DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

CHEMISTRY

Tuesday

22 October 2013

Time allowed:

2 hours and 30 minutes

(8:00am – 10:30 am)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to fully utilise the allocated time

INSTRUCTIONS TO CANDIDATES

To be read by the external invigilator to all candidates

1. The subject code for **Chemistry** is **6.**

2. There are **11** printed pages in the question booklet and **9 printed** pages in the answer booklet. The formula sheet is inserted in the middle of the question booklet.

3. There are two parts in this paper. Answer all questions.

   Part A: Multiple Choice Questions - 30 marks

   This section will be electronically marked.

   Electronic Answer Sheets will be distributed by your external invigilator. All answers to the Multiple Choice Part MUST be answered on this Answer Sheet.

   Carefully following the instructions, fill in your Candidate Information and Subject Information.

   Part B: Short Answer Questions - 70 marks

   Write down your name, your school name and your 10 digit candidate number on the Section B Answer Sheet Provided.

4. You are required to only write the correct answer in the spaces provided.

5. Calculators may be used.

6. Answers written on the question paper will not be marked. Write answers neatly in spaces as allocated on the answer sheet. Answer **ALL** questions.

7. Answer all questions on the answer sheet. Answers on any other paper including rough work paper and the question paper **will not be marked.**

8. ALL working must be shown step by step to get full marks. Students may lose marks for writing down final answers only.

9. Enough spaces have been allocated for answers to every question. Questions must be answered in spaces as allocated. Answers all over the answer booklet may not be marked.

10. Correctional Fluid is not allowed on the answer sheet. Where you have made an error, cross out all the working and start on a new line.

11. Graphical Calculators are not permitted.

DO NOT TURN OVER THE PAGE AND DO NOT WRITE

UNTIL YOU ARE TOLD TO START.

PART A: MULTIPLE CHOICE (QUESTIONS 1 TO 30) 30 MARKS

For each question, choose the best answer and shade in the circle representing the letter of your choice A, B, C or D printed on the electronic answer sheet.

QUESTION 1

Which of the following is NOT true about states of matter?

A. They are solids, liquids and gases.
B. Gases can be compressed only at low temperatures.
C. A solid has a definite shape and definite volume.
D. Liquids have a definite volume but no definite shape.

QUESTION 2

You can identify homogenous mixtures by the fact that

A. they are of uniform composition throughout.
B. they cannot be separated into its original components.
C. mixtures of immiscible liquids are homogenous mixture.
D. it is easy to distinguish between the different components of the mixture.

QUESTION 3

In a chemical reaction, N^{-3} ion is formed when nitrogen atom

A. gains 3 electrons.
B. gains 3 protons.
C. loses 3 electrons.
D. shares 3 protons.

QUESTION 4

Which of the following remains the same after a chemical reaction takes place?

A. Mass.
B. Moles.
C. Molarity.
D. Molar Mass.

QUESTION 5

Which of the following metals is most likely to react with solid CuO?

A. Ag
B. Au
C. Zn
D. Pt

QUESTION 6

What type of reaction is shown by the equation $H_{2\,(g)} + Br_{2\,(g)} \longrightarrow 2HBr_{\,(g)}$?

A. Synthesis.
B. Combustion.
C. Precipitation.
D. Displacement.

QUESTION 7

The products of the reaction of calcium metal and water are

A. $CaOH_{(aq)} + H_{2\,(g)}$

B. $H_2O_{(l)} + H_{2\,(g)}$

C. $Ca(OH)_{2\,(aq)} + H_{2\,(g)}$

D. $CaOH_{(aq)} + H_2O_{(l)}$

QUESTION 8

Slow rate of a reaction may be due to

A. high temperature.

B. high activation energy.

C. low activation energy.

D. high concentration of reactants.

QUESTION 9

When dynamite explodes, it produces a vast amount of energy. This is because the energy of the

