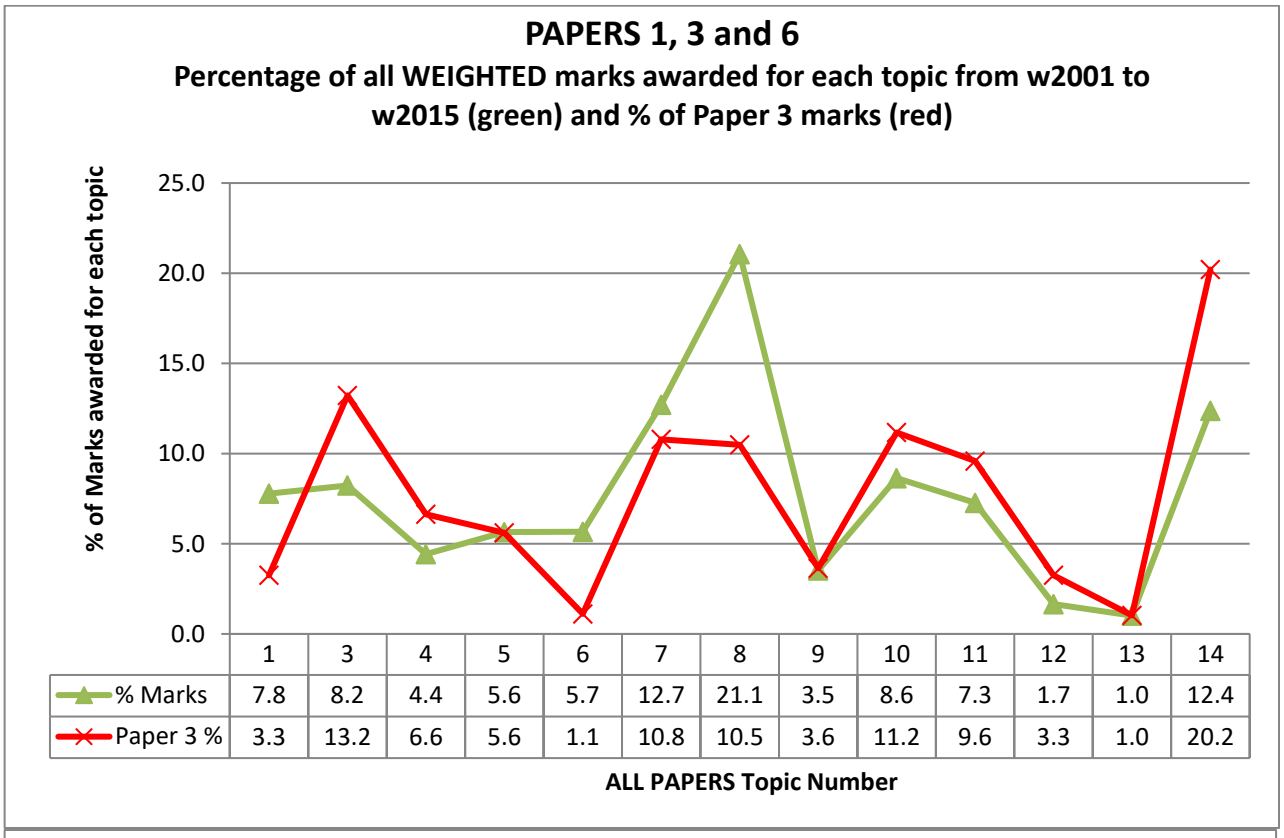
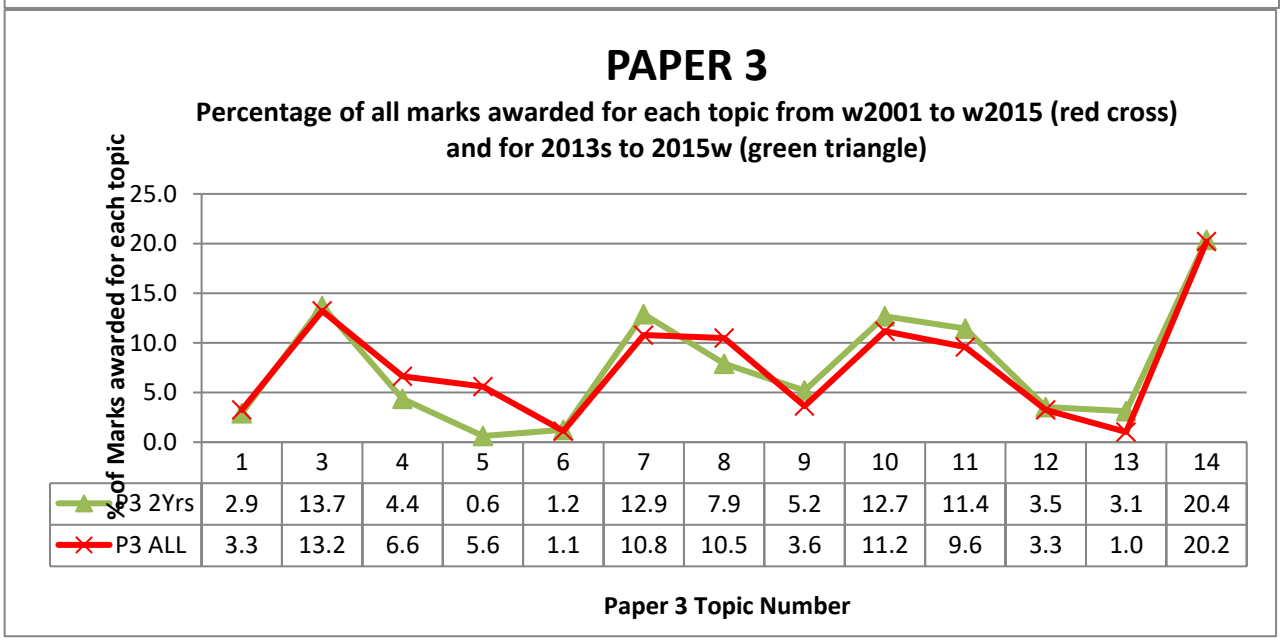
iG Chem 3 EQ P3 13w to 10s 4Students 261marks NEW





