GCSE SCIENCE YEAR 9 SUMMER PREPARATION WORK CHEMISTRY STUDENT BOOK HIGHER

Please complete all of these questions in this book and store this work in your student revision files.

This will provide a useful resource for revision.

Name	
Class	
Teacher	

Revision Question Book 1c

GCSE Science

This book is suitable for students currently in Year 8.

In the following booklet there are several questions based on GCSE Chemistry Paper One. These questions are additional to the work which you must do on your GCSE course.

To gain the highest grade possible in your GCSE examinations it is recommended that you complete these questions at home or in revision sessions outside of lessons.

This will both familiarise yourself with both the concepts found in the GCSE syllabus and the examination technique found in examinations.

The mark scheme to the questions is integrated in the book for you to use independently.

To improve competency in answering questions on GCSE Science and achieve mastery in this module, answer all of these questions independently.

When you have completed your work in this book, please store this work at home.

Many thanks for all of your hard work in GCSE Science.

Mr. Turnbull

TOPIC 1: ATOMIC STRUCTURE

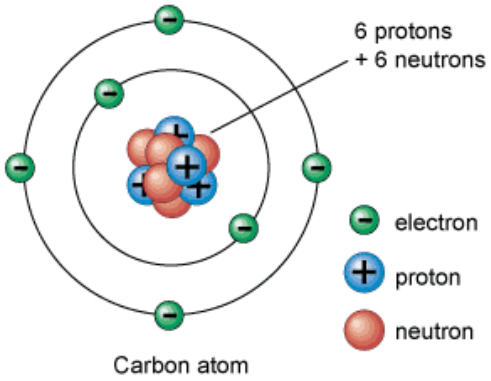
This section contains the key information you must learn for this part of the course.

KEY INFORMATION

Keyword	Definition	Keyword	Definition
1. Atoms	The smallest part of an element that can still be recognised as that element.	13. Reactant	The substances you start a reaction with
2. Element	A substance made up from only one type of atom. An element cannot be broken down chemically into any simpler substance.	14. Product	The substances made from the reaction
3. Compound	A substance made when two or more elements are chemically bonded together.	15. Symbol Equation	An equation that uses the symbols for elements found in the periodic table.
4. Mixture	When some elements or compounds are mixed together and intermingle but do not react together (i.e. no new substance is made)	16. Word Equation	An equation that uses words to name the substances found in the reaction.
5. Periodic Table	An arrangement of elements in the order of their atomic numbers, forming groups and periods.	17. Law of the conversation of mass	The total mass of the products formed in the reaction is equal to the total mass of the reactants.
6. Group	A column of the periodic table.	18. State symbol	Added to a reactant or product to tell you whether or not a substance is solid (s), liquid, (l), gas, (g) or aqueous (aq)
7. Period	A row of the periodic table.	19. Atomic Number	The amount of protons found in the nucleus for that particular element.
8. Nucleus	The very small and dense central part of an atom that contains protons and neutrons.	20. Ion	When an electron is either gained or lost from an atom
9. Electron	A tiny particle with a negative charge. Electrons orbit the nucleus of atoms or ions in shells. It has a negligible mass.	21. Isotope	When the number of electrons and protons for an element is the same but the neutrons have changed
10. Proton	A tiny positive particle found inside the nucleus. It has a mass of one.	22. Shell	Electrons are arranged around the nucleus, going up in energy per shell.
11. Neutron	A dense particle found in the nucleus of an atom. It is electrically neutral, carrying no charge.	23. Electronic Structure	The arrangement of electrons around the nucleus. There are 2 electrons in the first shell, and 8 in every shell after that.
12. Molecule	A grouping of two or more atoms bonded together.	24. Noble Gas	Gases that always have a full outer shell of electrons.

The Structure of the Atom

Name	Charge	Mass
Proton	+1	1
Neutron	0	1
Electron	-1	1/1840

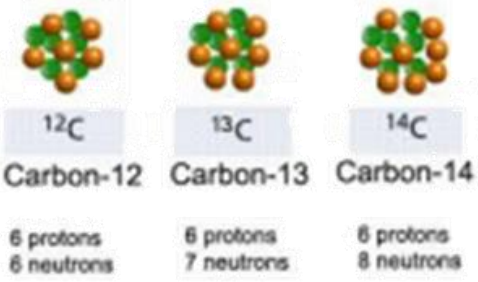


Year	History of the Atom
1800s	John Dalton came up with the idea of the atom—tiny, hard, indivisible spheres.
1800s	J.J. Thomson discovered the electron and theorised the Plum Pudding model.
1900s	Geiger and Marsden completed the gold-foil experiment and discovered the nucleus.
1914	Niels Bohr came up with the idea of energy levels.
1932	James Chadwick discovered the neutron.

The History of the Periodic Table

- Throughout history scientists have tried to classify substances and many scientists attempted to construct a Periodic Table.
- Before the knowledge of protons, neutrons and electrons, scientists arranged the Periodic table by **atomic weight**. This meant the groups were not always correct.
- In 1869 Dimitri **Mendeleev**, a Russian Scientist, published his Periodic Table. It was slightly different to those that had been before. He still arranged elements by atomic weight but he also left gaps for where he predicted elements would be.
- He very accurately predicted the properties of elements that were not discovered until many years later; for example, Gallium.
- Mendeleev's Periodic Table is still different from the modern one as some of his masses were wrong due to the existence of **isotopes**
- Isotopes are elements with same number of protons and electrons but a different number of neutrons and therefore different atomic weights.

Isotopes of Carbon



Mendeleev's Periodic Table

Key Terms	Definitions
Dimitri Mendeleev	A Russian Chemist, who in 1869 published a Periodic Table containing gaps.
Periodic Table	The table which organises the 118 elements based on atomic structure
Isotope	Two atoms with the same number of protons and electrons but a different number of neutrons
Metal	An element which loses electrons to form a positive charge
Non Metal	An element which gains electrons to form a negative charge
Ion	An element with a positive or negative charge

Groups in the Periodic Table

	Physical properties	Chemical Properties	Equation	Trends/Explanation
Group 1 (Alkali metals)	Soft, low density	React vigorously with water releasing hydrogen	Sodium + Water → Sodium Hydroxide + Hydrogen	More reactive as you go down, outermost electron further from the nucleus so it's easier to lose
Group 7 (Halogens)	Low melting point, exist as pair (Cl_2)	React with group 1 metals to form compounds . Can carry out displacement reactions	Sodium + Chlorine → Sodium Chloride Sodium Bromide + Chlorine → Sodium Chloride + Bromine	Higher melting point as you go down the group (higher molecular mass). Less reactive as you go down the group.
Group 0 (Noble Gases)	Low melting point/boiling point Eight electrons in outer shell (except helium)	Unreactive, as they have a full outer shell	N/A	Higher melting point and boiling point as you go down the group (due to increase in density)

The transition metals, in the central block of the periodic table are:

· Good conductors of heat and electricity.

