5. a) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$
   b) i) carbon dioxide ii) 80 cm^3 iii) 110 cm^3

6. 250 cm^3

7. a) $Xe(g) + 3F_2(g) \rightarrow XeF_6(s)$
   b) 250 cm^3 unreacted F_2 only

8. 40 cm^3 $CO_2(g)$ only

9. 750 cm^3 gas made up of 300 cm^3 $CO_2(g)$ and 450 cm^3 unreacted $O_2(g)$

10. **x** = 3 **y** = 6

11. a) 100 cm^3
    b) 50 cm^3 $CO_2(g)$ and 150 cm^3 $H_2O(g)$
    c) 150 cm^3 (ignoring contraction due to temperature change)

12. a) 120 cm^3
    b) C_6H_{10}

Unit 2 The World of Carbon

Exercise 2.1 Fuels

1. a) reforming
   b) i) To improve the efficiency of combustion.
   ii) The products are branched-chain, cyclic and aromatic hydrocarbons which burn more efficiently.
   c) **C**

2. a) Changing the structure of the carbon skeleton of a molecule.
   b) naphtha

3. a) i) Nitrogen oxides form from molecules of nitrogen and oxygen in the air/fuel mixture. The sparking of the ignition provides the activation energy necessary to allow nitrogen and oxygen to combine.
   ii) Carbon monoxide is formed by the incomplete combustion of hydrocarbons in a limited supply of air.
   b) carbon dioxide and nitrogen

4. a) A discharge of electricity in the spark plug.
   b) So that the fuel is more volatile at low temperatures.
   c) So that lead compounds can be omitted from the blend of petrol.

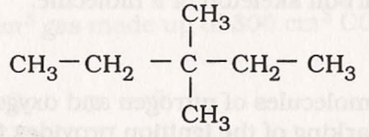
5. a) A substance which burns in air to release energy.
   b) i) fermentation (incomplete respiration)
   ii) The source of ethanol, sugar cane, is a renewable resource.

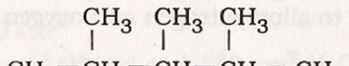
6. a) Conditions where air is absent.
   b) fermentation c) methane

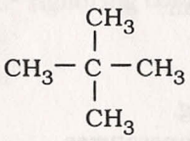
7. a) Only water vapour is released to the amosphere when hydrogen burns. Petrol releases carbon dioxide and carbon monoxide also.
   b) For example, methanol can be produced from synthesis gas and helps conserve oil supplies, methanol is less volatile than petrol and so is less likely to explode in a car collision.
   For example, methanol is toxic, it is difficult to get methanol to mix with petrol.

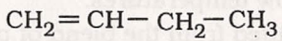
Exercise 2.2 Nomenclature and structural formulae - hydrocarbons

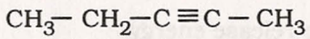
1. a) 2-methylpentane
   b) 2,3-dimethylbutane
   c) 3-methylpentane
   d) 2,2dimethylbutane
   e) 3,3-dimethylbut-1-ene
   f) 4-ethyl,5-methylhex-1-yne
   g) 2-ethyl,5-methylhex-2-ene
   h) 2-ethylbut-1-ene
   i) methylcyclobutane
   j) 1,2-dimethylcyclohexane
   k) 1,5-dimethylcyclopentene
   l) methylbut-1-yne

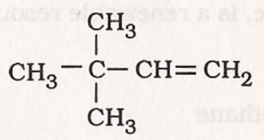
2. a)  3,3-dimethylpentane

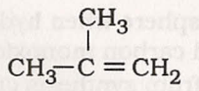
   b)  2,3,4-trimethylpentane

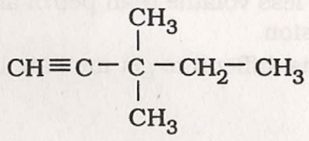
   c)  dimethylpropane

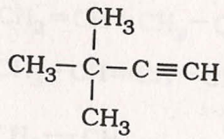
   d)  but-1-ene

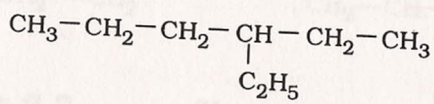
   e)  pent-2-yne

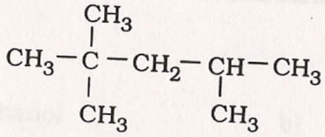
   f)  3,3-dimethylbut-1-ene

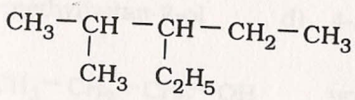
   g)  methylpropene

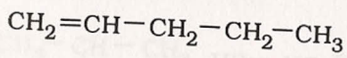
   h)  3,3-dimethylpent-1-yne

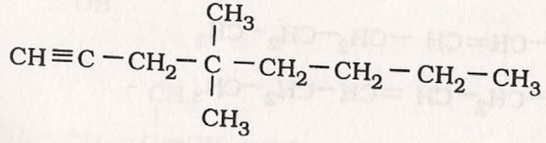
i)  3,3-dimethylbut-1-yne

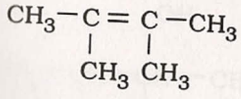
3. a) 

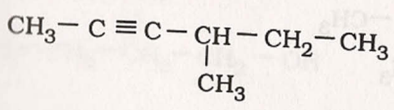
   b) 

   c) 

   d) 

