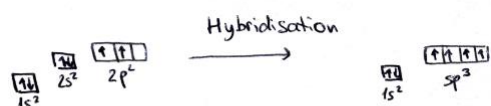


1

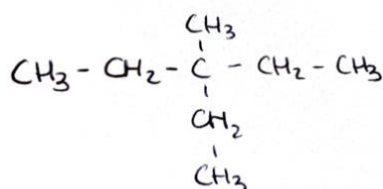
A) Explain, with reference to hybridisation of bonding orbitals, why carbon can form 4 single covalent bonds

4 x  $sp^3$  hybridised orbitals are formed by the hybridisation of the orbital 2s with three 2p orbitals. This gives space for four other electrons to bond with the atom C.

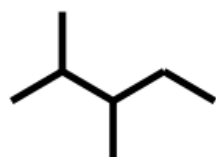
C ( $Z = 6$ )  $1s^2 2s^2 2p^2$



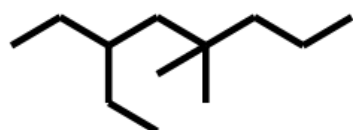
B) Draw the structure of 3-ethyl-3-methylpentane



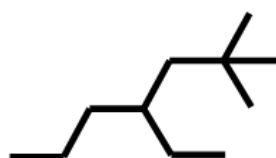
2. Name the following alkanes



2,3-dimethylpentane



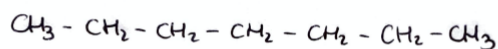
3-ethyl-5,5-dimethyloctane



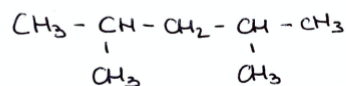
4-ethyl-2,2-dimethylpentane

### 3. Draw and name 5 isomers of $C_7H_{16}$

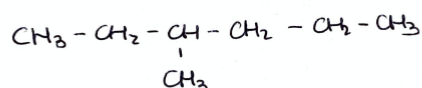
A) Heptane



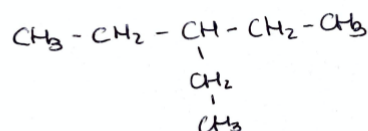
B) 2,4-dimethylpentane



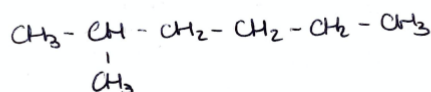
C) 3-methylhexane



D) 3-ethylpentane

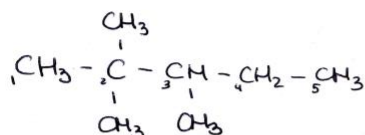


E) 2-methylhexane



### 4. State the classification of each carbon atom in the following

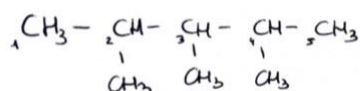
a) 2,2,3-trimethylpentane



- 1 - Bonded to one other C atom. Primary
- 2 - Bonded to four other C atoms. Quaternary
- 3 - Bonded to three other C atoms. Tertiary
- 4 - Bonded to two other C atoms. Secondary
- 5 - Bonded to one other C atom. Primary

All the radicals are bonded to one other C atom. Their C atom is primary.

