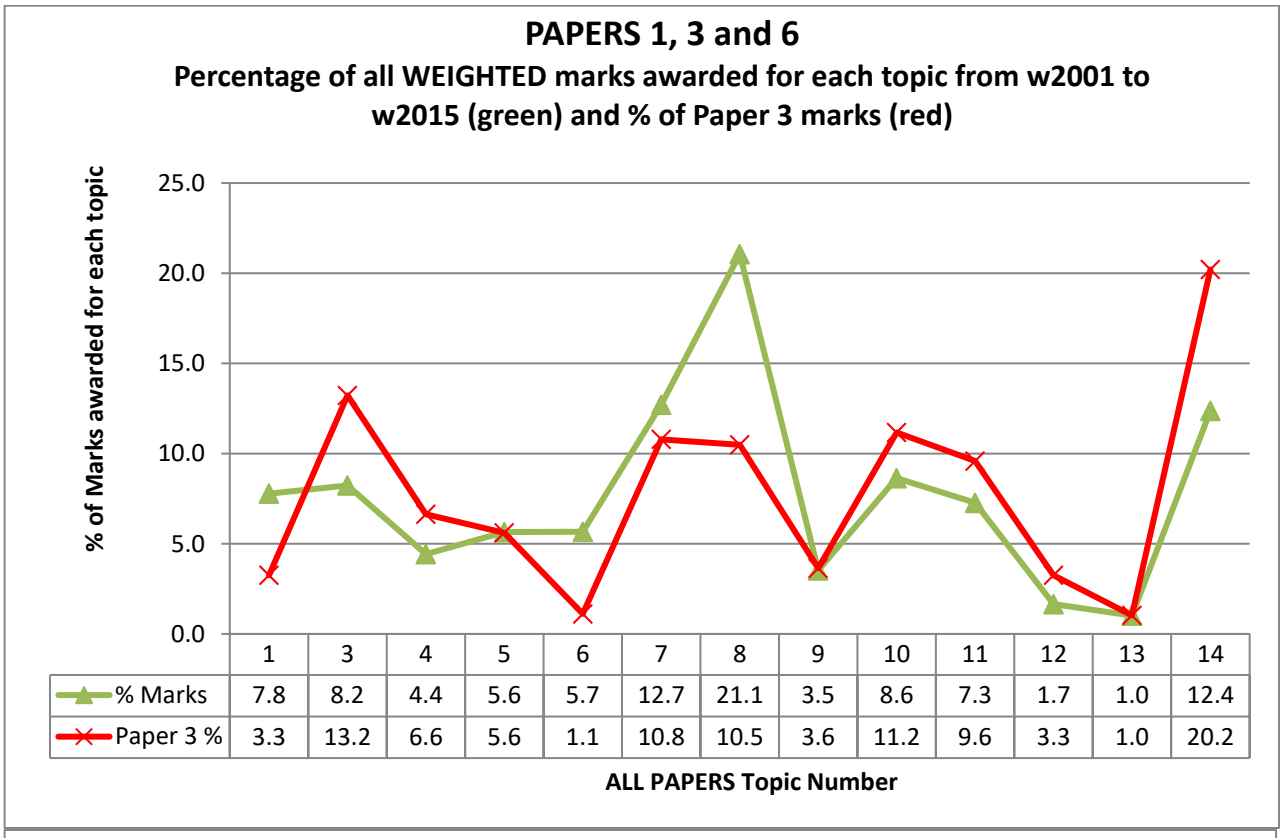
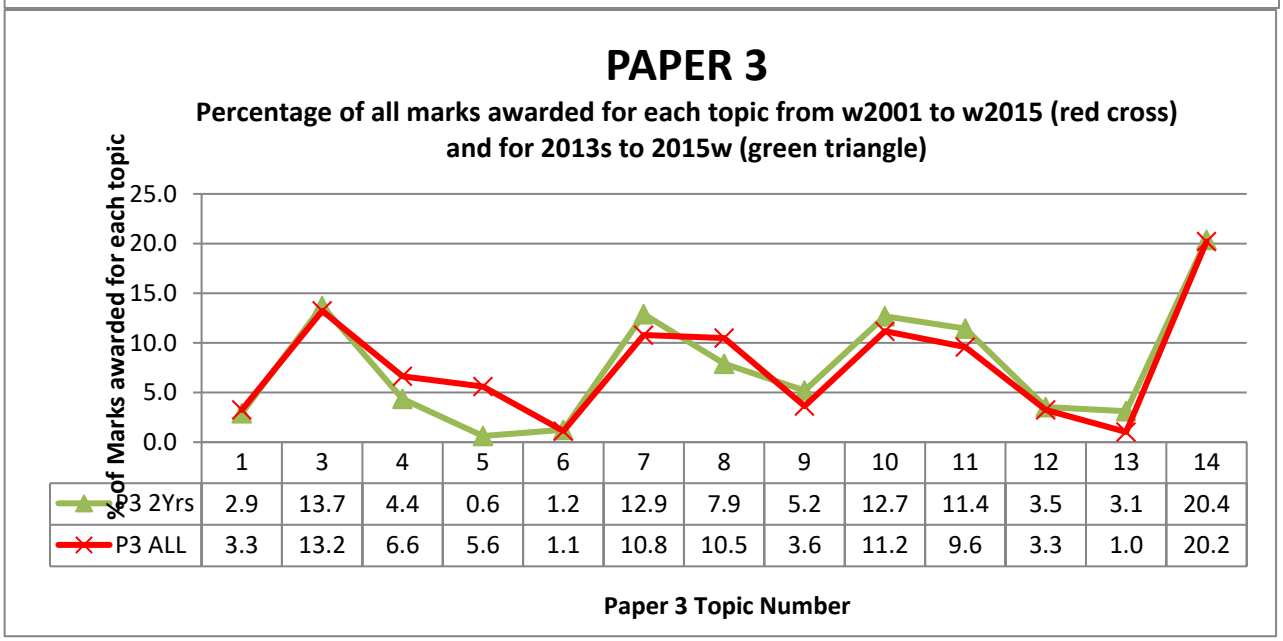
Name

