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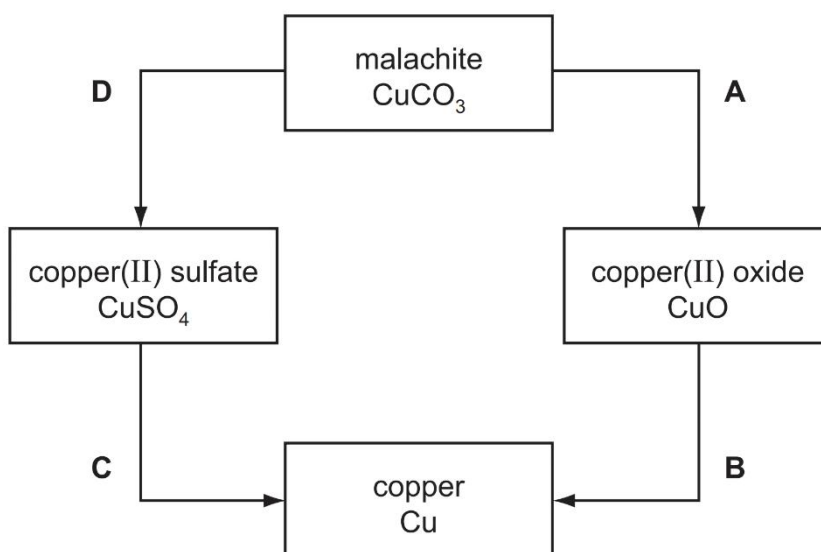
Multiple-choice Questions on Acids, Bases and Salts #6

- Which mixture would react with dilute sulfuric acid to form two different gases?
 - Copper and magnesium carbonate
 - Copper(II) carbonate and magnesium
 - Copper(II) carbonate and magnesium oxide
 - Copper(II) oxide and magnesium
- Which salts are soluble in water?
 - ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$
 - calcium carbonate, CaCO_3
 - lead(II) carbonate, PbCO_3
 - sodium carbonate, Na_2CO_3

A 1 only	B 1 and 2 only
C 1 and 4 only	D 2 and 3 only
- Which compound in a 1 mol/dm^3 solution has the lowest pH value?
 - Ethanoic acid
 - Hydrogen chloride
 - Sulfuric acid
 - Sodium hydroxide
- Salts containing which of the following anions are always soluble in water?

A Carbonates	B Chlorides
C Nitrates	D Sulfates
- What is a property of the hydroxide, OH^- , ion?
 - It combines with hydrogen to form water.
 - It is present in water.
 - It readily breaks down into hydrogen ions and oxide ions.
 - It travels to the cathode in electrolysis of an aqueous solution.

6. The diagram shows some reactions of copper compounds.
Which change is made by adding an acid?



7. When the product of a reaction between two gases is added to water, a solution of pH 7 is formed. Which could be these gases?
- A Hydrogen and chlorine
 - B Hydrogen and nitrogen
 - C Hydrogen and oxygen
 - D Oxygen and carbon monoxide
8. Which reagent is added to aqueous potassium chloride to prepare lead(II) chloride?
- A Aqueous lead(II) nitrate
 - B Lead
 - C Lead(II) carbonate
 - D Lead(II) sulfate
9. Which statement about amphoteric oxides is **not** correct?
- A They dissolve in water.
 - B They are formed only by metals.
 - C They react with aqueous sodium hydroxide to give salts.
 - D They react with aqueous acids to give salts.
10. To which substance is dilute sulfuric acid added to prepare lead(II) sulfate?
- A Aqueous lead(II) nitrate
 - B Lead foil
 - C Powdered lead(II) carbonate
 - D Powdered lead(II) oxide

11. Which pair of substances reacts to form a salt and water only?

- A Aqueous sodium chloride and aqueous silver nitrate.
- B Aqueous sodium hydroxide and dilute ethanoic acid.
- C Aqueous sodium carbonate and dilute sulfuric acid.
- D Zinc and dilute hydrochloric acid.

