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IGCSE Chemistry

P-1

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# Chemistry Paper-I

## Classified Past Paper Questions

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# Topic 1 – Matters

**1.**

In which substance are the particles close together and slowly moving past each other?

**A** air

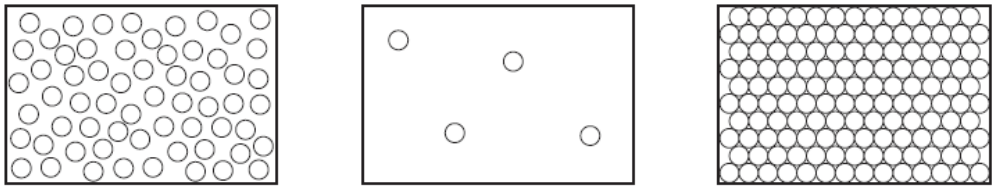
**B** ice

**C** steam

**D** water

**2.**

The diagrams show the arrangement of particles in three different physical states of substance X.



state 1 state 2 state 3

Which statement about the physical states of substance X is correct?

**A** Particles in state 1 vibrate about fixed positions.

**B** State 1 changes to state 2 by diffusion.

**C** State 2 changes directly to state 3 by condensation.

**D** The substance in stage 3 has a fixed volume.

**3.**

The diagram shows a cup of tea.

Which row describes the water particles in the air above the cup compared with the water particles in the cup?

| | moving faster | closer together |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**4.**

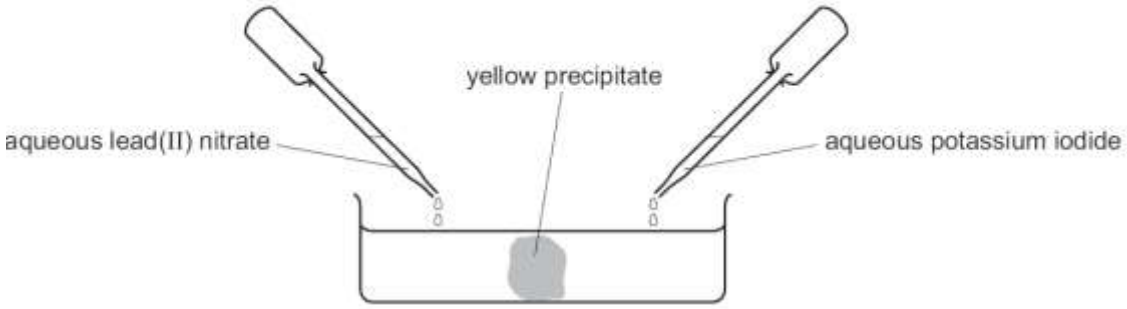
In which changes do the particles move further apart?

$$\text{gas} \underset{Y}{\overset{W}{\rightleftharpoons}} \text{liquid} \underset{Z}{\overset{X}{\rightleftharpoons}} \text{solid}$$

**A** W and X **B** W and Z **C** X and Y **D** Y and Z

**5.**

Aqueous lead(II) nitrate and aqueous potassium iodide are added to a dish containing water, as shown.




A yellow precipitate forms after a few minutes.

Which process occurs before the precipitate forms?

**A** diffusion

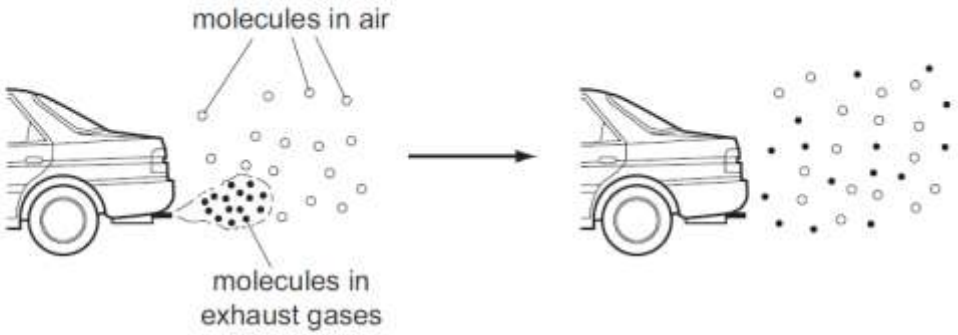
**B** distillation

**C** fermentation

**D** filtration

**6.**

The diagram shows how the molecules in the exhaust gases diffuse into the air.




Which statement describes what happens to these molecules next?

**A** The molecules fall to the ground because they are heavier than air molecules.

**B** The molecules go back together as they cool.

**C** The molecules spread further into the air.

**D** The molecules stay where they are.

**7.**

Oxides of nitrogen from car exhausts can spread through the atmosphere.


This occurs because gas molecules move from a region of ……1…… concentration to a region of ……2…… concentration by a process called ……3…… .

Which words correctly complete the gaps?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | high | low | diffusion |
| **B** | high | low | evaporation |
| **C** | low | high | diffusion |
| **D** | low | high | evaporation |

**8.**

In which substance are the particles furthest apart at room temperature?

**A** ethanol

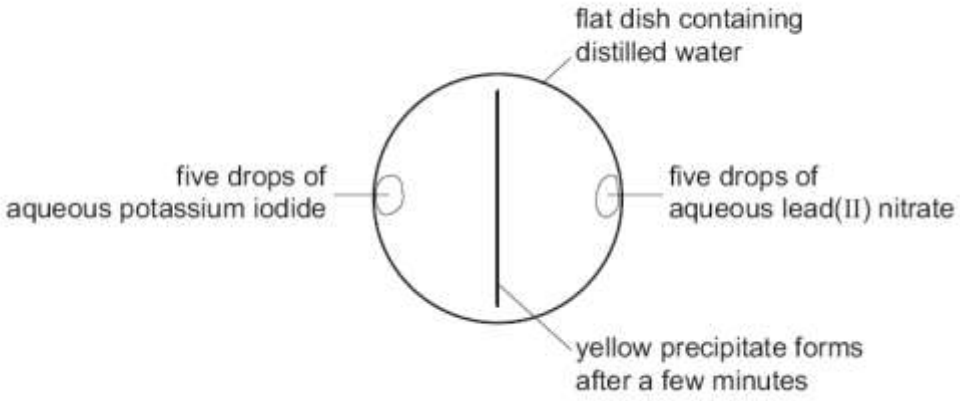
**B** methane

**C** salt

**D** sugar

**9.**

A yellow precipitate is formed in the experiment shown.




How is the precipitate formed?

**A** Particles collide, diffuse and then react.

**B** Particles collide, react and then diffuse.

**C** Particles diffuse, collide and then react.

**D** Particles diffuse, react and then collide

**10.**
When there is no wind, the scent of flowers can be detected more easily on a warm evening than on a cold evening.

This is because the molecules of the scent .....1..... .....2..... than in colder conditions.

Which words correctly complete gaps 1 and 2?

| | gap 1 | gap 2 |
|---|---|---|
| **A** | condense | nearer to the flowers |
| **B** | condense | further from the flowers |
| **C** | diffuse | nearer to the flowers |
| **D** | diffuse | further from the flowers |

**11.**
When steam at 100 °C condenses to water at 25 °C, what happens to the water molecules?

**A** They move faster and closer together.

**B** They move faster and further apart.

**C** They move slower and closer together.

**D** They move slower and further apart.

**12.**
In which change of state do the particles become more widely separated?

**A** gas to liquid

**B** gas to solid

**C** liquid to gas

**D** liquid to solid

**13.**
In which of the following are the particles arranged in a regular pattern?

**A** a gas

**B** a liquid

**C** a metal

**D** a solution

**14.**
In which states do particles diffuse rapidly?

| | in a gas | in a solid |
|---|---|---|
| **A** | ✔ | ✔ |
| **B** | ✔ | ✘ |
| **C** | ✘ | ✔ |
| **D** | ✘ | ✘ |

**15.**

Some students are asked to describe differences between gases and liquids.

Three of their suggestions are:

| | |
|---|---|
| 1 | gas molecules are further apart; |
| 2 | gas molecules are smaller; |
| 3 | liquid molecules vibrate around fixed positions. |

Which suggestions are correct?

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

**16.**

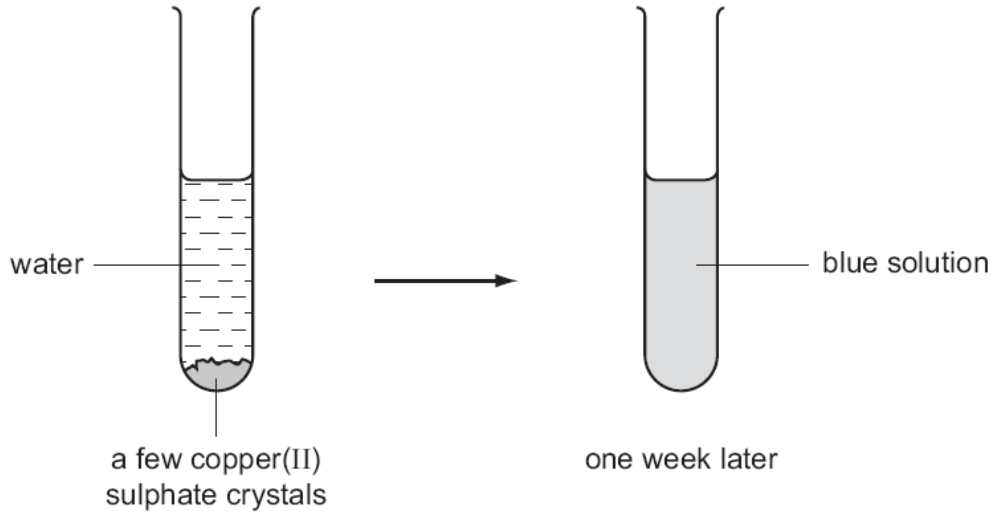
The melting points and boiling points of four substances are shown.

Which substance is liquid at 100 °C?

| substance | melting point / °C | boiling point / °C |
|---|---|---|
| **A** | –203 | –17 |
| **B** | –25 | 50 |
| **C** | 11 | 181 |
| **D** | 463 | 972 |

**17.**

Blue copper(II) sulphate crystals are soluble in water.




What has happened after one week?

**A** crystallisation

**B** diffusion

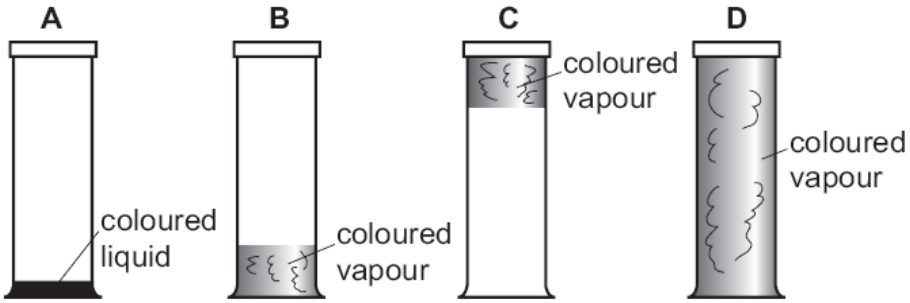
**C** distillation

**D** filtration

**18.**

A coloured liquid vaporises easily at room temperature. Some of the liquid is placed at the bottom of a sealed gas jar.

Which diagram shows the appearance of the jar after several hours?




**19.**

At room temperature, in which substance are the particles furthest apart?

**A** $H_2$ **B** $H_2O$ **C** Mg **D** MgO

**20.**

In which change of state do the particles become more widely separated?

**A** gas to liquid

**B** gas to solid

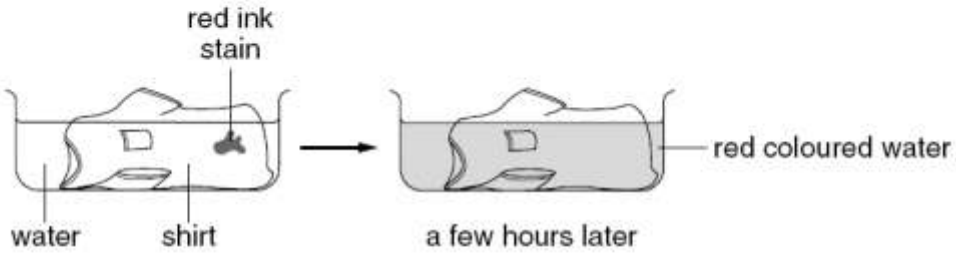
**C** liquid to gas

**D** liquid to solid

21.

A shirt is stained with red ink from a pen.

The shirt is left to soak in a bowl of water.




Which process causes the red colour to spread?

**A** diffusion

**B** evaporation

**C** melting

**D** neutralisation

# Topic 2 – Experimental techniques

**1.**

A student was provided with only a thermometer, a stopwatch and a beaker.

What could the student measure?

**A** 10.5 g solid and 24.8 $cm^3$ liquid

**B** 10.5 g solid and 25 °C

**C** 24.8 $cm^3$ liquid and 45 seconds

**D** 25 °C and 45 seconds

**2.**

Mixture 1 contains sand and water.

Mixture 2 contains salt and water.

Which method of separation could be used to obtain each of the required products from each mixture?

| | mixture 1 | | mixture 2 | |
|---|---|---|---|---|
| | to obtain sand | to obtain water | to obtain salt | to obtain water |
| **A** | crystallisation | distillation | filtration | filtration |
| **B** | crystallisation | filtration | filtration | distillation |
| **C** | filtration | distillation | crystallisation | filtration |
| **D** | filtration | filtration | crystallisation | distillation |

**3.**

The table gives the solubility of four substances in ethanol and in water.

A mixture containing all four substances is added to ethanol, stirred and filtered.

The solid residue is added to water, stirred and filtered.

The filtrate is evaporated to dryness, leaving a white solid.

Which is the white solid?

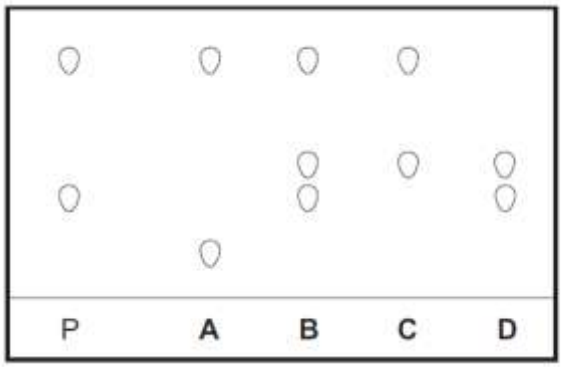
| | solubility in | |
|---|---|---|
| | ethanol | water |
| **A** | insoluble | insoluble |
| **B** | insoluble | soluble |
| **C** | soluble | insoluble |
| **D** | soluble | soluble |

**4.**

Chromatography is used to find out if a banned dye, P, is present in foodstuffs.

The results are shown in the diagram.

Which foodstuff contains P?




**5.**

An aqueous solution is coloured.

Which method of separation would show that the solution contains ions of different colours?

**A** chromatography

**B** crystallisation

**C** distillation

**D** filtration

**6.**

A mixture of ethanol and methanol are separated by fractional distillation.

This method of separation depends on a difference in property X of these two alcohols.

What is property X?

**A** boiling point

**B** colour

**C** melting point

**D** solubility

**7.**

A fruit drink coloured orange contains a dissolved mixture of red and yellow colouring agents. One of these colouring agents is suspected of being illegal.

Which method could be used to show the presence of this illegal colouring agent?

**A** chromatography

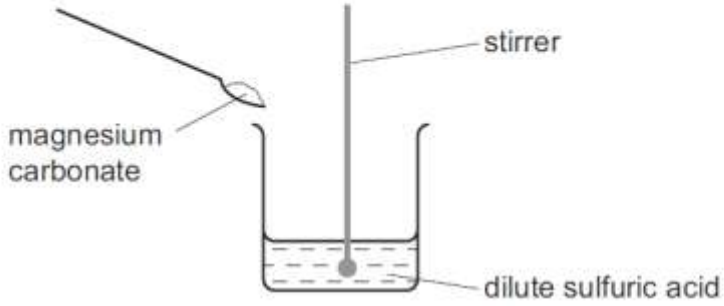
**B** distillation

**C** evaporation

**D** filtration

**8.**
A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.




He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

**A** crystallisation

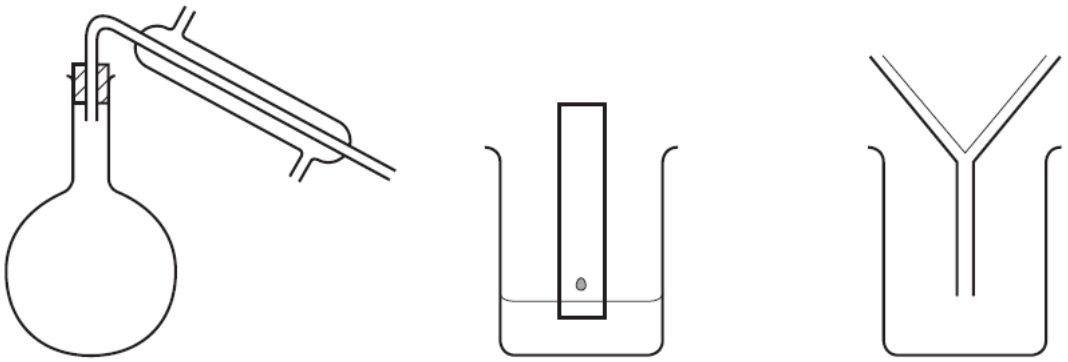
**B** evaporation

**C** filtration

**D** neutralisation

**9.**
The outline diagrams show three methods of separation.

X Y Z

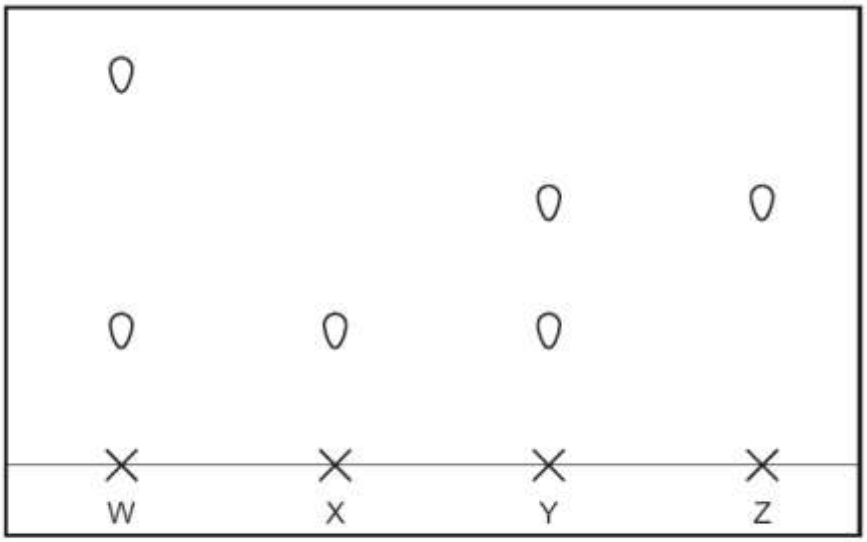


What are the three methods called?

| | X | Y | Z |
|---|---|---|---|
| **A** | chromatography | distillation | filtration |
| **B** | distillation | chromatography | filtration |
| **C** | distillation | filtration | chromatography |
| **D** | filtration | chromatography | distillation |

**10.**

The diagram shows the paper chromatograms of four substances, W, X, Y and Z.




Which two substances are pure?

**A** W and X **B** W and Y **C** X and Y **D** X and Z

**11.**

A student separates salt from a mixture of salt and sand.

What is the correct order of steps for the student to take?

**A** filter → evaporate → shake with water

**B** filter → shake with water → evaporate

**C** shake with water → evaporate → filter

**D** shake with water → filter → evaporate

**12.**

A student takes 2 g samples of calcium carbonate and adds them to 20 $cm^3$ samples of dilute hydrochloric acid at different temperatures. She measures how long it takes for the effervescence to stop.

Which apparatus does she use?

| | balance | clock | filter funnel | measuring cylinder | thermometer |
|---|---|---|---|---|---|
| **A** | ✓ | ✓ | ✓ | ✓ | ✗ |
| **B** | ✓ | ✓ | ✗ | ✓ | ✓ |
| **C** | ✓ | ✗ | ✓ | ✓ | ✓ |
| **D** | ✗ | ✓ | ✓ | ✗ | ✓ |

**13.**

A student is asked to measure the time taken for 4.00 g of magnesium carbonate to react completely with 25.0 $cm^3$ (an excess) of dilute hydrochloric acid.

Which pieces of apparatus does the student need?

**A** balance, clock, pipette

**B** balance, clock, thermometer

**C** balance, pipette, thermometer

**D** clock, pipette, thermometer

**14.**

A sample of a drug is analysed by using a chemical test for aspirin and measuring its melting point.

The chemical test is positive but the melting point is 130 °C not 135 °C as it should be.

What is correct?

| | the sample contains aspirin | the sample has an impurity |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**15.**

Chromatography and fractional distillation can be used to separate compounds.

In which type of separation is a thermometer needed for checking that complete separation has occurred?

**A** chromatographic separation of two colourless solids

**B** chromatographic separation of two solids of different colours

**C** fractional distillation of two colourless liquids

**D** fractional distillation of two liquids of different colours

**16.**

A student carries out an experiment to find how fast 3 cm pieces of magnesium ribbon dissolve in 10 $cm^3$ samples of sulfuric acid at different temperatures.

Which piece of apparatus does the student **not** need?

**A** balance

**B** measuring cylinder

**C** stop-clock

**D** thermometer

**17.**

The boiling point of liquid X is lower than that of water. To test a student, a teacher covers up the numbers on a thermometer. The student places the thermometer in boiling liquid X.

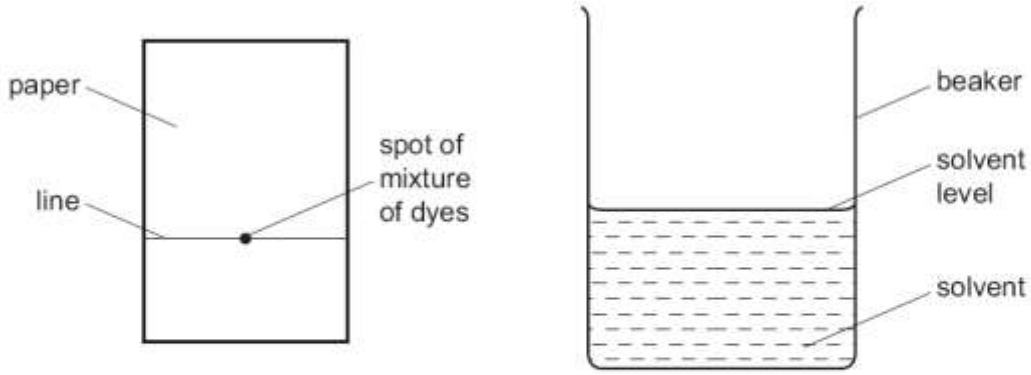
The diagram represents part of the stem of this thermometer.


What could the temperature on the thermometer be?

**A** 75.5 °C **B** 84.5 °C **C** 104.5 °C **D** 105.5 °C

**18. ?**

An experiment is carried out to separate a mixture of two dyes. A line is drawn on a piece of chromatography paper and a spot of the dye mixture placed on it. The paper is dipped into a solvent and left for several minutes.




Which statement about this experiment is correct?

**A** The dyes must differ in their boiling points.

**B** The dyes must differ in their solubilities in the solvent.

**C** The line must be drawn in ink.

**D** The line must be placed below the level of the solvent.

**19.**

The diagram shows a chromatogram obtained from three sweets, X, Y and Z.

| | | |
|---|---|---|
| ● yellow<br>● red | ● red<br>● yellow | ● red<br>● yellow<br>● red |
| sweet X | sweet Y | sweet Z |

How many different red dyes are present in the sweets?

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

**20.**

The diagram shows a chromatogram obtained from three orange sweets, 1, 2 and 3.

| | | |
|---|---|---|
| yellow<br>red | red<br>yellow | red<br>yellow<br>red |
| sweet 1 | sweet 2 | sweet 3 |

How many different red dyes are present in the sweets?

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

**21.**

A student mixes 25 $cm^3$ samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide. Each time, the student measures the change in temperature to test if the reaction is exothermic.

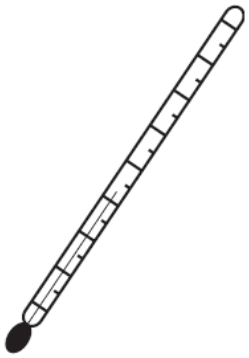
Which piece of apparatus is **not** needed?

**A**

**B**

**C**

**D**



**22.**

Which method can be used to obtain crystals from aqueous copper(II) sulphate?

**A** chromatography

**B** electrolysis

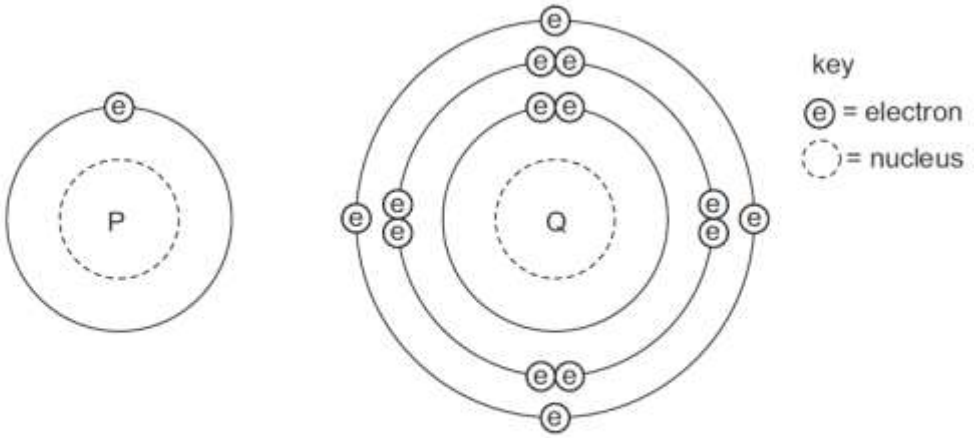
**C** evaporation

**D** neutralisation

# Topic 3: Atoms, elements and compounds

**1.**

The diagram shows the electronic structures of atoms P and Q.




