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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 $\rightarrow$ The number of Protons within the nucleus

Mass number $\rightarrow$ The number of Protons and Neutrons in the nucleus.

Isotope $\rightarrow$ 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 $\rightarrow 1s^2 2s^2 2p^6 3s^2 3p^1$

F $\rightarrow 1s^2 2s^2 2p^5$

2.2 AL has a likely Valency of +3 as it has 3 electrons 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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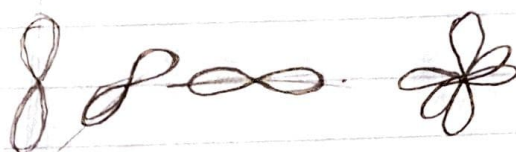
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Q3. AL - $1s^2 2s^2 2p^6 3s^2 3p^1$

S-orbital



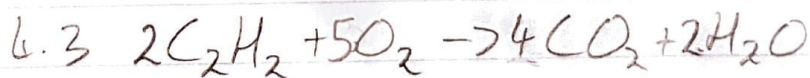
P-orbitals



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)



4.4 Sum of products

$$4(-393) + 2(-241.8) = -2057.6 \text{ kJ}$$

Sum of Reactants

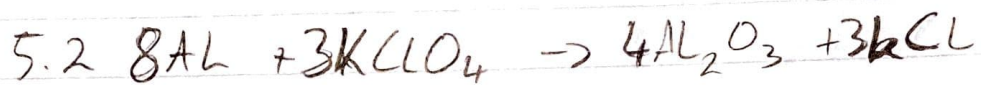
$$2(227) + 5(0) = 454 \text{ kJ}$$

$$\Delta H = -2057.6 - (454) = -2511.6 \text{ kJ}$$

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Q 5.1 Stoichiometry is the measure of
Oxygen to propellant where a
Stoichiometrically balanced equation
has enough Oxygen to completely
combust the propellant without excess



$$5.3 \quad \text{Al} = 27 \times 8 = 216$$

$$\text{K} = 39 \times 3 = 117$$

$$\text{Cl} = 35.5 \times 3 = 106.5$$

$$\text{O} = 16 \times 12 = 192$$

$$631.5$$

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

Q 6.1 The lines observed in the electronic spectra
is due to photons being emitted by
electrons in the shells

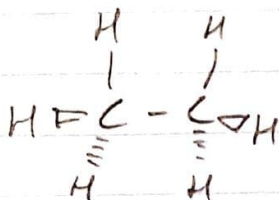
6.2

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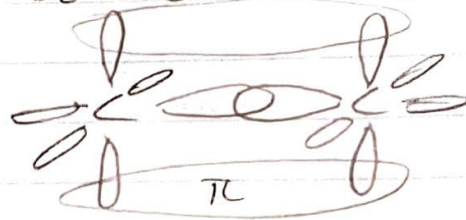
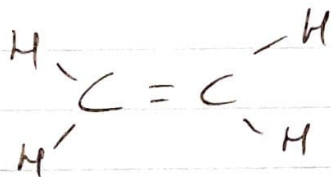
Q7

Alkanes have single bond between the carbons



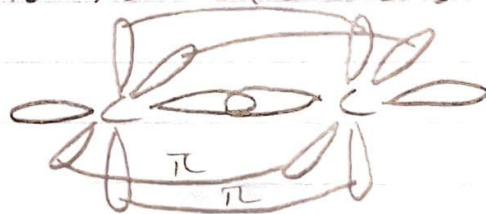
one of the p orbitals overlaps

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



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

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Q7 cont

Benzene



Toluene

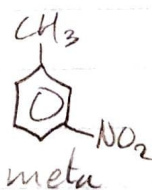
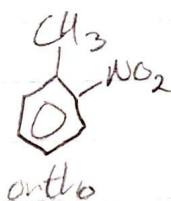


Benzene and Toluene are both aromatic hydrocarbons which means they each contain a benzene ring of 6 carbon atoms which all share a ring of delocalised electrons similar to a C=C bond. (Pi bonds)

Adding a NO₂ group to each of these would result in the NO₂ group replacing a H atom on the ring



Benzene would always create 1-Nitro Benzene



Toluene would create 1 of 3 different molecules with the Ortho and Para isomers being more likely due to the CH₃ group disturbing the electron ring. Shifting the electrons to the ortho and para locations.

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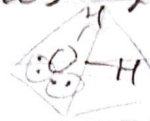
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Q9 Hydrogen $\rightarrow 1s^1$

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

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

Due to the two lone electron pairs
in the 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 e.g. 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.