

Interactive Example Candidate Responses

Paper 33 (May/June 2016), Question 3(a)

Cambridge International AS & A Level Chemistry 9701

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3 Qualitative Analysis

At each stage of any test you are to record details of the following.

- colour changes seen
- the formation of any precipitate
- the solubility of such precipitates in an excess of the reagent added

Where gases are released they should be identified by a test, **described in the appropriate place in your observations.**

You should indicate clearly at what stage in a test a change occurs.
Marks are **not** given for chemical equations.

No additional tests for ions present should be attempted.

If any solution is warmed, a boiling tube MUST be used.

Rinse and reuse test-tubes and boiling tubes where possible.

Where reagents are selected for use in a test, the name or correct formula of the element or compound must be given.

(a) FA 5, FA 6, FA 7 and FA 8 are aqueous solutions of organic compounds. All of FA 5, FA 6, FA 7 and FA 8 contain carbon, hydrogen and oxygen only.

Half fill the 250 cm³ beaker with water and heat it to about 80°C. Turn off the Bunsen burner. This will be used as a water bath.

To a 2 cm depth of aqueous silver nitrate in a boiling tube add 2 drops of aqueous sodium hydroxide and then add ammonia dropwise until the brown solid just disappears. This solution is Tollens' reagent and is needed in a test in (i).

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

(a)(i)	FA 5	FA 6	FA 7	FA 8	
	Fizz / bubbles / effervescence	Fizz / bubbles / effervescence	no change	no change	
	Gas turns limewater milky / cloudy white / white ppt / chalky	Gas turns limewater milky / cloudy white / white ppt / chalky	No reaction/no change	No reaction/no change	
	Silver / black / dark grey and mirror / solid / ppt	No reaction / no change / no silver mirror	No reaction / no change / no silver mirror	Silver / black / dark grey and mirror / solid / ppt	
	Purple to colourless or solution / MnO ₄ ⁻ / manganate (VII) decolourised / disappeared	No reaction or remains / turns purple or pink	Purple to colourless or solution / MnO ₄ ⁻ / manganate(VII) decolourised / disappeared	Purple to colourless or solution / MnO ₄ ⁻ / manganate (VII) decolourised / disappeared	[4]
(a)(ii)	(-)CO ₂ H / carboxylic acid				[1]
(a)(iii)	(-)CHO / aldehyde / alkanal or alkene / C=C				[1]
(a)(iv)	Oxidation of organic compound / reduction of MnO ₄ ⁻ / redox or if alkene in (iii) then electrophilic addition				[1]
(a)(v)	(-)OH / (1° / 2°) alcohol / alkanol / hydroxy or alkene / C=C				[1]
(a)(vi)	transport / transporter / carrier, protein ; R pump protein Add Na to give effervescence / hydrogen / gas which pops with lighted splint, or Add PCl ₅ / SOCl ₂ to give misty fumes / steamy fumes / HCl, or Add carboxylic acid AND (conc) sulfuric acid to produce fruity / sweet smell or if alkene in (v) Br ₂ decolourised / brown to colourless				[1] [Total: 9]

- (i) Carry out the following tests on FA 5, FA 6, FA 7 and FA 8 and record your observations in the table.

test	observations			
	FA 5	FA 6	FA 7	FA 8
To a 1 cm depth in a test-tube, add a small spatula measure of sodium carbonate.	Effervescence occur	Effervescence occur	No observable change	No observable change
To a few drops in a test-tube, add a 1 cm depth of Tollens' reagent. Place the tube in the water bath and leave to stand. When you have completed this test rinse all tubes used.	Grey precipitate formed	No observable change	Grey solution form produced	Silver mirror formed
To a 1 cm depth in a test-tube, add a few drops of acidified potassium manganate(VII). Place the tube in the water bath and leave to stand.	Purple decolourise	No observable change	Purple decolourise	Purple decolourise

- (ii) Using your observations from the table, what functional group is present in both FA 5 and FA 6?

carboxylic acid

- (iii) Using your observations from the table, what functional group is present in both FA 5 and FA 8?

alkene aldehyde

- (iv) What type of reaction is occurring in the potassium manganate(VII) test?

redox

- (v) Using your observations from the table, what functional group is present in FA 7?

alkene

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

(a)(i)	FA 5	FA 6	FA 7	FA 8	
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	Silver / black / dark grey and mirror / solid / ppt	No reaction / no change / no silver mirror	No reaction / no change / no silver mirror	Silver / black / dark grey and mirror / solid / ppt	
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(a)(ii)	$(-)\text{CO}_2\text{H}$ / carboxylic acid				[1]
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(a)(vi)	transport / transporter / carrier, protein ; R pump protein Add Na to give effervescence / hydrogen / gas which pops with lighted splint, or Add PCl_5 / SOCl_2 to give misty fumes / steamy fumes / HCl , or Add carboxylic acid AND (conc) sulfuric acid to produce fruity / sweet smell or if alkene in (v) Br_2 decolourised / brown to colourless				[1] [Total: 9]

- (vi) Suggest a test that would confirm the presence of the functional group in a pure sample of FA 7. Include the result you would expect the test to give.