12. Which reaction does **not** involve neutralisation?

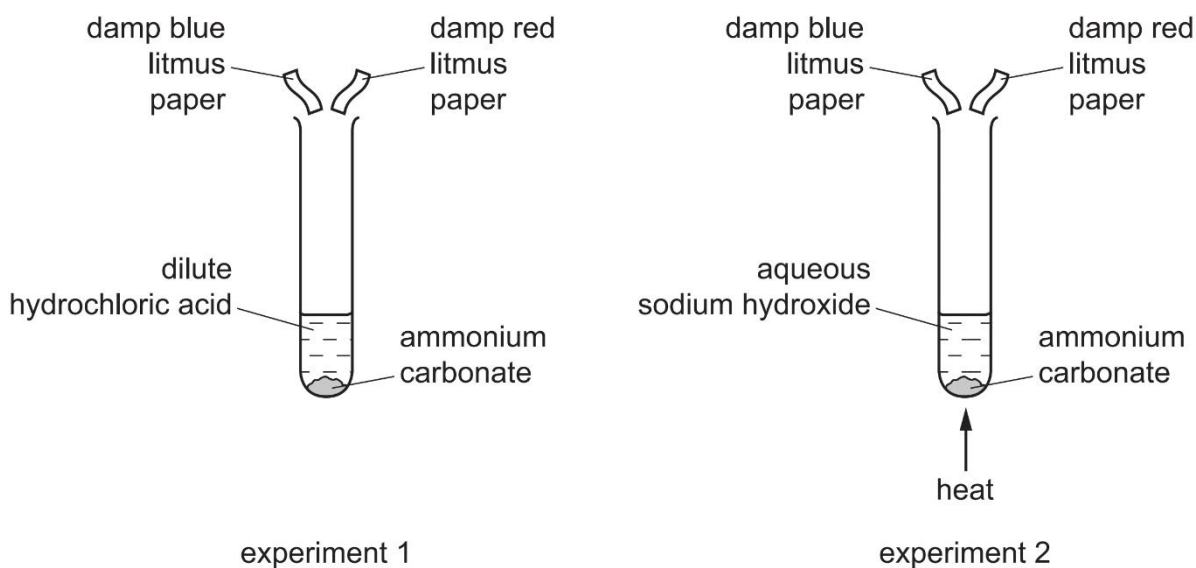
- A $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
- B $\text{H}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- C $\text{H}_2\text{SO}_4(\text{aq}) + \text{CuO}(\text{s}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

13. Two experiments were carried out.

In experiment 1, ammonium carbonate was reacted with dilute hydrochloric acid.

In experiment 2, ammonium carbonate was heated with aqueous sodium hydroxide.

In each experiment, the gas evolved was tested with damp blue litmus paper and damp red litmus paper.



Which row correctly shows the colour of both the pieces of litmus paper at the end of each experiment?

	experiment 1	experiment 2
A	blue	blue
B	blue	red
C	red	blue
D	red	red

14. The table shows some properties of four metal chlorides.

Which row is magnesium chloride?

	colour	solubility in water	method of preparation
A	green	insoluble	precipitation
B	green	soluble	metal and acid
C	white	insoluble	precipitation
D	white	soluble	metal and acid

15. Which row shows the pH values for 0.1 mol/dm³ solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	NH ₃	HCl	NaCl	NaOH
A	1	7	13	11
B	7	1	11	13
C	11	1	7	13
D	13	11	7	1

16. A student has five reagents.

- dilute hydrochloric acid
- dilute sulfuric acid
- dilute nitric acid
- solid calcium carbonate
- solid copper(II) carbonate

How many soluble salts can be prepared?

- A** 3 **B** 4 **C** 5 **D** 6

17. Which statement is correct?

- A** Ammonia is produced when an ammonium salt is warmed with a dilute acid.
- B** Amphoteric oxides are oxides of certain metals.
- C** A neutral solution does not contain hydroxide ions.
- D** Soil with a high pH can be neutralised by adding lime, Ca(OH)₂.

18. Which reagent can be used to react with dilute hydrochloric acid to prepare silver chloride?

- A Aqueous silver nitrate
- B Solid silver
- C Solid silver carbonate
- D Solid silver oxide

19. Three separate mixtures of a solution and a solid are made, as shown in the table.

The mixtures are warmed.

In which mixtures does a gas form?

	NaOH(aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and Mg(s)
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key:

✓ = gas forms

✗ = no gas forms

20. Insoluble salts are prepared by reacting aqueous solutions of soluble salts. A precipitate forms. Which pairs of aqueous solutions form a precipitate?

