

Chemistry Exam 2021

S 13:45

E 15:45

Section A

Q1) Protons and neutrons are similar mass and have charges of +1 and 0 respectively

Atomic number is the number of protons in a nucleus of a specified element

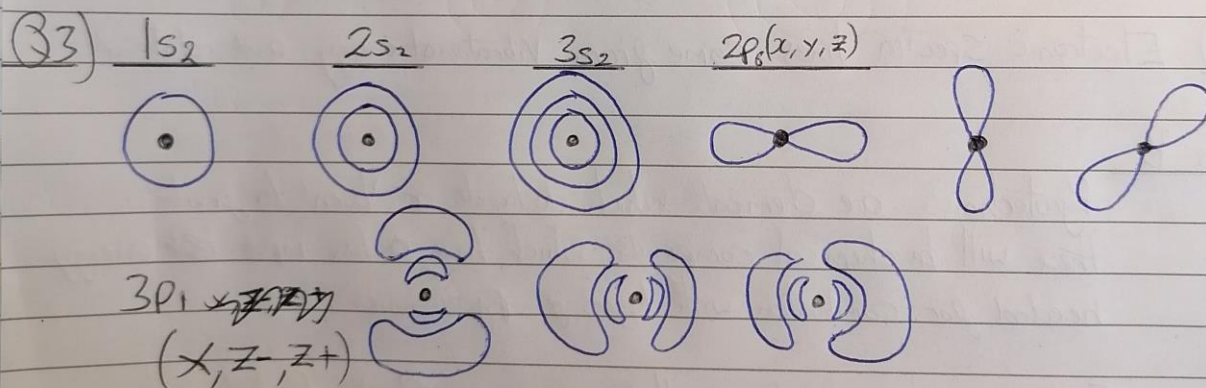
Mass number is the number of protons and neutrons combined

Isotopes are elements that share the same number of protons but varying numbers of neutrons

Q2) Al^{27}_{13} $1s^2 2s^2 2p^6 3s^2 3p^1$ Valence of 3 as it has 3 electrons in its outer shell

F^{19}_9 ~~$1s^2 2s^2 2p^6 3s^2 3p^4$~~
 $1s^2 2s^2 2p^5$ Valence of 7 or -1 as it has 7 electrons in its outer shell

Al needs 3 electrons $\therefore$ Aluminium fluoride = AlF_3



Q4) Heat of formation is the heat change when a mole of compound is formed from the elements

Endothermic - absorbs heat

Exothermic - releases heat

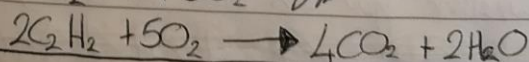
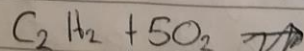
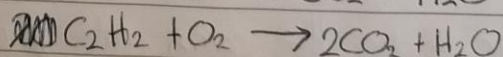
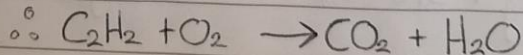
$$(4 \times -393.5) + (2 \times -241.8) = -2057.6$$

$$\Delta H^\circ = -2057.6 - (227 \times 2)$$

$$= -2284.6 - 2511.6$$

Acetylene = C_2H_2

Needs O_2



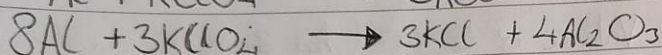
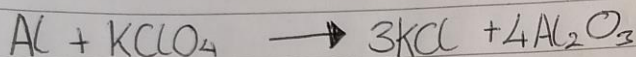
(2)

Q5)

Stoichiometry is representing the exact mass or moles of reactants and products without wastage.

It doesn't change the acetylene reaction as we have all reactants and products accounted for.

$$2C_2H_2 = 52g, 5O_2 = 160g, \text{Total} = 212g$$

$$4CO_2 = 176g, 2H_2O = 36g, \text{total} = 212g$$


$$8(27) + 3(39 + 35.5 + 64) \Rightarrow 216g + 415.5g$$

$$\text{Total} = 631.5g$$

$$\% Al = 100 \left(\frac{216}{631.5} \right)$$

$$= 34.2\%$$

Q6) Electronic spectra lines come from vibrational energy and rotational

Section B

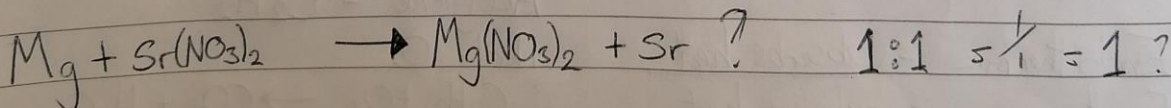
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Pyrotechnics are chemicals which degenerate or 'burn' to pyrolysis. These will be chemical compounds which have a low input ~~test~~ energy needed for combustion with layers of pyrotechnics.

1

Explosives are substances that require a 'Shock' to help and will detonate rather than burn.

Pyros depend on burn rate whereas explosives depend on shockwaves.



Other factors that govern rate of reaction are heat, surface area/volume, whether you can add a catalyst or not.

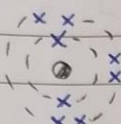
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Section B

(3)

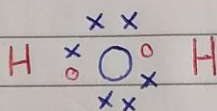
Q9

Hydrogen  $1s^1$

Oxygen  $1s^2 2s^2 2p^4$

Oxygen has a Valency of -2
and Hydrogen has a Valency of ± 1
Therefore Oxygen would want 2 Hydrogen particles to be stable

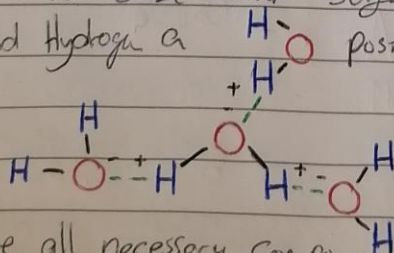
A water molecule does exactly this " H_2O " 2 Hydrogen for 1 oxygen



Because the bonds between the Hydrogen and Oxygen are Covalent, they are incredibly strong, held by electrostatic forces.

However as it is a simple molecule, the intermolecular forces are very weak so easily broken by heat. This is why Water's melting point is so high at $+0^\circ C$.

Water also has a common attribute being it bonds to other molecules of H_2O via Hydrogen bonds. These are weaker than covalent bonds but have enough force to cause water 'surface tension'. Oxygen has a slight negative charge and Hydrogen a positive charge even when sharing electrons



Most explosives have all necessary components such as oxidants & fuels built into them so will still detonate under water, however if electrically initiated they could be shorted by water, if the device were initiated or designed to burn, water could also smother the flames thereby stopping further energy transfer.