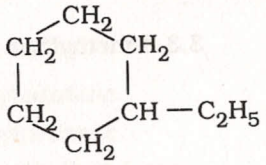
   e) 

   f) 

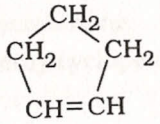
   g) 

   h)

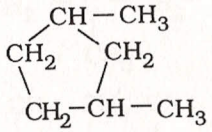
i)



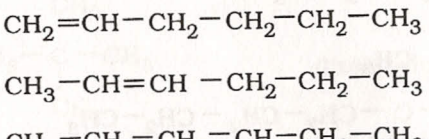
j)



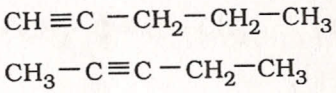
k)



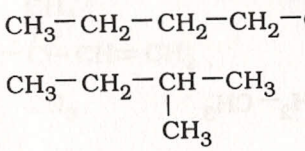
4. a)

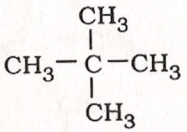


b)

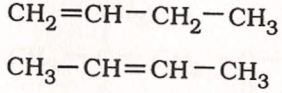


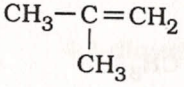
c)

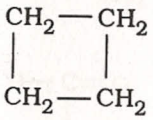


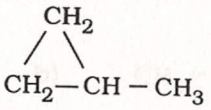


d)





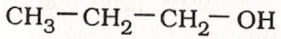




Exercise 2.3 Nomenclature and structural formulae - alkanols

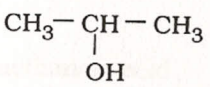
1. a) ethanol b) butan-2-ol
   c) 2-methylbutan-2-ol d) 4-methylpentan-2-ol

2. a)



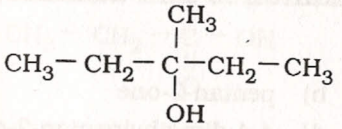
propan-1-ol

b)



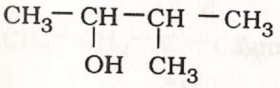
propan-2-ol

c)



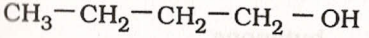
3-methylpentan-3-ol

d)

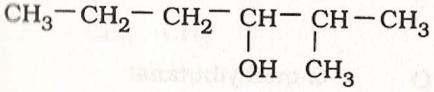


3-methylbutan-2-ol

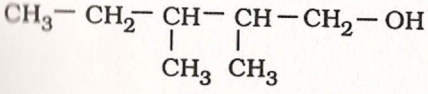
3. a)

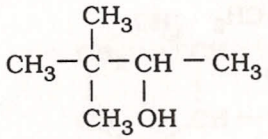


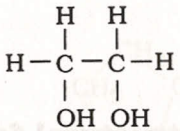
b)



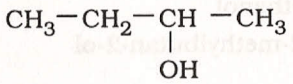
c)

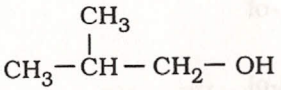


d) 

4. a) 

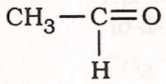
b) An alcohol with two -OH functional groups.

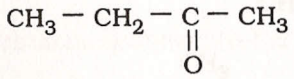
5. a) $CH_3-CH_2-CH_2-CH_2-OH$ 

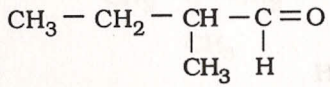
b) 

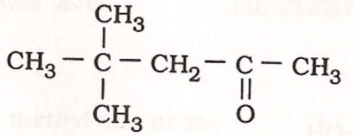
Exercise 2.4 Nomenclature and structural formulae - alkanals, alkanones and alkanoic acids

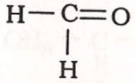
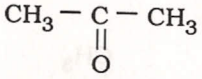
1. a) propanal
   b) pentan-2-one
   c) 3-methylbutanal
   d) 4,4-dimethylpentan-2-one

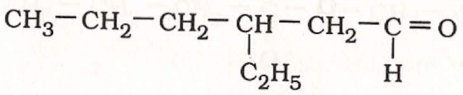
2. a)  ethanal

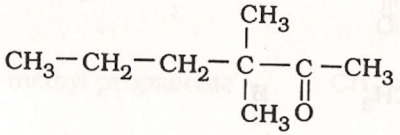
   b)  butanone

   c)  2-methylbutanal

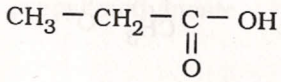
d)  4,4-dimethylpentan-2-one

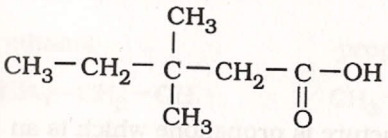
3. a)  b) 

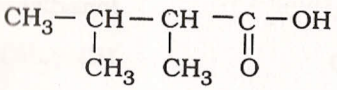
c) 

d) 

4. a) methanoic acid
   b) 3-methylbutanoic acid
   c) 3-methylpentanoic acid

5. a)  propanoic acid

   b)  3,3-dimethylpentanoic acid

   c)  2,3-dimethylbutanoic acid