

PiXL Independence:

Chemistry – Student Booklet

KS5

Tests for ions

Contents:

- I. Level 1- Multiple Choice Quiz – 20 credits
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PiXL Independence – Level 1
Multiple Choice Questions
A Level Chemistry – Tests for ions

INSTRUCTIONS

Score: /20

- Read the question carefully.
 - Circle the correct letter.
 - Answer all questions
1. What test would you use to identify a Group 2 ion?
 - a. Add warm ammonia.
 - b. Flame test.
 - c. Add silver nitrate followed by ammonia.
 - d. Add acidified barium chloride.

 2. What test would you use to identify a sulfate ion?
 - a. Add warm ammonia.
 - b. Flame test.
 - c. Add silver nitrate followed by ammonia.
 - d. Add acidified barium chloride.

 3. Which of the following tests would be used to differentiate between Br⁻ and Cl⁻?
 - a. Add warm ammonia.
 - b. Flame test.
 - c. Add silver nitrate followed by ammonia.
 - d. Add acidified barium chloride.

 4. An unknown substance gives the following results in tests to identify the ions present:
 1. Dilute nitric acid followed by silver nitrate – white precipitate
 2. Sodium hydroxide – pale blue precipitate which did not dissolve in excessWhich of the following chemicals would produce these results?
 - a. CuCl₂
 - b. FeCl₂
 - c. CuBr₂
 - d. CuI₂

 5. A flame test on a chemical produced a red flame. Which Group 2 metal ion is responsible for this colour?
 - a. Ca²⁺
 - b. Sr²⁺
 - c. Ba²⁺
 - d. Cu²⁺

 6. An unknown chemical was tested with silver nitrate followed by ammonia. A yellow precipitate formed. Which of the following ions was present?
 - a. Br⁻
 - b. CO₃²⁻
 - c. Cu²⁺
 - d. I⁻

7. When sodium hydroxide is added to substance X a green gelatinous precipitate is formed. What ion does X contain?
- Fe^{2+}
 - Fe^{3+}
 - Cu^{2+}
 - Cr^{3+}
8. Which of the following tests would be used to determine the presence of the ammonium ion?
- Add silver nitrate.
 - Add warm sodium hydroxide.
 - Add hydrochloric acid.
 - Add acidified barium chloride.
9. Aqueous ammonia can be used to distinguish Fe^{2+} ions from Fe^{3+} ions. How would the results help to distinguish between the two ions?
- Fe^{2+} would form a green precipitate; Fe^{3+} would form a blue precipitate
 - Fe^{2+} would form a blue precipitate; Fe^{3+} would form a green precipitate
 - Fe^{2+} would form a green precipitate; Fe^{3+} would form a re/brown precipitate
 - Fe^{2+} would form a red/brown precipitate; Fe^{3+} would form a green precipitate
10. Fe^{2+} ions are reacted with sodium hydroxide. Which of the following shows the correct ionic equation for the reaction?
- $\text{Fe}^{2+}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \longrightarrow \text{Fe}(\text{OH})_{2(\text{aq})}$
 - $\text{Fe}^{2+}_{(\text{aq})} + 3\text{OH}^{-}_{(\text{aq})} \longrightarrow \text{Fe}(\text{OH})_{3(\text{s})}$
 - $\text{Fe}^{2+}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \longrightarrow \text{Fe}(\text{OH})_{2(\text{s})}$
 - $\text{Fe}^{2+}_{(\text{aq})} + \text{OH}^{-}_{(\text{aq})} \longrightarrow \text{FeOH}_{(\text{s})}$
11. How would you test a gas to determine if it was ammonia?
- Damp red litmus paper would turn red.
 - Damp red litmus paper would turn blue.
 - Damp red litmus paper would turn white.
 - Damp red litmus paper would turn purple.
12. Identify the anion and cation using the following results:
- | | |
|--|-----------------------------|
| Flame test | Pale green |
| Addition of HNO_3 followed by AgNO_3 | White precipitate |
| As above followed by NH_3 | White precipitate dissolves |
- Cation = Ba^{2+} Anion = Br^-
 - Cation = Cu^{2+} Anion = I^-
 - Cation = Ba^{2+} Anion = Cl^-
 - Cation = Ba^{2+} Anion = SO_4^{2-}
13. Which of the following tests is designed to identify the carbonate ion?
- Add warm ammonia.
 - Add dilute hydrochloric acid.
 - Add silver nitrate followed by ammonia.
 - Add acidified barium chloride.