P and Q combine to form a molecule.

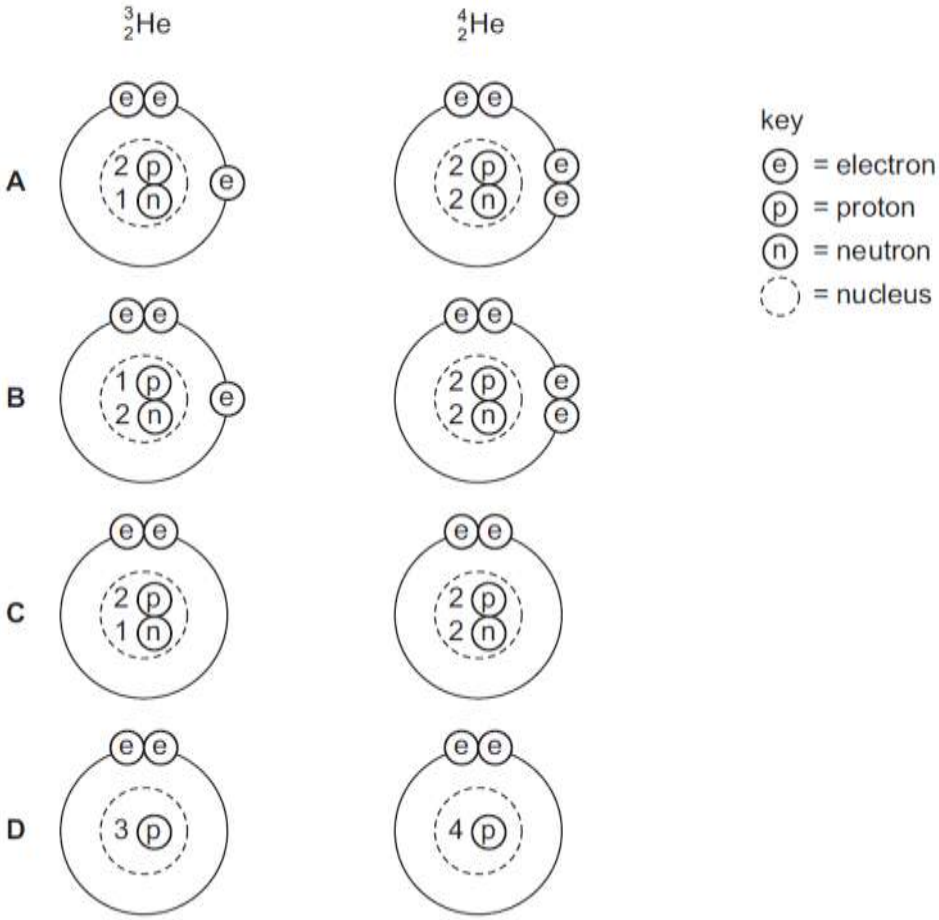
What is the formula of this molecule?

**A** $PQ_4$ **B** PQ **C** $P_2Q$ **D** $P_4Q$

**2.**

Two isotopes of helium are $^{3}_{2}He$ and $^{4}_{2}He$.

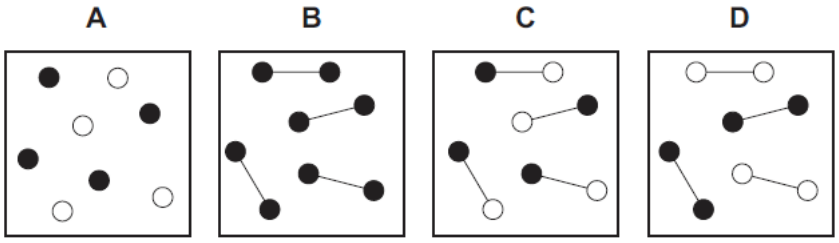
Which two diagrams show the arrangement of particles in these two isotopes?



**3.**

Two elements, represented by ○ and ●, form a compound.

Which diagram shows molecules of the compound?




**4.**

The table describes the structures of four particles.

| particle | number of protons | number of neutrons | number of electrons |
|---|---|---|---|
| O | 8 | 8 | 8 |
| $O^{2-}$ | 8 | 8 | **X** |
| Na | 11 | **Y** | 11 |
| $Na^{+}$ | 11 | 12 | **Z** |

What are the correct values of **X**, **Y** and **Z**?

| | **X** | **Y** | **Z** |
|---|---|---|---|
| **A** | 9 | 11 | 10 |
| **B** | 9 | 11 | 11 |
| **C** | 10 | 12 | 10 |
| **D** | 10 | 12 | 11 |

**5.**

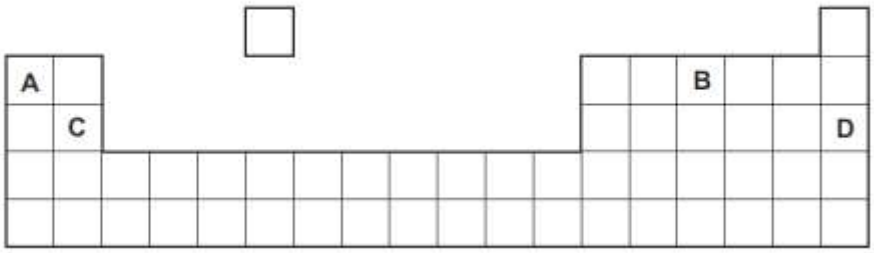
Which two elements react together to form an ionic compound?

| element | electronic structure |
|---|---|
| W | 2,4 |
| X | 2,8 |
| Y | 2,8,1 |
| Z | 2,8,7 |

**A** W and X **B** X and Y **C** Y and Z **D** Z and W

**6.**

The diagram shows part of the Periodic Table.



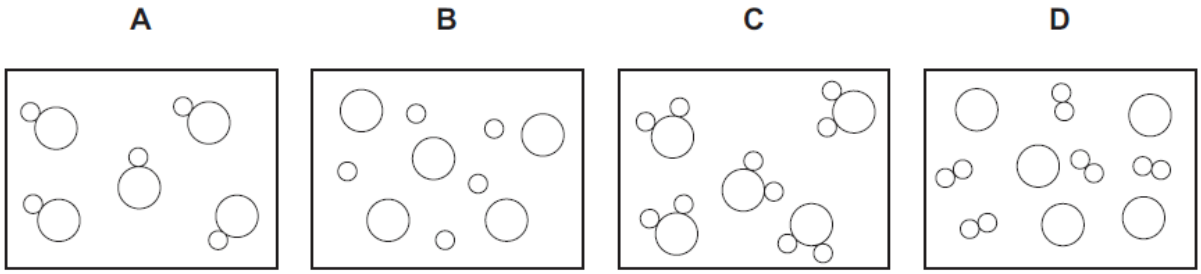

Which element is correctly matched with its electronic structure?

| | electronic structure |
|---|---|
| **A** | 2,8,1 |
| **B** | 2,4 |
| **C** | 2,8,2 |
| **D** | 2,8 |

**7.**

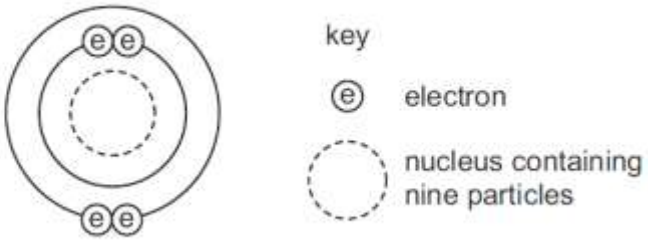
In the diagrams, circles of different sizes represent atoms of different elements.

Which diagram represents hydrogen chloride gas?




**8.**

The diagram shows an atom.




What is the proton number and neutron number of the atom?

| | proton number | neutron number |
|---|---|---|
| **A** | 4 | 5 |
| **B** | 4 | 9 |
| **C** | 5 | 4 |
| **D** | 5 | 9 |

**9.**

The nucleon number and proton number of the lithium atom are shown by the symbol $^{7}_{3}Li$.

What is the correct symbol for the lithium ion in lithium chloride?

**A** $^{6}_{2}Li^{-}$ **B** $^{6}_{3}Li^{+}$ **C** $^{7}_{3}Li^{+}$ **D** $^{7}_{3}Li^{-}$

**10.**

Element X has a nucleon (mass) number of 19 and a proton (atomic) number of 9.

To which group in the Periodic Table does it belong?

**A** I **B** III **C** VII **D** 0

**11.**

The table shows the structure of different atoms and ions.

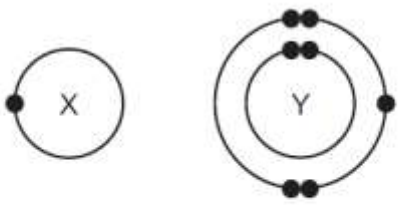
| particle | proton number | nucleon number | number of protons | number of neutrons | number of electrons |
|---|---|---|---|---|---|
| Mg | 12 | 24 | 12 | W | 12 |
| $Mg^{2+}$ | X | 24 | 12 | 12 | 10 |
| F | 9 | 19 | 9 | Y | 9 |
| $F^{-}$ | 9 | 19 | 9 | 10 | Z |

What are the values of W, X, Y and Z?

| | W | X | Y | Z |
|---|---|---|---|---|
| **A** | 10 | 10 | 9 | 9 |
| **B** | 10 | 12 | 10 | 9 |
| **C** | 12 | 10 | 9 | 10 |
| **D** | 12 | 12 | 10 | 10 |

**12.**

The electronic structures of atoms X and Y are shown.



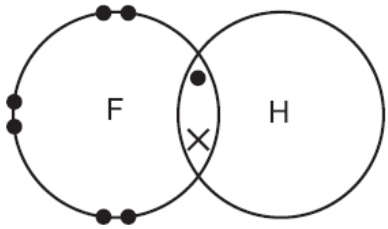

X and Y form a covalent compound.

What is its formula?

**A** $XY_5$ **B** $XY_3$ **C** XY **D** $X_3Y$

**13.**

The diagram shows a molecule of hydrogen fluoride.




In the molecule hydrogen fluoride, HF,

**A** the hydrogen and fluorine share a pair of electrons.

**B** the hydrogen and fluorine share a pair of protons.

**C** the hydrogen gives the fluorine an electron.

**D** the hydrogen gives fluorine a proton.

**14.**

What do the nuclei in hydrogen molecules contain?

**A** electrons and neutrons

**B** electrons and protons

**C** neutrons only

**D** protons only

**15.**

Which atom has two more electrons than an atom of a noble gas?

**A** aluminium

**B** bromine

**C** calcium

**D** rubidium

**16.**

Statements 1, 2 and 3 are about diamond and graphite.

1 They are different solid forms of the same element.

2 They each conduct electricity.

3 They have atoms that form four equally strong bonds.

Which statements are correct?

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

**17.**

An element S has the proton number 18. The next element in the Periodic Table is an element T.

Which statement is correct?

**A** Element T has one more electron in its outer shell than element S.

**B** Element T has one more electron shell than element S.

**C** Element T is in the same group of the Periodic Table as element S.

**D** Element T is in the same period of the Periodic Table as element S.

**18.**

Which atom has twice as many neutrons as protons?

**A** $^{1}_{1}H$ **B** $^{2}_{1}H$ **C** $^{3}_{1}H$ **D** $^{4}_{2}He$

**19.**

Which change to an atom occurs when it forms a positive ion?

**A** It gains electrons.

**B** It gains protons.

**C** It loses electrons.

**D** It loses protons.

**20.**

Which numbers are added together to give the nucleon number of an ion?

**A** number of electrons + number of neutrons

**B** number of electrons + number of protons

**C** number of electrons + number of protons + number of neutrons

**D** number of protons + number of neutrons

**21.**

The electronic configuration of an ion is 2.8.8.

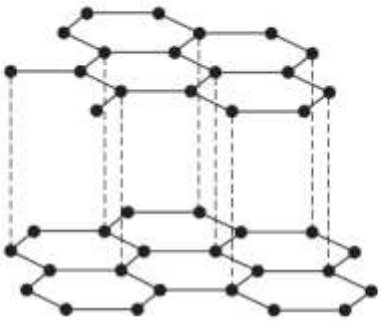
What could this ion be?

| | $S^{2-}$ | $Ca^{2+}$ |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**22.**

The diagrams show the structures of two forms, P and Q, of a solid element.

P



Q

What are suitable uses of P and Q, based on their structures?

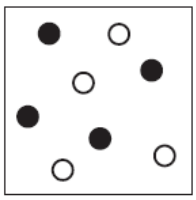
| | use of solid P | use of solid Q |
|---|---|---|
| **A** | drilling | drilling |
| **B** | drilling | lubricating |
| **C** | lubricating | drilling |
| **D** | lubricating | lubricating |

**23. ?**

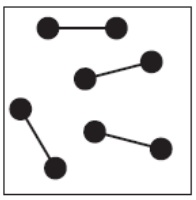
Two elements represented by ○ and ● can form a compound.

Which diagram shows molecules of the compound?

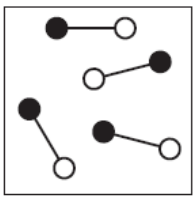
A



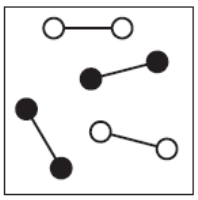
B



C



D



**24.**

When sodium chloride is formed from its elements, each chlorine atom ……1…… one ……2…….

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | gains | electron |
| **B** | gains | proton |
| **C** | loses | electron |
| **D** | loses | proton |

# Topic 9 –Periodic table

**1.**

Statement 1: Helium is a reactive gas.

Statement 2: Helium can be used to fill balloons.

Which is correct?

**A** Both statements are correct and statement 2 explains statement 1.

**B** Both statements are correct but statement 2 does not explain statement 1.

**C** Statement 1 is correct but statement 2 is incorrect.

**D** Statement 2 is correct but statement 1 is incorrect.

**2.**

An element has the following properties.

- It forms coloured compounds.
- It acts as a catalyst.
- It melts at 1539 °C.

In which part of the Periodic Table is the element found?

**A** Group I

**B** Group IV

**C** Group VII

**D** transition elements

**3.**

The table shows some properties of two elements in Group VII of the Periodic Table.

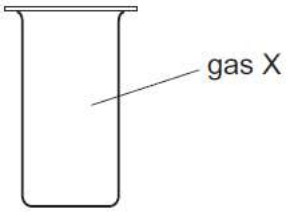
| element | state at 20 °C | density / g per $cm^3$ | melting point / °C |
|---|---|---|---|
| chlorine | gas | 0.0032 | –101 |
| bromine | liquid | 3.1 | –7 |

Which properties is fluorine likely to have?

| | state at 20 °C | density / g per $cm^3$ | melting point / °C |
|---|---|---|---|
| **A** | gas | 0.0017 | –220 |
| **B** | gas | 0.17 | –188 |
| **C** | liquid | 0.0017 | –220 |
| **D** | liquid | 0.17 | –188 |

**4.**

X is a monatomic gas.




Which statement about X is correct?

**A** X burns in air.

**B** X is coloured.

**C** X is unreactive.

**D** X will displace iodine from potassium iodide.

**5.**

The diagram shows a section of the Periodic Table.

| I | II | III | IV | V | VI | VII | 0 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| V | | | W | | | X | |
| | Y | | | | Z | | |

Which elements will conduct electricity at room temperature?

**A** V, W and X **B** V, Y and W **C** W, X and Z **D** Y and Z

**6.**

The equation shows the reaction between a halogen and aqueous bromide ions.

$$\underset{\text{...1...}}{X_2} + \underset{\text{...2...}}{2Br^-(aq)} \rightarrow 2X^-(aq) + \underset{\text{...3...}}{Br_2}$$

Which words correctly complete gaps 1, 2 and 3?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | chlorine | brown | colourless |
| **B** | chlorine | colourless | brown |
| **C** | iodine | brown | colourless |
| **D** | iodine | colourless | brown |

**7.**
Which statement is correct for the element of proton number 19?

**A** It is a gas that dissolves in water.

**B** It is a hard metal that is not very reactive with water.

**C** It is a non-metal that burns quickly in air.

**D** It is a soft metal that is highly reactive with water.

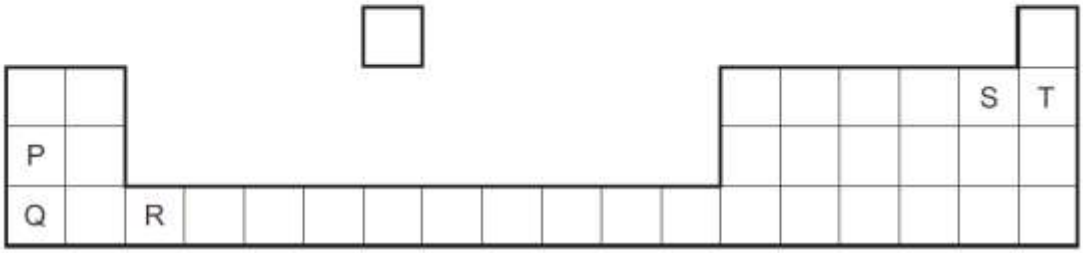
**8.**
The table compares the properties of Group I elements with those of transition elements.

Which entry in the table is correct?

| | property | Group I elements | transition elements |
|---|---|---|---|
| **A** | catalytic activity | low | high |
| **B** | density | high | low |
| **C** | electrical conductivity | low | high |
| **D** | melting point | high | low |

**9.**
The diagram shows the positions of elements P, Q, R, S and T in the Periodic Table.

These letters are not the chemical symbols for the elements.




Which statement about the properties of these elements is correct?

**A** P reacts more vigorously with water than does Q.

**B** P, Q and R are all metals.

**C** T exists as diatomic molecules.

**D** T is more reactive than S.

**10.**
The table shows some reactions of the halogens.

Which reaction is the most likely to be explosive?

| reaction | chlorine gas | bromine gas | iodine gas |
|---|---|---|---|
| reaction with hydrogen | **A** | **B** | **C** |
| reaction with iron | very vigorous | less vigorous | **D** |

**11.**

Which is **not** a property of Group I metals?

**A** They are soft and can be cut with a knife.

**B** They corrode rapidly when exposed to oxygen in the air.

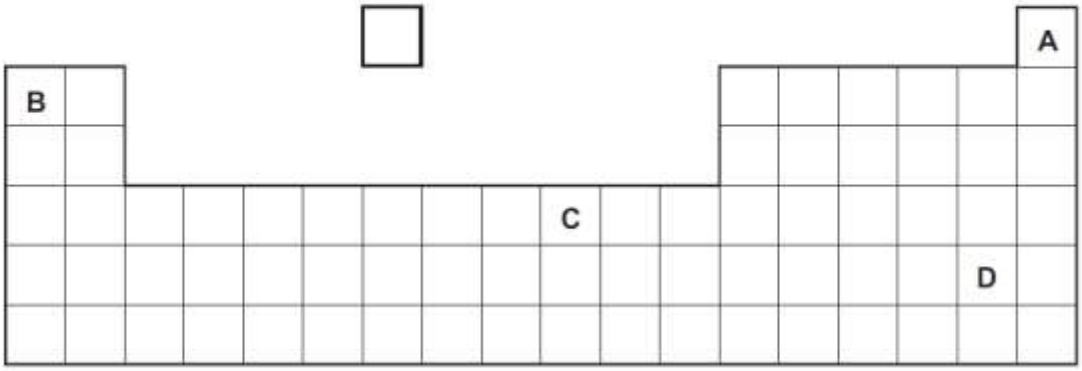
**C** They produce an acidic solution when they react with water.

**D** They react rapidly with water producing hydrogen gas.

**12.**

An element melts at 1455 °C, has a density of 8.90 g / $cm^3$ and forms a green chloride.

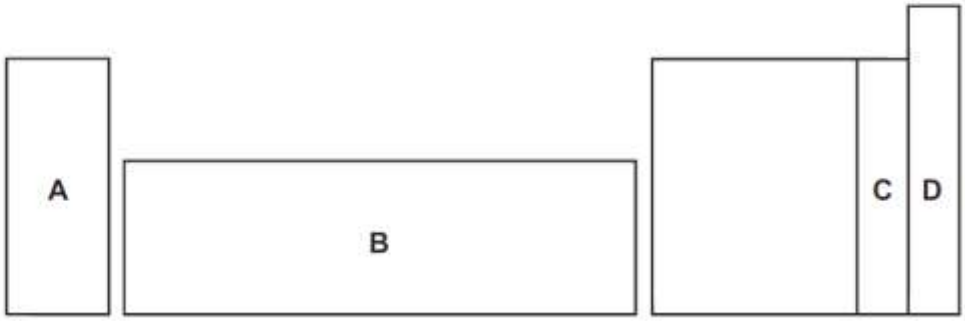
Where in the Periodic Table is this element found?




**13.**

An element does not conduct electricity and exists as diatomic molecules.

In which area of the Periodic Table is the element to be found?




**14.**

Solutions of a halogen and a sodium halide are mixed.

Which mixture darkens in colour because a reaction occurs?

**A** bromine and sodium chloride

**B** bromine and sodium fluoride

**C** chlorine and sodium fluoride

**D** chlorine and sodium iodide

**15.**

The table gives information about four elements.

Which element is a transition metal?

| | colour of element | electrical conductivity of element | colour of oxide |
|---|---|---|---|
| **A** | black | high | colourless |
| **B** | colourless | low | white |
| **C** | grey | high | red |
| **D** | yellow | low | colourless |

**16.**

Elements in Group 0 of the Periodic Table have uses.

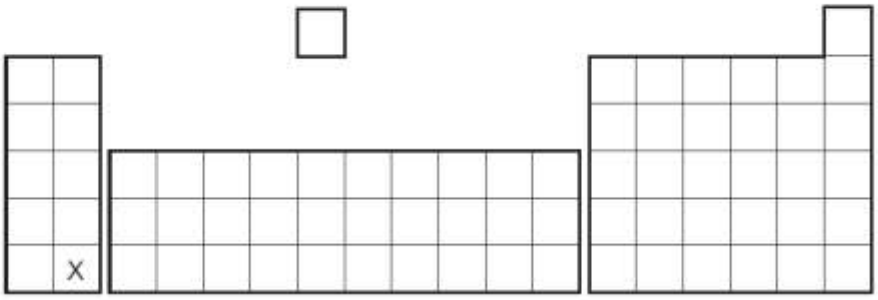
These noble gases are ……1…… and this explains why argon ……2…… be used in lamps.

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | reactive | can |
| **B** | reactive | cannot |
| **C** | unreactive | can |
| **D** | unreactive | cannot |

**17.**

The diagram shows the position of an element X in the Periodic Table.




What is the correct classification of element X and its oxide?

| | X | oxide of X |
|---|---|---|
| **A** | metal | acidic |
| **B** | metal | basic |
| **C** | non-metal | acidic |
| **D** | non-metal | basic |

**18.**

Astatine is an element in Group VII of the Periodic Table. It has only ever been produced in very small amounts.

What is the best description of its likely properties?

| | colour | state | reaction with aqueous potassium iodide |
|---|---|---|---|
| **A** | black | solid | no reaction |
| **B** | dark brown | gas | brown colour |
| **C** | green | solid | no reaction |
| **D** | yellow | liquid | brown colour |

**19.**

Which statement describes the trends going down group VII of the Periodic Table?

**A** The boiling point and melting point both decrease.

**B** The boiling point and melting point both increase.

**C** The boiling point decreases but the melting point increases.

**D** The boiling point increases but the melting point decreases.

**20.**

An inert atmosphere is needed in a lamp to lengthen the useful life of the metal filament.

Why is argon, rather than helium, used for this purpose?

| | argon is more abundant in the air | argon is less dense than helium |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**21.**

Which compound is likely to be coloured?

**A** $KMnO_4$ **B** $KNO_3$ **C** $K_2CO_3$ **D** $K_2SO_4$

# Topic4 – Stoichiometry

**1.**

The relative formula mass, $M_r$, of copper(II) sulfate, $CuSO_4$, is 160.

Which mass of sulfur is present in 160 g of copper(II) sulfate?

**A** 16 g **B** 32 g **C** 64 g **D** 128 g

**2.**

What is the relative molecular mass ($M_r$) of $HNO_3$?

**A** 5 **B** 31 **C** 32 **D** 63

**3.**

Hydrogen and chlorine react as shown.

1 molecule of hydrogen + 1 molecule of chlorine → 2 molecules of hydrogen chloride

What is the equation for this reaction?

**A** $2H + 2Cl \rightarrow 2HCl$

**B** $2H + 2Cl \rightarrow H_2Cl_2$

**C** $H_2 + Cl_2 \rightarrow 2HCl$

**D** $H_2 + Cl_2 \rightarrow H_2Cl_2$

**4.**

The chemical compositions of two substances, W and X, are given.

W $Na(AlSi_3)O_8$

X $Ca(Al_2Si_2)O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

3 X contains twice as much aluminium as W.

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

**5.**

Boron, B, forms an oxide.

Which equation is correctly balanced?

**A** $2B + 3O_2 \rightarrow B_2O_3$

**B** $2B + 3O_2 \rightarrow 2B_2O_3$

**C** $4B + 2O_2 \rightarrow 2B_2O_3$

**D** $4B + 3O_2 \rightarrow 2B_2O_3$

**6.**
Carbon and chlorine form a chloride.

What is the formula of this chloride?

