Candidate Name	Centre Number					Candidate Number				
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GCSE

CHEMISTRY

UNIT 1: CHEMICAL SUBSTANCES, REACTIONS AND ESSENTIAL RESOURCES
FOUNDATION TIER

SAMPLE ASSESSMENT MATERIALS

(1 hour 45 minutes)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**10**	
2.	**7**	
3.	**8**	
4.	**7**	
5.	**6**	
6.	**5**	
7.	**8**	
8.	**9**	
9.	**9**	
10.	**11**	
Total	**80**	

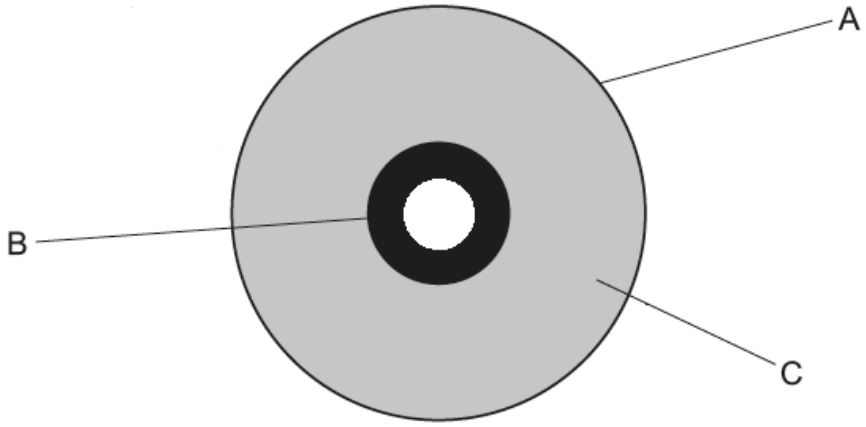
ADDITIONAL MATERIALS
In addition to this paper you will require a calculator.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets at the end of each question or part-question.
Question **5** is a quality of extended response (QER) question where your writing skills will be assessed.

Answer **all** *questions.*

1. The layered structure of the Earth is shown in the diagram.



Earth

(a) Draw a line from each letter to the correct name of layer. [3]

A

B

C

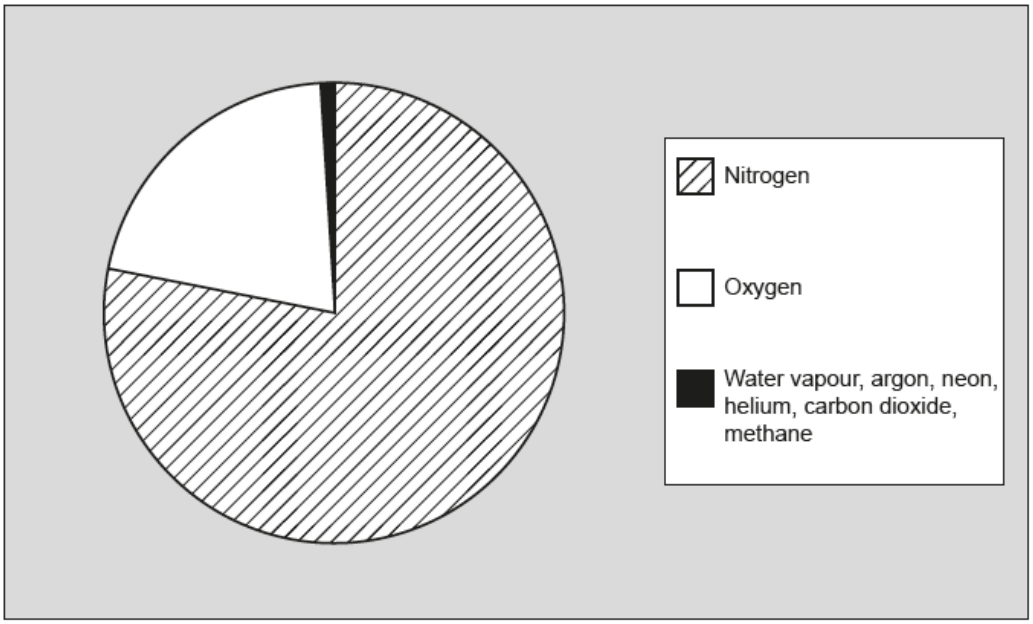
mantle

crust

outer core

inner core

(b) The chart shows the gases present in today's atmosphere.



The named gases have many uses. Select the correct gas from the chart to match each of the following descriptions.