	Total	Chem 1	Chem 3	Chem 4	Chem 5	Chem 6	Chem 7	Chem 8	Chem 9	Chem 10	Chem 11	Chem 12	Chem 13	Chem 14
Total Marks	2320	74	312	155	81	26	256	246	85	296	231	76	24	474
% of Marks	2336	3.2	13.4	6.6	3.5	1.1	11.0	10.5	3.6	12.7	9.9	3.3	1.0	20.3
# of Questions		19	59	39	18	6	47	54	19	58	48	14	5	80
Average marks per Q		**3.9**	**5.3**	**4.0**	**4.5**	**4.3**	**5.4**	**4.6**	**4.5**	**5.1**	**4.8**	**5.4**	**4.8**	**5.9**

	1st Paper	1st P rank	Last Paper	Last P rank	Total # Papers	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Weight per paper	Weight per mark
Paper 1	**2002s**	**5**	**2012w**	**26**	**22**	**40**	**880**	**869**	**-11**	**30**	**0.75**
Paper 3	**2001w**	**4**	**2015w**	**32**	**29**	**80**	**2320**	**2336**	**16**	**50**	**0.625**
Paper 6	**2001w**	**4**	**2015w**	**32**	**29**	**60**	**1740**	**1890**	**150**	**20**	**0.625**

Topic	**14**	**3**	**10**	**7**	**8**	**11**	**4**	**5**	**9**	**1**	**12**	**6**	**13**
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

CIE iGCSE Chemistry Syllabus Details – Changes from 2016 onwards

(syllabus code 0620)

Before 2016:

For the highest grades students had to sit three different papers (P1, P3 & P6):

Paper 1 (multiple choice) was easier (didn't contain supplement material)

Paper 3 was the extension paper, needed to get grades higher than a C

2016 and later:

Still need to sit three papers (**P2, P4 & P6**), but:

Paper 2 is a new multiple choice paper which also contains supplement material (is harder)

Paper 4 is the new name for the extension paper. So **if you are looking for the types of questions that you will be asked on Paper 4 from 2015 and earlier they will be found in paper 3 revision packs.**

Material that is new or changed in 2016 is highlighted with BLACK LINES next to it.

