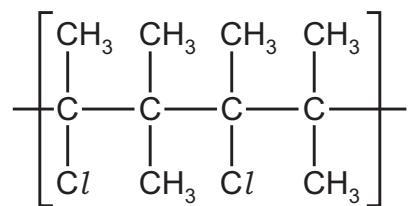


1. Question | 9701 Feb-March 2016 P1 V2 Q22

22 A section showing two repeat units of an addition polymer is shown.



What is the identity of the monomer that produced this polymer?

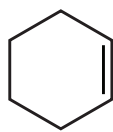
- A** 2-chloro-3-methylbutane
- B** 2-chloro-3-methylbut-2-ene
- C** 2-chloropent-2-ene
- D** 2,4-dichloro-3,3,4,5-tetramethylhexane

2. Question | 9701 Feb-March 2016 P1 V2 Q29

29 Which statement about poly(chloroethene) is correct?

- A** The polymer can be cracked to produce chlorinated alkenes.
- B** The polymer has harmless combustion products.
- C** The polymer is readily biodegradable when buried.
- D** The repeat unit of the polymer has an M_r of 97.

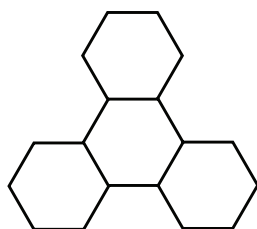
38 The diagram shows the structure of cyclohexene.



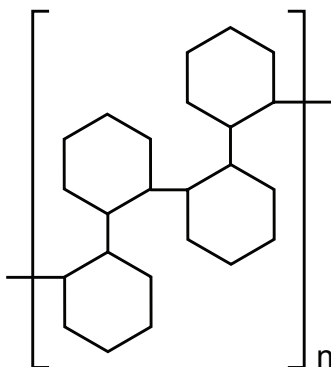
cyclohexene

Which structures could be formed by addition reactions with cyclohexene as the only reactant?

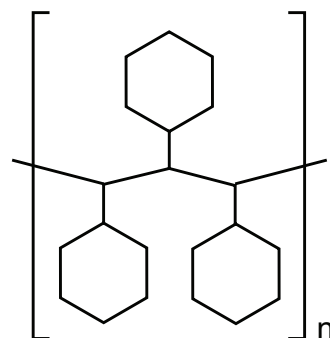
1



2



3

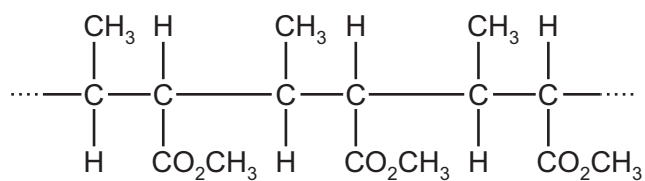


9701 Chemistry Paper 1 - Polymerisation

Topical questions | 61 questions

4. Question | 9701 May-June 2016 P1 V1 Q40

40 The diagram shows the structure of an addition polymer, X.



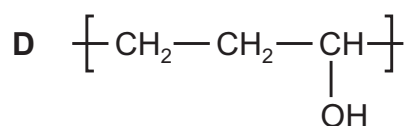
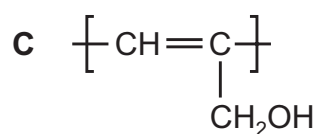
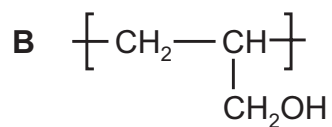
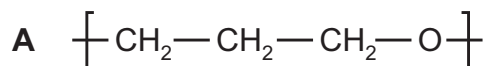
Which reagents react with polymer X?

- 1** aqueous sulfuric acid
- 2** aqueous sodium hydroxide
- 3** sodium

5. Question | 9701 May-June 2016 P1 V2 Q21

- 21** Synthetic resins can be made by polymerisation of a variety of monomers including prop-2-en-1-ol, $\text{CH}_2=\text{CHCH}_2\text{OH}$.

Which structure represents the repeat unit in poly(prop-2-en-1-ol)?



6. Question | 9701 Oct-Nov 2016 P1 V1 Q22

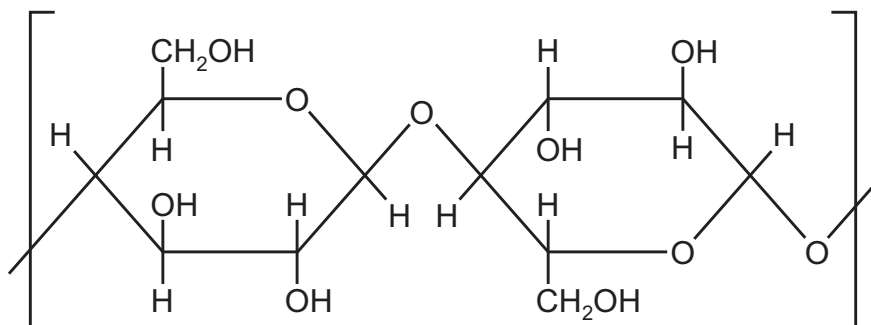
- 22** PVC is difficult to dispose of. Two possible methods are burying it in landfill sites and disposal by combustion.

Which row of the table is correct?

	rate of biodegradation of PVC in landfill sites	gases produced when PVC combusts
A	fast	CO_2 , H_2O , HCl
B	fast	CO_2 , H_2O , Cl_2
C	slow	CO_2 , H_2O , Cl_2
D	slow	CO_2 , H_2O , HCl

7. Question part 1/2 | 9701 Oct-Nov 2016 P1 V2 Q32

- 32** A cathedral in New Zealand has been constructed from cardboard. Cardboard contains polymer molecules. Part of one such polymer molecule is shown below.