iG Chem 14 EQ P3 15w to 10s 4Teachers NEW 127marks





	Total	Chem 1	Chem 3	Chem 4	Chem 5	Chem 6	Chem 7	Chem 8	Chem 9	Chem 10	Chem 11	Chem 12	Chem 13	Chem 14
Total Marks	2320	74	312	155	81	26	256	246	85	296	231	76	24	474
% of Marks	2336	3.2	13.4	6.6	3.5	1.1	11.0	10.5	3.6	12.7	9.9	3.3	1.0	20.3
# of Questions		19	59	39	18	6	47	54	19	58	48	14	5	80
Average marks per Q		**3.9**	**5.3**	**4.0**	**4.5**	**4.3**	**5.4**	**4.6**	**4.5**	**5.1**	**4.8**	**5.4**	**4.8**	**5.9**

	1st Paper	1st P rank	Last Paper	Last P rank	Total # Papers	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Weight per paper	Weight per mark
Paper 1	**2002s**	**5**	**2012w**	**26**	**22**	**40**	**880**	**869**	**-11**	**30**	**0.75**
Paper 3	**2001w**	**4**	**2015w**	**32**	**29**	**80**	**2320**	**2336**	**16**	**50**	**0.625**
Paper 6	**2001w**	**4**	**2015w**	**32**	**29**	**60**	**1740**	**1890**	**150**	**20**	**0.625**

Topic	**14**	**3**	**10**	**7**	**8**	**11**	**4**	**5**	**9**	**1**	**12**	**6**	**13**
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

CIE iGCSE Chemistry Syllabus Details

(syllabus code 0620)

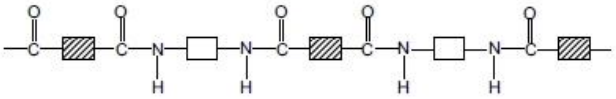
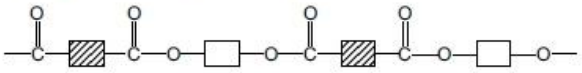
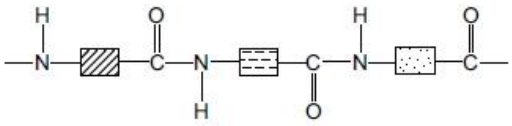
The core material is examined in all three exam papers (papers 1,3 and 6) and is intended to assess understanding up to a grade C level. From 2016, the Supplement material is **examined in all three papers**, however, before 2016 papers 1 and 6 did not contain any Supplement material. If the number of marks that can be awarded above a C grade will remain the same, in practice this means that:

1. Paper 3 will contain fewer Supplement marks, so more core marks so will be easier (if you can answer the Paper 3 questions from before 2016 then you will be fine)
2. Papers 1 and 3 will contain Supplement marks, unlike in all papers before 2016, so will assess material they have not done before, so will be harder because of the questions and as there are no previous questions to practice on, will be harder because of the newness.

Material that is new or changed in 2016 is highlighted with BLACK LINES next to it.

14. Organic chemistry	
14.1 Names of compounds **Core** • Name and draw the structures of methane, ethane, ethene, ethanol, ethanoic acid and the products of the reactions stated in sections 14.4–14.6 • State the type of compound present, given a chemical name ending in *-ane, -ene, -ol,* or *-oic acid* or a molecular structure	**Supplement** • Name and draw the structures of the unbranched alkanes, alkenes (not *cis-trans*), alcohols and acids containing up to four carbon atoms per molecule • Name and draw the structural formulae of the esters which can be made from unbranched alcohols and carboxylic acids, each containing up to four carbon atoms