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

(i) The gas used in weather balloons. …… [1]

(ii) One of the gases that formed the early atmosphere. [1]

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(iii) The gas produced by burning natural gas and responsible for global warming. [1]

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(c) Describe the test that can be used in the laboratory to test for oxygen gas. Include the observation that tells you the gas is oxygen. [2]

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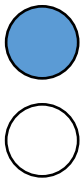
(d) Use the following key to draw diagrams to represent molecules of oxygen gas (O_2) and carbon dioxide (CO_2). [2]



carbon

oxygen

oxygen	carbon dioxide

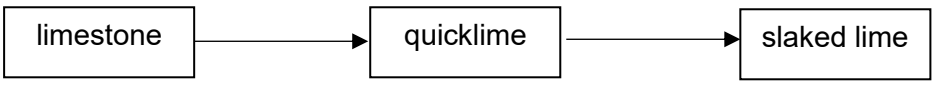
10

2. Limestone has many different uses.

(a) Tick (✓) the **two** boxes that show a use of limestone. [2]

making dyes	☐
making glass	☐
extraction of aluminium	☐
making cement	☐
making plastics	☐

(b) The flowchart shows the materials that can be formed from limestone.



(i) What is done to limestone to change it to quicklime? [1]

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(ii) Water is added to quicklime to form slaked lime. Give **two** observations you would make during this reaction. [2]

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(c) Limestone is obtained by quarrying. State and explain **one** argument used by people who oppose the opening of a quarry in their area. [2]

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7

3. The Sun contains mainly the elements hydrogen and helium.

(a) State what you understand by the term *element.* [2]

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(b) The diagrams show an atom of hydrogen and an atom of helium. Use the diagrams to help you complete the sentences below.

(i) The symbol ● represents a ……. [1]

(ii) The mass number of this helium atom is …… [1]

(c) The Sun is 72 % hydrogen and 26 % helium. The rest is made from other elements. Calculate the percentage of other elements in the Sun. [1]

percentage = ……%

(d) Neon is directly below helium in the Periodic Table. It has three stable isotopes – neon-20, neon-21 and neon-22.

(i) Draw a diagram to show the electronic structure of neon. [1]

(ii) Describe how the nuclei of neon-20, neon-21 and neon-22 are similar and how they are different. [2]

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8

4. This question is about elements, compounds and mixtures.

(a) Refer to the table of common ions and the Periodic Table to answer parts (i)-(iv).

(i) Name the metal that has an atomic number of 64. [1]

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(ii) Name a non-metal which is found in Period 3 of the Periodic Table. [1]

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(iii) Give the chemical formula of the product formed when lithium reacts with oxygen. [1]

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(iv) Give the chemical formula of the compound in a solution which gives an apple-green flame test and a white precipitate with silver nitrate solution. [2]

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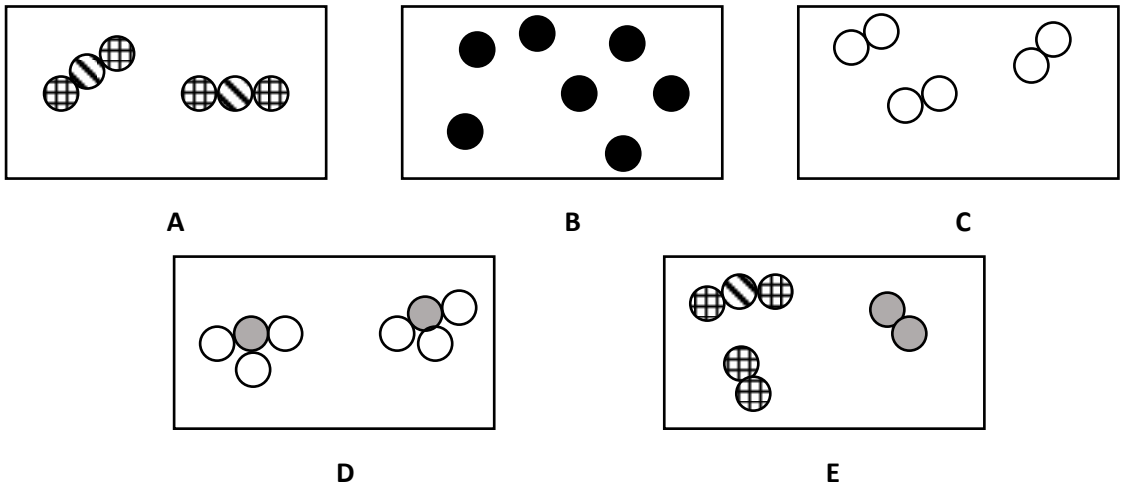
(b) Five different substances (**A**, **B**, **C**, **D** and **E**) are shown in the diagrams.