Which statements about this polymer are correct?

- 1 The polymer molecules can form hydrogen bonds with each other.
- 2 The polymer can form intermolecular forces with water molecules.
- 3 The polymer will not burn easily because it is a secondary alcohol.

9701 Chemistry Paper 1 - Polymerisation

Topical questions | 61 questions

7. Question part 2/2 | 9701 Oct-Nov 2016 P1 V2 Q32

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

No other combination of statements is used as a correct response.

8. Question | 9701 Oct-Nov 2016 P1 V3 Q22

22 PVC is difficult to dispose of. Two possible methods are burying it in landfill sites and disposal by combustion.

Which row of the table is correct?

	rate of biodegradation of PVC in landfill sites	gases produced when PVC combusts
A	fast	CO_2 , H_2O , HCl
B	fast	CO_2 , H_2O , Cl_2
C	slow	CO_2 , H_2O , Cl_2
D	slow	CO_2 , H_2O , HCl

9. Question | 9701 Feb-March 2017 P1 V2 Q24

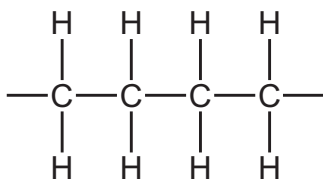
24 Polymerisation of ethene gives poly(ethene).

How does the bonding between carbon atoms in poly(ethene) compare with that in ethene?

- A** longer and stronger in poly(ethene)
- B** longer and weaker in poly(ethene)
- C** shorter and stronger in poly(ethene)
- D** shorter and weaker in poly(ethene)

10. Question | 9701 May-June 2017 P1 V1 Q23

23 The diagram shows a short length of an addition polymer chain.



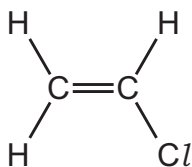
The polymer has a relative molecular mass of approximately 10 000.

Approximately how many monomer units are joined together in each polymer molecule?

- A** 180 **B** 360 **C** 625 **D** 710

11. Question part 1/2 | 9701 May-June 2017 P1 V2 Q38

38 The diagram shows the monomer used to make polyvinyl chloride, PVC.



Assuming that one particular molecule of the polymer forms from n molecules of the monomer (where n is many thousands), which statements are correct?

- 1** The relative molecular mass of this polymer molecule is approximately $62.5n$.
- 2** There are n chiral carbon atoms in this polymer molecule.
- 3** There are $5n$ σ bonds in one polymer molecule.

11. Question part 2/2 | 9701 May-June 2017 P1 V2 Q38

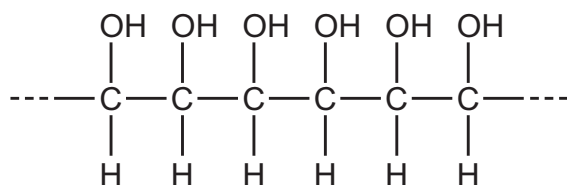
The responses **A** to **D** should be selected on the basis of

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

No other combination of statements is used as a correct response.

12. Question | 9701 May-June 2017 P1 V3 Q24

24 The diagram represents the structure of a polymer.

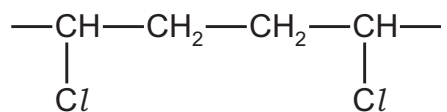


By which method might this polymer be made?

- A** polymerise ethene followed by hydration
- B** polymerise ethene followed by oxidation with cold, acidified KMnO_4
- C** polymerise 1,2-dichloroethene followed by hydrolysis
- D** polymerise 1,2-dichloroethene followed by oxidation with cold, acidified KMnO_4

13. Question | 9701 Oct-Nov 2017 P1 V1 Q23

23 A section of an addition polymer chain is shown.



Which monomer could be used to make this polymer?

- A** $\text{CH}_2\text{CHCH}_2\text{Cl}$
- B** CH_2CHCl
- C** CH_3CHCHCl
- D** $\text{CHClCHCH}_2\text{CH}_2\text{Cl}$

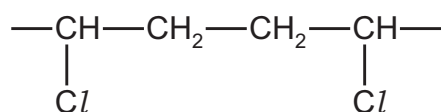
14. Question | 9701 Oct-Nov 2017 P1 V2 Q23

23 Which types of bond are broken and formed in the addition polymerisation of alkenes?

	type of bond broken	type of bond formed
A	π only	σ only
B	π only	σ and π
C	σ and π	σ only
D	σ and π	σ and π

15. Question | 9701 Oct-Nov 2017 P1 V3 Q23

23 A section of an addition polymer chain is shown.



Which monomer could be used to make this polymer?

- A** $\text{CH}_2\text{CHCH}_2\text{Cl}$
- B** CH_2CHCl
- C** CH_3CHCHCl
- D** $\text{CHClCHCH}_2\text{CH}_2\text{Cl}$

16. Question | 9701 Feb-March 2018 P1 V2 Q37

37 Poly(ethene) and PVC are examples of addition polymers.

Which statements are correct?

- 1** On combustion, PVC can produce carbon monoxide, carbon dioxide and hydrogen chloride.
- 2** When poly(ethene) is buried in a landfill site, it will not significantly biodegrade.
- 3** The empirical formula of an addition polymer is the same as that of the monomer.

17. Question part 1/2 | 9701 May-June 2018 P1 V1 Q37

37 Polymer Z contains the length of polymer chain shown below.

This short length of chain is found many times within the chains of polymer Z, although it is **not** the repeat unit.



