
CHEMISTRY MULTIPLE CHOICE QUESTIONS

Organic Chemistry
Hydrocarbons

2002 -2009

1. Which substance in a vehicle exhaust results from incomplete combustion of a hydrocarbon fuel?

- A CO B H₂O C N₂ D NO

[2002 M/J (24)]

2. Which compounds would be formed in the reaction of ethene with aqueous bromine in the presence of sodium chloride?

- 1 CH₂ClCH₂Cl
2 CH₂BrCH₂Cl
3 CH₂BrCH₂Br

[2002 M/J (38)]

3. Chloroethane is used as a starting material for the production of 'time-release capsules' in pharmaceutical products. One way of preparing chloroethane is to react chlorine and ethane in the presence of ultraviolet light.

Which statement is correct about the **first** stage of the mechanism of this reaction?

- A The Cl – Cl bond is split homolytically.
B The Cl – Cl bond is split heterolytically.
C The C – H bond is split homolytically.
D The C – H bond is split heterolytically.

[2002 O/N (22)]

4. Chlorofluorocarbons (CFCs) have been widely used in aerosol sprays, refrigerators and in making foamed plastics, but are now known to destroy ozone in the upper atmosphere.

Which of the following will not destroy ozone, and therefore can be used safely as a replacement for CFCs?

- A CHBr₃ B CCl₃CBr₃ C CHClFCClF₂ D CH₃CH₂CH₂CH₃

[2002 O/N (25)]

5. When octane is subjected to catalytic cracking, which compounds can be obtained?

- 1 CH₂=CH₂
2 CH₃CH₂CH=CH₂
3 CH₃(CH₂)₄CH₃

[2002 O/N (38)]

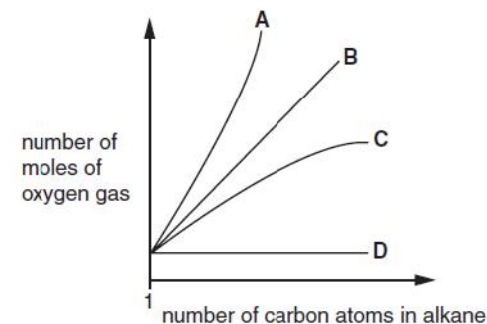
6. Which pollutant is formed in the internal combustion engine and, if not removed by the catalytic converter, may become involved in the formation of acid rain?

- A C B C₈H₁₈ C CO D NO

[2003 M/J (19)]

7. The complete combustion of alkanes to produce carbon dioxide and water is an important exothermic reaction.

Which line on the graph shows the relationship between the number of carbon atoms in the alkane and the number of moles of oxygen gas needed for complete combustion of the alkane?



[2003 M/J (23)]

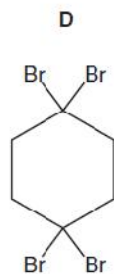
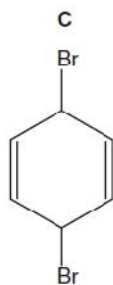
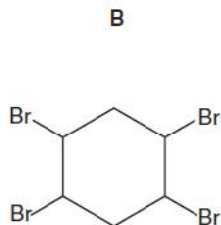
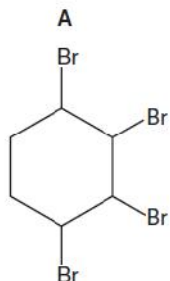
8.

Cyclohexa-1,4-diene is treated with a solution of bromine in tetrachloromethane.



cyclohexa-1,4-diene

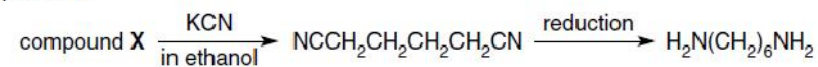
Which product is formed?



[2003 M/J (24)]

9.

The reaction scheme outlines the production of one of the monomers of nylon 66 from compound X.



Which compound could be X?

- A $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
 B $\text{CH}_2=\text{CHCH}=\text{CH}_2$
 C $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 D $\text{HO}_2\text{CCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$

[2003 M/J (26)]

10.

In a preparation of ethene, ethanol is added a drop at a time to a heated reagent Y. To purify the ethene it is bubbled through a solution Z and then collected.