A. product is higher than that of the reactants in the exothermic reaction.

B. reactant is higher than that of the products in the exothermic reaction.

C. product is higher than that of the reactants in the endothermic reaction.

D. reactant is higher than that of the products in the endothermic reaction.

QUESTION 10

Which of the following is NOT true about the nucleus of an atom? It

A. is positively charged.

B. is the heavy part of the atom.

C. contains both protons and neutrons.

D. spins in the opposite direction to electrons.

QUESTION 11

The atomic number is the

A. number of neutrons in a neutral element.

B. number of electrons in an element that has reacted.

C. number of protons in both neutral and reacted element.

D. different number of protons in both neutral and reacted elements.

QUESTION 12

Which of the following is true of metals? They are generally

A. ductile and malleable.

B. poor conductor of heat and electricity.

C. highly soluble in fatty acids.

D. substances with low boiling points.

QUESTION 13

Zinc is used for

A. car batteries and soldering.

B. electric cables and pipes.

C. ships, aeroplanes and utensils.

D. galvanizing and alloying.

QUESTION 14

Which statement is true about natural gas?

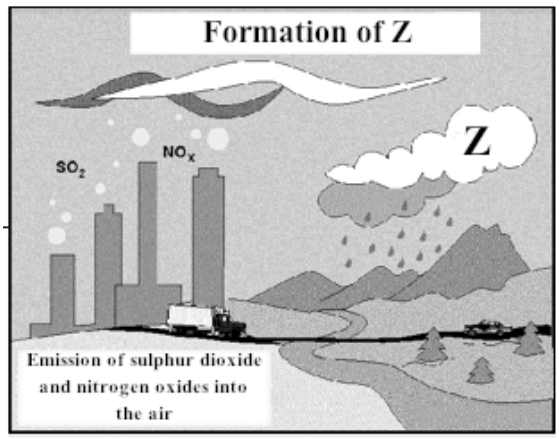
A. Consists of mainly methane.

B. A non-flammable hydrocarbon gas.

C. Is liquefied to make it biodegradable.

D. Causes more pollution when compared to other fossil fuels.

QUESTION 15



Which of the following is true about **Z**?

A. Minimize corrosion.

B. Supports aquatic life.

C. Make water very much palatable.

D. Dissolve calcium carbonate rocks.

QUESTION 16

An electrolytic cell is an electrochemical cell

A. which generates electricity.

B. in which anode is positive.

C. where reduction occurs at anode.

D. where oxidation occurs at cathode.

QUESTION 17

During the electrolysis of concentrated potassium chloride

A. chlorine generates at the anode.

B. oxygen generates at the anode.

C. hydrogen generates at the anode.

D. oxygen generates at the cathode.

QUESTION 18

Which statement is NOT true about the usage of methyl alcohol? It is used

A. as an industrial solvent.

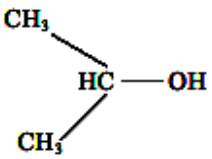
B. to produce methylated spirits.

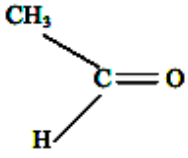
C. as an alternative fuel for motorcars.

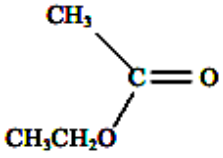
D. to produce alcoholic beverages.

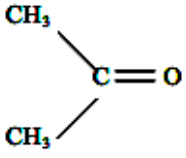
QUESTION 19

From the structures given below identify the compound with the ketone functional group.

A. 

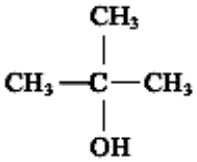
B. 

C. 

D. 

QUESTION 20

The correct name for the compound below is



A. 1-pentanol
B. pentanoic acid
C. 1-propanol
D. 2-methyl-2-propanol

QUESTION 21

C_4H_9COOH is the formula for

A. 1-butanol
B. butanoic acid
C. propanoic acid
D. pentanoic acid

QUESTION 22

In the production of beer, _____ is NOT a procedure.

A. flotation.
B. filtration.
C. maturation.
D. sedimentation.

QUESTION 23

Which statement is false about coconut oil?

A. Is a product made from a renewable source.
B. Is the raw material in the formulation of biodiesel.
C. Can be used for cosmetic and skin care products.
D. Is used as lubricant in gearboxes of motor vehicles.

QUESTION 24

Which of the following is a step in gold production?

A. Mashing.
B. Steeping.
C. Bessemerization.
D. Carbon-in-pulp method.

QUESTION 25

Which list given below contains substances that fall between the pH values of 3 – 5?

