Name: Class: Date:

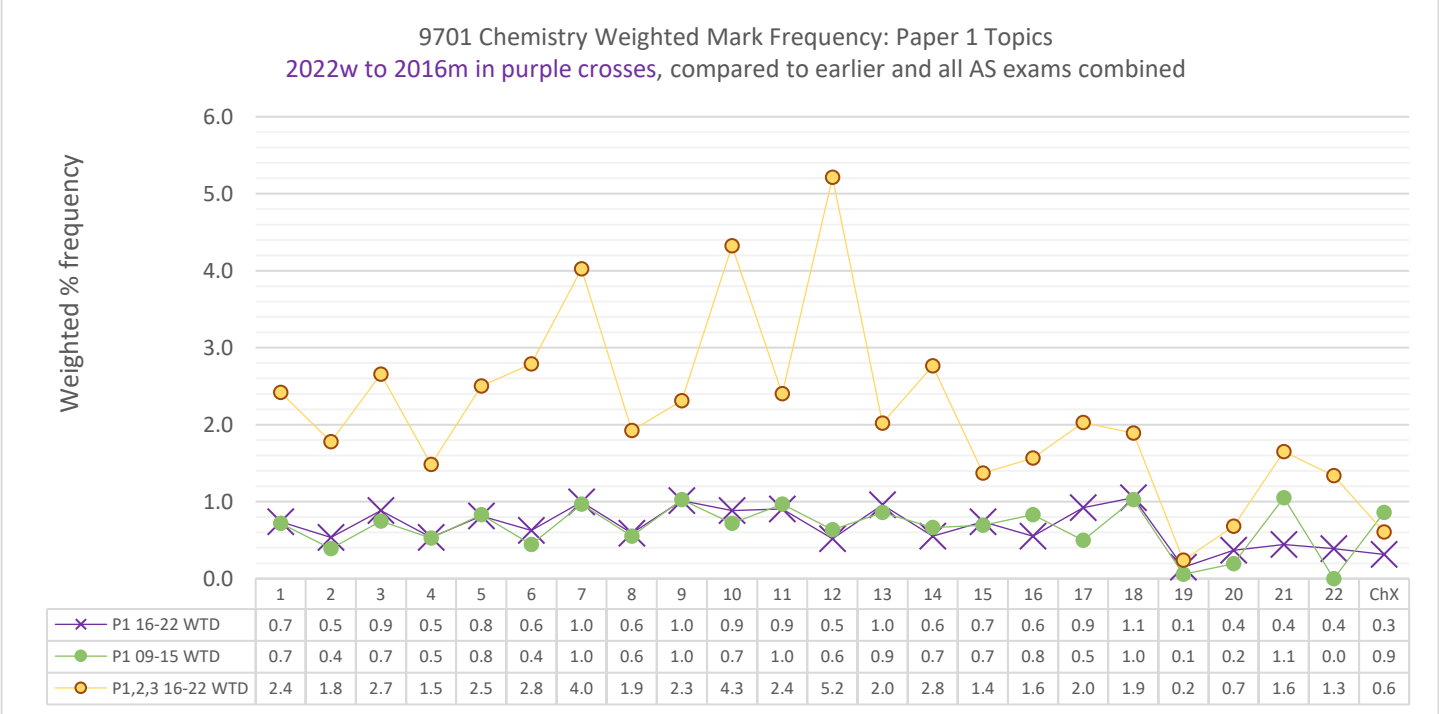
ALvl Chem 14 EQ P1 22w to 09s Paper 1 Hydrocarbons 54marks

As you start and work through this worksheet you can tick off your progress to show yourself how much you have done, and what you need to do next. The first task is just to read the first question and should take you less than one minutes to complete.

Paper 1 **Topic 14**

Checklist Tick each task off as you go along

	RANK:	P1 Noob	P1 Novice	P1 Bronze	P1 Silver	P1 Gold	P1[1] Winner	P1 Hero	P1 Legend
		1 Q started	1 Q done	10% of marks	25% of marks	40% of marks	50% of marks	75% of marks	100% of marks
Topic (marks)	54		1	5	14	22	27	41	54
Time @75s/mark (minutes)	68		1	7	17	27	34	51	68



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	ChX
P1 16-22 WTD	0.7	0.5	0.9	0.5	0.8	0.6	1.0	0.6	1.0	0.9	0.9	0.5	1.0	0.6	0.7	0.6	0.9	1.1	0.1	0.4	0.4	0.4	0.3
P1 09-15 WTD	0.7	0.4	0.7	0.5	0.8	0.4	1.0	0.6	1.0	0.7	1.0	0.6	0.9	0.7	0.7	0.8	0.5	1.0	0.1	0.2	1.1	0.0	0.9
P1,2,3 16-22 WTD	2.4	1.8	2.7	1.5	2.5	2.8	4.0	1.9	2.3	4.3	2.4	5.2	2.0	2.8	1.4	1.6	2.0	1.9	0.2	0.7	1.6	1.3	0.6

What the most thoughtful students will get out of their extensive studying will be a capacity to do meaningful brain-based work even under stressful conditions, which is a part of the self-mastery skillset that will continue to deliver value for the whole of their lives. Outstanding grades will also happen, but the most important goal from skillful action in study is being better at any important task, even if circumstances do not feel ideal.

