# Atoms, Elements and Compounds – 2021 IGCSE 0620

**1.** Nov/2021/Paper_11/No.4

Two isotopes of carbon are $^{12}C$ and $^{14}C$.

Which statement about these two isotopes is correct?

**A** Their electronic structure is different.

**B** They have different numbers of nucleons.

**C** They have different numbers of protons.

**D** They have the same number of neutrons.

**2.** Nov/2021/Paper_11,12,13,21,22&23/No.5

Which description of brass is correct?

**A** alloy

**B** compound

**C** element

**D** non-metal

**3.** Nov/2021/Paper_11/No.6

The element livermorium, Lv, was discovered in the year 2000.

Which statement predicts what will happen to an Lv atom when it forms an $Lv^{2-}$ ion?

**A** The atom will gain two electrons.

**B** The atom will lose two electrons.

**C** The atom will lose two protons.

**D** The atom will gain two protons.

**4.** Nov/2021/Paper_11/No.7

Which substance is a diatomic covalent compound?

**A** $Cl_2$ **B** $HCl$ **C** $H_2O$ **D** $MgO$

**5.** Nov/2021/Paper_11/No.8

Which statement about carbon is correct?

**A** Diamond and graphite both have simple molecular structures.

**B** Diamond and graphite are both used to make cutting tools.

**C** Each carbon atom in diamond is bonded to three other carbon atoms.

**D** Graphite conducts electricity and has a giant covalent structure.

**6.** Nov/2021/Paper_12&22/No.4

How many protons, neutrons and electrons are there in one atom of the isotope $^{27}_{13}Al$ ?

| | protons | neutrons | electrons |
|---|---|---|---|
| **A** | 13 | 13 | 13 |
| **B** | 13 | 14 | 13 |
| **C** | 14 | 13 | 13 |
| **D** | 14 | 14 | 13 |

**7.** Nov/2021/Paper_12/No.6

Rubidium is in Group I and iodine is in Group VII of the Periodic Table.

Which row describes what happens when rubidium and iodine react together to form rubidium iodide?

| | rubidium | iodine |
|---|---|---|
| **A** | each atom gains one electron | each atom loses one electron |
| **B** | each atom loses one electron | each atom gains one electron |
| **C** | each atom loses more than one electron | each atom gains more than one electron |
| **D** | each atom neither gains nor loses an electron | each atom neither gains nor loses an electron |

**8.** Nov/2021/Paper_12/No.7

Which row shows the properties for an ionic compound?

| | volatility | electrical conductivity when solid |
|---|---|---|
| **A** | high | good |
| **B** | high | poor |
| **C** | low | good |
| **D** | low | poor |

**9.** Nov/2021/Paper_12/No.8

Which substance is described as a macromolecule?

**A** ammonia

**B** graphite

**C** iron

**D** sodium chloride

**10.** Nov/2021/Paper_13&23/No.4

The nucleus of a particular atom consists of nineteen particles.

Nine of them are positively charged and ten of them are uncharged.

Which statement about this nucleus is correct?

**A** The nucleus has a nucleon number of nine.

**B** The nucleus has a nucleon number of ten.

**C** The nucleus has a proton number of nine.

**D** The nucleus has a proton number of ten.

**11.** Nov/2021/Paper_13&23/No.6

A Group I element combines with a Group VII element and forms an ionic bond.

Which row shows how the electronic structures change?

| | Group I element | | Group VII element | |
|---|---|---|---|---|
| | before bonding | after bonding | before bonding | after bonding |
| **A** | 2,8,1 | 2,8,2 | 2,7 | 2,6 |
| **B** | 2,8 | 2,7 | 2,8 | 2,8,1 |
| **C** | 2,8,1 | 2,8 | 2,7 | 2,8 |
| **D** | 2,8 | 2,8,1 | 2,8 | 2,7 |

**12.** Nov/2021/Paper_13/No.7

Four covalent compounds are listed.

chlorine

methane

ammonia

water

Which row identifies the total number of covalent bonds in each compound?

| | chlorine | methane | ammonia | water |
|---|---|---|---|---|
| **A** | 2 | 4 | 3 | 2 |
| **B** | 1 | 3 | 2 | 2 |
| **C** | 2 | 3 | 2 | 3 |
| **D** | 1 | 4 | 3 | 2 |



**13.** Nov/2021/Paper_13/No.8

Magnesium reacts with dilute hydrochloric acid to produce a salt and hydrogen gas.

What is the equation for this reaction?

**A** $Mg + HCl \rightarrow MgCl + H$

**B** $Mg + H_2Cl_2 \rightarrow MgCl_2 + H_2$

**C** $Mg + 2HCl \rightarrow MgCl_2 + H_2$

**D** $Mg + 2HCl \rightarrow MgCl_2 + 2H$

**14.** Nov/2021/Paper_21/No.4

Which statement explains why metals conduct electricity when solid?

**A** They have atoms which are free to move.

**B** They have electrons which are free to move.

**C** They have molecules which are free to move.

**D** They have positive ions which are free to move.

**15.** Nov/2021/Paper_21,22&23/No.7

Which statement describes the attractive forces between molecules?