· Can be bent or hammered into shape.

Copper is used in plumbing because it is resistant to corrosion (will not react with the water in the pipes) and electrical wiring because it is a good conductor of heat and electricity.

Aluminium and titanium are useful metals because they have a low density and are resistant to corrosion.

QUESTIONS

This section contains sample questions to assess your understanding of knowledge.

Q1. In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands' periodic table is shown below.

Column	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe

Newlands' periodic table arranged all the known elements into columns in order of their atomic weight.

Newlands was trying to show a pattern by putting the elements into columns.

Q1.1 Iron (Fe) does **not** fit the pattern in column 7.

Give a reason why.

[1 Mark]

.....

.....

Q1.2 In 1869 Dmitri Mendeleev produced his version of the periodic table.

Why did Mendeleev leave gaps for undiscovered elements in his periodic table?

[1 Mark]

.....

.....

Q1.3 Newlands and Mendeleev placed the elements in order of atomic weight.

Complete the sentence.

[1 Mark]

The modern periodic table places the elements in order of _____ .

Q1.4 Lithium, sodium and potassium are all in Group 1 of the modern periodic table.

Explain why.

[2 Marks]

.....

.....

Q2. John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.
He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.
Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	**Li**	**G**	**Bo**	**C**	**N**	**O**
F	**Na**	**Mg**	**Al**	**Si**	**P**	**S**
Cl	**K**	**Ca**	**Cr**	**Ti**	**Mn**	**Fe**
Co, Ni	**Cu**	**Zn**	**Y**	**In**	**As**	**Se**
Br	**Rb**	**Sr**	**Ce, La**	**Zr**	**Di, Mo**	**Ro, Ru**
Pd	**Ag**	**Cd**	**U**	**Sn**	**Sb**	**Te**
I	**Cs**	**Ba, V**	**Ta**	**W**	**Nb**	**Au**
Pt, Ir	**Tl**	**Pb**	**Th**	**Hg**	**Bi**	**Os**

Newlands' periodic table

Q2.1 In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

[2 Marks]

1.

.....

.....

2.

.....

.....

Q2.2 Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.
Use the Newlands' periodic table above to help you to answer this question.

[3 Marks]

.....

.....

.....

.....

.....

.....

Q2.3 State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

[2 Marks]

.....

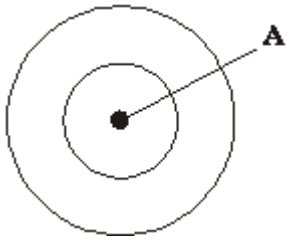
.....

Q3. This question is about oxygen atoms. The periodic table on the Data Sheet may help you to answer this question.

Q3.1 Oxygen atoms have 8 electrons.

Complete the diagram to represent the arrangement of electrons in an oxygen atom.
Use crosses (×) to represent the electrons.

[1 Mark]



Q3.2 Name the part of the oxygen atom that is labelled **A** on the diagram.

[1 Mark]

.....

.....

Q3.3 Two isotopes of oxygen are oxygen-16 and oxygen-18.

$^{16}_{8}O$ $^{18}_{8}O$

oxygen-16 **oxygen-18**

Explain, in terms of particles, how the nucleus of an oxygen-18 atom is different from the nucleus of an oxygen-16 atom.

[2 Marks]

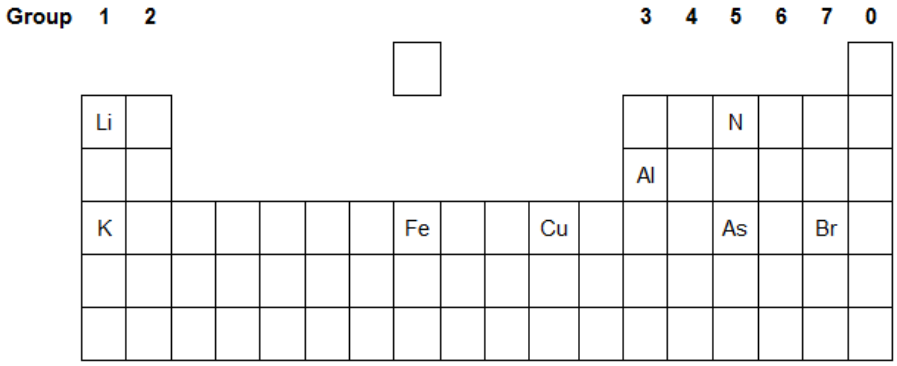
.....

.....

.....

.....

Q4. The positions of eight elements in the modern periodic table are shown below.



Choose the correct chemical symbols to complete each sentence.

Q4.1 The **two** metals that react vigorously with water are _____ and

_____ .

(1)

Q4.2 The element used as a catalyst in the Haber process is _____ .

(1)

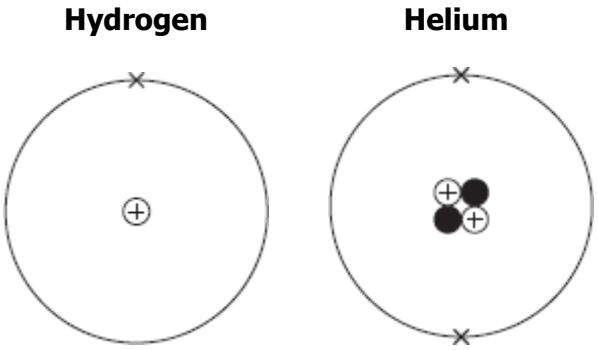
Q4.3 The **two** elements with five electrons in their outer shell (highest energy level) are _____ and _____ .

(1)

Q4.4 Iron has ions with different charges.

The other metal that has ions with different charges is _____ . **(1)**

Q5. The Sun produces helium atoms from hydrogen atoms by nuclear fusion reactions.



Q5.1 Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

[3 Marks]

.....

.....

.....

.....

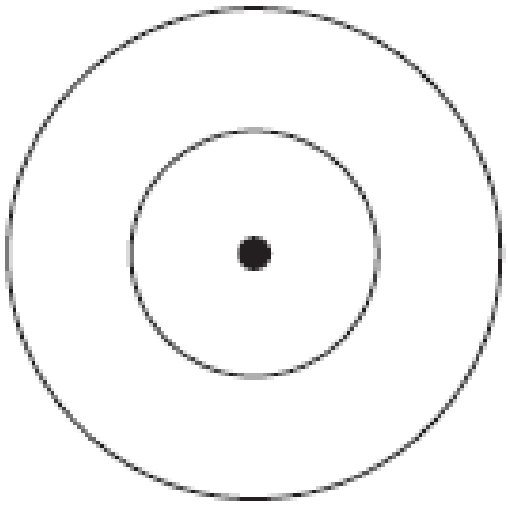
.....

.....

The Sun consists of 73% hydrogen and 25% helium.
The rest is other elements.
One of the other elements in the Sun is neon.