As you are moving through your studies you can learn more about yourself by trying out new ways to manage yourself, and analysing how effective those new techniques were. In this reflective process not only will you get better at working positively and productively to deliver ambitious and successful outcomes, but you will be working towards one aspect of life's highest pursuit, summarised and inscribed on the Temple of Apollo at Delphi: "know thyself".

1. To complete these questions, as important as your answer, is checking your answer against the mark scheme.
2. For each page or group of 10 questions, convert your mark score into a percentage. This will allow you to see (and feel) your progress as you get more experience and understanding with each topic.
3. Multiple choice questions, done carefully where you explain and show yourself your thinking using written notes as you move through each question, can be more useful than just Paper 2 for students aiming for a C or B grade. Paper 2 should be the larger focus for students aiming for A and A* grades, however.
4. If you find you get a higher percentage answering short answer questions than multiple choice questions that often means you are NOT using the marking scheme correctly; your correct answer might not be fully complete for all the marks you are awarding. The marks easiest to miss rely on providing the largest amount of detail.

[1] **DO NOT** work on these higher levels of completion in your A2 year unless you have also achieved at least a "**Silver**" (25%) in the same topic in **Paper 2**, which is **MOST** of your **AS grade**, and Paper 3 which is a smaller part of your year but still important.

14 Hydrocarbons

14.1 Alkanes

Learning outcomes

Candidates should be able to:

1 recall the reactions (reagents and conditions) by which alkanes can be produced:
   (a) addition of hydrogen to an alkene in a hydrogenation reaction, $H_2(g)$ and Pt/Ni catalyst and heat
   (b) cracking of a longer chain alkane, heat with Al_2O_3
2 describe:
   (a) the complete and incomplete combustion of alkanes
   (b) the free-radical substitution of alkanes by Cl_2 or Br_2 in the presence of ultraviolet light, as exemplified by the reactions of ethane
3 describe the mechanism of free-radical substitution with reference to the initiation, propagation and termination steps
4 suggest how cracking can be used to obtain more useful alkanes and alkenes of lower M_r from heavier crude oil fractions
5 understand the general unreactivity of alkanes, including towards polar reagents in terms of the strength of the C–H bonds and their relative lack of polarity
6 recognise the environmental consequences of carbon monoxide, oxides of nitrogen and unburnt hydrocarbons arising from the combustion of alkanes in the internal combustion engine and of their catalytic removal

14.2 Alkenes

Learning outcomes

Candidates should be able to:

1 recall the reactions (including reagents and conditions) by which alkenes can be produced:
   (a) elimination of HX from a halogenoalkane by ethanolic NaOH and heat
   (b) dehydration of an alcohol, by using a heated catalyst (e.g. Al_2O_3) or a concentrated acid
   (c) cracking of a longer chain alkane
2 describe the following reactions of alkenes:
   (a) the electrophilic addition of
      (i) hydrogen in a hydrogenation reaction, $H_2(g)$ and Pt/Ni catalyst and heat
      (ii) steam, $H_2O(g)$ and H_3PO_4 catalyst
      (iii) a hydrogen halide, HX(g) at room temperature
      (iv) a halogen, X_2
   (b) the oxidation by cold dilute acidified $KMnO_4$ to form the diol
   (c) the oxidation by hot concentrated acidified $KMnO_4$ leading to the rupture of the carbon–carbon double bond and the identities of the subsequent products to determine the position of alkene linkages in larger molecules
   (d) addition polymerisation exemplified by the reactions of ethene and propene
3 describe the use of aqueous bromine to show the presence of a C=C bond
4 describe the mechanism of electrophilic addition in alkenes, using bromine / ethene and hydrogen bromide / propene as examples
5 describe and explain the inductive effects of alkyl groups on the stability of primary, secondary and tertiary cations formed during electrophilic addition (this should be used to explain Markovnikov addition)

Q# 881/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30 Oct-1-ene, $CH_3(CH_2)_5CH=CH_2$, can be thermally cracked.

Which of the compounds W, X, Y and Z can be obtained by thermally cracking oct-1-ene?

W	X	Y	Z
$CH_2=CH_2$	$CH_3CH=CH_2$	$CH_3CH_2CH_3$	$CH_2=CHCH=CH_2$

A W, X, Y and Z

B W, X and Y only

C W, X and Z only

D W and X only

Q# 882/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 28//www.SmashingScience.org :o)

28 Alkenes react with aqueous hydrogen bromide. The reaction proceeds via an intermediate carbocation. The more stable the intermediate, the faster the reaction.

Which sequence correctly shows an **increase** in the speed of reaction of the alkenes with hydrogen bromide?

