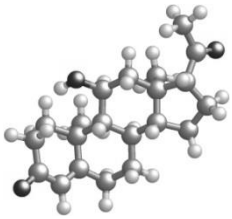


Chem!stry

Name: …… **( )**

Class: ……

Date: …… **/** …… **/** ……

Crude Oil

Introduction:

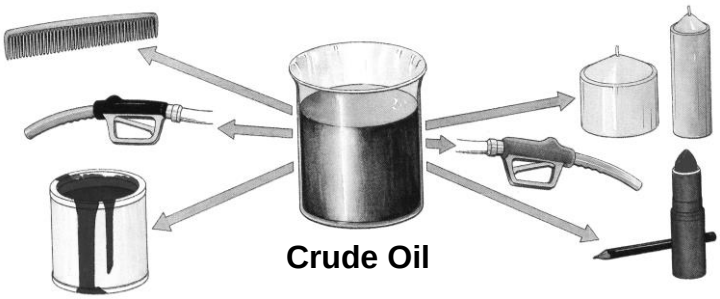
1) Complete the two paragraphs below using the terms given in *italics*. Each term may be used once, more than once, or not at all:

The simplest homologous series of organic compounds are the ……. The ……. are composed only of the two elements ……. and ……. covalently bonded together and are therefore known as ……. In each molecule (except methane) the carbon atoms are joined together by ……. covalent bonds.

One of the major sources of alkanes is ……. (also known as …….). Another major source is ……. which may be found dissolved in ……. or in underground reservoirs containing gases alone. ……. is a mixture of hundreds of different ……., most of which are …….

carbohydrates	*alkenes*	*double*	*oxygen*	*alkynes*	*natural gas*	*hydrocarbons*
hydrogen	*single*	*petroleum*	*alkanes*	*paraffin*	*crude oil*	*carbon*

Uses of Crude Oil:



2) Identify the materials in the diagram that are manufactured using crude oil as the raw material. Supplement this list with your own knowledge of materials that are manufactured from crude oil:

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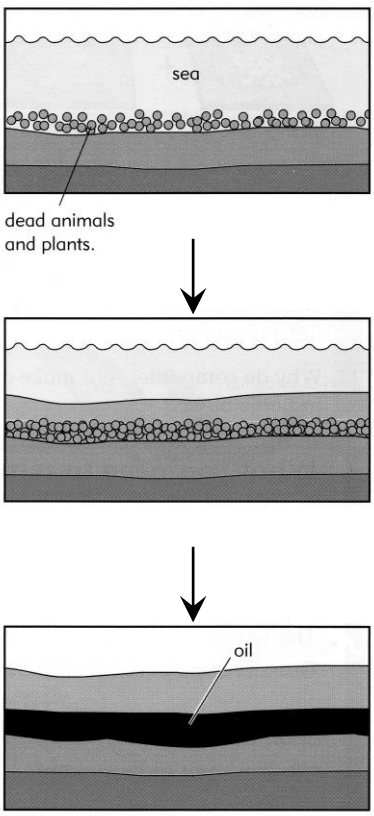
The Formation of Crude Oil (Chemistry and Geography):



3) With reference to the diagrams shown on the left-hand side, clearly explain how crude oil is formed:

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4) Why is crude oil described as a *fossil fuel*? Name two other fossil fuels:

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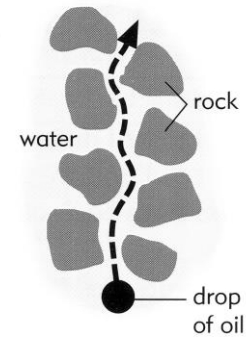
Drilling for Crude Oil (Chemistry and Geography):



5) With reference to the diagrams shown on the left-hand side, clearly explain how crude oil accumulates within the Earth's crust:

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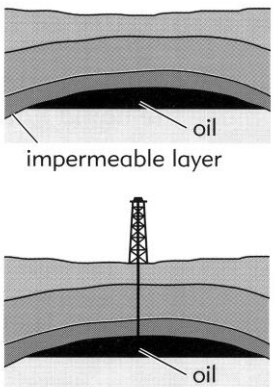

6) Crude oil is extracted from the Earth's crust by drilling through hard rock using diamond-tipped drill-heads. Do you expect the crude oil extracted from different regions of the world to have the same composition? Explain your answer:

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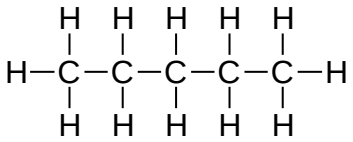
The Fractional Distillation of Crude Oil:

Crude oil contains many important chemical components. For these chemicals to be used for any given application, they must firstly be separated from each other.

