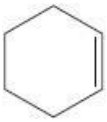
Questions

Q1.

This question is about hydrocarbons.

How many σ bonds and π bonds are there in one molecule of cyclohexene?



(1)

		σ bonds	π bonds
☐	**A**	5	2
☐	**B**	6	1
☐	**C**	15	2
☐	**D**	16	1

(Total for question = 1 mark)

Q2.

This question is about 2-methylpropan-2-ol.

Which observation would be expected when 2-methylpropan-2-ol is heated with potassium dichromate(VI) and dilute sulfuric acid?

(1)

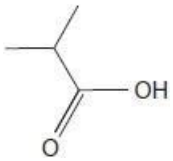
☐ **A** orange to green
☐ **B** green to orange
☐ **C** purple to colourless
☐ **D** no change

(Total for question = 1 mark)

Q3.

Some alcohols can be oxidised by acidified sodium dichromate(VI), $Na_2Cr_2O_7$.

The carboxylic acid shown can be produced by oxidation of an alcohol under reflux.



Which alcohol would be oxidised under reflux to produce this carboxylic acid?

(1)

- ☐ **A** 1,1-dimethylethanol
- ☐ **B** 2-methylpropan-1-ol
- ☐ **C** 2-methylbutan-1-ol
- ☐ **D** propan-2-ol

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about alcohols and their reactions.

2-methylpropan-2-ol may be formed by the reaction between
2-bromo-2-methylpropane and aqueous potassium hydroxide.

What is the role of the hydroxide ions in this reaction?

(1)

- ☐ **A** alkali
- ☐ **B** catalyst
- ☐ **C** electrophile
- ☐ **D** nucleophile

(Total for question = 1 mark)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of the following changes to the proportions of organic molecules within a fraction results from the reforming process?

(1)

	Proportion of branched chain alkanes	Proportion of cyclic hydrocarbons
☐ A	decrease	decrease
☐ B	decrease	increase
☐ C	increase	decrease
☐ D	increase	increase

(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about alkenes.

Which of these has the molecular formula C_6H_{10}?

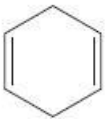
(1)

☐ A

☐ B

☐ C

☐ D



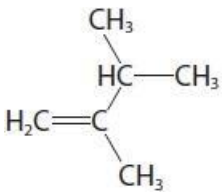
(Total for question = 1 mark)

Q7.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about alkenes.

What is the systematic name of this alkene?



(1)

- ☐ **A** 2-methylpent-1-ene
- ☐ **B** 3-methylpent-1-ene
- ☐ **C** 2,3-dimethylbut-1-ene
- ☐ **D** 2,3-dimethylbut-3-ene

(Total for question = 1 mark)

Q8.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

This question is about alkenes with the molecular formula C_5H_{10}.

Which of these compounds would form pent-2-ene **only**, when reacted with concentrated phosphoric acid, H_3PO_4?

(1)

- ☐ **A** $CH_3CH(OH)CH(CH_3)_2$
- ☐ **B** $CH_2(OH)CH_2CH_2CH_2CH_3$
- ☐ **C** $CH_3CH_2CH_2CH(OH)CH_3$
- ☐ **D** $CH_3CH_2CH(OH)CH_2CH_3$

(Total for question = 1 mark)

Q9.

This question is about alkanes.

The black smoke produced from the incomplete combustion of alkane fuels is

(1)

- ☐ **A** carbon particulates
- ☐ **B** oxides of nitrogen
- ☐ **C** oxides of sulfur
- ☐ **D** unburnt hydrocarbons

(Total for question = 1 mark)

Q10.

The number of structural isomers with the molecular formula C_5H_{12} is

(1)

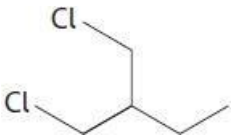
- ☐ **A** 3
- ☐ **B** 4
- ☐ **C** 5
- ☐ **D** 6

(Total for question = 1 mark)

Q11.

This is a question about dihalogenoalkanes.

What is the classification of the dihalogenoalkane shown?



(1)

☐ **A** primary
☐ **B** secondary
☐ **C** tertiary
☐ **D** primary and secondary

(Total for question = 1 mark)

Q12.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

The structures of two isomers are shown.

What kind of isomerism is shown by these molecules?