14.2 Fuels **Core** • Name the fuels: coal, natural gas and petroleum • Name methane as the main constituent of natural gas • Describe petroleum as a mixture of hydrocarbons and its separation into useful fractions by fractional distillation • Describe the properties of molecules within a fraction • Name the uses of the fractions as: – refinery gas for bottled gas for heating and cooking – gasoline fraction for fuel (petrol) in cars – naphtha fraction for making chemicals – kerosene/paraffin fraction for jet fuel – diesel oil/gas oil for fuel in diesel engines – fuel oil fraction for fuel for ships and home heating systems – lubricating fraction for lubricants, waxes and polishes – bitumen for making roads	
14.3 Homologous series **Core** • Describe the concept of homologous series as a 'family' of similar compounds with similar chemical properties due to the presence of the same functional group	**Supplement** • Describe the general characteristics of an homologous series • Recall that the compounds in a homologous series have the same general formula • Describe and identify structural isomerism
14.4 Alkanes **Core** • Describe the properties of alkanes (exemplified by methane) as being generally unreactive, except in terms of burning • Describe the bonding in alkanes	**Supplement** • Describe substitution reactions of alkanes with chlorine
14.5 Alkenes **Core** • Describe the manufacture of alkenes and of hydrogen by cracking • Distinguish between saturated and unsaturated hydrocarbons: – from molecular structures – by reaction with aqueous bromine • Describe the formation of poly(ethene) as an example of addition polymerisation of monomer units	**Supplement** • Describe the properties of alkenes in terms of addition reactions with bromine, hydrogen and steam
14.6 Alcohols **Core** • Describe the manufacture of ethanol by fermentation and by the catalytic addition of steam to ethene • Describe the properties of ethanol in terms of burning • Name the uses of ethanol as a solvent and as a fuel	**Supplement** • Outline the advantages and disadvantages of these two methods of manufacturing ethanol

14.7 Carboxylic acids **Core** • Describe the properties of aqueous ethanoic acid	**Supplement** • Describe the formation of ethanoic acid by the oxidation of ethanol by fermentation and with acidified potassium manganate(VII) • Describe ethanoic acid as a typical weak acid • Describe the reaction of a carboxylic acid with an alcohol in the presence of a catalyst to give an ester
14.8.1 Polymers **Core** • Define polymers as large molecules built up from small units (monomers)	**Supplement** • Understand that different polymers have different units and/or different linkages
14.8.2 Synthetic polymers **Core** • Name some typical uses of plastics and of man-made fibres such as nylon and *Terylene* • Describe the pollution problems caused by non-biodegradable plastics	**Supplement** • Explain the differences between condensation and addition polymerisation • Deduce the structure of the polymer product from a given alkene and *vice versa* • Describe the formation of nylon (a polyamide) and *Terylene* (a polyester) by condensation polymerisation, the structure of nylon being represented as:  and the structure of *Terylene* as:  (Details of manufacture and mechanisms of these polymerisations are **not** required.)
14.8.3 Natural polymers **Core** • Name proteins and carbohydrates as constituents of food	**Supplement** • Describe proteins as possessing the same (amide) linkages as nylon but with different units • Describe the structure of proteins as:  • Describe the hydrolysis of proteins to amino acids (Structures and names are **not** required.) • Describe complex carbohydrates in terms of a large number of sugar units, considered as HO—□—OH, joined together by condensation polymerisation, e.g. —O—□—O—□—O—□—O— • Describe the hydrolysis of complex carbohydrates (e.g. starch), by acids or enzymes to give simple sugars • Describe the fermentation of simple sugars to produce ethanol (and carbon dioxide) (Candidates will **not** be expected to give the molecular formulae of sugars.) • Describe, in outline, the usefulness of chromatography in separating and identifying the products of hydrolysis of carbohydrates and proteins

Q# 1/ iGCSE Chemistry/2013/w/Paper 31/

7 **(a)** The following are two examples of substitution reactions. Only the reaction involving chlorine is a photochemical reaction.

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$$

$$CH_4 + Br_2 \rightarrow CH_3Br + HBr$$

(i) Explain the phrase *substitution reaction*.

.....

..... [1]

(ii) How do photochemical reactions differ from other reactions?

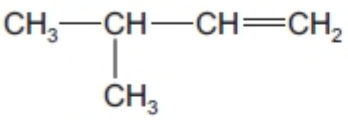
.....

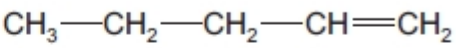
..... [1]

Q# 2/ iGCSE Chemistry/2013/w/Paper 31/

5 The alkenes are unsaturated hydrocarbons. They form a homologous series, the members of which have the same chemical properties.
They undergo addition reactions and are easily oxidised.

(a) The following hydrocarbons are isomers.





(i) Explain why these two hydrocarbons are isomers.

.....

..... [2]

(ii) Give the structural formula of another hydrocarbon which is isomeric with the above.

[1]

(b) Give the structural formula and name of each of the products of the following addition reactions.

(i) ethene and bromine

structural formula of product

name of product ..... [2]

(ii) propene and hydrogen

structural formula of product

name of product ..... [2]

(iii) but-1-ene and water

structural formula of product

name of product ..... [2]

(c) Alkenes can be oxidised to carboxylic acids.

(i) For example, propene, $CH_3-CH=CH_2$, would produce ethanoic acid, CH_3-COOH, and methanoic acid, $H-COOH$. Deduce the formulae of the alkenes which would form the following carboxylic acids when oxidised.

ethanoic acid and propanoic acid

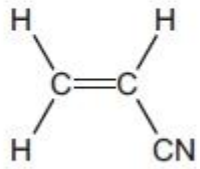
only ethanoic acid

[2]

(ii) Describe the colour change you would observe when an alkene is oxidised with acidified potassium manganate(VII).

..... [2]

(d) Alkenes polymerise to form addition polymers.
Draw the structural formula of poly(cyanoethene), include at least **two** monomer units.
The structural formula of the monomer, cyanoethene, is given below.



[3]

Q# 3/ iGCSE Chemistry/2013/s/Paper 31/

1 Petroleum contains hydrocarbons which are separated by fractional distillation.

(a) (i) Complete the following definition of a hydrocarbon.

