

Summer
Start for
A-Level
Chemistry





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Other books in this series

Previously published...

- | | |
|--|------------|
| • Maths and Calculator skills for Science Students | March 2016 |
| • Maths (The Chemistry bits) for GCSE Combined Science | May 2016 |
| • Maths (The Chemistry bits) for GCSE Triple Science | May 2016 |
| • Science revision Guide | April 2017 |
| • Maths Revision Guide | April 2017 |
| • Summer Start for A-Level Chemistry | May 2017 |

Coming soon...

- Atoms, Electrons, Structure and Bonding Workbook
- Organic Chemistry Workbook
- Maths (The Physics bits) for GCSE Combined Science
- Maths (The Physics bits) for GCSE Triple Science
- Summer Start for A-Level Physics
- Maths for A-Level Chemistry

Chances are if you want a maths/science book I've written it or I am writing it.

For full book listings visit www.PrimroseKitten.com

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Acknowledgements

Thank you to my husband for putting up with my spending every night writing this and for correcting all of my SPG mistakes. To my sons for being the inspiration behind Primrose Kitten. To Aimee for kick-starting this book. 😊



Introduction

Welcome to this workbook and thank you for supporting me to make more videos by buying this. 😊

I'm constantly telling you the best way to learn is by practising questions, so I've made you a book full of practice questions.

135 multiple choice questions to reflect the style of exam questions, 60 equations for you to balance (in 3 different formats), 65 compounds for you to work out the formula for and a lots of things that you need to recall for A-Level.

This book is not designed as a text book or revision guide, but as a workbook. There are lots of good (and bad) expensive and free revision guides out there, on my YouTube channel and other great websites. So there is no point in me adding to the masses.

Taking some GCSE topics, a bit further and introducing some new topics for A-Level. This is not a complete list of all the GCSE topics that also come up at A-Level; just enough to keep you (Very) busy over the summer and give you an advantage when you start year 12.

All the teaching, all the new content, is available for free on my YouTube channel, this book is for you to practice and learn. The best way to approach this is to watch the teaching video, or after class try a section and check the answers.

All the videos mentioned in this workbook are collected together in this playlist <https://www.youtube.com/playlist?list=PL7O6CcKg0HaEXpTtPXeiOfcZFsmhdle6e>



Atomic Structure

Video links; The Atom, Isotopes and Ions - Atoms, Electrons, Structure and Bonding #1

<https://youtu.be/POTn3f4O-iE>

1. Which element has 2 protons?
 - a. Hydrogen
 - b. Helium
 - c. Lithium
 - d. Neon
2. Which element has 7 protons?
 - a. Nitrogen
 - b. Lithium
 - c. Carbon
 - d. Helium
3. Which element has 31 protons?
 - a. Gallium
 - b. Sodium
 - c. Phosphorus
 - d. Vanadium
4. Which element has 24 protons?
 - a. Chromium
 - b. Cobalt
 - c. Magnesium
 - d. Gallium
5. Which element has an atomic number of 38?
 - a. Potassium
 - b. Strontium
 - c. Calcium
 - d. Rubidium
6. Which element has an atomic number of 20?
 - a. Neon
 - b. Calcium
 - c. Potassium
 - d. Argon



7. Which element has an atomic number of 11?
- a. Boron
 - b. Lithium
 - c. Sodium
 - d. Helium
8. Which element has an atomic number of 12?
- a. Magnesium
 - b. Carbon
 - c. Fluorine
 - d. Silicon
9. Which element has an atomic number of 14?
- a. Carbon
 - b. Nitrogen
 - c. Silicon
 - d. Fluorine
10. Which element has a mass number of 14?
- a. Carbon
 - b. Nitrogen
 - c. Silicon
 - d. Fluorine
11. Which element has a mass number of 12?
- a. Magnesium
 - b. Carbon
 - c. Fluorine
 - d. Silicon
12. Which element has a mass number of 11?
- a. Boron
 - b. Lithium
 - c. Sodium
 - d. Helium
13. Which element has a mass number of 40?
- a. Zirconium
 - b. Scandium
 - c. Potassium
 - d. Argon
14. Which element has 3 electrons?
- a. Hydrogen
 - b. Helium
 - c. Lithium
 - d. Neon



15. Which element has 10 electrons?

- a. Neon
- b. Calcium
- c. Potassium
- d. Argon

16. Which element has 19 electrons?

- a. Neon
- b. Calcium
- c. Potassium
- d. Argon

17. Which element has 8 neutrons?

- a. Oxygen
- b. Sodium
- c. Phosphorus
- d. Vanadium

18. Which element has 12 neutrons?

- a. Oxygen
- b. Sodium
- c. Phosphorus
- d. Magnesium

19. Which element has 35 neutrons?

- a. Cobalt
- b. Zinc
- c. Arsenic
- d. Yttrium

20. Which element has 50 neutrons?

- a. Cobalt
- b. Zinc
- c. Arsenic
- d. Yttrium



Properties of Ionic Compounds

Video links;

Drawing Ionic Bonding - Atoms, Electrons, Structure and Bonding #3

<https://youtu.be/pvaQMCKuGLE>

Properties of ionic compounds - Atoms, Electrons, Structure and Bonding #4

https://youtu.be/_h4mVHBAANA

1. Which of the following are likely to show ionic bonding?
 - a. HCl
 - b. NaCl
 - c. Na
 - d. Cl₂
2. Which of the following are likely to show ionic bonding?
 - a. H₂SO₄
 - b. Fe
 - c. MgO
 - d. CO
3. Which of the following are likely to show ionic bonding?
 - a. I₂
 - b. K
 - c. KI
 - d. HI
4. Which of the following are properties of ionic compounds
 - a. High melting point high boiling point and always conducts electricity
 - b. Low melting point low boiling point and always conducts electricity
 - c. High melting point high boiling point and conducts when molten or dissolved
 - d. Low melting point low boiling point and conducts when molten or dissolved
5. Why do ionic compounds conduct when molten or dissolved?
 - a. They always conduct electricity no matter what the state.
 - b. The positive ions need to be able to give up electrons
 - c. They don't
 - d. Free movement of ions



6. What happens to electrons in ionic bonding?
- Nothing
 - Shared
 - Disappears
 - Transferred
7. Which of the following pair of statements about charges is true?
- Both metals and non-metals will be positive
 - Both metals and non-metals will be negative
 - Metals will be positive and non-metals will be negative
 - Metals will be negative and non-metals will be positive
8. What charge will a sodium ion have?
- 0
 - +1
 - 1
 - +2
9. What charge will a calcium ion have?
- 0
 - +1
 - 1
 - +2
10. What charge will a chlorine ion have?
- 0
 - +1
 - 1
 - +2
11. a negative ion is attracted to ...
- only the positive ion that donated an electron
 - only the closest positive ion to it
 - any positive ion that is close enough to feel an attraction
 - all positive ions in the lattice
12. an ionic bond is...
- one atom donating an electron to another atom
 - an electrostatic attraction between two neighbouring ions
 - an electrostatic attraction between any neighbouring ions
 - two atoms sharing electrons
13. ionic compounds are soluble in water because...
- water wiggles in-between ions
 - the slight charges on water break down the lattice
 - everything is soluble in water
 - they are not soluble in water



14. ionic compounds are soluble in...
- a. only non-polar solvents
 - b. any solvent
 - c. only polar solvents
 - d. any solvent at high enough temperatures
15. a giant ionic lattice is made up of...
- a. groups of molecules
 - b. a large network of paired ions
 - c. only giant ions, smaller ions don't form a lattice
 - d. ions that are strongly bonded to all neighbouring ions



Simple Covalent Bonding

Video links;

Drawing Covalent Bonding Lewis Structures or Dot and Cross-Atoms, Electrons, Structure and Bonding #6 <https://youtu.be/4SkHncOprhs>

Properties of simple covalent compounds - Atoms, Electrons, Structure and Bonding #7 <https://youtu.be/2-CjI8nWFW0>

Dative Coordinate Covalent Bonding - Atoms, Electrons, Structure and Bonding #8 <https://youtu.be/2sRU6KbL3sE>

1. Which pair of elements is going to form a covalent bond?
 - a. magnesium and iodine
 - b. aluminium and oxygen
 - c. fluorine and sulfur
 - d. sodium and iron
2. Which pair of elements is going to form a covalent bond?
 - a. lithium and chlorine
 - b. hydrogen and oxygen
 - c. calcium and carbon
 - d. aluminium and nitrogen
3. Which pair of elements is most likely to form a covalent bond?
 - a. carbon and chlorine
 - b. carbon and iron
 - c. carbon and neon
 - d. carbon and magnesium
4. Which of these compounds show covalent bonding?
 - a. $AlCl_3$
 - b. PCl_3
 - c. Al_2O_3
 - d. Li_2O
5. Which of these compounds show covalent bonding?
 - a. MgO
 - b. $CHCl_3$
 - c. BeF_2
 - d. $NaOH$



6. Which of the following reasons explains the low melting point of covalent substances?
- Weak intramolecular forces within the molecules
 - The free electrons between the atoms creates weak bonding
 - The metals create uneven bonding with the non-metals
 - Weak intermolecular forces between the molecules.
7. Which set of properties are true for covalent compounds
- low melting point, low boiling point and conducts electricity
 - low melting point, high boiling point and doesn't conduct electricity
 - low melting point, high boiling point and conducts electricity
 - low melting point, low boiling point and doesn't conduct electricity
8. How many electrons are shared by each element in a single covalent bond?
- 1
 - 2
 - 3
 - 4
9. How many electrons are shared by each element in a double covalent bond?
- 1
 - 2
 - 3
 - 4
10. How many electrons are shared by each element in a dative covalent bond?
- 1 and 1
 - 2 and 2
 - 2 and 0
 - 2 and 1
11. Which of the following have only single bonds?
- CO_2
 - CO
 - Cl_2
 - N_2
12. Which of the following have only double bonds?
- CO_2
 - CO
 - Cl_2
 - N_2



13. Which of the following have only triple bonds?
- a. CO_2
 - b. CO
 - c. Cl_2
 - d. N_2
14. Which of the following is going to show dative covalent bonding?
- a. NH_3
 - b. NH_4^+
 - c. H_2O
 - d. CH_4
15. Which of the following is going to show dative covalent bonding?
- a. NH_3BF_3
 - b. PF_3
 - c. H_2SO_4
 - d. CaCO_3
16. Which of the following is going to show dative covalent bonding?
- a. CO
 - b. CO_2
 - c. CH_4
 - d. NaOH
17. What type of bonds are in O_2 ?
- a. Single
 - b. Double
 - c. Triple
 - d. Dative
18. What type of bonds are in HF ?
- a. Single
 - b. Double
 - c. Triple
 - d. Dative
19. What type of bonds are in pentane?
- a. Single
 - b. Double
 - c. Triple
 - d. Dative
20. What type of bonds are in CN^- ?
- a. Single
 - b. Double
 - c. Triple
 - d. Dative



Reference table of common ions formulae

YOU NEED TO LEARN ALL OF THESE!!!

I don't like to shout but it's really important, readymade flashcards are available from my website to help

As a general rule; elements in group one form +1 ions, group 2 +2 ions, group 6 -2 ions and group 7 -1 ions.

The roman numerals in brackets refer to the oxidation state. Oxidation states are explained a bit later on.