☐ **A** carbon chain

☐ **B** positional

☐ **C** *E*/*Z*

☐ **D** *cis*/*trans*

(Total for question = 1 mark)

Q13.

Ethene reacts with bromine in the dark.

(i) What is the classification of the mechanism for the reaction between ethene and bromine?

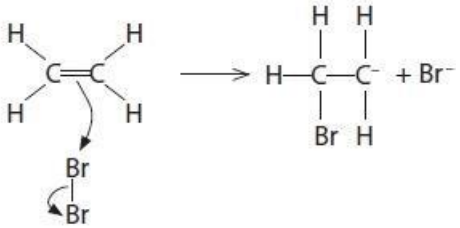
(1)

- ☐ **A** electrophilic addition
- ☐ **B** electrophilic substitution
- ☐ **C** nucleophilic addition
- ☐ **D** nucleophilic substitution

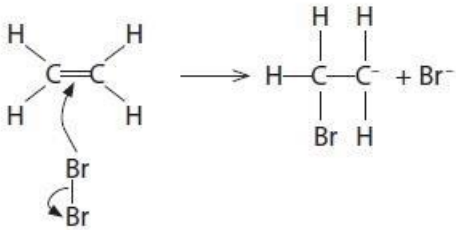
(ii) Which of the following shows the formation of the intermediate in the mechanism for the reaction between ethene and bromine?

(1)

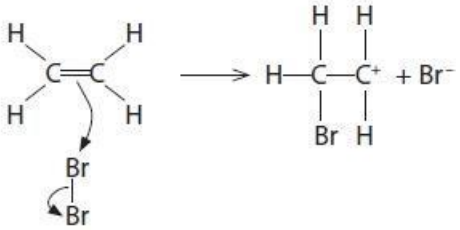
☐ **A**



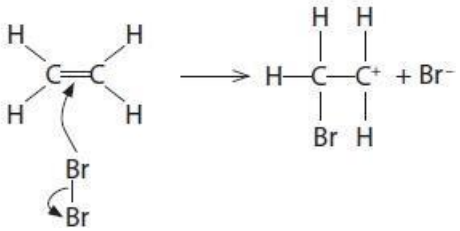
☐ **B**



☐ **C**



☐ **D**



(Total for question = 2 marks)

Q14.

This question is about compounds of Group 5 elements.

Which of these compounds produces hydrogen chloride when it reacts with PCl_5?

(1)

- ☐ **A** propanal
- ☐ **B** propan-1-ol
- ☐ **C** propanone
- ☐ **D** propyl propanoate

(Total for question = 1 mark)

Q15.

This is a question about hydrocarbons.

The **heterolytic** bond fission of a sigma (σ) bond in an alkane would produce

(1)

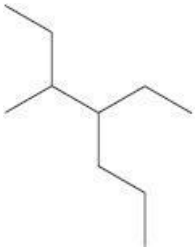
- ☐ **A** only carbocations
- ☐ **B** only free radicals
- ☐ **C** free radicals and ions
- ☐ **D** ions

(Total for question = 1 mark)

Q16.

This is a question about alkanes.

What is the name of this alkane?



(1)

- ☐ **A** 2-ethyl-3-propylpentane
- ☐ **B** 4-ethyl-3-methylheptane
- ☐ **C** 3-methyl-4-propylhexane
- ☐ **D** 4-methyl-3-propylhexane

(Total for question = 1 mark)

Q17.

This is a question about alkanes.

What is the reaction mechanism when ethane and chlorine react in UV light?

(1)

- ☐ **A** electrophilic addition
- ☐ **B** electrophilic substitution
- ☐ **C** free radical addition
- ☐ **D** free radical substitution

(Total for question = 1 mark)

Q18.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about hydrocarbons.

Which of these molecular formulae represents a non-cyclic, saturated hydrocarbon?