Do not carry out this test.

Add bromine solution. Brown colour will decolourise.

[9]

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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3 Qualitative Analysis

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- colour changes seen
- the formation of any precipitate
- the solubility of such precipitates in an excess of the reagent added

Where gases are released they should be identified by a test, described in the appropriate place in your observations.

You should indicate clearly at what stage in a test a change occurs.
Marks are **not** given for chemical equations.

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Rinse and reuse test-tubes and boiling tubes where possible.

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Select
page

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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- (i) Carry out the following tests on FA 5, FA 6, FA 7 and FA 8 and record your observations in the table.

test	observations			
	FA 5	FA 6	FA 7	FA 8
To a 1 cm depth in a test-tube, add a small spatula measure of sodium carbonate.	NaCO_3 dissolve some bubble given out react violently red litmus paper turn blue	NaCO_3 dissolve some gas produce the tube become warm give white ppt with Ca(OH)_2	No reaction NaCO_3 not dissolve	NaCO_3 dissolve
To a few drops in a test-tube, add a 1 cm depth of Tollens' reagent. Place the tube in the water bath and leave to stand. When you have completed this test rinse all tubes used.	liquid become milky after warm it turn brown and black	liquid become milky after warm it turn pink.	liquid still colourless after warm it turn deep yellow	same order same like After liquid turn yellow after warm it just like a mirror
To a 1 cm depth in a test-tube, add a few drops of acidified potassium manganate(VII). Place the tube in the water bath and leave to stand.	add KMnO_4 then liquid is purple purple litmus paper turn red liquid become colourless	add KMnO_4 then liquid is purple purple litmus paper turn red colour unchanged	add KMnO_4 then liquid is yellow liquid become colourless (after water bath)	add KMnO_4 then liquid is colourless liquid still colourless

- (ii) Using your observations from the table, what functional group is present in both FA 5 and FA 6?

Acid COOH

- (iii) Using your observations from the table, what functional group is present in both FA 5 and FA 8?

CHO

- (iv) What type of reaction is occurring in the potassium manganate(VII) test?

endothermic

- (v) Using your observations from the table, what functional group is present in FA 7?

alcohol

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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- (vi) Suggest a test that would confirm the presence of the functional group in a pure sample of FA 7. Include the result you would expect the test to give.

Do not carry out this test.

Add $\text{CuSO}_4(\text{aq})$ to FA 7, and shake. Then it produce blue ppt.

[9]

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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Select
page

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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test	observations			
	FA 5	FA 6	FA 7	FA 8
To a 1 cm depth in a test-tube, add a small spatula measure of sodium carbonate.	Effervescence occur. colourless The lime water turns cloudy. CO ₂ is present.	Effervescence occur The colourless gas produced does not turn lime water cloudy.	No ppt	No ppt
To a few drops in a test-tube, add a 1 cm depth of Tollens' reagent. Place the tube in the water bath and leave to stand. When you have completed this test rinse all tubes used.	Silver mirror is formed	Silver mirror is formed.	Black solution.	Silver mirror is formed.
To a 1 cm depth in a test-tube, add a few drops of acidified potassium manganate(VII). Place the tube in the water bath and leave to stand.	Red to Purple solution turn red-brown ppt colourless turn to Ppt	Purple solution remains purple after heating	Purple solution remain purple.	Purple solution turn colourless

- (ii) Using your observations from the table, what functional group is present in both FA 5 and FA 6?

aldehyde

- (iii) Using your observations from the table, what functional group is present in both FA 5 and FA 8?

aldehyde

- (iv) What type of reaction is occurring in the potassium manganate(VII) test?

oxidation

- (v) Using your observations from the table, what functional group is present in FA 7?

ketone

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

(a)(i)	FA 5	FA 6	FA 7	FA 8	
	Fizz / bubbles / effervescence	Fizz / bubbles / effervescence	no change	no change	
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- (vi) Suggest a test that would confirm the presence of the functional group in a pure sample of FA 7. Include the result you would expect the test to give.

Do not carry out this test.

PNH. DNPH turn orange ppt.

[9]

Your
Mark

3(a)(i)

3(a)(ii)

3(a)(iii)

3(a)(iv)

3(a)(v)

3(a)(vi)

Q3 Mark scheme

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