14. Which of the following equations is for the reaction between sodium chloride and silver nitrate?
- $\text{NaCl}_{(\text{aq})} + \text{AgNO}_{3(\text{aq})} \longrightarrow \text{NaNO}_{3(\text{aq})} + \text{AgCl}_{(\text{s})}$
 - $\text{NaCl}_{(\text{aq})} + \text{Ag}(\text{NO}_3)_{2(\text{aq})} \longrightarrow \text{Na}(\text{NO}_3)_{2(\text{aq})} + \text{AgCl}_{(\text{s})}$
 - $\text{NaCl}_{(\text{aq})} + \text{AgNO}_{3(\text{aq})} \longrightarrow \text{NaNO}_{3(\text{aq})} + \text{AgCl}_{(\text{aq})}$
 - $\text{NaCl}_{(\text{aq})} + \text{Ag}_2\text{NO}_{3(\text{aq})} \longrightarrow \text{NaNO}_{3(\text{aq})} + \text{Ag}_2\text{Cl}_{(\text{s})}$
15. What is produced when copper carbonate reacts with hydrochloric acid?
- Carbon dioxide.
 - Copper chloride and carbon dioxide.
 - Copper chloride, carbon dioxide and water.
 - Carbon dioxide and water.
16. Which of the following is a product of the reaction between Fe^{3+} ions and OH^- ions?
- $\text{Fe}(\text{OH})_{2(\text{s})}$
 - $\text{Fe}(\text{OH})_{3(\text{s})}$
 - $\text{Fe}(\text{OH})_{3(\text{aq})}$
 - $\text{Fe}_3\text{OH}_{(\text{s})}$
17. Which of the following ions gives a white precipitate when dissolved in nitric acid and then added to barium chloride?
- NO_2^-
 - Cl^-
 - Al^{3+}
 - SO_3^-
18. Which of the following ions gives a white precipitate when added to sodium hydroxide that dissolves in excess sodium hydroxide?
- NO_2^-
 - Cl^-
 - Al^{3+}
 - SO_3^-
19. Which of the following would give a pale blue precipitate when added to sodium hydroxide?
- Cu^{2+}
 - Fe^{2+}
 - Fe^{3+}
 - Mn^{2+}
20. A flame test was carried out with a substance containing calcium. What colour would the flame be?
- Orange.
 - Lilac.
 - Red.
 - Brick red.

PiXL Independence – Level 2
5 questions, 5 sentences, 5 words
A Level Chemistry – Tests for ions

INSTRUCTIONS

- For each statement, use either the suggested website or your own text book to write a 5-point summary. In examinations, answers frequently require more than 1 key word for the mark, so aim to include a few key words.
- It is important to stick to 5 sentences. It is the process of selecting the most relevant information and summarizing it, that will help you remember it.
- Write concisely and do not elaborate unnecessarily, it is harder to remember and revise facts from a big long paragraph.
- Finally, identify 5 key words that you may have difficulty remembering and include a brief definition. You might like to include a clip art style picture to help you remember it.

Example:

QUESTION:	How do you distinguish between the halide ions Cl⁻, Br⁻ and I⁻?				
Sources:	<ol style="list-style-type: none"> 1. Website – http://chemguide.co.uk/inorganic/group7/testing.html 2. Website – http://www.bbc.co.uk/schools/gcsebitesize/science/add_edexcel/ionic_compounds/ionicanalysisrev5.shtml 				
	<ol style="list-style-type: none"> 1. Acidify the solution by adding dilute nitric acid. 2. Add silver nitrate. 3. Cl⁻ = white precipitate, Br⁻ = pale cream precipitate and I⁻ = pale yellow precipitate. 4. Add ammonia to the precipitates. 5. AgCl dissolves to colourless; AgBr dissolves in concentrated ammonia; AgI is insoluble in ammonia. 				
	Nitric acid	Silver nitrate	Cl ⁻ white; Br ⁻ cream; I ⁻ yellow	Ammonia	AgI not dissolve

QUESTION 1:

Describe how to use a flame test to distinguish between Group 2 metal ions.

Sources:

Website –

1. <http://www.compoundchem.com/2014/02/06/metal-ion-flame-test-colours-chart/>
<http://www.rsc.org/learn-chemistry/resource/res00001875/flame-tests-using-metal-salts?cmpid=CMP00004545#!cmpid=CMP00004545>

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QUESTION 2:

Describe how to use aqueous sodium hydroxide and aqueous ammonia to distinguish between Cu^{2+} , Fe^{2+} and Fe^{3+} ions.