Positive		Negative	
Hydrogen	H ⁺	Fluoride	F ⁻
Lithium	Li ⁺	Chloride	Cl ⁻
Sodium	Na ⁺	Bromide	Br ⁻
Potassium	K ⁺	Iodide	I ⁻
Copper (I)	Cu ⁺	Hydroxide	OH ⁻
Silver	Ag ⁺	Nitrate	NO ₃ ⁻
Ammonium	NH ₄ ⁺	Nitrite	NO ₂ ⁻
		Hydrogencarbonate	HCO ₃ ⁻
Magnesium	Mg ²⁺	Hydrogensulfate	HSO ₄ ⁻
Barium	Ba ²⁺		
Strontium	Sr ²⁺	Sulfate	SO ₄ ²⁻
Calcium	Ca ²⁺	Carbonate	CO ₃ ²⁻
Iron (II)	Fe ²⁺	Sulfide	S ²⁻
Copper (II)	Cu ²⁺	Oxide	O ²⁻
Nickel (II)	Ni ²⁺		
Zinc	Zn ²⁺	Nitride	N ³⁻
Tin (II)	Sn ²⁺	phosphate	PO ₄ ³⁻
Lead (II)	Pb ²⁺		
Chromium	Cr ³⁺		
Iron (III)	Fe ³⁺		
Aluminium	Al ³⁺		



Formula of Ionic Compounds

Video links;

Formula of Ionic Compounds - Atoms, Electrons, Structure and Bonding #5

<https://youtu.be/ipz1UMP1YYY>

For each of these give the formula

1. silver iodide
2. magnesium iodine
3. lithium iodide
4. lead (II) iodide
5. copper (II) iodide
6. iron (III) bromide
7. iron (II) bromide
8. barium bromide
9. strontium bromide
10. strontium chloride
11. copper (II) chloride
12. iron (II) chloride
13. calcium chloride
14. lithium chloride
15. barium chloride
16. sodium oxide
17. potassium oxide
18. zinc oxide
19. aluminium oxide
20. strontium oxide
21. copper (I) oxide
22. copper (II) oxide
23. iron (III) oxide
24. iron (II) oxide
25. chromium (III) oxide
26. iron (II) carbonate
27. ammonium carbonate
28. copper (II) carbonate
29. lead (II) carbonate



30. sodium carbonate
31. magnesium carbonate
32. iron (II) carbonate
33. barium carbonate
34. potassium hydrogencarbonate
35. strontium hydrogencarbonate
36. lithium hydrogencarbonate
37. ammonium hydrogencarbonate
38. sodium hydrogencarbonate
39. magnesium hydrogencarbonate
40. ammonium sulfide
41. iron (II) sulfide
42. aluminium sulfide
43. iron (III) sulfate
44. iron (II) sulfate
45. lead (II) sulfate
46. aluminium sulfate
47. zinc sulfate
48. barium sulfate
49. ammonium sulfate
50. magnesium sulfate
51. lithium sulfate
52. magnesium hydroxide
53. aluminium hydroxide
54. potassium hydroxide
55. ammonium hydroxide
56. barium hydroxide
57. lithium hydroxide
58. calcium hydroxide
59. strontium hydroxide
60. aluminium nitrate
61. ammonium nitrate
62. lead (II) nitrate
63. sodium nitrite
64. lithium nitride
65. magnesium nitride



Oxidation Numbers

Video links;

The Rules - Oxidation States - Atoms, Electrons, Structure and Bonding #12

<https://youtu.be/DILY8nJlwgE>

Naming Compound Using Oxidation States - Atoms, Electrons, Structure and Bonding #13

<https://youtu.be/Nr4hZYGjm0A>

Formula of Compounds Using Oxidation States - Atoms, Electrons, Structure and Bonding #14

<https://youtu.be/GFYvIliJheI>

Redox Reactions and Oxidation States - Atoms, Electrons, Structure and Bonding #15

<https://youtu.be/OLPhqYrMoWI>

Exceptions to the Rules of Oxidation States - Atoms, Electrons, Structure and Bonding #16

<https://youtu.be/1qxLlogM8Sq>

Disproportionation Redox Reactions and Oxidation States-Atoms, Electrons, Structure and Bonding

#17 <https://youtu.be/59Dn63BEDMA>

The Rules

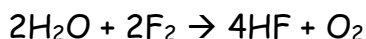
- all uncombined elements have an oxidation state of 0
- molecules with only one element in have an oxidation state of 0
- the oxidation state of an ion is the same as its charge.
- in a compound the sum of the oxidation states is equal to the overall oxidation state.
- oxygen nearly always has an oxidation state of -2, except when combined with fluorine or a peroxide.
- hydrogen in nearly always +1, except when combined as a hydride when it is -1.
- fluorine is always -1.
- chlorine is nearly always -1, except when combined with fluorine or oxygen



1. What is the oxidation state of Br in Br₂?
 - a. 0
 - b. +2
 - c. -2
 - d. +1
2. What is the oxidation state of H⁺?
 - a. 0
 - b. +1
 - c. -1
 - d. 1
3. What is the oxidation state of C in CO₂?
 - a. +4
 - b. +2
 - c. -2
 - d. -4
4. What is the oxidation state of F in SF₆?
 - a. -1
 - b. +6
 - c. +1
 - d. -6
5. What is the oxidation state of P in PO₄³⁻?
 - a. +11
 - b. +8
 - c. +5
 - d. +3
6. In the following reaction state which element has been oxidised.
$$2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$$
 - a. both
 - b. neither
 - c. iron
 - d. chlorine
7. In the following reaction state which element has been oxidised.
$$\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$$
 - a. both
 - b. neither
 - c. hydrogen
 - d. chlorine
8. In the following reaction state which element has been oxidised.
$$2\text{FeCl}_2 + \text{Cl}_2 \rightarrow 2\text{FeCl}_3$$
 - a. both
 - b. neither
 - c. iron
 - d. chlorine

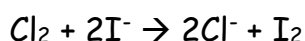


9. In the following reaction state which element has been oxidised.



- a. none of them
- b. fluorine
- c. hydrogen
- d. oxygen

10. In the following reaction state which element has been oxidised.



- a. both
- b. neither
- c. chlorine
- d. iodine

11. Give the full name for SnO

- a. tin oxide
- b. tin oxide (II)
- c. tin(II) oxide
- d. tin(IV) oxide

12. Give the full name for SnO₂

- a. tin oxide
- b. tin oxide (II)
- c. tin(II) oxide
- d. tin(IV) oxide

13. Give the full name for PbCl₄

- a. lead chloride (IV)
- b. lead(IV) chloride
- c. lead(IV) chloride (IV)
- d. lead(I) chloride

14. Give the full name for Mn(OH)₂

- a. manganese(II) hydroxide
- b. manganese hydroxide (II)
- c. manganese(I) hydroxide
- d. manganese(II) hydroxide (II)

15. Give the full name for Cu₂O

- a. copper(I) oxide
- b. copper(II) oxide
- c. copper(III) oxide
- d. copper(IV) oxide

16. Write the formula for copper (II) nitrate (V)

- a. Cu₂(NO₃)₅
- b. CuNO₃
- c. Cu(NO₃)₂
- d. Cu₂NO₅



17. Write the formula for potassium chlorate (III)

- a. KCl_2
- b. $KClO_2$
- c. KCl_3
- d. $KClO_3$

18. Write the formula for iron (III) hydroxide

- a. Fe_3OH
- b. $Fe_3(OH)_3$
- c. $Fe(OH)_3$
- d. $Fe_2(OH)_2$

19. Write the formula for sodium chlorate (v)

- a. $NaCl_5$
- b. $NaCl_3$
- c. $NaClO_5$
- d. $NaClO_3$

20. Write the formula for chromium(III) oxide

- a. Cr_2O_3
- b. Cr_3O_2
- c. Cr_3O
- d. Cr_3O_3



Balancing Equations 1

These are best done by trial and error

Video links; <https://youtu.be/HxKOigOcJD8>

1. $\text{Mg} + \text{HIO}_3 \rightarrow \text{Mg}(\text{IO}_3) + \text{H}_2$
2. $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{NaCl} + \text{BaSO}_4$
3. $\text{NaI} + \text{HOCl} \rightarrow \text{NaIO}_3 + \text{HCl}$
4. $\text{Al} + \text{MnO}_2 \rightarrow \text{Al}_2\text{O}_3 + \text{Mn}$
5. $\text{Ba}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{H}_2\text{O}$
6. $\text{K}_2\text{CO}_3 + \text{AgNO}_3 \rightarrow \text{KNO}_3 + \text{Ag}_2\text{CO}_3$
7. $\text{Sr}(\text{ClO}_4)_2 + \text{K}_2\text{SO}_4 \rightarrow \text{SrSO}_4 + \text{KClO}_4$
8. $\text{Al} + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2$
9. $\text{HNO}_3 + \text{H}_2\text{S} \rightarrow \text{NO} + \text{S} + \text{H}_2\text{O}$
10. $\text{Pb}(\text{NO}_3)_2 + \text{KCl} \rightarrow \text{PbCl}_2 + \text{KNO}_3$
11. $\text{MgCO}_3 + \text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$
12. $\text{H}_2\text{SO}_4 + \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
13. $\text{SO}_2 + \text{HNO}_2 \rightarrow \text{H}_2\text{SO}_4 + \text{NO}$
14. $\text{HI} + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{O} + \text{H}_2\text{S} + \text{I}_2$
15. $\text{HCl} + \text{Al}(\text{OH})_3 \rightarrow \text{H}_2\text{O} + \text{AlCl}_3$
16. $\text{NaOH} + \text{CuSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Cu}(\text{OH})_2$
17. $\text{HF} + \text{Ba}(\text{NO}_3)_2 \rightarrow \text{HNO}_3 + \text{BaF}_2$
18. $\text{NO}_2 + \text{H}_2 \rightarrow \text{NH}_3 + \text{H}_2\text{O}$
19. $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$
20. $\text{HCl} + \text{FeCl}_2 + \text{H}_2\text{O}_2 \rightarrow \text{FeCl}_3 + \text{H}_2\text{O}$



Balancing Equations 2

These are best done using the oxidation numbers method

Video links; Balancing Equations Using Oxidation States - Atoms, Electrons, Structure and Bonding #18 <https://youtu.be/xQ9th5CpKgo>

1. $\text{KBr} + \text{H}_2\text{SO}_4 \rightarrow \text{KHSO}_4 + \text{Br}_2 + \text{SO}_2 + \text{H}_2\text{O}$
2. $\text{KCl} + \text{MnO}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Cl}_2 + \text{H}_2\text{O}$
3. $\text{NaI} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{I}_2 + \text{H}_2\text{S} + \text{H}_2\text{O}$
4. $\text{Zn} + \text{NO}_3^- + \text{H}^+ \rightarrow \text{Zn}^{2+} + \text{NH}_4^+ + \text{H}_2\text{O}$
5. $\text{HNO}_3 + \text{H}_3\text{AsO}_3 \rightarrow \text{NO} + \text{H}_3\text{AsO}_4 + \text{H}_2\text{O}$
6. $\text{PbS} + \text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + \text{H}_2\text{O}$
7. $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$
8. $\text{KIO}_3 + \text{KI} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O} + \text{I}_2$
9. $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$
10. $\text{HNO}_3 + \text{I}_2 \rightarrow \text{HIO}_3 + \text{NO}_2 + \text{H}_2\text{O}$
11. $\text{H}_2\text{SO}_3 + \text{KMnO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{SO}_4 + \text{H}_2\text{O}$
12. $\text{FeSO}_4 + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 \rightarrow \text{Cr}_2(\text{SO}_4)_3 + \text{K}_2\text{SO}_4 + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
13. $\text{MnSO}_4 + \text{NaBiO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NaMnO}_4 + \text{Bi}_2(\text{SO}_4)_3 + \text{H}_2\text{O} + \text{Na}_2\text{SO}_4$
14. $\text{FeSO}_4 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
15. $\text{H}_2\text{C}_2\text{O}_4 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O}$
16. $\text{MoO}_3 + \text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{Mo}_2\text{O}_3 + \text{ZnSO}_4 + \text{H}_2\text{O}$
17. $\text{KMnO}_4 + \text{KCl} + \text{H}_2\text{SO}_4 \rightarrow \text{MnSO}_4 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O} + \text{Cl}_2$
18. $\text{KNO}_2 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{MnSO}_4 + \text{H}_2\text{O} + \text{KNO}_3 + \text{K}_2\text{SO}_4$
19. $\text{K}_2\text{CrO}_4 + \text{Na}_2\text{SO}_3 + \text{HCl} \rightarrow \text{KCl} + \text{Na}_2\text{SO}_4 + \text{CrCl}_3 + \text{H}_2\text{O}$
20. $\text{NaOH} + \text{Br}_2 \rightarrow \text{NaBr} + \text{NaBrO}_3 + \text{H}_2\text{O}$