Q5.2 Complete the diagram to show the electronic structure of a neon atom.

[1 Mark]



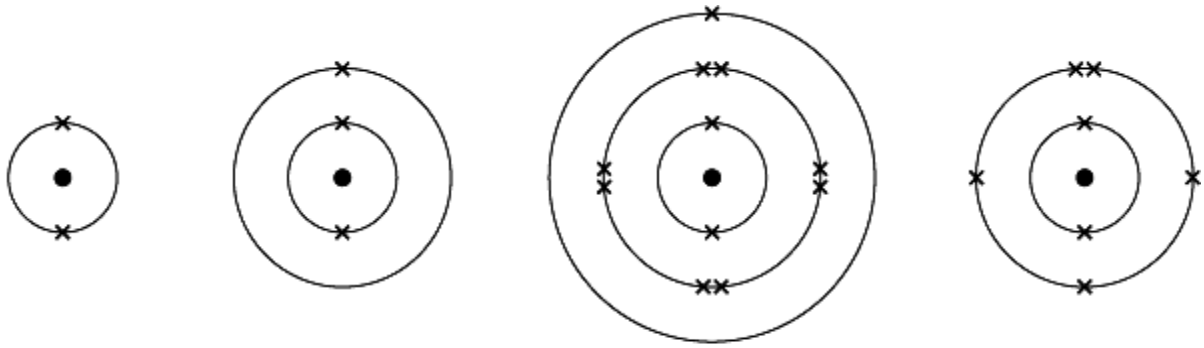
Q5.3 Why is neon in the same group of the periodic table as helium?

[1 Mark]

.....

.....

Q6. The diagrams show the electronic structure of four different atoms.



Atom A **Atom B** **Atom C** **Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

Q6.1 Name the two sub-atomic particles in the nucleus of an atom.

[1 Mark]

.....

Q6.2 Why is there no overall electrical charge on each atom?

[1 Mark]

.....

Q6.3 Why is **Atom A** unreactive?

[1 Mark]

.....

Q6.4 Which **two** of these atoms have similar chemical properties?
Give a reason for your answer.

[2 Marks]

.....

.....

MARK SCHEME

This section contains the mark schemes provided for the previous questions.

Q1.1 (iron) is a metal
accept transition element
allow (iron) had different properties (to oxygen and sulfur)
ignore electrons

1

Q1.2 so that elements with similar properties could be placed together
allow to make the pattern fit
ignore undiscovered elements

1

Q1.3 atomic number(s)
allow proton number(s)

1

Q1.4 all have one electron in the outer shell (highest energy level)
allow same number of electrons in the outer shell (highest energy level)

1

(so they) have similar properties
or
react in the same way
allow specific reactions e.g. with water

1
[5]

Q2.1 any **two** from:

• react with water **or** very reactive

• (react with water) releasing gas / hydrogen / fizzing

• (react with water) to form an alkaline / hydroxide solution

• form ions with a 1+ charge
allow lose one electron from the outer shell
ignore other references to electronic structure
ignore physical properties

2

Q2.2 any **three** from:

• some boxes contain two elements
allow specific examples:
*Co, Ni **or** Ce, La **or** Di, Mo **or** Ro, Ru **or** Ba, V **or** Pt, Ir*

• groups / columns contain elements with different properties
allow groups / columns contain both metals and non-metals
ignore examples

• Newlands not a well-known / respected scientist
ignore references to sugar factory

• new idea (not readily accepted by other scientists)
allow musical scales thought to be silly by some scientists

3

Q2.3 one for improvement **and** one for explanation from:

• left gaps (for undiscovered elements) (1)

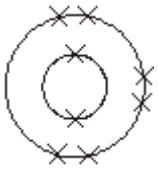
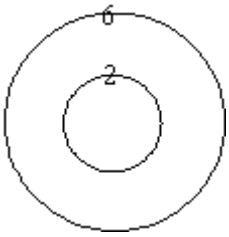
• so that elements were in their correct group (1)
allow so the elements fitted the pattern of properties

or

• did not always follow order of relative atomic weights / masses (1)
ignore references to atomic number / electronic structure

• so that elements were in their correct group (1)
allow so the elements fitted the pattern of properties

2
[7]

Q3.1  or 

1

allow any arrangement of electrons on the shells
*accept o, x, - **or** e as representing electrons*

Q3.2 nucleus
accept nucleus (protons plus neutrons)
*do **not** accept protons plus neutrons on its own*
allow nuclei / nucles / neucleus / phonetic spelling
*do **not** accept neutron*

1

Q3.3 it has **2** more neutrons **or** converse
*accept 'it has more neutrons' **or** 'different number of neutrons' for **1 mark***
*'2 more protons / electrons + correct number of neutrons' = max **1** mark*

or

O-16 has 8 neutrons (**1 mark**)(*)

O-18 has 10 neutrons (**1 mark**)(*)
*(*)if incorrectly calculated but shows more neutrons in 0-18 allow for **1** mark*
accept it has more particles
or
*it has 2 more particles for **1** mark*
ignore any reference to charges

*just 2 more without reference to particles = **0** marks*

2

[4]

Q4.1 Li **and** K

either order

*allow lithium **and** potassium*

1

Q4.2 Fe

allow iron

1

Q4.3 N **and** As

either order

*allow nitrogen **and** arsenic*

1

Q4.4 Cu

allow copper

1

[4]

Q5.1 hydrogen has one proton whereas helium has two protons

accept numbers for words

accept hydrogen only has one proton

ignore references to groups

1

hydrogen has one electron whereas helium has two electrons

accept hydrogen only has one electron

allow helium has a full outer shell (of electrons)

1

hydrogen has no neutrons **or** helium has two neutrons

*if no other mark awarded, allow helium has more electrons / protons / neutrons for **1** mark*

1

Q5.2 2 electrons on first shell **and**

8 electrons on outer shell

1

Q5.3 they have a stable arrangement of electrons

accept they have full outer energy level / shell of electrons

*do **not** accept they have the same number of electrons in their outer energy level / shell*

allow they are noble gases

ignore they are in group 0

1

[5]

Q6.1 protons **(and)** neutrons

*both needed for **1** mark*

ignore p / + and n / 0

*do **not** accept electrons*

1

Q6.2 because the number of protons is equal to the number of electrons
allow protons and electrons balance / cancel out
allow positive / + and negative / - balance / cancel out

1

Q6.3 *it = atom A*

because atom A has a full highest energy level **or** full outer shell
*allow all the shells are full **or** no incomplete shell*

or because atom A has a stable arrangement of electrons
allow because atom A is in Group 0 / a noble gas

1

Q6.4 (atom) B / lithium / Li **(and)**

(atom) C / sodium / Na
*both needed for **1** mark*

1

because they have the same number/one outer electron(s)
linked to answer for first mark
accept because both need to lose one / an electron
allow because (atoms) B and C are in Group 1 / the same group / are alkali metals

