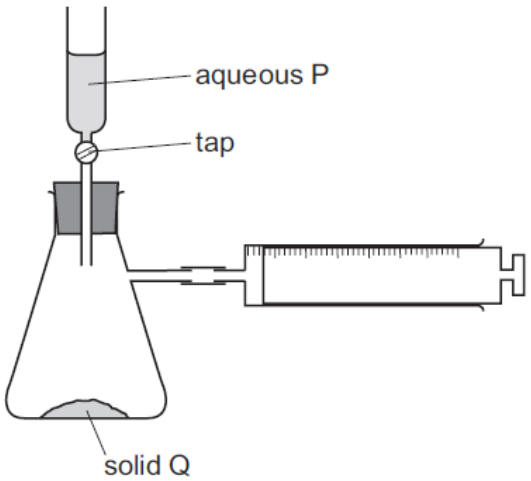
1. Nov/2022/Paper_11,21/No.17

The diagram shows an experiment.



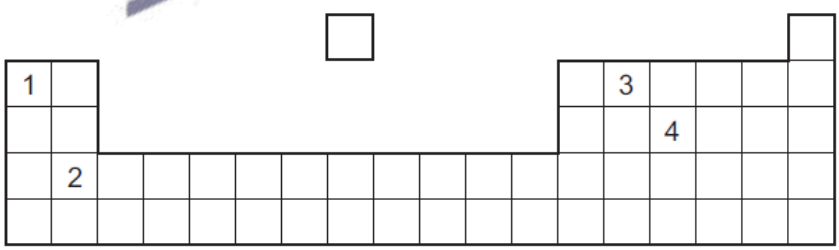
A small volume of aqueous P is poured on to solid Q and the tap of the funnel closed.

Which pairs of substances cause the syringe to fill with gas?

	HNO_3 and Mg	HCl and Cu	H_2SO_4 and Na_2CO_3
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

2. Nov/2022/Paper_11/No.18

Part of the Periodic Table is shown.



Which elements form basic oxides?

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

3. Nov/2022/Paper_11/No.19

Aqueous ammonium sulfate is made by reacting aqueous ammonia with dilute sulfuric acid.

How is solid ammonium sulfate obtained from the resulting solution?

A crystallisation

B distillation

C filtration

D solvent extraction

4. Nov/2022/Paper_12/No.17

X and Y are oxides of two different elements.

- X reacts with water to produce aqueous solution Z.
- Z turns universal indicator paper blue.
- An aqueous solution of Y reacts with sodium carbonate to produce carbon dioxide gas.

Which statement is correct?

A X and Y are both the oxides of metals.

B X and Y are both the oxides of non-metals.

C X is the oxide of a metal and Y is the oxide of a non-metal.

D X is the oxide of a non-metal and Y is the oxide of a metal.

5. Nov/2022/Paper_12/No.18

Copper(II) sulfate is made by reacting excess insoluble solid M and solution N.

Which row identifies M and N and the method used to extract crystals of copper(II) sulfate from the mixture?

	M	N	method
A	copper	sodium sulfate	crystals are filtered out from the mixture
B	copper	sulfuric acid	mixture is filtered and the filtrate evaporated until crystals form
C	copper(II) carbonate	sulfuric acid	mixture is filtered and the filtrate evaporated until crystals form
D	copper(II) oxide	sulfuric acid	mixture is filtered and the residue dried

6. Nov/2022/Paper_12/No.19

Which row shows the observation when a few drops of aqueous P is added to concentrated aqueous Q?

	P	Q	observation
A	acidified potassium manganate(VII)	sodium sulfite	purple solution
B	sodium hydroxide	zinc chloride	white precipitate
C	ammonia	potassium carbonate	fizzing
D	barium chloride	iron(III) sulfate	brown precipitate

7. Nov/2022/Paper_13/No.17

Which row about sodium oxide and sulfur dioxide is correct?

	sodium oxide	sulfur dioxide
A	acidic	acidic
B	acidic	basic
C	basic	acidic
D	basic	basic

8. Nov/2022/Paper_13/No.18

Copper(II) sulfate is a soluble compound that is made by reacting copper(II) oxide with dilute sulfuric acid.

