

Distinguish between style of question
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12 WATP 2008 paper

11. Four white crystalline substances in identical unmarked jars need to be identified. The substances are barium hydroxide, magnesium nitrate, sodium sulfate and aluminium carbonate.

Complete the following table giving a relevant distinguishing **chemical** test which will enable you to correctly identify each substance. Give the accompanying observation and your conclusion. Equations are unnecessary.

Test	Observation	Conclusion
1. To a little of each of the four solid samples, add
2. To a little of each of the three remaining samples add water to dissolve, then.....
3. To a little of the two remaining samples add water to dissolve, then.....

(9 marks)

ANSWER

11. 1. Add hydrochloric acid. (1)
One white solid will produce bubbles of colourless gas. (1)
The substance which produces gas bubbles with the acid is the aluminium carbonate. (1)
2. Add $\text{BaCl}_2(\text{aq})$. (1)
One solution will produce a white precipitate. (1)
- (1)
The substance which produced the white precipitate is the sodium sulfate. (1)
3. Add $\text{Na}_2\text{SO}_4(\text{aq})$. (1)
One solution will produce a white precipitate. (1)
- (1)
The one which produces the white precipitate is the barium hydroxide. (1)

Note: There are a number of alternative answers to this question based on various solubility rules.

12 Edwest 2004 paper

9. Three solutions; **A**, **B** and **C** where known to be aluminium nitrate, lead nitrate and sodium nitrate. Describe chemical tests that you would carry out to determine the identity of the three solutions. Flame tests are not permitted. Write equations for any reactions used.

[6 marks]

ANSWER

9. possible process:

Test	Result /Conclusion	Equation
Measure pH of solution. [1]	Solution that is < pH 7 is aluminium nitrate [1]	$[\text{Al}(\text{H}_2\text{O})_6]^{3+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \longrightarrow [\text{Al}(\text{OH})(\text{H}_2\text{O})_5]^{2+}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ [1]
Add solution to sodium sulphate solution. . [1]	Solution that forms ppt is lead nitrate [1]	$\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \longrightarrow \text{PbSO}_4(\text{s})$ [1]
	Remaining solution is sodium nitrate	

Other solutions possible based on solubilities.

12 Edwest 2003 paper

11. Explain how you could distinguish between the following pairs of compounds using chemical tests.

	Compounds	Description of Test	Observations
(a)	$\text{PbCl}_{2(s)}$		with $\text{PbCl}_{2(s)}$
	$\text{KCl}_{(s)}$		with $\text{KCl}_{(s)}$
(b)	$\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$		with $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$
	$\text{C}_3\text{H}_7\text{CO}_2\text{H}$		with $\text{C}_3\text{H}_7\text{CO}_2\text{H}$
(c)	1-pentanol		with 1-pentanol
	2-ethyl-2-propanol		with 2-ethyl-2-propanol

[6 marks]

ANSWER

11.

	Compound s	Test [1 mark each]	Observations [both required for 1 mark]
(a)	PbCl _{2(s)}	dissolve in water and add OH ⁻ /SO ₄ ²⁻ to solution formed.	precipitate
	KCl _(s)		no precipitate
(b)	CH ₃ CO ₂ C ₂ H ₅	Add carbonate or use indicator	no fizzing indicator = neutral
	C ₃ H ₇ CO ₂ H		fizzing indicator = acidic
(c)	1-pentanol	Add acidified dichromate or permanganate	colour change: orange to green or purple to colourless
	2-ethyl-2-propanol		no visible change

[6]

12 Edwest 2001 paper had to alter this question due to syllabus change

1. For each of the following pairs of substances, describe a **chemical test** that could be used to distinguish between the two substances. You must predict your observation for the same test with each substance.

- (a) solutions of magnesium nitrate and zinc chloride.

Description of Test

Observation with magnesium nitrate

Observation with zinc chloride

- (b) samples of ammonia gas and nitrogen gas.

Description of Test

Observation with ammonia gas

Observation with nitrogen gas

[8 marks]

ANSWER

7. (a) solutions of magnesium nitrate and zinc chloride.

Description of Test

eg: Add aqueous silver nitrate to samples of each.

Observation with magnesium nitrate

Two colourless solutions combine to form colourless solution.

Observation with zinc chloride

Two colourless solutions combine and a white solid forms in a colourless solution

- (b) samples of ammonia gas and nitrogen gas.

Description of Test

eg: Bubble each through distilled water and test with red litmus paper.

Observation with ammonia gas

Turns red litmus blue.

Observation with nitrogen gas

No observable reaction with red litmus.