A ethene, propene, 2-methylpropene

B 2-methylpropene, ethene, propene

C propene, ethene, 2-methylpropene

D propene, 2-methylpropene, ethene

Q# 883/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 27//www.SmashingScience.org :o)

27 Which compound will decolourise $Br_2(aq)$?

A $CH_3CH_2CH_2CH_2CH_2CO_2H$

B $CH_3CH_2CH_2CH_2CH_2CHO$

C $CH_3CHCHCH_2CH_2CH_2OH$

D $CH_3CH_2CH_2CO_2CH_2CH_3$

Q# 884/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

38 One molecule of dodecane, $C_{12}H_{26}$, is cracked, producing three product molecules, X, Y and Z.

X is a straight chain alkane. Y and Z are straight chain alkenes with different M_r values.

Which statements about X, Y and Z are correct?

1 If Y and Z are but-1-ene and ethene respectively, X will be hexane.

2 If X is butane, then Y and Z could both show *cis-trans* isomerism.

3 X could be octane.

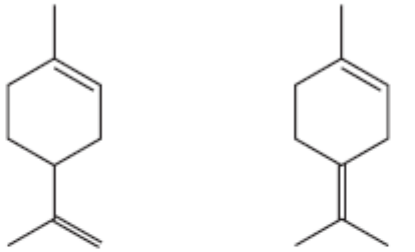
Q# 885/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 A diketo acid is a compound with two ketone groups and one carboxylic acid group.

limonene terpinolene



Which statements about the reactions of limonene and terpinolene are correct?

1 When reacted with an excess of hydrogen and a nickel catalyst, limonene and terpinolene produce the same compound.

2 An excess of hot concentrated acidified $KMnO_4$ reacts with limonene and with terpinolene to form different diketo acids.

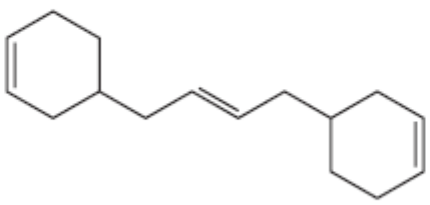
3 The reactions of limonene and terpinolene with an excess of Br_2 produce positional isomers with the same number of chiral carbon atoms.

Q# 886/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 Structural isomerism **only** should be considered when answering this question.

Molecule X contains three C=C double bonds. One mole of X is reacted with three moles of HBr. The carbon skeleton is unchanged.

molecule X



How many different products are formed?

A 3 **B** 4 **C** 6 **D** 8

Q# 887/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 33//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

33 A gaseous hydrocarbon has a density of 2.42 g dm^{-3} under room conditions.

What could be the skeletal formula of this hydrocarbon?

1 

2 

3 

Q# 888/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

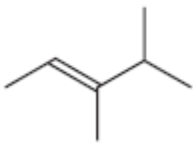
29 The table describes four reactions of propene.

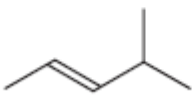
Which row is correct?

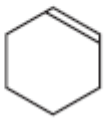
	reagent used	name of main organic product
A	aqueous bromine	2-bromopropane
B	cold acidified aqueous potassium manganate(VII)	propane-1,3-diol
C	hydrogen chloride	2-chloropropane
D	steam	propan-1-ol

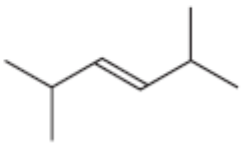
Q# 889/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 Which compound would produce two different carboxylic acids when treated with hot, concentrated, acidified manganate(VII) ions?

A 

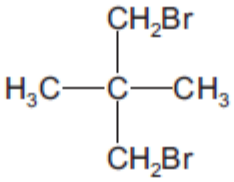
B 

C 

D 

Q# 890/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22 The diagram shows the structure of a bromo compound that may be formed by the reaction of bromine with a hydrocarbon.



Which row is correct?

	type of reaction	mechanism
A	addition	electrophilic
B	addition	nucleophilic
C	substitution	nucleophilic
D	substitution	free-radical

Q# 891/ AS Chemistry/2020/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 Two students each make a statement about 2-methylbut-1-ene.

Student 1 states that 2-methylbut-1-ene has geometrical isomers.

Student 2 states that 2-methylbut-1-ene reacts with HBr in an addition reaction to give 1-bromo-2-methylbutane as the main product.

Which students are correct?

A both 1 and 2

B 1 only

C 2 only

D neither 1 nor 2

Q# 892/ AS Chemistry/2020/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

35 The catalytic converters fitted to cars remove pollutants from the exhaust gases. Some of the reactions that occur involve oxygen, which comes from the air.

Which pollutants in the exhaust gases will react with oxygen on the surface of the catalytic converter?

1 NO_2

2 unburnt fuel

3 CO

Q# 893/ AS Chemistry/2020/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 But-1-ene and but-2-ene are treated separately with cold, dilute acidified manganate(VII) ions.

Four students, W, X, Y and Z, make statements about these alkenes and the diols formed from them.