- 1 barium chloride and nitric acid
- 2 barium chloride and sulfuric acid
- 3 barium nitrate and nitric acid
- 4 barium nitrate and sulfuric acid

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 4 only
- D 3 and 4 only

21. What is a use of sulfuric acid?

- A As a bleach.
- B As a food preservative.
- C In the manufacture of detergents.
- D In the manufacture of vanadium(V) oxide, V₂O₅.

22. Which compound can be formed by precipitation?

- A AgCl
- B CaCl₂
- C K₂SO₄
- D Pb(NO₃)₂

23. Sodium hydroxide is added to a solution to alter its pH. A neutral solution is formed.

Which statement is correct?

- A Sodium hydroxide is an acid and reacts with an alkali to form water as a product.
- B Sodium hydroxide will lower the pH of the solution.
- C The pH of the neutral solution is 14.
- D The pH of the solution before sodium hydroxide is added is below 7.

24. Lead(II) chloride is an insoluble salt.

Which two reagents are used to prepare a pure sample of lead(II) chloride?

- A Lead(II) carbonate and dilute hydrochloric acid.
- B Lead metal and dilute hydrochloric acid.
- C Aqueous lead(II) nitrate and dilute hydrochloric acid.
- D Lead(II) oxide and dilute hydrochloric acid.

25. A compound X, when heated with an aqueous solution of compound Y, produces a gas that turns red litmus blue.

- 1 Y could be potassium hydroxide
- 2 X is an acid
- 3 X could be an ammonium salt
- 4 X could be sodium nitrate

Which statements are correct?

- A 1, 2 and 3
- B 1 and 3 only
- C 3 only
- D 2 and 4 only

26. In a neutralisation reaction, which change in particles occurs?

- A atoms → molecules
- B ions → molecules
- C atoms → ions
- D ions → atoms

37. Which equation represents the reaction between aqueous sodium carbonate and dilute hydrochloric acid?

- A $\text{NaCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- B $\text{NaCO}_3 + 2\text{HCl} \rightarrow \text{NaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- C $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- D $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$

28. Two solutions are prepared.

- Solution **P** is 0.050 mol/dm³ hydrochloric acid.
- Solution **Q** is 0.100 mol/dm³ ethanoic acid.

A 2 cm strip of magnesium ribbon is put into 100 cm³ of each solution. Effervescence is seen in both solutions but the effervescence is faster in solution **P** than it is in solution **Q**.

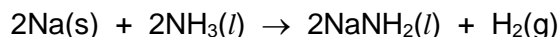
Which statement helps to explain this observation?

- A** Magnesium reacts with solution **P** to form a salt, but does not form a salt with solution **Q**.
- B** More molecules are dissociated in solution **P** than are dissociated in solution **Q**.
- C** Solution **Q** contains a stronger acid than solution **P**.
- D** The particles are closer together in solution **Q** than they are in solution **P**.

29. Which one of the following, when added in **excess** to acidic soil, will increase the pH of the soil to exactly 7.0?

- A** Calcium carbonate
- B** Calcium chloride
- C** Sodium hydroxide
- D** Sodium sulfate

30. Sodium reacts with liquid ammonia at a temperature of –33 °C according to the following balanced chemical equation.



How is the liquid ammonia behaving in this reaction?

- A** As an acid.
- B** As an alkali.
- C** As an indicator.
- D** As a salt.

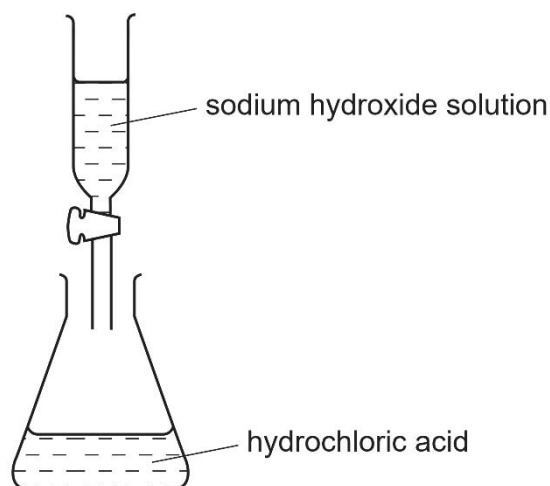
31. The table below shows information about four different pH indicators.

indicator	pH at which colour change takes place	colour at low pH	colour at high pH
methyl orange	3.2 to 4.4	red	yellow
bromocresol blue	3.8 to 5.4	yellow	blue
methyl red	4.8 to 6.0	red	yellow
bromothymol blue	6.0 to 7.6	yellow	red

Which indicator, or set of indicators, is most precise in showing that a solution has a pH of approximately 4.5 to 4.7?