A. Vinegar, wine, diet coke.
B. Oven cleaner, aspirin, milk of magnesia.
C. Lime juice, apple juice, ammonia solution.
D. Ethanoic acid, baking soda, hydrochloric acid.

QUESTION 26

What is the pH of a 0.08M solution of sodium hydroxide? (pH= - log $[H^+]$, pH + OH = 14]

A. 1.29
B. 8.50
C. 12.91
D. 13.10

QUESTION 27

The solubility of potassium nitrate at 20°C is 316g/L.

How many grams of KNO_3 can dissolve in 185mL of water?

A. 50.5 B. 52.5

C. 58.5 D. 62.5

QUESTION 28

Sulfur reacts with oxygen according to the following equation: $2\ S_{(s)} + 3O_{2\ (g)} \longrightarrow 2SO_{3\ (g)}$

If 4 moles of sulfur react with 9.5 moles of oxygen, how many moles of oxygen would remain after the reaction?

A. 1.5 B. 2.5

C. 3.5 D. 4.5

QUESTION 29

Zinc reacts with hydrochloric acid to give zinc chloride and hydrogen. If 130.0g of zinc are reacted with excess HCl, how many grams of zinc chloride is formed?

A. 130 B. 178

C. 260 D. 272

QUESTION 30

Aluminium reacts with sulfuric acid to give aluminium sulfate and hydrogen. If 81.0g of aluminium react with excess sulfuric acid, how many grams of aluminium sulfate will be formed?

A. 243 B. 273

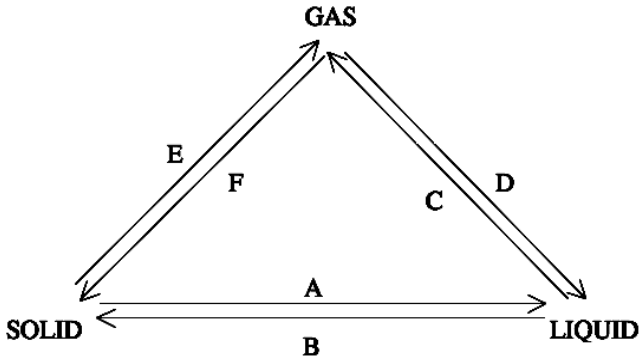
C. 324 D. 513

PART B: SHORT ANSWERS (QUESTIONS 31 TO 40) 70 MARKS

Write your answer to the questions in the spaces provided in your Part B Answer Booklet.

QUESTION 31

a. The following diagram shows the three states of matter and how they can be interchanged through physical changes.



Name the changes

i. A (1 mark)

ii. C (1 mark)

iii. D (1 mark)

iv. E (1 mark)

b. The table below shows the solubilities of oxygen gas in water at different temperatures. The solubility is in g per 100g of water at 1 atm.

Temperature °C	0	20	40
Solubility of oxygen/g	0.007	0.004	0.003

i. In the given range, at what temperature does oxygen have the highest solubility? (1 mark)

ii. What is the likely solubility of oxygen at 100°C? (1 mark)

iii. Explain the solubility trend of oxygen against the increase in temperature. (1 mark)

QUESTION 32

a. Calculate the mass of 1 mole of copper (II) sulphate pentahydrate. (2 marks)

b. A compound formed by calcium and carbon has the following composition by mass: 62.5% calcium and 37% carbon.

What is the empirical formula of the compound? (2 marks)

c. A saturated solution of calcium hydroxide contains 0.185g per 100 mL of solution.

Calculate the molarity of the saturated calcium hydroxide solution. (3 marks)

QUESTION 33

a. i. Why does atomic radius change from left to right in the same period? (1 mark)

ii. Why is diamond a poor conductor of electricity? (1 mark)

iii. Why is graphite a good conductor of electricity? (1 mark)

b. Which two of the following types of orbitals 5s, 2d, 6d and 1p do not exist? (2 marks)

c. Write the electronic configuration of the following elements.

i. Boron. (1 mark)

ii. Chlorine. (1 mark)

QUESTION 34

a. An example of a precipitation reaction is the reaction of an aqueous silver nitrate and aqueous barium chloride solution. A precipitate of silver chloride is formed.

i. Write the balanced chemical equation for the precipitation reaction. (2 marks)

ii. Write the net ionic equation for the reaction. (1 mark)

b. The following reaction can occur.