W One diol contains two primary alcohol groups.

X One diol contains a primary and a secondary alcohol group.

Y One diol contains two secondary alcohol groups.

Z Both alkenes exhibit *cis-trans* isomerism.

Which two students are correct?

A W and Y **B** W and Z **C** X and Y **D** X and Z

Q# 894/ AS Chemistry/2020/m/TZ 2/Paper 1/Q# 40//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

40 Which statements comparing ethene and ethane are correct?

1 The bond angles in ethene are larger than the bond angles in ethane.

2 Ethene reacts much more quickly with bromine in the dark than ethane does.

3 Complete combustion of 0.01 mol of ethene or ethane produces the same volume of gas measured at room temperature and pressure.

Q# 895/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27 Compound Q shows the following reactions.

- It gives an orange precipitate with 2,4-dinitrophenylhydrazine.
- It gives a red-brown precipitate with Fehling's reagent.
- It gives a pale yellow precipitate with alkaline aqueous iodine.

What could be the identity of Q?

A ethanal

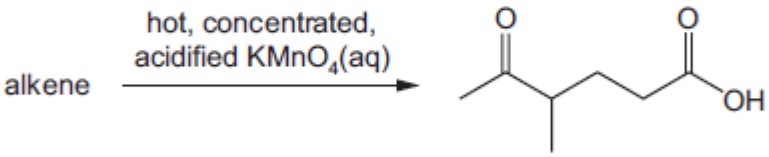
B propan-2-ol

C propanal

D propanone

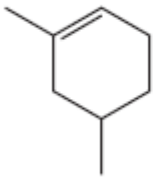
Q# 896/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 An alkene reacts with hot, concentrated, acidified potassium manganate(VII) to produce a single organic product as shown.

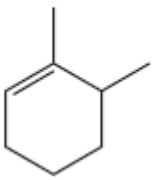


What is the structure of the alkene?

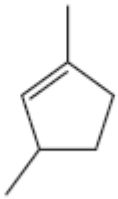
A



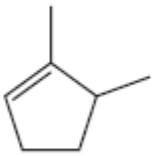
B



C



D



Q# 897/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 Alkanes are saturated hydrocarbons.

Which type of reaction are alkanes most likely to undergo?

A electrophilic addition

B electrophilic substitution

C free radical substitution

D nucleophilic addition

Q# 898/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 20//www.SmashingScience.org :o)

20 Which substance reacts with trichloroethene to give a chiral product?

A Br_2 **B** HCl **C** NaCN **D** NaOH

Q# 899/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 What is the structural formula of the major product when hydrogen bromide reacts with 2-methylbut-2-ene?

A $CH_2BrCH(CH_3)CH_2CH_3$

B $(CH_3)_2CBrCH_2CH_3$

C $(CH_3)_2CHCHBrCH_3$

D $(CH_3)_2CHCH_2CH_2Br$

Q# 900/ AS Chemistry/2019/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22 Many reactions take place in the engine and catalytic converter of a car.

Which pair of substances is produced **both** by the reactions in a car engine and in a catalytic converter?

A carbon dioxide and unburnt hydrocarbons

B carbon dioxide and water

C carbon monoxide and nitrogen

D carbon monoxide and unburnt hydrocarbons

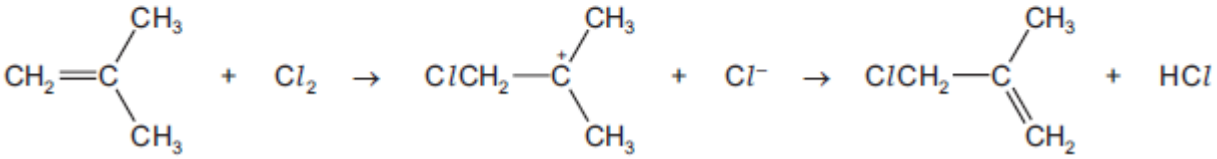
Q# 901/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 2-methylpropene can react in more than one way with chlorine.

One of the reactions follows the pathway shown.



2-methylpropene intermediate product

Which statements about this mechanism are correct?

1 The intermediate has all carbon atoms in the same plane.

2 There is an electrophilic attack on the double bond.

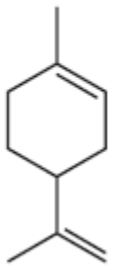
3 It is a free radical mechanism.

Q# 902/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

38 Limonene is found in lemons.



limonene

Limonene is heated with concentrated acidified potassium manganate(VII).

Which compounds are produced?

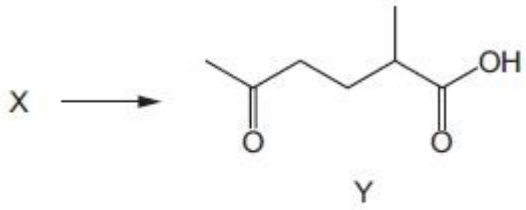
1 $CH_3COCH_2CH_2CH(CH_2CO_2H)_2$

2 CO_2

3 $CH_3COCH_2CH_2CH(COCH_3)CH_2CO_2H$

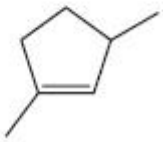
Q# 903/ AS Chemistry/2018/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22 Compound X can be converted into compound Y in a single step.