This can be completed in the following steps.

1 Add excess copper(II) oxide to dilute sulfuric acid and heat the mixture.

2 Filter off any unreacted copper(II) oxide.

3 Heat to remove most of the water from the filtrate.

4 Leave the solution to cool and filter off the solid copper(II) sulfate which forms.

Which row shows the processes used in this preparation?

	crystallisation	distillation	evaporation
A	✗	✗	✗
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

9. Nov/2022/Paper_13/No.19

Tests are done on an aqueous solution.

test	a few drops of aqueous sodium hydroxide are added	aqueous sodium hydroxide is added in excess
observation	white precipitate	precipitate dissolves to give a colourless solution

Which cations produce these observations?

1 aluminium, Al^{3+}

2 calcium, Ca^{2+}

3 zinc, Zn^{2+}

A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

10. Nov/2022/Paper_21/No.18

Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

11. Nov/2022/Paper_21/No.19

Aqueous ammonium sulfate is made by reacting aqueous ammonia with dilute sulfuric acid.

How is solid ammonium sulfate obtained from the resulting solution?

A crystallisation

B distillation

C filtration

D solvent extraction

12. Nov/2022/Paper_21/No.20

Carbon forms two oxides: carbon monoxide, CO, and carbon dioxide, CO_2.

Which row describes these two oxides?

	CO	CO_2
A	acidic	acidic
B	acidic	neutral
C	neutral	acidic
D	neutral	neutral

13. Nov/2022/Paper_22/No.18

X and Y are oxides of two different elements.

- X reacts with water to produce aqueous solution Z.
- Z turns universal indicator paper blue.
- An aqueous solution of Y reacts with sodium carbonate to produce carbon dioxide gas.

Which statement is correct?

A X and Y are both the oxides of metals.

B X and Y are both the oxides of non-metals.

C X is the oxide of a metal and Y is the oxide of a non-metal.

D X is the oxide of a non-metal and Y is the oxide of a metal.

14. Nov/2022/Paper_22/No.19

Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

15. Nov/2022/Paper_22/No.20

Copper(II) sulfate is a soluble salt.

Calcium sulfate is an insoluble salt.

Which row shows suitable reactants for preparing a pure sample of the named salt?

	salt	reactants
A	calcium sulfate	calcium carbonate + dilute sulfuric acid
B	calcium sulfate	aqueous calcium chloride and aqueous sodium sulfate
C	copper(II) sulfate	copper + dilute sulfuric acid
D	copper(II) sulfate	aqueous copper(II) chloride and aqueous sodium sulfate

16. Nov/2022/Paper_23/No.18

Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

17. Nov/2022/Paper_23/No.19

Tests are done on an aqueous solution.

test	a few drops of aqueous sodium hydroxide are added	aqueous sodium hydroxide is added in excess
observation	white precipitate	precipitate dissolves to give a colourless solution

Which cations produce these observations?

1 aluminium, Al^{3+}

2 calcium, Ca^{2+}

3 zinc, Zn^{2+}

A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

18. Nov/2022/Paper_31/No.6

This question is about acids, bases and salts.

(a) Describe the reaction of excess hydrochloric acid with zinc and with zinc oxide. Give the names of the products and any observations.

reaction with zinc

- products

..... and .....

- observations

.....

.....

reaction with zinc oxide

- products

..... and .....

- observations

.....

.....

[4]

(b) (i) Small pieces of zinc react with excess hydrochloric acid of different concentrations. The time taken for each reaction to finish is recorded.

The concentrations of each acid are:

- $0.5\,mol/dm^3$
- $1.0\,mol/dm^3$
- $2.0\,mol/dm^3$.

All other conditions stay the same.

Complete the table by writing the concentrations in the first column.

concentration of acid in mol/dm^3	time taken for reaction to finish / s
	40
	20
	80

[1]

(ii) Describe the effect on the time taken for the reaction to finish when it is carried out at a lower temperature.

All other conditions stay the same.

..... [1]

(c) Acids react with alkalis.

Choose the pH value which is alkaline.