What could be the name of polymer Z?

- 1** poly(2-chloropropene)
- 2** poly(chloroethene)
- 3** PVC

9701 Chemistry Paper 1 - Polymerisation

Topical questions | 61 questions

17. Question part 2/2 | 9701 May-June 2018 P1 V1 Q37

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

No other combination of statements is used as a correct response.

18. Question | 9701 May-June 2018 P1 V3 Q22

22 Which statement is **not** correct?

- A** Combustion of PVC produces a highly acidic gas.
- B** PVC molecules are saturated.
- C** The empirical formula of PVC is the same as the empirical formula of its monomer.
- D** The repeat unit of PVC is -(CHClCHCl)- .

19. Question | 9701 Oct-Nov 2018 P1 V2 Q22

22 Polyethene is made by the polymerisation of ethene.

Which statement is correct?

- A** The monomer and the polymer have different empirical formulae.
- B** The monomer can be oxidised without heat whereas the polymer cannot.
- C** The monomer can be used as a fuel whereas the polymer cannot.
- D** The monomer has greater van der Waals' forces than the polymer.

37 Which statements about poly(alkene)s are correct?

- 1** Poly(alkene)s do not react with $\text{Br}_2(\text{aq})$ in the dark.
- 2** Disposal of poly(alkene)s by combustion can produce harmful products.
- 3** Poly(alkene)s do not readily biodegrade.

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

No other combination of statements is used as a correct response.

21. Question | 9701 May-June 2019 P1 V3 Q22

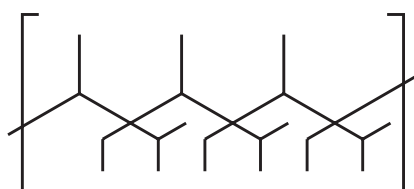
- 22** In polymer Z every carbon atom in the polymer chain is bonded to one hydrogen atom and one methyl group.

Which alkene could be polymerised to make polymer Z?

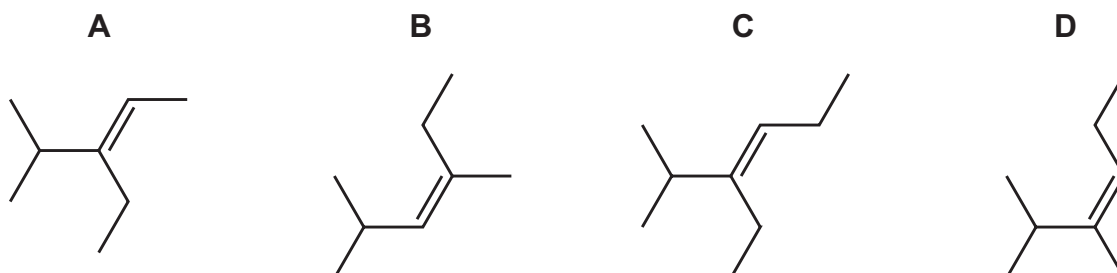
- A** but-1-ene
- B** but-2-ene
- C** methylpropene
- D** propene

22. Question | 9701 Feb-March 2020 P1 V2 Q24

- 24** A section of a polymer chain is shown.



What is the correct monomer?



23. Question | 9701 May-June 2020 P1 V1 Q24

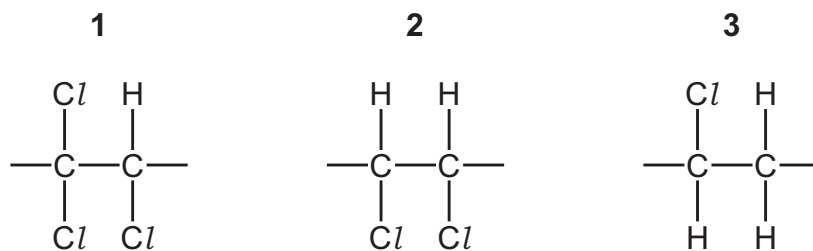
- 24** Poly(propene) is an addition polymer.

What are the C–C–C bond angles along its polymer chain?

- A** They are all 109° .
- B** Half of them are 109° and half are 120° .
- C** Half of them are 90° and half are 180° .
- D** They are all 120° .

40 A mixture of the three isomers of $C_2H_2Cl_2$ is polymerised.

Which sequences will be seen within the polymer chains?



25. Question | 9701 May-June 2020 P1 V2 Q29

29 PVC is used as a packaging material.

What holds the different polymer strands together in a piece of solid PVC?

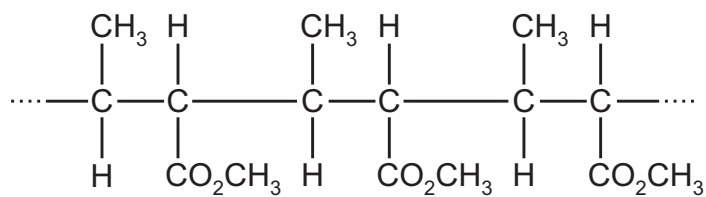
- A** covalent bonds
- B** hydrogen bonds
- C** ionic bonds
- D** van der Waals' forces

26. Question | 9701 Oct-Nov 2020 P1 V1 Q22

22 Which statement is correct when referring to the complete combustion of PVC?

- A** A gas is made which contributes to global warming.
- B** Carbon dioxide and water are the only products.
- C** If water is used to clean the exhaust gases, the water becomes alkaline.
- D** There is no need to treat the exhaust gases as the products are non-hazardous.

40 The diagram shows part of the structure of polymer X.

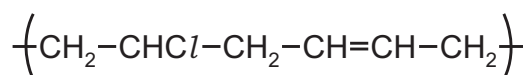


Which reagents react with polymer X?