1

[5]

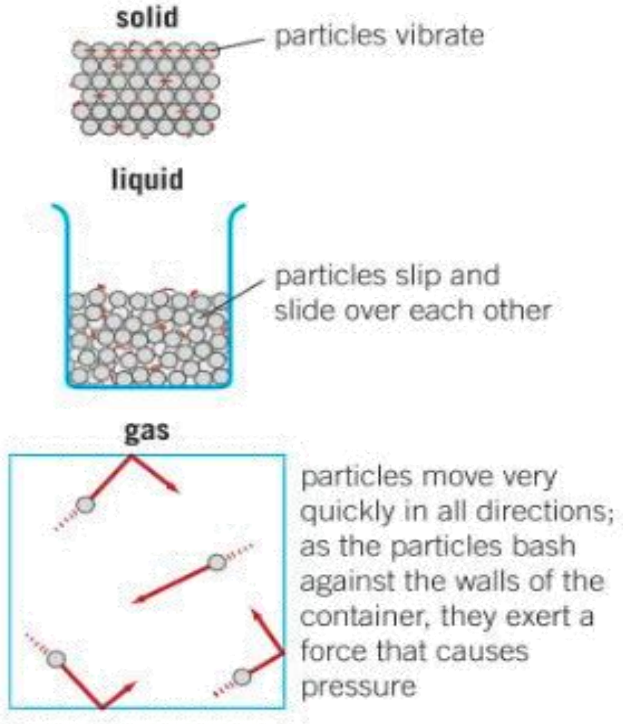
TOPIC 2: BONDING AND STRUCTURE

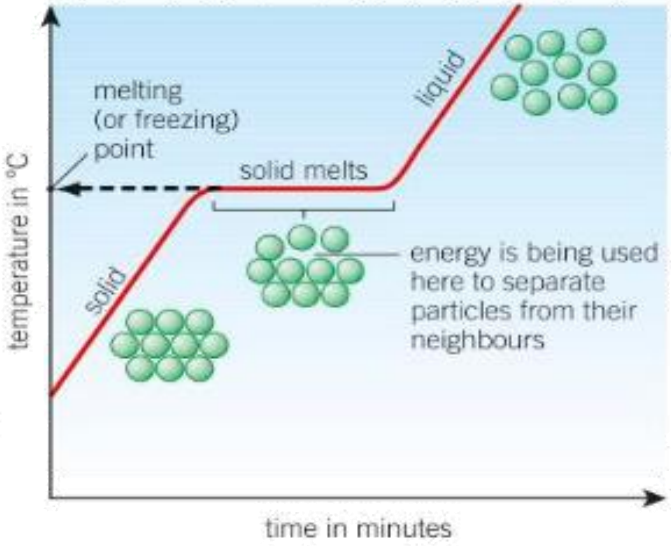
This section contains the key information you must learn for this part of the course.

KEY INFORMATION

Key words	
1 Particle theory	Explains the properties of **solids, liquids and gases** by using the fact that they are all made up of particles and describes the **movement of particles and the average distance between particles.**
2 Covalent bonding	**Sharing electrons** between two elements to form a **chemical bond.**
3 Electrostatic force	The force between something **negative and positive**.
4 Ionic bonding	The electrostatic attraction between a **positive ion and a negative ion.**
5 Giant lattice	The electrostatic forces act in every direction of the ion, meaning ions come together to form a **regular lattice shape**
6 Dot and cross	The diagram used to show the **transfer of electrons from atoms to ions.**
7 Simple molecule	A molecule with few covalent bonds between atoms.
8 Intermolecular forces	The weak forces between molecules that can be overcome to **change the state of a covalent compound**
9 Giant covalent structure	A structure with many (usually hundreds) of covalent bonds, which **require a lot of energy to break**
10 Delocalised electrons	Electrons that an atom has lost and now no longer belong to any particular atom. They have the ability to **carry electrical charge.**
11 Fullerenes	Massive carbon based structures that are spherical or cylindrical. They have special properties and uses.
12 Metallic bonding	The electrostatic forces between a **positive metal ion and a negative electron.**
13 Alloys	The combination of two or more elements, in which one is a metal, to give the metal new properties.
14 Nanoscience	The study of particles that are between 1nm and 100nm.

States of Matter

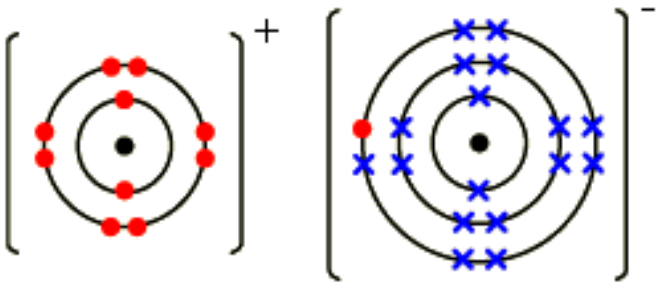




Dot and Cross Diagrams

Sodium atoms have an electronic structure of 2,8,1—the sodium ion loses 1 electron and donates it to the chlorine atom, which has an electronic structure of 2,8,7

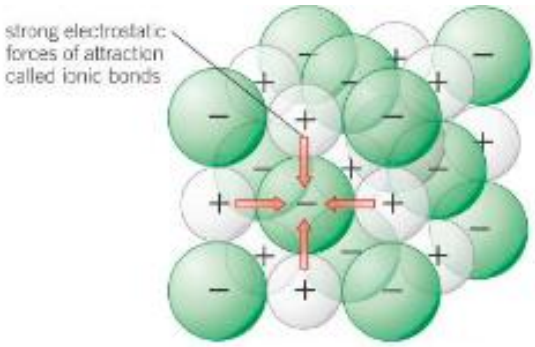
As sodium loses a negative charge, it becomes positive, with a structure of 2, 8, and chlorine, having gained a negative charge, becomes negative, with a structure of 2,8,8.