Draw a circle around your answer.

pH 1 **pH 5** **pH 7** **pH 12** [1]

(d) State the colour change when excess hydrochloric acid is added to a solution of methyl orange in alkali.

from ..... to ..... [2]

(e) Soils where crops are grown can become acidic after fertilisers have been spread on the soil.

(i) Explain why controlling soil acidity is important.

..... [1]

(ii) Name a compound used to control soil acidity.

..... [1]

(f) Describe how to prepare pure dry crystals of sodium sulfate from an aqueous solution of sodium sulfate.

.....

.....

.....

..... [2]

[Total: 13]

19. Nov/2022/Paper_32/No.6(a_ d)

This question is about acids, bases and salts.

(a) Describe the reaction of excess dilute sulfuric acid with magnesium carbonate and with magnesium oxide. Give the names of the products and any observations.

reaction with magnesium carbonate

- products

.....

- observations

.....

.....

reaction with magnesium oxide

- products

.....

- observations

.....

.....

[4]

(b) State the colour change when excess aqueous sodium hydroxide is added to a solution of litmus in dilute sulfuric acid.

from ..... to ..... [2]

(c) **(i)** Describe how universal indicator can be used to find the pH of an acidic solution.

.....

.....

..... [2]

(ii) Choose the pH value that is acidic.

Draw a circle around your answer.

pH 2 **pH 7** **pH 10** **pH 14** [1]

(d) The salt zinc chloride can be prepared by reacting hydrochloric acid with zinc oxide.

(i) Choose the type of reaction that occurs.

Draw a circle around your answer.

addition **neutralisation** **polymerisation** **reduction** [1]

(ii) The method for preparing pure dry crystals of zinc chloride is given.

Complete the missing steps 3 and 6.

1 Add excess zinc oxide to dilute hydrochloric acid.

2 Warm the mixture to complete the reaction.

3 .....

4 Evaporate the filtrate until the point of crystallisation and leave for crystals to form.

5 Remove the crystals.

6 .....

[2]

(e) (i) Small pieces of zinc react with excess dilute hydrochloric acid at different temperatures. The time taken for each reaction to finish is recorded.

The temperatures are:

- 20 °C
- 40 °C
- 60 °C.

All other conditions stay the same.

Complete the table by writing the temperatures in the first column.

temperature of acid / °C	time taken for the reaction to finish / s
	64
	16
	256

[1]

(ii) Describe the effect on the time taken for the reaction to finish when it is carried out with dilute hydrochloric acid of a higher concentration.

All other conditions stay the same.

..... [1]

[Total: 14]

20. Nov/2022/Paper_33/No.6

This question is about acids, bases and salts.

(a) Describe the reaction of excess dilute hydrochloric acid with magnesium and with magnesium carbonate. Give the names of the products and any observations.

reaction with magnesium

- products

.....

- observations

.....

.....

reaction with magnesium carbonate

- products

.....

- observations

.....

.....

[4]

(b) (i) Different sized pieces of magnesium react with excess dilute hydrochloric acid. The time taken for each reaction to finish is recorded.

The sizes of the pieces of magnesium are:

- large
- small
- very small.

Equal masses of magnesium are used in each reaction.

All other conditions stay the same.

Complete the table by writing the size of the magnesium pieces in the first column.

size of magnesium pieces	time taken for the reaction to finish / s
	30
	200
	90

[1]

(ii) Describe the effect on the time taken for small pieces of magnesium to react with hydrochloric acid of a lower concentration.

All other conditions stay the same.

..... [1]

(c) **(i)** Sodium hydroxide is an alkali.

State the colour change when excess aqueous sodium hydroxide is added to a solution of methyl orange in acid.

from ..... to ..... [2]

(ii) Choose the pH value of an alkali.

Draw a circle around your answer.

pH 3 **pH 5** **pH 7** **pH 14** [1]

(d) The salt magnesium chloride can be prepared by reacting hydrochloric acid with magnesium oxide.

(i) The method for preparing pure dry crystals of magnesium chloride is given.

Complete the missing steps 4 and 6.