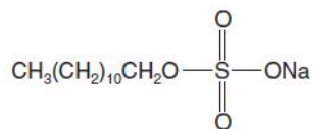
What could reagent Y and solution Z be?

	reagent Y	solution Z
A	acidified $\text{K}_2\text{Cr}_2\text{O}_7$	dilute NaOH
B	concentrated H_2SO_4	dilute H_2SO_4
C	concentrated H_2SO_4	dilute NaOH
D	ethanolic NaOH	concentrated H_2SO_4

[2003 M/J (29)]

11.

Long-chain alkanes are converted on an industrial scale into alkylsulphates for use as detergents, e.g. sodium lauryl sulphate.



sodium lauryl sulphate

What deductions about the properties of this substance can be made from this structure?

- 1 Part of the structure is polar and is water-attracting.
- 2 The alkyl chain is soluble in oil droplets.
- 3 All the C-C-C bond angles are tetrahedral.

[2003 M/J (32)]

12.

Hydrogen bromide reacts with ethene to form bromoethane.

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

- A It contains carbon, hydrogen and bromine.
- B It has a negative charge.
- C It is an electrophile.
- D It is a free radical.

[2003 O/N (21)]

13.

On strong heating a hydrocarbon produces ethene, propane and but-1-ene in the mole ratio 5 : 1 : 1.

What is the molecular formula of the hydrocarbon?

- A $\text{C}_{17}\text{H}_{34}$ B $\text{C}_{17}\text{H}_{36}$ C $\text{C}_{19}\text{H}_{38}$ D $\text{C}_{19}\text{H}_{40}$

[2003 O/N (22)]

14.

Which molecules would be present in the photochemical chlorination of methane?

- 1 hydrogen
- 2 hydrogen chloride
- 3 dichloromethane

[2003 O/N (36)]

15.

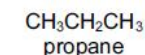
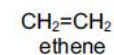
Which compound could **not** be obtained from cracking a sample of nonane, $\text{CH}_3(\text{CH}_2)_7\text{CH}_3$?

- A $\text{CH}_3\text{CH}=\text{CHCH}=\text{CHCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$
- D $(\text{CH}_3\text{CH}_2\text{CH}_2)_3\text{CH}$

[2004 M/J (23)]

16.

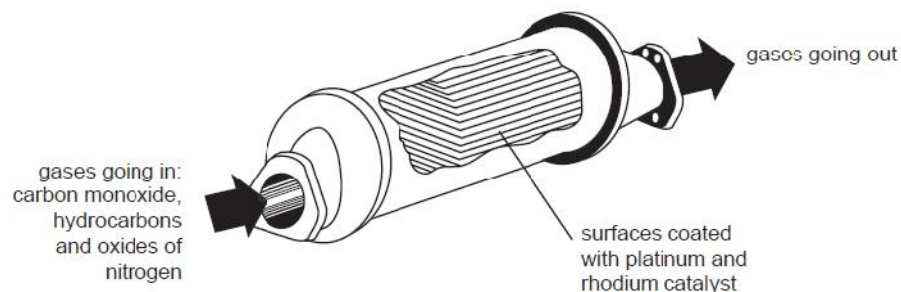
In which way are ethene and propane similar?



- A They are both obtained by the dehydration of alcohols.
- B They are both neutral to an indicator solution.
- C They can both be hydrogenated using a suitable catalyst.
- D They can both undergo polymerisation under suitable conditions.

[2004 M/J (24)]

17. Which reaction in the catalytic converter does **not** remove hazardous and polluting gases from the exhaust fumes of a motor car?



These equations are qualitative and unbalanced.
[HC = unburnt hydrocarbons; NO_x = oxides of nitrogen]

- A $\text{HC} + \text{NO}_x \rightarrow \text{H}_2\text{O} + \text{CO} + \text{N}_2$
 B $\text{CO} + \text{NO}_x \rightarrow \text{CO}_2 + \text{N}_2$
 C $\text{HC} + \text{NO}_x \rightarrow \text{H}_2\text{O} + \text{CO}_2 + \text{N}_2$
 D $\text{CO} + \text{O}_2 \rightarrow \text{CO}_2$

[2004 M/J (25)]

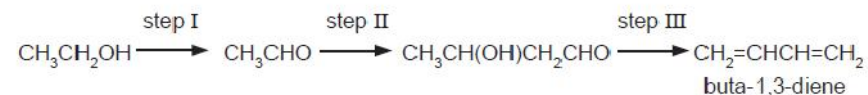
18. Ethene reacts with aqueous bromine to give two products, CH₂BrCH₂Br and CH₂BrCH₂OH.