- 1** aqueous sulfuric acid
- 2** aqueous sodium hydroxide
- 3** sodium

28. Question | 9701 Oct-Nov 2020 P1 V2 Q22

22 A polymer has the following repeat unit. It is made from two different monomers.

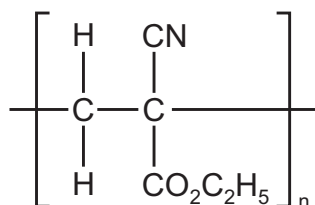


Which pair of monomers could be used to make this polymer?

- A** $\text{CH}_2 = \text{CHCl}$ and $\text{CH}_2 = \text{CH}_2$
- B** $\text{CH}_2 = \text{CHCl}$ and $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$
- C** $\text{CH}_3 - \text{CH}_2\text{Cl}$ and $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$
- D** $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$ and $\text{CH}_2 = \text{CHCl}$

29. Question part 1/2 | 9701 Oct-Nov 2020 P1 V2 Q32

32 The repeat unit of a polymer is shown.



Which types of intermolecular forces exist in the solid polymer?

- 1** temporary dipole – induced dipole interactions
- 2** permanent dipole – permanent dipole interactions
- 3** hydrogen bonds

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

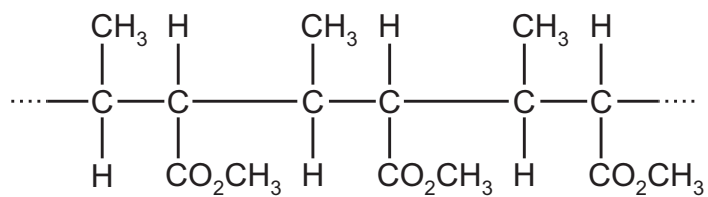
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

No other combination of statements is used as a correct response.

22 Which statement is correct when referring to the complete combustion of PVC?

- A** A gas is made which contributes to global warming.
- B** Carbon dioxide and water are the only products.
- C** If water is used to clean the exhaust gases, the water becomes alkaline.
- D** There is no need to treat the exhaust gases as the products are non-hazardous.

40 The diagram shows part of the structure of polymer X.



Which reagents react with polymer X?

- 1** aqueous sulfuric acid
- 2** aqueous sodium hydroxide
- 3** sodium

32. Question part 1/2 | 9701 May-June 2021 P1 V2 Q38

38 Which changes are commonly involved in the formation of an addition polymer?

- 1** the formation of a σ -bond
- 2** the breaking of a π -bond
- 3** the change in hybridisation of the orbitals of a carbon atom from sp^2 to sp^3

32. Question part 2/2 | 9701 May-June 2021 P1 V2 Q38

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

No other combination of statements is used as a correct response.

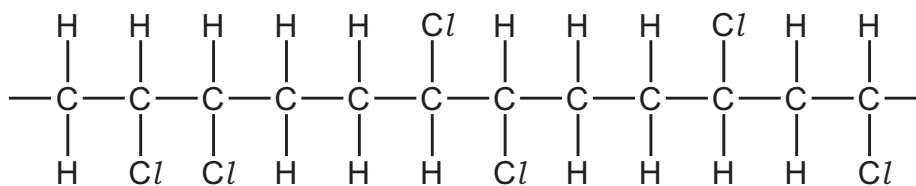
33. Question | 9701 Oct-Nov 2021 P1 V2 Q38

38 Which of the molecular formulae represent at least one compound that can undergo addition polymerisation?

- 1** C_4H_8
- 2** C_2H_3Cl
- 3** C_3H_6O

34. Question | 9701 Feb-March 2022 P1 V2 Q37

37 A molecule of a polymer contains the sequence shown.

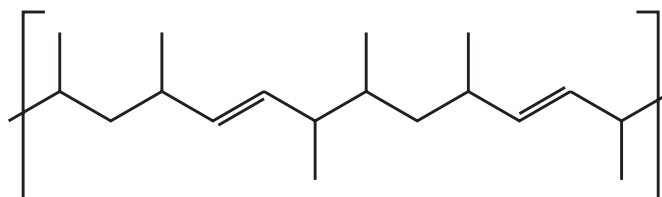


Which monomer could produce this polymer by addition polymerisation?

- A** $\text{CHCl}=\text{CHCl}$
- B** $\text{CH}_2=\text{CHCl}$
- C** $\text{CH}_3\text{CCl}=\text{CHCl}$
- D** $\text{CH}_3\text{CCl}=\text{CH}_2$

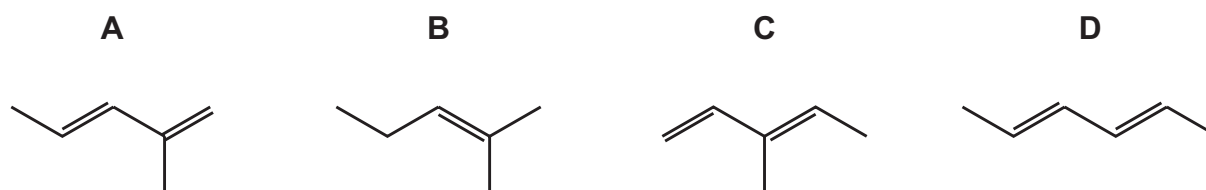
35. Question | 9701 May-June 2022 P1 V1 Q39

39 The diagram shows a section of an addition polymer formed from two different monomers.



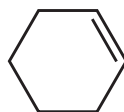
One of the monomers is propene.

What is the other monomer?