[8 marks]

12 Edwest 2008 paper

9. A student places the following substances in jars in the laboratory: sodium carbonate, calcium carbonate, barium hydroxide, zinc hydroxide and sodium hydroxide.

Unfortunately he forgets to label the jars, and as they are all white solids, he does not know which one is which. Describe how you could carry out tests to distinguish between them. Write equations for any reactions that would occur in the tests. You are allowed to use normal laboratory reagents.

[7 marks]

ANSWER

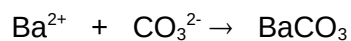
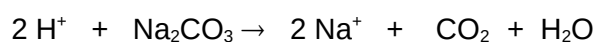
9. [4 marks for correct tests to identify solids]

For example:

Test	Result	Identified
Add dilute acid to all solids	Those that give off a gas	sodium carbonate, calcium carbonate
Add both of these solids to water	Soluble in water	sodium carbonate
	Insoluble in water	calcium carbonate
Add water to the other three solids	Insoluble in water	zinc hydroxide
Add sodium carbonate solution to the other two solutions	White precipitate	barium hydroxide
	No precipitate	sodium hydroxide

[4 marks]

[Up to 3 marks for correct equations]

For example: equations must relate to the tests shown

[3 marks]

12 WATP 2007 paper

4. A student carries out 4 experiments and makes the following observations:

Experiment	Observations
1	A green compound is heated strongly to produce a black residue, a brown gas and another gas which rekindles a glowing splint.
2	The black residue is mixed with sulfuric acid and is heated to produce a blue solution.
3	When sodium hydroxide is added to the blue solution a blue precipitate is formed.
4	When zinc powder is added to the blue solution from Experiment 2, a solid is obtained.

- (a) Write an equation showing what happened in Experiment 1

.....
.....(2 marks)

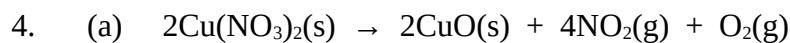
- (b) What is the name/formula of the blue precipitate in Experiment 3?

.....
.....(1 mark)

- (c) What type of reaction is occurring in Experiment 4?

.....

(1 mark)

ANSWER

(2)

(b) $\text{Cu}(\text{OH})_2$: Copper(II) hydroxide

(1)

(c) Metal displacement or redox

(1)

11 Edwest 2003 paper

9. Explain how you could distinguish between the following pairs of compounds using chemical tests.

	Compounds	Description of Test	Observations
(a)	$\text{PbI}_{2(\text{s})}$		with $\text{PbI}_{2(\text{s})}$
	$\text{PbCO}_{3(\text{s})}$		with $\text{PbCO}_{3(\text{s})}$
(b)	C_3H_6		with C_3H_6
	C_3H_8		with C_3H_8
(c)	AlPO_4		with AlPO_4

	K_3PO_4		with K_3PO_4
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[6 marks]

ANSWERS

9.

	Compounds	Description of Test	Observations
(a)	$PbI_{2(s)}$	add dilute acid	with $PbI_{2(s)}$ fizzing
	$PbCO_{3(s)}$		with $PbCO_{3(s)}$ no reaction
(b)	C_3H_6	add bromine water	with C_3H_6 decolourise
	C_3H_8		with C_3H_8 no reaction
(c)	$AlPO_4$	Add water	with $AlPO_4$ no reaction
	K_3PO_4		with K_3PO_4 solid dissolves

[6]

11 WATP 2005 paper this question modified due to syllabus change

4. For each of the following pairs of substances, describe a chemical test that will enable you to distinguish between them. Include equations, relevant diagrams and observations where applicable.
- a. Solid Aluminium Hydroxide and solid Barium Hydroxide
- b. Pentane and Pentene
- c. Oxygen gas and Hydrogen gas.

(9 marks)

ANSWERS

4. For each of the following pairs of substances, describe a chemical test that will enable you to distinguish between them. Include equations, relevant diagrams and observations where applicable.

a Solid Aluminium Hydroxide and solid Barium Hydroxide

a. Add water to each solid. (1 mark)

- Aluminium Hydroxide will not dissolve, barium hydroxide will dissolve.
- $\text{Ba}(\text{OH})_{2(\text{s})} \rightarrow \text{Ba}^{2+}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})}$
- (2 marks)

b Pentane and Pentene

b. Add a solution of a coloured halogen. eg Bromine water.

- Pentane no reaction.
- 1- Pentene $\rightarrow \text{CH}_2\text{BrCHBrCH}_2\text{CH}_2\text{CH}_3_{(\text{l})}$
- $\text{Br}_{2(\text{aq})}$ is a red/brown colour. On addition to pentene bromine water quickly decolourises leaving colourless solution.

c Oxygen gas and Hydrogen gas

c. Place a glowing splint into both samples.