b) 2,3,4-trimethylpentane

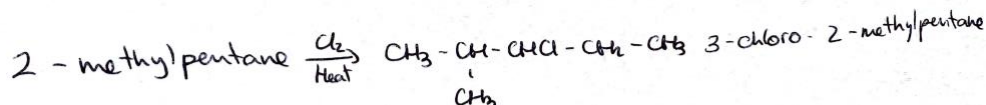
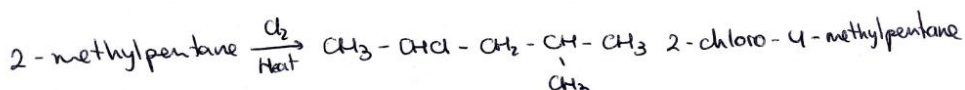
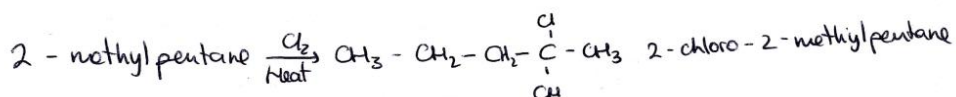
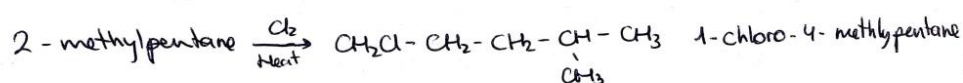
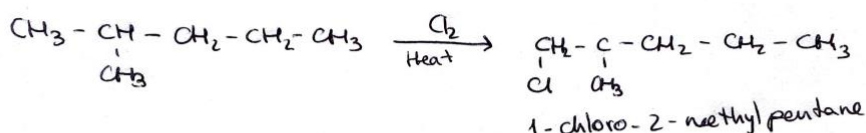


- 1, 5 - Bonded to one other C atom. Primary
- 2, 3, 4 - Bonded to three other C atoms. Tertiary

All the radicals are bonded to one other C atom. Their C atom is primary.

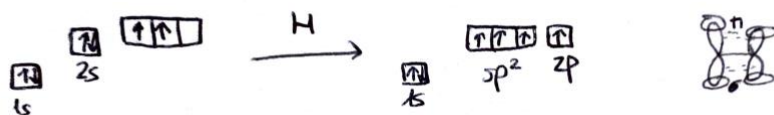
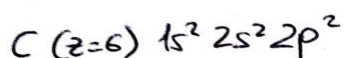
5. For 2-methylpentane, how many mono-chlorinated isomers are possible? Draw them all. Hint: look for symmetry when deciding how many there are.

There are 5 isomers possible:



6. Explain, with reference to hybridisation of bonding orbitals, why a carbon to carbon double bond does not rotate

When two carbons form a double bond, 3x sp<sup>2</sup> hybrid orbitals are formed by combining three atomic orbitals (2s, 2x 2p) on each carbon. This forms one sigma bond and a pi bond. This π bond is not free to rotate.

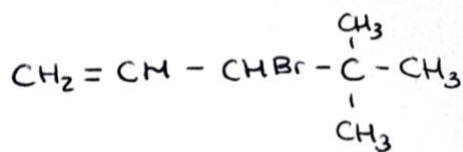


7

A) What is the expected product formed from the reaction between 2-butene and Cl<sub>2</sub>?

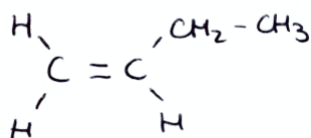
(c) 2,3-dichlorobutane

B) Draw the structure of 3-bromo-4,4-dimethylpent-1-ene

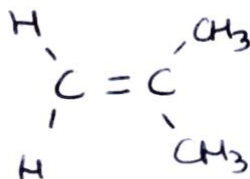


8. 2-butene,  $\text{C}_4\text{H}_8$  exists as a cis/trans isomeric pair. There are two other alkenes with the formula  $\text{C}_4\text{H}_8$ . Draw their structures and state whether they too can exist in cis and trans forms.

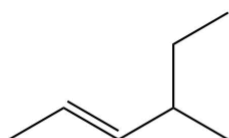
1-butene does not have cis and trans forms because there are 3 out of 4 substituents are the same atom, H.



2-methylprop-1-ene does not have cis and trans forms either, the substituents bonded to the C atom are the same in both sides.

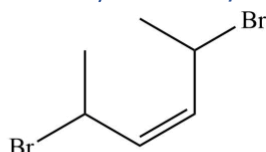


9. Name the following compounds, with cis/trans nomenclature.



A

A) Trans-4-methylhex-2-ene



B

B) Cis-1,5-dibromo-2-methylhex-3-ene

10. Draw the structure of 1-ethyl-2-methyl-1,3-dipropylcyclopentane