Which statement is correct for these products?

- A Both products are obtained in this reaction by electrophilic substitution.
 B Both products are obtained in this reaction by nucleophilic addition.
 C Both products can be hydrolysed to form the same diol.
 D Both products can form hydrogen bonds with water.

[2004 M/J (27)]

19. Instead of obtaining buta-1,3-diene from fossil fuel sources, it is proposed to obtain it from ethanol, which can be obtained from non-food agricultural crops. The sequence of reactions is as follows.



Which term could be used to describe step I?

- A condensation
 B dehydration
 C dehydrogenation
 D hydrogenation

[2004 O/N (22)]

20. How many different substitution products are possible, in principle, when a mixture of bromine and ethane is allowed to react?

- A 3 B 5 C 7 D 9

[2004 O/N (23)]

21. Which reaction occurs with saturated hydrocarbons?

- A catalytic hydrogenation
 B ready decolourisation of aqueous bromine
 C polymerisation
 D thermal cracking

[2004 O/N (25)]

22. The reaction of chlorine with methane is carried out in the presence of light.

What is the function of the light?

- A to break the C–H bonds in methane
- B to break up the chlorine molecules into atoms
- C to break up the chlorine molecules into ions
- D to heat up the mixture

[2004 O/N (26)]

23. Which compounds may result from mixing ethane and chlorine in the presence of sunlight?

- 1 $\text{CH}_3\text{CH}_2\text{Cl}$
- 2 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- 3 $\text{CH}_3\text{CHClCHClCH}_3$

[2004 O/N (37)]

24. When bromine reacts with propene in an organic solvent at room temperature, what is the mechanism by which the bromine attacks the propene?

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

[2005 M/J (22)]

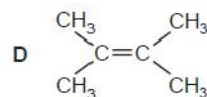
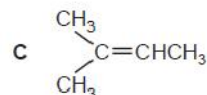
25. Which compounds can be obtained from ethene in a **single** reaction?

- 1 CH_3CH_3
- 2 $(-\text{CH}_2\text{CH}_2-)_n$
- 3 $\text{HOCH}_2\text{CH}_2\text{OH}$

[2005 M/J (38)]

26. Which hydrocarbon, on treatment with hot acidified potassium manganate(VII), would give ethanoic acid **only**?

- A $\text{CH}_3\text{CH}=\text{CH}_2$
- B $\text{CH}_3\text{CH}=\text{CHCH}_3$



[2005 O/N (21)]

27. Compound X on reaction with hot concentrated sulphuric acid gave a mixture of **three** alkenes.

What could X be?

- A butan-2-ol
- B propan-2-ol
- C 2-methylbutan-2-ol
- D 2-methylpropan-2-ol

[2005 O/N (24)]

28. Modern cars are fitted with catalytic converters. These remove carbon monoxide, unburnt hydrocarbons and oxides of nitrogen from exhaust gases.

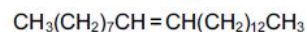
Which of these pollutant gases are removed by oxidation?

- 1 carbon monoxide
- 2 hydrocarbons
- 3 nitrogen oxides

[2005 O/N (39)]

29.

The sex-attractant of the house-fly is muscalure, with the following formula.



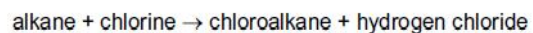
Which statements about muscalure are correct?

- 1 It will decolourise aqueous bromine.
- 2 It will be oxidised by cold aqueous alkaline KMnO_4 to give a diol.
- 3 It will be optically active.

[2005 O/N (40)]

30.

Light initiates the following reaction.



What happens to chlorine in this photochemical reaction?

- A heterolytic fission to give an electrophile
- B homolytic fission to give an electrophile
- C heterolytic fission to give a free radical
- D homolytic fission to give a free radical

[2006 M/J (24)]

31.

Which equation or statement describes what happens when poly(propene) is burned in an excess of air?

