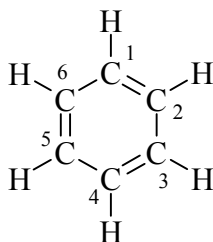


1. Benzene, C_6H_6 , is an industrial solvent and important chemical reagent. It is part of a class of compounds originally dubbed "aromatic" due to their unique odours; today "aromatic" also defines a unique electronic property that these molecules possess.



a) Please indicate the hybridisation of each carbon atom in benzene: (3 marks)

1: sp^2 2: sp^2 3: sp^2 4: sp^2 5: sp^2 6: sp^2

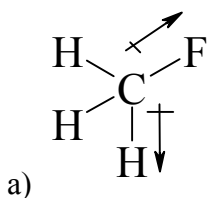
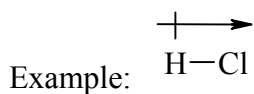
b) How many C-C sigma bonds are there in benzene? 6 (1.5 marks)

c) How many π bonds are there in benzene? 3 (1.5 marks)

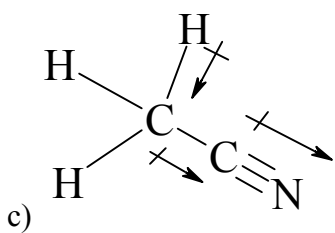
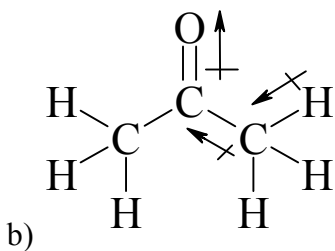
d) Is the following statement true? Yes or No. YES (2 marks)

The valence bond depiction of benzene implies that there are alternating single and double bonds in the molecule. However, in reality the phenomenon of resonance causes all the bonds in benzene to be equivalent.

2. For the following molecules, indicate the dipole in each *different* polar covalent bond, using the dipole symbol as illustrated in the example. (10 marks)



hint: how many *different* types of polar covalent bonds does this molecule possess?



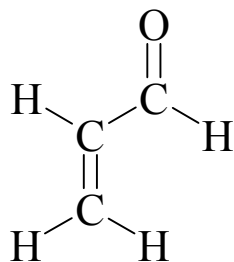
d) Name the main functional group present in molecules 2a - 2c

2a: alkyl fluoride (alkyl halide, haloalkane, fluoroalkane, halide also acceptable)

2b: ketone

2c: nitrile

3. Acrolein is a highly toxic aldehyde. Consider its structure:



Use as many of the boxes below as you need to draw all possible resonance structures for acrolein. Be sure to draw all arrows, and indicate all formal charges. Also indicate whether the resonance forms are MAJOR or MINOR contributors compared to the structure above. (12 marks)

