

A

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P1

① The proton and neutron occur in the nucleus

Atomic number: the number of protons

Mass number: the number of protons + the number of neutrons

Isotope: an element that has more than one number of ~~net~~ neutrons in the nucleus ~~net~~ i.e. two ~~forms~~ forms.

The number of protons is the same

②  $Mg = 1s^2, 2s^2, 2p^6, 3s^2$

$Cl = 1s^2, 2s^2, 2p^6, 3s^2, 3p^5$

Mg valence, will be  $+2$  as it has 2 electrons in the outer ~~shell~~ shell needs to lose them to be stable

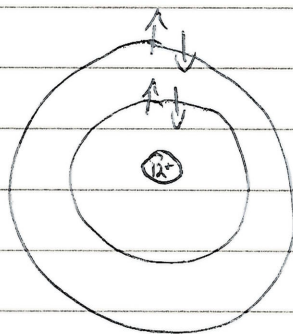
Cl valence will be  $-1$  as it only needs one electron to fill the outer shell and make it stable

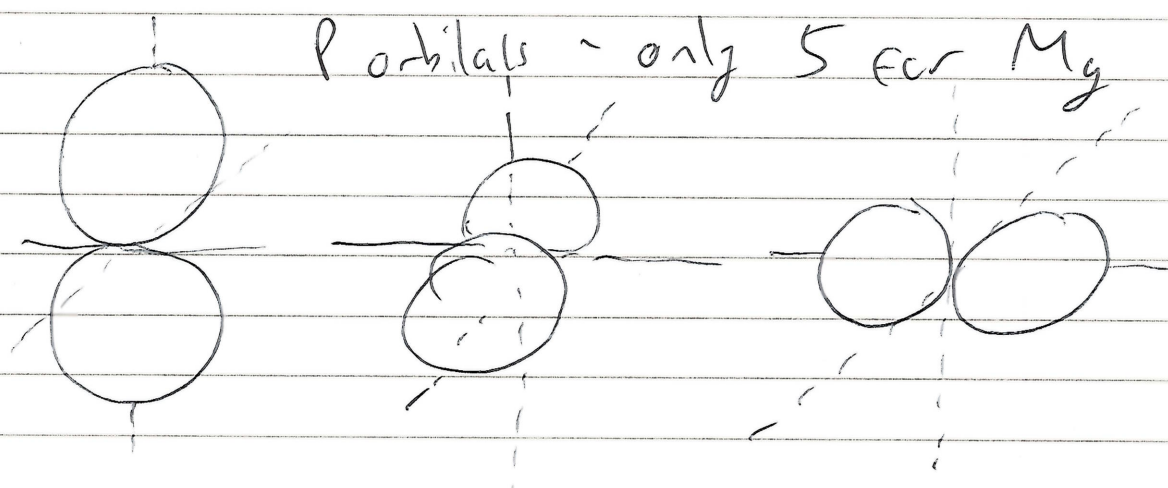
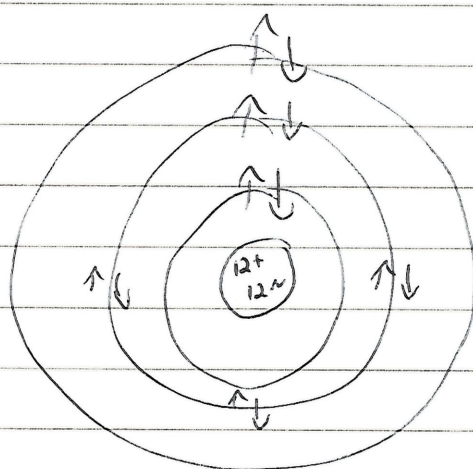
† Magnesium chloride =  $MgCl_2$

③

~~S orbital~~

S orbital



③  
on~~12~~that structure  
basic

- ④ Heat of formation is the energy that is required to form the compound from its elements. The energy change when one mole of the chemical compound is formed from its elements under standard conditions.

Exothermic is a reaction with negative enthalpy change  $\Delta H < 0$ ,  
"it releases ~~heat~~ energy"

endothermic is a reaction with positive enthalpy change  $\Delta H > 0$   
"it absorbs energy"

4 dm



$$\Delta_f CO = -155.8 \text{ kJ/mol}$$

$$\Delta_f Al_2O_3 = -167.7$$

$$\Delta_r = ?$$

balance



$$0 + 3(-155.8) = \overset{-1675.7}{\cancel{-167.7}} + 0$$

$$\Delta_{H_f \text{ prod.}} - \Delta_{H_f \text{ react}} = \Delta_{\text{reac}}$$

$$\overset{-1675.7}{\cancel{-167.7}} - \overset{-1208.3}{-467.4} = \overset{-1208.3}{\cancel{299.7}} \text{ kJ/mol}$$