A hydrocarbon is a compound which .....

..... [2]

(ii) Explain what is meant by the term *fractional distillation*.

.....

.....

..... [2]

(b) Some of the fractions obtained from petroleum are given below.
State a use for each fraction.

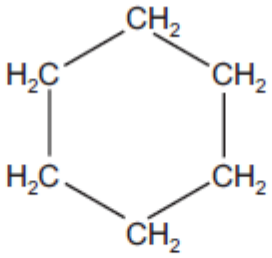
bitumen .....

lubricating fraction .....

paraffin fraction .....

gasoline fraction ..... [4]

4 The structural formula of cyclohexane is drawn below.



(a) The name gives information about the structure of the compound.
Hex because there are six carbon atoms and **cyclo** because they are joined in a ring.
What information about the structure of this compound is given by the ending **ane**?

.....

..... [2]

(b) What are the molecular and empirical formulae of cyclohexane?

molecular formula .....

empirical formula ..... [2]

(c) Draw the structural formula of cyclobutane.

[1]

(d) **(i)** Deduce the molecular formula of hexene.

..... [1]

(ii) Explain why cyclohexane and the alkene, hexene, are isomers.

.....

.....

..... [2]

(e) Describe a test which would distinguish between cyclohexane and the unsaturated hydrocarbon hexene.

test .....

result of test with cyclohexane .....

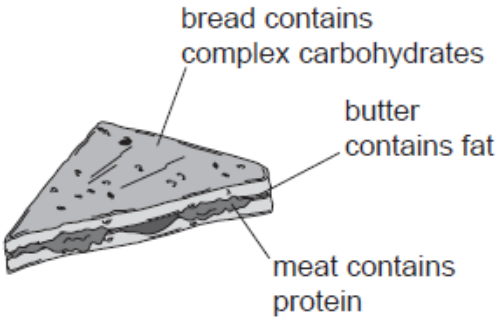
.....

result of test with hexene .....

..... [3]

Q# 5/ iGCSE Chemistry/2012/w/Paper 31/

6 A sandwich contains three of the main constituents of food.



(a) (i) These constituents of food can be hydrolysed by boiling with acid or alkali. Complete the table.

constituent of food	product of hydrolysis
protein	
fat	
complex carbohydrate	

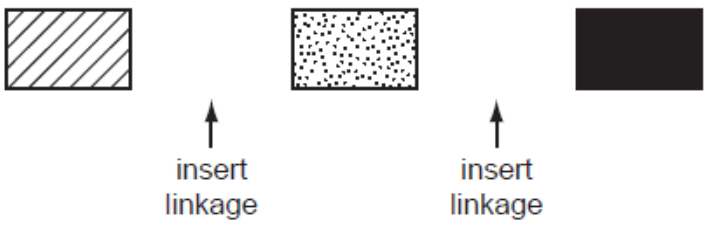
[3]

(ii) What type of synthetic polymer contains the same linkage as

fats, ...

proteins? ..... [2]

(b) An incomplete structural formula of a protein is given below. Complete this diagram by inserting the linkages.



[2]

(c) Butter contains mainly saturated fats. Fats based on vegetable oils, such as olive oil, contain mainly unsaturated fats.

A small amount of fat was dissolved in an organic solvent.
Describe how you could determine if the fat was saturated or unsaturated.

.....

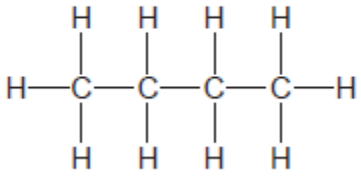
.....

..... [3]

[Total: 10]

Q# 6/ iGCSE Chemistry/2012/s/Paper 31/

6 Butane is an alkane. It has the following structural formula.



(b) Butane reacts with chlorine to form two isomers of chlorobutane.

(i) What type of reaction is this?

..... [1]

(ii) Explain the term *isomer*.

.....

..... [2]

(iii) Draw the structural formulae of these two chlorobutanes.

[2]

(c) One of the chlorobutanes reacts with sodium hydroxide to form butan-1-ol. Butan-1-ol can be oxidised to a carboxylic acid.

(i) State a reagent, other than oxygen, which will oxidise butan-1-ol to a carboxylic acid.

..... [1]

(ii) Name the carboxylic acid formed.

..... [1]

(iii) Butan-1-ol reacts with ethanoic acid to form an ester. Name this ester and give its structural formula showing all the individual bonds.

name ..... [1]

structural formula

[2]

Q# 7/ iGCSE Chemistry/2012/s/Paper 31/

7 Plastics are polymers. They are formed from their monomers by polymerisation.

(a) Two methods for the disposal of waste plastics are

- burning
- recycling.

Describe one advantage **and** one disadvantage of each method.

burning .....

.....

.....

recycling .....

.....

..... [4]

(b) (i) There are two types of polymerisation reaction. Give their names and explain the differences between them.

.....

.....

.....