3. Atoms, elements and compounds	
3.1 Atomic structure and the Periodic Table **Core**	**Supplement**
• State the relative charges and approximate relative masses of protons, neutrons and electrons	
• Define *proton number* (atomic number) as the number of protons in the nucleus of an atom	
• Define *nucleon number* (mass number) as the total number of protons and neutrons in the nucleus of an atom	
• Use proton number and the simple structure of atoms to explain the basis of the Periodic Table (see section 9), with special reference to the elements of proton number 1 to 20	
• Define *isotopes* as atoms of the same element which have the same proton number but a different nucleon number	• Understand that isotopes have the same properties because they have the same number of electrons in their outer shell
• State the two types of isotopes as being radioactive and non-radioactive	
• State one medical and one industrial use of radioactive isotopes	
• Describe the build-up of electrons in 'shells' and understand the significance of the noble gas electronic structures and of the outer shell electrons (The ideas of the distribution of electrons in s and p orbitals and in d block elements are **not** required.)	
Note: a copy of the Periodic Table, as shown in the Appendix, will be available in Papers 1, 2, 3 and 4.	

3.2.1 Bonding: the structure of matter **Core** • Describe the differences between elements, mixtures and compounds, and between metals and non-metals • Describe an alloy, such as brass, as a mixture of a metal with other elements	
3.2.2 Ions and ionic bonds **Core** • Describe the formation of ions by electron loss or gain • Describe the formation of ionic bonds between elements from Groups I and VII	**Supplement** • Describe the formation of ionic bonds between metallic and non-metallic elements • Describe the lattice structure of ionic compounds as a regular arrangement of alternating positive and negative ions
3.2.3 Molecules and covalent bonds **Core** • Describe the formation of single covalent bonds in H_2, Cl_2, H_2O, CH_4, NH_3 and HCl as the sharing of pairs of electrons leading to the noble gas configuration • Describe the differences in volatility, solubility and electrical conductivity between ionic and covalent compounds	**Supplement** • Describe the electron arrangement in more complex covalent molecules such as N_2, C_2H_4, CH_3OH and CO_2 • Explain the differences in melting point and boiling point of ionic and covalent compounds in terms of attractive forces
3.2.4 Macromolecules **Core** • Describe the giant covalent structures of graphite and diamond • Relate their structures to their uses, e.g. graphite as a lubricant and a conductor, and diamond in cutting tools	**Supplement** • Describe the macromolecular structure of silicon(IV) oxide (silicon dioxide) • Describe the similarity in properties between diamond and silicon(IV) oxide, related to their structures
3.2.5 Metallic bonding	**Supplement** • Describe metallic bonding as a lattice of positive ions in a 'sea of electrons' and use this to describe the electrical conductivity and malleability of metals

Q# 15/ iGCSE Chemistry/2013/w/Paper 31/

6 Lead is an excellent roofing material. It is malleable and resistant to corrosion. Lead rapidly becomes coated with basic lead carbonate which protects it from further corrosion.

(a) Lead has a typical metallic structure which is a lattice of lead ions surrounded by a 'sea' of mobile electrons. This structure is held together by attractive forces called a metallic bond.

(i) Explain why there are attractive forces in a metallic structure.

.....

..... [2]

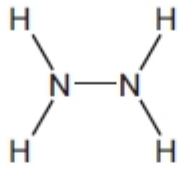
(ii) Explain why a metal, such as lead, is malleable.

.....

..... [2]

Q# 16/ iGCSE Chemistry/2013/s/Paper 31/ Q6

(d) The structural formula of hydrazine is given below.



Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound hydrazine.
Use x to represent an electron from a nitrogen atom.
Use o to represent an electron from a hydrogen atom.

[3]

Q# 17/ iGCSE Chemistry/2013/s/Paper 31/

8 There are three types of giant structure - ionic, metallic and giant covalent.

(a) In an ionic compound, the ions are held in a lattice by strong forces.

(i) Explain the term *lattice*.

.....

..... [2]

(ii) Explain how the ions are held together by strong forces.

.....

..... [1]

(b) Describe the bonding in a typical metal.

.....

.....

..... [3]

(c) The electrical conductivities of the three types of giant structure are given in the following table.

type of structure	conductivity of solid	conductivity of liquid
ionic	poor	good
metallic	good	good
giant covalent	poor	poor

Explain the differences in electrical conductivity between the three types of giant structure and the difference, if any, between the solid and liquid states of the same structure.

.....

.....

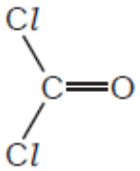
.....