**A** $CCl_2$ **B** $CCl_4$ **C** $CaCl_2$ **D** $CaCl_4$

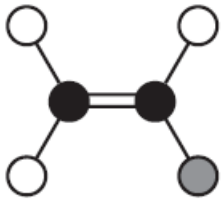
**7.**
Lead(II) nitrate can be decomposed as shown.

$$xPb(NO_3)_2 \rightarrow yPbO + zNO_2 + O_2$$

Which numbers x, y and z balance the equation?

| | x | y | z |
|---|---|---|---|
| **A** | 2 | 2 | 2 |
| **B** | 2 | 2 | 4 |
| **C** | 2 | 4 | 4 |
| **D** | 4 | 4 | 2 |

**8. ?**
The diagram shows a molecule of vinyl chloride (used to make pvc).



key
- a carbon atom
- a chlorine atom
- a hydrogen atom

What is the formula of vinyl chloride?

**A** $CH_2Cl_3$ **B** $CH_3Cl_2$ **C** $C_2HCl_3$ **D** $C_2H_3Cl$

**9. ?**
For which compound is the formula correct?

| | compound | formula |
|---|---|---|
| **A** | ammonium chloride | $NH_3Cl$ |
| **B** | copper(II) sulphide | CuS |
| **C** | iron(II) sulphide | $Fe_3S$ |
| **D** | silver nitrate | $Ag_2NO_3$ |

**10. ?**

For complete combustion, one molecule of an organic compound needs 8 molecules of oxygen.

What could the formula of this compound be?

**A** $C_5H_{11}OH$

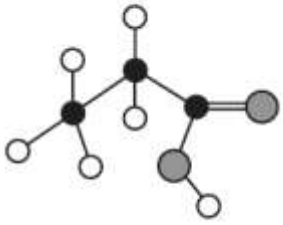
**B** $C_6H_9OH$

**C** $C_6H_{11}OH$

**D** $C_6H_{12}$

**11. ?**

The diagram shows a model of a molecule of an organic acid.



What is the relative molecular mass of this acid?

**A** 11 **B** 40 **C** 58 **D** 74

**12. ?**

Students are asked to state

- the number of atoms in one molecule of ethanoic acid,
- the relative molecular mass, $M_r$, of this acid.

Which line is correct?

| | number of atoms | $M_r$ |
|---|---|---|
| **A** | 8 | 32 |
| **B** | 8 | 60 |
| **C** | 9 | 26 |
| **D** | 9 | 46 |

**13. ?**

Magnesium and sulphur each form a chloride.

What could be the formulae of these chlorides?

| | magnesium | sulphur |
|---|---|---|
| **A** | $Mg_2Cl$ | $S_2Cl$ |
| **B** | $Mg_2Cl$ | $SCl_2$ |
| **C** | $MgCl_2$ | $S_2Cl$ |
| **D** | $MgCl_2$ | $SCl_2$ |

**14.**

For which compound is the formula correct?

| | compound | formula |
|---|---|---|
| **A** | ammonia | $NH_4$ |
| **B** | carbon dioxide | CO |
| **C** | potassium oxide | $P_2O$ |
| **D** | zinc chloride | $ZnCl_2$ |

**15. ?**

The diagrams show the molecules of three elements.

1 2 3

Which of these elements are present in water?

**A** 1 and 2 only

**B** 1 and 3 only

**C** 2 and 3 only

**D** 1, 2 and 3

**16. ?**

Which formula represents a compound containing three atoms?

**A** $HNO_3$ **B** $H_2O$ **C** LiF **D** $ZnSO_4$

**17. ?**

The equation shows the reaction that occurs when ethanol burns in air.

$$C_2H_5OH + x\,O_2 \longrightarrow y\,CO_2 + z\,H_2O$$

Which values of x, y and z are needed to balance this equation?

| | x | y | z |
|---|---|---|---|
| **A** | 2 | 2 | 2 |
| **B** | 2 | 2 | 3 |
| **C** | 2 | 3 | 3 |
| **D** | 3 | 2 | 3 |

**18. ?**

Water is formed when 48 g of oxygen combine with 6 g of hydrogen.

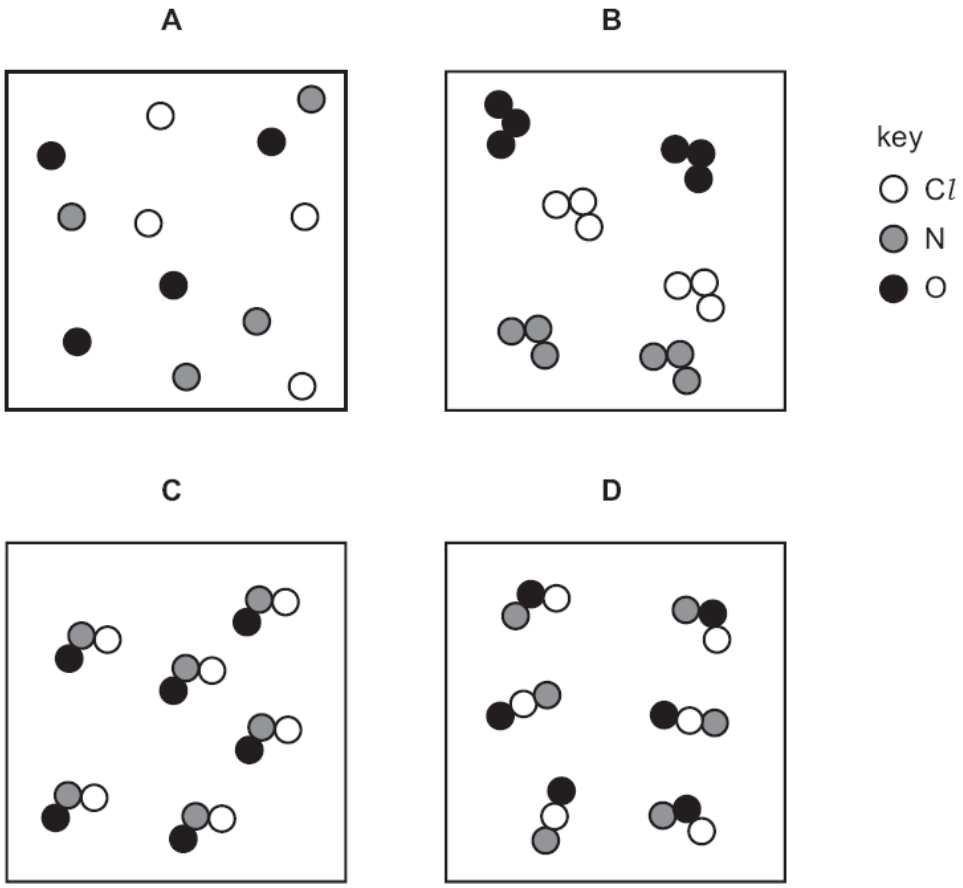
What mass of oxygen combines with 2 g of hydrogen?

**A** 12 g **B** 16 g **C** 96 g **D** 144 g

**19.**

A gas has the molecular formula NOC*l*.

Which diagram could show molecules of the pure gas NOC*l*?




**20. ?**

A substance **X** is heated in an evaporating basin until there is no further change.

| | mass of basin and contents |
|---|---|
| before heating | 25.52 g |
| after heating | 26.63 g |

What could **X** be?

**A** copper

**B** copper(II) carbonate

**C** copper(II) oxide

**D** hydrated copper(II) sulphate

**21. ?**

For which compound is the formula correct?

| | compound | formula |
|---|---|---|
| **A** | ammonia | $NH_4$ |
| **B** | carbon monoxide | $CO_2$ |
| **C** | iron(III) oxide | $Fe_3O_2$ |
| **D** | zinc hydroxide | $Zn(OH)_2$ |

**22. ?**

When propane is burned, carbon dioxide and water are formed, as shown.

$$C_3H_8 + 5O_2 \rightarrow rCO_2 + sH_2O$$

Which values of *r* and *s* balance the equation?

| | *r* | *s* |
|---|---|---|
| **A** | 1 | 3 |
| **B** | 1 | 5 |
| **C** | 3 | 4 |
| **D** | 3 | 8 |

**23. ?**

The oxide $Pb_3O_4$ reacts with dilute nitric acid to form lead(II) nitrate, lead(IV) oxide and another product.

What is the equation for this reaction?

**A** $Pb_3O_4 + 4HNO_3 \rightarrow 2Pb(NO_3)_2 + PbO_2 + 2H_2O$

**B** $Pb_3O_4 + 2HNO_3 \rightarrow 2PbNO_3 + PbO_4 + H_2$

**C** $Pb_3O_4 + 4HNO_3 \rightarrow Pb(NO_3)_4 + 2PbO + 2H_2O$

**D** $2Pb_3O_4 + 2HNO_3 \rightarrow 2Pb_2NO_3 + 2PbO_2 + H_2$

**24. ?**

Carbon and chlorine form a chloride.

What is the formula of this chloride?

**A** $CCl_2$

**B** $CCl_4$

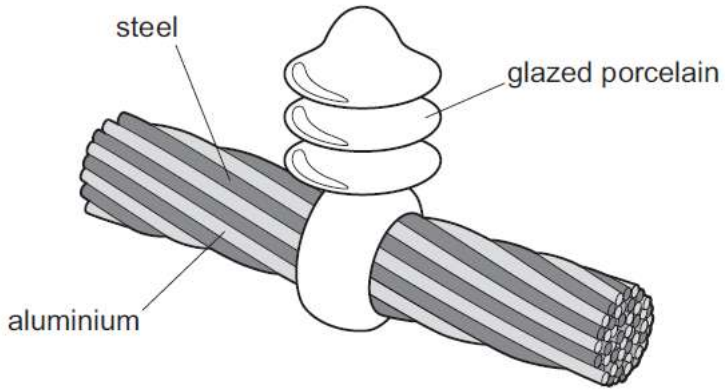
**C** $CaCl_2$

**D** $CaCl_4$

# Topic 5 – Electricity and chemistry

**1.**

The diagram shows a section of an overhead power cable.




Which statement explains why a particular substance is used?

**A** Aluminium has a low density and is a good conductor of electricity.

**B** Porcelain is a good conductor of electricity.

**C** Steel can rust in damp air.

**D** Steel is more dense than aluminium.

**2.**

Metals could be extracted from their molten chlorides using electrolysis.

Which substances are formed at each electrode?

| | anode | cathode |
|---|---|---|
| **A** | chlorine | hydrogen |
| **B** | chlorine | metal |
| **C** | hydrogen | metal |
| **D** | metal | chlorine |

**3.**

Concentrated aqueous potassium bromide solution is electrolysed using inert electrodes.

The ions present in the solution are $K^+$, $Br^-$, $H^+$ and $OH^-$.

To which electrodes are the ions attracted during this electrolysis?

| | attracted to anode | attracted to cathode |
|---|---|---|
| **A** | $Br^-$ and $K^+$ | $H^+$ and $OH^-$ |
| **B** | $Br^-$ and $OH^-$ | $H^+$ and $K^+$ |
| **C** | $H^+$ and $K^+$ | $Br^-$ and $OH^-$ |
| **D** | $H^+$ and $OH^-$ | $Br^-$ and $K^+$ |

**4.**

Electricity from a power station passes through overhead cables to a substation and then to a school where it is used to electrolyse concentrated hydrochloric acid using inert electrodes.

Which substances are used for the overhead cables and for the electrodes?

| | overhead cables | electrodes |
|---|---|---|
| **A** | aluminium | copper |
| **B** | aluminium | platinum |
| **C** | copper | platinum |
| **D** | platinum | aluminium |

**5.**

Which statement about the electrolysis of molten lead(II) bromide is correct?

**A** A colourless gas is seen at the cathode.

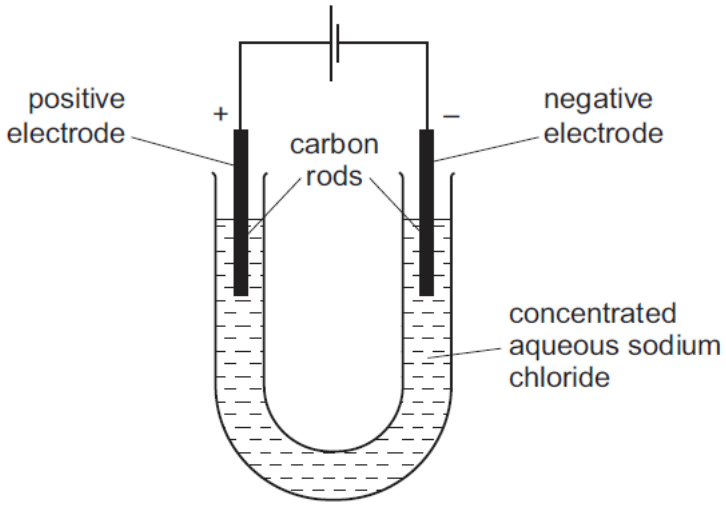
**B** A grey metal is seen at the anode.

**C** A red/brown gas is seen at the anode.

**D** A red/brown metal is seen at the cathode.

**6.**

Electricity is passed through concentrated aqueous sodium chloride, as shown.




What is the test for the gas formed at the positive electrode?

**A** bleaches damp litmus paper

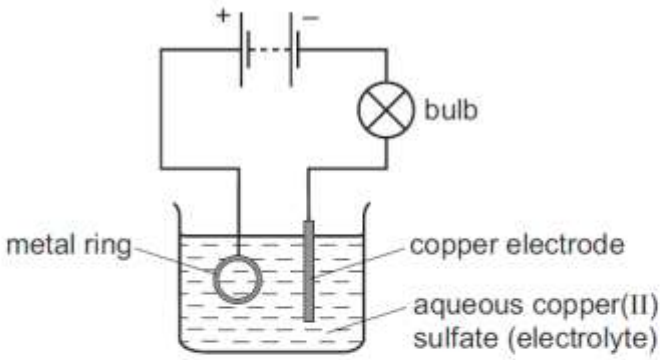
**B** 'pops' with a lighted splint

**C** relights a glowing splint

**D** turns damp red litmus paper blue

**7.**

The diagram shows apparatus used in an attempt to electroplate a metal ring with copper.




The experiment did not work.

What change is needed in the experiment to make it work?

**A** Add solid copper(II) sulfate to the electrolyte.

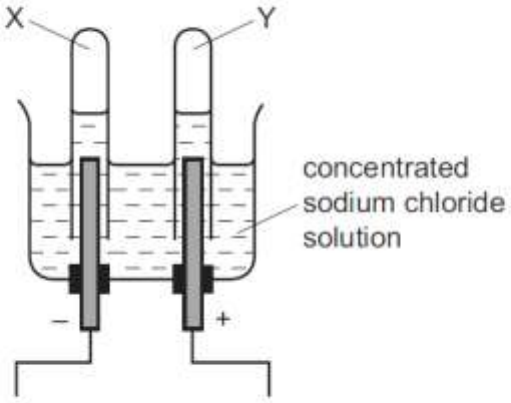
**B** Increase the temperature of the electrolyte.

**C** Replace the copper electrode by a carbon electrode.

**D** Reverse the connections to the battery.

**8.**

When concentrated sodium chloride solution is electrolysed, elements X and Y are formed.



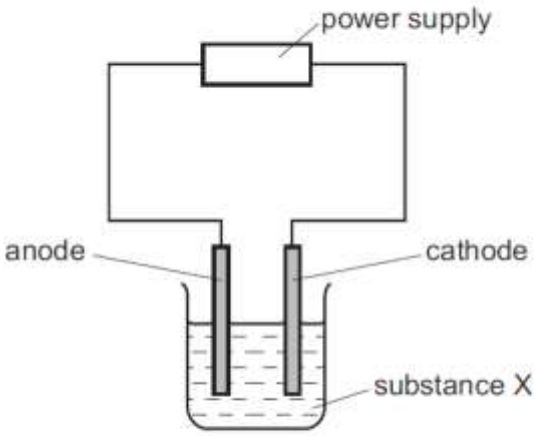

What are X and Y?

| | X | Y |
|---|---|---|
| **A** | chlorine | hydrogen |
| **B** | hydrogen | chlorine |
| **C** | hydrogen | oxygen |
| **D** | oxygen | hydrogen |

**9.**

Substance X was electrolysed in an electrolytic cell.

A coloured gas was formed at the anode and a metal was formed at the cathode.




What is substance X?

**A** aqueous sodium chloride

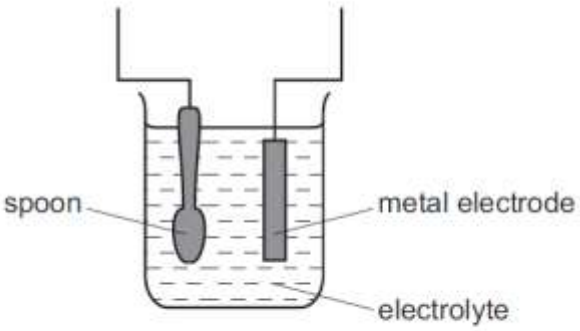
**B** molten lead bromide

**C** molten zinc oxide

**D** solid sodium chloride

**10.**

The diagram shows apparatus for plating a spoon with silver.




Which statement is **not** correct?

**A** Silver would stick to the spoon because it is a very reactive metal.

**B** The electrolyte would be a silver salt dissolved in water.

**C** The metal electrode would be made from silver.

**D** The spoon would be connected to the negative of the power supply.

**11.**

Aqueous copper(II) sulfate solution is electrolysed using inert electrodes.

Copper(II) ions ($Cu^{2+}$), hydrogen ions ($H^+$), hydroxide ions ($OH^-$) and sulfate ions ($SO_4^{2-}$) are present in the solution.

To which electrodes are the ions attracted during this electrolysis?

| | attracted to anode | attracted to cathode |
|---|---|---|
| **A** | $Cu^{2+}$ and $H^+$ | $OH^-$ and $SO_4^{2-}$ |
| **B** | $Cu^{2+}$ and $SO_4^{2-}$ | $H^+$ and $OH^-$ |
| **C** | $H^+$ and $OH^-$ | $Cu^{2+}$ and $SO_4^{2-}$ |
| **D** | $OH^-$ and $SO_4^{2-}$ | $Cu^{2+}$ and $H^+$ |

**12.**

Three electrolysis cells are set up. Each cell has inert electrodes.

The electrolytes are listed below.

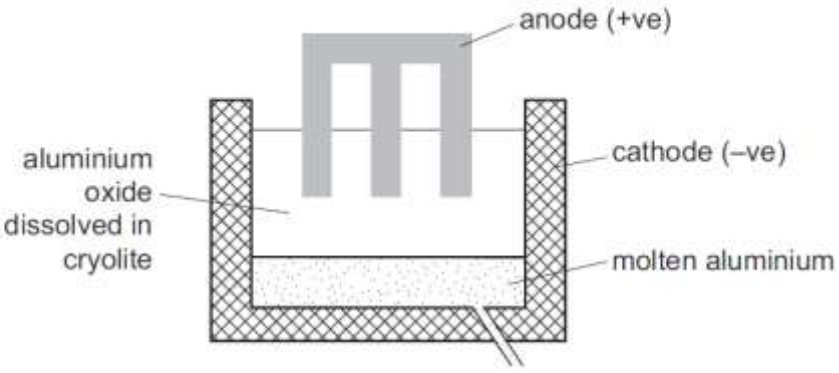
| | |
|---|---|
| cell 1 | aqueous sodium chloride |
| cell 2 | concentrated hydrochloric acid |
| cell 3 | molten lead(II) bromide |

In which cells is a gas formed at **both** electrodes?

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

**13.**

The diagram shows how aluminium is manufactured by electrolysis.

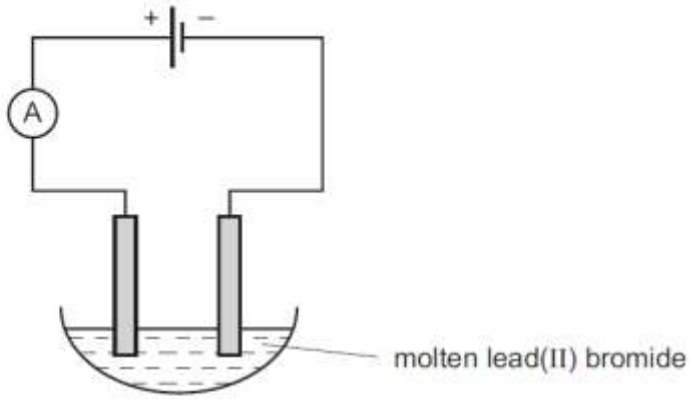



What are the anode and cathode made of?

| | anode | cathode |
|---|---|---|
| **A** | aluminium | aluminium |
| **B** | aluminium | graphite |
| **C** | graphite | aluminium |
| **D** | graphite | graphite |

**14.**

Molten lead(II) bromide is electrolysed as shown.

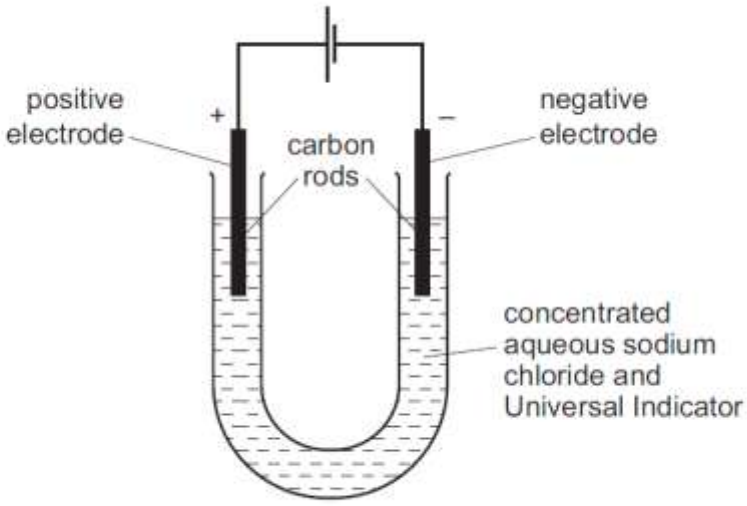



Which ions are discharged at each electrode?

| | positive electrode | negative electrode |
|---|---|---|
| **A** | $Pb^{+}$ | $Br^{2-}$ |
| **B** | $Pb^{2+}$ | $Br^{-}$ |
| **C** | $Br^{2-}$ | $Pb^{+}$ |
| **D** | $Br^{-}$ | $Pb^{2+}$ |

**15.**

The diagram shows the electrolysis of concentrated aqueous sodium chloride.




What is the colour of the Universal Indicator at each electrode after five minutes?

| | colour at anode (+ electrode) | colour at cathode (– electrode) |
|---|---|---|
| **A** | blue/purple | red |
| **B** | red | blue/purple |
| **C** | red | colourless |
| **D** | colourless | blue/purple |

**16.**
Aluminium is extracted from its oxide by electrolysis.

The oxide is dissolved in ……1…… cryolite and aluminium is deposited at the ……2……

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | aqueous | cathode |
| **B** | aqueous | anode |
| **C** | molten | cathode |
| **D** | molten | anode |

**17.**
Which of these elements could be formed at the anode when a molten salt is electrolysed?

**A** copper

**B** iodine

**C** lithium

**D** strontium

**18. ?**
Copper and hydrogen can each be formed by electrolysis.

At which electrodes are these elements formed?

| | copper | hydrogen |
|---|---|---|
| **A** | anode | anode |
| **B** | anode | cathode |
| **C** | cathode | anode |
| **D** | cathode | cathode |

**19. ?**
Metal X is low in the reactivity series and it is liberated by electrolysis of its bromide.

Metal X is ……1…… and the bromide is ……2…… .

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | lead | in solution |
| **B** | lead | molten |
| **C** | sodium | in solution |
| **D** | sodium | molten |

**20. ?**

Which change can take place during electrolysis?

**A** lead(IV) oxide → lead(II) oxide + oxygen

**B** concentrated hydrochloric acid → hydrogen + chlorine

**C** sodium hydroxide + nitric acid → sodium nitrate + water

**D** lead(II) nitrate + sulphuric acid → lead(II) sulphate + nitric acid

**21. ?**

Two elements X and Y form ionic compounds, $XBr_2$ and $Y_2O_3$. The compounds are separately melted and electricity is passed through the liquids.

What are the products at the cathodes?

**A** bromine and oxygen

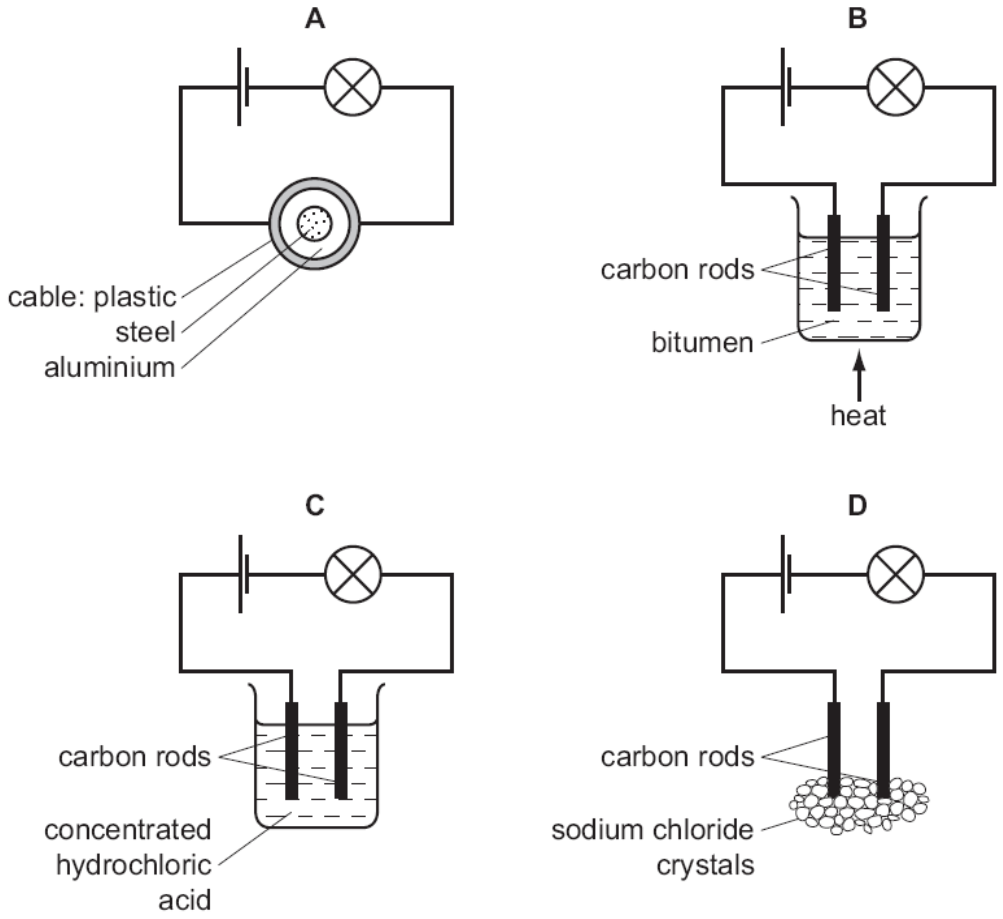
**B** bromine and Y

**C** oxygen and X

**D** X and Y

**22. ?**

Which diagram shows an experiment in which the bulb lights?