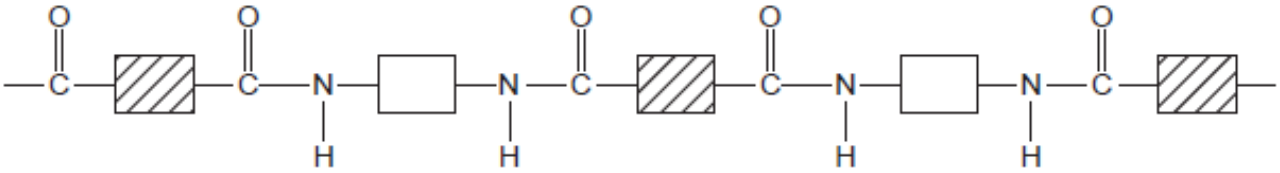
..... [4]

(ii) Give the structural formula of a polymer which is formed from two different monomers.

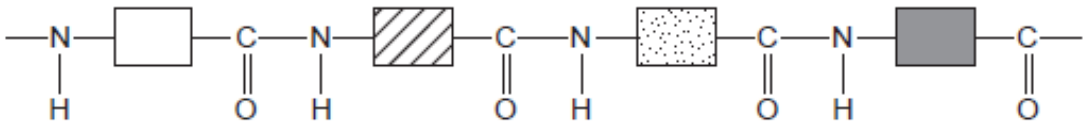
[2]

Q# 8/ iGCSE Chemistry/2011/w/Paper 31/ Q6

(c) Two macromolecules have the same amide linkage.
Nylon, a synthetic polymer, has the following structure.



Protein, a natural macromolecule, has the following structure.



How are they different?

.....

.....

..... [2]

6 Structural formulae are an essential part of Organic Chemistry.

(a) Draw the structural formula of each of the following. Show all the bonds in the structure.

(i) ethanoic acid

[1]

(ii) ethanol

[1]

(b) **(i)** Ethanoic acid and ethanol react to form an ester.
What is the name of this ester?

..... [1]

(ii) The same linkage is found in polyesters. Draw the structure of the polyester which can be formed from the monomers shown below.

$HOOC—C_6H_4—COOH$ and $HO—CH_2—CH_2—OH$

[3]

(iii) Describe the pollution problems caused by non-biodegradable polymers.

.....

.....

..... [2]

Q# 10/ iGCSE Chemistry/2011/s/Paper 31/ Q8

(d) A condensation polymer can be made from the following monomers.

$HOOC(CH_2)_4COOH$ and $H_2N(CH_2)_6NH_2$

Draw the structural formula of this polymer.

[3]

Q# 11/ iGCSE Chemistry/2011/s/Paper 31/ Q6 (a)

(ii) Explain, in general terms, what is meant by *fermentation*.

.....

.....

.....

..... [3]

(b) Butanol can be oxidised to a carboxylic acid by heating with acidified potassium manganate(VII). Give the name and structural formula of the carboxylic acid.

name ..... [1]

structural formula

[1]

(c) Butanol reacts with ethanoic acid to form a liquid, **X**, which has the sweet smell of bananas. Its empirical formula is C_3H_6O and its M_r is 116.

(i) What type of compound is liquid **X**?

..... [1]

(ii) Give the molecular formula of liquid **X**.

..... [1]

(iii) Draw the structural formula of **X**. Show all the individual bonds.

[2]

Q# 12/ iGCSE Chemistry/2011/s/Paper 31/

8 There are two types of polymerisation - addition and condensation.

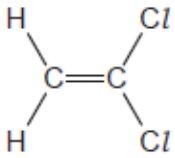
(a) Explain the difference between them.

.....

.....

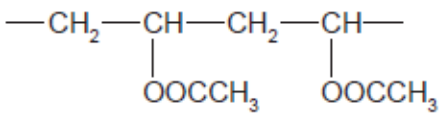
..... [2]

(b) Poly(dichloroethene) is used to package food. Draw its structure. The structural formula of dichloroethene is shown below.



[2]

(c) The polymer known as PVA is used in paints and adhesives. Its structural formula is shown below.



Deduce the structural formula of its monomer.

[1]

Q# 13/ iGCSE Chemistry/2011/s/Paper 31/

6 The structural formula of a butanol is given below.

$$CH_3—CH_2—CH_2—CH_2—OH$$

(a) Butanol can be made from petroleum and also by fermentation.

(i) Describe the chemistry of making butanol from petroleum by the following route.

petroleum → butene → butanol

.....

.....

..... [3]

Q# 14/ iGCSE Chemistry/2010/w/Paper 31/

5 Monomers polymerise to form polymers or macromolecules.

(a) (i) Explain the term *polymerise*.

.....

..... [1]

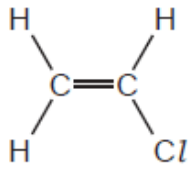
(ii) There are two types of polymerisation - addition and condensation. What is the difference between them?

.....

.....

..... [2]

(b) An important monomer is chloroethene which has the structural formula shown below.



It is made by the following method.

$$C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2 \text{ dichloroethane}$$

This is heated to make chloroethene.

$$C_2H_4Cl_2 \rightarrow C_2H_3Cl + HCl$$

(i) Ethene is made by cracking alkanes. Complete the equation for cracking dodecane.

$$C_{12}H_{26} \rightarrow \text{.....} + 2C_2H_4$$

[1]

Another method of making dichloroethane is from ethane.

$$C_2H_6 + 2Cl_2 \rightarrow C_2H_4Cl_2 + 2HCl$$

(ii) Suggest a reason why the method using ethene is preferred.

.....

