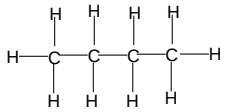
Answers to Uni 3.1 Exercises

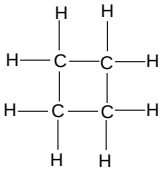
Exercise 1

1. a) C_4H_{10} b) C_4H_8 c) C_4H_8

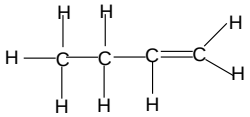
a) b) c)



(1 other possibility)



(one other possibility)



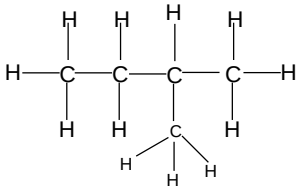
(two other possibilities)

2. a) alkane b) alkene c) bromoalkane

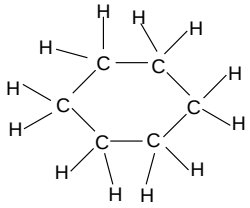
Exercise 2

1. a) 2,2-dimethylbutane b) 4-bromobut-1-ene c) but-2-ene
   d) chlorodimethylpropane e) methylpropane f) 1,2-dibromopropane
   g) but-1-ene h) methylbut-2-ene

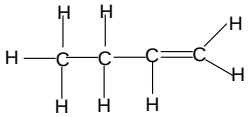
2. a)



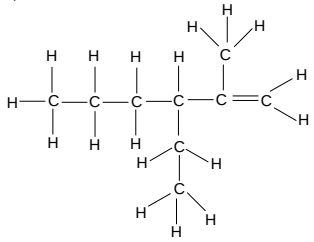
b)



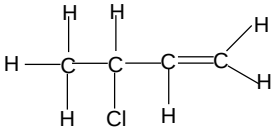
c)



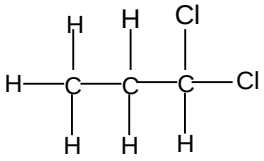
d)



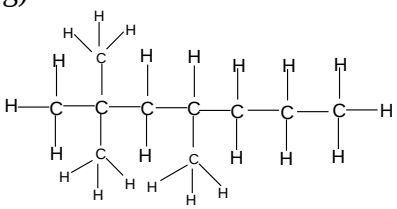
e)



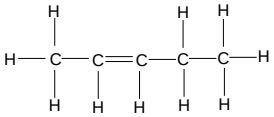
f)



g)

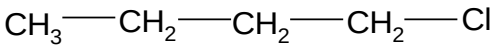


h)

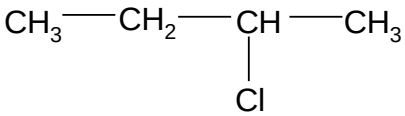


Exercise 3

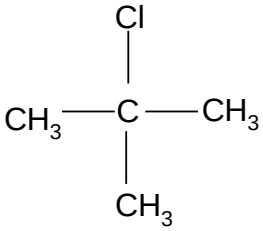
1.



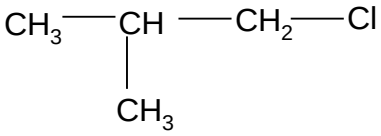
1-chlorobutane



2-chlorobutane

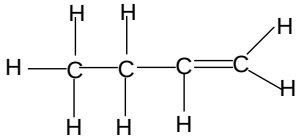


2-chloromethylpropane

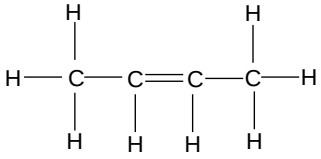


1-chloromethylpropane

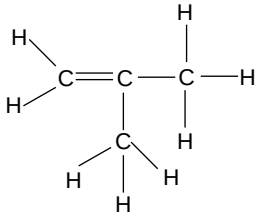
2.



but-1-ene

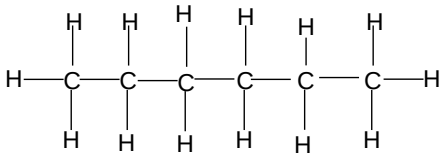


but-2-ene

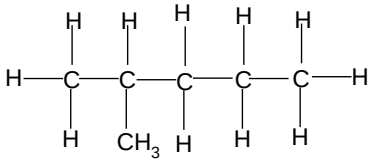


methylpropene

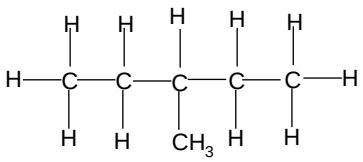
3.



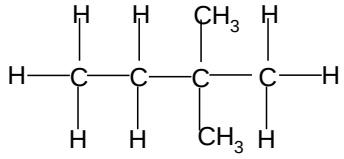
hexane



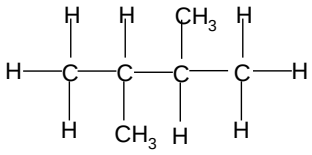
2-methylpentane



3-methylpentane



2,2-dimethylbutane



2,3-dimethylbutane

lowest boiling point: 2,2-dimethylbutane
2,3-dimethylbutane
3-methylpentane
2-methylpentane
highest boiling point: hexane

Exercise 4

1. a) mixtures of hydrocarbons with similar boiling points

b)

- crude oil is passed into a fractionating column where it boils
- the column is hotter at the bottom than at the top
- the vapour rises up the column until it condenses
- small hydrocarbons have weak van der Waal's forces, hence low boiling points and condense near the top of the column
- large hydrocarbons have strong van der Waal's forces, hence high boiling points and condense near the base of the column

c)

liquefied petroleum gas	camping stoves, gas for cooking
gasoline	fuel for cars
naphtha	petrochemicals
kerosine	fuel for aircraft
diesel	fuel for lorries
lubricating oil	lubrication
fuel oil	fuel for ships
wax	candles
tar	road surfacing

d) the fractions all have different uses
mixed together they have no useful applications

2. a) thermal cracking: high temperature
high pressure
makes alkenes
catalytic cracking: high temperature
slight pressure
zeolite catalyst
makes motor fuels
makes aromatic hydrocarbons

b) it converts hydrocarbons for which supply exceeds demand
into hydrocarbons for which demand exceeds supply

3. a) $C_8H_{18} + 12½O_2 \rightarrow 8CO_2 + 9H_2O$

b) $C_8H_{18} + 8½O_2 \rightarrow 8CO + 9H_2O$
$C_8H_{18} + 4½O_2 \rightarrow 8C + 9H_2O$

c) less energy released, CO is a toxic gas, C particulates are carcinogenic

4. a) CO_2, CO, C, NO_2 or NO, SO_2, unburned hydrocarbons

b)

CO_2	greenhouse gas
CO	reduces ability of blood to carry oxygen
C	carcinogen
NO_2 or NO	cause acid rain/destruction of ozone layer
SO_2	acid rain
unburned hydrocarbons	greenhouse gases/photochemical smog

c) $2CO + 2NO \rightarrow N_2 + 2CO_2$