The structural formulae of two hydrocarbons that are found in crude oil are given below:

Pentane: melting point = 143 K and boiling point = 309 K

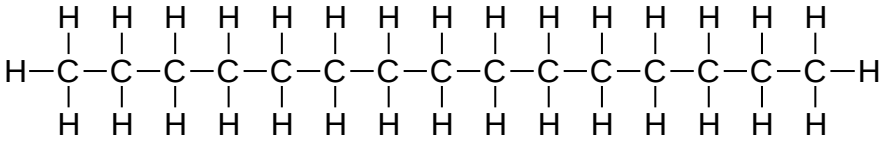


7) Complete the following information about pentane:

Molecular formula = …… Relative molecular mass = ……

Physical state at room temperature and pressure = ……

Pentadecane: melting point = 283 K and boiling point = 544 K



8) Complete the following information about pentadecane:

Molecular formula = …… Relative molecular mass = ……

Physical state at room temperature and pressure = ……

9) Give a comprehensive explanation as to why the boiling point of pentadecane is greater than the boiling point of pentane:

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10) Explain clearly and concisely the theory behind fractional distillation and how it is used to separate a complex mixture of hydrocarbons ranging in formulae from CH_4 to $C_{60}H_{122}$:

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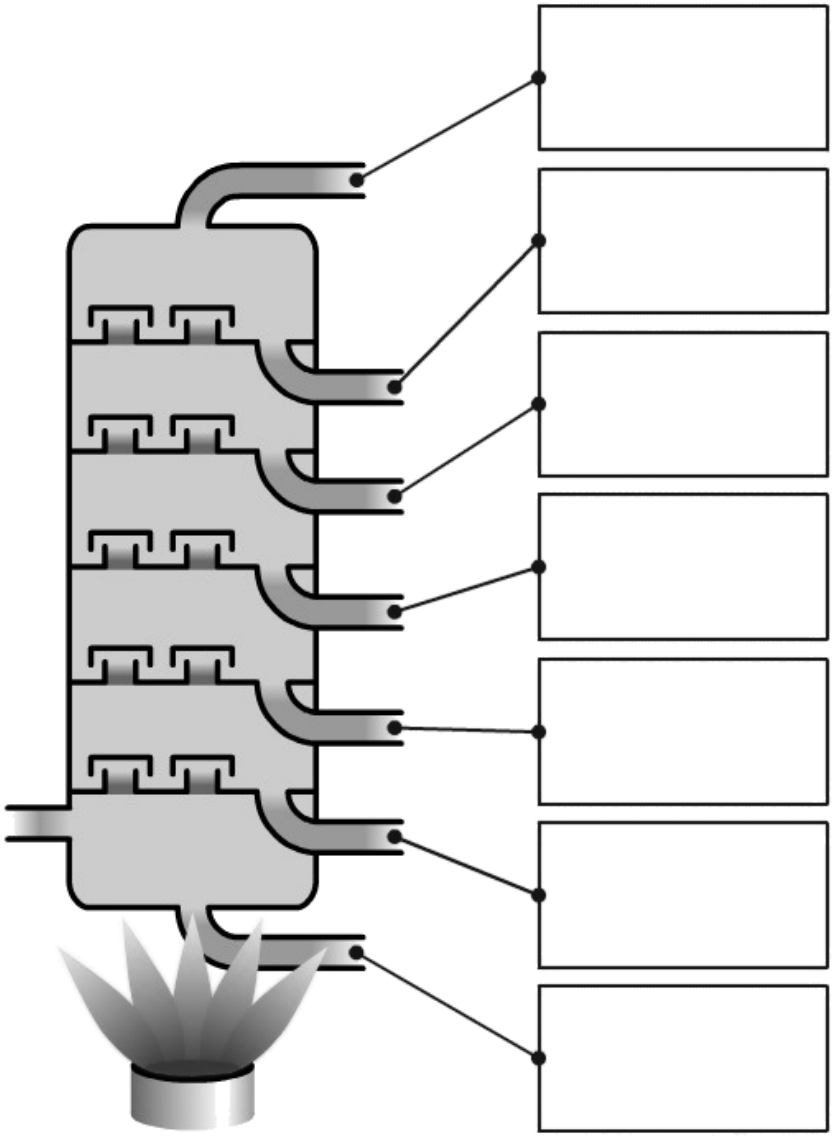
The Industrial Fractional Distillation of Crude Oil:

An oil refinery converts crude oil into a range of useful products. Some of the products obtained from the fractional distillation of crude oil are ready for use, while other products are used as chemical feedstocks for the manufacture of pharmaceuticals, cosmetics and plastics.

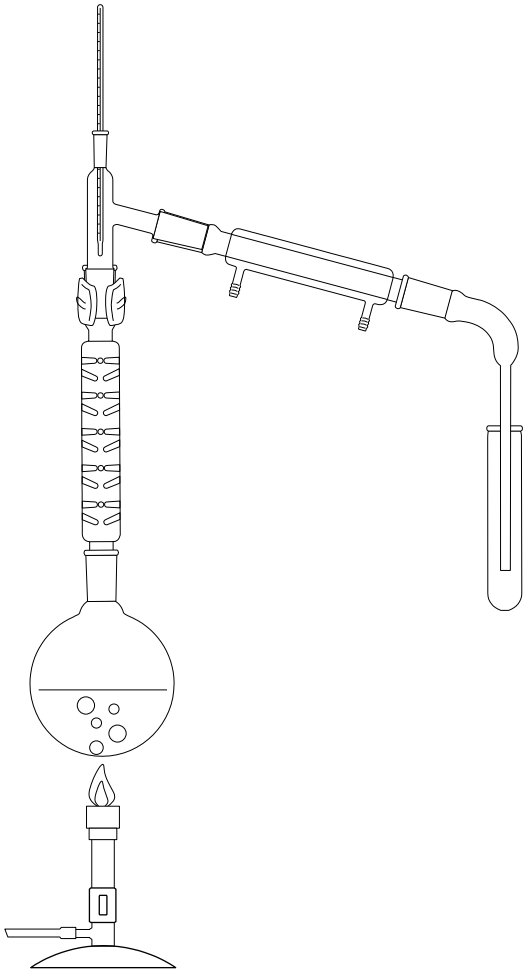
11) On the fractional distillation column below, label each of the fractions with the following information:

- Name of fraction.
- Most important uses of the fraction.
- Range over which the fraction boils.
- Minimum $\rightarrow$ maximum number of carbon atoms that the hydrocarbon molecules in the fraction contain.



The Laboratory Fractional Distillation of Crude Oil (Practical Demonstration):

12) Label the fractional distillation apparatus shown below:



13) State the function of each of the following pieces of apparatus:

a) The thermometer:

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b) The fractionating column:

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c) The water cooled condenser:

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d) The porcelain chips in the round bottomed flask:

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14) Use your knowledge of fractional distillation to summarise the method for this experiment:

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15) Complete the table below to summarise the results of the experiment:

Fraction:	Boiling Range:	Relative Size of the Molecules:	Appearance:	Flammability:	Volatility:	Viscosity:
First →						
Second →						
Third →						
Fourth →						
Fifth →						

16) Which fraction(s) would be suitable to be used as the fuel in an internal combustion engine? Which properties make this fraction(s) useful as a fuel? Explain your answers:

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17) Which fraction(s) would be suitable to be used as a lubricating oil? Which properties make this fraction(s) useful as a lubricating oil? Explain your answers:

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- *New Edition Chemistry* (Second Edition), Bryan Milner and Jean Martin, Cambridge University Press, 2001.
- *Advanced Chemistry*, Michael Clugston and Rosalind Flemming, Oxford University Press, 2000