Drawing Organic Molecules: Four Ways

One butane molecule, four ways to write it: complete, condensed, bond-line and 3D. How to read each, and how to count what a zigzag hides.

Name: Date: Score: ____ / 19

A. Fill in the blanks

1. In a bond-line formula, every corner and line end is a ____.

2. Each carbon forms ____ bonds.

3. $CH_3CH_2CH_2CH_3$ is a ____ formula.

4. A solid wedge comes ____ you.

5. A dashed wedge goes ____ from you.

B. True or False

6. H atoms on carbon are written in a bond-line formula. True / False

7. Atoms other than C and H are written as letters. True / False

8. Butane and 2-methylpropane have the same formula. True / False

9. A normal line in a 3D drawing lies in the plane of the paper. True / False

C. Assertion and reason

10. Assertion (A): Bond-line formulas leave out H atoms on carbon.
Reason (R): Carbon's 4 bonds tell us how many H atoms there are.

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

11. Assertion (A): But-1-ene has 2 fewer H atoms than butane.
Reason (R): A double bond uses 2 of carbon's bonds on one neighbour.

(a) Both A and R are true, and R explains A
(b) Both A and R are true, but R does not explain A
(c) A is true, R is false
(d) A is false, R is true

Answer: _____

D. Choose the correct option

12. A zigzag with 4 points and only single bonds is:

(a) propane
(b) butane
(c) pentane
(d) butene

Answer: _____

13. A middle carbon with 2 single bonds shown carries:

(a) 0 H
(b) 1 H
(c) 2 H
(d) 3 H

Answer: _____

14. $CH_3(CH_2)_2CH_3$ is the same as:

(a) $CH_3CH_2CH_3$
(b) $CH_3CH_2CH_2CH_3$
(c) $CH_2{=}CH_2$
(d) C_6H_{12}

Answer: _____

15. A hexagon in bond-line form with single bonds is:

(a) benzene
(b) hexane
(c) cyclohexane
(d) cyclopentane

Answer: _____

E. Numerical problems

16. How many H atoms are in cyclohexane?

17. How many H atoms does an end carbon with one single bond carry?

F. Short answer questions

18. Write the condensed and molecular formula of a 3-point zigzag ending in OH.

G. Match the columns

19. Match each item in Column A with the correct item in Column B.

Column A	Column B	Your answer
1. Solid wedge	(a) towards you	1 → ____
2. Dashed wedge	(b) one carbon	2 → ____
3. Normal line	(c) plane of the paper	3 → ____
4. Corner	(d) away from you	4 → ____

Detailed solutions

1. carbon

2. 4

3. condensed

4. towards

5. away

6. False. They are left out.

7. True. For example OH.

8. True. Both are C_4H_{10}.

9. True. Only wedges leave the plane.

10. (a) R explains A.

11. (a) R explains A.

12. (b) butane. 4 carbons.

13. (c) 2 H. 4 − 2 = 2.

14. (b) $CH_3CH_2CH_2CH_3$. The bracket repeats CH_2 twice.

15. (c) cyclohexane. C_6H_{12}.

16. 6 carbons × 2. **Answer: 12**

17. 4 − 1. **Answer: 3**

18. $CH_3CH_2CH_2OH$, which is C_3H_8O.

19. 1 → (a), 2 → (d), 3 → (c), 4 → (b). Each item matches its partner.