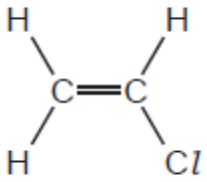
..... [1]

Q# 15/ iGCSE Chemistry/2010/w/Paper 31/

5 Monomers polymerise to form polymers or macromolecules.

(b)

An important monomer is chloroethene which has the structural formula shown below.



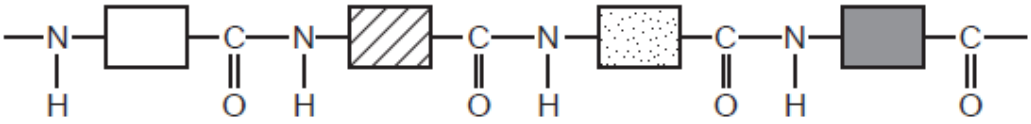
(iv) Draw the structural formula of poly(chloroethene).

Include three monomer units.

[2]

Q# 16/ iGCSE Chemistry/2010/s/Paper 31/Q4

(b) The structure of a typical protein is drawn below.



(i) What is the name of the polymer linkage?

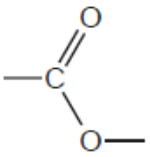
..... [1]

(ii) Draw the structural formula of a man-made polymer with the same linkage.

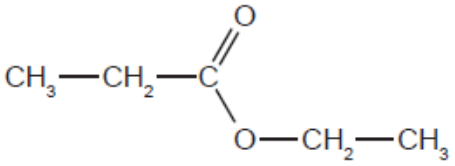
[3]

Q# 17/ iGCSE Chemistry/2010/s/Paper 31/

4 Hydrolysis is used in chemistry to break down complex molecules into simpler ones.

(a) Compounds containing the group  or —COO— are esters.

(i) Give the names and formulae of the two compounds formed when the ester ethyl propanoate is hydrolysed.

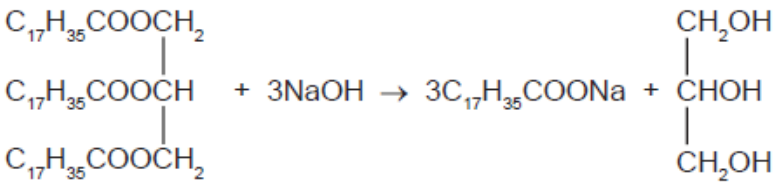


name ..... name .....

formula formula

[4]

(ii) Fats are naturally occurring esters. They can be hydrolysed by boiling with aqueous sodium hydroxide.



fat

What type of compound has the formula $C_{17}H_{35}COONa$ and what is its main use?

type of compound ..... [1]

use ..... [1]

(iii) Name a synthetic polyester.

..... [1]

Q# 18/ iGCSE Chemistry/2010/s/Paper 31/

2 Ozone is a form of oxygen. Ozone is present in the upper atmosphere and it prevents dangerous solar radiation from reaching the Earth's surface. Some of the chemicals that diffuse into the upper atmosphere decompose ozone. Chemicals that have this effect are methane (CH_4), chloromethane (CH_3Cl) and an oxide of nitrogen (NO_2).

(iii) How can chloromethane be made from methane?

reagent .....

condition ..... [2]

Q# 19/ iGCSE Chemistry/2010/s/Paper 31/

8 Methanoic acid is the first member of the homologous series of carboxylic acids.

(a) Give **two** general characteristics of a homologous series.

.....

.....

..... [2]

(b) In some areas when water is boiled, the inside of kettles become coated with a layer of calcium carbonate. This can be removed by adding methanoic acid.

(i) Complete the equation.

..... $HCOOH + CaCO_3 \rightarrow Ca(HCOO)_2$ + ... + ...

[2]

(ii) Methanoic acid reacts with most metals above hydrogen in the reactivity series. Complete the word equation.

zinc + methanoic acid → ..... + ...

[2]

(iii) Aluminium is also above hydrogen in the reactivity series.
Why does methanoic acid not react with an aluminium kettle?

.....

..... [1]

(c) Give the name, molecular formula and empirical formula of the fourth acid in this series.

name ..... [1]

molecular formula ..... [1]

empirical formula ..... [1]

Mark Scheme

Q# 1/ iGCSE Chemistry/2013/w/Paper 31/

7 **(a) (i)** hydrogen (atoms) replaced by (atoms) of a different element e.g. chlorine [1]
NOT: substitute

(ii) light required [1]

Q# 2/ iGCSE Chemistry/2013/w/Paper 31/

5 **(a) (i)** have same molecular formula / both are C_5H_{12} [1]
they have different structural formulae / different structures [1]

(ii) CH_3-CH_2-CH=CH-CH_3 / any other correct isomer [1]

(b) (i) CH_2-(Br)-CH_2Br [1]
NOT: $C_2H_4Br_2$
dibromoethane [1]
NOTE: numbers not required but if given must be 1, 2

(ii) CH_3-CH_2-CH_3 [1]
NOT: C_3H_8
propane [1]

(iii) CH_3-CH_2-CH_2-OH / CH_3-CH_2-CH(OH)-CH_3 [1]
butanol [1]
numbers not required but if given must be correct and match formula

(c) (i) CH_3-CH=CH-CH_2-CH_3 [1]
CH_3-CH=CH-CH_3 [1]

(ii) pink / purple [1]
colourless [1]
NOT: clear

(d) -CH_2-CH(CN)-CH_2-CH(CN)-
correct repeat unit CH_2-CH(CN) [1]
COND: at least 2 units in diagram [1]
continuation [1]