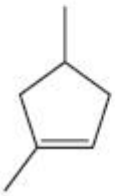


What could be the identity of X?

A



B



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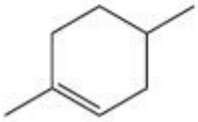
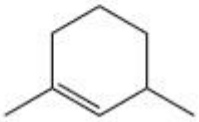


D



Q# 904/ AS Chemistry/2017/w/TZ 1/Paper 1/Q# 22//

22 Many, but not all, organic reactions need to be heated before a reaction occurs.

Which reaction occurs quickly at room temperature, 20 °C?

A $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

B $C_2H_4 + H_2O \rightarrow CH_3CH_2OH$

C $CH_3CH_2OH \rightarrow C_2H_4 + H_2O$

D $CH_3CH_2OH + HBr \rightarrow CH_3CH_2Br + H_2O$

Q# 905/ AS Chemistry/2017/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 An alkene is reacted with acidified manganate(VII) ions, MnO_4^-. The desired organic product has a relative molecular mass greater than that of the alkene by 34.

What conditions should be used?

A cold, concentrated MnO_4^-

B cold, dilute MnO_4^-

C hot, concentrated MnO_4^-

D hot, dilute MnO_4^-

Q# 906/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 Which compounds can be obtained from but-2-ene in a **single** reaction?

1 $CH_3CH(OH)CH(OH)CH_3$

2 $CH_3CH(OH)CH_2CH_3$

3 CH_3CO_2H

Q# 907/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 23//www.SmashingScience.org :o)

23 Propene undergoes a variety of reactions.

Which row is correct?

	reagent added to propene	products include
A	$Br_2(aq)$	1-bromopropane
B	cold, dilute, acidified $KMnO_4(aq)$	propanoic acid
C	HBr(g)	2-bromopropane
D	hot, concentrated, acidified $KMnO_4(aq)$	propanoic acid

Q# 908/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 20//www.SmashingScience.org :o)

20 Structural isomerism and stereoisomerism should be considered when answering this question.

How many isomers with the formula C_4H_8 have structures that contain a π bond?

A 1 **B** 2 **C** 3 **D** 4

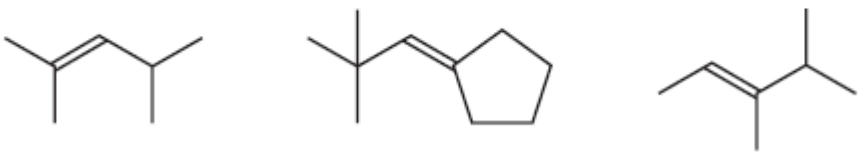
Q# 909/ AS Chemistry/2016/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 Which compounds would produce a carboxylic acid and a ketone when treated with hot, concentrated, acidified $KMnO_4$?

1 **2** **3**



Q# 910/ AS Chemistry/2016/s/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 The **first** propagation step in the reaction between methane and chlorine is shown.

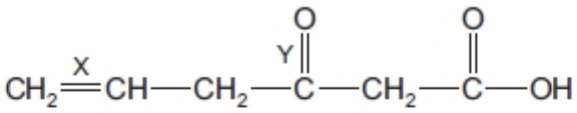
$$CH_4 + Cl\bullet \rightarrow CH_3\bullet + HCl$$

How many different **first** propagation steps are possible in the reaction between pentane and chlorine?

A 2 **B** 3 **C** 4 **D** 5

Q# 911/ AS Chemistry/2015/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 Compound Q contains three double bonds per molecule.



Q

Which bond, X or Y, will be ruptured by hot, concentrated acidified $KMnO_4$ and how many lone pairs of electrons are present in one molecule of Q?

	bond ruptured by hot, concentrated acidified $KMnO_4$	number of lone pairs
A	X	5
B	X	6
C	Y	5
D	Y	6

Q# 912/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 Which intermediate ion forms in the greatest amount during the addition of HBr to propene?

A $CH_3CH^+CH_3$

B $CH_3CH_2CH_2^+$

C $CH_3CH^-CH_2Br$

D $CH_3CHBrCH_2^-$

Q# 913/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 Cottonseed oil contains large amounts of polyunsaturated carboxylic acids. When this oil is used to make margarine, the C=C double bonds in the unsaturated carboxylic acids are hydrogenated.

What reagents and conditions would be suitable to bring about this hydrogenation reaction?