(1)

☐ **A** C_6H_6
☐ **B** C_6H_{10}
☐ **C** C_6H_{12}
☐ **D** C_6H_{14}

(Total for question = 1 mark)

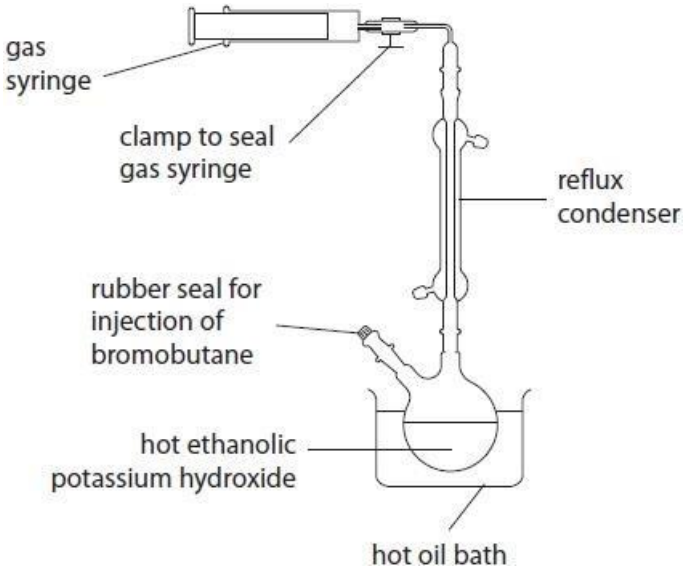
Q19.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Bromobutanes react with hot ethanolic potassium hydroxide solution to produce gaseous butenes.

$$C_4H_9Br + OH^- \rightarrow C_4H_8 + Br^- + H_2O$$

Apparatus



Procedure

- 0.0080 mol of liquid 1-bromobutane was injected into a round bottom flask containing hot ethanolic potassium hydroxide.
- After the reaction, the syringe was sealed using a clamp.
- The syringe was then removed from the apparatus and allowed to cool to room temperature (298 K).

Result

The final volume of but-1-ene collected was 22.0 cm^3.

Alkene molecules are formed by elimination from 2-bromobutane.

How many isomeric alkene products will be formed in this reaction?

(1)

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

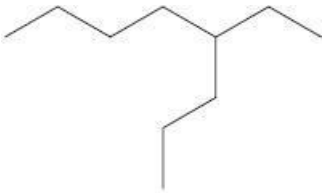
(Total for question = 1 mark)

Q20.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about alkanes and their reactions.

What is the IUPAC name for this alkane?



(1)

- ☐ **A** 4-ethyloctane
- ☐ **B** 5-ethyloctane
- ☐ **C** 3-propylheptane
- ☐ **D** 5-propylheptane

(Total for question = 1 mark)

Q21.

This is a question about polymers.

Which approach used by chemists would not contribute to a more sustainable use of materials over the life cycle of a polymer?

(1)

- ☐ **A** make more efficient use of energy
- ☐ **B** make more efficient use of resources
- ☐ **C** use catalysts for a faster reaction rate
- ☐ **D** use a higher temperature for a faster reaction rate

(Total for question = 1 mark)

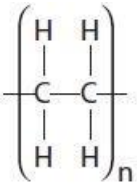
Q22.

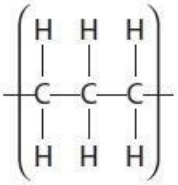
Plastic products often have a symbol on them. Two of the symbols are shown.

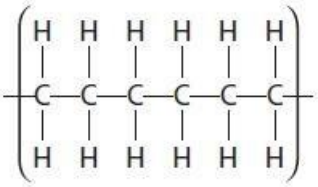
LDPE stands for low density poly(ethene).

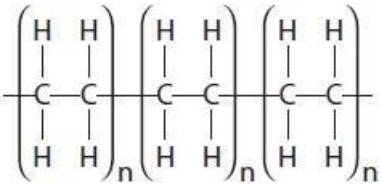
Which of the diagrams shows exactly three repeat units of poly(ethene)?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

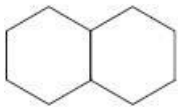
☒ **D** 

(Total for question = 1 mark)

Q23.

This question is about alkanes.

The skeletal formula of decalin is



The molecular formula of decalin is

(1)

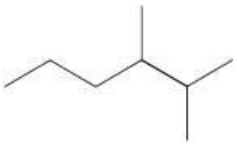
- ☐ **A** $C_{10}H_{22}$
- ☐ **B** $C_{10}H_{20}$
- ☐ **C** $C_{10}H_{18}$
- ☐ **D** $C_{10}H_{16}$

(Total for question = 1 mark)

Q24.

Alkanes are a homologous series of hydrocarbons.

What is the name of this compound?