# Topic 6 –Chemical Changes

**1.**

Which fuel needs oxygen in order to produce heat energy and which type of reaction produces the energy?

| | fuel | type of reaction |
|---|---|---|
| **A** | a radioactive isotope | endothermic |
| **B** | a radioactive isotope | exothermic |
| **C** | hydrogen | endothermic |
| **D** | hydrogen | exothermic |

**2.**

Some reactions are listed.

methane + oxygen → carbon dioxide + water

sodium + water → sodium hydroxide + hydrogen

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Which word correctly describes all of these reactions?

**A** combustion

**B** endothermic

**C** exothermic

**D** neutralisation

**3.**

Three processes are listed.

burning methane in air

radioactive decay of $^{235}U$

reacting hydrogen with oxygen.

Which statements about these processes are correct?

1 Hydrogen and methane are being used as fuels.

2 All the processes involve oxidation.

3 All the processes are used to produce energy.

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

**4.**

Which substance is **not** used as a fuel?

**A** ethanol

**B** methane

**C** oxygen

**D** uranium

**5.**

Butane, ethanol and hydrogen are fuels.

Which substances produce **both** carbon dioxide and water when used as a fuel?

| | butane | ethanol | hydrogen |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✓ |
| **D** | ✗ | ✓ | ✗ |

**6.**

Which is an endothermic process?

**A** burning hydrogen

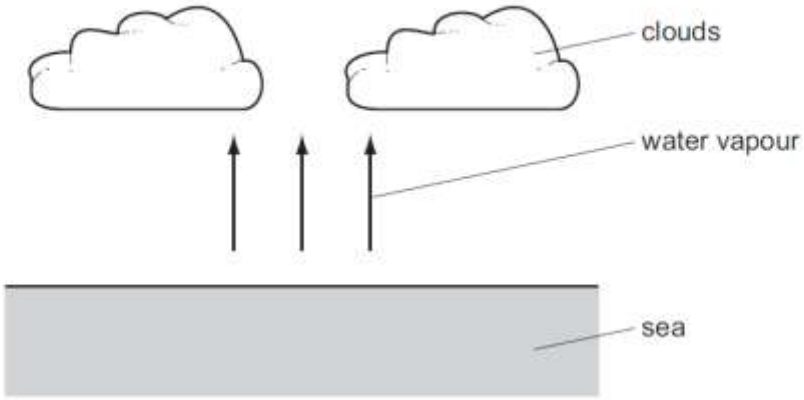
**B** distilling petroleum

**C** reacting potassium with water

**D** using petrol in a motor car engine

**7.**

Clouds are formed when water vapour evaporates from the sea.



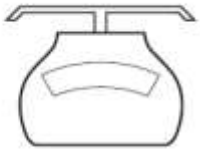

What is the energy change and what name is given to the type of change when water evaporates?

| | energy change | type of change |
|---|---|---|
| **A** | energy given out | endothermic |
| **B** | energy given out | exothermic |
| **C** | energy taken in | endothermic |
| **D** | energy taken in | exothermic |

**8.**

The diagrams show some pieces of laboratory equipment.

1 balance



2 stop-clock


3 thermometer

Which equipment is needed to find out whether dissolving salt in water is an endothermic process?

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

**9.**

Which process is **not** exothermic?

**A** burning a fossil fuel

**B** obtaining lime from limestone

**C** radioactive decay of $^{235}U$

**D** reacting hydrogen with oxygen

**10.**

Substance X requires oxygen in order to produce energy.

It does **not** form carbon dioxide as a result of this energy production.

What is substance X?

**A** hydrogen

**B** natural gas

**C** petrol

**D** $^{235}U$

**11. ?**

Coal, methane and hydrogen are burned as fuels.

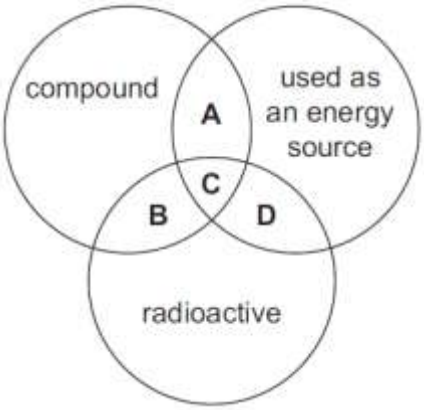
Which descriptions of this process are correct?

| | what happens to the fuel | type of reaction |
|---|---|---|
| **A** | oxidised | endothermic |
| **B** | oxidised | exothermic |
| **C** | reduced | endothermic |
| **D** | reduced | exothermic |

**12.**

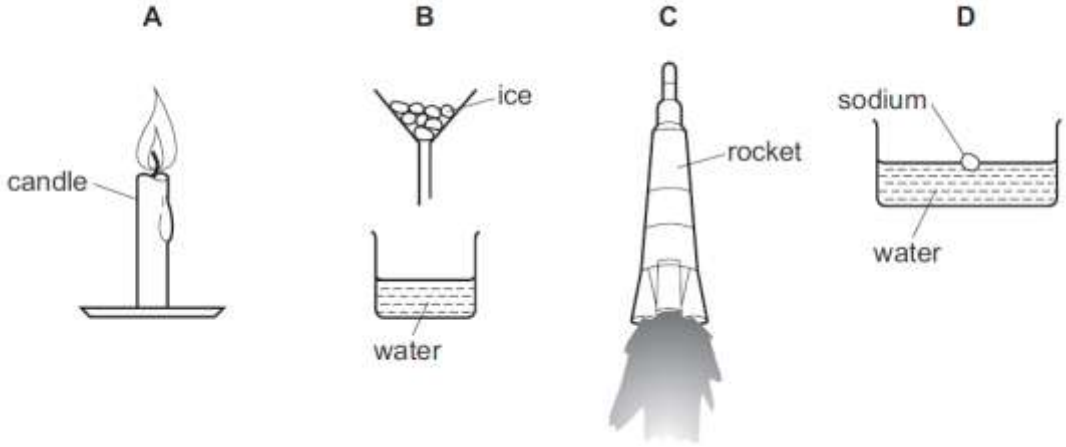
The diagram shows some properties that substances may have.

To which labelled part of the diagram does $^{235}U$ belong?



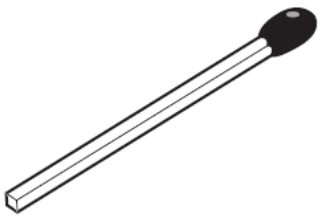

**13.**

Which diagram shows a process in which an endothermic change is taking place?




**14. ?**

The diagram shows a match.



By striking the match, a chemical reaction takes place.

Which statements about the chemical reaction are correct?

| | type of reaction | reason |
|---|---|---|
| **A** | endothermic | because energy is used to strike the match |
| **B** | endothermic | because energy is given out as the match burns |
| **C** | exothermic | because energy is used to strike the match |
| **D** | exothermic | because energy is given out as the match burns |

**15. ?**

The elements $H_2$ and $^{235}U$ are both used as fuels.

In these processes, the reactions are ……1…… and ……2…… oxidised.

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | endothermic | both elements are |
| **B** | endothermic | only hydrogen is |
| **C** | exothermic | both elements are |
| **D** | exothermic | only hydrogen is |

**16.**

When solid X is dissolved in water, an endothermic change takes place.

When 5 g of X are dissolved in 1000 $cm^3$ of water, a temperature change of 10 °C occurs.

Which temperature change occurs when 5 g of X are dissolved in 500 $cm^3$ of water?

**A** a decrease of 20 °C

**B** a decrease of 5 °C

**C** an increase of 20 °C

**D** an increase of 5 °C

**17. ?**

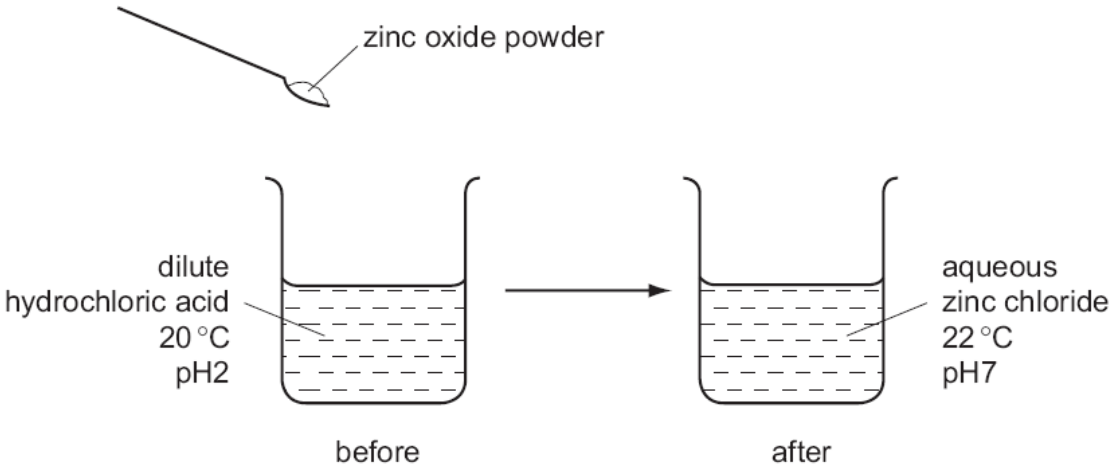
Charcoal and uranium are used as sources of energy.

Which of them are oxidised when used in this way?

| | charcoal | uranium |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**18.**

The diagram shows an experiment.




Which terms describe the experiment?

| | endothermic | neutralisation |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**19. ?**

Which process is **not** exothermic?

**A** burning a fossil fuel

**B** obtaining lime from limestone

**C** radioactive decay of $^{235}U$

**D** reacting hydrogen with oxygen

**20. ?**

Which process is endothermic?

**A** burning hydrogen to form water

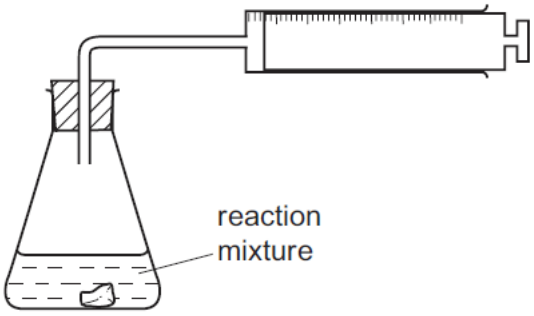
**B** condensing steam to water

**C** melting ice to form water

**D** reacting sodium with water

# Topic 7.1 – Chemical reactions

**1.**
An experiment to determine the rate of a chemical reaction could be carried out using the apparatus shown.




Which reaction is being studied?

**A** $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$

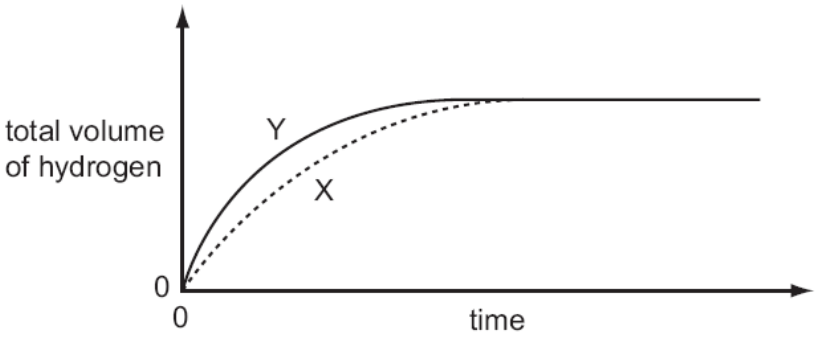
**B** $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

**C** $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

**D** $NaOH + HCl \rightarrow NaCl + H_2O$

**2.**
In an experiment using dilute acid and a metal, the speed at which hydrogen is released is measured (curve X on graph).

The experiment is repeated but with one of the conditions changed (curve Y on graph).




Which changes in condition could result in curve Y?

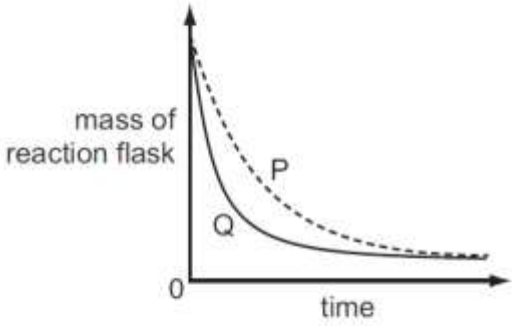
| | increase in concentration of acid | increase in particle size of metal | increase in temperature |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✓ | ✗ | ✓ |
| **D** | ✗ | ✓ | ✓ |

**3.**

A student investigates the rate of reaction between marble chips and hydrochloric acid.

The loss in mass of the reaction flask is measured.

The graph shows the results of two experiments, P and Q.




Which change explains the difference between P and Q?

**A** A catalyst is added in P.

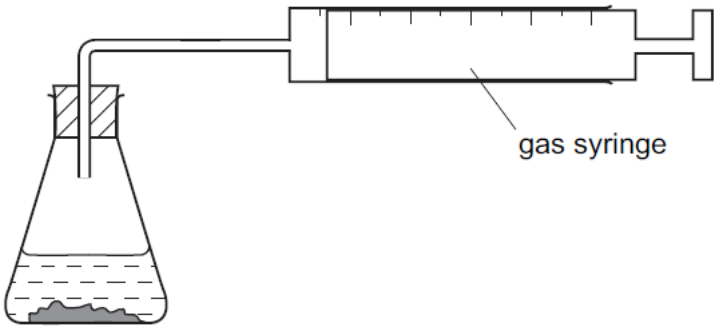
**B** A higher temperature is used in P.

**C** Bigger marble chips are used in Q.

**D** Hydrochloric acid is more concentrated in Q.

**4.**

The apparatus shown can be used to measure the rate of some chemical reactions.




For which two reactions would the apparatus be suitable?

| | |
|---|---|
| reaction 1 | $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$ |
| reaction 2 | $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ |
| reaction 3 | $MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$ |
| reaction 4 | $ZnCO_3(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + CO_2(g) + H_2O(l)$ |

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

**5.**

Copper(II) carbonate reacts with dilute sulfuric acid.

$$CuCO_3(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + CO_2(g) + H_2O(l)$$

The speed of the reaction can be changed by varying the conditions.

Which conditions would always increase the speed of this chemical reaction?

1 Increase the concentration of the reactants.

2 Increase the size of the pieces of copper(II) carbonate.

3 Increase the temperature.

4 Increase the volume of sulfuric acid.

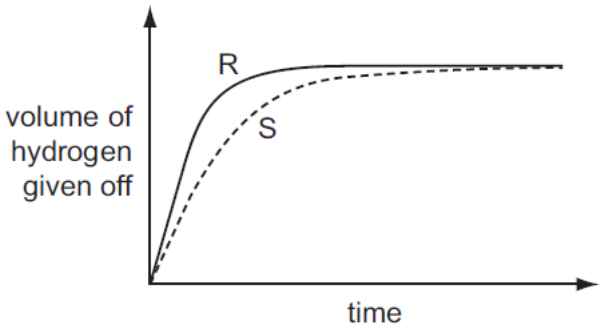
**A** 1, 3 and 4 **B** 1 and 3 only **C** 2 and 3 **D** 3 and 4 only

**6.**

A student investigates the rate of reaction between magnesium and excess sulfuric acid.

The volume of hydrogen given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.




Which change in conditions would cause the difference between R and S?

**A** A catalyst is added in S.

**B** The acid is more concentrated in R than in S.

**C** The magnesium is less finely powdered in R than in S.

**D** The temperature in R is lower than in S.

**7. ?**

Which piece of apparatus is essential to measure the speed of a reaction?

**A** accurate balance

**B** gas syringe

**C** stopwatch

**D** thermometer

**8.**

Calcium carbonate was reacted with hydrochloric acid in a conical flask. The flask was placed on a balance and the mass of the flask and contents was recorded as the reaction proceeded.

During the reaction, carbon dioxide gas was given off.

The reaction was carried out at two different temperatures.

Which row is correct?

| | change in mass | temperature at which mass changed more quickly |
|---|---|---|
| **A** | decrease | higher temperature |
| **B** | decrease | lower temperature |
| **C** | increase | higher temperature |
| **D** | increase | lower temperature |

**9.**

Which change does **not** increase the speed of reaction between zinc and hydrochloric acid?

**A** adding a catalyst

**B** decreasing the temperature

**C** decreasing the particle size of the zinc

**D** using more concentrated acid

**10. ?**

Magnesium reacts with acids to produce hydrogen gas.

Under which set of conditions is hydrogen formed the most slowly?

| | magnesium | acid | temperature / °C |
|---|---|---|---|
| **A** | ribbon | concentrated | 40 |
| **B** | ribbon | dilute | 20 |
| **C** | powder | concentrated | 40 |
| **D** | powder | dilute | 20 |

**11. ?**

Which does **not** increase the speed of a reaction?

**A** adding a catalyst

**B** increasing the concentration of one of the reactants

**C** increasing the particle size of one of the reactants

**D** increasing the temperature

**12.**

Which changes of condition slow down the reaction between magnesium and air?

1 heating the magnesium to a higher temperature

2 using a higher proportion of oxygen in the air

3 using magnesium ribbon instead of powdered magnesium

**A** 1 only

**B** 2 only

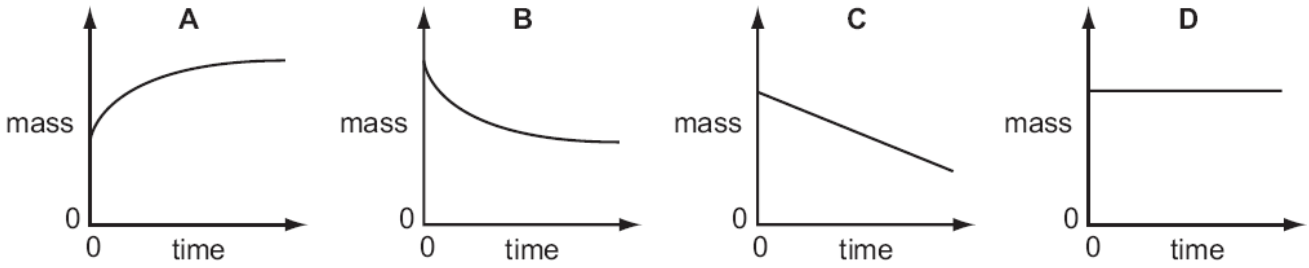
**C** 3 only

**D** 1, 2 and 3

**13. ?**

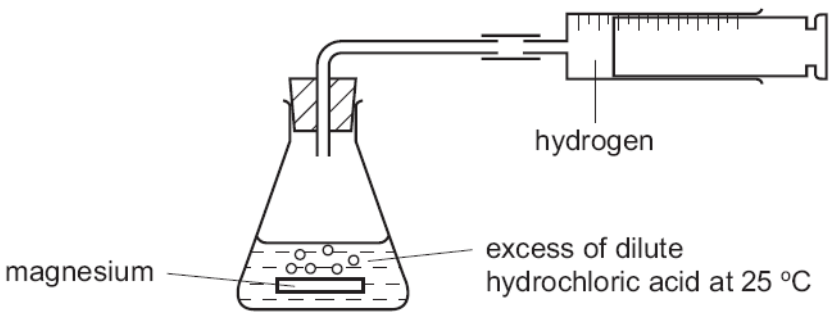
The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?




**14.**

The diagram shows a speed of reaction experiment.




Increasing the concentration of the acid and increasing the temperature both affect the speed of reaction.

Which line of the table is correct?

| | increase concentration of acid | increase temperature |
|---|---|---|
| **A** | decrease speed of reaction | decrease speed of reaction |
| **B** | decrease speed of reaction | increase speed of reaction |
| **C** | increase speed of reaction | decrease speed of reaction |
| **D** | increase speed of reaction | increase speed of reaction |

**15. ?**

Why does the powdering of calcium carbonate increase the speed of its reaction with an acid?

**A** It increases the mass of calcium carbonate.

**B** It increases the surface area of the calcium carbonate.

**C** The powder becomes more concentrated.

**D** The powder floats on top of the acid.

**16. ?**

In separate experiments, a catalyst is added to a reaction mixture and the temperature of the mixture is decreased.

What is the effect of these changes on the speed of the reaction?

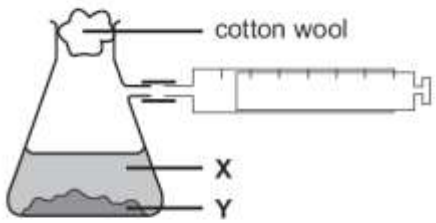
| | catalyst added | temperature decreased |
|---|---|---|
| **A** | faster | faster |
| **B** | faster | slower |
| **C** | slower | faster |
| **D** | slower | slower |

**17. ?**

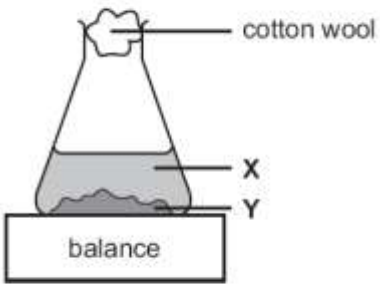
A liquid **X** reacts with solid **Y** to form a gas.

Which **two** diagrams show suitable methods for investigating the speed of the reaction?

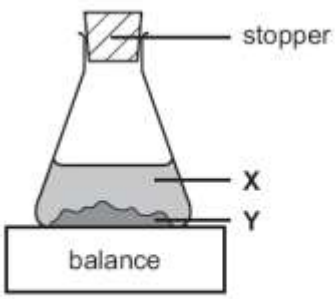
1



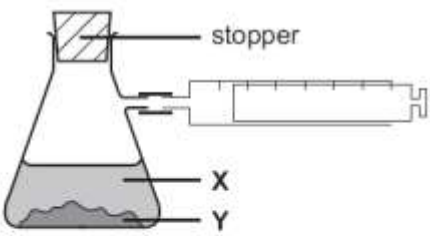

2




3




4



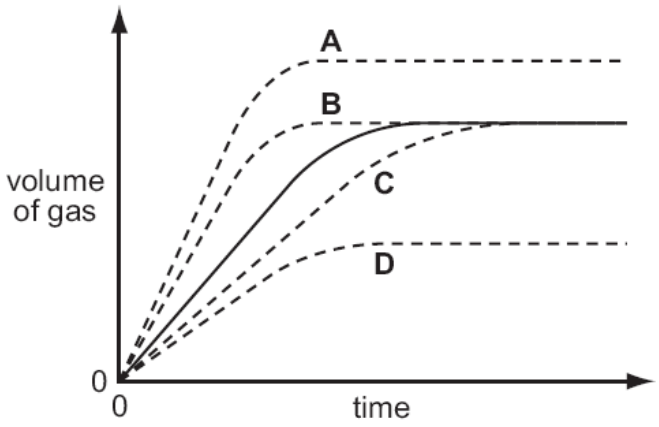

**A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

**18.**

In an experiment, a 2 g lump of zinc and 2 g of powdered zinc are added separately to equal volumes of dilute sulphuric acid.

The solid line on the graph shows the volume of gas given off when the 2 g lump is used.

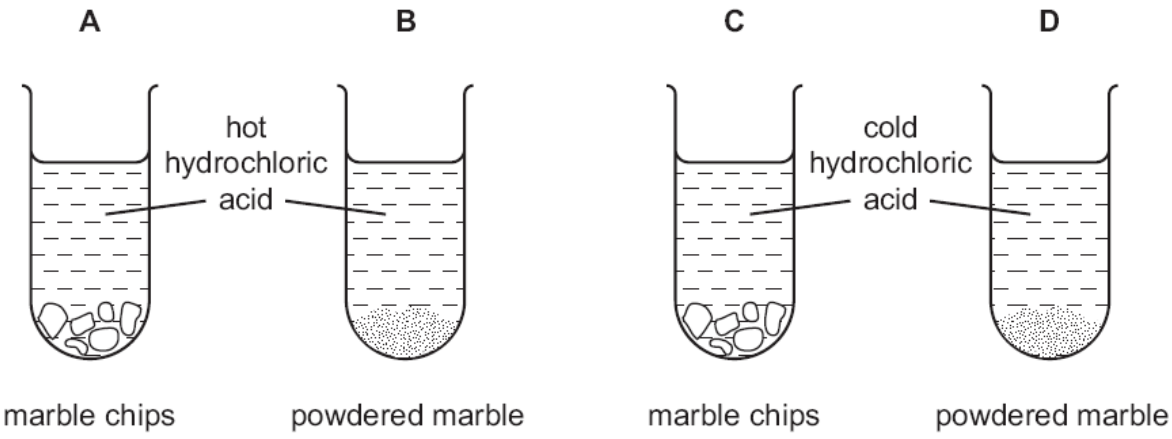
Which dotted line is obtained when the zinc is powdered?




**19.**

In different experiments, 2 g of marble are added to 10 $cm^3$ of hydrochloric acid.