- ③ When given an appropriate stimulus, electrons get excited and move to different orbitals. When they lose the excitation they move back down to the original orbital. This moving gives off energy in the form of EMR. The frequency this happens at produces colored spectra

The main lines in  $CH_4$  are  $3000 \text{ cm}^{-1}$  and  $1300 \text{ cm}^{-1}$

The main lines in  $C_2H_6$  are  $2900-3100 \text{ cm}^{-1}$ ,  $1400-1600 \text{ cm}^{-1}$  and  $700-900 \text{ cm}^{-1}$

⑥

At standard conditions 1 mole of gas occupies  
 $22.4 \text{ dm}^3$  (molar gas volume)  $22.4 \text{ litres}$

1 mole of  $\text{NaClO}_3$  ~~occupies~~ =  $106.4 \text{ g}$

$\text{NaCl} = 58.4$

~~$\text{O} = 16 (\times 3) = 48$~~   ~~$45.28301\% \text{ of } 106.4$~~

~~$45.28301\% \times 22.4 \text{ litres} = 10.1479 \text{ litres Oxygen}$~~

~~$2 \times 8 \times 3 = 48$~~

Please ignore cross through

This is my answer

③

② Phosphorus is an allotrope element this means that although it is one element, it can take more than one form. The same can be seen in carbon, it can be graphite and diamond. The same element, different structure.

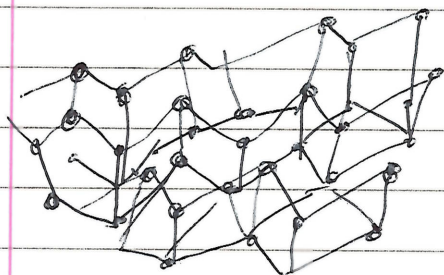
Phosphorus can be white hexagonal, white cubic, liquid, vapour, red, ~~black~~ amorphous, red tetragonal, red triclinic, black orthorhombic, black rhombohedral and black cubic. The most stable form of phosphorus is black orthorhombic.

Red phosphorus which is amorphous is made by heating white phosphorus at  $400^\circ\text{C}$ . It is high melting and takes on different structures.

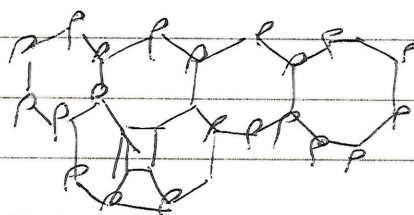
At very high pressure white phosphorus turns to black phosphorus, this is the most stable form of phosphorus.

B2

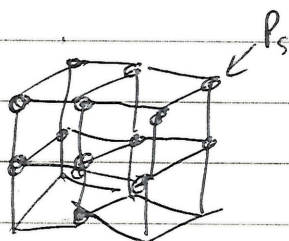
Chd



Orthorhombic



rhombohedral



Cubic

Phosphorus has the symbol  $P$ , an atomic number 15

The electron configuration  $1s^2, 2s^2 2p^6, 3s^2, 3p^3$

Above  $280^\circ\text{C}$  phosphorus is a gas. If it cools fast, it will condensate to white phosphorus. If it cools slow it will condensate to red phosphorus.

Phosphorus can be used for safety matches, tracer bullets and other munitions. It makes non-sparking tools when alloyed to make phosphor bronze.

Phosphorus is commonly used as a smoke screen a mixture of red + white phos.



Due to being hygroscopic, it has a very good yield factor, and on a damp or humid day mixes with ~~water~~ moisture in the air. Can have a yield factor of  $\sim 10$ .

(B) ③

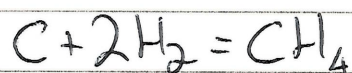
heat of formation is the energy required to make a compound from its elements. The energy change when one mole of compound is formed from its elements under standard conditions

③

heat of formation gives an indication of the energy of the compound, However the heat of formation may not give you the stability of the compound under normal conditions.

However it can be "assumed" that materials with large  $\Delta H_f$  of formation may be less stable. Lead styphate is unstable or easy to initiate with  $\Delta H_f$  of  $-836.8 \text{ kJ/mol}$ , where as TNT with  $\Delta H_f$  of  $-62.07 \text{ kJ/mol}$  is much more stable, hard to initiate. Lead azide is sensitive with  $\Delta_f$  of  $+468 \text{ kJ/mol}$ , RDX less sensitive  $+70.29 \text{ kJ/mol}$

Methane  $\text{CH}_4$



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

$$= -79.8 \text{ kJ/mol}$$

$$\Delta H_f = -396.5 - 566.9 + 883.6 = -79.8 \text{ kJ/mol}$$