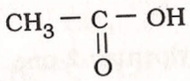
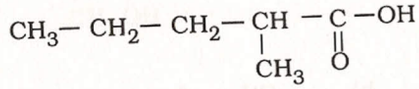
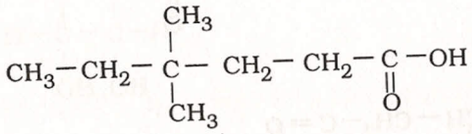
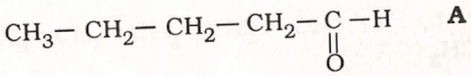
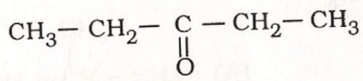
6. a) 

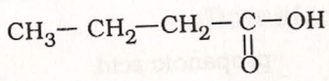
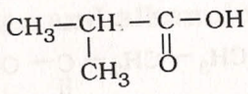
b) 

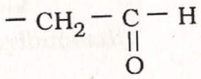
c) 

7. a)  **A**

 **B**

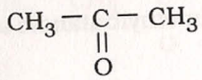
b) **A** pentanal
B pentan-3-one

8. a)  b) 

9. a) 

b) alkanals

c) i) no
ii) The only alternative structure is propanone which is an alkanone.

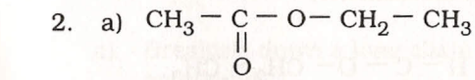
d) 

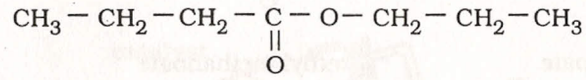
e) alkanones

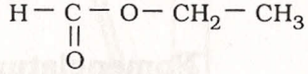
10. a) alkanals
b) **X** = methanal **Y** = ethanal

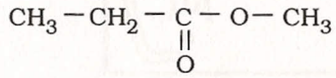
Exercise 2.5 Nomenclature and structural formulae - esters

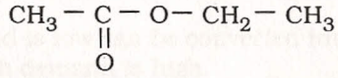
1. a) methyl ethanoate b) methyl methanoate
c) propyl ethanoate d) ethyl methanoate

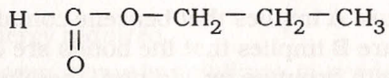
2. a) 

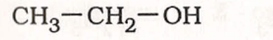
b) 

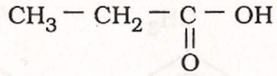
3. a) ethyl methanoate 

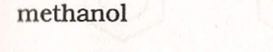
b) methyl propanoate 

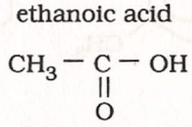
c) ethyl ethanoate 

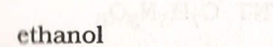
d) propyl methanoate 

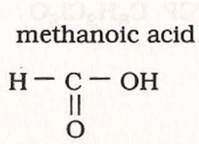
4. a) ethanol 

propanoic acid 

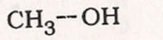
b) methanol 

ethanoic acid 

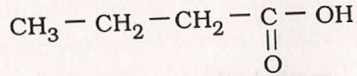
c) ethanol 

methanoic acid 

d) methanol

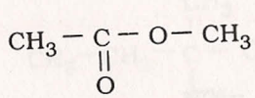


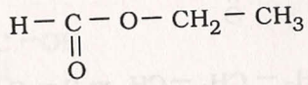
butanoic acid



5. a) methyl methanoate
   b) methanol, methanoic acid (sodium methanoate)

6. a)





   b) methyl ethanoate

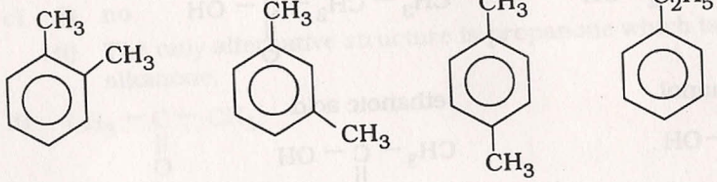
   ethyl methanoate

Exercise 2.6 Nomenclature and structural formulae - aromatic compounds

1. a) benzene
   b) C_6H_6
   c) phenyl

2. Structure **A** implies that benzene contains 3 localised double bonds whilst structure **B** implies that the bonds are delocalised. The molecule does not react with bromine by addition, therefore structure **B** is a better representation.

3.

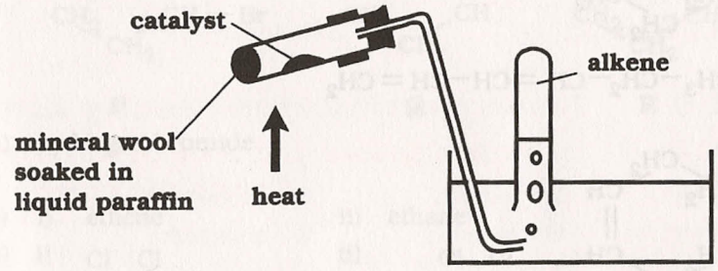


4. aspirin $C_9H_8O_4$ TCP $C_6H_3Cl_3O$ TNT $C_7H_5N_3O_6$

5. The electrons in benzene are delocalised within the molecule but are not free to move from molecule to molecule, hence benzene does not conduct.
   In graphite the electrons are delocalised over an entire plane of carbon atoms and can move throughout he bulk material.