- A** Methyl red only
- B** Bromocresol blue only
- C** Methyl red and methyl orange
- D** Methyl red and bromothymol blue

41. Sodium hydroxide solution was added to dilute hydrochloric acid. The pH of the solution in the flask was measured at intervals until no further change of pH took place.



What would be the pH change of this reaction?

- A Decrease to 1
 - B Decrease to 7
 - C Increase to 7
 - D Increase to 12
42. Titration of an acid against a base is a method often used in the preparation of salts.
Which properties of the acid, the base and the salt are required if this method is to be used?

	acid	base	salt
A	insoluble	insoluble	insoluble
B	soluble	insoluble	insoluble
C	soluble	soluble	insoluble
D	soluble	soluble	soluble

43. Which acid and base react together to produce an insoluble salt?
- A Hydrochloric acid and sodium hydroxide
 - B Nitric acid and calcium oxide
 - C Sulfuric acid and barium hydroxide
 - D Sulfuric acid and zinc oxide

49. Which row correctly describes the oxides?

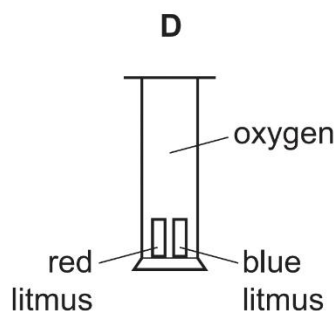
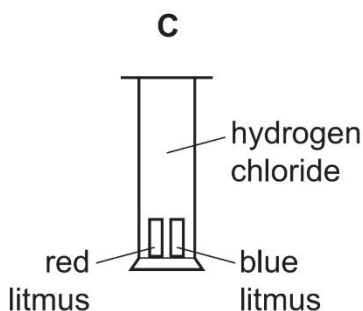
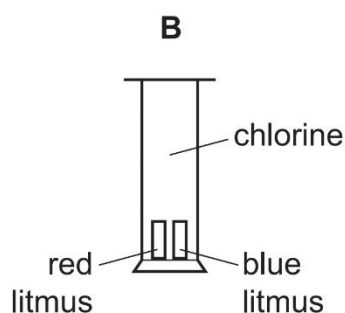
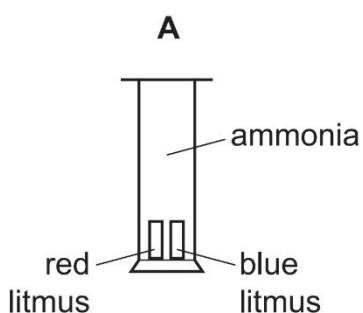
	Al_2O_3	K_2O	MgO	SO_2
A	basic	acidic	acidic	amphoteric
B	acidic	basic	amphoteric	acidic
C	amphoteric	basic	amphoteric	acidic
D	amphoteric	basic	basic	acidic

50. Powdered calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.

Which is the correct ionic equation, including state symbols, for this reaction?

- A** $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$
B $Ca^{2+}(aq) + CO_3^{2-}(aq) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l) + CO_2(g)$
C $CO_3^{2-}(aq) + 2H^+(aq) \rightarrow H_2O(l) + CO_2(g)$
D $CaCO_3(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l) + CO_2(g)$

51. Four gas jars each contain one of the gases ammonia, chlorine, hydrogen chloride and oxygen. A strip of damp blue litmus paper and a strip of damp red litmus paper are placed in each jar. In which gas jar will both the damp blue litmus paper and the damp red litmus paper change colour?