A H_2 gas, nickel catalyst, 400 °C

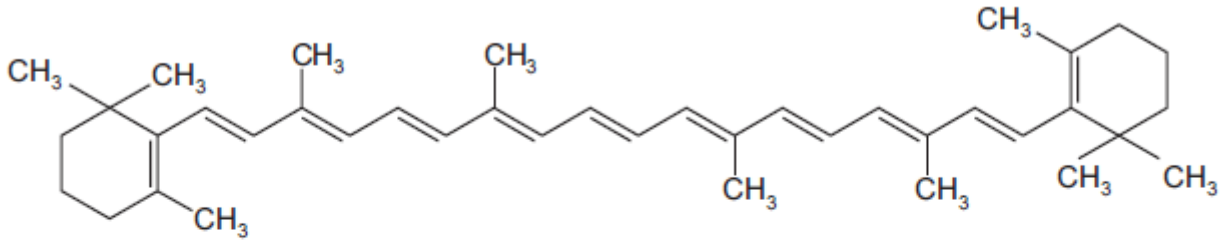
B $LiAlH_4$ in dry ether

C $NaBH_4$, aqueous solution

D steam, concentrated H_2SO_4, 300 °C and 60 atm pressure

Q# 914/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30 β-carotene is responsible for the orange colour of carrots.



β-carotene

β-carotene is oxidised by hot, concentrated, acidified $KMnO_4$.

When an individual molecule of β-carotene is oxidised in this way, many product molecules are formed.

How many of these product molecules contain a ketone functional group?

A 4 **B** 6 **C** 9 **D** 11

Q# 915/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29 Which equation correctly represents the balanced equation for the complete combustion of a hydrocarbon with the formula C_xH_y?

A $C_xH_y + (x + \frac{y}{2})O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

B $C_xH_y + (x + \frac{y}{4})O_2 \rightarrow xCO_2 + yH_2O$

C $C_xH_y + (x + \frac{y}{4})O_2 \rightarrow xCO_2 + \frac{y}{4}H_2O$

D $C_xH_y + (x + \frac{y}{4})O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

Q# 916/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 20//www.SmashingScience.org :o)

20 Which row correctly describes the reaction between propene and bromine, $Br_2(l)$?

	reaction mechanism	organic product
A	electrophilic addition	$CH_3CHBrCH_2Br$
B	electrophilic addition	$CH_3CH_2CH_2Br$
C	nucleophilic substitution	$CH_3CH_2CH_2Br$
D	nucleophilic substitution	$CH_3CHBrCH_2Br$

Q# 917/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27 The hydrocarbon $C_{17}H_{36}$ can be cracked.

Which compound is the **least** likely to be produced in this reaction?

A C_3H_8 **B** C_4H_8 **C** C_8H_{16} **D** $C_{16}H_{34}$

Q# 918/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 How many moles of oxygen molecules are needed for the complete combustion of one mole of 3-methylpent-2-ene?

A 9 **B** $9\frac{1}{2}$ **C** 18 **D** 19

Q# 919/ AS Chemistry/2013/w/TZ 1/Paper 1/Q# 7//www.SmashingScience.org :o)

7 Which stage in the free radical substitution of methane by chlorine will have the lowest activation energy?

A $CH_3\bullet + Cl_2 \rightarrow CH_3Cl + Cl\bullet$

B $Cl\bullet + Cl\bullet \rightarrow Cl_2$

C $Cl\bullet + CH_4 \rightarrow CH_3\bullet + HCl$

D $Cl_2 \rightarrow Cl\bullet + Cl\bullet$

Q# 920/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 Which molecules would be present in the mixture produced by the photochemical chlorination of methane?

1 hydrogen

2 hydrogen chloride

3 dichloromethane

Q# 921/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 Pentane, C_5H_{12}, is reacted with chlorine in the presence of ultraviolet light. A compound R is found in the products. R has molecular formula $C_5H_{10}Cl_2$. Each molecule of R contains **one** chiral carbon atom.

Which two atoms of the pentane chain could be bonded to chlorine atoms in this isomer?

A 1 and 3 **B** 1 and 5 **C** 2 and 3 **D** 2 and 4

Q# 922/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 Bromine reacts with ethene to form 1,2-dibromoethane.

What is the correct description of the organic intermediate in this reaction?

A It has a negative charge.

B It is a free radical.

C It is a nucleophile.

D It is an electrophile.

Q# 923/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 Which reagents and conditions will convert propane into 1-chloropropane?

1 Cl_2 and sunlight

2 conc. HCl, reflux

3 PCl_5

Q# 924/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

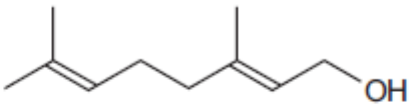
23 The cracking of a single hydrocarbon molecule, C_nH_{2n+2}, produces two hydrocarbon molecules only. Each hydrocarbon product contains the same number of carbon atoms in one molecule. Each hydrocarbon product has non-cyclic structural isomers.

What is the value of n?

A 4 **B** 6 **C** 8 **D** 9

Q# 925/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29 Geraniol is a constituent of some perfumes.



geraniol

Which statement about geraniol is **not** correct?

A Geraniol causes hot acidified potassium dichromate(VI) to change colour from orange to green.

