Education Scotland
Foghlam Alba

National 5 Chemistry

Relevant Past Paper Questions from SQA Standard Grade Credit and Intermediate 2 papers

Unit 2: Nature's Chemistry

March 2014

N5 Chemistry Past Paper Questions

This resource has been produced in response to the requests from practitioners who attended the National Qualifications Sciences events at Hampden Stadium in December 2013 which Education Scotland organised in partnership with the SQA.

The questions in this resource relate to the Nature's Chemistry Unit for National 5 Chemistry and have been taken from the 2011, 2012 and 2013 Standard Grade and Intermediate 2 Past Papers.

For Nature's Chemistry (Unit 2), the mandatory course key areas are as follows:

- Homologous series
- Everyday consumer products
- Energy from fuels

In cases where the questions relate to more than one of the National 5 Units, the constituent parts of the question have been separated into their respective key areas. The stem of the question has been retained to give the context of the question. If practitioners require the full integrated question, they should refer to the original past paper on the SQA website.

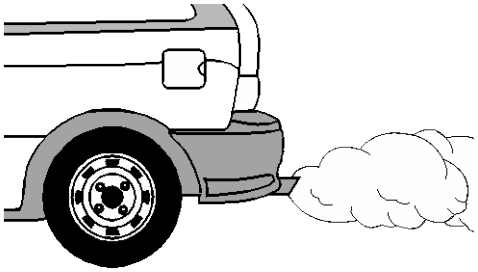
Past paper questions for the other two National 5 Units, Chemical Changes and Structure and Chemistry in Society, are also available from Education Scotland's National Qualifications Glow portal: http://www.educationscotland.gov.uk/nqcoursematerials/ (cut and paste link into your browser).

Education Scotland would like to acknowledge the support of the SQA in helping us produce this resource. We hope it proves helpful to practitioners across Scotland and assists with the implementation of the national qualifications.

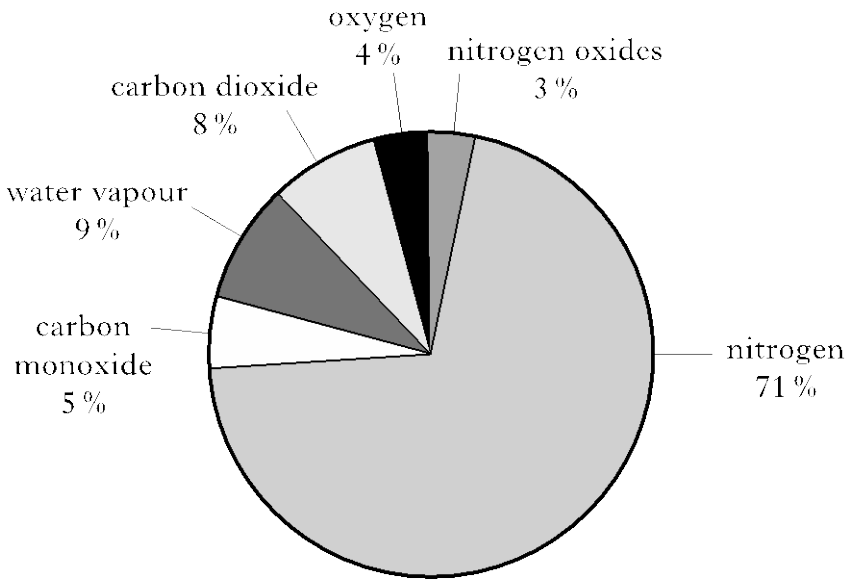
Homologous series

Int 2 2011 — Marks

8 Many different gases are found in car exhaust fumes. Some of these gases are produced by the combustion of petrol in car engines.



The pie chart shows the gases present in the exhaust fumes of a car.