Q# 3/ iGCSE Chemistry/2013/s/Paper 31/

1 **(a) (i)** contains carbon and hydrogen [1]
cond: only / just [1]

(ii) (different) boiling points [1]
cond: separate [1]

(b) bitumen-making roads / roofs / water-proofing, etc. [1]

lubricating fraction – waxes / vaseline / grease, etc. or machinery example, e.g. (oil a) bike / hinges / reducing friction [1]

paraffin fraction – jet fuel / (home) heating or tractors or cooking or lighting [1]

gasoline fraction – petrol or fuel for cars / vans / trucks [1]

Q# 4/ iGCSE Chemistry/2013/s/Paper 31/

3 (a) (i) pieces have (same) surface area [1]
same amount / mass / quantity / volume / number of moles of carbonate [1]

(ii) no more bubbles / carbon dioxide **or** piece disappears / dissolves [1]

(b) experiment 1 $Ca^{2+} + CO_2 + H_2O$ [1]

(c) (i) more concentrated **or** higher concentration (of acid) (in experiment 1) [1]
accept: arguments based on collision theory

(ii) ethanoic acid is a weak acid **or** hydrochloric acid is a strong acid [1]
accept: stronger or weaker

ethanoic acid less ionised / dissociated / lower / smaller concentration of hydrogen ions [1]
accept: less hydrogen ions and vice versa argument but not dissociation of ions

(iii) lower temperature (particles) have less energy [1]
moving more slowly [1]
fewer collisions / lower collision rate [1]
or
lower temperature (particles) have less energy [1]
fewer particles collide [1]
with the necessary energy to react [1]
note: less energy fewer successful collisions gains all 3 marks

(d) (i) C_6H_{12} [1]
accept: a correct structural formula

(ii) same molecular formula **not**: chemical formula [1]
different structural formulae / structures [1]

(e) add bromine (water) or (l) [1]

cond: (remains) brown **or** orange **or** red or yellow [1]

cond: changes from brown, etc. to colourless or decolourises [1]
not: clear

OR
potassium manganate(VII) [1]
note: oxidation state not essential but if given must be correct or [0]
accept: potassium permanganate

cond: remains pink / purple [1]

cond: changes from pink to colourless **(acidic)** [1]
not: clear

cond: change from pink to green / brown **(alkaline)**

Q# 5/ iGCSE Chemistry/2012/w/Paper 31/

6 (a) (i) amino acid / peptides; [1]
salt / carboxylate or soap / fatty acid or glycerine / alcohol; [1]
sugars or glucose; [1]
accept: named sugar

(ii) polyester; [1]
allow: named polyester
polyamide; [1]
allow: nylon

(b) one correct amide linkage; [1]
second amide linkage correctly orientated
– NHCO – followed by – NHCO –; [1]
note: monomers are amino acids not diamines or dicarboxylic acid

(c) bromine / bromine water / aqueous bromine; [1]
unsaturated - brown / orange to colourless **not:** clear [1]
saturated - stays brown / orange [1]

or: alkaline potassium manganate(VII);
from purple / pink to green / brown;
stays purple;
or: acidic potassium manganate(VII)
from purple / pink to colourless; **not:** clear
stays purple;

[Total: 10]

Q# 6/ iGCSE Chemistry/2012/s/Paper 31/

(b) (i) chlorination / substitution / photochemical / exothermic / halogenation / free radical; [1]

(ii) (compounds) same molecular formula; different structural formulae; [2]

(iii) $CH_3–CH_2–CH_2–CH_2–Cl$ [1]
$CH_3–CH_2–CH(Cl)–CH_3$ [1]

(c) (i) potassium manganate(VII) / potassium dichromate(VI) / copper(II) oxide; [1]
note: do not insist on oxidation numbers but if given must be correct

(ii) butanoic acid; [1]

(iii) butyl ethanoate; [1]

correct formula all bonds shown = [2]
if alkyl groups incorrect then correct ester linkage showing bonds = [1] [2]

Q# 7/ iGCSE Chemistry/2012/s/Paper 31/

7 (a) **burning**
produces toxic gases / harmful to health
increases greenhouse gases / global warming
reduces visual pollution / litter
reduces risks to wildlife
shortage of landfill sites / reduces space needed in landfill sites / saves space
non-biodegradable / long time to rot / decompose / accumulates waste
burning source of energy / used to generate electricity

recycling
conserves petroleum / natural resources
difficult to recycle / expensive / takes much energy
problems over sorting
reduces need for landfill
quality of plastic is reduced each time it is recycled
four DIFFERENT valid points which are advantages or disadvantages of burning and/or recycling [4]

(b) (i) addition (polymerisation); [1]

(polymer) only product / no by-products; [1]

condensation (polymerisation); [1]

(polymer and) simple molecule / water / hydrogen chloride / one other product forms; [1]

(ii) a correct linkage (for a polyamide / polyester); [1]
two different monomers; [1]

Q# 8/ iGCSE Chemistry/2011/w/Paper 31/ Q6

(c) synthetic – only two monomers [1]
protein – many different monomers [1]
or:
protein has 1 C=O and 1N–H [1]
nylon has 2 C=O / 2N–H [1]
or:
synthetic – one monomer is a dicarboxylic acid and the other is a diamine [1]
protein all monomers are amino acids [1]