58. Which experiment will result in the formation of a white precipitate?
- A Aqueous barium nitrate added to aqueous sodium chloride.
 - B Aqueous sodium carbonate added to aqueous calcium chloride.
 - C Carbon dioxide passed through aqueous potassium chloride.
 - D Dilute hydrochloric acid added to aqueous ammonia.
59. How should a pure, dry sample of barium sulfate be prepared from a sample of barium carbonate?
- A Titrate sulfuric acid against the barium carbonate using a suitable indicator. Heat the resulting solution until it is saturated and then crystallise the barium sulfate from solution.
 - B Add excess sulfuric acid to the barium carbonate. Filter the mixture. Wash and dry the residue.
 - C Add excess aqueous sodium sulfate to the barium carbonate. Filter the mixture. Wash and dry the residue.
 - D Add excess nitric acid to the barium carbonate. Add excess sodium sulfate to the resulting solution. Filter the mixture. Wash and dry the residue.
60. Why is ethanoic acid described as a weak acid?
- A It is an organic acid.
 - B It is a poor conductor of electricity.
 - C It is only slightly dissociated in water.
 - D It reacts only with very reactive metals.
61. What is the best method to prepare a sample of silver chloride?
- A Add silver nitrate to chlorine.
 - B Add silver to hydrochloric acid.
 - C Burn silver in chlorine.
 - D Mix aqueous solutions of silver nitrate and sodium chloride.
62. Solution **T** has the following properties.
- 1 It reacts with magnesium forming a gas.
 - 2 It reacts with calcium carbonate forming a gas.
- Which statement about solution **T** is correct?
- A It contains more OH^- ions than H^+ ions.
 - B It has pH 9.
 - C Its reaction with calcium carbonate produces hydrogen.
 - D It reacts with aqueous ammonia.

67. Two incomplete statements about the preparation of an insoluble salt are given.

.....1..... can be used to prepare insoluble salts, such as2..... .

The salt is collected by 3..... and it is then4..... .

Which words correctly complete gaps 1 - 4?

	1	2	3	4
A	precipitation	barium nitrate	filtration	evaporated
B	precipitation	lead(II) sulfate	evaporation	washed and dried
C	precipitation	lead(II) sulfate	filtration	washed and dried
D	titration	barium nitrate	evaporation	washed and dried

68. Which statement about acids and bases is correct?

- A** All strong acids react with carbonates, but all weak acids do not.
- B** The oxides of Group 1 metals are amphoteric.
- C** The pH of 1.0 mol/dm³ ethanoic acid, CH₃COOH, is higher than the pH of 1.0 mol/dm³ sulfuric acid, H₂SO₄.
- D** The pH of 1.0 mol/dm³ nitric acid, HNO₃, is lower than the pH of 1.0 mol/dm³ hydrochloric acid, HCl.

69. Which method should be used to make a pure sample of potassium chloride?

- A** Adding AgCl(s) to KNO₃(aq)
- B** Adding excess K₂CO₃(s) to HCl(aq)
- C** Mixing KNO₃(aq) with NaCl(aq)
- D** Titrating KOH(aq) with HCl(aq)

70. A pure sample of lead(II) sulfate is made by reacting aqueous solutions of two salts. The lead(II) sulfate formed is then separated from the mixture.

Which solutions and method of separation are used?

	salt solution 1	salt solution 2	salt solution 3
A	lead(II) chloride	sodium sulfate	crystallisation
B	lead(II) chloride	sodium sulfate	filtration
C	lead(II) nitrate	potassium sulfate	crystallisation
D	lead(II) nitrate	potassium sulfate	filtration

71. Which row shows the correct state symbols for the reaction between calcium carbonate and dilute hydrochloric acid? (The conditions are room temperature and pressure.)

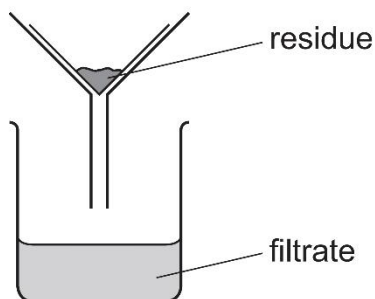
	$\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$				
A	(s)	(aq)	(s)	(aq)	(g)
B	(s)	(l)	(aq)	(l)	(g)
C	(s)	(l)	(s)	(aq)	(g)
D	(s)	(aq)	(aq)	(l)	(g)

72. Aqueous calcium hydroxide is an alkali. It is neutralised by dilute nitric acid to produce calcium nitrate and water.