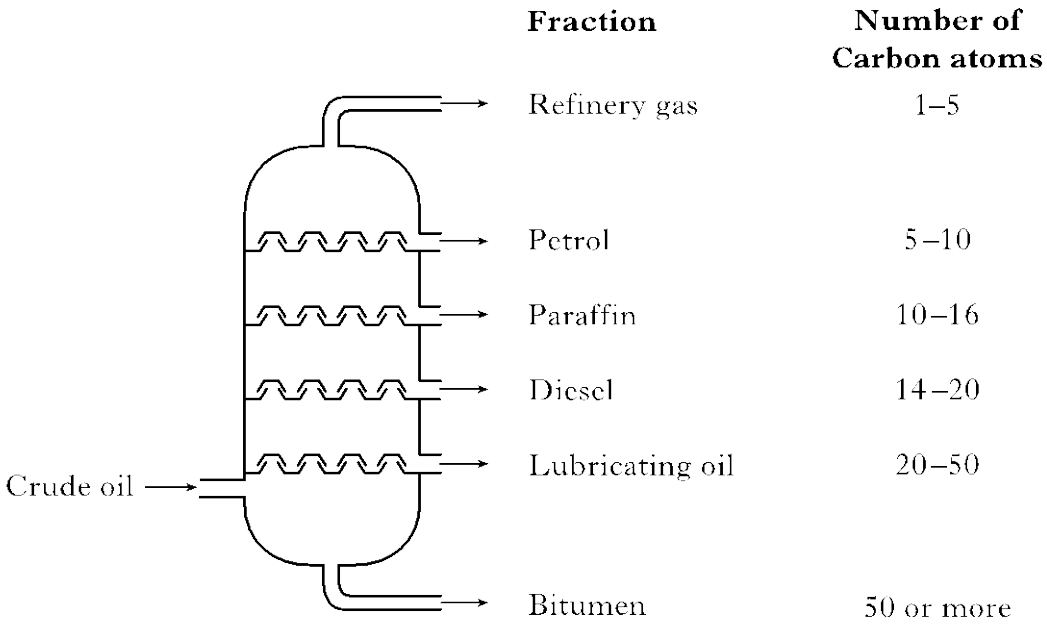
(a) What evidence in the pie chart shows that incomplete combustion of petrol has taken place? 1

Answer
Presence of carbon monoxide/
CO present/
5% CO present
Carbon monoxide with nitrogen oxides does not cancel

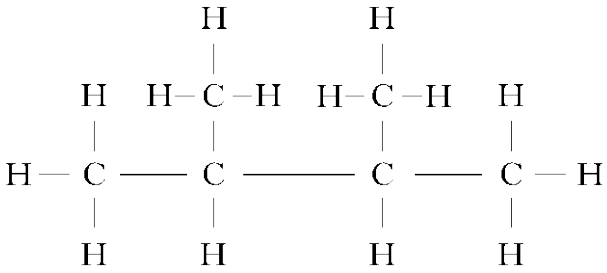
1

Int 2 2013 | Marks

8 Crude oil is a mixture of hydrocarbons which can be separated into fractions by fractional distillation.



(c) Petrol contains the following molecule. 1



Name this molecule.

Answer 2,3-dimethylbutane/
2,3 dimethylbutane/
2-3 dimethylbutane/
23- dimethylbutane

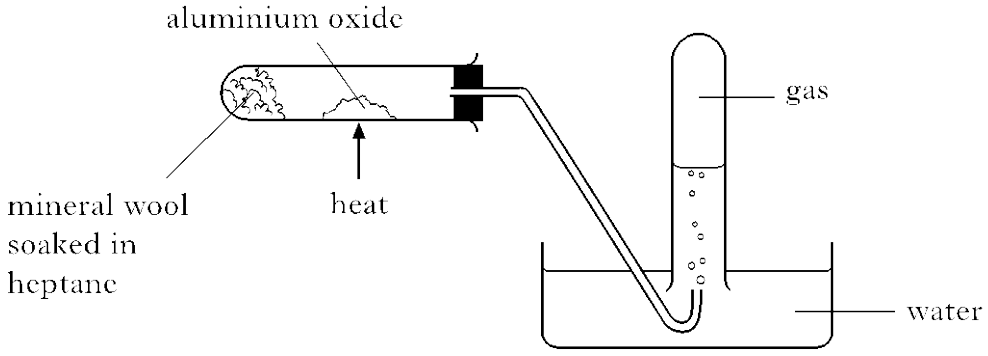
Accept loose spelling of methyl and butane but ane must be present eg buthane
Accept (di)
Accept spaces between di and methyl and butane

Ignore wrong use of commas and dashes

S Gr 2011 16

Marks

Heptane can be cracked as shown.



One of the reactions which takes place is:

$$C_7H_{16} \longrightarrow C_4H_{10} + C_3H_6$$

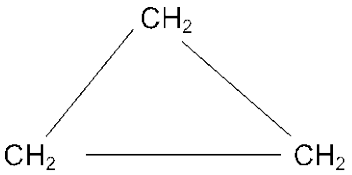
(a) The product C_3H_6 decolourises bromine solution quickly. 1

Draw a structural formula for an isomer of C_3H_6, which would **not** decolourise bromine solution quickly.