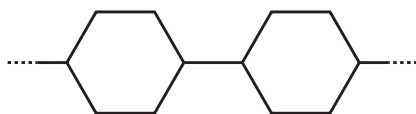
39 Cyclohexene, as shown in the diagram, can form an addition polymer.

cyclohexene

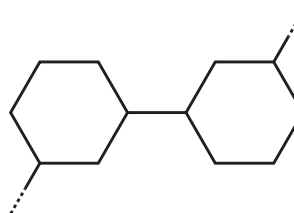


Which structure represents a section of the polymer?

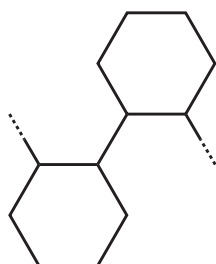
A



B



C



D



40 One molecule of an addition polymer containing 2000 repeat units has an M_r of 112 000.

The polymer molecule contains chiral centres.

What is a possible monomer for this polymer?

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

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Important values, constants and standards

molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Faraday constant	$F = 9.65 \times 10^4 \text{ C mol}^{-1}$
Avogadro constant	$L = 6.02 \times 10^{23} \text{ mol}^{-1}$
electronic charge	$e = -1.60 \times 10^{-19} \text{ C}$
molar volume of gas	$V_m = 22.4 \text{ dm}^3 \text{ mol}^{-1}$ at s.t.p. (101 kPa and 273 K) $V_m = 24.0 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions
ionic product of water	$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ (at 298 K (25 °C))
specific heat capacity of water	$c = 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1}$ (4.18 J g ⁻¹ K ⁻¹)

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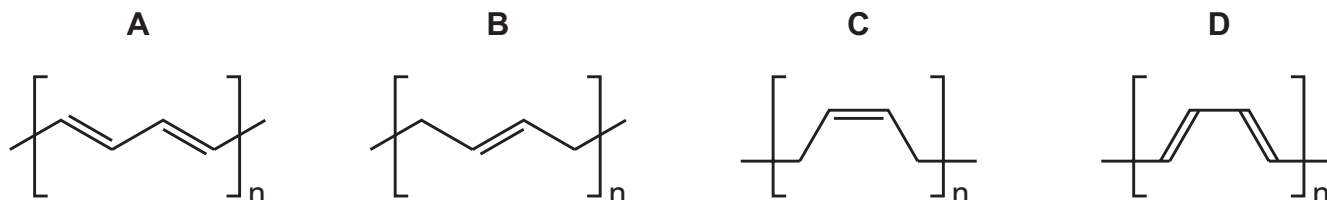
The Periodic Table of Elements

Group																									
1	2	Key												13	14	15	16	17	18						
		atomic number atomic symbol name relative atomic mass												1 H hydrogen 1.0											
3	4																								
Li lithium 6.9	Be beryllium 9.0																								
11	12																								
Na sodium 23.0	Mg magnesium 24.3																								
19	20																								
K potassium 39.1	Ca calcium 40.1																								
37	38																								
Rb rubidium 85.5	Sr strontium 87.6																								
55	56																								
Cs caesium 132.9	Ba barium 137.3																								
87	88																								
Fr francium —	Ra radium —																								
</																									

38. Question | 9701 Oct-Nov 2022 P1 V1 Q39

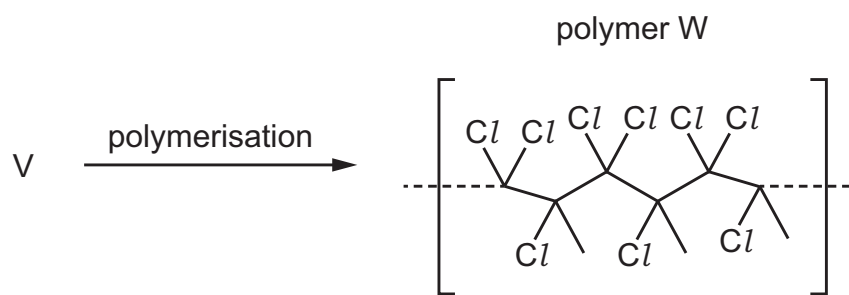
- 39** The monomer buta-1,3-diene can undergo addition polymerisation in various ways. Two of the polymers that can be made are called *cis*-poly(buta-1,3-diene) and *trans*-poly(buta-1,3-diene). In these names *cis* and *trans* have their usual meanings.

What is the structure of the repeat unit of *cis*-poly(buta-1,3-diene)?



39. Question | 9701 Oct-Nov 2022 P1 V2 Q39

- 39** Compound V polymerises to form polymer W. A section of polymer W is shown.



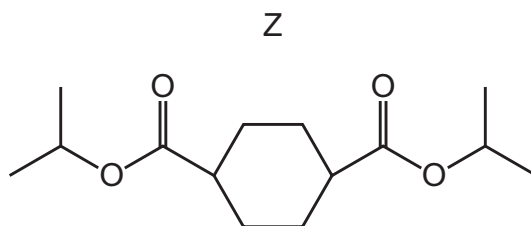
What is the correct name of compound V?

- A** 1,1,2-trichlorobutene
B 1,1,2-trichloroethene
C 1,1,2-trichloropropene
D 1,1,2-trichloro-2-methylethene

40. Question | 9701 Oct-Nov 2022 P1 V3 Q32

32 An alcohol, X, reacts with a dicarboxylic acid, Y, to form a double ester, Z.

The diagram shows the structure of the ester.