Turning experiments in to balanced symbol equations

For each of the following experiments give the balanced symbol equation

Video links; Writing Balanced Equations from Word Descriptions. <https://youtu.be/WtkxGYAuZqU>

1. Aluminium and iron (III) oxide are reacted together.
2. Nitrogen and chlorine gas react together.
3. Carbon and chlorine gas react together.
4. Calcium chloride is reacted potassium hydroxide.
5. Tetraphosphorus reacts with chlorine.
6. Ethene completely combusts.
7. Magnesium reacts with carbon dioxide.
8. Hydrogen peroxide decomposes.
9. Ethane completely combusts.
10. Iron (III) oxide can carbon react.
11. Titanium (IV) chloride reacts with magnesium.
12. Phosphine (PH_3) is reacted with oxygen.
13. Phosphane (PH_5) is reacted with oxygen.
14. Copper (II) chloride is reacted with sodium hydroxide.
15. Potassium iodide reacts with lead (II) nitrate.
16. Phosphorus trichloride reacts with water.
17. Propane burns completely.
18. Lead (II) nitrate decomposes.
19. Glucose reacts with oxygen.
20. Ammonia reacts with oxygen.



Organic Chemistry Keywords

You need to learn these, again flashcards to help are available on my website

Addition polymerisation - A long chain formed of repeating units, eg alkenes

Alkane - a hydrocarbon that only has single bonds in it.

General Formula - the simplest algebraic formula for a compound

Empirical Formula - a formula showing the lowest whole number ratios of elements in a compound.

Structural Formula - The minimal amount of detail needed to determine the special arrangement of elements in a compound

Unsaturated - a compounds that has double or triple bonds

Hydrocarbon - a compounds that is made from hydrogen and carbon only

Alkene - a compound that has at least one double bond

Alkyl group - a side chain that has been forms from an alkane by removing a hydrogen

Functional group - the part of an organic compound that is responsible for the properties

Saturated - a compound that only has single bonds

Aromatic - a compound that contains a benzene ring

Alkynes - A compound that has a least one triple bond

Radical - an element or compound that has an unpaired electron

Homologous Series - a set of organic compounds with the same functional group

Displayed formula - This shows that position of all atoms and the bonding between them



Naming Organic Compounds - The Rules

The prefix of the name indicates the number of carbon atoms present in the molecule.

The functional group, and hence the homologous series to which the compound belongs is usually indicated by the suffix of the name.

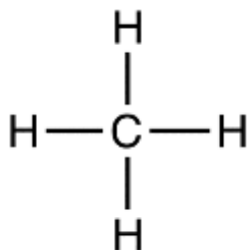
1. Find the longest carbon - carbon chain (not always straight).
2. Identify the side branches.
3. Circle all the functional groups and identify them.
4. Number the chain so that the branch with the highest priority functional group has the lowest number possible.
5. Di-, tri etc used for more than one branch of same kind.
6. Branches in alphabetical order.
7. Comma's between numbers eg 2,2 or 2,3.
8. Hyphens separate numbers from letters eg 2,2-dimethyl and no gaps between names eg methylpropane



Naming alkanes

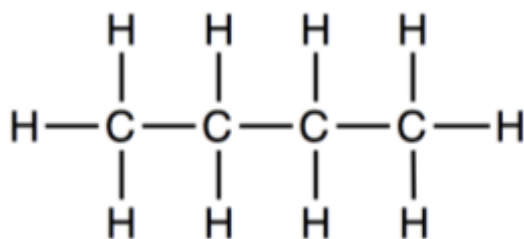
Video link; Naming Alkanes Using IUPAC Systematic Nomenclature - Organic Chemistry #1

<https://youtu.be/uv7pJsSiq5w>



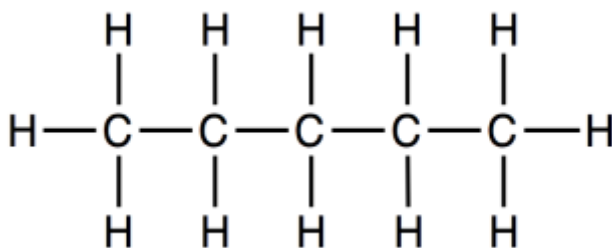
1.

- a. methane
- b. ethane
- c. propane
- d. butane



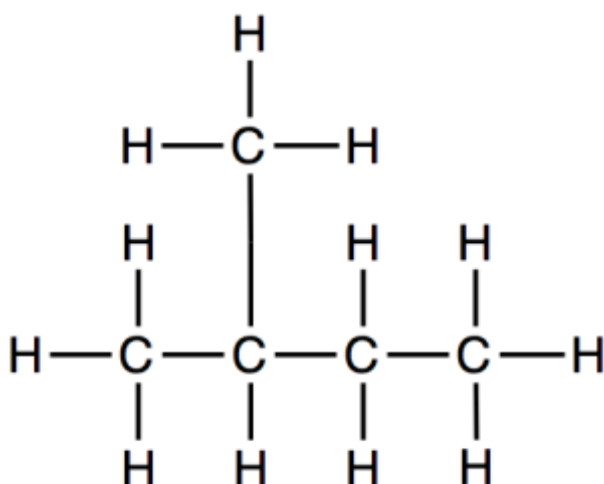
2.

- a. butane
- b. propane
- c. pentane
- d. ethane



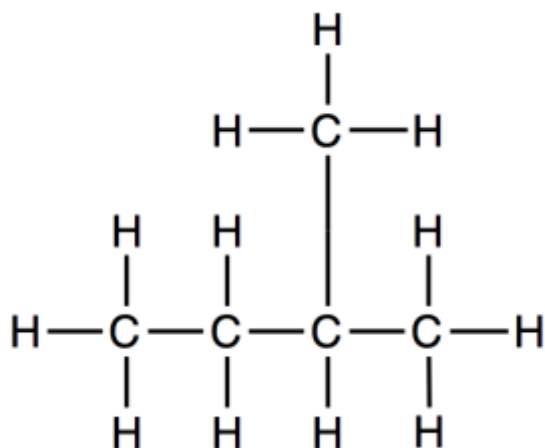
3.

- a. 2-ethylpropane
- b. 1-methylbutane
- c. pentane
- d. 2-methylpentane



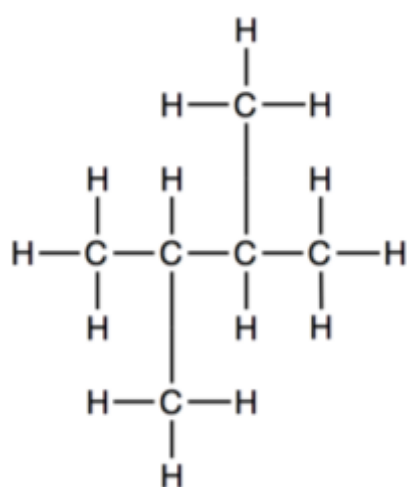
4.

- a. pentane
- b. 2-methylbutane
- c. 1-methylbutane
- d. 3-methylbutane



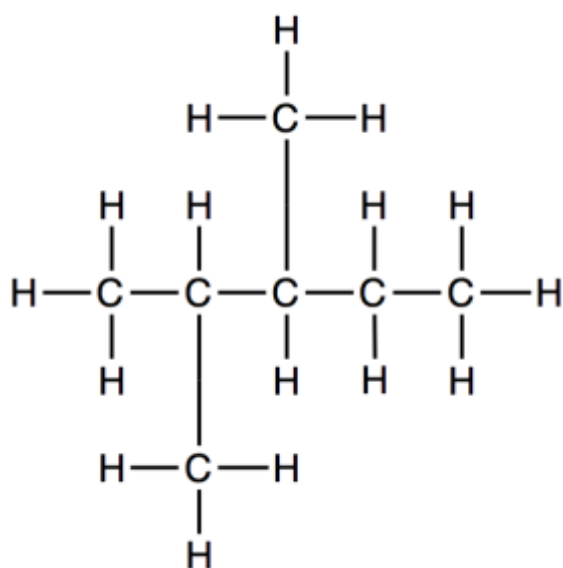
5.

- a. pentane
- b. 2-methylbutane
- c. 1-methylbutane
- d. 3-methylbutane



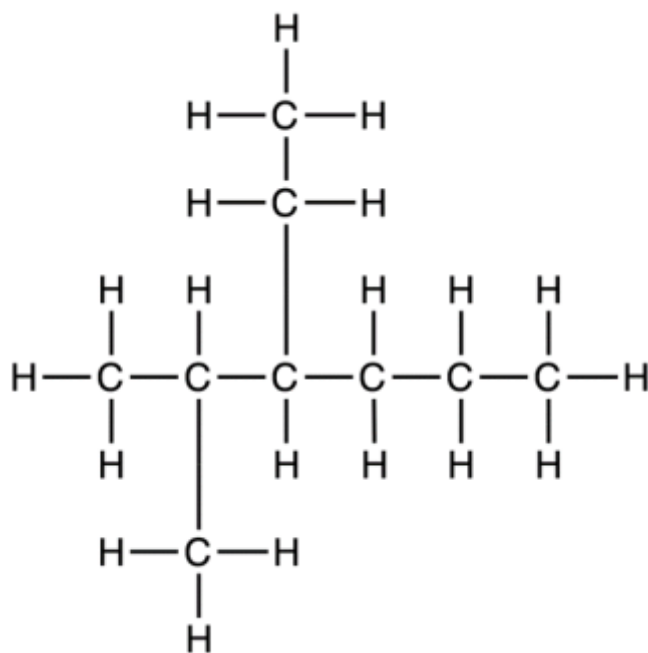
6.

- a. 2,3-methylbutane
- b. 2,2-dimethylbutane
- c. 2,3-dimethylpentane
- d. 2,3-dimethylbutane

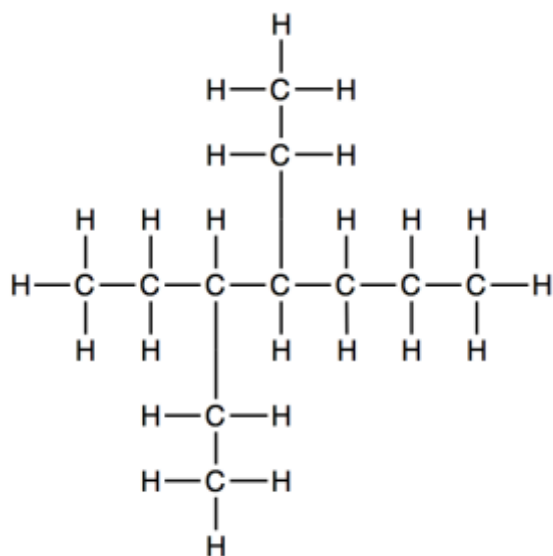


7.