**A** They are strong covalent bonds which hold molecules together.

**B** They are strong ionic bonds which hold molecules together.

**C** They are weak forces formed between covalently-bonded molecules.

**D** They are weak forces which hold ions together in a lattice.

**16.** Nov/2021/Paper_21/No.8

Which statement about carbon is correct?

**A** Diamond and graphite both have simple molecular structures.

**B** Diamond and graphite are both used to make cutting tools.

**C** Each carbon atom in diamond is bonded to three other carbon atoms.

**D** Graphite conducts electricity and has a giant covalent structure.

**17.** Nov/2021/Paper_21/No.9

The formula of an aluminium ion is $Al^{3+}$.

What is the formula of aluminium sulfate?

**A** $Al_2SO_4$ **B** $Al(SO_4)_2$ **C** $Al_2(SO_4)_3$ **D** $Al_3(SO_4)_2$

**18.** Nov/2021/Paper_22/No.6

Some properties of diamond are shown.

1 It is very hard.

2 Every atom forms four bonds.

3 It does not conduct electricity.

Which properties are also shown by silicon(IV) oxide?

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

**19.** Nov/2021/Paper_22/No.8

Which substance is described as a macromolecule?

**A** ammonia

**B** graphite

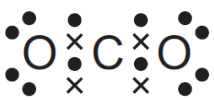
**C** iron

**D** sodium chloride

**20.** Nov/2021/Paper_23/No.8

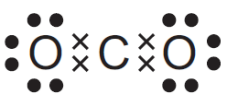
Which diagram shows the outer electron arrangement in a molecule of carbon dioxide?

**A**



**B**

**C**



**D**

**21.** Nov/2021/Paper_23/No.9

Aluminium oxide is an ionic compound containing $Al^{3+}$ ions and $O^{2-}$ ions.

Aluminium hydroxide is an ionic compound containing $Al^{3+}$ ions and $OH^-$ ions.

In which row are the formulae for aluminium oxide and aluminium hydroxide correct?

| | aluminium oxide | aluminium hydroxide |
|---|---|---|
| **A** | $Al_2O_3$ | $Al(OH)_3$ |
| **B** | $Al_3O_2$ | $AlOH_3$ |
| **C** | $Al_2O_3$ | $AlOH_3$ |
| **D** | $Al_3O_2$ | $Al(OH)_3$ |

**22.** Nov/2021/Paper_31/No.1

**(a)** A list of formulae is shown.

$AlCl_3$
$CaCO_3$
$CO$
$CO_2$
$CoCl_2$
$CuSO_4$
$MgCl_2$
$N_2$
$NaCl$
$NH_3$
$O_2$
$SO_2$

Answer the following questions using these formulae.
Each formula may be used once, more than once or not at all.

State which formula represents:

**(i)** a compound that changes colour from white to blue when water is added

..... [1]

**(ii)** a compound that is used to make cement

..... [1]

**(iii)** an element that forms 78% of clean, dry air

..... [1]

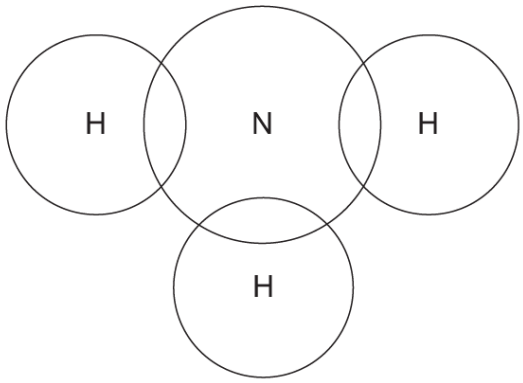
**(iv)** a compound that contains an ion with a single positive charge

..... [1]

**(v)** a compound that dissolves in water to form an alkaline solution.

..... [1]

**(b)** Complete the dot-and-cross diagram to show the electron arrangement in a molecule of ammonia.




[2]

**(c)** State whether magnesium oxide is a basic oxide or an acidic oxide.
Give a reason for your answer.

.....

..... [1]

[Total: 8]

**23.** Nov/2021/Paper_32/No.1

**(a)** A list of formulae is shown.

$CaCO_3$
$CaO$
$Cl_2$
$CH_4$
$C_2H_5OH$
$C_2H_6$
$CuSO_4$
$H_2$
$H_2O$
$MgO$
$NaCl$
$SO_2$

Answer the following questions using these formulae.
Each formula may be used once, more than once or not at all.

