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Chemistry 18th Jan 2021

ACDA4011

Section A

Q1.1. Neutrons and Protons have similar mass

1.2. Neutron = Neutral

Proton = Positive

1.3 Atomic number → The number of Protons within the neucleus

Mass number ⇒ The number of Protons and Neutrons in the neucleus.

Isotope → An atom which has the same Atomic Number and a different Mass Number (i.e same element, same Protons different number of Neutrons)

Q2.1. AL → $1s^2 2s^2 2p^6 3s^2 3p^1$

F → $1s^2 2s^2 2p^5$

2.2 AL has a likely Valency of +3 as it has 3 eletrons in its outer shell it can use

F has a valency of -1 as it needs 1 electron to fill the outer shell.

2.3 ALF_3

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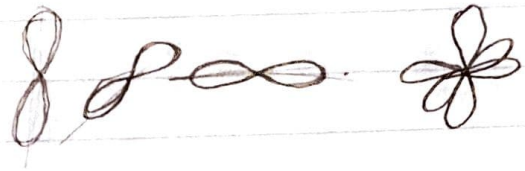
Q3. AL - $1s^2 2s^2 2p^6 3s^2 3p^1$

S orbital

P-orbitals 

Q4.1 Heat of formation is the energy needed or emitted when forming one mol. of a compound.

4.2 Endothermic is a reaction which absorbs energy (negative)

Exothermic is a reaction which gives out energy (positive)

4.3 $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

4.4 Sum of products

$4(-393) + 2(-241.8) = -2057.6\,kJ$

Sum of Reactants

$2(227) + 5(0) = 454\,kJ$

$\Delta H = -2057.6 - (454) = -2511.6\,kJ$

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Q 5:1 Stoichiometry is the measure of Oxygen to propelant where a Stoichiometricly balanced equation has enough Oxygen to complety combust the propelant without excess

5.2 $8AL + 3KClO_4 \rightarrow 4Al_2O_3 + 3KCL$

5.3 AL = 27 x 8 = 216
K = 39 x 3 = 117
Cl = 35.5 x 3 = 106.5
O = 16 x 12 = 192
631.5

$\frac{216}{631.5} \times 100 = 34.2\%$

Q6.1 The lines observed in the electronic spectra is due to photons being emited by electrons in the shells

6.2

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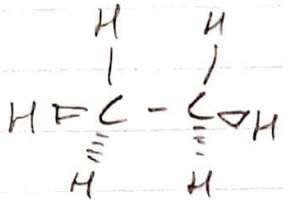
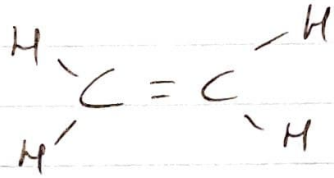
Q7

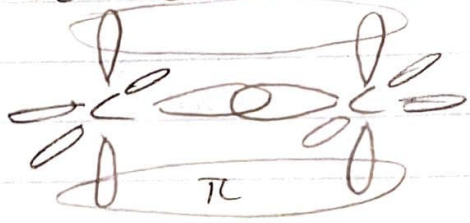
Alkanes have single bond between the carbons



one of the P orbitals overlaps

Alkenes have a double bond between carbons

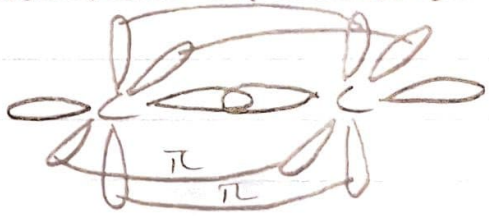




one of the p orbitals overlap with the second one sharing electrons (π bond)

Alkynes have a triple bond between carbons

H-C≡C-H



One of the P orbitals overlap with the other two sharing electrons.

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Q7 cont

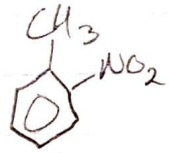
Benzene

Toluene

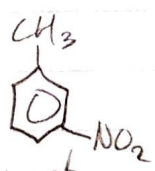
Benzen and Toluene are both aromatic hydrocarbons which means the each contain a benzene ring of 6 carbon atoms which all share a ring of delocalised electrons similar to a C=C bond. (π bonds)

Adding a NO_2 group to each of these would result in the NO_2 group replacing a H atom on the ring

Benzene would always create 1-Nitro Benzene



ortho



meta

Para

Toluene would create 1 of 3 different molecules with the Ortho and Para isomers being more likely due to the CH_3 group disturbing the electron ring shifting the eletrons to the ortho and para locations.

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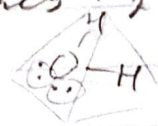
Q9 Hydrogen -> $1s^1$

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

Oxygen has space for 2 electrons and Hydrogen has 1 electron in its shell
∴ H_2O where each H shares its electron in a covalent bond.

Due to the two lone electron pairs in the P orbital this causes H_2O to take on a tetrahedral shape



The polarity of the two atoms allows H_2O molecules to undergo hydrogen bonding (where hydrogen in one molecule is attracted to the Oxygen in another) As this is much stronger than normal intermolecular bonds (Van der Waals) this gives water a very high specific heat capacity

An example of water giving undesirable effects could be seen in several areas
- Reacting with components as Magnesium
- Creating acids or bases (Amphoteric behaviour)
- If it freezes it will expand unlike most compounds, this can lead to cracking etc in OME Devices.