Answer

Full or shortened structural formula of cyclopropane

eg

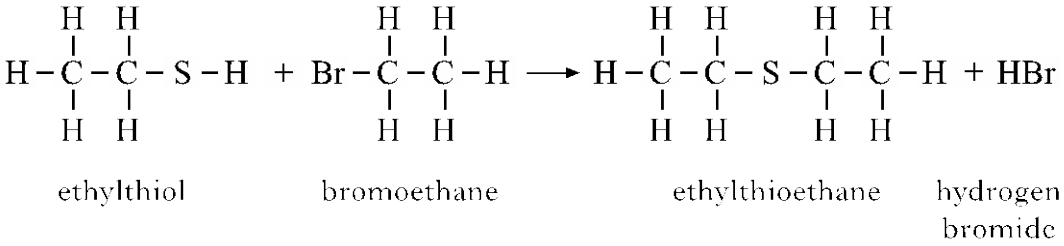


S Gr 2011 22 — Marks

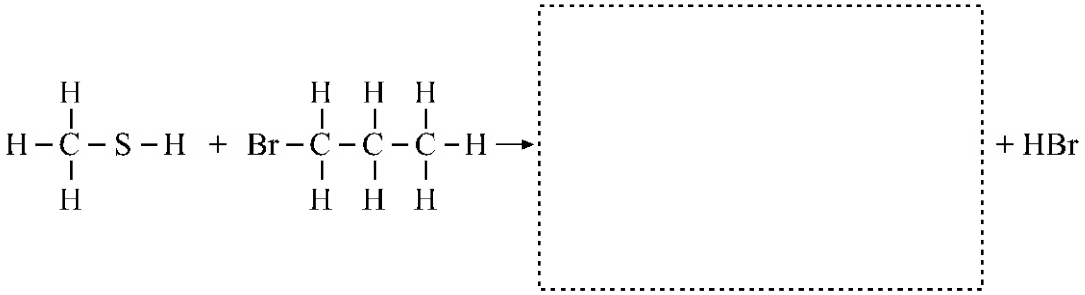
Ethylthioethane belongs to a homologous series of compounds called thioethers.

(a) What is meant by a homologous series? 1

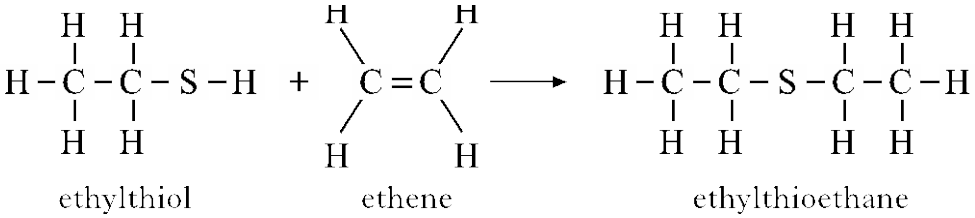
(b) Ethylthioethane is formed when ethylthiol reacts with bromoethane as shown. 1



Draw the full structural formula for the thioether produced in the following reaction.



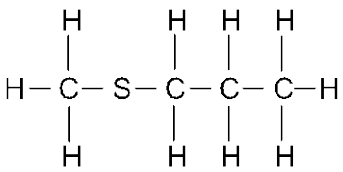
(c) Ethylthioethane can also be formed by the reaction of ethylthiol with ethene. 1



Suggest a name for the type of chemical reaction taking place.

Answers (a) Same general formula and same/similar properties OR same/similar chemical properties
Both required

(b)

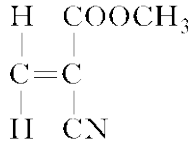


Allow one missing H or bond to a H but not a missing C or S or bonds between

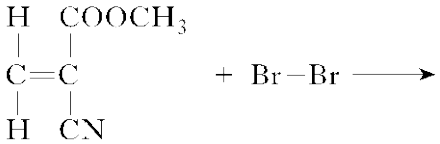
(c) addition

S Gr 2012 20 — Marks

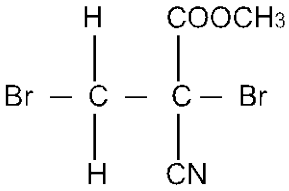
The monomer in superglue has the following structure.