Identify the substances which are compounds and those which are mixtures. Write the appropriate letters in the correct columns. [2]

Compound	Mixture

5. Burning fossil fuels such as coal causes acid rain. Describe how acid rain is formed and its effects on the environment. [6 QER]

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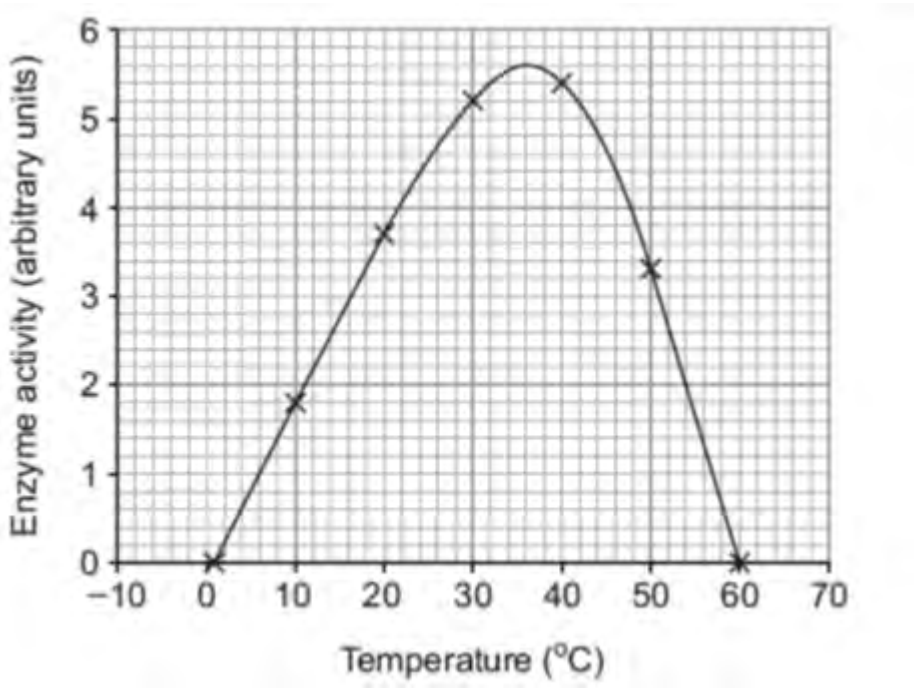
6

6. The activity of an enzyme at various temperatures is shown in the graph.



Use the graph to answer parts (a)-(c).

(a) State the temperature at which the enzyme activity is highest. [1]

temperature = …… °C

(b) Calculate the difference between the enzyme activity at 10 °C and 30 °C. [2]

difference = ……. arbitrary units

(c) Pepsin is an enzyme which breaks down proteins in the stomach. Its optimum activity is pH 2. Describe how this property of pepsin is different from most enzymes. [2]

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5

7. Potassium reacts vigorously with water forming potassium hydroxide and hydrogen gas, H_2.

(a) Complete and balance the symbol equation for this reaction. [2]

$2K + 2H_2O \rightarrow$ …….. + ……

(b) Give **two** observations made when potassium reacts with water in a large trough. [2]

1. ……..

2. ……..

(c) Caesium is an element in the same group as potassium. State why the reaction of caesium with water is not shown as a classroom demonstration. [1]

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(d) Potassium hydroxide reacts with nitric acid forming potassium nitrate (KNO_3) and with sulfuric acid forming potassium sulfate (K_2SO_4).

A student told her teacher that K_2SO_4 contains a greater percentage by mass of oxygen than is found in KNO_3. Is she correct? Show your working. [3]

A_r(K) = 39 A_r(N) = 14 A_r(O) = 16 A_r(S) = 32

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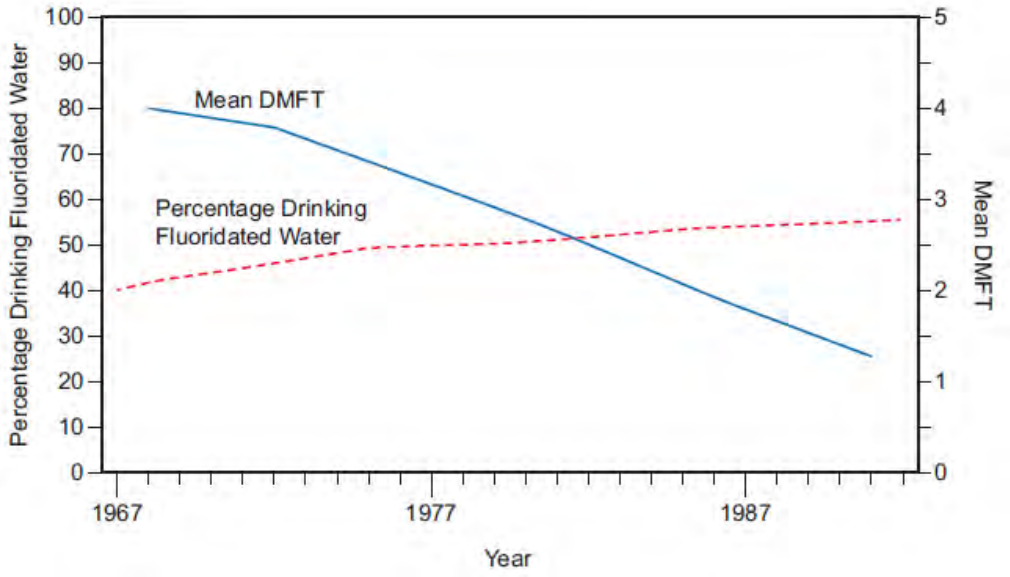
8