- Oxygen will relight the glowing splint.
- Hydrogen, (in the presence of oxygen from the atmosphere will produce the characteristic “pop”).
 $2\text{H}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2\text{H}_2\text{O}_{(\text{l})}$

11 WATP 2006 paper

8. Explain how you could distinguish between the following pairs of substances using **chemical** tests.

	Compounds	Description of test	Observations
(a)	O₂(g)		with O ₂
	CO₂(g)		with CO ₂
(b)	NaCl(s)		with NaCl
	NaNO₃(s)		with NaNO ₃

[4 marks]

ANSWERS

8(a). Glowing splint test: with $\text{O}_2(\text{g})$, the splint stays alight; with $\text{CO}_2(\text{g})$, the splint goes out.

OR Bubble through limewater: with $\text{O}_2(\text{g})$, no reaction; with $\text{CO}_2(\text{g})$, white ppt forms.

OR Dissolve in water and test

for pH (meter/litmus): with $\text{O}_2(\text{g})$, remains neutral: with $\text{CO}_2(\text{g})$, acidic soln. produced. (2)

8(b) Dissolve in water, then add

$\text{AgNO}_3(\text{aq})$: with NaCl , white ppt forms; with NaNO_3 , no visible reaction.

(2)

Other school paper

1. For each of the following describe briefly a chemical test and observation by which you could distinguish between the substances listed.

Chemicals	Chemical test	What you would observe in each case
Two black solids Copper(II) oxide and Iron(II) oxide		With copper(II) oxide
		With iron(II) oxide
Two colourless solutions Potassium nitrate and Potassium chloride		With potassium nitrate
		With potassium chloride

2. For each of the following, describe briefly a test and observation by which you could distinguish between the substance listed. You must indicate which of the two substances tested gives rise to the observation. No equations are necessary.

- a) Sodium nitrate solution and sodium sulfate solution.

Test: _____

Observation : _____

(1 mark)

- b) Carbon dioxide gas and hydrogen gas.

Test: _____

Observation : _____

(1 mark)

- c) Solid magnesium hydroxide and solid lead (II) sulfate.

Test: _____

Observation : _____

(1 mark)

- d) Ammonium chloride solution and potassium iodide solution.

Test: _____

Observation : _____

ANSWERS

1. For each of the following describe briefly a chemical test and observation by which you could distinguish between the substances listed.

Chemicals	Chemical test	What you would observe in each case
Copper(II) oxide and Iron(II) oxide	Add dilute HCl to both solids	With copper(II) oxide the black solid will dissolve to form a blue solution
		With iron(II) oxide the black solid will dissolve to form a green solution
Potassium nitrate and Potassium chloride	Add aqueous AgNO ₃ to both solutions	With potassium nitrate two colourless, clear solutions combine to form a clear colourless solution
		With potassium chloride to clear, colourless solutions combine to form a white precipitate in a colourless solution

2. For each of the following, describe briefly a test and observation by which you could distinguish between the substance listed. You must indicate which of the two substances tested gives rise to the observation. No equations are necessary.

- a) Sodium nitrate solution and sodium sulfate solution.

Test: Add barium nitrate solutions to both solutions.

Observation : When Ba(NO₃)₂(aq) is added to NaNO₃(aq) two clear, colourless solutions are combined and a clear, colourless solution is formed. When Ba(NO₃)₂(aq) is added to Na₂SO₄(aq) two clear, colourless solutions are combined and a white precipitate forms in a colourless solution.

(1 mark)

- b) Carbon dioxide gas and hydrogen gas.

Test: Place a lighted taper in samples of both gases.

Observation : There is a loud 'pop' sound when the lighted taper is placed in H₂ gas sample. The lighted taper goes out when placed in the CO₂ gas sample.

(1 mark)

- c) Solid magnesium hydroxide and solid lead (II) sulfate.

Test: Add dilute hydrochloric acid to both solids.

Observation : The solid magnesium hydroxide (white solid) would dissolve to form a clear, colourless solution. The solid lead II sulfate would not dissolve.

(1 mark)

- d) Ammonium chloride solution and potassium iodide solution.

Test: Add dilute NaOH(aq) to both and heat gently.

Observation : With the NH₄Cl(aq) two colourless solutions are combined and on heating a pungent gas is given off, the resulting solution is colourless with the KI(aq) two colourless solutions are combined to form a colourless solution.

(1 mark)