.....

..... [5]

Q# 18/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(c) The structural formula of carbonyl chloride is given below.



Draw a diagram showing the arrangement of the outer (valency) electrons in one molecule of this covalent compound.

Use o to represent an electron from a carbon atom.
Use x to represent an electron from a chlorine atom.
Use • to represent an electron from an oxygen atom.

[3]

Q# 19/ iGCSE Chemistry/2012/w/Paper 31/ Q2

(b) A radioactive isotope of iodine, $^{131}_{53}I$, is used to treat cancer.

(i) Define the term *isotope*.

.....

..... [2]

(ii) How many protons, electrons and neutrons are there in one atom of $^{131}_{53}I$?

number of protons .....

number of electrons .....

number of neutrons ..... [2]

(iii) When this isotope, $^{131}_{53}I$, emits radiation, a different element with a proton number of 54 is formed.
What is the name of this element?

..... [1]

Q# 20/ iGCSE Chemistry/2012/w/Paper 31/

7 Both strontium and sulfur have chlorides of the type XCl_2. The table below compares some of their properties.

	strontium chloride	sulfur chloride
appearance	white crystals	red liquid
formula	$SrCl_2$	SCl_2
melting point / °C	874	–120
boiling point / °C	1250	59
conductivity of liquid	good	poor
solubility in water	dissolves to form a neutral solution	reacts to form a solution of pH 1

(a) (i) Use the data in the table to explain why sulfur chloride is a liquid at room temperature, 25 °C.

.....

..... [2]

(ii) Strontium is a metal and sulfur is a non-metal. Explain why both have chlorides of the type XCl_2.
The electron distribution of a strontium atom is 2 + 8 + 18 + 8 + 2.

.....

.....

..... [2]

(iii) Deduce the name of the acidic compound formed when sulfur chloride reacts with water.

..... [1]

(iv) Explain the difference in the electrical conductivity of liquid strontium chloride and liquid sulfur chloride.

.....

.....

..... [3]

Q# 21/ iGCSE Chemistry/2012/w/Paper 31/

4 Silicon(IV) oxide, SiO_2, and zirconium(IV) oxide, ZrO_2, are both macromolecules.
They have similar physical properties but silicon(IV) oxide is acidic and zirconium(IV) oxide is amphoteric.

(a) Define the term *macromolecule*.

.....

..... [1]

(b) (i) Predict **three** physical properties of these two oxides.

.....

.....

..... [3]

(ii) Name an element which has the same physical properties as these two oxides.

..... [1]

Q# 22/ iGCSE Chemistry/2012/s/Paper 31/Q3

(b) Lithium reacts with nitrogen to form the ionic compound, lithium nitride.

(i) State the formula of the lithium ion. ..... [1]

(ii) Deduce the formula of the nitride ion. ..... [1]

(iii) In all solid ionic compounds, the ions are held together in a lattice.
Explain the term *lattice*.

.....

..... [1]

(iv) What is the ratio of lithium ions to nitride ions in the lattice of lithium nitride?
Give a reason for your answer.

..... lithium ions : ..... nitride ions

.....

..... [2]

Q# 23/ iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state.
The element and its compounds are often used as catalysts.

(a) Complete the electron distribution of vanadium by inserting one number.

2 + 8 + ... + 2

[1]

Q# 24/ iGCSE Chemistry/2011/w/Paper 31/

1 This question is concerned with the following oxides.

sulfur dioxide
carbon monoxide
lithium oxide
aluminium oxide
nitrogen dioxide
strontium oxide

(c) Lithium oxide is an ionic compound.

(i) Identify another ionic oxide in the list on page 3.

..... [1]

(ii) Draw a diagram which shows the formula of lithium oxide, the charges on the ions and the arrangement of the valency electrons around the negative ion.
Use x to represent an electron from an atom of oxygen.
Use o to represent an electron from an atom of lithium.

[2]

Q# 25/ iGCSE Chemistry/2011/s/Paper 31/ Q3

(c) Both iron and steel have typical metallic structures - a lattice of positive ions and a sea of electrons.

(i) Suggest an explanation for why they have high melting points.

.....

.....

..... [2]

(ii) Explain why, when a force is applied to a piece of steel, it does not break but just changes its shape.

.....

..... [2]

Q# 26/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(b) The electron distribution of a selenium atom is 2 + 8 + 18 + 6.