B Geraniol decolourises bromine water.

C There are three methyl groups and three methylene (CH_2) groups in geraniol.

D There are two pairs of *cis-trans* isomers of geraniol.

Q# 926/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27 A reaction between chlorine and propane in ultraviolet light produces two isomeric monochloropropanes, C_3H_7Cl, as products.

Which information about this reaction is correct?

	type of bond fission in initiation step	expected ratio of 1-chloropropane to 2-chloropropane produced
A	heterolytic	1 : 1
B	heterolytic	3 : 1
C	homolytic	1 : 1
D	homolytic	3 : 1

Q# 927/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 Energy is released in the human body by the oxidation of glucose in a complex sequence of reactions. Part of this sequence is the Krebs cycle. One reaction in the Krebs cycle is the conversion of fumaric acid into malic acid.

$$HO_2CCH{=}CHCO_2H \rightarrow HO_2CCH(OH)CH_2CO_2H$$

fumaric acid malic acid

Which reagents could achieve this transformation in the laboratory?

A acidified $KMnO_4$

B $Br_2(aq)$ followed by hot NaOH(aq)

C H_2O with Pt catalyst

D steam with H_2SO_4

Q# 928/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

38 Which alkenes, on reaction with steam at 600 K and 6 x 10^6 Pa pressure in the presence of a phosphoric acid catalyst, could produce an alcohol containing a chiral carbon atom?

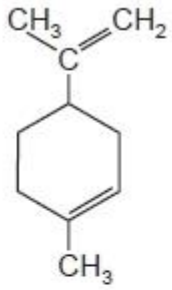
1 $(CH_3)_2C{=}CH_2$

2 $CH_3CH{=}CHCH_3$

3 $CH_3CH_2CH{=}CH_2$

Q# 929/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

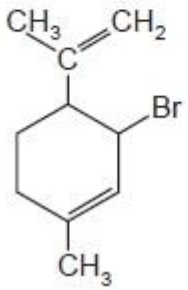
25 Limonene is an oil formed in the peel of citrus fruits.



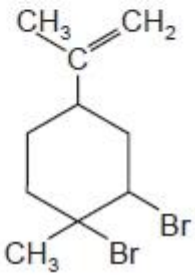
limonene

Which product is formed when an excess of bromine, $Br_2(l)$, reacts with limonene at room temperature in the dark?

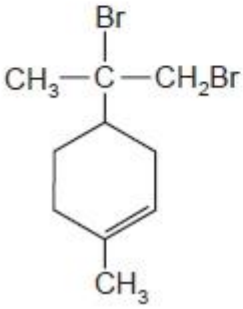
A



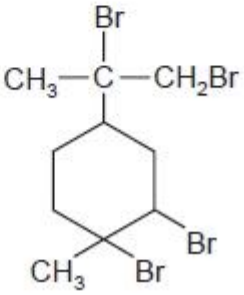
B



C



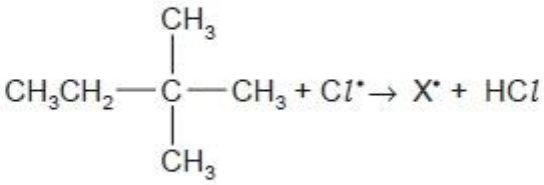
D



Q# 930/ AS Chemistry/2010/s/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 When heated with chlorine, the hydrocarbon 2,2-dimethylbutane undergoes free radical substitution.

In a propagation step the free radical $X^{\bullet}$ is formed.



How many different forms of $X^{\bullet}$ are possible?

A 1 **B** 2 **C** 3 **D** 4

Q# 931/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 Which equation represents a valid propagation step in the free radical reaction between ethane and chlorine?

A $C_2H_6 + Cl^{\bullet} \rightarrow C_2H_5Cl + H^{\bullet}$

B $C_2H_5Cl + Cl^{\bullet} \rightarrow C_2H_4Cl^{\bullet} + HCl$

C $C_2H_6 + H^{\bullet} \rightarrow C_2H_5^{\bullet} + HCl$

D $C_2H_5^{\bullet} + Cl^{\bullet} \rightarrow C_2H_5Cl$

Q# 932/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 Bromine reacts with ethene to form 1,2-dibromoethane.

What is the correct description of the organic intermediate in this reaction?

A It has a negative charge.

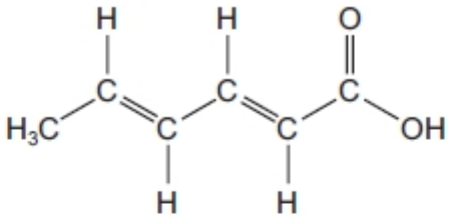
B It is a free radical.

C It is a nucleophile.

D It is an electrophile.

Q# 933/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 24//www.SmashingScience.org :o)

24 Sorbic acid is used as a food preservative because it kills fungi and moulds.



sorbic acid

Sorbic acid will react with

- hydrogen in the presence of a nickel catalyst,
- bromine in an organic solvent.