1 Add excess magnesium oxide to dilute hydrochloric acid.

2 Warm the mixture to complete the reaction.

3 Filter off the excess magnesium oxide and collect the filtrate.

4 .....

5 Remove the crystals.

6 .....

[2]

(ii) Magnesium oxide is used as a catalyst in some reactions.

State the purpose of using a catalyst.

..... [1]

[Total: 12]

21. Nov/2022/Paper_41/No.2(d, e)

(d) Aqueous potassium hydroxide reacts with a dilute acid to produce aqueous potassium chloride, $KCl(aq)$, which is a salt.

(i) Name the dilute acid used.

..... [1]

(ii) State the type of reaction taking place.

..... [1]

(iii) Name the experimental technique used when salts are made by reacting a dilute acid with an aqueous alkali.

..... [1]

(e) When aqueous silver nitrate, $AgNO_3(aq)$, is added to aqueous potassium chloride, a precipitate is formed.

(i) State the colour of the precipitate formed.

..... [1]

(ii) Name the precipitate formed.

..... [1]

(iii) Write the ionic equation for the reaction. Include state symbols.

..... [3]

22. Nov/2022/Paper_41/No.4(a_ d)

A student prepares calcium nitrate, $Ca(NO_3)_2$, by adding calcium carbonate to dilute nitric acid.

(a) Write the chemical equation for this reaction.

..... [2]

(b) Describe **two** observations during this reaction.

1 .....

2 .....

[2]

(c) The student continues to add calcium carbonate until it is in excess. The student then removes the excess calcium carbonate by filtration and collects the aqueous calcium nitrate.

State the general term given to a solution collected from filtration.

..... [1]

(d) The student gently heats the aqueous calcium nitrate until the solution is saturated.

(i) Suggest what is meant by the term *saturated solution*.

.....

..... [2]

(ii) Describe how crystals are produced from a hot saturated solution.

..... [1]

23. Nov/2022/Paper_42/No.2(d)

(d) Identify the substance, **D**, **E**, **F**, **G**, **H** or **I**, which is an ionic solid. Give a reason for your choice.

substance .....

reason .....

.....

[2]

24. Nov/2022/Paper_42/No.4(a_ d)

This question is about compounds of phosphorus.

(a) Gaseous phosphorus(V) chloride decomposes into gaseous phosphorus(III) chloride and gaseous chlorine.

When the three gases are present in a closed container the system reaches equilibrium.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

(i) Complete the table using only the words *increases*, *decreases* or *no change*.

	effect on the rate of the forward reaction	effect on the equilibrium yield ($PCl_3(g)$ and $Cl_2(g)$)
increasing the temperature		increases
decreasing the pressure		
adding a catalyst		no change

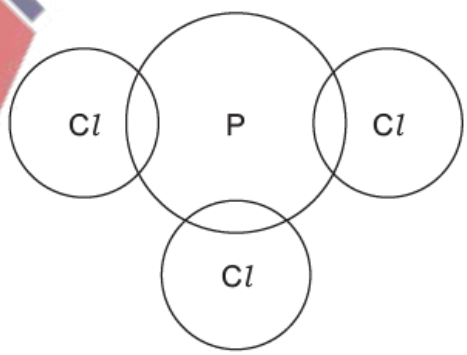
[4]

(ii) The table shows that when the temperature increases, the equilibrium yields of $PCl_3(g)$ and $Cl_2(g)$ increase.

State what conclusion can be made from this.

..... [1]

(b) Complete the dot-and-cross diagram to show the electron arrangement in a molecule of phosphorus(III) chloride, PCl_3. Show outer shell electrons only.



[2]

(c) Phosphorus oxychloride has the formula $POCl_3$.

Phosphorus oxychloride is the only product of the reaction between phosphorus(V) chloride, PCl_5, and phosphorus(V) oxide, P_4O_{10}.

Write a chemical equation for the reaction between phosphorus(V) chloride and phosphorus(V) oxide.

..... [2]

(d) Compound **X** has the following composition by mass.

H, 3.66%; P, 37.80%; O, 58.54%

Calculate the empirical formula of compound **X**.

empirical formula = ... [2]