Exercise 2.7 Cracking

1. a) Breaking down a long chain alkane to give a shorter chain alkane and an alkene.
   b)



   c) C_2H_4 ethene
   d) Fractions for which demand is low can be converted into more valuable fractions for which demand is high.

2. a) It would reduce the heat energy required.
   b) There are insufficient hydrogen atoms in an alkane to produce two shorter chain alkane molecules.

3. a) chloroethene
   b) **Y** - hydrogen **Z** - carbon

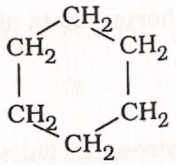
Exercise 2.8

Addition reactions

1. Add bromine water. If the bromine water is decolourised rapidly, the hydrocarbon is unsatuated.

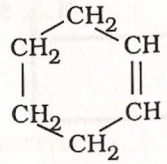
2. **A** $CH_2=CH-CH_2-CH_2-CH_2-CH_3$

B

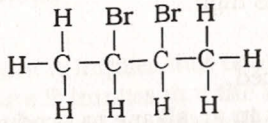


C $CH_3-CH_2-CH=CH-CH=CH_2$

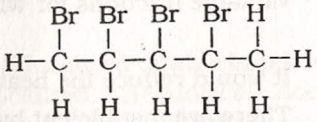
D



3. a) i)



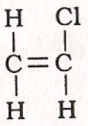
ii)



b) i) 2,3-dibromobutane ii) 1,2,3,4-tetrabromopentane

c) addition

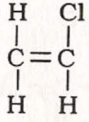
4. a)



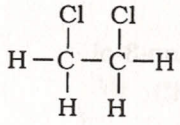
b) hydrogen chloride

5. a) addition

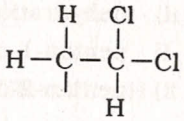
b) i)



ii)

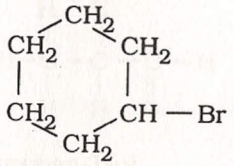


iii)

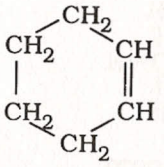


c) 1,2-dichloroethane

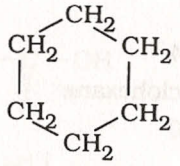
6. a)



P



Q

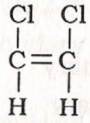


R

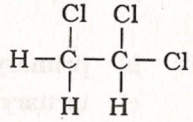
b) hydrogen bromide

7. a) i) ethene ii) ethane

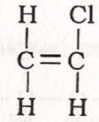
b) i)



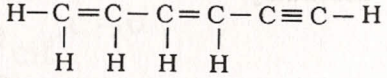
ii)



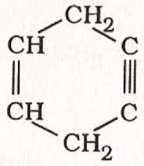
c) i) hydrogen chloride ii)



8. a) i)



ii)



b) Add bromine solution to each. Isomers i) and ii) will decolourise bromine solution quickly.

9. a) i) $CH_2=CH-CH_2-CH_3$ $CH_3-CH=CH-CH_3$
   ii) dehydration
   b) i) pentan-1-ol pentan-3-ol
   ii) pentan-2-ol

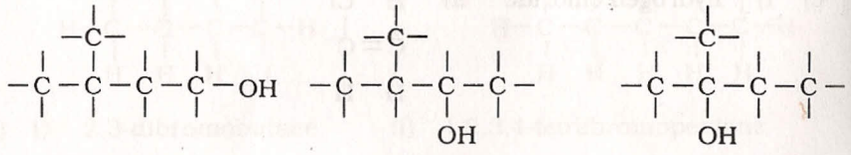
10. a) catalytic hydration
    b) fermentation of glucose

11. a) 0.4
    b) cyclohexane
    c) 1.0

Exercise 2.9 Primary, secondary and tertiary alcohols

1. a) primary b) tertiary c) secondary
   d) primary e) primary f) secondary

2. a) secondary b) primary c) primary
   d) secondary e) tertiary f) tertiary

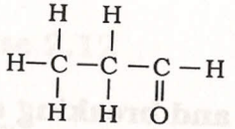
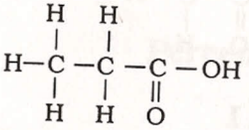
3. 

primary secondary tertiary

Exercise 2.10 Oxidation

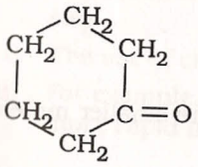
1. a) ethanol
   b) $CH_3-\overset{\overset{O}{\|}}{C}-H$
   c) acidified potassium dichromate solution or copper(II) oxide

2. a) $-\overset{\overset{O}{\|}}{C}-H$ b) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-H$
   c) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ d) $CH_3-CH_2-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-H$

3. a)  
   b) propan-1-ol propanoic acid
   c) The orange solution turns green.

4. a) $CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$ **X** $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ **Y**
   b) butan-2-ol
   c) secondary

5. a) butan-1-ol
   b) propanoic acid
   c) The blue solution gives a brick red precipitate.

6. a)  b) cyclohexanol

7. a) i) $CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$ ii) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$
   b) oxidation
   c) 2-methylpropan-2-ol is a tertiary alcohol and is not easily oxidised.