In which tube is the reaction fastest?




**20. ?**

A television news programme shows an explosion at a flour mill.

What could have increased the risk of such an explosion?

**A** adding salt to the flour

**B** employing more staff in the mill

**C** grinding the flour more finely

**D** opening the windows

# *Topic 7.2–Reversible reactions*

**1.**

The sign ⇌ is used in some equations to show that a reaction is reversible.

Two incomplete equations are given.

| | reactants | products |
|---|---|---|
| **P** | $CoCl_2 + 2H_2O$ | $CoCl_2.2H_2O$ |
| **Q** | $C + O_2$ | $CO_2$ |

For which of these reactions can a ⇌ sign be correctly used to complete the equation?

| | P | Q |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**2.**

The equation for the effect of heat on hydrated sodium carbonate is as shown.

$$Na_2CO_3.10H_2O(s) \rightleftharpoons Na_2CO_3(s) + 10H_2O(g)$$

Statements made by four students about the reaction are given.

**P** Anhydrous sodium carbonate is formed.

**Q** Steam is formed.

**R** There is a colour change from blue to white.

**S** The reaction is reversible.

Which students' statements are correct?

**A** P, Q and R only

**B** P, Q and S only

**C** Q, R and S only

**D** P, Q, R and S

**3. ?**

When drops of water are added to a sample of an anhydrous salt, a reaction occurs.

How can the reaction be reversed?

**A** cool the salt

**B** crystallise the salt

**C** filter the salt

**D** heat the salt

**4.**

When pink crystals of cobalt(II) chloride are heated, steam is given off and the colour of the solid changes to blue.

$$CoCl_2.6H_2O \rightleftharpoons CoCl_2 + 6H_2O$$

What happens when water is added to the blue solid?

| | colour | temperature |
|---|---|---|
| **A** | changes to pink | decreases |
| **B** | changes to pink | increases |
| **C** | remains blue | decreases |
| **D** | remains blue | increases |

**5.**

When pink cobalt(II) sulfate crystals are heated, they form steam and a blue solid.

When water is added to the blue solid, it turns pink and becomes hot.

Which terms describe the pink cobalt(II) sulfate crystals and the reactions?

| | pink cobalt sulfate | reactions |
|---|---|---|
| **A** | aqueous | irreversible |
| **B** | aqueous | reversible |
| **C** | hydrated | irreversible |
| **D** | hydrated | reversible |

**6. ?**

The sign $\rightleftharpoons$ is used in some equations to show that a reaction can be reversed.

Two incomplete equations are given.

| | reagents | products |
|---|---|---|
| **P** | $C + O_2$ | $CO_2$ |
| **Q** | $CoCl_2 + 2H_2O$ | $CoCl_2.2H_2O$ |

For which of these reactions can a $\rightleftharpoons$ sign be correctly used to complete the equation?

| | P | Q |
|---|---|---|
| **A** | ✔ | ✔ |
| **B** | ✔ | ✘ |
| **C** | ✘ | ✔ |
| **D** | ✘ | ✘ |

**7.**

The equation shows a reaction that is reversed by changing the conditions.

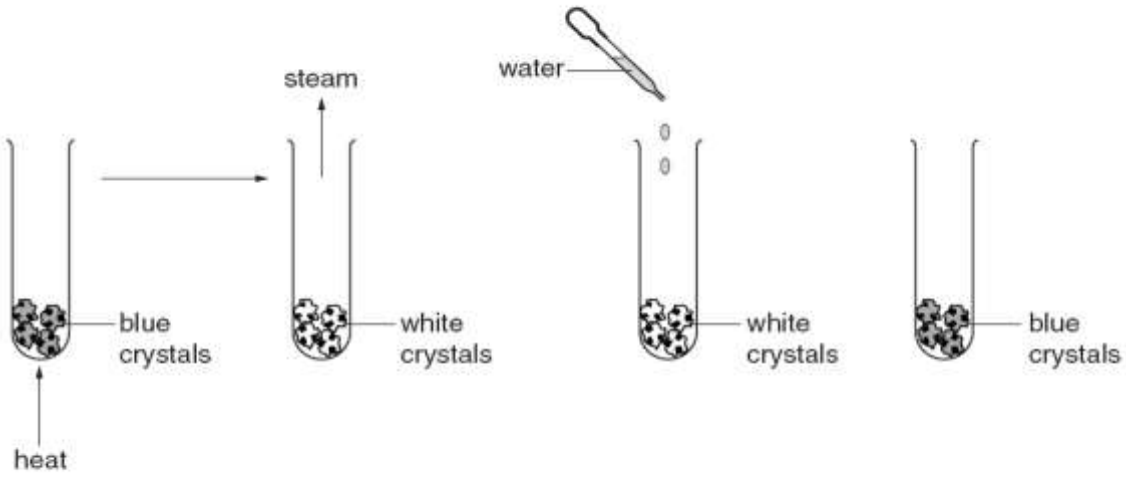
$$CuSO_4.5H_2O \xrightarrow{\text{forward reaction}} CuSO_4 + 5H_2O$$

How can the forward reaction be reversed?

| | by adding water | by heating |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**8. ?**

The diagrams show an experiment using copper(II) sulphate.




What do these diagrams represent?

**A** a redox reaction

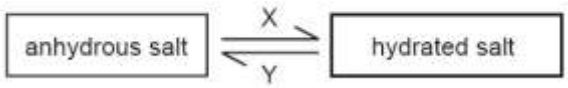
**B** a reversible reaction

**C** crystallisation

**D** purification

**9. ?**

The diagram shows the change from a salt to its hydrated form.




Which labels can be used for X and Y?

| | X | Y |
|---|---|---|
| **A** | + heat | + water |
| **B** | + heat | – water |
| **C** | + water | + heat |
| **D** | + water | – heat |

# *Topic 7.3 –Redox reactions*

**1.**

Iron is extracted from iron oxide using carbon monoxide as shown in the equation.

iron oxide + carbon monoxide → iron + carbon dioxide

What does the equation show?

**A** Carbon monoxide is oxidised to carbon dioxide.

**B** Carbon monoxide is reduced to carbon dioxide.

**C** Iron is oxidised to iron oxide.

**D** Iron oxide is oxidised to iron.

**2.**

The red colour in some pottery glazes may be formed as a result of the reactions shown.

$$CuCO_3 \xrightarrow{\text{heat}} CuO + CO_2$$

$$CuO + SnO \longrightarrow Cu + SnO_2$$

These equations show that ……1…… is oxidised and ……2…… is reduced.

Which substances correctly complete gaps 1 and 2 in the above sentence?

| | 1 | 2 |
|---|---|---|
| **A** | $CO_2$ | $SnO_2$ |
| **B** | $CuCO_3$ | CuO |
| **C** | CuO | SnO |
| **D** | SnO | CuO |

**3.**

The reactions shown may occur in the air during a thunder storm.

$N_2 + O_2 \rightarrow 2NO$

$2NO + O_2 \rightarrow 2NO_2$

$NO + O_3 \rightarrow NO_2 + O_2$

Which line shows what happens to the reactant molecules in each of these reactions?

| | $N_2$ | NO | $O_3$ |
|---|---|---|---|
| **A** | oxidised | oxidised | oxidised |
| **B** | oxidised | oxidised | reduced |
| **C** | reduced | reduced | oxidised |
| **D** | reduced | reduced | reduced |

**4.**

The equations represent redox reactions.

In which equation is the underlined substance acting as a reducing agent?

**A** $\underline{CaO} + H_2O \rightarrow Ca(OH)_2$

**B** $\underline{CO_2} + C \rightarrow 2CO$

**C** $\underline{CuO} + H_2 \rightarrow Cu + H_2O$

**D** $3\underline{CO} + Fe_2O_3 \rightarrow 2Fe + 3CO_2$

**5. ?**

The equation explains the colour change that occurs when aqueous potassium hydroxide is added to aqueous potassium dichromate(VI).

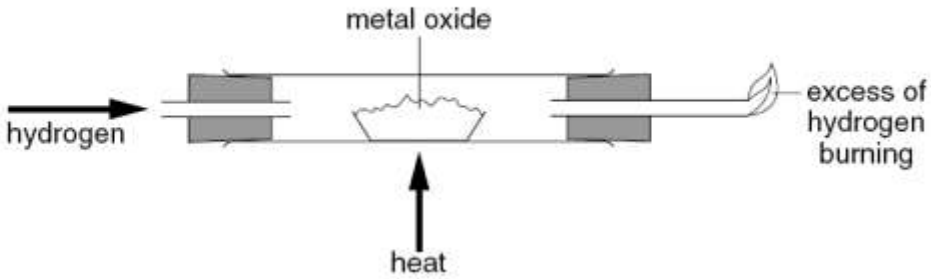
$$\underset{\substack{\text{potassium}\\\text{dichromate(VI)}\\\text{orange}}}{K_2Cr_2O_7} + 2KOH \rightarrow \underset{\substack{\text{potassium}\\\text{chromate(VI)}\\\text{yellow}}}{2K_2CrO_4} + H_2O$$

As a result of adding an excess of aqueous potassium hydroxide to aqeous potassium dichromate(VI), what happens to the oxidation state of the chromium and the pH of the reaction mixture?

| | oxidation state of the chromium | pH of the mixture |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | stays the same | decreases |
| **D** | stays the same | increases |

**6.**

When hydrogen is passed over a heated metal oxide, the metal and steam are formed.




What happens to the hydrogen and to the metal oxide?

| | hydrogen | metal oxide |
|---|---|---|
| **A** | oxidised | oxidised |
| **B** | oxidised | reduced |
| **C** | reduced | oxidised |
| **D** | reduced | reduced |

**7.**

Three reactions used in the manufacture of sulphuric acid are shown.

1 $S + O_2 \rightarrow SO_2$

2 $2SO_2 + O_2 \rightarrow 2SO_3$

3 $SO_3 + H_2O \rightarrow H_2SO_4$

Which of these reactions are redox reactions?

**A** 1 only

**B** 3 only

**C** 1 and 2 only

**D** 2 and 3 only

**8.**

In which of the following reactions is the substance printed in **bold** oxidised?

**A** burning the **wax** in a candle

**B** dissolving **hydrogen chloride** in water

**C** making glucose from **carbon dioxide** and water by photosynthesis

**D** reacting **sodium hydroxide** with sulphuric acid

**9. ?**

Zinc reacts with steam to form zinc oxide and hydrogen.

$$Zn + H_2O \longrightarrow ZnO + H_2$$

During the reaction, which substance is oxidised?

**A** hydrogen

**B** water

**C** zinc

**D** zinc oxide

**10.**

Which process does **not** involve either oxidation or reduction?

**A** burning methane in the air

**B** extracting iron from hematite

**C** heating copper(II) oxide with carbon

**D** reacting sodium carbonate with dilute hydrochloric acid

**11. ?**

In an experiment, copper(II) oxide is changed to copper by a gas **X**.

What happens to the copper(II) oxide and what is **X**?

| | copper(II) oxide | gas **X** |
|---|---|---|
| **A** | oxidised | carbon dioxide |
| **B** | oxidised | carbon monoxide |
| **C** | reduced | carbon dioxide |
| **D** | reduced | carbon monoxide |

**12. ?**

Which equation shows an oxidation reaction?

**A** $C + O_2 \rightarrow CO_2$

**B** $CaCO_3 \rightarrow CaO + CO_2$

**C** $2H_2O_2 \rightarrow 2H_2O + O_2$

**D** $N_2O_4 \rightarrow 2NO_2$

**13. ?**

A piece of copper sheet is heated gently in air and then cooled.

What happens to the mass of the copper sheet and why?

| | the mass | because the copper is |
|---|---|---|
| **A** | decreases | oxidised |
| **B** | decreases | reduced |
| **C** | increases | oxidised |
| **D** | increases | reduced |

**14.**

Iron(II) ions in FeO react with oxgen to form $Fe_2O_3$.

Which statement about the iron ions is correct?

**A** Iron(II) ions are oxidised because they gain oxygen.

**B** Iron(II) ions are reduced because they lose oxygen.

**C** Iron(III) ions are oxidised because they gain oxygen.

**D** Iron(III) ions are reduced because they lose oxygen.

# Topic 8 –Acids, bases and salts

**23.**
Which type of reaction always forms a salt and water?

**A** exothermic

**B** neutralisation

**C** oxidation

**D** polymerisation

**24.**
Which property is **not** characteristic of a base?

**A** It reacts with a carbonate to form carbon dioxide.

**B** It reacts with an acid to form a salt.

**C** It reacts with an ammonium salt to form ammonia.

**D** It turns universal indicator paper blue.

**25.**
An alloy contains copper and zinc.

Some of the zinc has become oxidised to zinc oxide.

What is the result of adding an excess of dilute sulfuric acid to the alloy?

**A** A blue solution and a white solid remains.

**B** A colourless solution and a pink/brown solid remains.

**C** The alloy dissolves completely to give a blue solution.

**D** The alloy dissolves completely to give a colourless solution.

**26.**
The results of three tests on a solution of compound **X** are shown.

| test | result |
|---|---|
| aqueous sodium hydroxide added | white precipitate formed, soluble in excess |
| aqueous ammonia added | white precipitate formed, soluble in excess |
| dilute hydrochloric acid added | bubbles of gas |

What is compound **X**?

**A** aluminium carbonate

**B** aluminium chloride

**C** zinc carbonate

**D** zinc chloride

**27.**

Carbon dioxide is an acidic oxide that reacts with aqueous calcium hydroxide.

Which type of reaction takes place?

**A** decomposition

**B** fermentation

**C** neutralisation

**D** oxidation

**28.**

Which is **not** a typical property of an acid?

**A** They react with alkalis producing water.

**B** They react with all metals producing hydrogen.

**C** They react with carbonates producing carbon dioxide.

**D** They turn litmus paper red.

**29.**

A solution contains barium ions and silver ions.

What could the anion be?

**A** chloride only

**B** nitrate only

**C** sulfate only

**D** chloride or nitrate or sulfate

**30.**

A mixture containing two anions was tested and the results are shown below.

| test | result |
|---|---|
| dilute nitric acid added | effervescence of a gas which turned limewater milky |
| dilute nitric acid added, followed by aqueous silver nitrate | yellow precipitate formed |

Which anions were present?

**A** carbonate and chloride

**B** carbonate and iodide

**C** sulfate and chloride

**D** sulfate and iodide

**31.**
Some barium iodide is dissolved in water.

Aqueous lead(II) nitrate is added to the solution until no more precipitate forms.

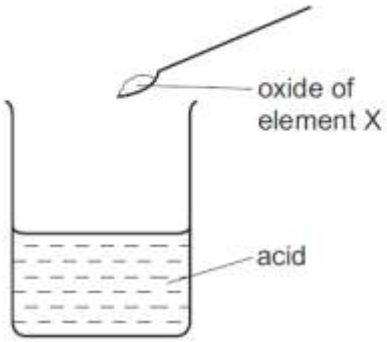
This precipitate, X, is filtered off.

Dilute sulfuric acid is added to the filtrate and another precipitate, Y, forms.

What are the colours of precipitates X and Y?

| | X | Y |
|---|---|---|
| **A** | white | white |
| **B** | white | yellow |
| **C** | yellow | white |
| **D** | yellow | yellow |

**32.**
The oxide of element X was added to an acid. It reacted to form a salt and water.




What is the pH of the acid before the reaction and what type of element is X?

| | pH | type of element X |
|---|---|---|
| **A** | greater than 7 | metal |
| **B** | greater than 7 | non-metal |
| **C** | less than 7 | metal |
| **D** | less than 7 | non-metal |

**33.**
A salt is made by adding an excess of an insoluble metal oxide to an acid.

How can the excess metal oxide be removed?

**A** chromatography

**B** crystallisation

**C** distillation

**D** filtration

**34.**

Aqueous sodium hydroxide is added to a solid, X, and the mixture is heated.

A green precipitate is formed and an alkaline gas is given off.

Which ions are present in X?

**A** $NH_4^+$ and $Fe^{2+}$

**B** $NH_4^+$ and $Fe^{3+}$

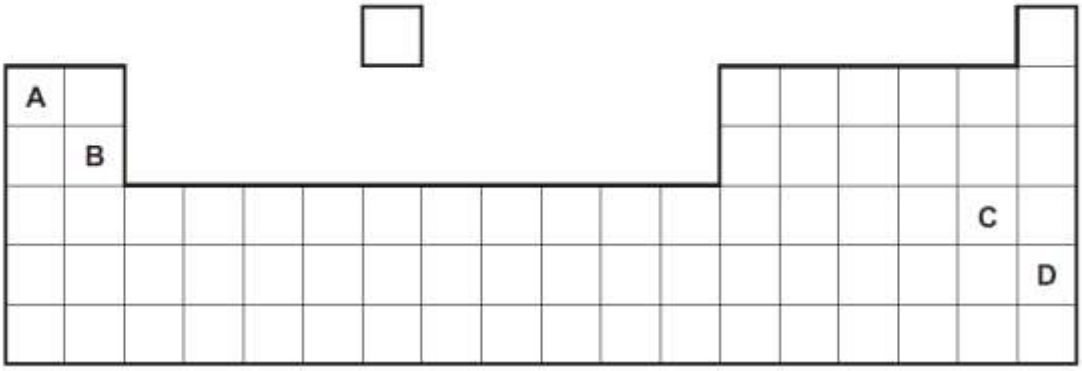
**C** $OH^-$ and $Fe^{2+}$

**D** $OH^-$ and $Fe^{3+}$

**35.**

The positions in the Periodic Table of four elements are shown.

Which element is **most** likely to form an acidic oxide?




**36.**

An excess of copper(II) oxide is added to dilute sulfuric acid to make crystals of hydrated copper(II) sulfate.

The processes listed may be used to obtain crystals of hydrated copper(II) sulfate.

1 concentrate the resulting solution

2 filter

3 heat the crystals

4 wash the crystals

Which processes are needed and in which order?

**A** 1, 2, 3 and 4

**B** 1, 2, 4 and 3

**C** 2, 1, 2 and 3

**D** 2, 1, 2 and 4

**37.**

An aqueous solution of the organic compound methylamine has a pH greater than 7.

Which statement about methylamine is correct?

**A** It neutralises an aqueous solution of sodium hydroxide.

**B** It reacts with copper(II) carbonate to give carbon dioxide.

**C** It reacts with hydrochloric acid to form a salt.

**D** It turns blue litmus red.

**38.**

Which reaction will result in a decrease in pH?

**A** adding calcium hydroxide to acid soil

**B** adding citric acid to sodium hydrogen carbonate solution

**C** adding sodium chloride to silver nitrate solution

**D** adding sodium hydroxide to hydrochloric acid

**39.**

Salts can be prepared by reacting a dilute acid

1 with a metal;

2 with a base;

3 with a carbonate.

Which methods could be used to prepare copper(II) chloride?

**A** 1 and 2 only

**B** 1 and 3 only

**C** 2 and 3 only

**D** 1, 2 and 3

**40.**

An element E is burned in air. A white solid oxide is formed.

The oxide is tested with damp red litmus paper. The paper turns blue.

What is element E?

**A** calcium

**B** carbon

**C** iodine

**D** sulfur

**41.**

An aqueous solution Y contains both barium ions and silver ions.

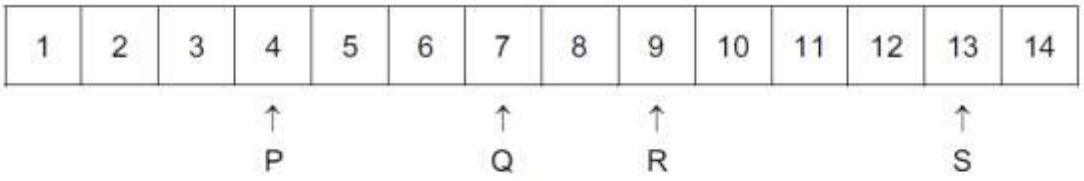
In separate experiments, dilute sulfuric acid and dilute hydrochloric acid are added to solution Y.

Which of these acids causes a precipitate to form in solution Y?

| | dilute sulfuric acid | dilute hydrochloric acid |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**42.**

The diagram shows the pH values of four solutions.




Which of these solutions are alkaline?

**A** P only

**B** P and Q only

**C** Q, R and S only

**D** R and S only

**43.**

Aqueous sodium hydroxide is added to a solution of a salt. A blue precipitate is formed which does not dissolve in excess.

Aluminium foil is added to the mixture and the mixture is warmed. A gas is produced that turns damp red litmus paper blue.

What is the name of the salt?

**A** ammonium nitrate

**B** ammonium sulfate

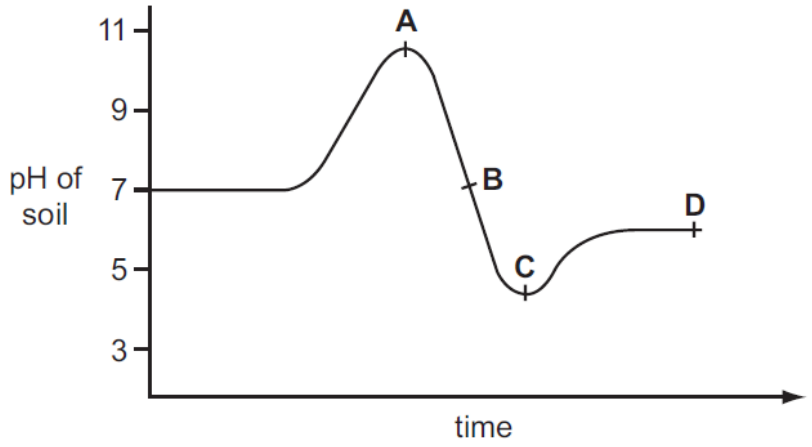
**C** copper(II) nitrate

**D** copper(II) sulfate

**44.**

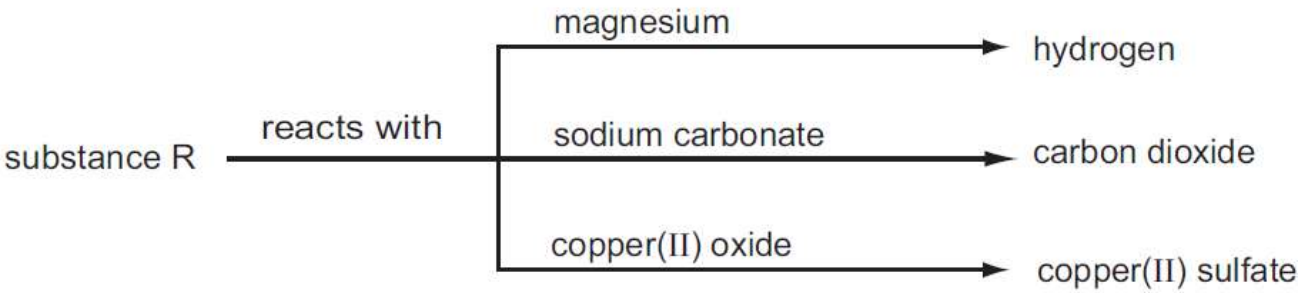
The graph shows how the pH of soil in a field changed over time.

At which point was the soil neutral?




**45.**

Some reactions of a substance, R, are shown in the diagram.




What type of substance is R?

**A** an acid

**B** a base

**C** an element

**D** a salt

**46. ?**

Dilute sulphuric acid is added to a mixture of copper, magnesium and zinc in a beaker. The beaker is left for about 10 minutes and its contents are then filtered.

What does the filtrate contain?

**A** copper(II) sulphate, magnesium sulphate and zinc sulphate

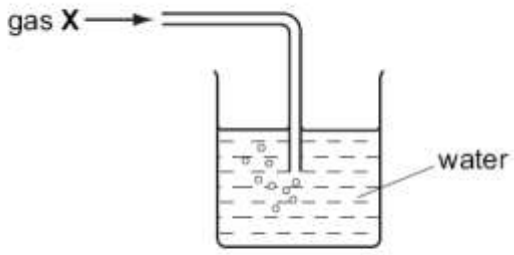
**B** copper(II) sulphate and zinc sulphate only

**C** magnesium sulphate and zinc sulphate only

**D** magnesium sulphate only

**47. ?**

Gas **X** is passed into water as shown.




The pH of the water changes from 7 to 10.

What is gas **X**?

**A** ammonia

**B** carbon dioxide

**C** nitrogen

**D** sulphur dioxide

**48. ?**

A solution of zinc sulphate can be made by adding an excess **either** of zinc carbonate **or** of zinc hydroxide to dilute sulphuric acid.

In which forms are these zinc compounds added to the acid?

| | zinc carbonate | zinc hydroxide |
|---|---|---|
| **A** | aqueous | aqueous |
| **B** | aqueous | solid |
| **C** | solid | aqueous |
| **D** | solid | solid |

**49. ?**

Two tests are carried out on a solution containing both copper(II) sulphate and sodium chloride.
A student records results as shown.

| test | reagent | result |
|---|---|---|
| 1 | aqueous barium chloride | blue precipitate |
| 2 | aqueous silver nitrate | white precipitate |

Which results are correctly recorded?

| | 1 | 2 |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**50. ?**

An oxide of element X dissolves in water to form a solution of pH 5.

Which line in the table is correct?

| | type of element | type of oxide |
|---|---|---|
| **A** | metallic | acidic |
| **B** | metallic | basic |
| **C** | non-metallic | acidic |
| **D** | non-metallic | basic |

**51. ?**

Which properties does an acid have?

1 reacts with ammonium sulphate to form ammonia

2 turns red litmus blue

| | 1 | 2 |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**52. ?**

Which statement describes a test for carbon dioxide gas?

