Homologous Series

Methane, ethane, propane, butane: four different compounds, one family. How each member differs from the next by one CH_2 unit, and what that means for their properties.

Name: Date: Score: ____ / 19

A. Fill in the blanks

1. Successive members of a homologous series differ by ____.

2. Each member of a homologous series is called a ____.

3. The general formula of the alkanes is ____.

4. Successive homologues differ in molar mass by ____ u.

5. Members of a homologous series have the same ____ group.

B. True or False

6. Members of a homologous series have identical chemical properties. True / False

7. The boiling point of straight-chain alkanes rises as the chain gets longer. True / False

8. CH_4 and C_2H_4 belong to the same homologous series. True / False

9. Methanol and propan-1-ol belong to the same homologous series. True / False

C. Assertion and reason

10. Assertion (A): Ethane and propane are members of the same homologous series.
Reason (R): They have the same general formula and differ by one CH_2 unit.

(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): Butane has a higher boiling point than ethane.
Reason (R): Members of a homologous series have similar chemical properties.

(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. The next member after C_2H_5OH in its series is:

(a) C_3H_7OH
(b) C_2H_7OH
(c) C_3H_5OH
(d) C_4H_9OH

Answer: _____

13. Which is not an alkane?

(a) C_3H_8 (b) C_5H_{12}

(c) C_4H_8 (d) C_6H_{14}

Answer: _____

14. Members of a homologous series show a gradual change in:

(a) functional group (b) general formula

(c) boiling point (d) type of bonds

Answer: _____

15. Which pair are homologues?

(a) CH_3COOH and C_2H_5COOH (b) C_2H_6 and C_2H_5OH

(c) CH_4 and C_2H_4 (d) CH_3OH and CH_3COOH

Answer: _____

E. Numerical problems

16. Find the molar mass of the fifth member of the alkane series (C = 12, H = 1).

17. How many CH_2 units separate CH_3OH and C_4H_9OH?

F. Short answer questions

18. Write the formulas of the first four alkanes and show the common difference.

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. Same functional group	(a) C_nH_{2n+2}	1 → ____
2. Longer carbon chain	(b) Differ by CH_2	2 → ____
3. Successive members	(c) Similar chemical properties	3 → ____
4. Alkanes	(d) Higher boiling point	4 → ____

Detailed solutions

1. CH_2

2. homologue

3. C_nH_{2n+2}

4. 14

5. functional

6. False. They are similar, not identical.

7. True. Methane −161.5 °C, butane −0.5 °C.

8. False. C_2H_4 is an alkene (C_nH_{2n}); they differ by C, not CH_2.

9. True. Both are alcohols and differ by 2 CH_2.

10. (a) R explains A.

11. (b) Both true; R does not explain A: the larger molecule attracts its neighbours more strongly.

12. (a) C_3H_7OH. Add CH_2.

13. (c) C_4H_8. C_4H_8 does not fit C_nH_{2n+2}.

14. (c) boiling point. Physical properties change gradually.

15. (a) CH_3COOH and C_2H_5COOH. Same group, differ by one CH_2.

16. C_5H_{12}: 5 × 12 + 12 × 1. **Answer: 72**

17. $C_4H_9OH - CH_3OH = C_3H_6 = 3\ CH_2$. **Answer: 3**

18. CH_4, C_2H_6, C_3H_8, C_4H_{10}; each differs from the next by CH_2 (14 u)

19. 1 → (c), 2 → (d), 3 → (b), 4 → (a). Each feature matches its consequence or formula.