$Fe_{(s)} + CuSO_{4\,(aq)} \longrightarrow FeSO_{4\,(aq)} + Cu_{(s)}$

i. Is the reverse reaction possible? (1 mark)

ii. State the reason why the reaction is possible or not possible. (2 marks)

iii. Would solid tin react with $CuSO_{4\,(aq)}$? (1 mark)

QUESTION 35

a. Write a balanced equation for the reaction of dilute nitric acid with

i. Sodium. (1 mark)

ii. Magnesium. (1 mark)

iii. Copper. (1 mark)

b. Write a balanced equation for the production of ammonia by Haber process. (2 marks)

c. Some fertilizers are highly soluble in water and are carried into lakes and rivers during rain. Dissolved fertilizers promote growth of algae.

Give two harmful effects of growth of algae in water. (2 marks)

QUESTION 36

a. Electro refining is carried out in the production of copper to refine blister copper. Refining is carried out in an electrolytic cell.

What are the materials used for making anode and cathode of the cell? (2 marks)

b. Write the equation for the reaction at the anode for the electrolysis of

i. molten sodium chloride. (1 mark)

ii. dilute aqueous solution of sodium chloride (<0.05 M/L). (1 mark)

iii. concentrated sodium chloride solution (>2 M/L). (1 mark)

c. Electroplating is a technique used to coat a more reactive metal with a less reactive metal in order to protect it from corrosion and also to make it more attractive.

A piece of steel was electroplated with copper using copper sulfate as the electrolyte.

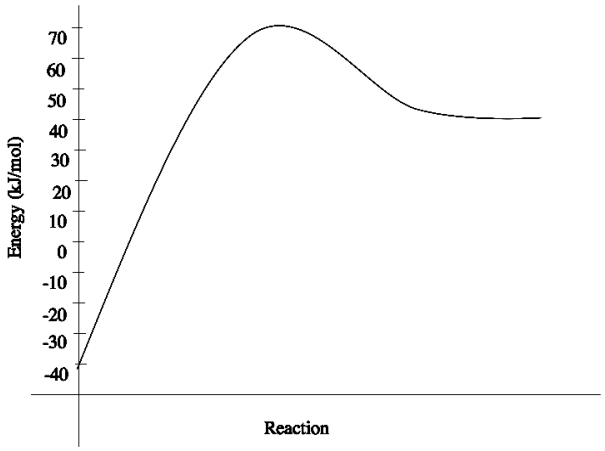
Write the equation at the

i. Anode. (1 mark)

ii. Cathode. (1 mark)

QUESTION 37

Refer to the energy profile diagram below and answer the questions that follow.



a. Is the above reaction an exothermic or an endothermic reaction? (1 mark)

b. What is the change in enthalpy (ΔH) of the reaction? (1 mark)

c. What is the activation energy of the reaction? (2 marks)

d. In order to lower the activation energy, what would you do? (1 mark)

e. Name two of the factors that could affect the rate of this reaction. (2 marks)

QUESTION 38

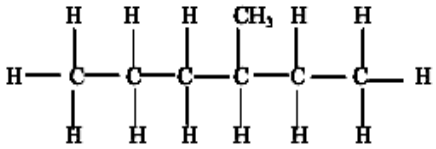
a. Draw the structural formula for the following:

i. 2,3-dimethyl-2-butene (1 mark)

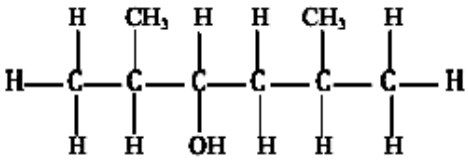
ii. 2-methylpentanol (1 mark)

b. Write the IUPAC name of the following compounds:

i. (1 mark)



ii. (1 mark)



c. Calcium carbide reacts with water to produce C_2H_2 and $Ca(OH)_2$.

Draw the structure and give the IUPAC name of C_2H_2. (2 marks)

d. Give another name for saturated hydrocarbons. (1 mark)

QUESTION 39

a. Desalting is the first step in the refining process of crude petroleum.

Give one of the reasons why desalting is carried out. (1 mark)

b. Malt is the main raw material in the production of beer.