- a. 3-ethyl-2-methylbutane
- b. 2-ethyl-2-methylbutane
- c. 2,3-dimethylpentane
- d. 2,3-dimethylbutane



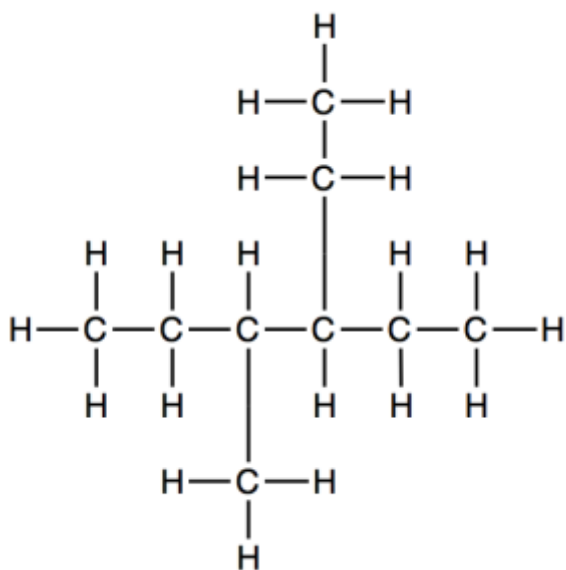
- a. 3-methyl-2-ethylhexane
- b. 3-ethyl-2-methylhexane
- c. 2-ethyl-3-methylhexane
- d. 2-methyl-3-ethylhexane



- a. 3-ethyl-4-propylhexane
- b. 3-propyl-4-ethylhexane
- c. 4-ethyl-3-propylhexane
- d. 3,4-diethylheptane

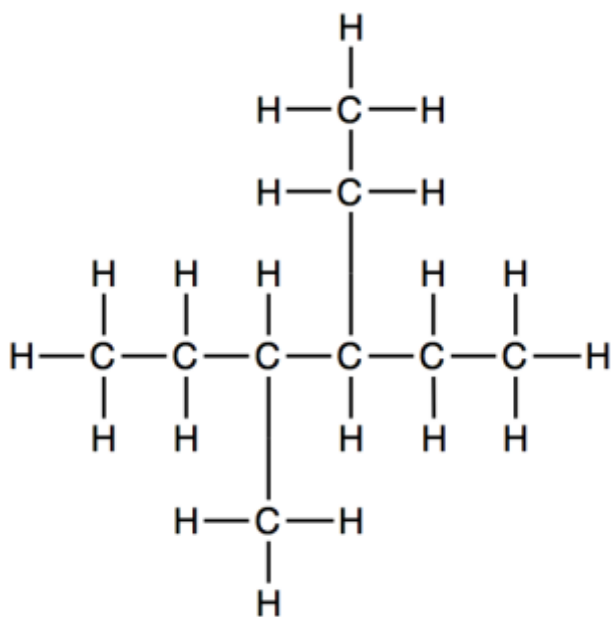


10.

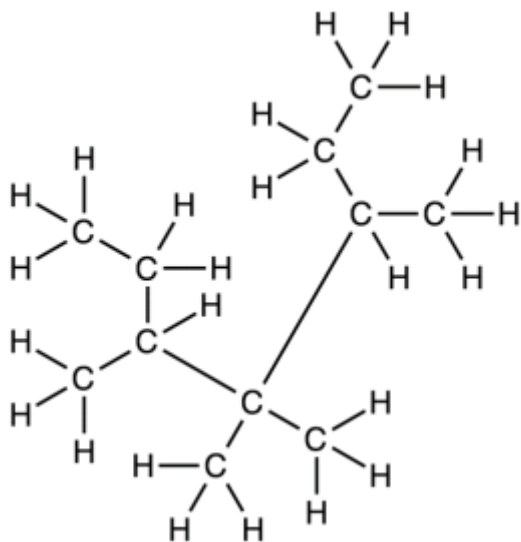


- a. 3-ethyl-4-methylhexane
- b. 3,4-diethylpentane
- c. 2,3-diethylpentane
- d. 2-ethyl-4-methylhexane

11.

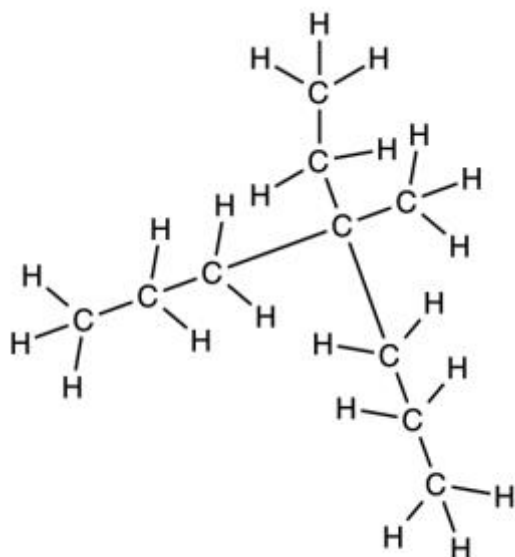


- a. 3,4-dimethylhexane
- b. 3,4-diethylhexane
- c. 4-ethyl-3-methylhexane
- d. 4-ethyl-3-methylheptane



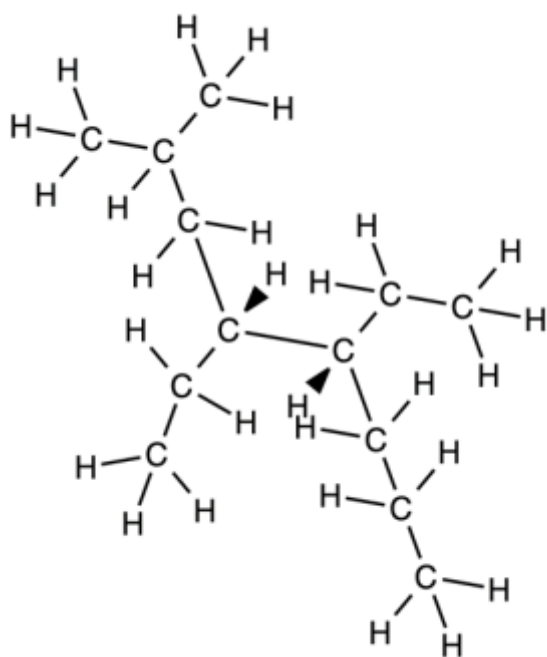
12.

- a. 3-methylheptane
- b. 3,4,4,5-methylheptane
- c. 3,4,5-tetramethylheptane
- d. 3,4,4,5-tetramethylheptane



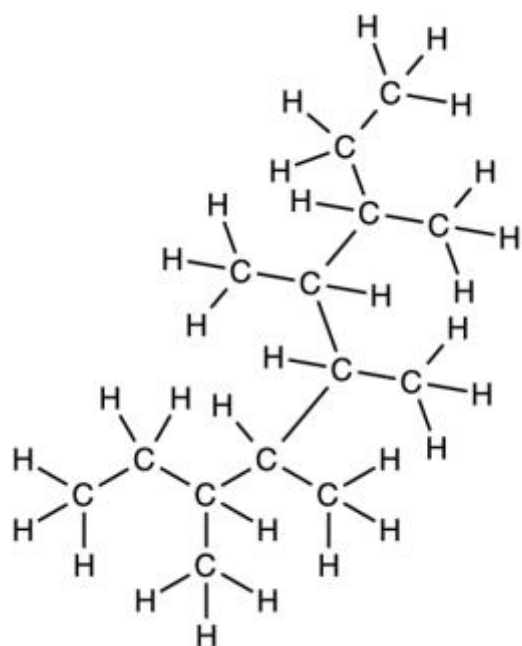
13.

- a. 4-ethyl-4-methylheptane
- b. 4-methyl-4-ethylheptane
- c. 4-methyl-4-propylhexane
- d. 3-methyl-3-propylhexane



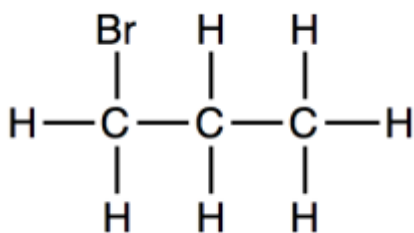
- a. 3,4-dipropylpentane
- b. 2,3-dipropylpentane
- c. 4,5-diethyl-2-methyloctane
- d. 4,5-diethyl-7-methyloctane

14.



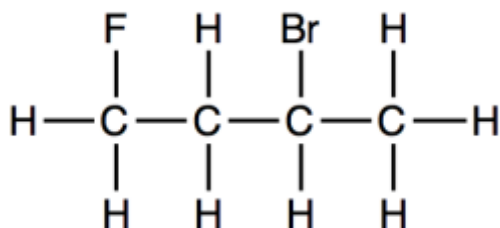
- a. 7,6,5,4-methylnonane
- b. 1,2,3,4,5,6,7-heptamethylheptane
- c. 1,2,3,4,5,6,7-methylheptane
- d. 3,4,5,6,7-pentamethylnonane

15.



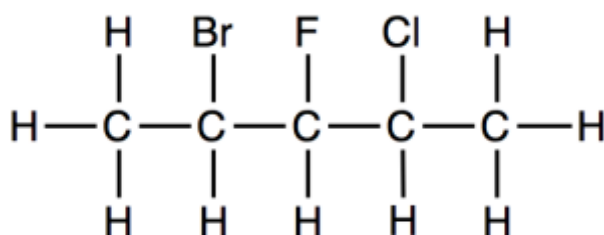
16.

- a. 3- bromopropane
- b. bromopropane
- c. 1-bromopropane
- d. 2- bromopropane



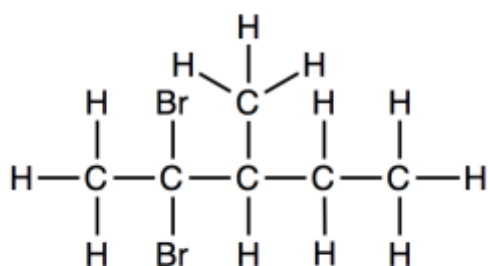
17.

- a. 3-bromo-1-fluorobutane
- b. 1-fluoro-3-bromobutane
- c. 2-bromo-4-fluorobutane
- d. 4-fluoro-2-bromobutane



18.

- a. 2-bromo-4-chloro-3-fluoropentane
- b. 2-bromo-3-fluoropentane
- c. 4-chloro-3-fluoropentane
- d. 2-bromo-4-chloropentane

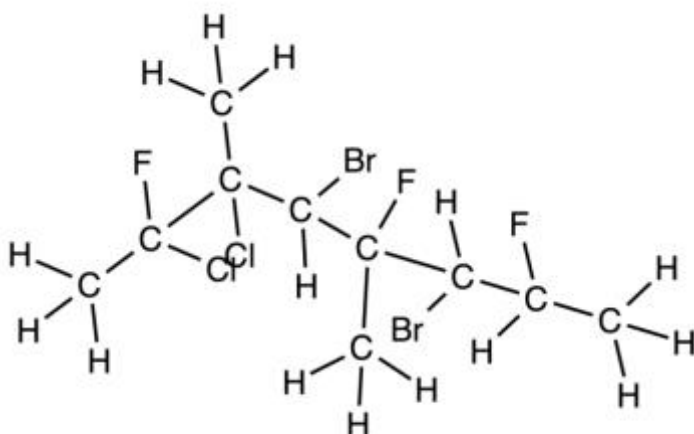


19.