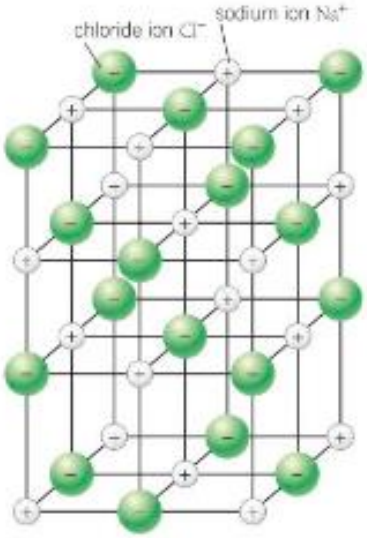
sodium ion, Na^+ [2,8] $^+$

chloride ion, Cl^- [2,8,8]$^-$

Ionic Bonding



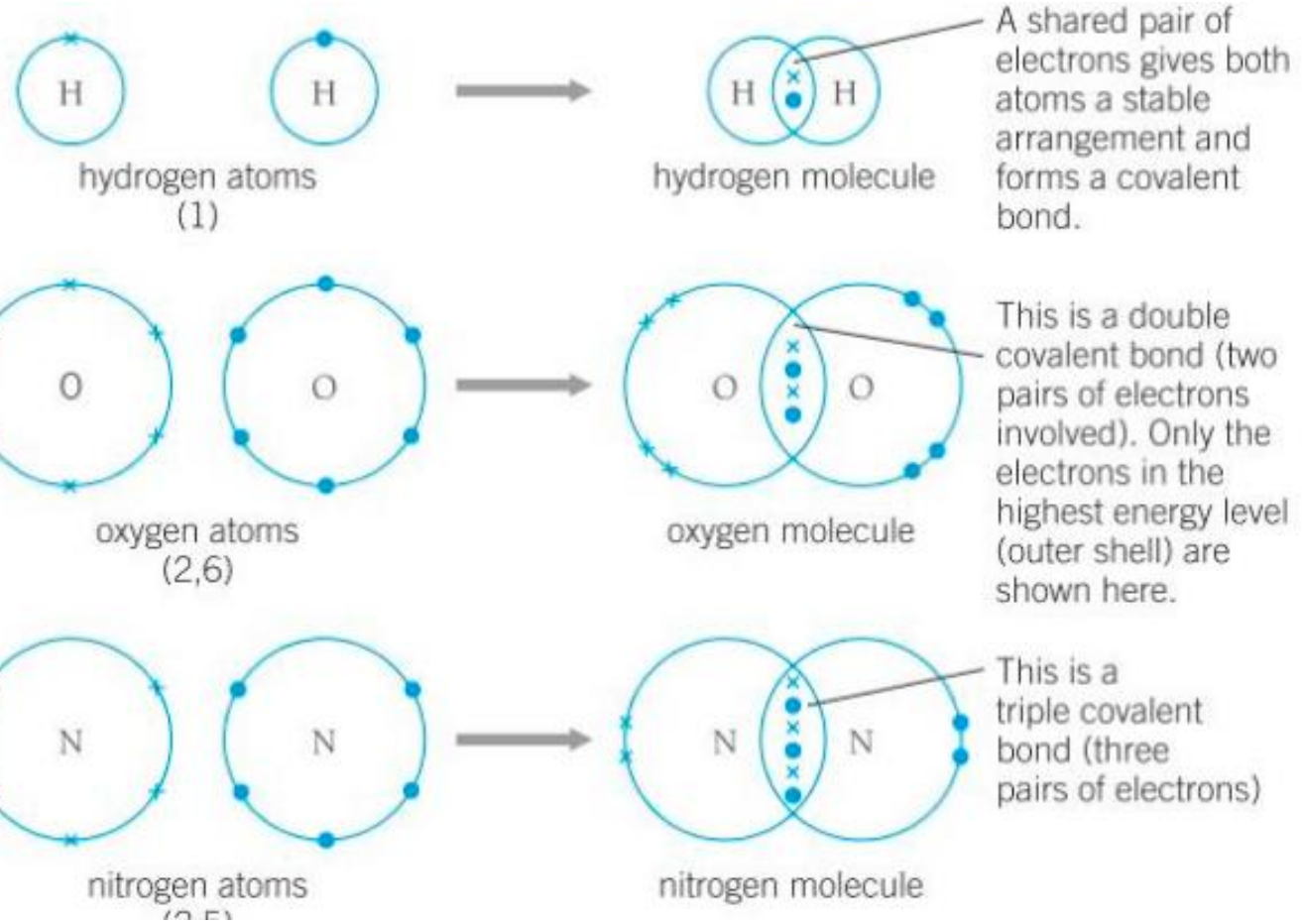
3D model of a giant ionic lattice



ball and stick model

Ionic solid	Molten ionic compound	Ionic compound in solution
Ions are fixed in position in a giant lattice. They vibrate but cannot move around. It does *not* conduct electricity.	High temperature provides enough energy to overcome the many strong attractive forces between ions. Ions are free to move around within the molten compound. It *does* conduct electricity.	Water molecules separate ions from the lattice. Ions are free to move around within the solution. It *does* conduct electricity.

Covalent Bonding



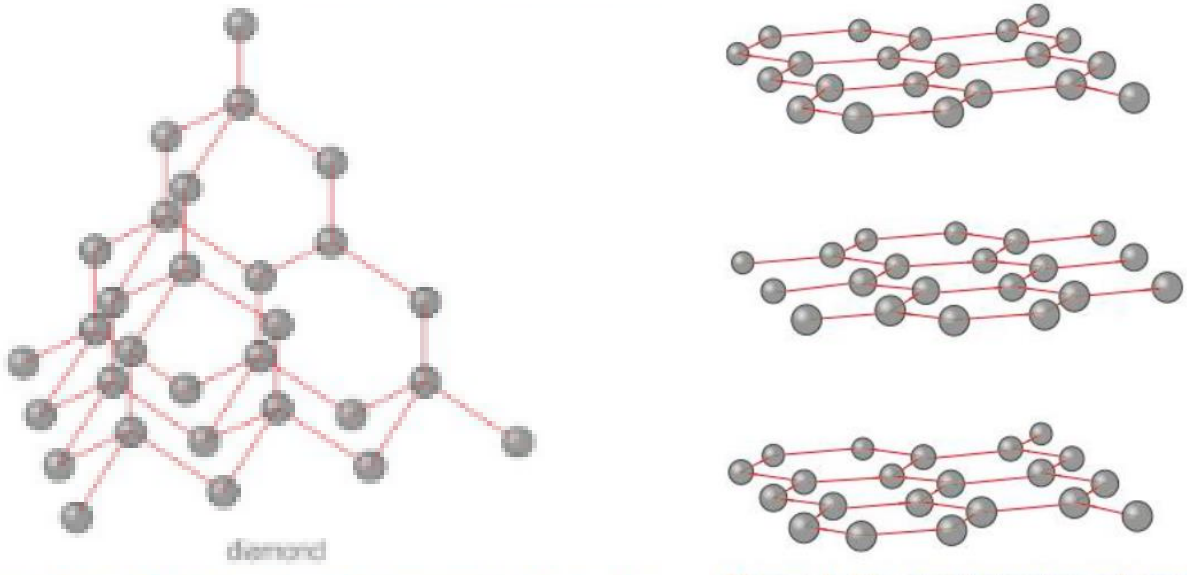


Figure 4 *The giant structure of graphite.*

Graphite is arranged in layers with weak intermolecular forces between layers. This allows it to have a soft feel to it and also makes it malleable—able to change shape. It also only forms three covalent bonds so has a spare electron per carbon atom which is delocalised – allowing it to conduct electricity.