What is malt? (1 mark)

c. Clarification is one of the steps in the production of palm oil.

What is the purpose of clarification? (1 mark)

d. Saponification is the main step in the production of soap.

Write a balanced equation of saponification reaction. (2 marks)

e. In case of low-grade ore, the gold is extracted by reaction with cyanide solution followed by precipitation of gold with zinc.

Write a balanced equation for the precipitation of gold by zinc. (2 marks)

QUESTION 40

a. A solution of sodium hydroxide in standardized by reacting it with a 0.5 M solution of sulfuric acid. It is found that 17.0 mL of the acid is required to neutralize 25.0 mL of sodium hydroxide solution.

Calculate the concentration of sodium hydroxide solution. (2 marks)

b. What is the pH of a 0.05 M solution of potassium hydroxide? (2 marks)

c. What is the pH of a 0.06 M sulfuric acid? (2 marks)

d. What is the difference between a strong acid and a weak acid? (1 mark)

END OF EXAMINATION

CHEMISTRY — 2013

PART B - ANSWER BOOKLET

Write your name, your province, school codes and your candidate number correctly and clearly in the space provided below.

Year		Province		School			Candidate No		
1	3								

Candidate Name: _____

School Name: _____

Answers written on the QUESTION paper or any other paper will NOT be marked. Write answers in the spaces as provided on this answer booklet.

FOR MARKERS USE ONLY

	Score	Markers Initials	
		M1	**M2**
Part B:			
Question 31			
Question 32			
Question 33			
Question 34			
Question 35			
Question 36			
Question 37			
Question 38			
Question 39			
Question 40			
FINAL TOTAL			

PART B: Answer Booklet

Write your answer in the space provided below. Your answers must be clear and precise.

QUESTION 31

a) (i). _____ 1

(ii). _____ 1

(iii). _____ 1

(iv). _____ 1

b) (i). _____ 1

(ii).

Ans: _____ 1

(iii). _____

_____ 1

For Markers Use Only	**Q31 Total**	

QUESTION 32

a)

Ans: _____ 2

b)

Ans: _____ 2

c)

Ans: _____

3

For Markers Use Only	**Q32 Total**	

QUESTION 33

a) (i) _____

_____ 1

(ii) _____

_____ 1

(iii) _____

_____ 1

b) _____ 2

c) (i) _____ 1

(ii) _____ 1

For Markers Use Only	**Q33 Total**	

QUESTION 34

a) (i) _____ 2

(ii) _____ 1

b) (i) _____ 1

(ii) _____ 2

(iii) _____ 1

For Markers Use Only	**Q34 Total**	

QUESTION 35

a) (i) _____	1
(ii) _____	1
(iii) _____	1
b) _____	2
c) (i) _____	1
(ii) _____	1
For Markers Use Only **Q35 Total**	

QUESTION 36

a) _____	2
b) (i) _____	1
(ii) _____	1
(iii) _____	1
c) (i) anode: _____	1
(ii) cathode: _____	1
For Markers Use Only **Q36 Total**	

QUESTION 37

a) _____ 1

b)

Ans: _____ 1

c)