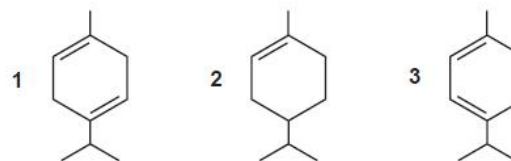
- A $(\text{C}_3\text{H}_6)_n + 1\frac{1}{2}n\text{O}_2 \rightarrow 3nC + 3n\text{H}_2\text{O}$
- B $(\text{C}_3\text{H}_6)_n + 4\frac{1}{2}n\text{O}_2 \rightarrow 3n\text{CO}_2 + 3n\text{H}_2\text{O}$
- C $(\text{C}_3\text{H}_6)_n + 6n\text{O}_2 \rightarrow 3n\text{CO}_2 + 3n\text{H}_2\text{O}$
- D Poly(propene) does not burn.

[2006 O/N (25)]

32.

The following three hydrocarbons all occur naturally.

Which of these will be split into two organic compounds, both containing a ketone group, when treated with hot acidified potassium manganate(VII)?



[2006 O/N (37)]

33.

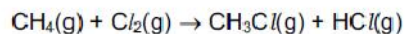
In which reaction is a carbocation (carbonium ion) an intermediate?

- A $\text{CH}_2=\text{CH}_2 + \text{Br}_2 \rightarrow \text{CH}_2\text{BrCH}_2\text{Br}$
- B $\text{CH}_3\text{CH}_2\text{Br} + \text{NaOH} \rightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{NaBr}$
- C $\text{CH}_3\text{CH}_3 + \text{Cl}_2 \rightarrow \text{CH}_3\text{CH}_2\text{Cl} + \text{HCl}$
- D $\text{CH}_3\text{CHO} + \text{HCN} \xrightarrow{\text{CN}^-} \text{CH}_3\text{CH}(\text{OH})\text{CN}$

[2007 M/J (22)]

34.

Tetramethyl-lead(IV), $(\text{CH}_3)_4\text{Pb}$, increases the rate of the reaction of methane with chlorine.



Why can tetramethyl-lead(IV) behave in this way?

- A It is a source of methyl radicals.
- B It releases CH_3^+ (g).
- C It reacts with chloromethane and prevents equilibrium being established.
- D Metal ions catalyse the reaction.

[2007 O/N (21)]

35.

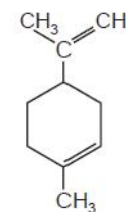
Which reaction occurs when ethane and chlorine are mixed in diffused sunlight?

- A a free-radical substitution with hydrogen given off
- B a free-radical substitution with hydrogen chloride given off
- C a free-radical substitution with no gas given off
- D a nucleophilic substitution with hydrogen chloride given off

[2007 O/N (22)]

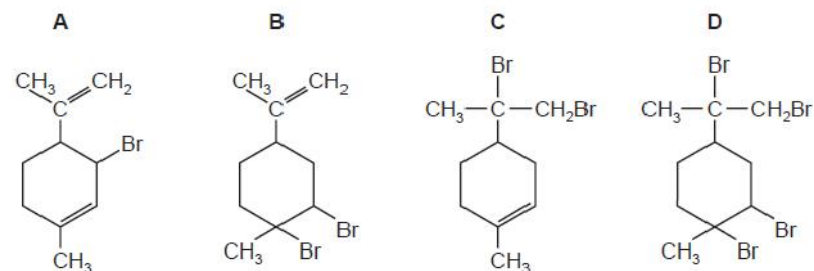
36.

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



limonene

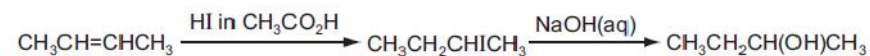
Which product is formed when molecular bromine reacts with limonene at room temperature in the dark?



[2007 O/N (23)]

37.

Which pair of reaction types is illustrated by the reaction sequence below?