Q# 9/ iGCSE Chemistry/2011/w/Paper 31/

6 (a) (i) correct structural formula of ethanoic acid [1]
allow: –OH **not:** –COOH

(ii) correct structural formula of ethanol [1]
allow: –OH

(b) (i) ethyl ethanoate [1]

(ii) $-OC_6H_4COOCH_2CH_2O-$
correct ester linkage [1]
correct repeat units [1]
continuation [1]
accept: boxes if it is clear what the box represents

(iii) any **two** from:
long time to decay
landfill sites
visual pollution / litter
danger to animals
poisonous gases when burnt [2]
accept: any correct suggestion

Q# 10/ iGCSE Chemistry/2011/s/Paper 31/ Q8

(d) $-OC(CH_2)_4CONH(CH_2)_6NH-$
COND amide correct linkage [1]
correct repeat units [1]
continuation [1]
not NH_2 **or** COOH endings

Q# 11/ iGCSE Chemistry/2011/s/Paper 31/ Q6 (a)

(ii) glucose / sugar changed to alcohol / ethanol [2]
accept an unbalanced equation
(catalysed by) enzymes / yeast [1]

(b) butanoic acid [1]
CH_3-CH_2-CH_2-COOH [1]
hydrogen atoms omitted from ends of bonds, penalise once

(c) (i) ester [1]

(ii) $C_6H_{12}O_2$
ignore $CH_3COOC_4H_9$ [1]

(iii) correct structural formula of butyl ethanoate showing all bonds [2]

Q# 12/ iGCSE Chemistry/2011/s/Paper 31/

8 **(a)** addition – polymer only product / only one product [1]
accept monomer has C=C
accept monomer and polymer have same empirical formula
accept no loss of material in polymerisation
not only one monomer

condensation – polymer and water / small molecule formed [1]

(b) -CH_2 – CCl_2-
repeat unit correct [1]
COND continuation [1]

(c) CH_2=$CHOOCCH_3$ [1]

Q# 13/ iGCSE Chemistry/2011/s/Paper 31/

6 **(a) (i)** cracking / heat with catalyst [1]
to make butane [1]
butene reacts with steam/water / hydrated [1]
accept heat and catalyst for cracking but if specified: 450 to 800°C zeolites / aluminosilicates / silica / aluminium oxide/alumina / china / broken pot / porcelain / chromium oxide

Q# 14/ iGCSE Chemistry/2010/w/Paper 31/

5 **(a) (i)** many (simple) molecules form one (large) molecule / monomer molecules form one polymer molecule [1]

(ii) addition - polymer is the only product [1]
accept - nX → Xn
condensation polymer and simpler molecules formed [1]
accept nX → Xn + nHCl / H_2O

(b) (i) $C_{12}H_{26} \rightarrow C_8H_{18} + 2C_2H_4$ [1]
/ any other correct version

(ii) ethane and chlorine give range of products [1]
/ ethene more readily available than ethane
/ waste half chlorine as hydrogen chloride
/ ethene more reactive than ethane

Q# 15/ iGCSE Chemistry/2010/w/Paper 31/ Q5 (b)

(iv) must have **three** correct units [1]
cond continuation [1]
accept –(CH2–CH(C*l*))n–

Q# 16/ iGCSE Chemistry/2010/s/Paper 31/

(b) **(i)** polyamide / amide / peptide / polypeptide [1]

(ii) correct amide linkage NHCO then CONH [1]
cond to mark 1, 2 monomers (different shading in box) [1]
cond continuation (to **ONE** correct linkage) [1]

OR nylon 6
only one linkage – NHCO [1]
cond only one monomer [1]
cond continuation (to correct linkage) [1]

Q# 17/ iGCSE Chemistry/2010/s/Paper 31/

4 **(a)** **(i)** ethanol [1]
CH_3-CH_2-OH [1]

propanoic acid [1]
CH_3-CH_2-COOH [1]
independent marking, no ecf
accept C_2H_5
not – HO

(ii) type of compound – salt / sodium carboxylate / alkanoate [1]
not soap / sodium stearate etc
use – soap / cleaning / detergent [1]

(iii) terylene / PET / Dacron / diolen / mylar / crimplene [1]

Q# 18/ iGCSE Chemistry/2010/s/Paper 31/

(iii) chlorine [1]
not chlorine water
cond light / UV / heat / high temperature if numerical value given about 200°C / lead tetraethyl [1]
not warm

Q# 19/ iGCSE Chemistry/2010/s/Paper 31/

8 **(a)** same general formula
same chemical properties
same functional group
physical properties vary in predictable way
common methods of preparation
consecutive members differ by CH_2
any **two** [2]
mark first two
ignore others unless it contradicts a point which has been awarded a mark

(b) **(i)** $2HCOOH + CaCO_3 \rightarrow Ca(HCOO)_2 + CO_2 + H_2O$ [2]
not balanced = [1]

(ii) zinc + methanoic acid → zinc methanoate + hydrogen [2]
[1] for each product

(iii) protected by oxide layer [1]

(c) butanoic acid [1]
CH_3-CH_2-CH_2-COOH / $C_4H_8O_2$ / C_3H_7COOH / C_4H_7OOH [1]
C_2H_4O [1]
mark **ecf** to molecular formula