Fullerenes

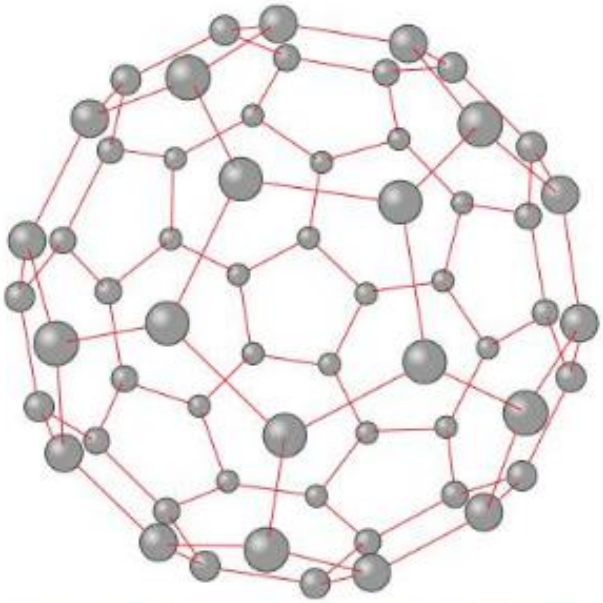
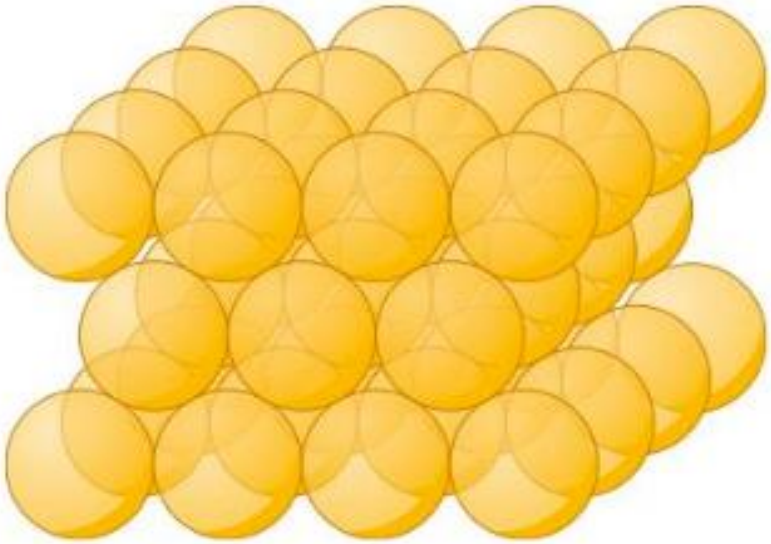


Figure 1 *The first fullerene to be discovered contained 60 carbon atoms but chemists can now make giant fullerenes that contain many thousands of carbon atoms. The name buckminsterfullerene was chosen for the C_{60} molecule after the Canadian architect Buckminster Fuller. He designed a similar shaped building in Montreal in 1967. The name is often abbreviated to 'bucky-ball'*

Fullerenes are used for: drug delivery, lubricants, and catalysts due to their large surface area.

Metallic Bonding

The atoms in metals are built up layer upon layer in a regular pattern.



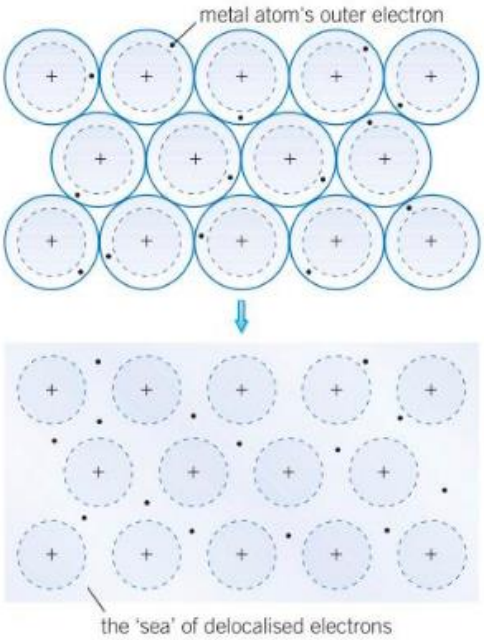


Figure 4 *A metal consists of positively charged metal ions surrounded by a 'sea' of delocalised electrons. This diagram shows a model of metallic bonding*

Layers allow the metal to be malleable—they can slide over one another. The delocalised electrons mean that they can carry electricity—they're also good thermal conductors as the atoms are close to one another so energy can pass along them via conduction.

Alloys

Adding elements to a normal metallic structure changes the properties:

1. They are usually stronger due to the atoms being added distorting the regular layers, meaning they can no longer slide over one another

2. It can change the melting and boiling point of the metal either way, but they are still very high due to all the electrostatic forces in the structure.

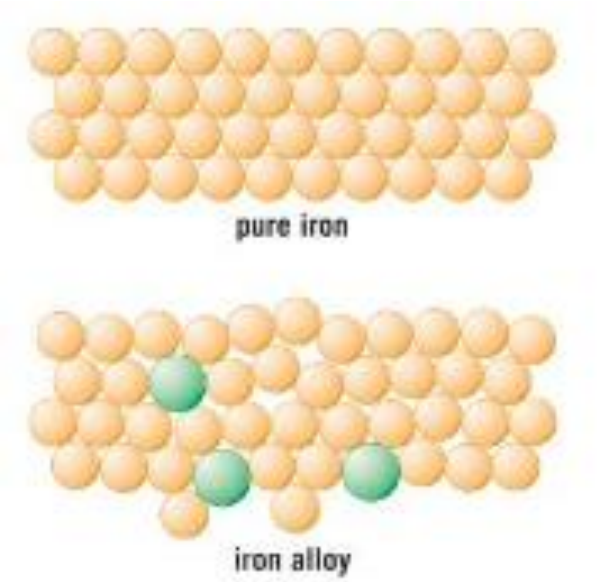


Figure 1 *The atoms in pure iron are arranged in layers, which can easily slide over each other. In alloys, the layers cannot slide so easily, because atoms of other elements distort the layers*

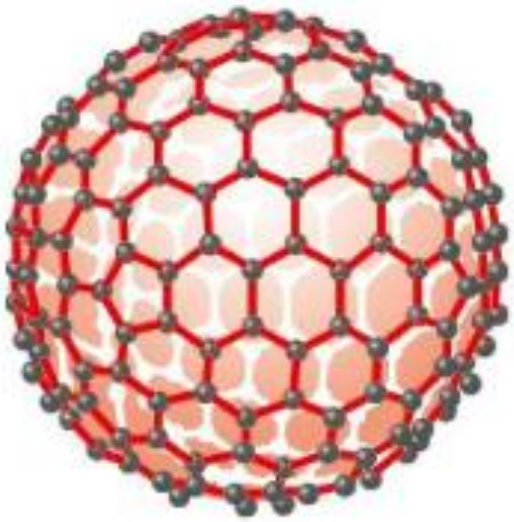
Nanoparticles

Nanoscience is the study of really small particles

A nanometre is 1 x 10^{-9} m—80000 x smaller than a human hair.