(c) Bromine reacts with the monomer to produce a saturated compound. Draw the structural formula for this compound. — 1



Answers



Everyday consumer products

Int 2 2011 9 Marks

The little pen-tailed tree shrew, found in the jungles of West Malaysia, feeds on nectar from the Bertam palm tree. This nectar contains glucose which ferments, producing solutions of up to 3·8 % alcohol. Therefore, the tree shrew regularly drinks a solution which is equivalent to a man drinking 9 units of alcohol per day. It seems that the tree shrew never gets drunk because it is able to breakdown the alcohol much quicker than humans can.

(c) The alcohol produced is ethanol. 1

Draw the **shortened structural formula** for ethanol.

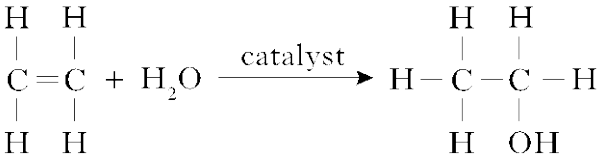
Answers

(c) $CH_3 — CH_2 — OH / CH_3\text{--}CH_2OH$
$CH_3\ CH_2\ OH / CH_3CH_2\text{--}OH$
$CH_3\ CH_2(OH)$

Int 2 2012 | Marks

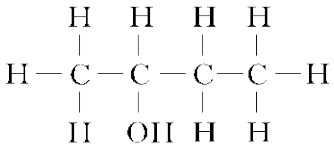
7 Ethanol is a member of the alkanol family of compounds.

(a) Ethanol can be manufactured from ethene as shown in the following addition reaction. 1



What other name can be given to this type of addition reaction?

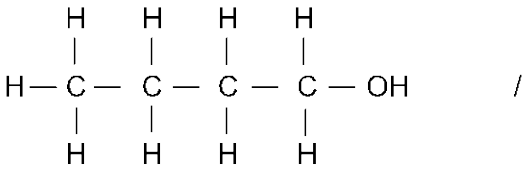
(c) Butan-2-ol is another member of the alkanol family. 1



Draw the full structural formula for an isomer of butan-2-ol.

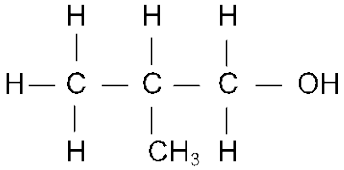
Answer (a) Hydration
Catalytic hydration

(c)

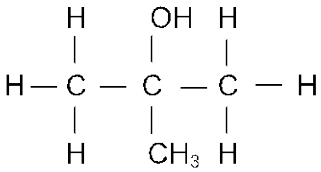


/

or



Or



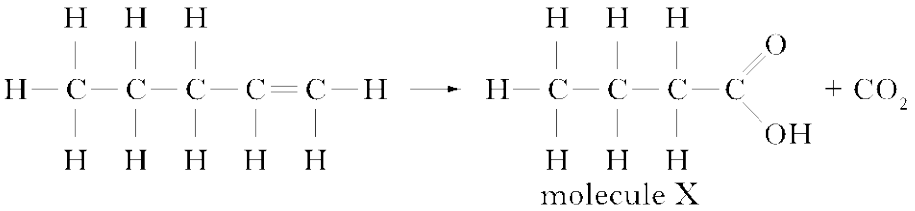
ANY Correct isomer worth 1 mark
accept shortened structures/mixtures
accept one slip of missing H atom **or** one missing bondC-H or C-C but not both

Int 2 2013 Marks

9 Alkenes can undergo different reactions.

(b) Potassium permanganate can be used to convert alkenes into two molecules.

The conversion of pent-1-ene is shown.



(i) Name molecule X. 1

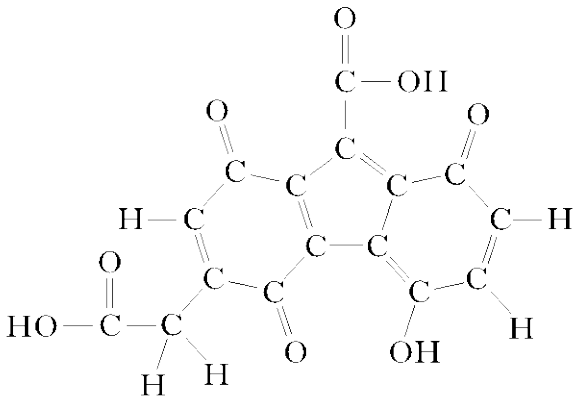
Answer

Butanoic acid
Accept loose spelling – must have oic acid
Ignore number 1 ie but-1-anoic acid

Int 2
2013
13

Marks

When a hippopotamus is seen out of water it looks as though it is bleeding. This is due to a red coloured secretion which protects the hippopotamus against sunburn caused by UVB radiation. Scientists have found that one of the active ingredients in this natural sunscreen is a chemical called hipposudoric acid.



