WORKSHEET 7

ALKANES AND ALKENES

Syllabus reference 8.5.3

1 The following table provides a revision of the main characteristics of hydrocarbons. Check your understanding by filling in the missing parts.

PROPERTY	ALKANES	ALKENES
General formula	C_nH_{2n+2}	
Ending for the name		-ene
Characteristic bond	Single	
Number of shared electron pairs	1	
Shape of the molecule around the characteristic bond		Planar
Intermolecular forces		Dispersion
Solubility in water		Insoluble
Density	Less than water	
Polarity of molecules		
Electrical conductivity	Non-conductor	

2 Name the following hydrocarbons.

a $CH_3CH_2CH_2CH_3$

b $CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$

c $CH_2=CH–CH_2–CH_2–CH_3$

d $CH_3–CH=CH–CH_3$

e $CH_3–CH=CH-CH_2-CH_3$

f $CH_3–CH_2–CH=CH-CH_2–CH_3$

3 Draw a structural formula for each of the following.

a Ethane

b Hexane

c 3-octene

d 1-pentene

e 2-heptene

4 What is wrong with the following names? Give the correct one.

a 5-hexene

b 4-heptene

In questions 5–8 circle the correct answer.

5 Which of the following is not an alkane?

A CH_4
B CH_2CH_2
C $CH_3CH_2CH_2CH_3$
D $C_{30}H_{62}$

6 Two compounds are structural isomers if they:

A differ from each other by a CH unit
B have the same physical properties
C have the same molecular formula but different structural formula
D have the same structural formula but different molecular formula

7 Which of the following could be an alkene?

A C_2H_4
B C_4H_{10}
C C_5H_8
D $C_{11}H_{20}$

8 Butadiene is a reactive chemical used extensively in the chemical industry to make synthetic rubber. It is also described as an alkene because:

A it contains fewer hydrogen atoms than butane
B it is very reactive
C it contains double bonds
D each carbon atom has a planar arrangement

9 **a** What is the distinguishing characteristic of homologous series?

b If $CH_3CH_2CH_3$ is a member of a homologous series, what is the structural formula of the next higher member of this series?

10 Consider the table below of the physical properties of alkanes.

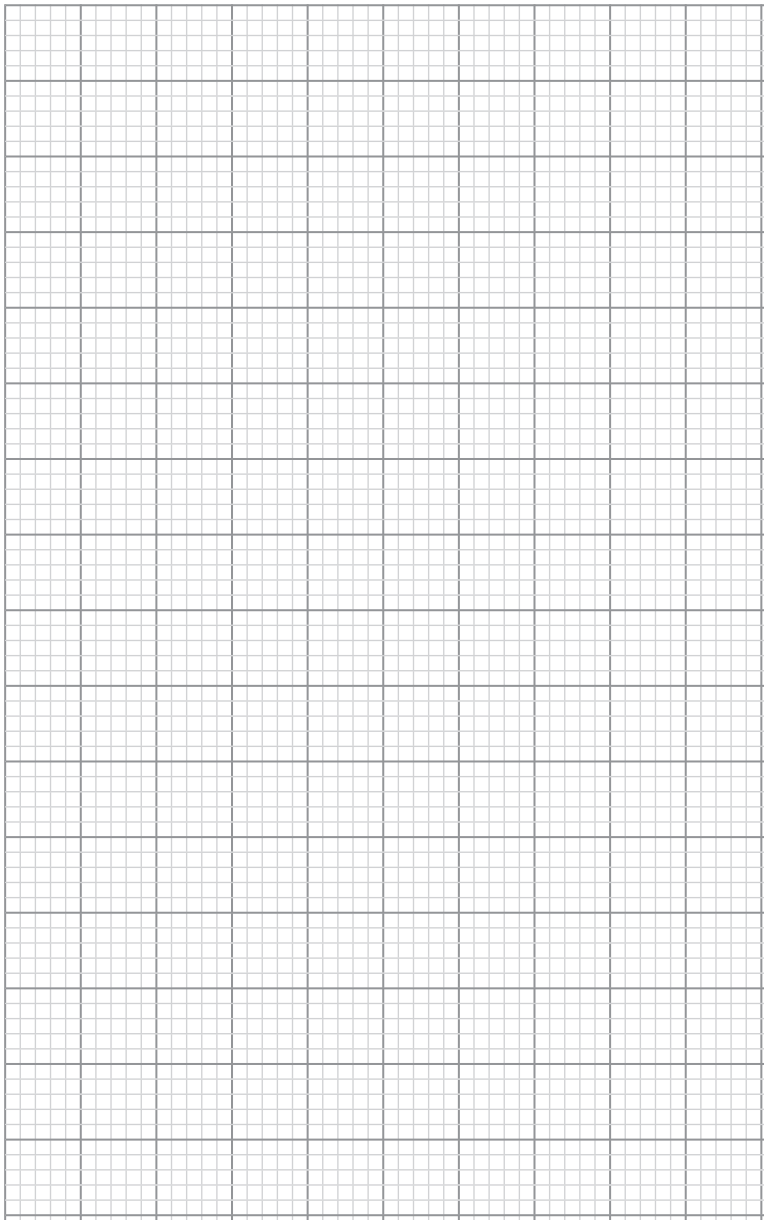
NAME	NO. OF CARBONS	PHYSICAL STATE (25°C)	MELTING POINT (°C)	BOILING POINT (°C)	DENSITY (g/mL^{-1})
Methane	1	Gas	–182	–162	—
Ethane	2	Gas	–183	–89	—
Propane	3	Gas	–188	–42	—
Butane	4	Gas	–138	–0.5	—
Pentane	5	Liquid	–130	36	0.62
Hexane	6	Liquid	–95	69	0.66
Heptane	7	Liquid	–91	98	0.68
Octane	8	Liquid	–57	126	0.70

How do each of melting point, boiling point and density vary with molecular size?

11 The table below presents boiling points for some alkenes.

NO. OF CARBON ATOMS	ALKENE	BOILING POINT (°C)
2	Ethene	–104
3	Propene	–48
4	1-butene	–6
5	1-pentene	30
6	1-hexene	64
7	1-heptene	94
8	1-octene	121

On the same piece of graph paper plot boiling point versus number of carbon atoms for each series of compounds. Draw a smooth curve through each set of points.



a How does boiling point vary with number of carbon atoms?

b How do the boiling points of alkanes compare with those of alkenes?

c What is the relationship between boiling point and strength of intermolecular forces?

12 **a** What is volatility?

b What is the relationship between volatility and boiling point?

13 Compound X has a boiling point of –6°C while compound Y has a boiling point of +12°C and compound Z has a boiling point of –55°C.

a List the compounds in order from most volatile to least volatile.

b Compare the strength of the intermolecular forces in each of these compounds.

c Compound Y is soluble in water but compounds X and Z are not. Use this information to decide whether the molecules are polar or non-polar giving a reason for your decision.