Nanoscience looks at 1-100nm particles.

They can be used for drug delivery (see fullerenes), as effective catalysts due to their large surface area, and for military uses.



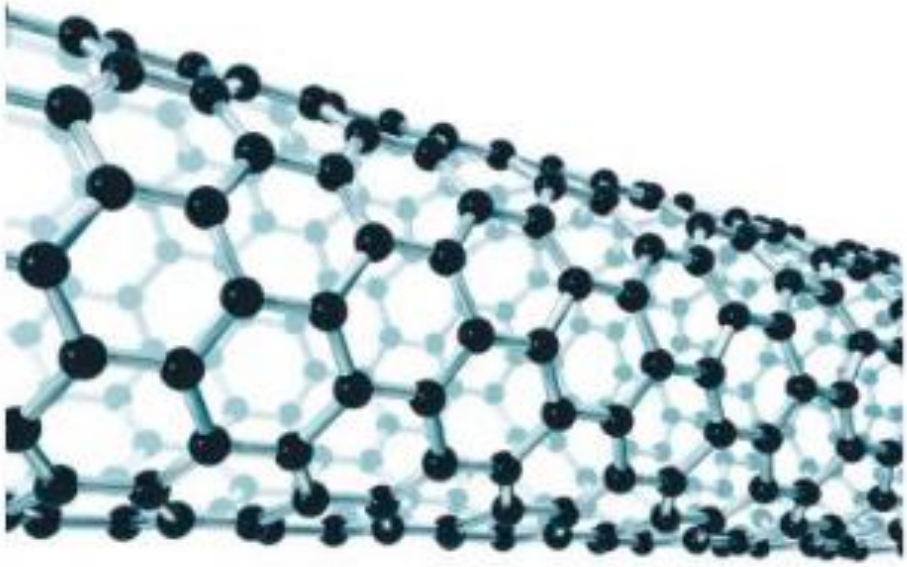


Figure 3 *Nanocages can carry drugs inside them and nanotubes can reinforce materials*

QUESTIONS

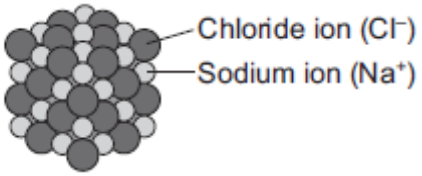
This section contains sample questions to assess your understanding of knowledge.

Q1.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Explain why chlorine (Cl_2) is a gas at room temperature, but sodium chloride (NaCl) is a solid at room temperature.

Chlorine **Sodium chloride**



Include a description of the bonding and structure of chlorine and sodium chloride in your answer.

[6 Marks]

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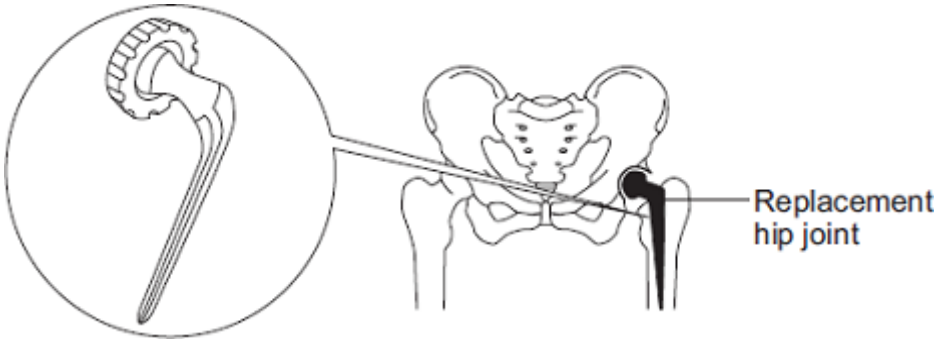
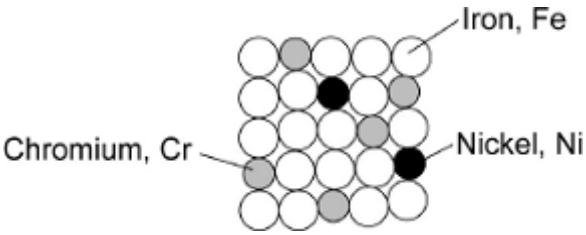
The hip joint sometimes has to be replaced.
Early replacement hip joints were made from stainless steel.



Stainless steel is an alloy of iron, chromium and nickel.
The diagram below represents the particles in stainless steel.



Paticle diagram of stainless steal

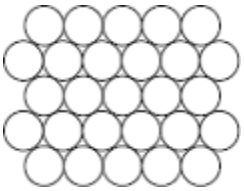
Q2.1 Use the diagram to complete the percentages of metals in this stainless steel.

The first one has been done for you.

Element	Percentage (%)
Iron, Fe	72
Chromium, Cr	
Nickel, Ni	

(2)

Pure iron is a soft, metallic *element*.



Q2.2 Why is iron described as an *element*?

[1 Mark]

.....

.....

Q2.3 Pure iron would **not** be suitable for a replacement hip joint.

Suggest why.

[1 Mark]

.....

.....

Q2.4 The three metals in stainless steel have different sized atoms.
Stainless steel is harder than pure iron.

Explain why.

[2 Marks]

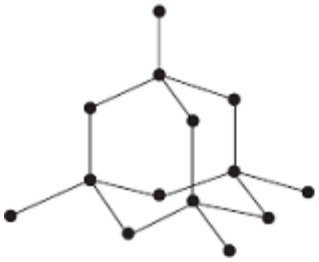
.....

.....

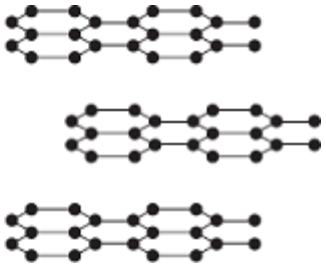
.....

Q3.

The diagrams show the structures of diamond and graphite.



Diamond



Graphite

Q3.1 Diamond and graphite both contain the same element.

What is the name of this element? _____

(1)

Use the diagrams above and your knowledge of structure and bonding to explain why:

Q3.2 graphite is very soft

[2 Marks]

.....

.....

.....

.....

Q3.3 diamond is very hard

[2 Marks]

.....

.....

.....

Q3.4 graphite conducts electricity.

[2 Marks]

.....

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.....

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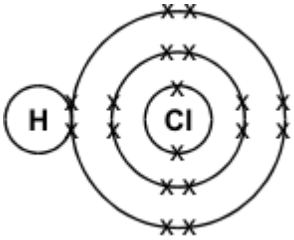
Q4.

The hydrogen halides (hydrogen fluoride, hydrogen chloride, hydrogen bromide and hydrogen iodide) are important chemicals.

The diagram below represents a molecule of hydrogen chloride.