- a. 2-bromo-3-methylpentane
- b. 2,2-dibromo-3-methylpentane
- c. 3-methyl 2,2-dibromopentane
- d. 4,4-dibromo-3-methylpentane



20.



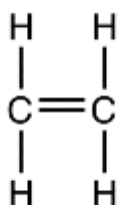
- a. 2,4,7-trifluoro-6,7-dichloro-4,6-diethyl-3,5-dibromooctane
- b. 2,5,7-trifluoro-2,3-dichloro-3,5-diethyl-4,6-dibromooctane
- c. 3,5-dibromo-6,7-dichloro-4,6-diethyl-2,4,7-trifluorooctane
- d. 4,6-dibromo-2,3-dichloro-3,5-diethyl-2,5,7-trifluorooctane



Naming Alkenes

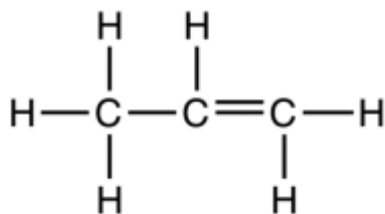
Video link; Naming Alkenes Using IUPAC Systematic Nomenclature - Organic Chemistry #2

<https://youtu.be/C-Rt17aLXWQ>



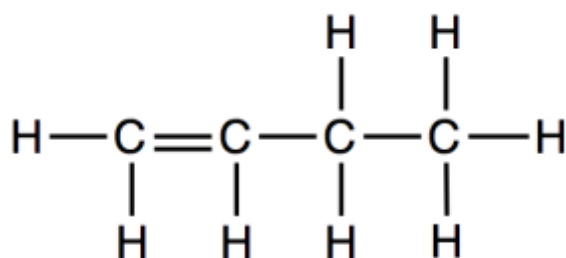
1.

- a. methene
- b. ethene
- c. methane
- d. ethane



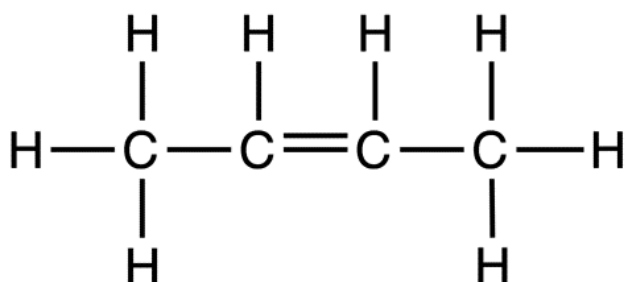
2.

- a. prop-1-ene
- b. prop-2-ene
- c. propane
- d. prop-3-ene



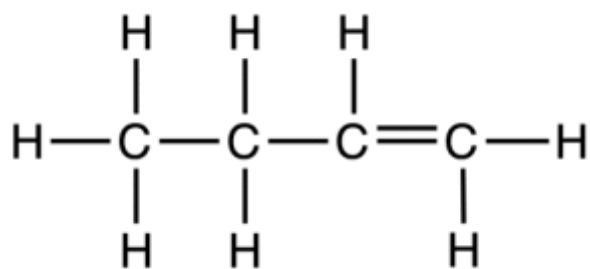
3.

- a. but-4-ene
- b. but-3-ene
- c. but-2-ene
- d. but-1-ene



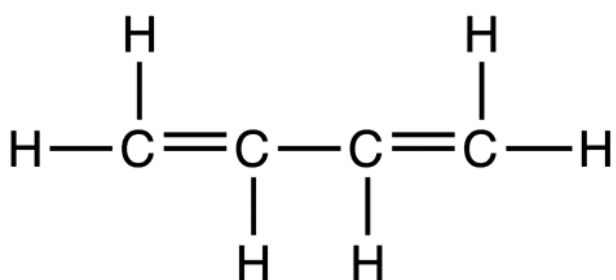
4.

- a. but-4-ene
- b. but-3-ene
- c. but-2-ene
- d. but-1-ene



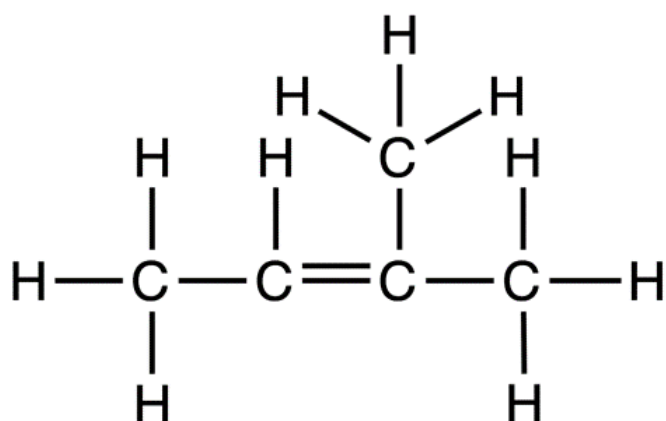
5.

- a. but-4-ene
- b. but-3-ene
- c. but-2-ene
- d. but-1-ene



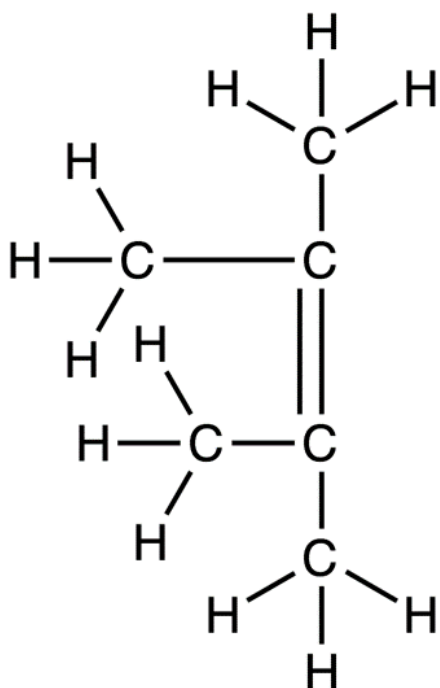
6.

- a. but-1,3-diene
- b. but-1-ene
- c. but-2-ene
- d. but-3-ene



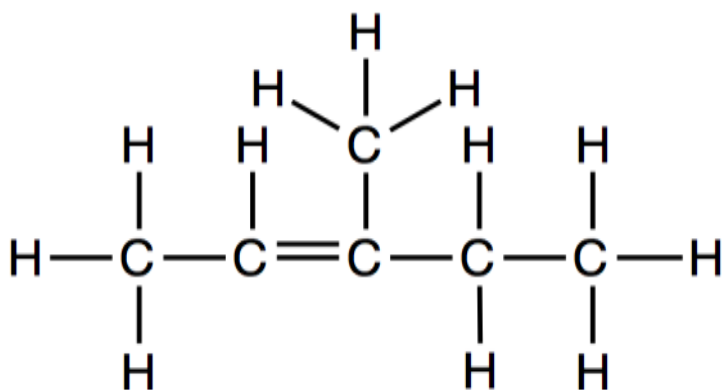
7.

- a. 3-methylbut-2-ene
- b. 2-methylbut-2-ene
- c. pent-2-ene
- d. 2-methylpent-2-ene



- a. 3,2-methylbut-2-ene
- b. 2,3-dimethylbut-2-ene
- c. pent-2-ene
- d. 2,3-methylpent-2-ene

8.

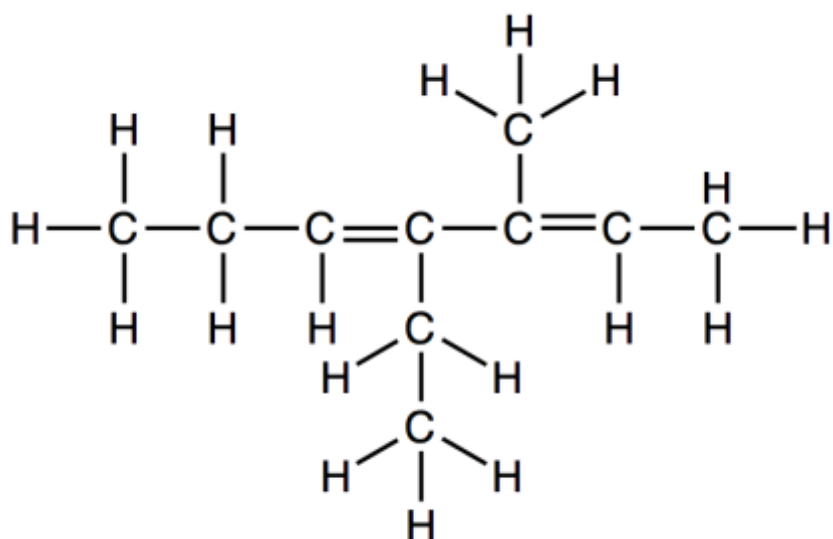


- a. 3-methylpent-2-ene
- b. 1,2-dimethylbut-1-ene
- c. 3,4-dimethylbut-3-ene
- d. 3-methylpent-3-ene

9.

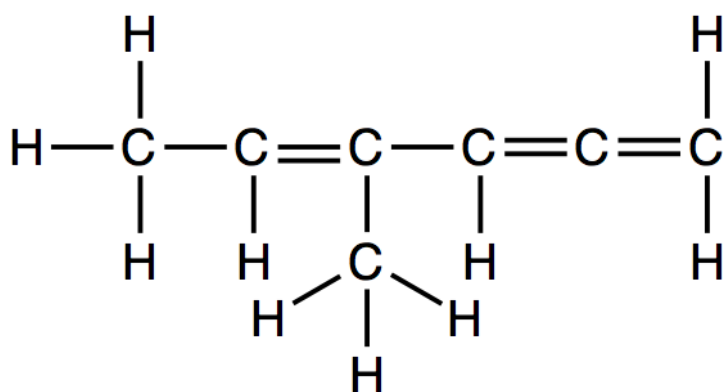


10.



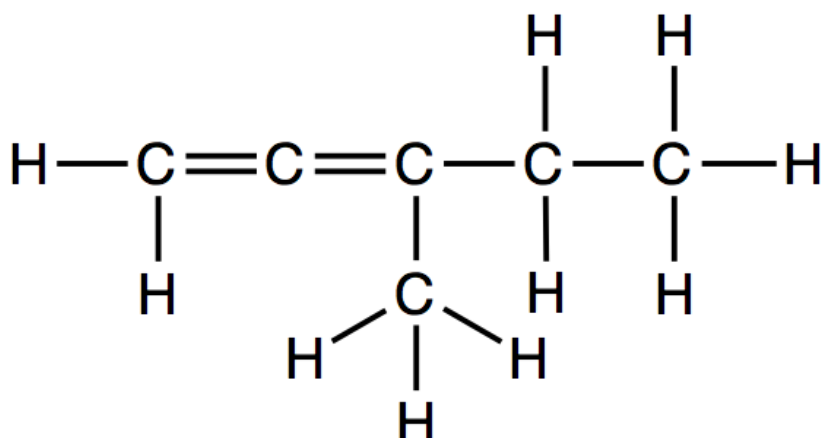
- a. 4-ethyl-5-methylhept-3,5-diene
- b. 4,5-diethylhex-3,5-diene
- c. 4-ethyl-3-methylhex-2,4-diene
- d. 4-ethyl-3-methylhept-2,4-diene

11.