Ans: _____ 2

d) _____

_____ 1

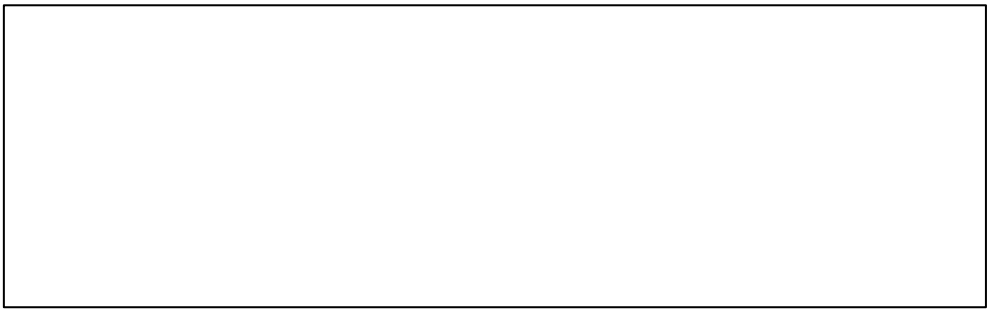
e) (i)_____ 1

(ii)_____ 1

For Markers Use Only	**Q37 Total**	

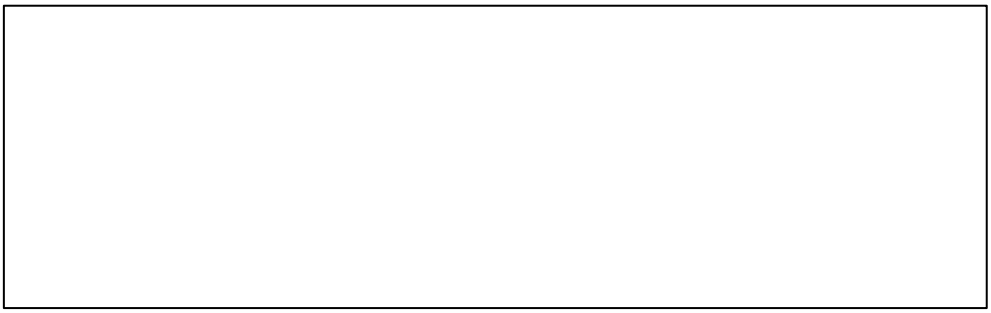
QUESTION 38

a) (i)



1

(ii)

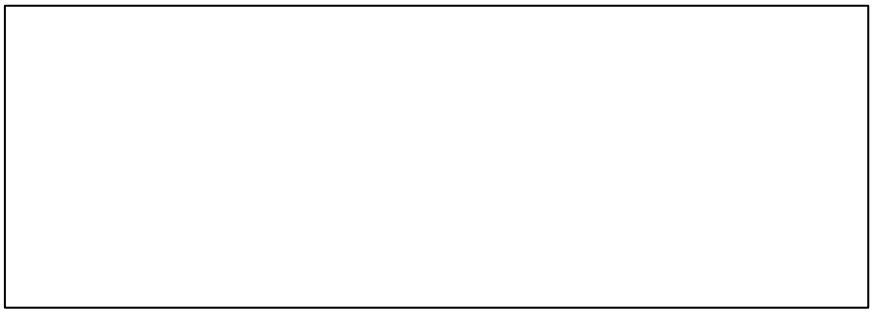


1

b) (i) _____ 1

(ii) _____ 1

c) Structure:



1

Name: _____ 1

d) _____ 1

For Markers Use Only **Q38 Total**

QUESTION 39

a) _____ 1

b) _____ 1

c) _____ 1

d) 2

e) 2

For Markers Use Only	**Q39 Total**	

QUESTION 40

a)

Ans: _____ 2

b)

Ans: _____ 2

c)