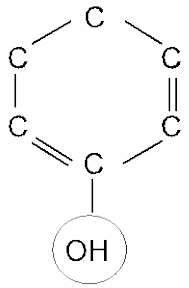
hipposudoric acid

(a) (i) Suggest a pH value for hipposudoric acid. 1

(ii) Hipposudoric acid contains a hydroxyl group. 1
Circle the hydroxyl group in the structure of hipposudoric acid.

Answers (i) Any value less than 7/
Accept acid pH number range eg 3 to 6

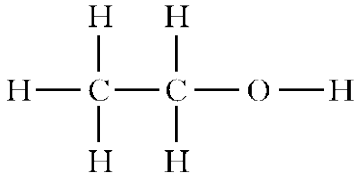
(ii)



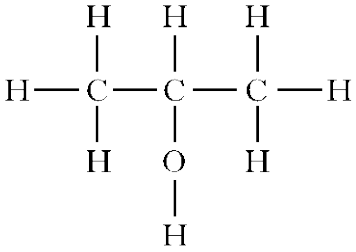
Can include C to O bond

S Gr 2013 15 — Marks

An antibacterial hand gel contains two alkanols, ethanol and propan-2-ol.

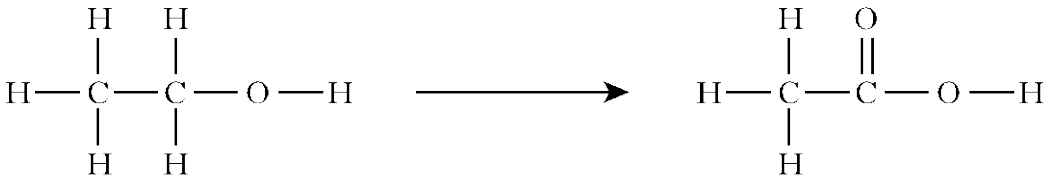


ethanol



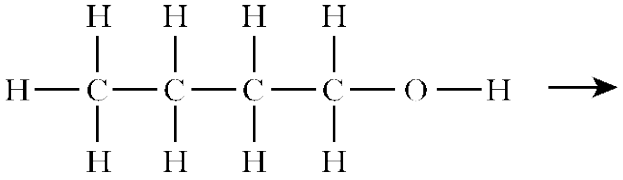
propan-2-ol

(c) When alkanols are oxidised alkanoic acids are produced. 1



ethanol — ethanoic acid

Draw the full structural formula for the alkanoic acid produced when butanol is oxidised.



butanol — butanoic acid

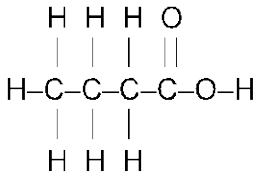
(d) Esters are produced when alkanols react with alkanoic acids. 1

The table gives information on esters.

Alkanol	Alkanoic acid	Ester
methanol	ethanoic acid	methyl ethanoate
ethanol	propanoic acid	ethyl propanoate
propanol	methanoic acid	propyl methanoate
butanol	ethanoic acid	butyl ethanoate
pentanol	butanoic acid	**X**

Suggest a name for X.

Answer (c)



-OH acceptable

(d) Pentyl butanoate
pentylbutanoate

Energy from fuels

Int 2 2012 5 — Marks

The alkanals are a homologous series of compounds that all contain the elements carbon, hydrogen and oxygen.

(b) The combustion of alkanals releases heat energy.

Name of alkanal	Heat energy released when one mole burns (kJ)
methanal	510
ethanal	1056
propanal	1624
butanal	2304

(i) Make a general statement linking the amount of heat energy released and the number of carbon atoms in the alkanal molecules. 1

(ii) Predict the amount of heat energy released, when 1 mole of pentanal burns. 1

_____kJ

Answers

(i) More carbons, the more heat (energy) released/
Greater number of carbon atoms, the greater the amount of heat (energy) (released)
The larger/bigger the alkanal/molecule the more heat energy (released)
Number increases by 600 each time C atom is added
Energy released is proportional to number of C atoms
Higher energy released means more C atoms
Treat energy needed as a slip

(ii) 2800 to 3200