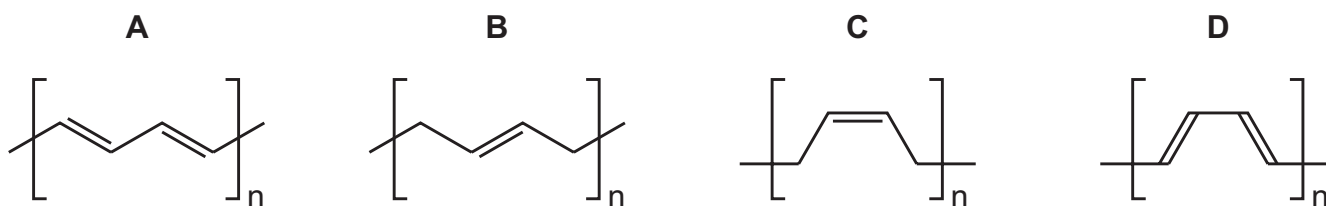
Which row about the reactants forming ester Z is correct?

	the class of alcohol X	the shape of the ring in Y
A	secondary	non-planar
B	secondary	planar
C	tertiary	non-planar
D	tertiary	planar

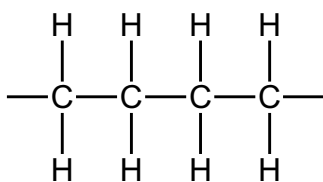
41. Question | 9701 Oct-Nov 2022 P1 V3 Q39

39 The monomer buta-1,3-diene can undergo addition polymerisation in various ways. Two of the polymers that can be made are called *cis*-poly(buta-1,3-diene) and *trans*-poly(buta-1,3-diene). In these names *cis* and *trans* have their usual meanings.

What is the structure of the repeat unit of *cis*-poly(buta-1,3-diene)?



28 The diagram shows a short length of an addition polymer chain.

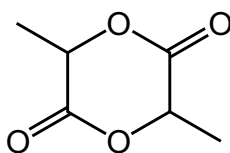


The polymer has a relative molecular mass of approximately 10 000.

Approximately how many monomer units are joined together in each polymer molecule?

- A** 180 **B** 360 **C** 625 **D** 710

29 Lactide is an intermediate in the manufacture of a synthetic fibre.



lactide

Which compound, on heating with an acid catalyst, can produce lactide?

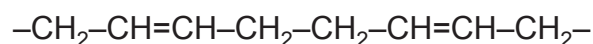
- A** hydroxyethanoic acid
B 2-hydroxybutanoic acid
C 2-hydroxypropanoic acid
D 3-hydroxypropanoic acid

9701 Chemistry Paper 1 - Polymerisation

Topical questions | 61 questions

44. Question | 9701 May-June 2023 P1 V1 Q39

39 The diagram shows a section of a polymer molecule.



Which monomer will produce this polymer?

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

45. Question | 9701 May-June 2023 P1 V3 Q39

39 In polymer G every carbon atom in the polymer chain is bonded to one hydrogen atom and one methyl group.

Which alkene could be polymerised to make polymer G?

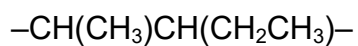
- A** but-1-ene
- B** but-2-ene
- C** methylpropene
- D** propene

46. Question | 9701 Oct-Nov 2023 P1 V2 Q6

6 Which feature is present in both ethene and poly(ethene)?

- A** bond angles of 109.5°
- B** π covalent bonds
- C** σ covalent bonds
- D** sp^3 orbitals

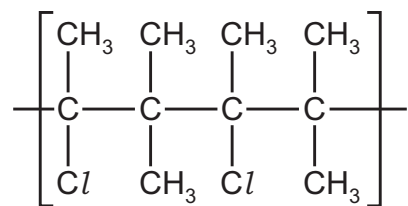
39 The formula shows the repeat unit of an addition polymer.



What is the correct name of the monomer from which this polymer is made?

- A** 1-methyl-2-ethylethene
- B** 1-ethylprop-1-ene
- C** pent-2-ene
- D** pent-1-ene

39 A section showing two repeat units of an addition polymer is shown.

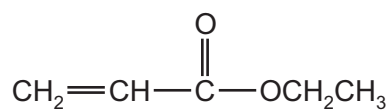


What is the identity of the monomer that produced this polymer?

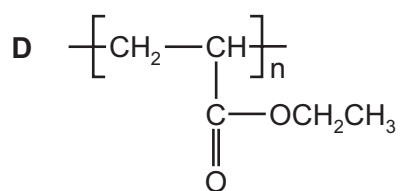
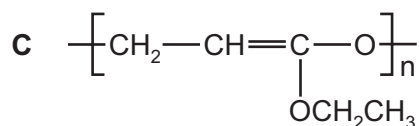
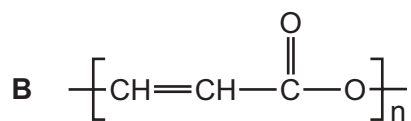
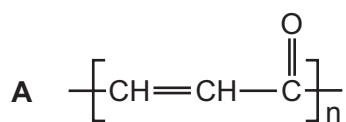
- A** 2-chloro-3-methylbutane
- B** 2-chloro-3-methylbut-2-ene
- C** 2-chloropent-2-ene
- D** 2,4-dichloro-3,3,4,5-tetramethylhexane

39 An addition polymer is made from monomer Z.

monomer Z



What is the structure of the polymer made from this monomer?



