomic number of an element is the number of protons in the nucleus.

The mass number is the number of protons and neutrons in the atom.

Isotopes are elements that contain ~~different~~ atoms with different numbers of neutrons.

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2 electronic structures:



Magnesium's likely valence is 2 because it is a reactive metal.

Chlorine's likely valence is -1 because it is a reactive gas.

The formula for magnesium chloride is  $\text{MgCl}_2$

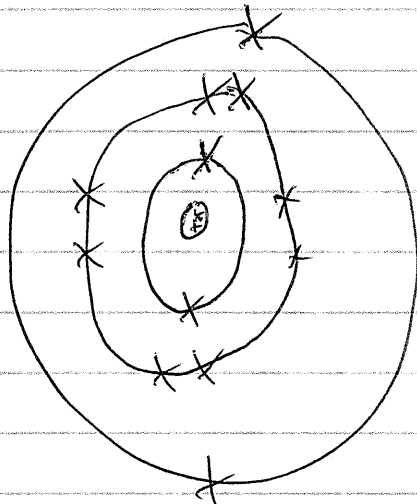
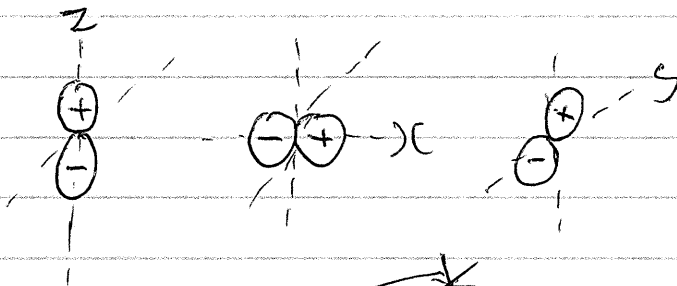
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3 There are two orbitals found in magnesium,  
s and p orbitals

s orbital



p orbital



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- 4 The heat of formation of a compound is the energy change when the compound is formed from its elements. This is the energy of all products minus the energy of all reactants.

An exothermic reaction releases heat and has a negative enthalpy change

An endothermic reaction absorbs heat and has a positive enthalpy change.

The balanced equation is:



From the above balanced equation:

$$\text{CuO} = -155.8 \text{ kJ/mol}$$

$$\text{Al}_2\text{O}_3 = -1675.7 \text{ kJ/mole}$$

As Al and Cu are elements they are zero

$$3 \times -155.8 = -1675.7$$

$$-467.4 = -1675.7$$

$$\therefore \Delta_f = -1208.3 \text{ kJ/mol}$$

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5

Under external stimulus electrons can move from one orbital to another. When the electron cools and falls back to its original orbital it releases energy in the form of electromagnetic radiation. The difference in energy between the levels is related to the frequency of the emitted or absorbed radiation.

The main line emitted from methane is approx  $3000 \text{ cm}^{-1}$  with a smaller line approx  $1300 \text{ cm}^{-1}$ .

The main line in ethane is approx  $2900 - 3000 \text{ cm}^{-1}$  with smaller lines at approx  $800 \text{ cm}^{-1}$  and  $1500 \text{ cm}^{-1}$ .

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6  $\text{NaClO}_3$  has a molecular weight of 106.4

1 mole of gas occupies 22.41 litres

Oxygen has a molecular weight of 16

Therefore

$$16 \times 3 = 48$$

$$48 \div 106.4 = 0.4511$$

$$0.4511 \times 22.41 = 10.109 \text{ litres of oxygen}$$

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## Section B

2 Phosphorus is an element with the atomic number 15. Phosphorus does not occur naturally but is ~~mined~~ found in minerals. Above  $280^{\circ}\text{C}$  phosphorus is a gas with a simple molecular structure. There are three types of phosphorus they are: white, red and black. White phosphorus is formed from a fast condensation process, red is formed from a slow condensation process. At very high pressures red phosphorus is converted to black.

White phosphorus is a waxy white solid. P is insoluble in water. It is highly toxic and can spontaneously combust in air, therefore it is stored under water.

Phosphorus uses:

matches

pesticides

pyrotechnic devices

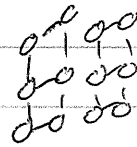
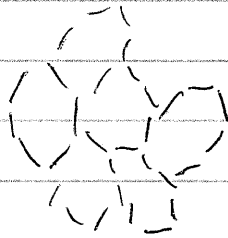
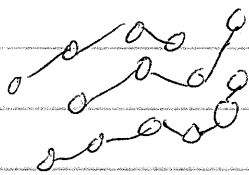
tracer bullets

fertilizer

used to make steels

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- 2 White Phosphorus has a melting point of  $44^{\circ}\text{C}$  and a boiling point of  $280^{\circ}\text{C}$ . If white P is heated in a sealed container at approx  $400^{\circ}\text{C}$  red P is obtained. It is high melting and assumes different forms.



orthorhombic

rhombohedral

Cubic

—————>  
increasing pressure

phosphorus compounds:

phosphorus acid

phosphorus nitride

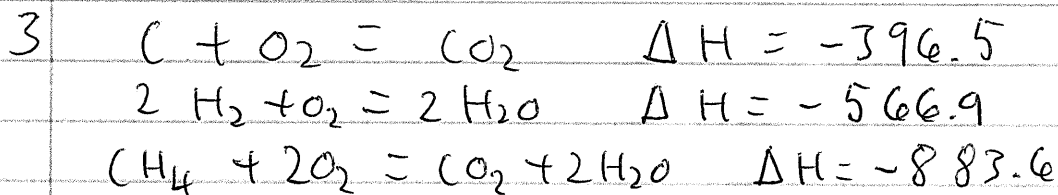
phosphorus sulphide

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### 3 Section B

The heat of formation of a chemical compound is the energy change when the compound is formed. This gives some information about the energy of the compound. This can be energy released or absorbed and happens at constant pressure. Generally the higher the heat of formation the less stable the compound. For example Nitroglycerine has a high  $\Delta H_f$  and is an unstable compound. However RDX has a low heat of formation and is stable.

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Section B



$$-883.6 + 0 = -396.5 + -566.9$$

$$-883.6 = -963.4$$

$$\Delta H_f = -79.8 \text{ KJ/mol}$$