(i) Selenium forms an ionic compound with potassium. Draw a diagram which shows the formula of this ionic compound, the charges on the ions and the arrangement of the **valency** electrons around the negative ion.
Use o to represent an electron from an atom of potassium.
Use x to represent an electron from an atom of selenium.

[3]

(ii) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound selenium chloride.
Use x to represent an electron from an atom of selenium.
Use o to represent an electron from an atom of chlorine.

[3]

(iii) Predict **two** differences in the physical properties of these two compounds.

.....

..... [2]

Q# 27/ iGCSE Chemistry/2010/w/Paper 31/ Q6

(c) (i) Give the formulae of lithium fluoride and nitrogen fluoride.

lithium fluoride .....

nitrogen fluoride ..... [2]

(ii) Predict **two** differences in their properties.

.....

..... [2]

(iii) Explain why these two fluorides have different properties.

.....

..... [2]

Q# 28/ iGCSE Chemistry/2010/w/Paper 31/

1 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	18	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....

..... [1]

(ii) They are all particles of the same element.

.....

..... [1]

(iii) Particle **B** is a negative ion.

.....

..... [2]

(iv) Particles **A** and **C** are isotopes.

.....

..... [2]

(b) (i) What is the electronic structure of particle **A**?

..... [1]

(ii) What is the valency of the element?

..... [1]

(iii) Is the element a metal or a non-metal? Give a reason for your choice.

.....

..... [1]

Q# 29/ iGCSE Chemistry/2010/w/Paper 31/

2 About 4000 years ago the Bronze Age started in Britain. Bronze is an alloy of copper and tin.

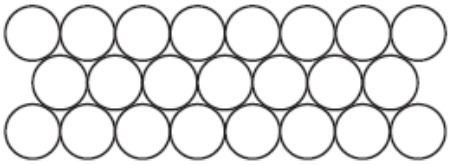
(a) (i) Suggest a reason why a bronze axe was better than a copper axe.

..... [1]

(ii) Brass is another copper alloy. Name the other metal in brass.

..... [1]

(b) The diagram below shows the arrangement of particles in a pure metal.



(i) What is the name given to a regular arrangement of particles in a crystalline solid?

..... [1]

(ii) Draw a diagram which shows the arrangement of particles in an alloy.

[2]

(iii) Explain the term *malleable*.

..... [1]

(iv) Why are metals malleable?

.....

..... [2]

Q# 30/ iGCSE Chemistry/2010/w/Paper 31/

4 Ammonia is an important industrial chemical.

(a) (i) Give the electron structure of an atom of nitrogen.

..... [1]

(ii) Use this electronic structure, rather than the valency of nitrogen, to explain why the formula of ammonia is NH_3 not NH_4.

.....

.....

..... [2]

Q# 31/ iGCSE Chemistry/2010/w/Paper 31/

6 The table below shows the elements in the second period of the Periodic Table and some of their oxidation states in their most common compounds.

element	Li	Be	B	C	N	O	F	Ne
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4	–3	–2	–1	0

(a)

(iii) Select **two** elements in the table which exist as diatomic molecules of the type X_2.

..... [1]

Q# 32/ iGCSE Chemistry/2010/s/Paper 31/ Q5 (a)

(iii) Explain why graphite is a soft material.

.....

..... [2]

(iv) Give **one** use of graphite.

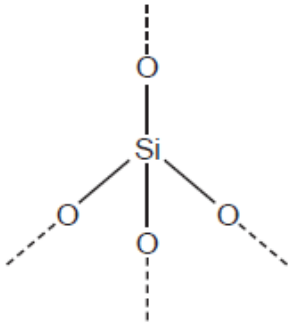
..... [1]

(b) Two of the oxides of these elements are carbon dioxide, CO_2, and silicon(IV) oxide, SiO_2.

(i) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound carbon dioxide.
Use x to represent an electron from a carbon atom.
Use o to represent an electron from an oxygen atom.

[3]

(ii) A section of the macromolecular structure of silicon(IV) oxide is given below.



Use this diagram to explain why the formula is SiO_2 not SiO_4.

.....

..... [2]

(iii) Predict **two** differences in the physical properties of these two oxides.

.....

..... [2]

Q# 33/ iGCSE Chemistry/2010/s/Paper 31/

5 Carbon and silicon are elements in Group IV. Both elements have macromolecular structures.

(a) Diamond and graphite are two forms of the element carbon.