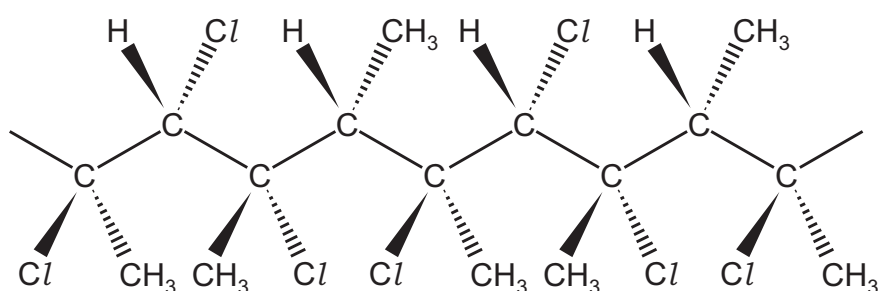
50. Question | 9701 May-June 2024 P1 V3 Q37

37 Which statement about PVC is correct?

- A** Combustion products of PVC are very alkaline and harmful to breathe in.
- B** The empirical formula of PVC is the same as the empirical formula of the monomer.
- C** Molecules of PVC are unsaturated.
- D** The repeat unit of PVC is $(\text{CH}_2\text{CCl}_2)$.

51. Question | 9701 Oct-Nov 2024 P1 V1 Q39

39 The diagram shows a section of an addition polymer. The polymer is made using two different monomers.

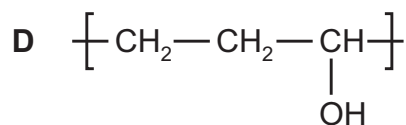
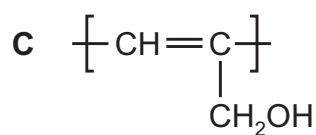
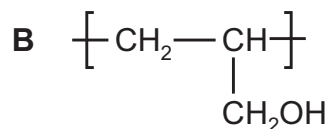
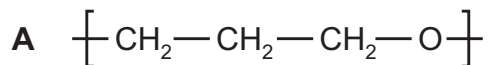


What are the names of the two monomers needed to make this polymer?

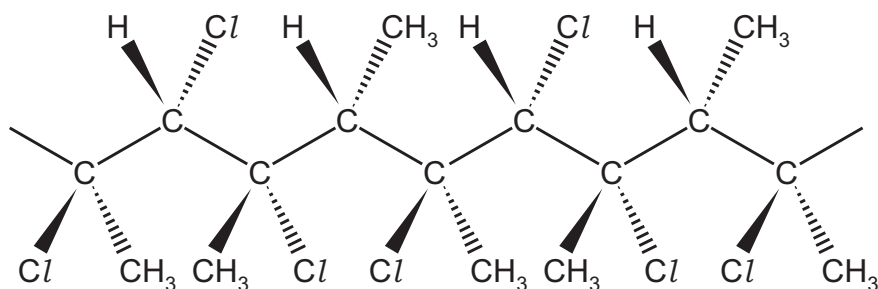
- A** 1,2-dichloropropene and 2-chlorobut-2-ene
- B** 2,3-dichlorobut-2-ene and chloropropene
- C** 1,2-dichloropropene and chloroethene
- D** chloropropene and 2-chlorobut-2-ene

- 39** Synthetic resins can be made by polymerisation of a variety of monomers including prop-2-en-1-ol, $\text{CH}_2=\text{CHCH}_2\text{OH}$.

Which structure represents the repeat unit in the polymer poly(prop-2-en-1-ol)?



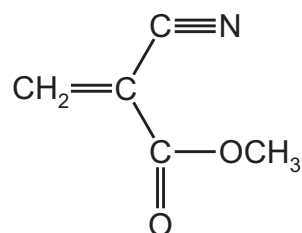
- 39** The diagram shows a section of an addition polymer. The polymer is made using two different monomers.



What are the names of the two monomers needed to make this polymer?

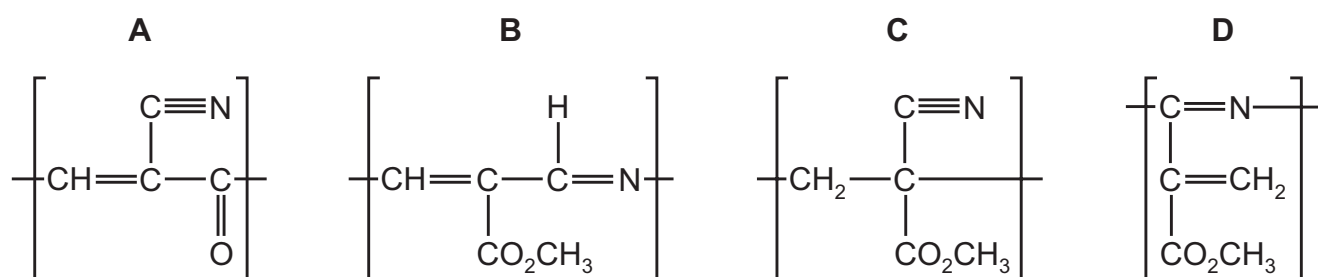
- A** 1,2-dichloropropene and 2-chlorobut-2-ene
- B** 2,3-dichlorobut-2-ene and chloropropene
- C** 1,2-dichloropropene and chloroethene
- D** chloropropene and 2-chlorobut-2-ene

29 The structure of compound G is shown.



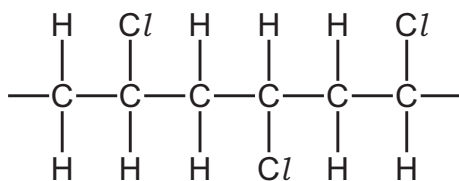
Compound G undergoes addition polymerisation.

Which diagram shows the repeat unit of the polymer formed?

