Same Weight, 0 °C vs 97 °C: Physical Properties of Aldehydes and Ketones

Five compounds of the same mass boil from 0 °C to 97 °C. Aldehydes and ketones sit in the middle: their polar C=O gives dipole-dipole attraction, but with no O–H they cannot hydrogen-bond with each other. Water can hydrogen-bond to the C=O oxygen, so small aldehydes and ketones mix with water while long chains do not.

Name: Date: Score: ____ / 15

A. Fill in the blanks

1. The C=O bond is polar: carbon carries a partial ____ charge.

2. Aldehydes and ketones attract each other by dipole-____ forces.

3. Methanal at room temperature is a ____.

4. Water's H forms a hydrogen bond with the carbonyl ____.

B. True or False

5. Aldehydes form hydrogen bonds with each other. True / False

6. Propanone mixes with water in all proportions. True / False

7. Solubility in water rises as the alkyl chain grows. True / False

C. Assertion and reason

8. Assertion (A): Acetone boils lower than propan-1-ol.
Reason (R): Acetone has no O–H, so it cannot hydrogen-bond with itself.

(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: _____

9. Assertion (A): Small aldehydes dissolve in water.
Reason (R): Water hydrogen-bonds to the carbonyl oxygen.

(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

10. Highest boiling point (similar mass):

(a) n-butane
(b) methoxyethane
(c) propanal
(d) propan-1-ol

Answer: _____

11. Aldehydes boil above alkanes of similar mass because of:

(a) hydrogen bonding
(b) dipole-dipole attraction
(c) ionic bonding
(d) higher mass

Answer: _____

12. Lowest boiling point (similar mass):

(a) acetone (b) propanal

(c) n-butane (d) propan-1-ol

Answer: _____

E. Numerical problems

13. Boiling point gap in °C between propanal (49 °C) and propan-1-ol (97 °C)?

F. Short answer questions

14. Arrange propane, ethanal and ethanol in increasing boiling point and give the reason.

G. Match the columns

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

Column A	Column B	Your answer
1. n-butane	(a) 56 °C	1 → ____
2. propanal	(b) 97 °C	2 → ____
3. acetone	(c) 49 °C	3 → ____
4. propan-1-ol	(d) 0 °C	4 → ____

Detailed solutions

1. positive

2. dipole

3. gas

4. oxygen

5. False. They have no O–H, so no H to donate.

6. True. It hydrogen-bonds with water through the C=O oxygen.

7. False. The non-polar part grows, so solubility falls.

8. (a) R explains A.

9. (a) R explains A.

10. (d) propan-1-ol. Hydrogen bonding through O–H.

11. (b) dipole-dipole attraction. The polar C=O.

12. (c) n-butane. Only weak dispersion forces.

13. subtract. **Answer: 48**

14. Propane (dispersion only, −42 °C) < ethanal (dipole-dipole, 20 °C) < ethanol (hydrogen bonds, 78 °C).

15. 1 → (d), 2 → (c), 3 → (a), 4 → (b). Same mass, boiling point rises with the attraction between molecules.