What is the **ionic** equation for this reaction?

- A** $\text{Ca}^+ + \text{OH}^- + \text{H}^+ + \text{NO}_3^- \rightarrow \text{CaNO}_3 + \text{H}_2\text{O}$
B $\text{Ca}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
C $\text{Ca}^{2+}(\text{OH}^-)_2 + 2\text{H}^+\text{NO}_3^- \rightarrow \text{Ca}^{2+}(\text{NO}_3^-)_2 + 2\text{H}_2\text{O}$
D $\text{OH}^- + \text{H}^+ \rightarrow \text{H}_2\text{O}$

73. Pure lead(II) sulfate is prepared by mixing two substances, **X** and **Y**. When the reaction is complete the mixture is filtered. Pure lead(II) sulfate is obtained.



Which row shows the best way to prepare lead(II) sulfate?

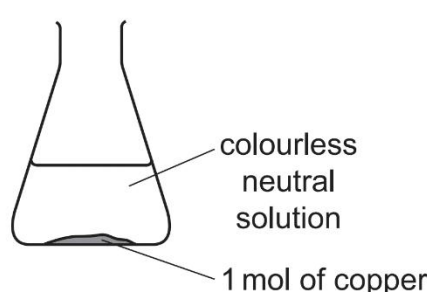
	substance X	substance Y	method after filtration
A	aqueous lead(II) nitrate	aqueous sodium sulfate	crystallise the filtrate
B	aqueous lead(II) nitrate	aqueous sodium sulfate	wash and dry the residue
C	solid lead(II) carbonate	dilute sulfuric acid	crystallise the filtrate
D	solid lead(II) carbonate	dilute sulfuric acid	wash and dry the residue

74. Which method of preparation would be suitable for making these salts?

	titration	metal + acid	metal carbonate + acid	precipitation
A	sodium nitrate	lead(II) chloride	copper(II) sulfate	zinc sulfate
B	zinc sulfate	copper(II) sulfate	sodium nitrate	lead(II) chloride
C	zinc sulfate	sodium nitrate	lead(II) chloride	copper(II) sulfate
D	sodium nitrate	zinc sulfate	copper(II) sulfate	lead(II) chloride

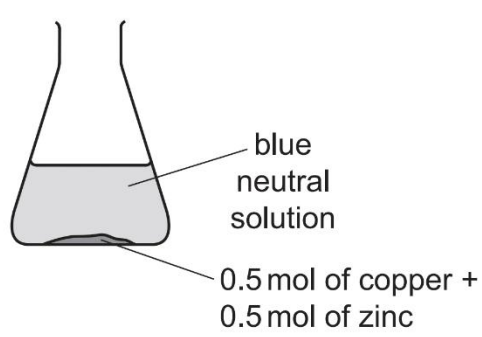
75. In an experiment, 1 mol of powdered copper and 1 mol of powdered zinc are placed in a flask. Dilute acid, containing 1 mol of acid, is added to the flask. The flask is left until all the reactions, if any, are complete. Which diagram shows the result of the experiment?

A



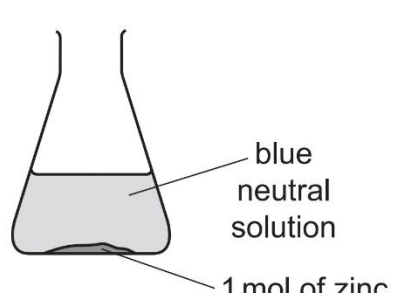
colourless neutral solution
1 mol of copper

B



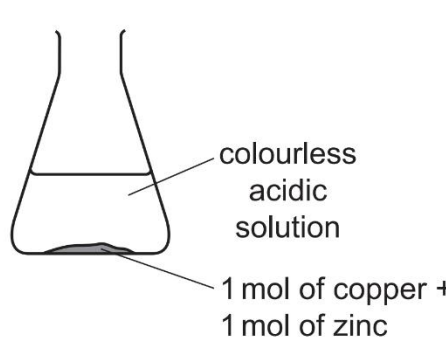
blue neutral solution
0.5 mol of copper + 0.5 mol of zinc

C



blue neutral solution
1 mol of zinc

D



colourless acidic solution
1 mol of copper + 1 mol of zinc

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