Q4.1 What type of particles are represented by the crosses (X)?

[1 Mark]

……

Q4.2 What type of chemical bond holds the atoms in this molecule together?

[1 Mark]

……

Q4.3 Would you expect hydrogen chloride to be a gas, a liquid or a solid, at room temperature and pressure? Explain your answer.

[3 Marks]

……

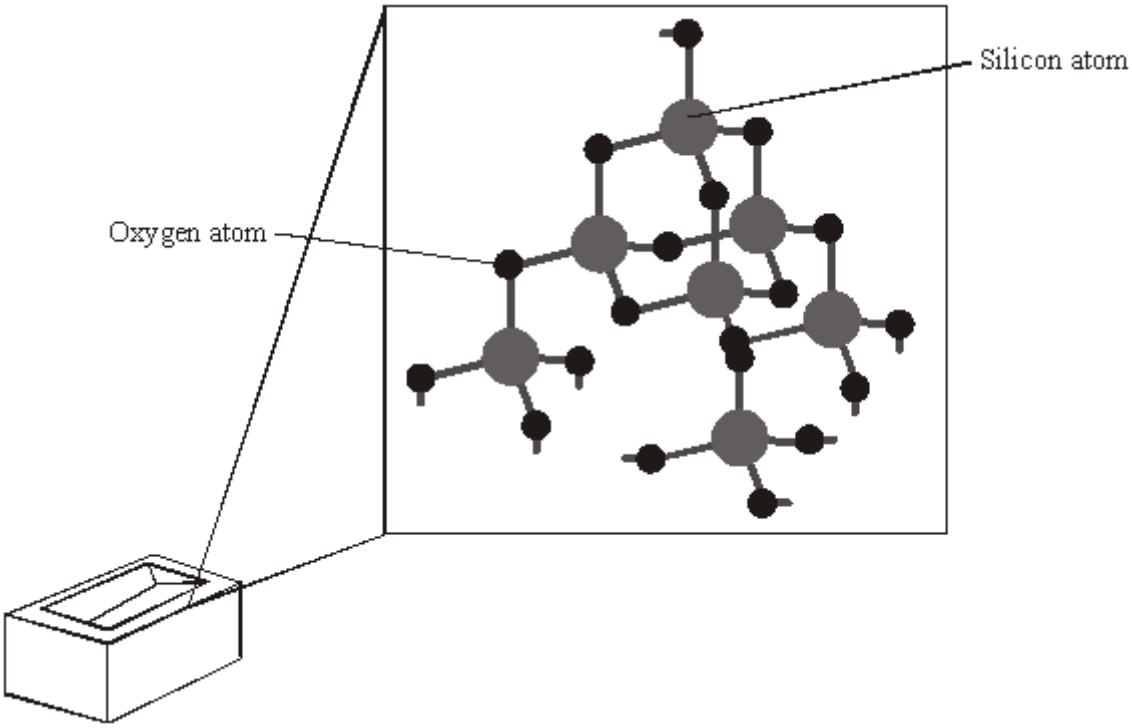
……

……

……

Q5. Bricks made from silica (silicon dioxide) are used to line furnaces that operate at high temperatures.

Part of the structure of silica is shown in the diagram.



Suggest and explain why silica is used to make bricks for high-temperature furnaces. In your answer, you should refer to the structure of, and bonding in, silica.

[4 Marks]

……

……

……

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……

……

……

MARK SCHEME

This section contains the mark schemes provided for the previous questions.

Q1.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

0 marks

No relevant content

Level 1 (1–2 marks)

*There is a statement about the bonding and / or structure **or** melting / boiling point of chlorine **or** sodium chloride.*

Level 2 (3–4 marks)

*There are statements about the bonding and / or structure of chlorine **or** sodium chloride.*

Level 3 (5–6 marks)

*There are statements about the bonding and / or structure of chlorine **and** sodium chloride.*

*There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.*

Examples of chemistry points made in response:

Chlorine:

covalent bonds between atoms

forming (simple) molecules

no / weak attraction / bonds between molecules

low boiling point

Sodium chloride:

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

large amounts of energy needed to break bonds

high melting point

[6]

Q2.

Q2.1 (Chromium =) 20

in correct order

1

(Nickel =) 8

accept Chromium = 8 ***and*** *Nickel = 20 for* ***1*** *mark*

1

Q2.2 (because iron is made up of only) one type of atom

1

Q2.3 not strong

allow too soft ***or*** *too flexible*

accept it rusts / corrodes ***or*** *that it could wear away*

accept could change shape / bend

accept layers / atoms could slide (over each other)

1

Q2.4 structure is different / distorted / disrupted

accept not in layers ***or*** *not regular*

1

so it is difficult for layers / atoms / particles to slip / slide (over each other)

accept layers cannot slip / slide

1

[6]

Q3.

Q3.1 carbon

allow C

1

Q3.2 (atoms are in) layers (that) can slide over each other

1

because between the layers there are only weak forces

accept because there are no (covalent) bonds between the layers

accept Van der Waals forces between the layers

if no other marks are awarded allow weak intermolecular forces for ***1*** *mark*

1

Q3.3 because each atom forms four (covalent) bonds **or** (diamond is a) giant (covalent) structure **or** lattice **or** macromolecular

any reference to ionic / metallic bonding or intermolecular forces scores a maximum of ***1*** *mark*

accept carbon forms a tetrahedral shape

1

(and) covalent bonds are strong

accept covalent bonds need a lot of energy / difficult to break

1

Q3.4 because graphite has delocalised electrons
allow sea of electrons
allow each carbon atom has one free electron

1

which can move <u>through the whole structure</u> (and carry the current / charge / electricity)

1

[7]

Q4.

Q4.1 electrons 1

for 1 mark

Q4.2 covalent 1

for 1 mark

Q4.3 made of small molecules:
usually gas or liquid) dependent on
have low melting points) having first
have low boiling points) point above
forces between molecules are weak

any 1 for 1 mark

3

[5]

Q5.

any **four** points from:

• high melting point owtte
ignore boiling point

• many **or** all atoms joined together

• each silicon (atom) joined to four oxygen (atoms) **or** each oxygen joined to two silicon

• covalent (bonds)

• many bonds would need to be broken

• strong bonds
allow hard to break bonds

• lot of energy / heat needed to break bonds
allow high temperature needed to break bonds

• giant / macromolecular / lattice / diamond structure

• unreactive
*allow doesn't react with materials within furnace = **1** mark*

• rigid / hard structure

• no free electrons

• poor conductor of heat
*giant covalent structure = **2** marks*
*max **3** if ionic / metallic bonding mentioned*
ignore electrostatic
ignore molecules / intermolecular forces

AQA

The Periodic Table of Elements

1	2											3	4	5	6	7	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	63.5 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	[97] 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	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganesson 118

Key: relative atomic mass; **atomic symbol**; name; atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Acknowledgements

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