**A** It bleaches damp litmus paper.

**B** It relights a glowing splint.

**C** It turns cobalt(II) chloride paper pink.

**D** It turns limewater cloudy.

**53. ?**

) Which two elements are correctly listed to show the natures of their oxides?

| | forms an acidic oxide | forms a basic oxide |
|---|---|---|
| **A** | magnesium | sulphur |
| **B** | phosphorus | sulphur |
| **C** | sulphur | phosphorus |
| **D** | sulphur | magnesium |

**54. ?**

What is the colour of gaseous chlorine and of solid sodium chloride?

| | chlorine | sodium chloride |
|---|---|---|
| **A** | colourless | yellow-green |
| **B** | colourless | white |
| **C** | yellow-green | yellow-green |
| **D** | yellow-green | white |

**55. ?**

Oxygen is formed when manganese(IV) oxide is added to hydrogen peroxide, $H_2O_2$.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

In this reaction, the manganese(IV) oxide acts as

**A** an acid.

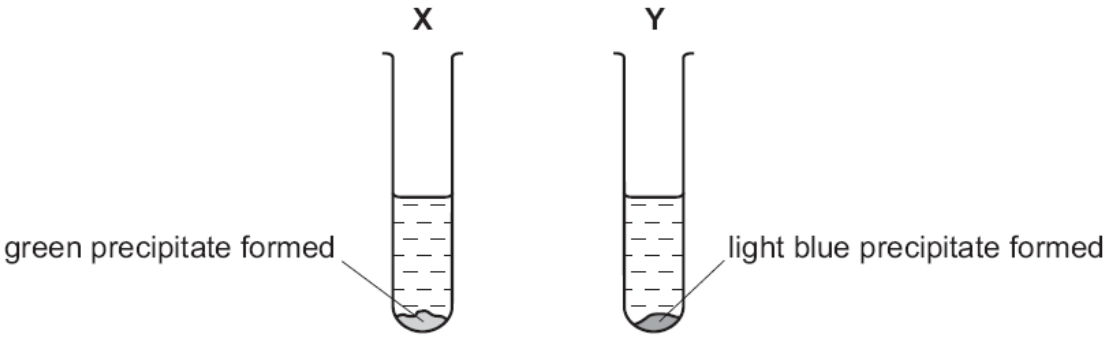
**B** a base.

**C** a catalyst.

**D** a drying agent.

**56. ?**

Aqueous sodium hydroxide is added to two different solutions with the results shown.




What are the cations present in **X** and **Y**?

| | **X** | **Y** |
|---|---|---|
| **A** | copper(II) | iron(II) |
| **B** | copper(II) | iron(III) |
| **C** | iron(II) | copper(II) |
| **D** | iron(III) | copper(II) |

**57. ?**

A colourless liquid in an unlabelled bottle is tested as shown.

- Litmus paper turns red.
- Magnesium ribbon fizzed.
- Reaction with aqueous barium nitrate produced a white precipitate.

What is the colourless liquid?

**A** aqueous sodium hydroxide

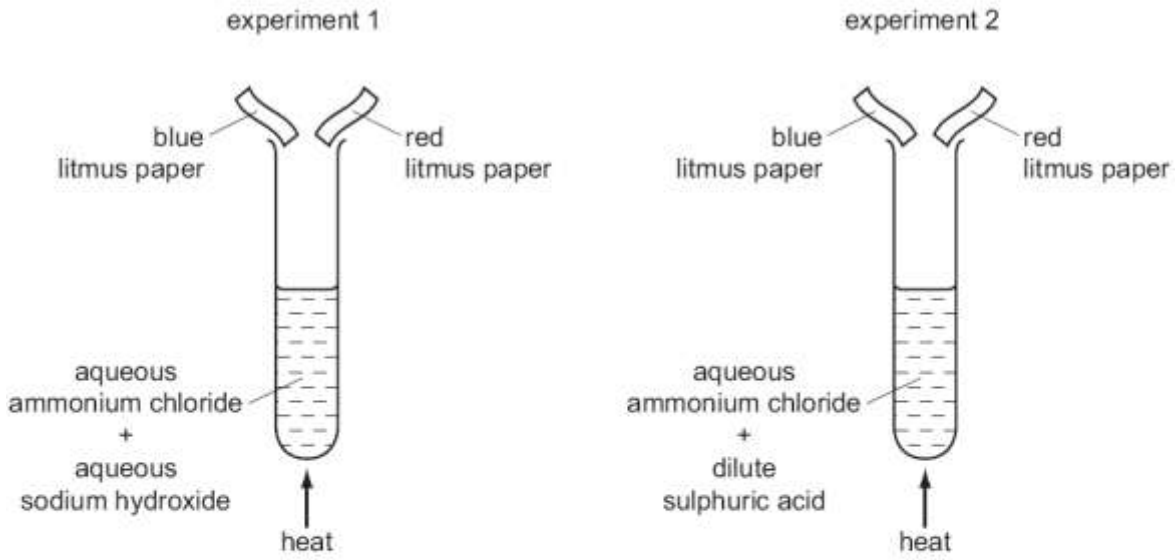
**B** aqueous sodium sulphate

**C** dilute hydrochloric acid

**D** dilute sulphuric acid

**58. ?**

? The diagrams show two experiments.




What happens to the pieces of litmus paper?

| | experiment 1 | experiment 2 |
|---|---|---|
| **A** | blue → red | both pieces bleached |
| **B** | blue → red | no change |
| **C** | red → blue | both pieces bleached |
| **D** | red → blue | no change |

**59. ?**

Which element has an oxide that forms a salt with an alkali?

**A** N **B** Na **C** Ne **D** Ni

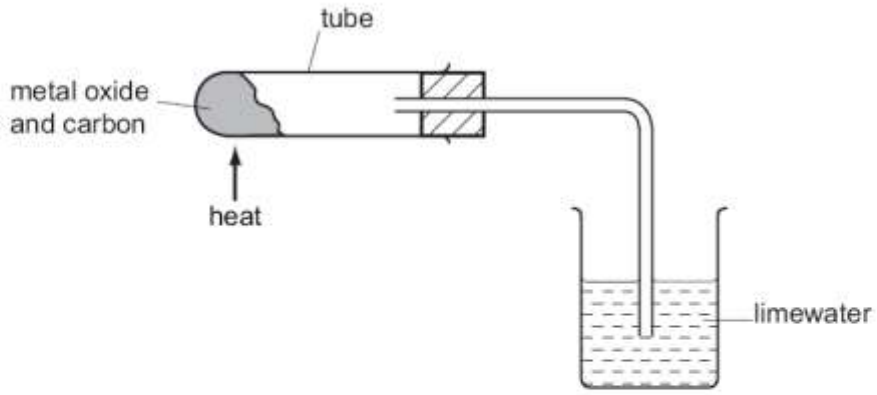
**60.**

Which element has an oxide that reacts with an alkali?

**A** K **B** Ne **C** Ni **D** P

**61. ?**

In separate experiments, mixtures of CuO/C and of MgO/C are strongly heated in the apparatus shown.



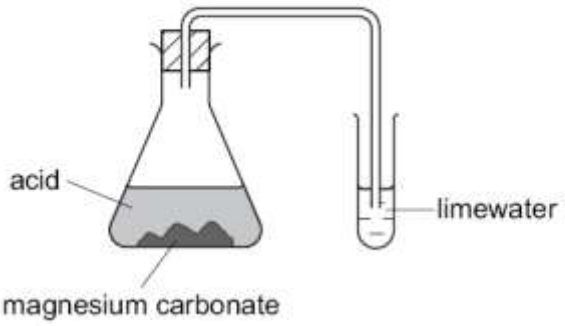

What happens to the limewater in these experiments?

| | CuO/C | MgO/C |
|---|---|---|
| **A** | goes cloudy | goes cloudy |
| **B** | goes cloudy | stays clear |
| **C** | stays clear | goes cloudy |
| **D** | stays clear | stays clear |

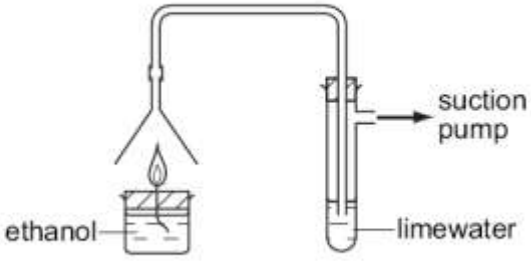
**62. ?**

In which experiment does the limewater **not** turn milky?

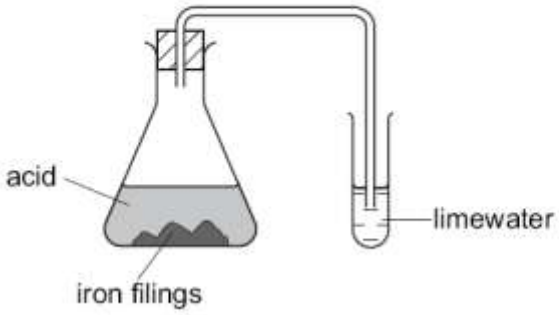
**A**



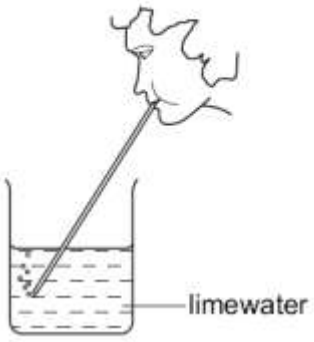

**B**




**C**



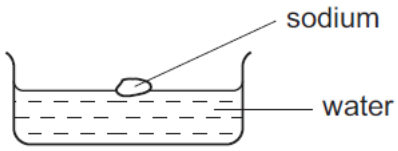

**D**



# Topic 10 – Metals

**1.**

When sodium reacts with water, a solution and a gas are produced.




The solution is tested with litmus paper and the gas is tested with a splint.

What happens to the litmus paper and to the splint?

| | litmus paper | splint |
|---|---|---|
| **A** | blue to red | glowing splint relights |
| **B** | blue to red | lighted splint 'pops' |
| **C** | red to blue | glowing splint relights |
| **D** | red to blue | lighted splint 'pops' |

**2.**

Which statements are correct?

1 Metals are often used in the form of alloys.

2 Stainless steel is an alloy of iron.

3 Alloys always contain more than two metals.

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

**3.**

Which statement is true about **all** metals?

**A** They are attracted to a magnet.

**B** They are weak and brittle.

**C** They may be used to form alloys.

**D** They react with water.

**4.**

A chemical engineer plans to produce hydrochloric acid.

Which metal is best for the reaction container?

**A** copper

**B** iron

**C** magnesium

**D** zinc

**5.**
Alloy X is strong and has a low density.

Alloy Y is heavy but is resistant to corrosion.

Which could be uses of X and Y?

| | bridge supports | aircraft | overhead cables |
|---|---|---|---|
| **A** | X | X | Y |
| **B** | X | Y | Y |
| **C** | Y | X | X |
| **D** | Y | Y | X |

**6.**
A metal is extracted from hematite, its oxide ore.

What is the metal and how is the oxide reduced?

| | metal | method of reduction |
|---|---|---|
| **A** | Al | electrolysis |
| **B** | Al | heating with carbon |
| **C** | Fe | electrolysis |
| **D** | Fe | heating with carbon |

**7.**
Brass is an alloy of copper and zinc.

Which statement is correct?

**A** Brass can be represented by a chemical formula.

**B** Brass is formed by a chemical reaction between copper and zinc.

**C** The alloy will dissolve completely in dilute hydrochloric acid.

**D** The zinc in the alloy will dissolve in dilute hydrochloric acid.

**8.**
Which substance is a metal?

| | electrical conductivity (solid) | electrical conductivity (molten) |
|---|---|---|
| **A** | high | high |
| **B** | high | low |
| **C** | low | high |
| **D** | low | low |

**9.**

The table shows the results of adding three metals, P, Q and R, to dilute hydrochloric acid and to water.

| metal | dilute hydrochloric acid | water |
|---|---|---|
| P | hydrogen produced | hydrogen produced |
| Q | no reaction | no reaction |
| R | hydrogen produced | no reaction |

What is the order of reactivity of the metals?

| | most reactive → | | least reactive |
|---|---|---|---|
| **A** | P | R | Q |
| **B** | P | Q | R |
| **C** | R | Q | P |
| **D** | R | P | Q |

**10.**

The properties of a metal are important in deciding its use.

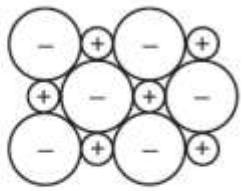
Which row lists a property that is **not** correct for the use given?

| | use of the metal | metal property needed |
|---|---|---|
| **A** | aluminium in aircraft wings | low density |
| **B** | aluminium in food containers | resists corrosion |
| **C** | mild steel in car bodies | high density |
| **D** | stainless steel in cutlery | does not rust |

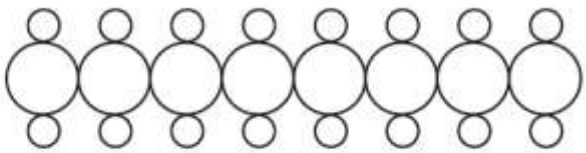
**11.**

Which diagram could represent the structure of an alloy?

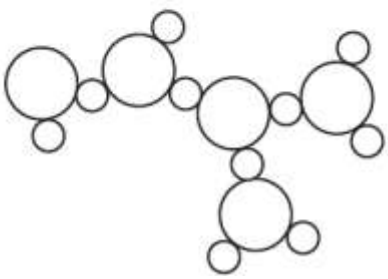
**A**



**B**



**C**



**D**

**12.**
Which property do **all** metals have?

**A** Their boiling points are low.

**B** Their densities are low.

**C** They conduct electricity.

**D** They react with water.

**13.**
Some metals react readily with dilute hydrochloric acid.

Some metals can be extracted by heating their oxides with carbon.

For which metal are **both** statements correct?

**A** calcium

**B** copper

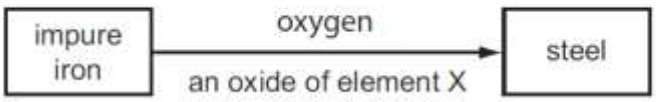
**C** iron

**D** magnesium

**14.**
Which row describes the conditions used to make steel from the iron produced by a blast furnace?

| | calcium oxide (lime) | oxygen | heat |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✗ | ✓ | ✓ |
| **D** | ✗ | ✓ | ✗ |

**15.**
The diagram shows the materials used in the production of steel from impure iron.




What could element X be?

**A** calcium

**B** carbon

**C** nitrogen

**D** sulfur

**16.**

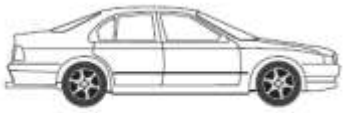
Which diagram shows a common use of stainless steel?

**A**

**B**

**C**

**D**



**17.**

Copper, iron and zinc are all used as pure metals.

Which of these three metals are also used in alloys?

| | copper | iron | zinc |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✗ | ✓ | ✓ |
| **D** | ✗ | ✗ | ✓ |

**18.**

Some properties of four elements are shown in the table.

Which element is a metal?

| | melting point/°C | electrical conductivity when liquid | electrical conductivity when solid |
|---|---|---|---|
| **A** | –7 | low | low |
| **B** | 801 | high | low |
| **C** | 1535 | high | high |
| **D** | 3550 | low | low |

**19.**

A student added dilute hydrochloric acid to four metals and recorded the results.

Not all of the results are correct.

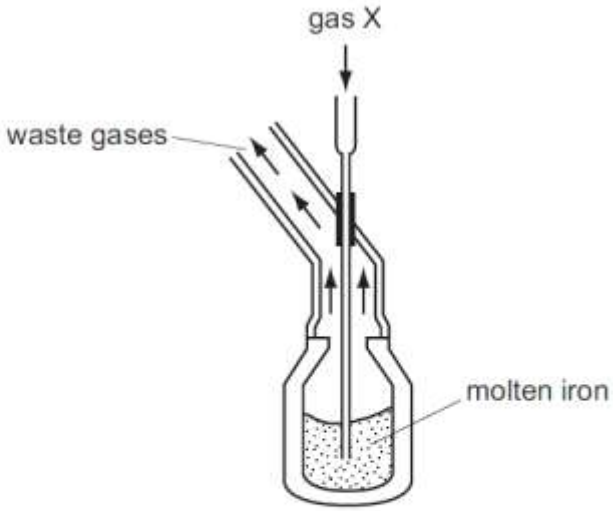
| | results | |
|---|---|---|
| | metal | gas given off |
| 1 | copper | yes |
| 2 | iron | yes |
| 3 | magnesium | no |
| 4 | zinc | yes |

Which two results are correct?

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

**20.**

The diagram shows the manufacture of steel.




What is gas X?

**A** carbon dioxide

**B** chlorine

**C** hydrogen

**D** oxygen

**21.**

Which object is **least** likely to contain aluminium?

**A** a bicycle frame

**B** a hammer

**C** a saucepan

**D** an aeroplane body

**22.**

Aluminium is an important metal with many uses.

Some of its properties are listed.

1 It is a good conductor of heat.

2 It is a reactive metal.

3 It has a low density.

4 It has an oxide layer that prevents corrosion.

Which set of properties help to explain the use of aluminium for cooking and storing food?

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

**23.**

In a blast furnace, iron(III) oxide is converted to iron and carbon monoxide is converted to carbon dioxide.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

What happens to each of these reactants?

**A** Both iron(III) oxide and carbon monoxide are oxidised.

**B** Both iron(III) oxide and carbon monoxide are reduced.

**C** Iron(III) oxide is oxidised and carbon monoxide is reduced.

**D** Iron(III) oxide is reduced and carbon monoxide is oxidised.

**24.**

The table gives information about three different metals G, H and J.

| metal | does it react with | |
|---|---|---|
| | water | steam |
| G | ✗ | ✗ |
| H | ✓ | ✓ |
| J | ✗ | ✓ |

key

✓ = does react

✗ = does not react

What is the order of reactivity of these metals?

| | most reactive → | | least reactive |
|---|---|---|---|
| **A** | G | H | J |
| **B** | H | G | J |
| **C** | H | J | G |
| **D** | J | H | G |

**25.**

Which property do **all** metals have?

**A** They are soluble in water.

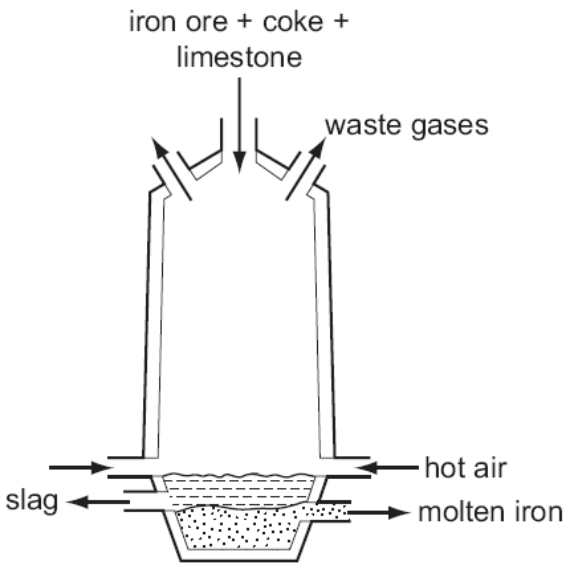
**B** They conduct electricity.

**C** They have high melting points.

**D** They react with dilute sulfuric acid.

**26. ?**

The diagram shows a blast furnace used to extract iron from iron ore




Why is limestone added to the furnace?

**A** to cause the furnace to heat up

**B** to change the ore into iron

**C** to convert impurities in the ore into slag

**D** to produce oxygen for the coke to burn

**27. ?**

Which statement is correct about **all** metals?

**A** They are attracted to a magnet.

**B** They are weak and brittle.

**C** They may be used to form alloys.

**D** They react with water.

**28. ?**

The following statements are about alloys.

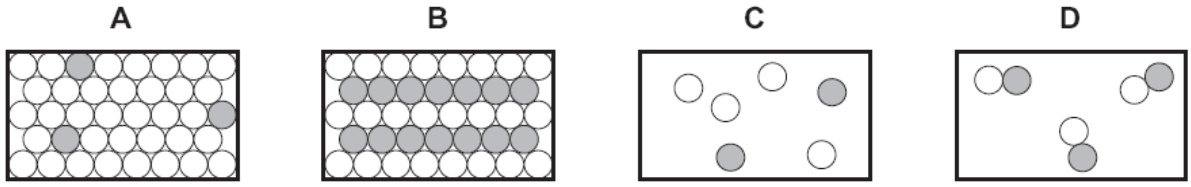
- Alloys are …X…. .
- …Y… alloys conduct electricity.

Which words complete the statements?

| | X | Y |
|---|---|---|
| **A** | compounds | All |
| **B** | compounds | Some |
| **C** | mixtures | All |
| **D** | mixtures | Some |

**29. ?**

Which diagram best represents the structure of a solid alloy?




**30. ?**

The table gives information about three different metals.

| metal | metal oxide reduced when heated with carbon | reacts with dilute hydrochloric acid |
|---|---|---|
| X | ✓ | ✗ |
| Y | ✗ | ✓ |
| Z | ✓ | ✓ |

What is the correct order of reactivity of these metals?

| | most reactive ⟶ | | least reactive |
|---|---|---|---|
| **A** | X | Y | Z |
| **B** | Y | X | Z |
| **C** | Y | Z | X |
| **D** | Z | X | Y |

**31. ?**

Which process takes place in the conversion of iron into steel?

**A** Basic oxides are removed.

**B** Carbon is converted to carbon dioxide.

**C** Iron is oxidised.

**D** Iron oxide is reduced.

**32. ?**

A piece of equipment needs to be made from a metal that is of low density, relatively strong and resistant to corrosion.

Which metal is best suited for this?

**A** aluminium

**B** copper

**C** iron

**D** silver

**33. ?**

The table shows the densities of some Group I metals.

Which of these metals sinks in benzene (density = 0.88 g / $cm^3$) but floats in nitrobenzene (density = 1.2 g/$cm^3$)?

| | metal | density, in g/$cm^3$ |
|---|---|---|
| **A** | lithium | 0.53 |
| **B** | sodium | 0.97 |
| **C** | potassium | 0.86 |
| **D** | rubidium | 1.53 |

**34. ?**

Element E

- forms an alloy;
- has a basic oxide;
- is below hydrogen in the reactivity series.

What is element E?

**A** carbon

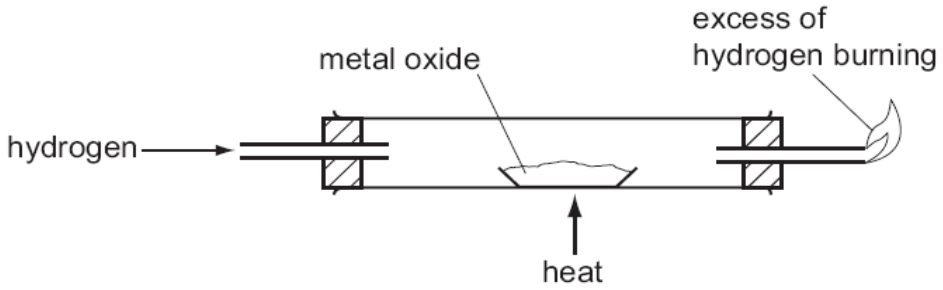
**B** copper

**C** sulphur

**D** zinc

**35. ?**

The diagram shows a method for displacing a metal from its oxide.




Which metal can be displaced from its oxide by using this method?

**A** calcium

**B** copper

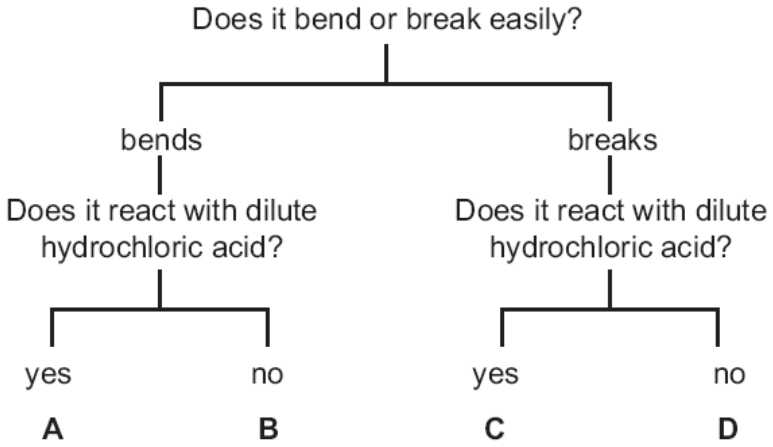
**C** magnesium

**D** potassium

**36. ?**

The diagram shows the properties of four substances.

Which one could be magnesium?




**37. ?**

The statements are about metals and their oxides.

Metals …X… electrons to form ions. The oxides of metals are …Y….

Which words correctly complete the statements?

| | X | Y |
|---|---|---|
| **A** | gain | acidic |
| **B** | gain | basic |
| **C** | lose | acidic |
| **D** | lose | basic |

**38. ?**

In 'native' copper, the element occurs as the metal, not as a compound.

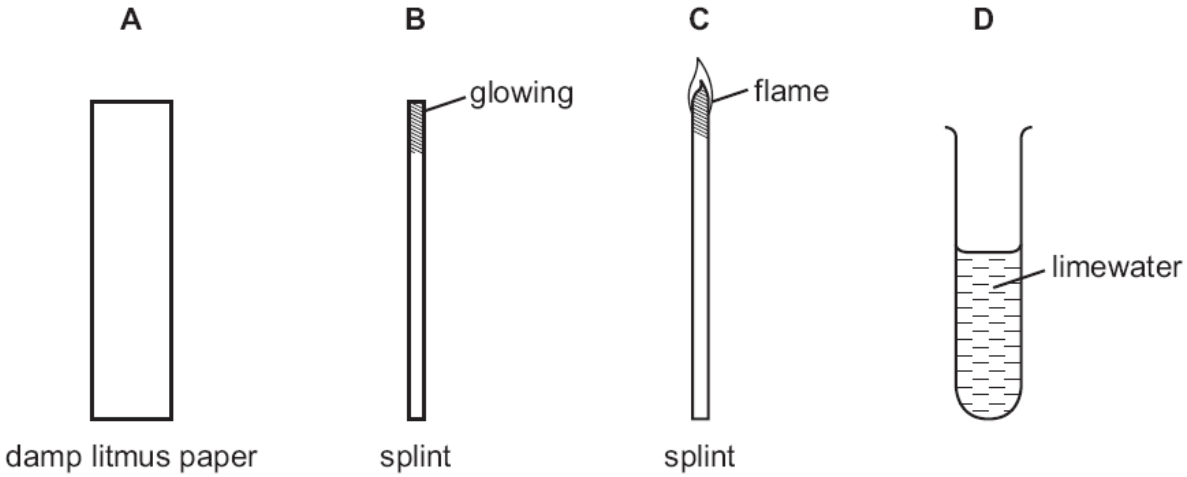
Gold is below copper in the reactivity series.

