Aldehyde vs Ketone: Why Aldehydes React Faster

Both have the same C=O, yet a nucleophile attacks an aldehyde faster. Two reasons: alkyl groups push electrons (+I) and lower the carbonyl carbon's δ+, and a ketone's two groups crowd the path to it. So HCHO > CH_3CHO > CH_3COCH_3.

Name: Date: Score: ____ / 15

A. Fill in the blanks

1. A nucleophile attacks the carbonyl ____ atom.

2. Alkyl groups release electrons; this is the +____ effect.

3. Blocking of the nucleophile by large groups is a ____ effect.

4. The most reactive carbonyl compound towards nucleophiles is ____.

B. True or False

5. A ketone has two alkyl groups on its carbonyl carbon. True / False

6. Alkyl groups make the carbonyl carbon more positive. True / False

7. Acetaldehyde is more reactive than acetone towards HCN. True / False

C. Assertion and reason

8. Assertion (A): Ketones are less reactive than aldehydes.
Reason (R): Two alkyl groups lower the δ+ and crowd the carbonyl carbon.

(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): Methanal is the most reactive aldehyde.
Reason (R): It has two H and no alkyl group on the carbonyl carbon.

(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. Most reactive towards nucleophilic addition:

(a) acetone
(b) ethanal
(c) methanal
(d) butanone

Answer: _____

11. Two reasons aldehydes react faster:

(a) resonance and H-bonding
(b) +I effect and steric hindrance
(c) mass and polarity
(d) acidity and basicity

Answer: _____

12. Increasing reactivity:

(a) HCHO < CH_3CHO < CH_3COCH_3

(b) CH_3COCH_3 < CH_3CHO < HCHO

(c) CH_3CHO < HCHO < CH_3COCH_3

(d) all equal

Answer: _____

E. Numerical problems

13. How many alkyl groups are on the carbonyl carbon of propanone?

F. Short answer questions

14. Why is benzaldehyde less reactive than ethanal in nucleophilic addition?

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. Electronic reason	(a) large groups block the nucleophile	1 → ____
2. Steric reason	(b) HCHO	2 → ____
3. Most reactive	(c) CH_3COCH_3	3 → ____
4. Least reactive of the three	(d) +I effect lowers δ+	4 → ____

Detailed solutions

1. carbon

2. I

3. steric

4. methanal

5. True. Propanone has two CH_3 groups.

6. False. They release electrons and lower the δ+.

7. True. One CH_3 instead of two.

8. (a) R explains A.

9. (a) R explains A.

10. (c) methanal. Two H on the carbonyl carbon.

11. (b) +I effect and steric hindrance. Electronic and steric.

12. (b) CH_3COCH_3 < CH_3CHO < HCHO. More alkyl groups, slower.

13. count the CH_3 groups. **Answer: 2**

14. The benzene ring's resonance with the C=O lowers the carbonyl carbon's δ+.

15. 1 → (d), 2 → (a), 3 → (b), 4 → (c). Each idea matches its meaning.