- a. 3-methylhex-2,4,5-triene
- b. 4-methylhex-1,2,4-triene
- c. 1-ethyl-1-methylbut-2,3-diene
- d. 4-ethyl-4-methyl-but-1,4-diene

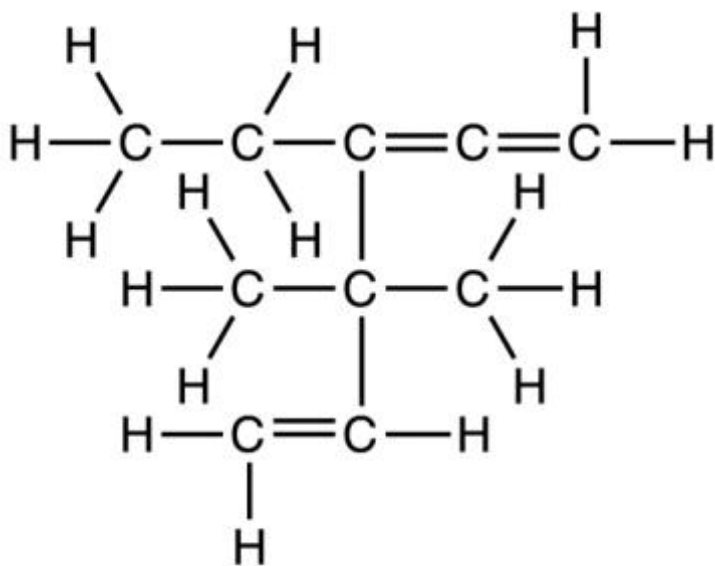
12.



- a. 2-ethylbutene
- b. 3-methylpent-3,4-diene
- c. 3-ethylbut-1,2-diene
- d. 3-methylpent-1,2-diene

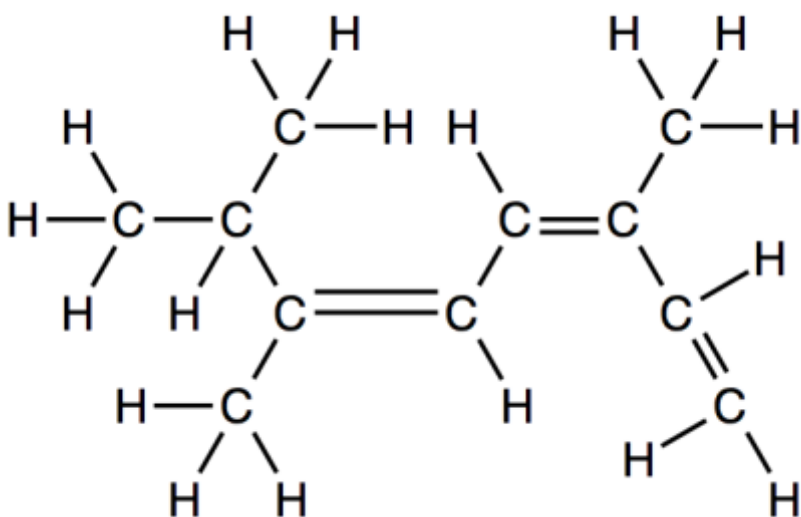


13.

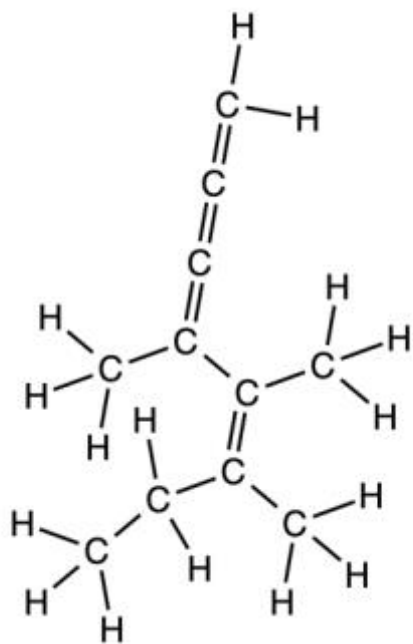


- a. 4-ethyl-3,3-dimethylhex-1,4,5-triene
- b. 4,4-diethyl-3-methylhex-1,4,5-triene
- c. 4,4-diethyl-3-methylhex-1,2,4-triene
- d. 4,4-diethyl-3,3-dimethylhex-1,2,5-triene

14.

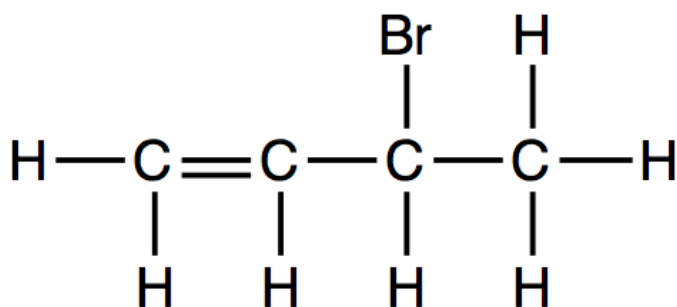


- a. 3,5,7-trimethylhept-3,5-diene
- b. 3,6,7-trimethyloct-1,3,5-triene
- c. 2,3,6-trimethylhept-3,5,7-diene
- d. 2,3,6-trimethylhept-3,5-diene



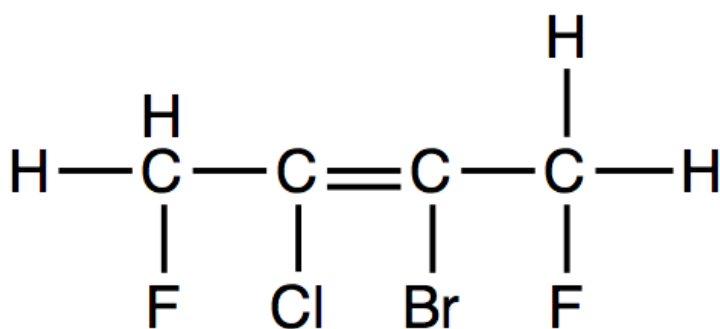
15.

- a. 6-ethyl-3,4-dimethylhept-2,4,5,6-tetraene
- b. 2-ethyl-4,5-dimethylhept-1,2,3,5-tetraene
- c. 3,5,6-trimethyloct-2,4,5,6-tetraene
- d. 4,5,6-trimethyloct-1,2,3,5-tetraene



16.

- a. 3-bromobut-1-ene
- b. 2-bromobut-3-ene
- c. 2-bromobut-2-ene
- d. 3-bromobut-2-ene

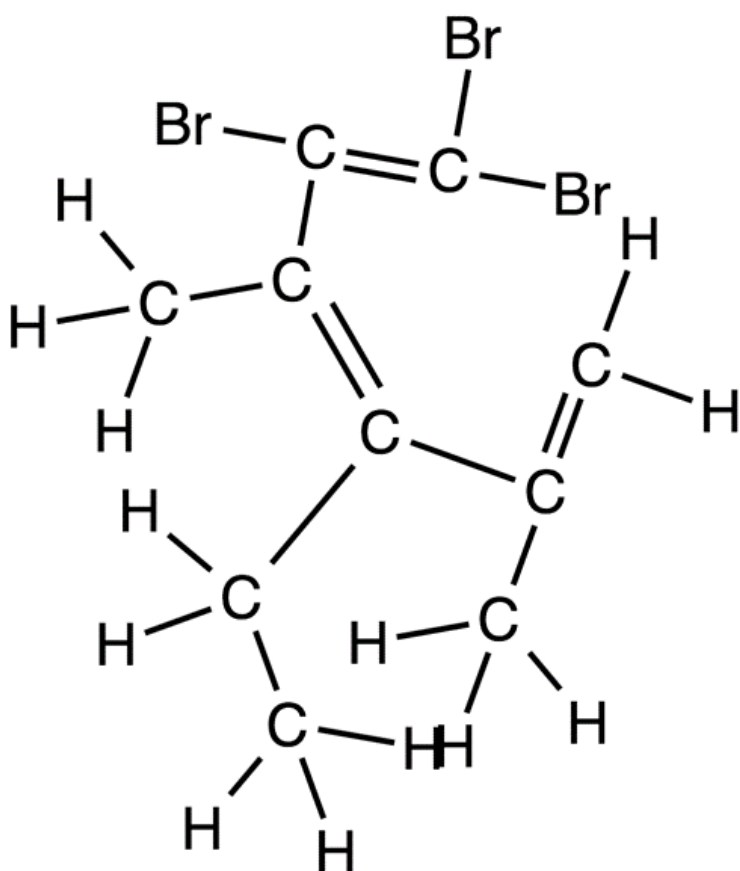


17.

- a. 1-flouro-2-bromo-3-chloro-4-flouorbut-2-ene
- b. 2-bromo-3-chloro-diflouorbut-2-ene
- c. 3-bromo-2-chloro-1,4-diflouorbut-2-ene
- d. 2-bromo-3-chloro-1,4-diflouorbutene

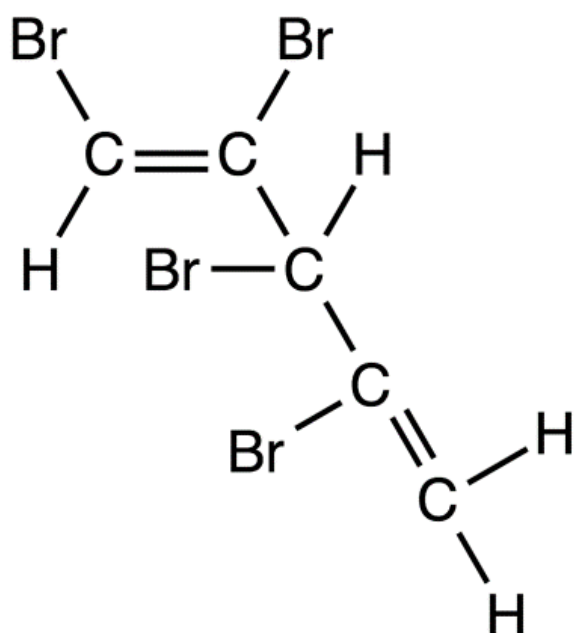


18.



- a. 1,1,2-tribromo-4-ethyl-3,5-dimethylhex-1,3,5-triene
- b. 1-tribromo-4-ethyl-3-dimethylhex-1-triene
- c. 1,1,2-tribromo-4-methyl-3,5-dimethylhex-1,3,5-triene
- d. 1,1,2-tribromo-4-methyl-3,5-dimethylhept-1,3,5-triene

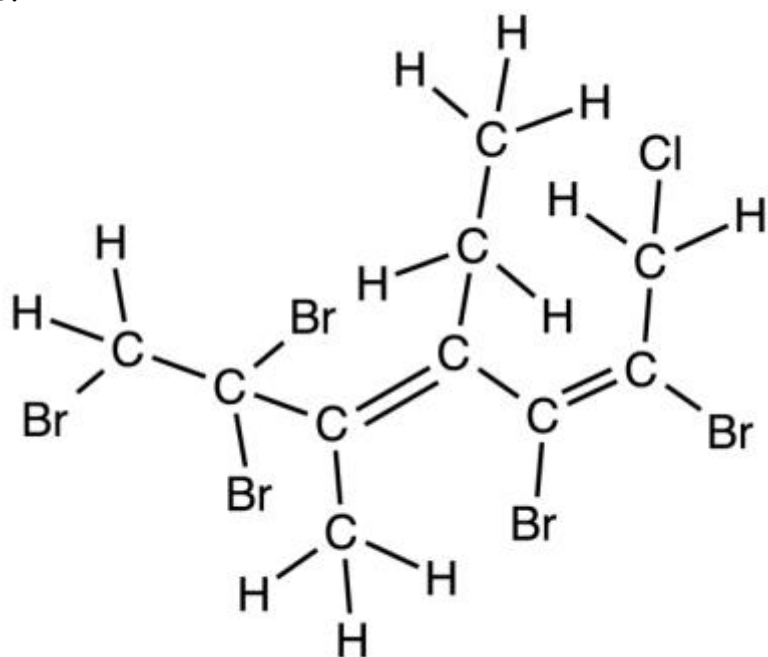
19.