Which can be deduced about the properties of gold?

| | it occurs 'native' | it reacts with dilute sulphuric acid |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

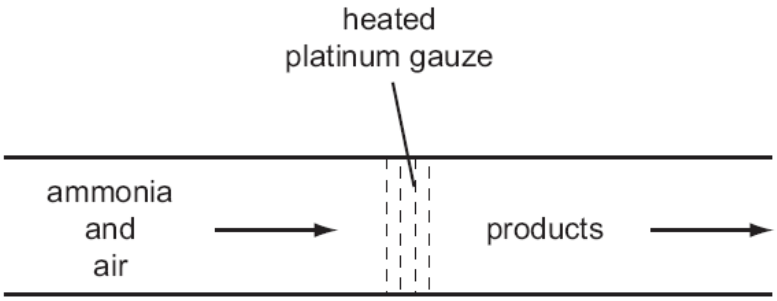
**39. ?**

Which piece of equipment can be used to show that a gas is hydrogen?




**40. ?**

The diagram shows one stage in the manufacture of nitric acid from ammonia.




What could be the use of the platinum gauze in this process?

**A** as a base

**B** as a catalyst

**C** as a filter

**D** as a fuel

**41. ?**

Copper, iron and zinc are all used to make things.

Which of these three metals are also used in the form of alloys?

| | copper | iron | zinc |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✓ | ✗ |
| **C** | ✗ | ✓ | ✓ |
| **D** | ✗ | ✗ | ✓ |

# Topic 11 – Air and water

**1.**

A liquid turns white anhydrous copper sulfate blue and has a boiling point of 103°C.

Which could be the identity of the liquid?

**A** alcohol

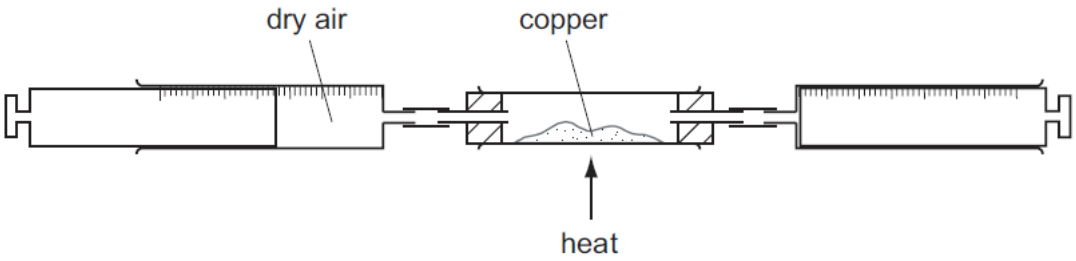
**B** petrol

**C** salt solution

**D** pure water

**2.**

Dry air is passed over hot copper until all the oxygen has reacted.




The volume of gas at the end of the reaction is 120 $cm^3$.

What is the starting volume of dry air?

**A** 132 $cm^3$ **B** 150 $cm^3$ **C** 180 $cm^3$ **D** 600 $cm^3$

**3.**

In which row is the air pollutant **not** correctly matched with its source?

| | air pollutant | source |
|---|---|---|
| **A** | carbon monoxide | incomplete combustion of fuels |
| **B** | lead compounds | burning petrol in cars |
| **C** | nitrogen oxides | decomposing vegetation |
| **D** | sulfur dioxide | burning coal and other fossil fuels |

**4.**

Water from a reservoir flows to the water works where purification processes 1 takes place followed by process 2.

What are purification processes 1 and 2?

| | purification process 1 | purification process 2 |
|---|---|---|
| **A** | chlorination | filtration |
| **B** | filtration | chlorination |
| **C** | fractional distillation | filtration |
| **D** | filtration | fractional distillation |

**5.**

Iron is a metal that rusts in the presence of oxygen and water.

Mild steel is used for ……1…… and is prevented from rusting by ……2…… .

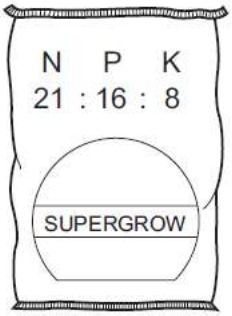
Stainless steel is prevented from rusting by ……3…… it with another metal.

Which words correctly complete gaps 1, 2 and 3?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | car bodies | greasing | covering |
| **B** | car bodies | painting | mixing |
| **C** | cutlery | greasing | covering |
| **D** | cutlery | painting | mixing |

**6.**

Which combination of chemical compounds could be used to produce the fertiliser shown?




**A** $NH_4NO_3$, $Ca_3(PO_4)_2$

**B** $NH_4NO_3$, $CO(NH_2)_2$

**C** $NH_4NO_3$, $K_2SO_4$, $(NH_4)_2SO_4$

**D** $(NH_4)_3PO_4$, $KCl$

**7.**

The table gives the composition of the atmosphere of four newly discovered planets.

| planet | composition of atmosphere |
|---|---|
| W | argon, carbon dioxide and oxygen |
| X | argon, nitrogen and oxygen |
| Y | argon, carbon dioxide and methane |
| Z | methane, nitrogen and oxygen |

On which planets is the greenhouse effect likely to occur?

**A** W only

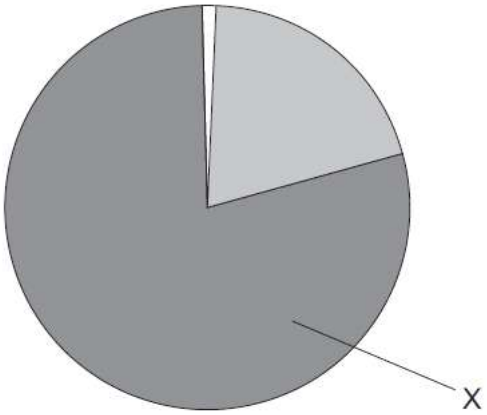
**B** W, X and Z

**C** W and Y only

**D** W, Y and Z

**8.**

The diagram shows the composition by volume of air.




What is X?

**A** argon

**B** carbon dioxide

**C** nitrogen

**D** oxygen

**9.**

Statement 1: Alloying iron with other materials to form stainless steel prevents iron from rusting by excluding oxygen.

Statement 2: Painting, oiling and electroplating are all methods of preventing iron from rusting.

Which is correct?

**A** Both statements are correct and statement 2 explains statement 1.

**B** Both statements are correct but statement 2 does not explain statement 1.

**C** Statement 1 is correct but statement 2 is incorrect.

**D** Statement 2 is correct but statement 1 is incorrect.

**10.**

Which two substances, when reacted together, would form a salt that contains two of the essential elements provided by fertilisers?

**A** potassium hydroxide and nitric acid

**B** potassium hydroxide and sulfuric acid

**C** sodium hydroxide and nitric acid

**D** sodium hydroxide and sulfuric acid

**11.**

Greenhouse gases may contribute to climate change.

Two of these gases are emitted into the atmosphere as a result of processes within animals.

Gas ……1…… is produced by process ……3…… .

Gas ……2…… is produced by process ……4…… .

Which words correctly complete gaps 1, 2, 3 and 4?

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **A** | CO | $C_2H_6$ | digestion | respiration |
| **B** | CO | $C_2H_6$ | respiration | digestion |
| **C** | $CO_2$ | $CH_4$ | digestion | respiration |
| **D** | $CO_2$ | $CH_4$ | respiration | digestion |

**12.**

Why is chlorination used in water treatment?

**A** to kill bacteria in the water

**B** to make the water neutral

**C** to make the water taste better

**D** to remove any salt in the water

**13.**

Which pollutant, found in car exhaust fumes, does **not** come from the fuel?

**A** carbon monoxide

**B** hydrocarbons

**C** lead compounds

**D** nitrogen oxides

**14.**

Which information about carbon dioxide and methane is correct?

| | | carbon dioxide | methane |
|---|---|---|---|
| **A** | formed when vegetation decomposes | ✓ | ✗ |
| **B** | greenhouse gas | ✓ | ✓ |
| **C** | present in unpolluted air | ✗ | ✗ |
| **D** | produced during respiration | ✗ | ✓ |

**15.**

A bag of fertiliser 'Watch it grow' contains ammonium sulfate and potassium sulfate.

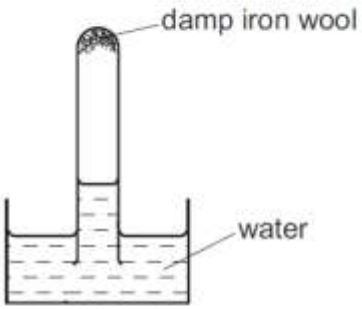
Which of the three elements N, P and K does 'Watch it grow' contain?

| | N | P | K |
|---|---|---|---|
| **A** | ✓ | ✓ | ✗ |
| **B** | ✓ | ✗ | ✓ |
| **C** | ✗ | ✓ | ✗ |
| **D** | ✗ | ✗ | ✓ |

**16.**

A test-tube containing damp iron wool is inverted in water.

After three days, the water level inside the test-tube has risen.




Which statement explains this rise?

**A** Iron oxide has been formed.

**B** Iron wool has been reduced.

**C** Oxygen has been formed.

**D** The temperature of the water has risen.

**17.**

To grow roses, a fertiliser containing nitrogen, phosphorus and potassium is needed.

For the best flowers, the fertiliser should contain a high proportion of potassium.

Which fertiliser is best for roses?

| fertiliser | proportion by mass | | |
|---|---|---|---|
| | N | P | K |
| **A** | 9 | 0 | 25 |
| **B** | 13 | 13 | 20 |
| **C** | 29 | 5 | 0 |
| **D** | 29 | 15 | 5 |

**18.**
Which statements about water are correct?

1 Water is treated with chlorine to kill bacteria.

2 Household water may contain salts in solution.

3 Water is used in industry for cooling.

4 Water for household use is filtered to remove soluble impurities.

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

**19.**
Which compound in polluted air can damage stonework and kill trees?

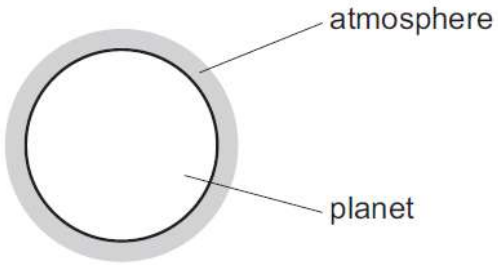
**A** carbon dioxide

**B** carbon monoxide

**C** lead compounds

**D** sulfur dioxide

**20.**
A new planet has been discovered and its atmosphere has been analysed.




The table shows the composition of the atmosphere.

| gas | percentage by volume |
|---|---|
| carbon dioxide | 4 |
| nitrogen | 72 |
| oxygen | 24 |

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

**A** carbon dioxide and oxygen

**B** carbon dioxide only

**C** nitrogen and oxygen

**D** nitrogen only

**21.**

The diagram shows three types of item.

cutlery | cooking pan | instruments used in hospitals

Which method of rust prevention can be used for all three types of item?

**A** coating with plastic

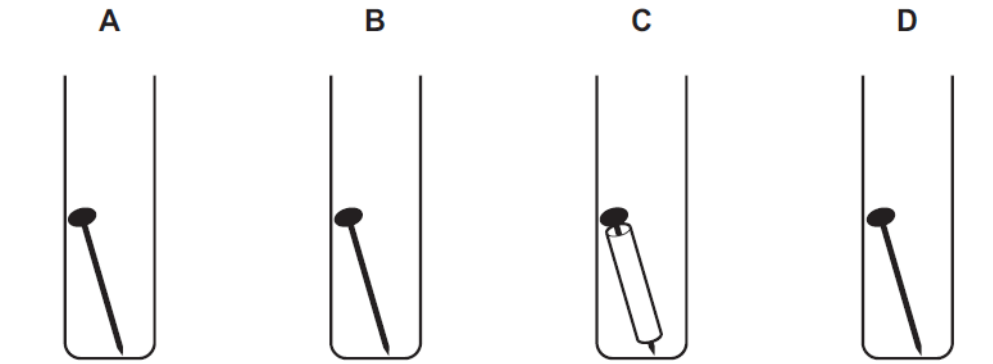
**B** covering with grease

**C** galvanising

**D** using stainless steel

**22.**

Which iron nail rusts?




zinc coated nail | painted nail | nail in damp cloth | nail covered in grease

**23.**

Which statements are correct?

1 Carbon monoxide is responsible for the production of 'acid rain'.

2 Oxides of nitrogen are present in car exhausts.

3 Sulfur dioxide can be produced by the combustion of fossil fuels.

**A** 1 and 2 only

**B** 1 and 3 only

**C** 2 and 3 only

**D** 1, 2 and 3

**24.**

Water must be purified before it is suitable for use in the home.

Which processes are used to remove solid impurities and bacteria?

| | to remove solid impurities | to remove bacteria |
|---|---|---|
| **A** | chlorination | chlorination |
| **B** | chlorination | filtration |
| **C** | filtration | chlorination |
| **D** | filtration | filtration |

**25.**

Fertilisers are used to provide three of the elements needed for plant growth.

Which two compounds would give a fertiliser containing all three of these elements?

**A** $Ca(NO_3)_2$ and $(NH_4)_2SO_4$

**B** $Ca(NO_3)_2$ and $(NH_4)_3PO_4$

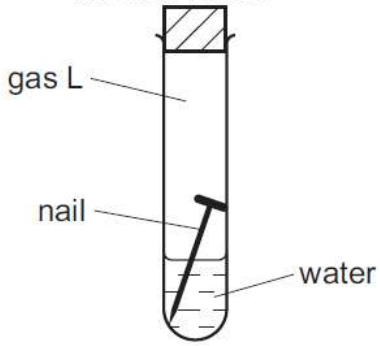
**C** $KNO_3$ and $(NH_4)_2SO_4$

**D** $KNO_3$ and $(NH_4)_3PO_4$

**26.**

**33** An iron nail is placed in a closed test-tube, containing gas L.

The nail rusts.




What is gas L?

**A** carbon dioxide

**B** hydrogen

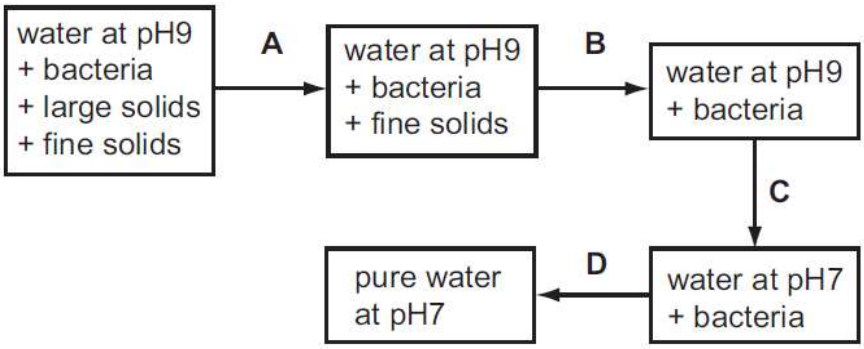
**C** nitrogen

**D** oxygen

**27.**

The diagram shows stages in the purification of water.

Which stage uses chlorine?




**28.**

Which element is **not** added to a fertiliser?

**A** aluminium

**B** nitrogen

**C** phosphorus

**D** potassium

**29. ?**

An excess of fertiliser on a field can be dissolved by rain water and washed into streams and rivers. Fertiliser can then find its way into water supplies.

Which process at the water works, if any, would remove this fertiliser?

| | filtration | chlorination |
|---|---|---|
| **A** | no | no |
| **B** | no | yes |
| **C** | yes | no |
| **D** | yes | yes |

**30. ?**

Air is a mixture of gases.

Which gas is present in the largest amount?

**A** argon

**B** carbon dioxide

**C** nitrogen

**D** oxygen

**31. ?**

An NPK fertiliser contains three elements required for plant growth.

Which two compounds, when mixed, provide the three elements?

**A** ammonium phosphate + potassium nitrate

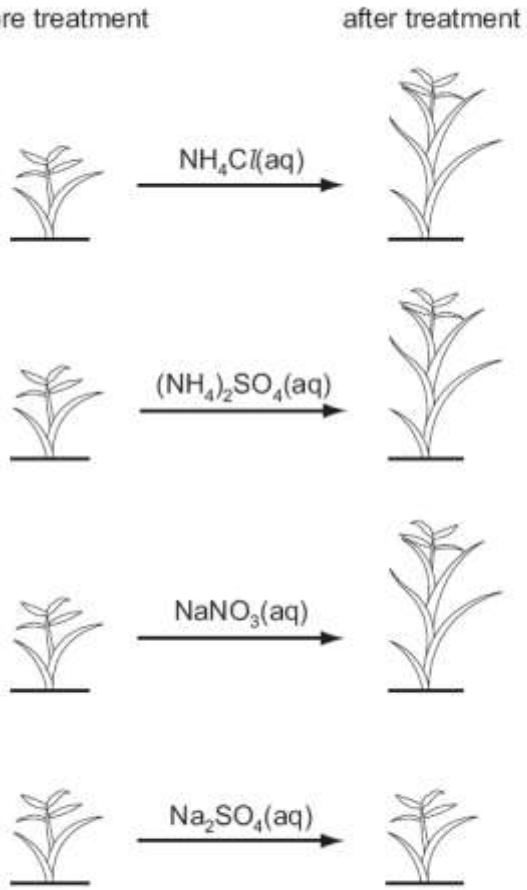
**B** ammonium sulphate + potassium nitrate

**C** ammonium sulphate + sodium nitrate

**D** sodium phosphate + potassium chloride

**32. ?**

The diagrams show the growth of four plants.




Which element is acting as a fertiliser?

**A** *Cl* **B** N **C** Na **D** S

# Topic 13 –Carbonates

**1.**

A newspaper article claims that carbon dioxide is formed as follows.

1 during respiration

2 when calcium carbonate reacts with hydrochloric acid

3 when methane burns in air

Which statements are correct?

**A** 1, 2 and 3

**B** 1 and 2 only

**C** 1 and 3 only

**D** 2 and 3 only

**2. ?**

In extracting iron from iron ore, limestone (calcium carbonate) is used.

Why is this?

**A** Limestone causes the ore to melt.

**B** Limestone oxidises the ore.

**C** Limestone removes impurities from the ore.

**D** Limestone stops the rusting of iron.

**3. ?**

When added in turn to four solutions, aqueous sodium carbonate gives the following results.

Which solution is acidic?

| solution | result |
|---|---|
| **A** | a blue precipitate forms |
| **B** | a white precipitate forms |
| **C** | bubbles of gas form |
| **D** | no visible reaction occurs |

**4.**

A bag of fertiliser 'Watch it grow' contains ammonium sulphate and potassium sulphate.

Which of the three elements N, P and K does 'Watch it grow' contain?

| | N | P | K |
|---|---|---|---|
| **A** | ✓ | ✓ | ✗ |
| **B** | ✓ | ✗ | ✓ |
| **C** | ✗ | ✗ | ✓ |
| **D** | ✗ | ✓ | ✗ |

**5.**
When calcium carbonate is heated, compound **X** and a gas are formed.

What is the name of **X** and what is its use?

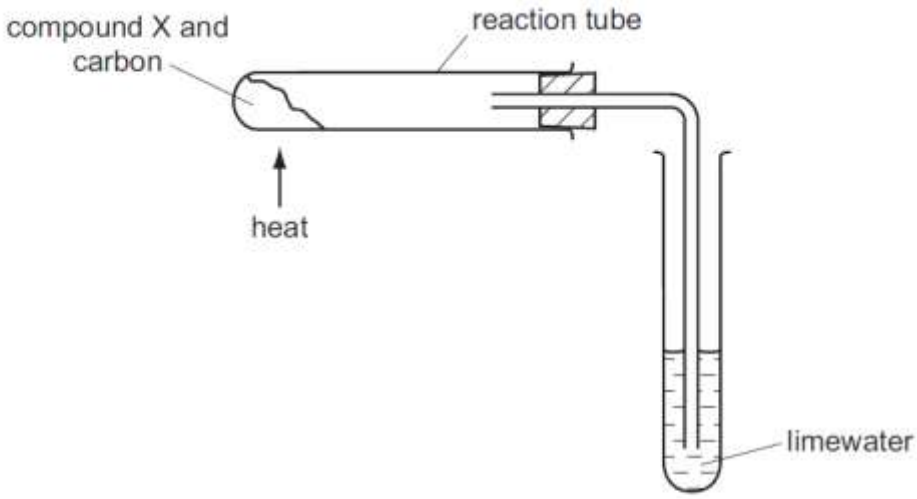
| | name of **X** | use of **X** |
|---|---|---|
| **A** | lime | to neutralise acid soil |
| **B** | lime | to provide nutrients for crop growth |
| **C** | slaked lime | to neutralise acid soil |
| **D** | slaked lime | to provide nutrients for crop growth |

**6. ?**
When limestone is heated very strongly in air, lime is made.

What is the formula of limestone and of lime?

| | limestone | lime |
|---|---|---|
| **A** | $CaCO_3$ | $CaO$ |
| **B** | $CaCO_3$ | $Ca(OH)_2$ |
| **C** | $CaO$ | $CaCO_3$ |
| **D** | $Ca(OH)_2$ | $CaCO_3$ |

**7.**
Compound X is heated with carbon using the apparatus shown.




A brown solid is formed in the reaction tube and the limewater turns cloudy.

What is compound X?

**A** calcium oxide

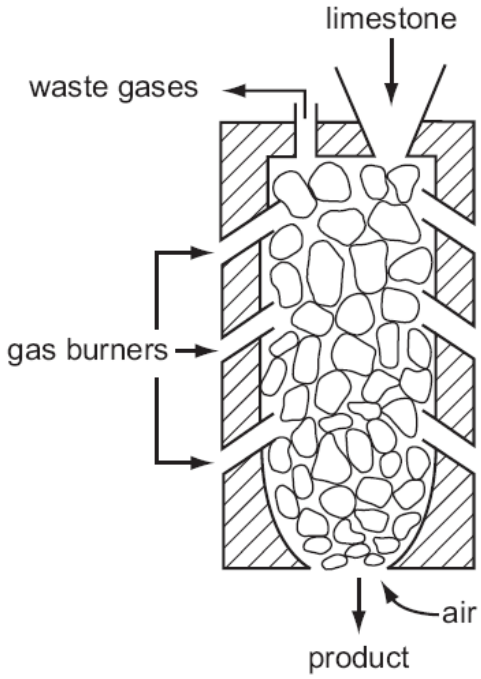
**B** copper(II) oxide

**C** magnesium oxide

**D** sodium oxide

**8. ?**

The diagram shows a kiln used to heat limestone.




What is the product and what waste gas is formed?

| | product | waste gas |
|---|---|---|
| **A** | lime | carbon monoxide |
| **B** | lime | carbon dioxide |
| **C** | slaked lime | carbon monoxide |
| **D** | slaked lime | carbon dioxide |

**9. ?**

A newspaper article claims that carbon dioxide is formed as follows.

1 during respiration

2 when calcium carbonate reacts with hydrochloric acid

3 when methane burns in air

Which statements are correct?

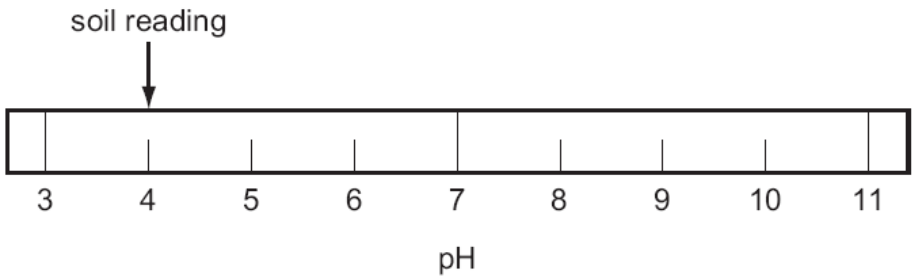
**A** 1, 2 and 3

**B** 1 and 2 only

**C** 1 and 3 only

**D** 2 and 3 only

**10.**
The diagram shows the results of a pH test on a sample of garden soil.




What could be added to the soil to change its pH to 7?

**A** ammonium nitrate

**B** lime

**C** sand

**D** sodium chloride

**11.**
The diagram shows the pH values of the soil in **X** and **Y**, two parts of the garden of a house.


The house owner wishes to use lime to neutralise the soil in one part of the garden.

To which part should the lime be added, and why?

| | part of garden | because lime is |
|---|---|---|
| **A** | **X** | acidic |
| **B** | **X** | basic |
| **C** | **Y** | acidic |
| **D** | **Y** | basic |

**12. ?**
What are the products when limestone (calcium carbonate) is strongly heated?

**A** calcium hydroxide and carbon dioxide

**B** calcium hydroxide and carbon monoxide

**C** calcium oxide and carbon dioxide

**D** calcium oxide and carbon monoxide

**13. ?**

Dolomite is a rock that contains magnesium carbonate.

A piece of dolomite is heated strongly in air.

Which word equation correctly describes the reaction that takes place?

**A** magnesium carbonate + water → magnesium hydroxide + carbon dioxide

**B** magnesium carbonate + oxygen → magnesium oxide + carbon dioxide + water

**C** magnesium carbonate + oxygen → magnesium oxide + water

**D** magnesium carbonate → magnesium oxide + carbon dioxide

**14. ?**

Compound **X**

- does not dissolve in water,
- does not react with water,
- is used to control soil acidity.