State which formula represents:

**(i)** a compound that is the main constituent of natural gas

..... [1]

**(ii)** an element that is used in water treatment

..... [1]

**(iii)** an element that bleaches damp litmus paper

..... [1]

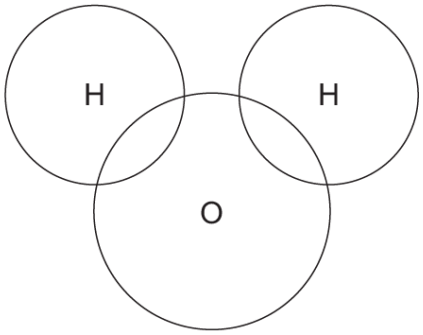
**(iv)** a compound that contains an ion with a single negative charge

..... [1]

**(v)** a hydrocarbon that is formed by the decomposition of vegetation.

..... [1]

**(b)** Complete the dot-and-cross diagram to show the electron arrangement in a molecule of water.




[2]

**(c)** State whether calcium oxide is a basic oxide or an acidic oxide.
Give a reason for your answer.

.....

..... [1]

[Total: 8]

**24.** Nov/2021/Paper_33/No.1

**(a)** A list of formulae is shown.

$Br_2$
$CO$
$CO_2$
$CH_4$
$C_2H_6$
$HCl$
$KBr$
$LiCl$
$MgCl_2$
$O_2$
$SO_2$

Answer the following questions using these formulae.
Each formula may be used once, more than once or not at all.

State which formula represents:

**(i)** a compound that gives a red colour in a flame test

..... [1]

**(ii)** a compound containing an ion with a 2+ charge

..... [1]

**(iii)** a compound that is a product of respiration

..... [1]

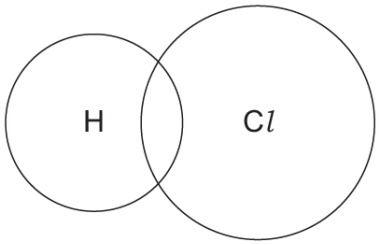
**(iv)** a compound used as a food preservative

..... [1]

**(v)** an element that is used in the production of steel.

..... [1]

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




[2]

**(c)** State whether carbon dioxide is a basic oxide or an acidic oxide.
Give a reason for your answer.

.....

..... [1]

[Total: 8]

**25.** Nov/2021/Paper_41/No.1

Some elements are shown in the order they appear in the reactivity series. The most reactive element is at the top.

**sodium**
**calcium**
**magnesium**
**aluminium**
**zinc**
**iron**
**hydrogen**
**copper**

**(a)** Answer the questions using the list of elements. Each element may be used once, more than once or not at all.

Identify:

**(i)** a non-metal

..... [1]

**(ii)** a metal which is stored under oil

..... [1]

**(iii)** the main component of steel

..... [1]

**(iv)** a metal with three electrons in the outer shell of its atoms

..... [1]

**(v)** a metal found in brass

..... [1]

**(vi)** a metal that forms chlorides of the type $XCl_2$ and $XCl_3$.

..... [1]

**(b)** Name the main ores of:

**(i)** zinc ..... [1]

**(ii)** aluminium. ..... [1]

**(c)** In an experiment, a sample of aluminium appeared less reactive than expected.

Explain why.

.....

..... [1]

**(d)** Name **two** metals from the list which are extracted by reduction of their ores using carbon.

1 .....

2 .....

[2]

**(e)** When zinc granules are added to aqueous copper(II) sulfate, a reaction occurs. During the reaction, a red-pink solid is formed and the solution becomes colourless.

**(i)** Name the red-pink solid.

..... [1]

**(ii)** Name the colourless solution.

..... [1]

**(iii)** Explain, in terms of particles, why the rate of this reaction increases when the temperature is increased.

.....

.....

.....

.....

.....

..... [3]

**(iv)** Suggest two **other** ways of increasing the rate of this reaction.

1 .....

2 .....

[2]

[Total: 18]

**26.** Nov/2021/Paper_42/No.3

Atoms contain protons, neutrons and electrons.

**(a)** Complete the table to show the relative mass and the relative charge of a proton, a neutron and an electron.

| | relative mass | relative charge |
|---|---|---|
| proton | | |
| neutron | | |
| electron | $\frac{1}{1840}$ | |

[3]

**(b)** The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

| atom or ion | number of protons | number of neutrons | number of electrons |
|---|---|---|---|
| $^{32}_{16}S$ | | | |
| $^{39}_{19}K^{+}$ | | | |
| | 35 | 44 | 36 |

[5]

[Total: 8]

**27.** Nov/2021/Paper_43/No.1

A list of substances is shown.

**ammonia**
**bauxite**
**carbon dioxide**
**carbon monoxide**
**ethanol**
**hematite**
**oxygen**
**sodium chloride**
**sulfur dioxide**

Answer the questions using the list of substances.

Each substance may be used once, more than once or not at all.

State which substance is:

**(a)** an element ..... [1]

**(b)** an ore of aluminium ..... [1]

**(c)** a gas that causes acid rain ..... [1]

**(d)** used as a fuel ..... [1]

**(e)** an ionic compound ..... [1]

**(f)** produced in the Haber process ..... [1]

**(g)** a product of respiration ..... [1]

**(h)** a toxic product of the incomplete combustion of hydrocarbons

..... [1]

**(i)** a gas produced in the test for nitrate ions. ..... [1]

[Total: 9]