- a. 1,2,3,4-tetrabromopent-1,4-diene
- b. tetrabromopent-1,4-diene
- c. 1,2,3,4,5-tetrabromopent-1,4-diene
- d. 1,2,3,4-tetrabromopent-1,4-diene



20.

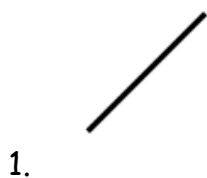


- a. 1,2,2,5,6-pentabromo-7-chloro-4-ethyl-3-methylhept-3,5-diene
- b. 2,3,6,6,7-pentabromo-1-chloro-4-ethyl-5-methylhept-2,4-diene
- c. pentabromochloroethylmethylhept-3,5-diene
- d. 2,3,6,7-pentabromo-1-chloro-4-ethylhept-2,4-diene



Skeletal formula

Video link; Skeletal Formula - Organic Chemistry #6 <https://youtu.be/yiuhhkO2QzY>



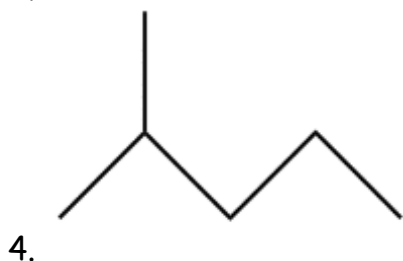
- a. methane
- b. ethene
- c. ethane
- d. propane



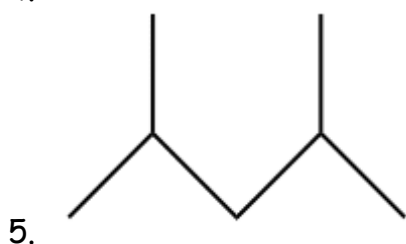
- a. propane
- b. methane
- c. ethane
- d. ethene



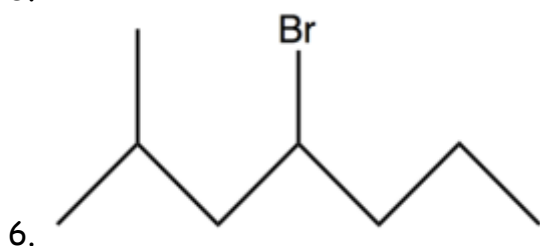
- a. butane
- b. propane
- c. hexane
- d. pentane



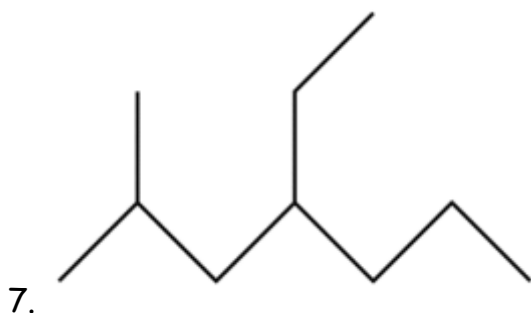
- a. 4-methylpentane
- b. methylbutane
- c. 2-methylpentane
- d. 2-methylbutane



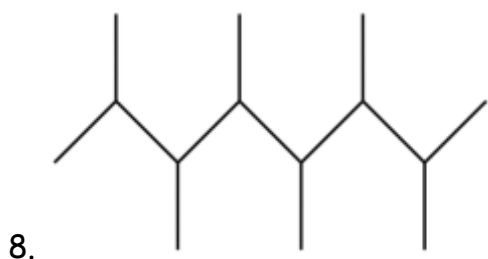
- a. pentane
- b. 2,4-dimethylbutane
- c. 2,4-dimethylpentane
- d. 2,4-dimethylhexane



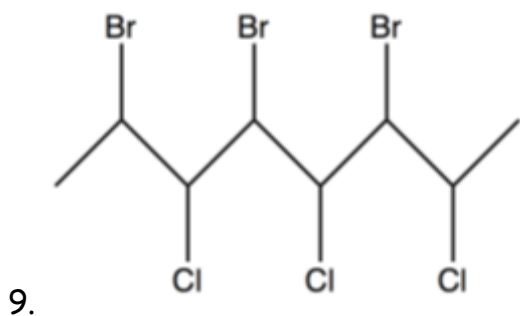
- a. 4-bromo-2-methylheptane
- b. 4-bromomethyl-2-methylheptane
- c. 4-bromomethyl-2-methylpentane
- d. 4-bromomethyl-2-methylhexane



- a. 4-ethyl-6-methylheptane
- b. 4-ethyl-2-methylheptane
- c. 4-ethyl-2-methylhexane
- d. -ethyl-6-methylhexane



- a. 1,2,3,4,5,6,7,8-hexamethyloctane
- b. Tetradecane
- c. 2,3,4,5,6,7-hexamethyloctane
- d. 2,3,4,5,6,7-methyloctane



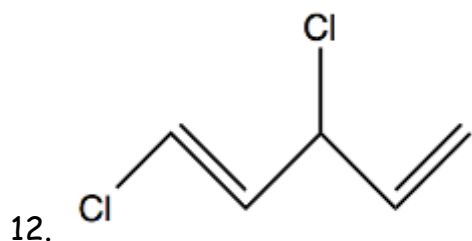
- a. 2,4,6-tribromo-3,5,7-trichlorooctane
- b. 2,3,4,5,6,7-tribromotrichlorooctane
- c. 2,4,6-tribromo-3,5,7-trichlorohexane
- d. 2,4,6,8-tribromo-1,3,5,7-trichlorohexane



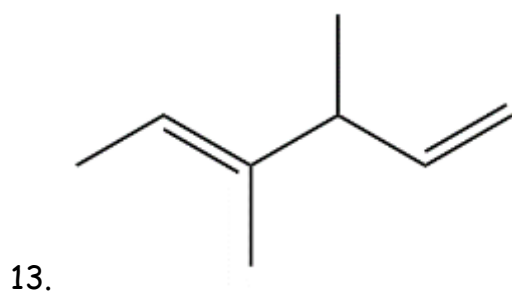
- a. pentane
- b. pent-3-ene
- c. pent-2-ene
- d. pent-1-ene



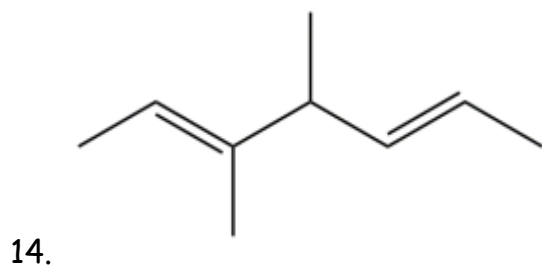
- a. hexene
- b. hex-1,4-diene
- c. hex-2,5-diene
- d. pent-1,4-diene



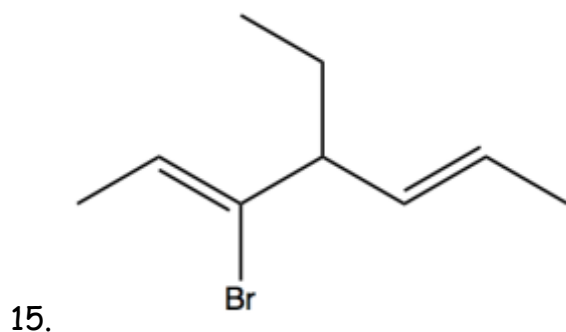
- a. 1,3-dichlorohex-2,5-diene
- b. 3,6-dichlorohex-1,4-diene
- c. 1,3-dichloropent-1,4-diene
- d. 3,5-dichloropent-1,4-diene



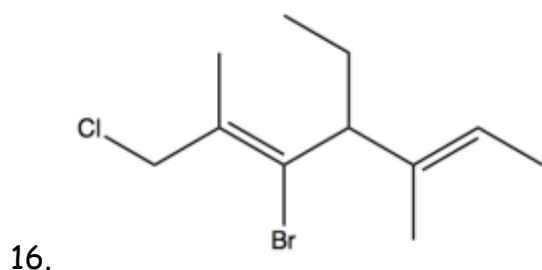
- a. 3,4-dimethylhex-2,5-diene
- b. 4-methylhex-1,4-diene
- c. 3,4-diethylhex-2,5-diene
- d. 3,4-dimethylhex-1,4-diene



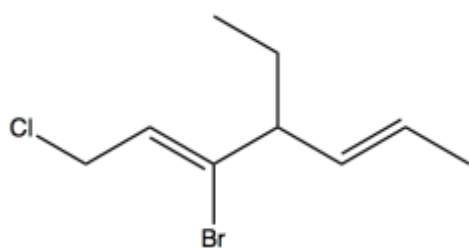
- a. 2,3-dimethylhex-1,4-diene
- b. 4,5-dimethylhept-2,5-diene
- c. 3,4-dimethylhex-1,4-diene
- d. 3,4-dimethylhept-2,5-diene



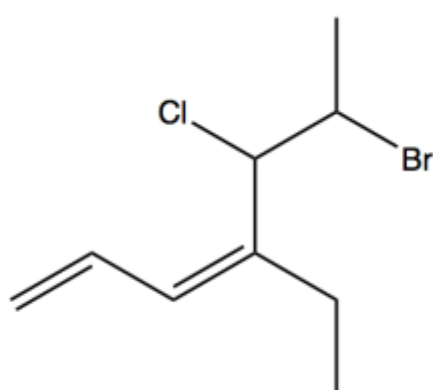
- a. 5-bromo-4-ethylhept-2,5-diene
- b. 3-bromo-4-ethylhept-2,5-diene
- c. 3-bromo-4-methylhept-2,5-diene
- d. 3-bromomethyl-4-ethylhept-2,5-diene



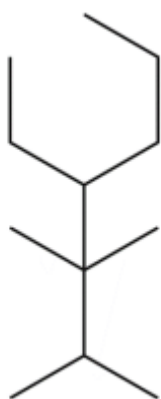
- a. 3-bromo-1-chloro-4-ethyl-2,5-dimethylhept-2,5-diene
- b. 1-chloro-3-bromo-4-ethyl-2,5-dimethylhept-2,5-diene
- c. 5-bromo-7-chloro-4-ethyl-3,6-dimethylhept-2,5-diene
- d. 5-bromo-8-chloro-4-ethyl-3,6-dimethyloct-2,5-diene



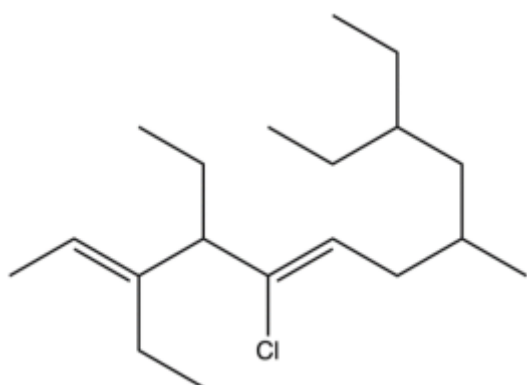
- a. 4-bromo-1-chloro-5-ethyloct-3,7-diene
- b. 5-bromo-7-chloro-4-ethylhept-2,5-diene
- c. 3-bromo-1-chloro-4-ethylhept-2,5-diene
- d. 3-bromo-1-chloro-4-ethylhex-2,5-diene



- a. 2-bromo-3-chloro-4-ethylhept-4,6-diene
- b. 6-bromo-5-chloro-4-ethylhept-1,3-diene
- c. 6-bromo-5-chloro-4-ethylhex-1,3-diene
- d. 2-bromo-3-chloro-4-ethylhex-4,6-diene