(i) Explain why diamond is a very hard substance.

.....

.....

..... [2]

(ii) Give **one** use of diamond.

..... [1]

Mark Scheme

Q# 15/ iGCSE Chemistry/2013/w/Paper 31/

6 **(a)** **(i)** (attractive force between) positive ions [1]
and (negative) electrons [1]
opposite charges attract ONLY [1]
electrostatic attraction ONLY [1]

(ii) lattice / rows / layers of lead ions / cations / positive ions [1]
NOT: atoms / protons / nuclei
can slide past each other / the bonds are non-directional [1]

Q# 16/ iGCSE Chemistry/2013/s/Paper 31/ Q6

(d) 4 hydrogen atoms 1 bonding pair each [1]
2 nitrogen atoms with 1 bonding pair between them [1]
one non-bonding pair on each N (need not be seen as a pair) [1]

Q# 17/ iGCSE Chemistry/2013/s/Paper 31/

8 (a) (i) regular arrangement / repeating pattern **NOT** structure [1]
cond: ions [1]
not molecules / atoms

(ii) attraction between opposite charges / electrostatic attraction [1]

(b) delocalised / mobile / free / sea of electrons [1]
positive ions / cations
not atoms / protons / nuclei [1]
attraction between these electrons and ions [1]

(c) **giant covalent**
no ions [1]
no delocalised / free / mobile / sea of electrons **or** all electrons [1]

ionic
in ionic solid ions cannot move [1]
liquid ionic compound ions can move [1]

metallic
(both solid and liquid) metals have delocalised (**or** alternative term) electrons [1]

Q# 18/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(c) each chlorine 1 bp and 3 nbps; [1]
4 e between carbon atom and oxygen atom; [1]
2 nbps on oxygen atom; [1]

Q# 19/ iGCSE Chemistry/2012/w/Paper 31/ Q22

(b) (i) same Z / same number of protons; [1]
accept: atoms of the same element
different number of neutrons / different nucleon number / different mass number; [1]

(ii) 53 protons and 53 electrons; [1]

78 neutrons; [1]

(iii) xenon; [1]

Q# 20/ iGCSE Chemistry/2012/w/Paper 31/

7 (a) (i) melting point is below 25°C; [1]
boiling point above 25°C; [1]
accept: argument based on actual values
note: 25°C is between mp and bp = [2]

(ii) strontium loses 2e; [1]
sulfur gains 2e; [1]

(iii) hydrogen chloride / hydrochloric acid; [1]
accept: sulfurous acid or sulfur dioxide

(iv) molten strontium chloride has ions / ionic compound; [1]
which can move; [1]
sulfur chloride has no ions / only molecules / molecular / covalent; [1]

Q# 21/ iGCSE Chemistry/2012/w/Paper 31/

4 (a) giant covalent; [1]
or: polymer made from monomers;

(b) (i) any three from:
high mp / bp;
hard;
brittle;
insoluble (in water);
poor conductor of electricity / heat; [3]

(ii) carbon / diamond / silicon / boron; [1]
not: graphite

Q# 22/ iGCSE Chemistry/2012/s/Paper 31/

(b) (i) Li^+ [1]

(ii) N^{3-} [1]

(iii) regular arrangement of ions / particles / positive and negative ions alternate; [1]
not: atoms

(iv) 3:1; [1]
ratio to balance charges / reason in terms of valency; [1]

Q# 23/ iGCSE Chemistry/2012/s/Paper 31/

4 (a) 2 + 8 + 11 + 2 [1]

Q# 24/ iGCSE Chemistry/2011/w/Paper 31/
iGCSE Chemistry/201

(c) (i) strontium oxide [1]
accept: aluminium oxide

(ii) use correct formula [1]
cond: charges on ions
6x and 2o around oxygen [1]
ignore: electrons around Li

Q# 25/ iGCSE Chemistry/2011/s/Paper 31/ Q3

(c) (i) strong attractive forces / strong bonds / bonds hard to break / requires a lot of energy to break bonds [1]
not between ions, **not** between positive and negative ions,
not between electrons

between positive ions and (negative) electrons / opposite charges attract [1]

(ii) because the layers, lattice or rows of ions/cations [1]
accept sheets of ions
not atoms / molecules / protons / nuclei

can move / slip / slide past each other [1]