What is **X**?

**A** calcium carbonate

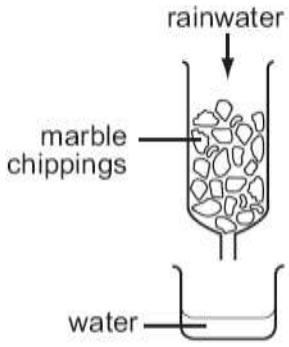
**B** calcium chloride

**C** calcium hydroxide

**D** calcium oxide

**15. ?**

A sample of acid rainwater (pH = 4) is passed down a glass column packed with marble chippings (calcium carbonate). The water coming from the bottom of the column is collected in a beaker. The pH is now 6.




What causes the change in pH?

**A** The acid has been filtered.

**B** The acid has been neutralised.

**C** The acid is made more concentrated.

**D** The acid is precipitated.

**16. ?**

A newspaper article claims that carbon dioxide is formed as follows.

1 during respiration

2 when calcium carbonate reacts with hydrochloric acid

3 when methane burns in air

Which statements are correct?

**A** 1, 2 and 3

**B** 1 and 2 only

**C** 1 and 3 only

**D** 2 and 3 only

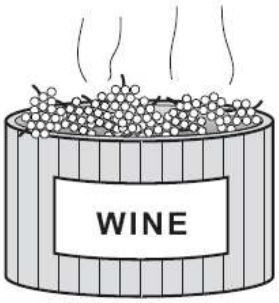
**17. ?**

Gas is released in all of the examples below.

acid rain on a limestone statue

a candle burning

a dog panting




fermenting grapes

Which gas do they **all** produce?

**A** carbon dioxide

**B** hydrogen

**C** methane

**D** oxygen

**18. ?**

A student suggests three uses of calcium carbonate (limestone).

1 manufacture of cement

2 manufacture of iron

3 treating alkaline soils

Which of these suggestions are correct?

**A** 1 and 2 only

**B** 1 and 3 only

**C** 2 and 3 only

**D** 1, 2 and 3

**19. ?**

What is formed when calcium carbonate is heated?

**A** calcium and carbon

**B** calcium and carbon dioxide

**C** calcium oxide and carbon

**D** calcium oxide and carbon dioxide

**20. ?**

Buildings made of calcium carbonate can react with 'acid rain'.

Which gas is formed as a result of this?

**A** carbon dioxide

**B** carbon monoxide

**C** nitrogen dioxide

**D** sulphur dioxide

**21. ?**

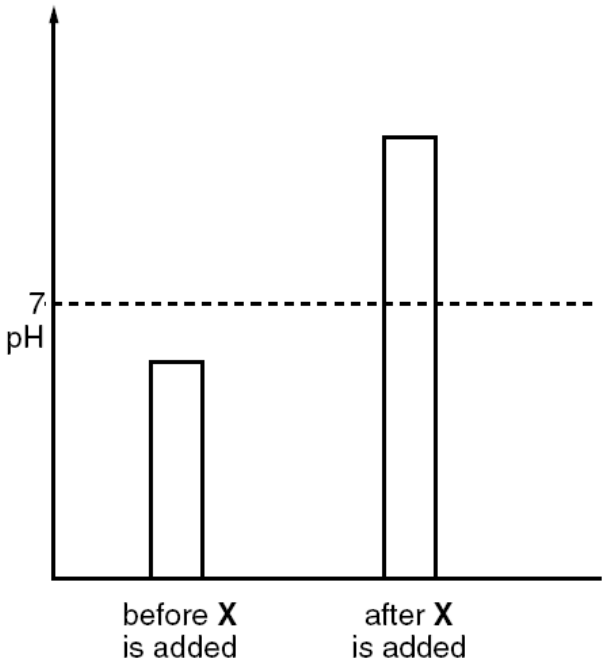
When limestone is heated very strongly, lime is made.

What is the formula of limestone and of lime?

| | limestone | lime |
|---|---|---|
| **A** | CaO | $CaCO_3$ |
| **B** | $CaCO_3$ | CaO |
| **C** | $CaCO_3$ | $Ca(OH)_2$ |
| **D** | $Ca(OH)_2$ | $CaCO_3$ |

**22. ?**

The diagram shows how the pH of an industrial waste changes when substance **X** is added to it.




What is substance **X**?

**A** coal

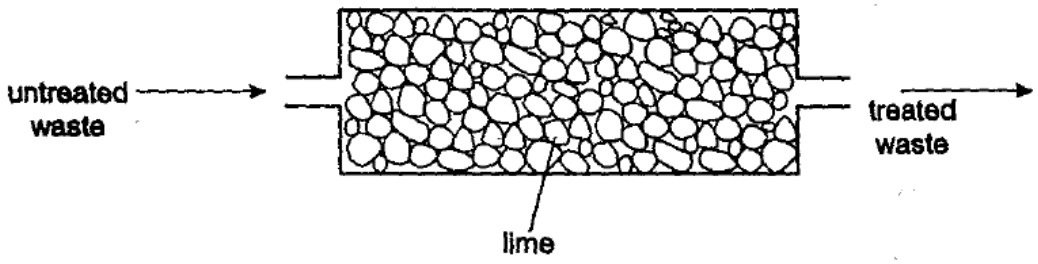
**B** lime

**C** salt

**D** water

**23. ?**

**Lime is used to treat an industrial waste.**




**Which pH change occurs in the treatment?**

| | untreated waste | → | treated waste |
|---|---|---|---|
| **A** | acidic | → | neutral |
| **B** | alkaline | → | acidic |
| **C** | alkaline | → | neutral |
| **D** | neutral | → | acidic |

**24. ?**

Two processes are listed.

1 treating acidic soil with slaked lime

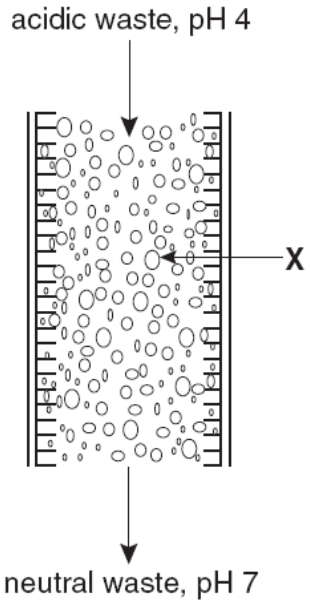
2 using limestone to extract iron

In which of these processes is carbon dioxide produced?

| | 1 | 2 |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

**25. ?**

Acidic waste gases from a factory are treated with substance **X** as shown.




What is **X**?

**A** polythene

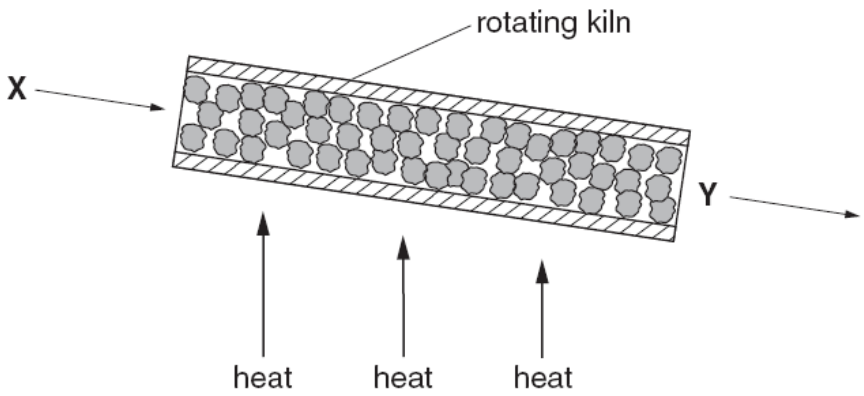
**B** slaked lime

**C** vinegar

**D** water

**26. ?**

5 The diagram shows a lime kiln.

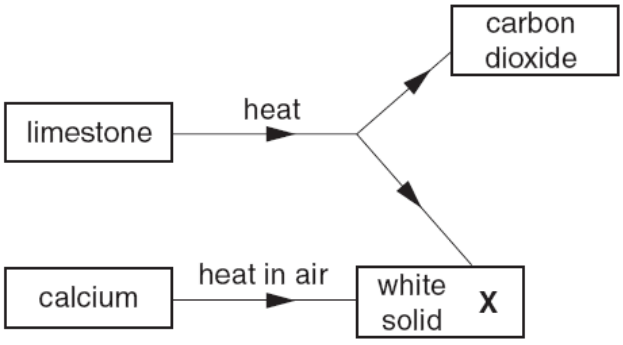



What are **X** and **Y**?

| | X | Y |
|---|---|---|
| **A** | lime | limestone |
| **B** | lime | slaked lime |
| **C** | limestone | lime |
| **D** | slaked lime | lime |

**27. ?**

The diagram shows some reactions.




What is **X**?

**A** calcium carbonate

**B** calcium hydroxide

**C** calcium nitride

**D** calcium oxide

# Topic 14 – Organic chemistry

**1.**

Which pollutant gas is produced by the decomposition of vegetation?

**A** carbon monoxide

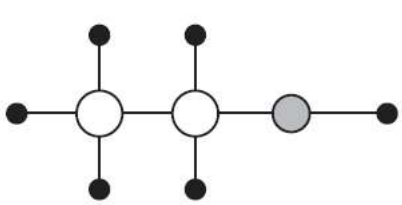
**B** methane

**C** nitrogen oxide

**D** sulfur dioxide

**2.**

The diagram represents the molecule of an organic compound.




What is the name of the compound?

**A** ethane

**B** ethanoic acid

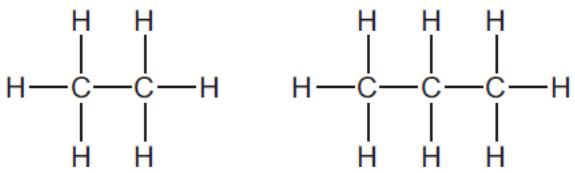
**C** ethanol

**D** ethene

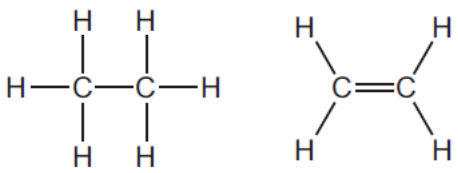
**3.**

Which pair of compounds are members of the same homologous series?

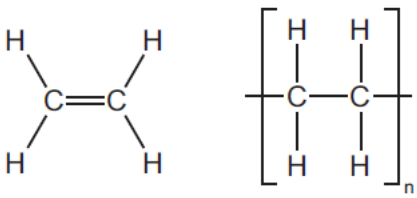
**A**



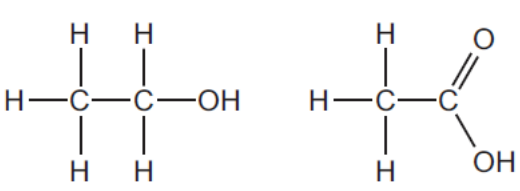
**B**



**C**



**D**



**4.**

Petroleum is a very important raw material that is separated into more useful products.

Which terms describe petroleum and the method used to separate it?

| | petroleum is a | method used to separate petroleum |
|---|---|---|
| **A** | compound | cracking |
| **B** | compound | fractional distillation |
| **C** | mixture | cracking |
| **D** | mixture | fractional distillation |

**5.**

The table shows the composition of four different types of petroleum (crude oil).

| fraction | Arabian Heavy / % | Arabian Light / % | Iranian Heavy / % | North Sea / % |
|---|---|---|---|---|
| gasoline | 18 | 21 | 21 | 23 |
| kerosene | 11.5 | 13 | 13 | 15 |
| diesel | 18 | 20 | 20 | 24 |
| fuel oil | 52.5 | 46 | 46 | 38 |

Which type of petroleum is best for the motor vehicle industry?

**A** Arabian Heavy

**B** Arabian Light

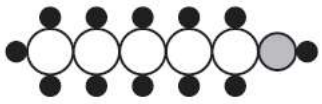
**C** Iranian Heavy

**D** North Sea

**6.**

Compounds containing five carbon atoms in a molecule may have names beginning with 'pent…'.

What is the name of the compound shown?



key

= carbon

= oxygen

= hydrogen

**A** pentane

**B** pentanoic acid

**C** pentanol

**D** pentene

**7.**
When glucose is fermented, ethanol is formed together with

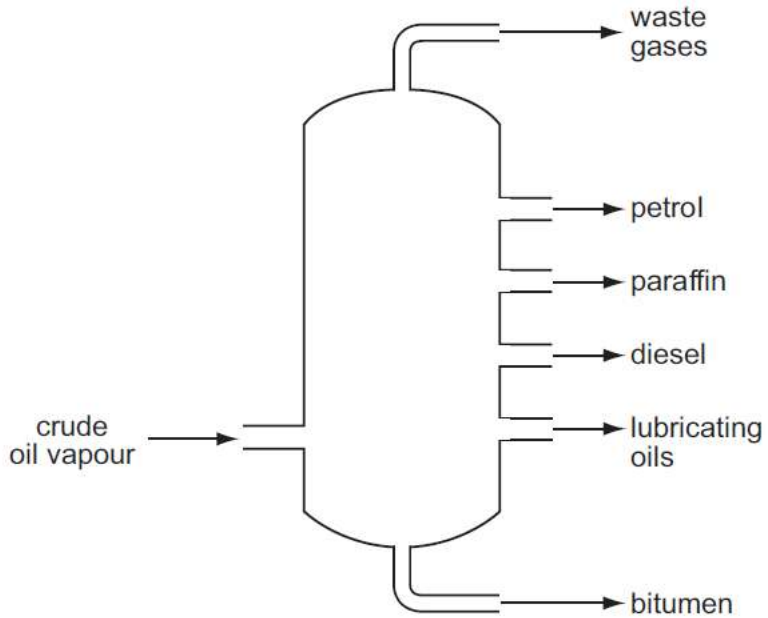
**A** carbon dioxide.

**B** ethene.

**C** methane.

**D** oxygen.

**8.**
Which industrial process is shown in the diagram?



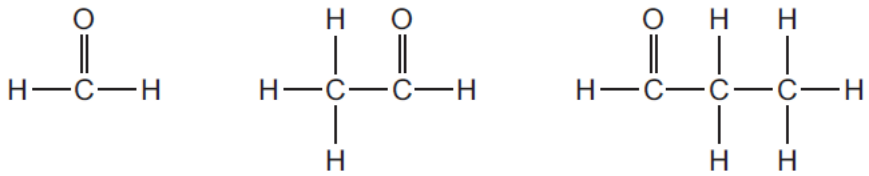

**A** cracking

**B** fermentation

**C** fractional distillation

**D** polymerisation

**9.**
The diagram shows the structures of three compounds.



Why do these three compounds belong to the same homologous series?

**A** They all contain carbon, hydrogen and oxygen.

**B** They all contain the same functional group.

**C** They are all carbon based molecules.

**D** They are all flammable liquids.

**10.**
What is the main constituent of natural gas?

**A** carbon dioxide

**B** ethane

**C** hydrogen

**D** methane

**11.**
What is **not** essential for the formation of ethanol by fermentation?

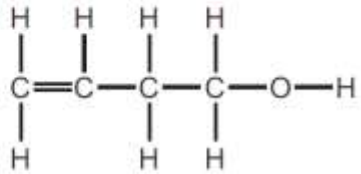
**A** light

**B** sugar

**C** yeast

**D** water

**12.**
The diagram shows the structure of a compound.



To which classes of compound does this molecule belong?

| | alkane | alkene | alcohol |
|---|---|---|---|
| **A** | no | no | no |
| **B** | no | yes | yes |
| **C** | yes | no | yes |
| **D** | yes | yes | yes |

**13.**
A macromolecule is a very large molecule.

Macromolecules can be made by joining smaller molecules together. This is called polymerisation.

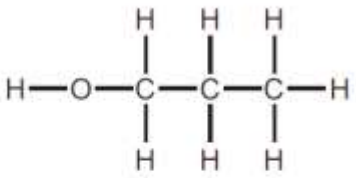
Which row in the table describes the formation of a polymer?

| | monomer | polymer |
|---|---|---|
| **A** | ethane | poly(ethane) |
| **B** | ethene | poly(ethene) |
| **C** | ethane | poly(ethene) |
| **D** | ethene | poly(ethane) |

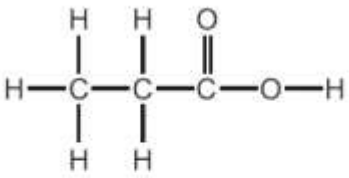
**14.**

Which structures show compounds that are members of the same homologous series?

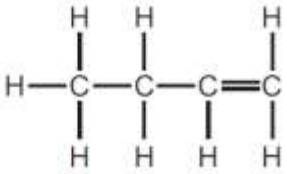
1



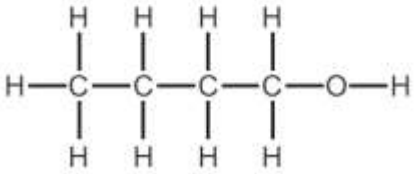
2



3



4

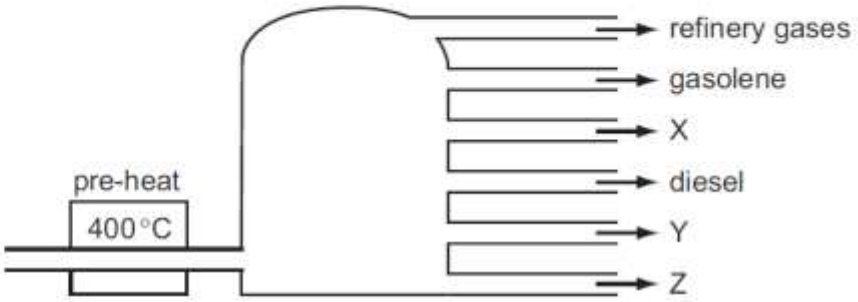


**A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

**15.**

In an oil refinery, crude oil is separated into useful fractions.

The diagram shows some of these fractions.




What are fractions X, Y and Z?

| | X | Y | Z |
|---|---|---|---|
| **A** | fuel oil | bitumen | paraffin (kerosene) |
| **B** | fuel oil | paraffin (kerosene) | bitumen |
| **C** | paraffin (kerosene) | bitumen | fuel oil |
| **D** | paraffin (kerosene) | fuel oil | bitumen |

**16.**

Which statement about methane is **not** correct?

**A** It is a liquid produced by distilling petroleum.

**B** It is produced as vegetation decomposes.

**C** It is produced by animals such as cows.

**D** It is used as a fuel.

**17.**

Ethene reacts with Y to produce ethanol.

$$\text{ethene} + Y \rightarrow \text{ethanol}$$

What is Y?

**A** hydrogen

**B** oxygen

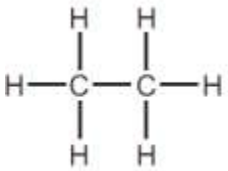
**C** steam

**D** yeast

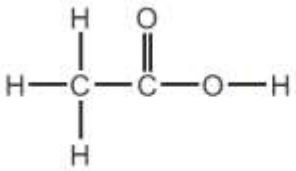
**18.**

Which structure is **incorrect**?

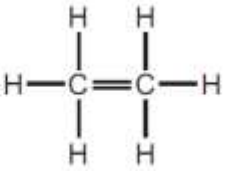
**A**



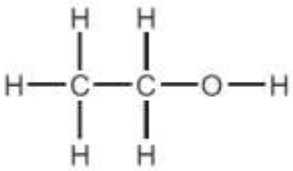
**B**



**C**

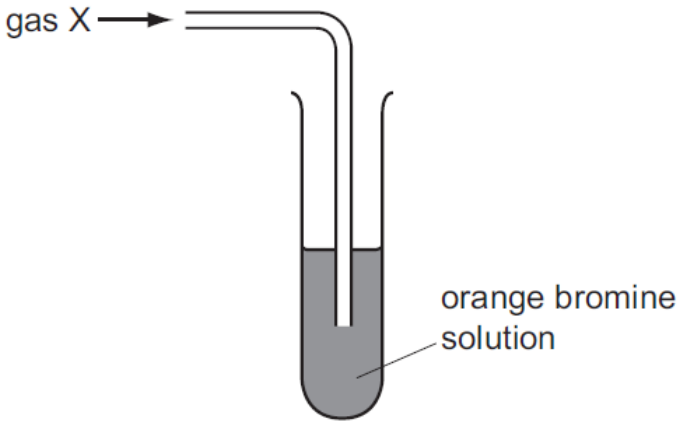


**D**



**19.**

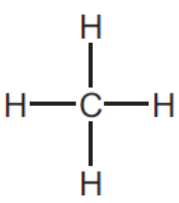
The apparatus shows an experiment used to test gas X.



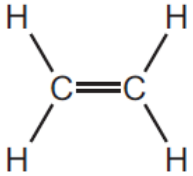

The bromine solution quickly becomes colourless.

What is the structure of gas X?

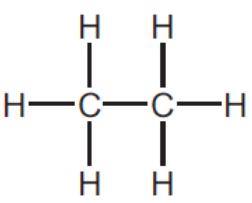
**A**



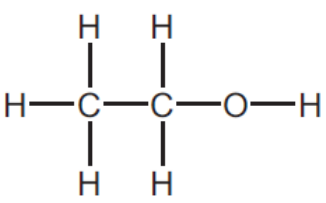
**B**



**C**



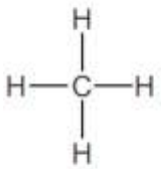
**D**



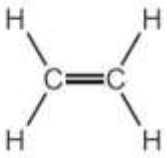
**20.**

**8** Which structure shows a compound that belongs to a **different** homologous series to propane?

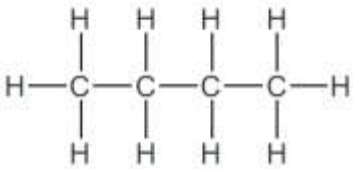
**A**



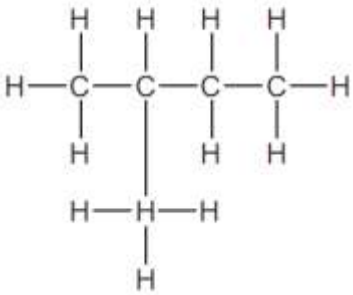
**B**



**C**



**D**



**21.**

Which statement about petroleum is **not** correct?

**A** It can be separated into useful substances by fractional distillation.

**B** It consists mainly of hydrocarbons.

**C** It is found underground in many parts of the world.

**D** Its main use is for making lubricants and polishes.

**22.**

Butene and hexene belong to the same homologous series.

What is the same for butene and hexene?

**A** boiling point

**B** functional group

**C** number of hydrogen atoms per molecule

**D** relative molecular mass

**23.**

The table shows the formulae of members of the alkane series.

| name of compound | formula |
|---|---|
| methane | $CH_4$ |
| ethane | $C_2H_6$ |
| propane | ? |
| butane | $C_4H_{10}$ |
| pentane | $C_5H_{12}$ |

What is the formula of propane?

**A** $C_2H_8$ **B** $C_3H_7$ **C** $C_3H_8$ **D** $C_3H_9$

**24.**
A compound has the formula $CH_3CH_2CH=CH_2$.

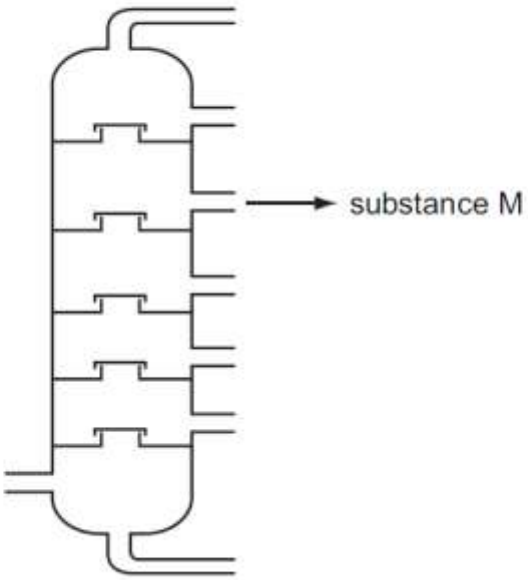
Which row in the table shows the type of compound and the colour change when aqueous bromine is added?

| | type of compound | colour change |
|---|---|---|
| **A** | saturated | brown to colourless |
| **B** | saturated | colourless to brown |
| **C** | unsaturated | brown to colourless |
| **D** | unsaturated | colourless to brown |

**25.**
Which bond is **not** in a molecule of ethanoic acid?

**A** C–O **B** C=O **C** C=C **D** O–H

**26.**
The diagram shows an industrial process. Substance M is one of the substances produced by this process and is used as aircraft fuel.




What is this process and what is substance M?

| | process | substance M |
|---|---|---|
| **A** | fractional distillation | paraffin |
| **B** | fractional distillation | petrol |
| **C** | thermal decomposition | paraffin |
| **D** | thermal decomposition | petrol |

# Periodic Table

## The Periodic Table of the Elements

| Group I | Group II | | | | | | | | | | | Group III | Group IV | Group V | Group VI | Group VII | Group 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 H Hydrogen 1 | | | | | | | | | | 4 He Helium 2 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | Po Polonium 84 | At Astatine 85 | Rn Radon 86 |
| Fr Francium 87 | 226 Ra Radium 88 | 227 Ac Actinium 89 † | | | | | | | | | | | | | | | |

C

*58–71 Lanthanoid series

†90–103 Actinoid series

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 163 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | Pa Protactinium 91 | 238 U Uranium 92 | Np Neptunium 93 | Pu Plutonium 94 | Am Americium 95 | Cm Curium 96 | Bk Berkelium 97 | Cf Californium 98 | Es Einsteinium 99 | Fm Fermium 100 | Md Mendelevium 101 | No Nobelium 102 | Lr Lawrencium 103 |

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).