Sources:

Website –

1. <http://www.compoundchem.com/2014/03/19/testing-for-cations-sodium-hydroxide-ammonia-precipitates/>
2. <http://www.docbrown.info/page13/ChemicalTests/ChemicalTestsc.htm>

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QUESTION 3: Describe how to determine if a mystery substance contains CO_3^{2-} ions.

Sources:

Website –

1. http://www.alevelchem.com/aqa_a_level_chemistry/unit3.3/331/analysis.htm
2. <http://www.docbrown.info/page13/ChemicalTests/ChemicalTestsa.htm>

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QUESTION 4: Describe how to test for the presence of ammonium ions.

Sources:

Website –

1. <http://pediaa.com/what-is-the-test-for-ammonium-ions/>
2. <http://www.rsc.org/learn-chemistry/resource/res00000757/microscale-reactions-of-positive-ions-with-sodium-hydroxide?cmpid=CMP00005906#!cmpid=CMP00005906>

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QUESTION 5:

Describe how to test for the presence of sulfate ions.

Sources:

Website –

1. <https://www.bbc.co.uk/education/guides/z27ycdm/revision/5>
2. <https://chemstuff.co.uk/analytical-chemistry/tests-for-ions/>

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PiXL Independence – Level 3

Science in the News

A Level Chemistry – Tests for ions

Fake news

Sensationalised news stories have been around for some time, but with the mass growth of social media, the problem seems to have grown in recent years.

Therefore, the ability to identify real information, track it back to the source article and make your own judgement is a very important skill. This activity will help you develop that skill.

The ion science behind a great cup of coffee

News article: <http://www.telegraph.co.uk/news/health/news/10875537/Secret-to-perfect-cup-of-coffee-lies-in-the-quality-of-the-water-researchers-say.html>

Discussion article: <https://www.baristainstitute.com/node/275>

Discussion article: <https://www.mnn.com/food/beverages/blogs/science-great-cup-coffee-chemistry-and-physics>

Discussion article:

<http://www.open.edu/openlearn/ocw/mod/oucontent/view.php?printable=1&id=20880>

Real article: <https://www.bath.ac.uk/announcements/scientists-say-chill-coffee-beans-for-a-more-flavoursome-brew/>

Task

You need to produce a 1-page essay on the ions found in tap water and their impact on the taste of coffee.

Essay section	Activity
Introduction	What ions are present in tap water?
Describe	Describe how to test for the presence of these ions.
Evaluate	Evaluate the impact of these ions on coffee taste.
Discuss	Discuss the balance between safe drinking water and flavor.

PiXL Independence – Level 4

Scientific Posters

A Level Chemistry – Tests for ions

Scientific Posters - Scientists communicate research findings in three main ways. Primarily, they write journal articles much like an experiment write up. These are very concise, appraise the current literature on the problem and present findings. Scientists then share findings at conferences through talks and scientific posters. During a science degree, you would practice all three of these skills.

Scientific posters are a fine balance between being graphically interesting and attracting attention and sharing just the right amount of text to convey a detailed scientific message. They are more detailed than a talk and less detailed than a paper.

Use this information to help structure your poster – <https://www.wikihow.com/Make-a-Scientific-Poster>

More detailed guidance is available at: <https://guides.nyu.edu/posters>

Creating your poster

It is easiest to create a poster in PowerPoint, however you need to add custom text boxes rather than using the standard templates.



Posters need to be eye catching, but readable from a distance. If you use PowerPoint, start with a 4:3 slide (for easier printing, it can then be printed on A3) and use a 14-16 pt font.

The first box could be larger to draw people in. You can use a background image, but pick a simple one that is of high quality. Select 'text box fill' and select 'change the transparency' to maintain the contrast and partially show the picture.

You can experiment with different layouts and you should include images. Avoid a chaotic layout, posters are read from top left column downwards.

Remember to include the authors and references.

Finally, look at the examples given on the University of Texas website which also offers an evaluation of each <https://ugs.utexas.edu/our/poster/samples>

Metal aqua ions - Describe the science behind the formation of precipitates when metal aqua ions react with excess aqueous sodium hydroxide and with aqueous ammonia.

Background

Transition metal ions form co-ordinate bonds forming metal-aqua ions; normally this will involve forming a complex with six water molecules acting as ligands (see diagram). These ions have the general formulae $[M(H_2O)_6]^{2+}$ and $[M(H_2O)_6]^{3+}$, where M is the metal ion.