(1)

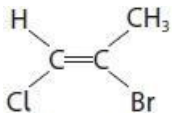
- ☐ **A** 1,1,2-trimethylpentane
- ☐ **B** 2,3-dimethylhexane
- ☐ **C** 4,5-dimethylhexane
- ☐ **D** 4,5,5-trimethylpentane

(Total for question = 1 mark)

Q25.

Compounds with a carbon−carbon double bond are unsaturated.

What is the name of the compound shown?



(1)

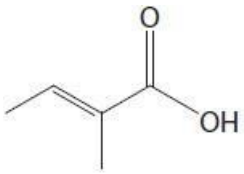
☐ **A** *cis*-2-bromo-1-chloroprop-1-ene
☐ **B** *E*-2-bromo-1-chloroprop-1-ene
☐ **C** *trans*-2-bromo-1-chloroprop-1-ene
☐ **D** *Z*-2-bromo-1-chloroprop-1-ene

(Total for question = 1 mark)

Q26.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

What is the systematic name for tiglic acid?



tiglic acid

☐ **A** *E*-2-methylbut-2-enoic acid

☐ **B** *Z*-2-methylbut-2-enoic acid

☐ **C** *E*-3-methylbut-2-enoic acid

☐ **D** *Z*-3-methylbut-2-enoic acid

(Total for question = 1 mark)

Q27.

Which of the following does **not** act as a nucleophile?

(1)

- ☐ **A** HBr
- ☐ **B** H_2O
- ☐ **C** NH_3
- ☐ **D** CN^-

(Total for question = 1 mark)

Q28.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

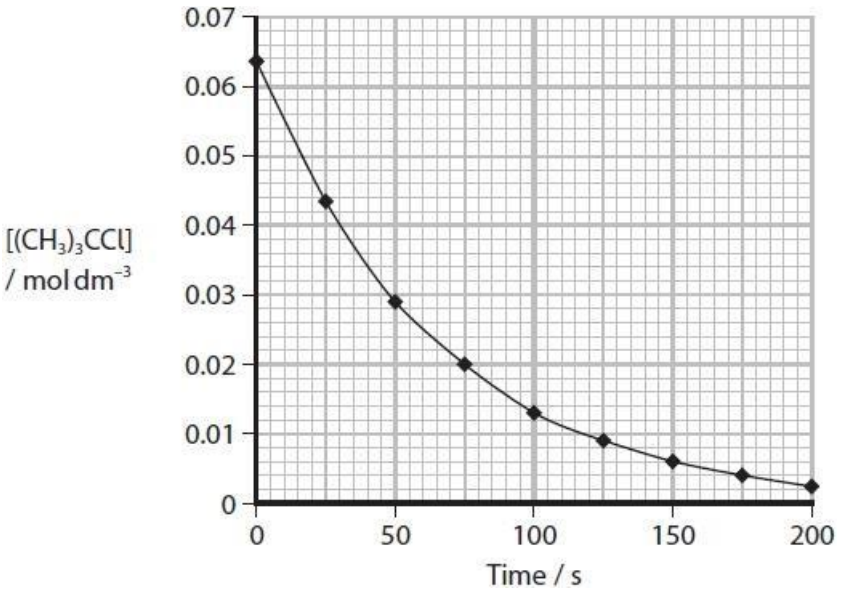
This question is about halogenoalkanes.

2-chloro-2-methylpropane can be hydrolysed by water.

The equation for this reaction is

$$(CH_3)_3CCl + H_2O \rightarrow (CH_3)_3COH + H^+ + Cl^-$$

The graph shows how the concentration of 2-chloro-2-methylpropane changes with time during an investigation of this reaction.



What is the classification of the mechanism for the hydrolysis of 2-chloro-2-methylpropane by water?

(1)

☐ **A** addition

☐ **B** elimination

☐ **C** free radical substitution

☐ **D** nucleophilic substitution

(Total for question = 1 mark)

Q29.

This question is about the chemistry of propane-1,3-diol and propanedioic acid.

Propane-1,3-diol can be oxidised to propanedioic acid in the same way as other primary alcohols.