Q# 26/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(b) (i) correct formula [1]

cond following marks conditional on correct formula
If covalent mark 1 only
correct charges [1]
6x and 2o around anion [1]
do **NOT** penalise for incorrect coding
ignore electrons around potassium

(ii) correct formula [1]

If ionic mark 1 only
cond
2 bp and 2 nbp around selenium [1]
1 bp and 3 nbp around both chlorine atoms [1]

(iii) the ionic compound
higher melting point / boiling point / less volatile
conducts when molten or aqueous, covalent compound does not
is soluble in water, covalent is not / ionic insoluble in organic solvents, covalent soluble in organic solvents
harder
any **two** [2]
note there has to be comparison between the ionic compound and the covalent compound
not density

Q# 27/ iGCSE Chemistry/2010/w/Paper 31/ Q6

(c) (i) LiF [1]
NF_3 [1]

(ii) LiF has higher mp / bp
LiF is a (crystalline) solid, NF_3 is probably a gas / a liquid
/ LiF is less volatile
as liquids only LiF conducts
LiF is soluble in water, NF_3 is not
when both solids LiF is harder
any **two** [2]

(iii) LiF is an ionic compound [1]
NF_3 is a covalent/molecular compound [1]
for stating that one is ionic and the other covalent [1] without specifying which is which

Q# 28/ iGCSE Chemistry/2010/w/Paper 31/

1 (a) (i) same number of protons and electrons [1]

(ii) all have the same number of protons / same proton number / same atomic number [1]

(iii) more electrons than protons [2]
number of protons and electrons not equal **ONLY** [1]

(iv) same number of protons (and electrons) / same proton number / same atomic number [1]
different number of neutrons / different mass number / nucleon number [1]

(b) (i) 2 + 8 + 5 [1]

(ii) 3 / 5 [1]

(iii) non-metal because it accepts electrons
/ needs 3e to complete outer energy level
/ because it is in Group V or 5e in outer shell [1]
note need both non-metal and reason for [1]

[Total: 9]

Q# 29/ iGCSE Chemistry/2010/w/Paper 31/

2 (a) (i) harder / stronger / any sensible suggestion which relates to better properties for purpose
e.g. stays sharp longer / cuts better / more corrosion resistant [1]

(ii) zinc [1]

(b) (i) lattice [1]

(ii) regular pattern of one type of atom [1]
with different atom interspersed [1]
can show the difference – size, shading, label etc.

(iii) can change its shape by force / plastically deform / can be hammered into sheets / can bend etc. [1]

(iv) particles / ions / atoms / layers [1]
cond can slide past each other [1]
or metallic bond is non-directional [1]
particles can move past each other [1]

Q# 30/ iGCSE Chemistry/2010/w/Paper 31/

4 (a) (i) nitrogen 2+5 [1]

(ii) needs three electrons [1]
to complete energy level [1]

Q# 31/ iGCSE Chemistry/2010/w/Paper 31/ Q6 (a)

(iii) any **two** from nitrogen, oxygen and fluorine [1]
accept symbols / molecular formulae

Q# 32/ iGCSE Chemistry/2010/s/Paper 31/ Q5 (a)

(iii) layer structure / sheets [1]
molecules / ions in layers = [0]
layers can slide (over each other) [1]

(iv) lubricant / pencils / electrodes [1]
mark first use offered

(b) (i) 4e between carbon and oxygens [1]
2 non-bonding pairs on both oxygens [1]
cond correct coding – only scored if marks 1 and 2 awarded [1]
ignore O_2 in atom

(ii) 4O around each Si [1]
2Si around each O [1]
must refer to diagram **not** valencies **or** electron distributions

(iii) SiO_2 has higher mp or bp
SiO_2 is a solid, CO_2 is a gas (at rtp)
(when both are solids) then SiO_2 is harder
has higher density
SiO_2 insoluble, CO_2 soluble [2]
any **two**, comparison needed

Q# 33/ iGCSE Chemistry/2010/s/Paper 31/

5 (a) (i) macromolecular / giant covalent / giant atomic [1]
all atoms held in position / in tetrahedral structure / to four other carbon atoms / all strong bonds [1]

(ii) jewellery / drilling / cutting / engraving / cutting edges in scalpels [1]
mark first use offered