Source articles:

- <https://secondaryscience4all.wordpress.com/a2-chemistry/a2-inorganic/2-6-reactions-of-ions-in-aqueous-solution/>
- <https://www.chemguide.co.uk/inorganic/complexions/acidity.html>
- <https://www.chemguide.co.uk/inorganic/complexions/aquah3.html>
- <https://www.chemguide.co.uk/inorganic/complexions/aquaoh.html>
- http://www.knockhardy.org.uk/sci_htm_files/a5tm2.pdf
- https://en.wikipedia.org/wiki/Metal_ions_in_aqueous_solution
- <https://chemrevise.files.wordpress.com/2018/04/2-6-revision-guide-reactions-of-aqueous-ions.pdf>

Use other sources as necessary.

Task

Produce a scientific poster on the mass spectrometer.

State	Define the terms co-ordinate bond, complex, ligand and metal aqua ion.
Describe	Describe the reaction between water and a transition metal ion to form a metal -
Discuss	Discuss the science behind the formation of the precipitates with excess aqueous sodium hydroxide and aqueous ammonia using relevant examples and equations.

PiXL Independence – Level 5

Video summaries

A Level Chemistry – Tests for ions

Cornell Notes

At A level and University, you will make large amounts of notes, but those notes are only of use if you record them in a sensible way. One system for recording notes is known as the Cornell notes system. This method encourages you to select relevant information, rather than trying to write a transcript of everything said. More importantly, it forces you to spend a few minutes reviewing what you have written, which has been scientifically proven to aid learning and memory retention.

The ideal is to write everything on one page, but some students may prefer to type and others will to handwrite their notes. Whichever option you use, remember the aim is to summarise and condense the content with a focus on the objectives that you are trying to learn and understand.

There are three main sections to the Cornell notes

- 1 **Cue/ Objectives** – This can be done before or after the lecture. You may have been provided with the objectives or you may need to decide what they were or you may want to make the link to your learning if this is an additional task or lecture you are viewing, such as this video.
- 2 **Notes** – In this space you record concisely, simply the things you are LESS likely remember - **The NEW knowledge**.
- 3 **Summary** – The most important step that is carried out after the lecture or video. This helps to reinforce learning.

Background

The following series of videos link to your learning. The first is a summary of essential learning on precipitation reactions produced by the excellent 'Crash Course'. The second discusses how to test a single sample, for various ions, in sequence.

Source article:

Video 1 – Precipitation reactions

CrashCourse YouTube channel: <https://www.youtube.com/watch?v=llu16dy3ThI>

Video 2 – Testing for ions in sequence

YouTube: <https://www.youtube.com/watch?v=mqZcJZnEphw>

Task:

**You need to produce a set of Cornell notes for each of the videos given above.
Use the following objective to guide your note taking, this links to your learning.**

1. Discuss precipitation reactions and how they occur.
2. Discuss how to test a mixture to determine which chemicals are present.

Objectives

What are the main learning outcomes that have been shared with you?
This will help guide you to taking the RIGHT notes during the video.

Title
Date

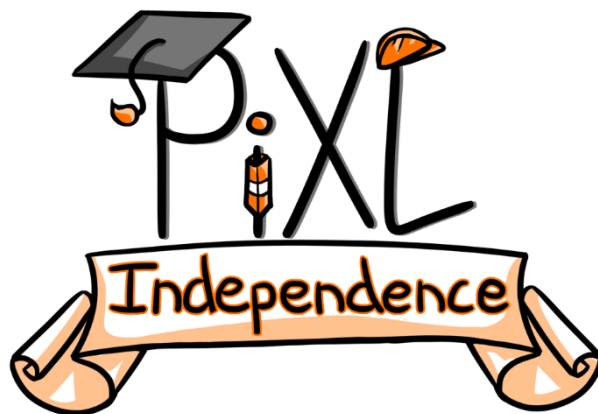
Sketch down note and key words
Do not write in full sentences whilst you listen, put quick sketches, single words, mind maps, short hand etc.
To help train you for university, try not to pause the video because you could not pause a live lecture (However, a lecture may give more natural pauses for you to catch up).

Summary (after the video)

What are your main points of learning from this video.
This is your chance to make sense of your notes.
Make clear connections to the things you need to know

	Title Date
Objectives	
Summary	

	Title Date
Objectives	
Summary	



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