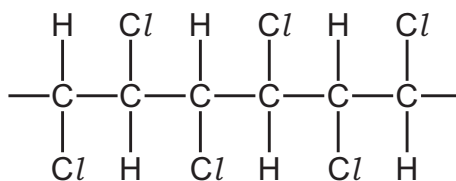


32 Which structure represents part of the polymer chain of PVC?

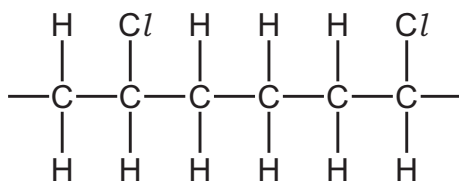
A



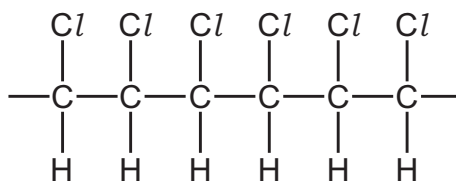
B



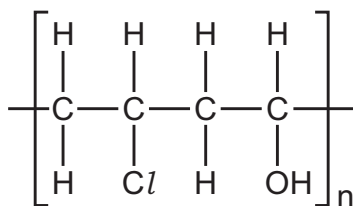
C



D



26 The repeat unit of a polymer is shown.



Three statements about this polymer are listed.

- 1 Its disposal is hazardous because it produces toxic gases when burned.
- 2 Two different monomers are used to make this polymer.
- 3 The monomer for this polymer is 3-chlorobut-2-ene-1-ol.

Which statements are correct?

- A** 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 only

25 Polymer J has repeat unit $-\text{[CH(C}_2\text{H}_5\text{)CH(CH}_3\text{)]}-$.

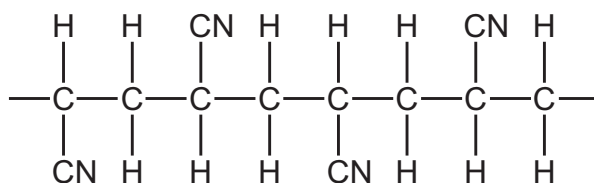
Polymer K has repeat unit $-\text{[CH(CH}_3\text{)CH(CH}_3\text{)]}-$.

Which row is correct?

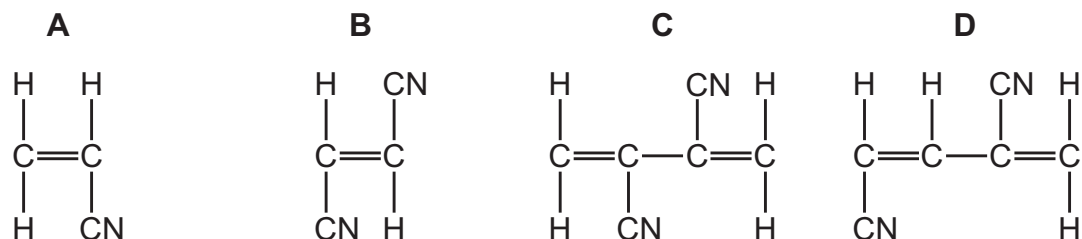
	monomer from which polymer J is produced	monomer from which polymer K is produced
A	pent-1-ene	but-1-ene
B	pent-1-ene	but-2-ene
C	pent-2-ene	but-1-ene
D	pent-2-ene	but-2-ene

58. Question | 9701 May-June 2025 P1 V4 Q39

39 The diagram shows part of a polymer chain.

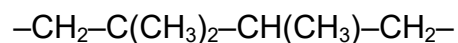


Which monomer would form this polymer?



59. Question | 9701 Oct-Nov 2025 P1 V1 Q32

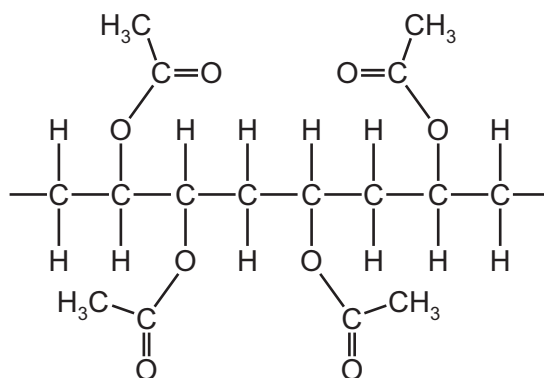
32 A small section of a polymer produced from two monomers is shown.



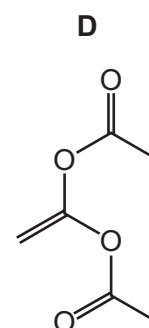
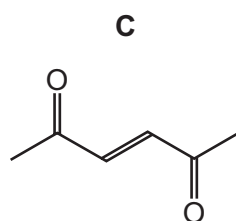
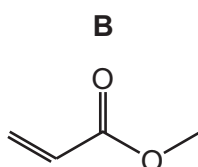
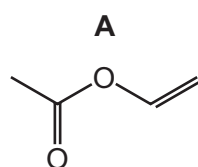
What are the two monomers?

- A** but-1-ene and propene
- B** but-2-ene and propene
- C** ethene and pent-2-ene
- D** methylpropene and propene

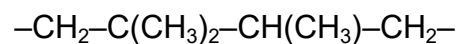
60. Question | 9701 Oct-Nov 2025 P1 V2 Q39

39 A section of an addition polymer is shown.

Which monomer is used to make this polymer?



32 A small section of a polymer produced from two monomers is shown.



What are the two monomers?

- A** but-1-ene and propene
- B** but-2-ene and propene
- C** ethene and pent-2-ene
- D** methylpropene and propene