How many moles of hydrogen and of bromine will be incorporated into one mole of sorbic acid by these reactions?

	moles of hydrogen	moles of bromine
A	2	2
B	2	$2\frac{1}{2}$
C	3	2
D	3	$2\frac{1}{2}$

Q# 934/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

37 A fraction of distilled crude oil contains molecules with between 15 and 19 carbon atoms. This fraction is cracked by strong heating.

Why is this done?

1 To produce alkenes.

2 To produce smaller molecules which are in higher demand.

3 To insert oxygen atoms into the hydrocarbons.

Mark Scheme ALvl Chem 14 EQ P1 22w to 09s Paper 1 Hydrocarbons 54marks

Q# 881/ AS Chemistry/2022/s/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30	A

Q# 882/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 28//www.SmashingScience.org :o)

28	A

Q# 883/ AS Chemistry/2022/m/TZ 2/Paper 1/Q# 27//www.SmashingScience.org :o)

27	C

Q# 884/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

38	D

Q# 885/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37	B

Q# 886/ AS Chemistry/2021/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21	B

Q# 887/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 33//www.SmashingScience.org :o)

33	D

Q# 888/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29	C

Q# 889/ AS Chemistry/2021/s/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21	B

Q# 890/ AS Chemistry/2021/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22	D

Q# 891/ AS Chemistry/2020/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21	D

Q# 892/ AS Chemistry/2020/s/TZ 1/Paper 1/Q# 35//www.SmashingScience.org :o)

35	C

Q# 893/ AS Chemistry/2020/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22	C

Q# 894/ AS Chemistry/2020/m/TZ 2/Paper 1/Q# 40//www.SmashingScience.org :o)

40	A

Q# 895/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27	A

Q# 896/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22	D

Q# 897/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21	C

Q# 898/ AS Chemistry/2019/w/TZ 1/Paper 1/Q# 20//www.SmashingScience.org :o)

20	A

Q# 899/ AS Chemistry/2019/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22	B

Q# 900/ AS Chemistry/2019/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22	B

Q# 901/ AS Chemistry/2018/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37	B

Q# 902/ AS Chemistry/2018/s/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

38	C

Q# 903/ AS Chemistry/2018/m/TZ 2/Paper 1/Q# 22//www.SmashingScience.org :o)

22 | A

Q# 904/ AS Chemistry/2017/w/TZ 1/Paper 1/Q# 22//

22 | A

Q# 905/ AS Chemistry/2017/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 | B

Q# 906/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 37//www.SmashingScience.org :o)

37 | A

Q# 907/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 23//www.SmashingScience.org :o)

23 | C

Q# 908/ AS Chemistry/2017/m/TZ 2/Paper 1/Q# 20//www.SmashingScience.org :o)

20 | D

Q# 909/ AS Chemistry/2016/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37 **A**

Q# 910/ AS Chemistry/2016/s/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 **B**

Q# 911/ AS Chemistry/2015/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 **B**

Q# 912/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 **A**

Q# 913/ AS Chemistry/2015/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 **A**

Q# 914/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 30//www.SmashingScience.org :o)

30 **B**

Q# 915/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29 **D**

Q# 916/ AS Chemistry/2014/w/TZ 1/Paper 1/Q# 20//www.SmashingScience.org :o)

20 **A**

Q# 917/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27 **D**

Q# 918/ AS Chemistry/2014/s/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 **A**

Q# 919/ AS Chemistry/2013/w/TZ 1/Paper 1/Q# 7//www.SmashingScience.org :o)

7 **B**

Q# 920/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37 **C**

Q# 921/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 **A**

Q# 922/ AS Chemistry/2013/s/TZ 1/Paper 1/Q# 22//www.SmashingScience.org :o)

22 **D**

Q# 923/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37 **D**

Q# 924/ AS Chemistry/2012/w/TZ 1/Paper 1/Q# 23//www.SmashingScience.org :o)

23 **C**

Q# 925/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 29//www.SmashingScience.org :o)

29 **D**

Q# 926/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 27//www.SmashingScience.org :o)

27 **D**

Q# 927/ AS Chemistry/2011/w/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 **D**

Q# 928/ AS Chemistry/2011/s/TZ 1/Paper 1/Q# 38//www.SmashingScience.org :o)

38 **C**

Q# 929/ AS Chemistry/2010/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 **D**

Q# 930/ AS Chemistry/2010/s/TZ 1/Paper 1/Q# 21//www.SmashingScience.org :o)

21 **C**

Q# 931/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 26//www.SmashingScience.org :o)

26 **B**

Q# 932/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 25//www.SmashingScience.org :o)

25 **D**

Q# 933/ AS Chemistry/2009/w/TZ 1/Paper 1/Q# 24//www.SmashingScience.org :o)

24 **A**

Q# 934/ AS Chemistry/2009/s/TZ 1/Paper 1/Q# 37//www.SmashingScience.org :o)

37 **B**