(i) Suitable reagents and conditions are

(1)

	Reagents	Conditions
☐ A	sodium dichromate(VI) + sulfuric acid	heating under reflux
☐ B	sodium dichromate(VI) + hydrochloric acid	heating under reflux
☐ C	potassium dichromate(VI) + sulfuric acid	room temperature
☐ D	potassium dichromate(VI) + hydrochloric acid	room temperature

(ii) The colour change in this reaction is

(1)

☐ **A** green to orange

☐ **B** orange to green

☐ **C** orange to colourless

☐ **D** colourless to orange

(Total for question = 2 marks)

Q30.

This is a question about polymers.

Which is **not** a use of waste poly(alkenes)?

(1)

- ☐ **A** feedstock for cracking
- ☐ **B** generation of biodegradable materials
- ☐ **C** incineration to release energy
- ☐ **D** make new materials by recycling

(Total for question = 1 mark)

Q31.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about some reactions of alcohols.

Which reagent is used with iodine to prepare iodoalkanes from alcohols?

(1)

- ☐ **A** red phosphorus
- ☐ **B** concentrated phosphoric acid
- ☐ **C** sulfur
- ☐ **D** concentrated sulfuric acid

(Total for question = 1 mark)

Q32.

This question is about alkanes and their reactions.

What is the name of the process that could be used to produce propane, C_3H_8, from decane, $C_{10}H_{22}$?

(1)

- ☐ **A** substitution
- ☐ **B** reforming
- ☐ **C** fractional distillation
- ☐ **D** cracking

(Total for question = 1 mark)

Q33.

This question is about alkanes.

The reaction of ethane and chlorine in UV radiation produces chloroethane.

$$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$$

This reaction is classified as

(1)

- ☐ **A** addition
- ☐ **B** elimination
- ☐ **C** initiation
- ☐ **D** substitution

(Total for question = 1 mark)

Q34.

This question is about alkanes.

A reaction of hexane is shown below.

This is **best** described as

(1)

- ☐ **A** elimination
- ☐ **B** hydrogenation
- ☐ **C** isomerisation
- ☐ **D** reforming

(Total for question = 1 mark)

Q35.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about some reactions of alcohols.

(i) Which alcohol **cannot** be oxidised by acidified potassium dichromate(VI)?

(1)

- ☐ **A** hexan-2-ol
- ☐ **B** 2-methylpentan-2-ol
- ☐ **C** hexan-3-ol
- ☐ **D** 2-methylpentan-3-ol

(ii) Which alcohol reacts with iodine in the presence of alkali to form a yellow solid?

(1)

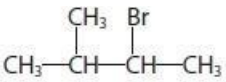
- ☐ **A** hexan-2-ol
- ☐ **B** 2-methylpentan-2-ol
- ☐ **C** hexan-3-ol
- ☐ **D** 2-methylpentan-3-ol

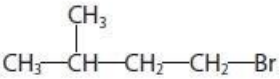
(Total for question = 2 marks)

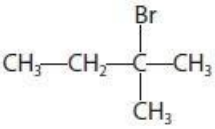
Q36.

This question concerns halogenoalkanes.

The bromoalkanes, X, Y and Z, were each added to a mixture of aqueous silver nitrate and ethanol at 50 °C. The rate of hydrolysis was compared by measuring the time for a precipitate to appear.

X 

Y 

Z 

The relative rates of hydrolysis are in the order (fastest first)

(1)

- ☒ **A** X, Y, Z
- ☒ **B** Z, X, Y
- ☒ **C** Z, Y, X
- ☒ **D** X, Z, Y

(Total for question = 1 mark)

Q37.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about hydrocarbons.

How many **structural** isomers are there with the molecular formula C_5H_{12}?

(1)

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

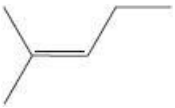
(Total for question = 1 mark)

Q38.

This is a question about polymers.

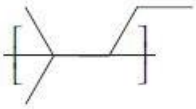
An addition polymer is formed from 2-methylpent-2-ene.

What is the repeat unit for poly(2-methylpent-2-ene)?

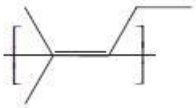


(1)

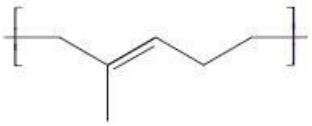
☐ **A**



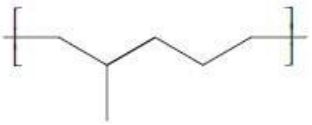
☐ **B**



☐ **C**



☐ **D**



(Total for question = 1 mark)