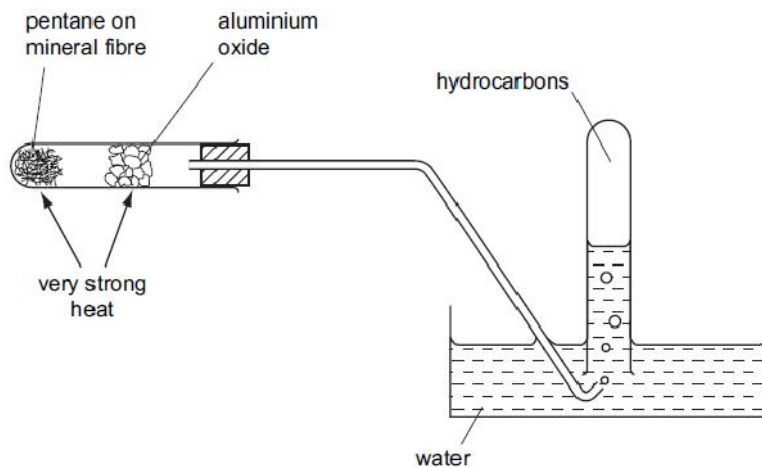


- A electrophilic addition and electrophilic substitution
- B electrophilic addition and nucleophilic substitution
- C nucleophilic addition and electrophilic substitution
- D nucleophilic addition and nucleophilic substitution

[2008 M/J (20)]

38.

Which hydrocarbon would **not** be collected in the inverted tube by heating pentane, $\text{CH}_3(\text{CH}_2)_3\text{CH}_3$, in the apparatus shown?



- A CH_4
- B CH_3CH_3
- C $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- D $\text{CH}_3(\text{CH}_2)_8\text{CH}_3$

[2008 M/J (23)]

39.

Which hydrocarbon can form a monochloro-substitution derivative which shows **both** chirality and *cis-trans* isomerism?

- A $\text{CH}_3\text{CH}=\text{CH}_2$
- B $(\text{CH}_3)_2\text{C}=\text{CH}_2$
- C $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$
- D $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_3$

[2008 O/N (22)]

40.

Which statements about alkenes are correct?

- 1 They are formed when higher alkanes are cracked.
- 2 They are used as monomers for polymerisation.
- 3 They are less reactive than alkanes towards electrophiles.

[2008 O/N (37)]

41.

During the bromination of methane, the free radical CH_3^\bullet is generated and a possible terminating step of this reaction is the formation of C_2H_6 by the combination of two free radicals.

What could be produced in a terminating step during the bromination of propane?

- 1 $\text{CH}_3\text{CH}_2\text{CH}_2\overset{\text{CH}_3}{\text{C}}\text{HCH}_3$
- 2 $\text{CH}_3\overset{\text{CH}_3}{\text{C}}\text{H}\overset{\text{CH}_3}{\text{C}}\text{HCH}_3$
- 3 $\text{CH}_3\text{CH}_2\overset{\text{CH}_3}{\text{C}}\text{HCH}_2\text{CH}_3$

[2008 O/N (39)]

42.

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.

[2009 M/J (37)]

43.

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.

[2009 O/N-11 (25)]

44.

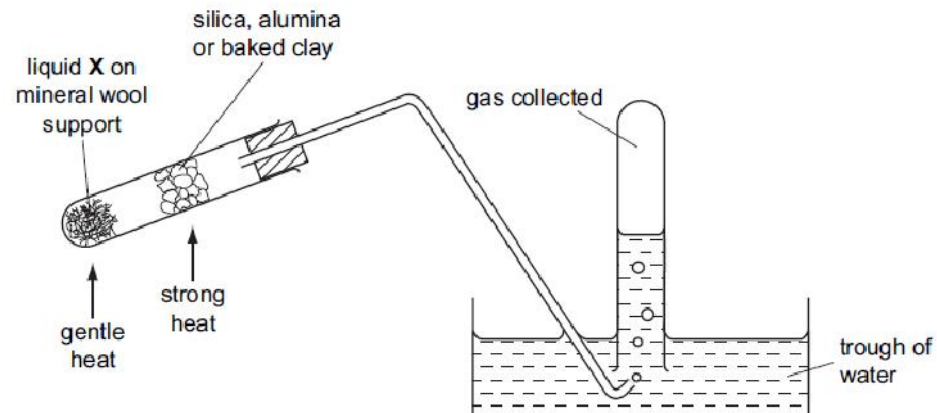
Which equation represents a valid propagation step in the free radical reaction between ethane and chlorine?

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

[2009 O/N-11 (26)]

45.

The diagram shows an experiment.



Which processes could be demonstrated by using the above apparatus?

- 1 the oxidation of ethanol (the liquid X)
- 2 the dehydration of ethanol (the liquid X)
- 3 the cracking of paraffin (the liquid X)

[2009 O/N-11 (39)]

