

1. Write down the products of the following reactions. (25%)
- $\text{K(s)} + \text{NH}_3(\text{l}) \rightarrow$
 - $\text{NaH(s)} + \text{H}_2\text{O(l)} \rightarrow$
 - $\text{HF(l)} + \text{SiO}_2(\text{s}) \rightarrow$
 - $\text{Al(OH)}_3(\text{s}) + \text{KOH(aq)} \rightarrow$
 - $\text{Mn}_2\text{O}_7(\text{s}) + \text{H}_2\text{O(l)} \rightarrow$
2. For each molecule or salt (27%)
- give chemical names
 - give electron count for the central atoms
 - sketch all isomers
- $\text{Os}(\text{CH}_3\text{NC})_3\text{Cl}_3$
 - $\text{Na}_2[\text{Zn}(\text{OH})_4]$
 - $\text{Cr}[(\text{en})_2(\text{H}_2\text{O})_2]$
3. Construct the MO diagram for each of the following diatomic molecules. (30%)
- C_2
 - Fe_2
 - H_2O
4. Find the number of unpaired electrons, magnetic moment, ligand field stabilization energy, and ground term symbol for each of the following complex ions:
- $\text{Co}(\text{NO}_2)_6]^{3+}$ (9%)
 - $\text{Zn}(\text{H}_2\text{O})_6]^{2+}$ (9%)