Ans: _____ 2

d) _____

_____ 1

For Markers Use Only	**Q40 Total**	

CHEMISTRY DATA SHEET

1 mole of any element contains 6.02×10^{23} molecules

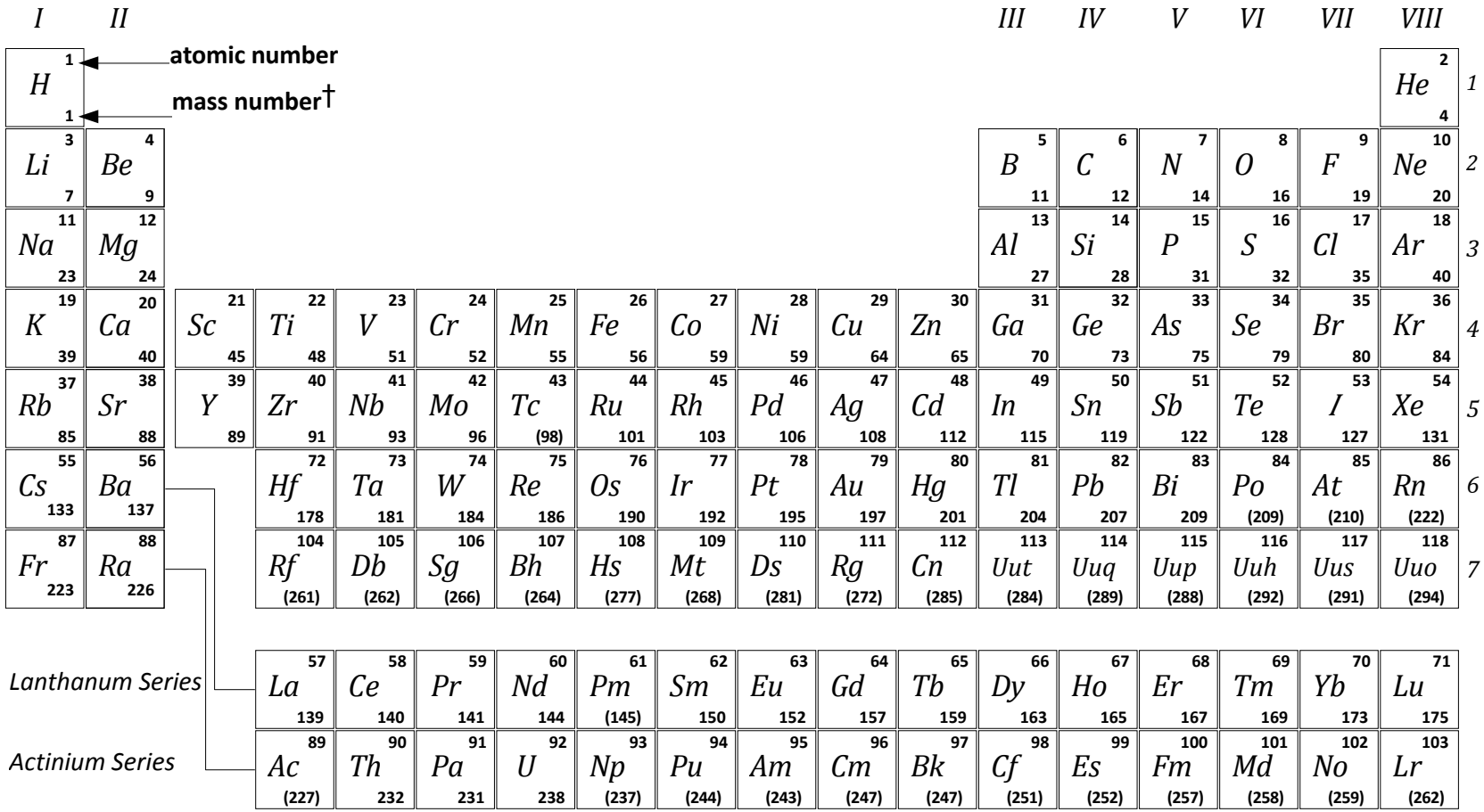
FORMULAE OF COMMON IONS	
Positive	**Negative**
Ag^{+}	Br^{-}
Al^{3+}	Cl^{-}
Ca^{2+}	CO_3^{2-}
Cu^{2+}	HCO_3^{-}
Fe^{2+}	HSO_4^{-}
Fe^{3+}	I^{-}
H^{+}	NO_3^{-}
K^{+}	O^{2-}
Li^{+}	OH^{-}
Mg^{2+}	S^{2-}
Na^{+}	SO_3^{2-}
NH_4^{+}	SO_4^{2-}
Pb^{2+}	PO_4^{3-}
Zn^{2+}	HPO_4^{3-}
Ba^{2+}	H_2PO^4

REACTIVITY SERIES	
Elements	**Reactivity**
Potassium	*Most reactive*
Sodium	
Lithium	
Calcium	
Magnesium	
Aluminium	
(Carbon)	
Zinc	
Iron	*Decrease in Reactivity*
Tin	
Lead	
(Hydrogen)	
Copper	
Silver	
Gold	
Platinum	*Least reactive*

SOLUBILITY OF SALTS AND HYDROXIDES IN COLD WATER

Soluble	Insoluble
All sodium, potassium and ammonium salts	
All nitrates	
Most bromides, chlorides & iodides	Bromides, chlorides & iodides of silver & lead*
Most sulphates	Sulphates of barium, calcium & lead*
Carbonates & hydroxides of sodium, potassium & ammonium	Most other carbonates & hydroxides
Calcium hydroxide is only slightly soluble	*lead salts are more soluble in hot water

Chemistry Data Sheet
The Periodic Table of Elements



† mass number relates to the commonest isotope.

For all calculations assume relative atomic mass = mass number, except for CHLORINE.
For chlorine, relative atomic mass = 35.5