- a. 4-ethyl-2,3,3-trimethylheptane
- b. Bob
- c. 4-propyl-2,3,3-trimethylhexane
- d. 4-ethyl-2,3,3-methylheptane



- a. 8-chloro-3,9,10-triethyl-5-methyldodec-7,10-diene
- b. 5-chloro-3,4,10-triethyl-8-methyldodec-2,5-diene
- c. 5-chloro-3,4,10-ethyl-8-methyldec-2,5-ene
- d. 8-chloro-3,9,10-triethyl-5-methyldec-7,10-diene





Answers

Atomic structure

1. b
2. a
3. a
4. a
5. b
6. b
7. c
8. a
9. c
10. b
11. b
12. a
13. d
14. c
15. a
16. c
17. a
18. b
19. b
20. D

Properties of ionic compounds

1. b
2. c
3. c
4. c
5. d
6. d
7. c
8. b



9. d
10. c
11. c
12. c
13. b
14. c
15. d

Covalent bonding

1. c
2. b
3. a
4. b
5. b
6. d
7. d
8. a
9. b
10. c
11. c
12. a
13. B and d
14. b
15. a
16. a
17. b
18. a
19. a
20. C

Formula of Ionic Compounds

1. AgI
2. MgI₂



3. LiI
4. PbI₂
5. CuI₂
6. FeBr₃
7. FeBr₂
8. BaBr₂
9. SrBr₂
10. SrCl₂
11. CuCl₂
12. FeCl₂
13. CaCl₂
14. LiCl₂
15. BaCl₂
16. Na₂O
17. K₂O
18. ZnO
19. Al₂O₃
20. SrO
21. Cu₂O
22. CuO
23. Fe₂O₃
24. FeO
25. Cr₂O₃
26. FeCO₃
27. (NH₄)₂CO₃
28. CuCO₃
29. PbCO₃
30. Na₂CO₃
31. MgCO₃
32. FeCO₃
33. BaCO₃
34. KHCO₃
35. Sr(HCO₃)₂
36. LiHCO₃
37. NH₄HCO₃
38. NaHCO₃
39. Mg(HCO₃)₂
40. (NH₄)₂S



41. FeS
42. Al₂S₃
43. Fe₂(SO₄)₃
44. FeSO₄
45. PbSO₄
46. Al₂(SO₄)₃
47. ZnSO₄
48. BaSO₄
49. (NH₄)₂SO₄
50. MgSO₄
51. Li₂SO₄
52. Mg(OH)₂
53. Al(OH)₃
54. KOH
55. NH₄OH
56. Ba(OH)₂
57. LiOH
58. Ca(OH)₂
59. Sr(OH)₂
60. Al(NO₃)₃
61. NH₄NO₃
62. Pb(NO₃)₂
63. NaNO₂
64. Li₃N
65. Mg₃N₂

Oxidation numbers

1. a
2. b
3. a
4. a
5. c
6. c
7. c
8. c
9. d
10. d



11. c
12. d
13. b
14. a
15. a
16. c
17. b
18. c
19. d
20. A

Balancing Equations 1

These are best done by trial and error

1. $2\text{Mg} + 2\text{HIO}_3 \rightarrow 2\text{Mg}(\text{IO}_3) + \text{H}_2$
2. $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow 2\text{NaCl} + \text{BaSO}_4$
3. $\text{NaI} + 3\text{HOCl} \rightarrow \text{NaIO}_3 + 3\text{HCl}$
4. $4\text{Al} + 3\text{MnO}_2 \rightarrow 2\text{Al}_2\text{O}_3 + 3\text{Mn}$
5. $\text{Ba}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{H}_2\text{O}$
6. $\text{K}_2\text{CO}_3 + 2\text{AgNO}_3 \rightarrow 2\text{KNO}_3 + \text{Ag}_2\text{CO}_3$
7. $\text{Sr}(\text{ClO}_4)_2 + \text{K}_2\text{SO}_4 \rightarrow \text{SrSO}_4 + 2\text{KClO}_4$
8. $2\text{Al} + 3\text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2$
9. $2\text{HNO}_3 + 3\text{H}_2\text{S} \rightarrow 2\text{NO} + 3\text{S} + 4\text{H}_2\text{O}$
10. $\text{Pb}(\text{NO}_3)_2 + 2\text{KCl} \rightarrow \text{PbCl}_2 + 2\text{KNO}_3$
11. $\text{MgCO}_3 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$
12. $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
13. $\text{SO}_2 + 2\text{HNO}_2 \rightarrow \text{H}_2\text{SO}_4 + 2\text{NO}$
14. $8\text{HI} + \text{H}_2\text{SO}_4 \rightarrow 4\text{H}_2\text{O} + \text{H}_2\text{S} + 4\text{I}_2$
15. $3\text{HCl} + \text{Al}(\text{OH})_3 \rightarrow 3\text{H}_2\text{O} + \text{AlCl}_3$
16. $2\text{NaOH} + \text{CuSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Cu}(\text{OH})_2$
17. $2\text{HF} + \text{Ba}(\text{NO}_3)_2 \rightarrow 2\text{HNO}_3 + \text{BaF}_2$
18. $2\text{NO}_2 + 7\text{H}_2 \rightarrow 2\text{NH}_3 + 4\text{H}_2\text{O}$
19. $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$
20. $2\text{HCl} + 2\text{FeCl}_2 + \text{H}_2\text{O}_2 \rightarrow 2\text{FeCl}_3 + 2\text{H}_2\text{O}$



Balancing Equations 2

These are best done using the oxidation numbers method

1. $2\text{KBr} + 3\text{H}_2\text{SO}_4 \rightarrow 2\text{KHSO}_4 + \text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O}$
2. $2\text{KCl} + \text{MnO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{Cl}_2 + 2\text{H}_2\text{O}$
3. $8\text{NaI} + 5\text{H}_2\text{SO}_4 \rightarrow 4\text{Na}_2\text{SO}_4 + 4\text{I}_2 + \text{H}_2\text{S} + 4\text{H}_2\text{O}$
4. $4\text{Zn} + \text{NO}_3^- + 10\text{H}^+ \rightarrow 4\text{Zn}^{2+} + \text{NH}_4^+ + 3\text{H}_2\text{O}$
5. $2\text{HNO}_3 + 3\text{H}_3\text{AsO}_3 \rightarrow 2\text{NO} + 3\text{H}_3\text{AsO}_4 + \text{H}_2\text{O}$
6. $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$
7. $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$
8. $\text{KIO}_3 + 5\text{KI} + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{K}_2\text{SO}_4 + 3\text{H}_2\text{O} + 3\text{I}_2$
9. $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$
10. $10\text{HNO}_3 + \text{I}_2 \rightarrow 2\text{HIO}_3 + 10\text{NO}_2 + 4\text{H}_2\text{O}$
11. $5\text{H}_2\text{SO}_3 + 2\text{KMnO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 2\text{H}_2\text{SO}_4 + 3\text{H}_2\text{O}$
12. $6\text{FeSO}_4 + \text{K}_2\text{Cr}_2\text{O}_7 + 7\text{H}_2\text{SO}_4 \rightarrow \text{Cr}_2(\text{SO}_4)_3 + \text{K}_2\text{SO}_4 + 3\text{Fe}_2(\text{SO}_4)_3 + 7\text{H}_2\text{O}$
13. $4\text{MnSO}_4 + 10\text{NaBiO}_3 + 14\text{H}_2\text{SO}_4 \rightarrow 4\text{NaMnO}_4 + 5\text{Bi}_2(\text{SO}_4)_3 + 14\text{H}_2\text{O} + 3\text{Na}_2\text{SO}_4$
14. $10\text{FeSO}_4 + 2\text{KMnO}_4 + 8\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 5\text{Fe}_2(\text{SO}_4)_3 + 8\text{H}_2\text{O}$
15. $5\text{H}_2\text{C}_2\text{O}_4 + 2\text{KMnO}_4 + 3\text{H}_2\text{SO}_4 \rightarrow 10\text{CO}_2 + \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 8\text{H}_2\text{O}$
16. $2\text{MoO}_3 + 3\text{Zn} + 3\text{H}_2\text{SO}_4 \rightarrow \text{Mo}_2\text{O}_3 + 3\text{ZnSO}_4 + 3\text{H}_2\text{O}$
17. $2\text{KMnO}_4 + 10\text{KCl} + 8\text{H}_2\text{SO}_4 \rightarrow 2\text{MnSO}_4 + 6\text{K}_2\text{SO}_4 + 8\text{H}_2\text{O} + 5\text{Cl}_2$
18. $5\text{KNO}_2 + 2\text{KMnO}_4 + 3\text{H}_2\text{SO}_4 \rightarrow 2\text{MnSO}_4 + 3\text{H}_2\text{O} + 5\text{KNO}_3 + \text{K}_2\text{SO}_4$
19. $2\text{K}_2\text{CrO}_4 + 3\text{Na}_2\text{SO}_3 + 10\text{HCl} \rightarrow 4\text{KCl} + 3\text{Na}_2\text{SO}_4 + 2\text{CrCl}_3 + 5\text{H}_2\text{O}$
20. $6\text{NaOH} + 3\text{Br}_2 \rightarrow 5\text{NaBr} + \text{NaBrO}_3 + 3\text{H}_2\text{O}$

Turning experiments in to balanced symbol equations

1. $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$
2. $\text{N}_2 + 3\text{Cl}_2 \rightarrow 2\text{NCl}_3$
3. $\text{C} + 2\text{Cl}_2 \rightarrow \text{CCl}_4$
4. $\text{CaCl}_2 + 2\text{KOH} \rightarrow \text{Ca}(\text{OH})_2 + 2\text{KCl}$
5. $\text{P}_4 + 6\text{Cl}_2 \rightarrow 4\text{PCl}_3$
6. $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$



7. $2\text{Mg} + \text{CO}_2 \rightarrow 2\text{MgO} + \text{C}$
8. $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$
9. $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$
10. $\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$
11. $\text{TiCl}_4 + 2\text{Mg} \rightarrow 2\text{MgCl}_2 + \text{Ti}$
12. $2\text{PH}_3 + 3\text{O}_2 \rightarrow \text{P}_2\text{O}_3 + 3\text{H}_2\text{O}$
13. $2\text{PH}_5 + 5\text{O}_2 \rightarrow \text{P}_2\text{O}_5 + 5\text{H}_2\text{O}$
14. $\text{CuCl}_2 + 2\text{NaOH} \rightarrow \text{Cu}(\text{OH})_2 + 2\text{NaCl}$
15. $2\text{KI} + \text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{KNO}_3 + \text{PbI}_2$
16. $\text{PCl}_3 + 3\text{H}_2\text{O} \rightarrow \text{P}(\text{OH})_3 + 3\text{HCl}$
17. $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 5\text{CO}_2 + 4\text{H}_2\text{O}$
18. $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$
19. $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 6\text{CO}_2$
20. $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$

Naming alkanes

1. a
2. a
3. c
4. b
5. b
6. d
7. c
8. b
9. d
10. a
11. c
12. d
13. a
14. c
15. d
16. c
17. a
18. a
19. b



20. D

Naming alkenes

Answer key

1. b
2. a
3. d
4. c
5. d
6. a
7. b
8. b
9. a
10. d
11. b
12. d
13. a
14. b
15. d
16. a
17. c
18. a
19. d
20. B

Skeletal formula

1. c
2. a
3. d
4. c
5. c
6. a
7. b
8. c
9. a



- 10. c
- 11. b
- 12. c
- 13. d
- 14. d
- 15. b
- 16. a
- 17. c
- 18. b
- 19. a
- 20. B