8. (a) The graphs show the percentage of people drinking fluoridated water in the U.S.A. and the mean number of decayed, missing or filled teeth (DMFT) among children aged 12 years between 1967 and 1992.



(i) Describe the relationship between the percentage of people drinking fluoridated water and the mean DMFT between 1967 and 1992. [1]

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(ii) Which of the following would have provided the data plotted in these graphs? Tick (✓) two boxes. [2]

Internet search	☐
Dental records	☐
Water company records	☐
Experiments	☐
Newspapers	☐

(iii) Explain why the graphs alone do not provide enough evidence to support the fluoridation of drinking water. [3]

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(b) The table below shows the volume of soap solution required by different samples of water to form a permanent lather. In each case 25 cm^3 of the water samples were used and the soap solution was added 1 cm^3 at a time.

Sample	Mean volume of soap solution added (cm^3)
distilled water	2
A before boiling	8
B before boiling	11
C before boiling	14
A after boiling	8
B after boiling	6
C after boiling	2

(i) State which of water samples **A**, **B** or **C** is the least hard **before** boiling. Give the reason for your answer. [1]

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(ii) Why was each sample boiled? [1]

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(iii) State which of samples **A**, **B** or **C** contains both temporary and permanent hardness. Give the reason for your answer. [1]

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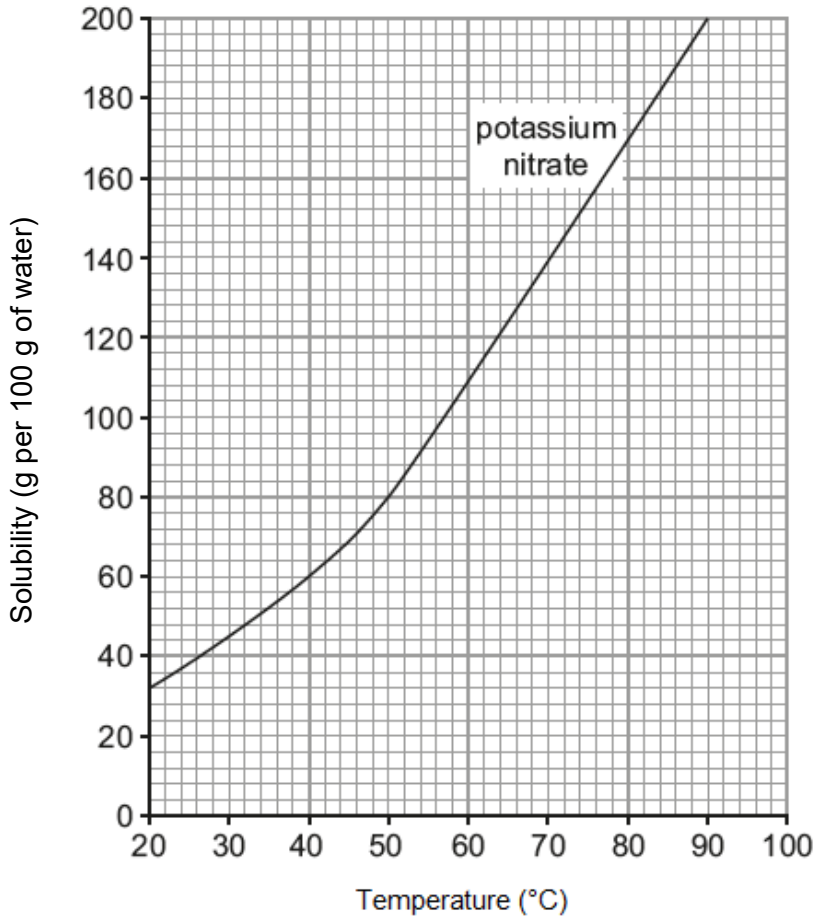
9

9. The graph shows the solubility curve of potassium nitrate.



(a) The table shows the solubility of lead nitrate at different temperatures.

Temperature (°C)	20	40	60	80	100
Solubility of lead nitrate (g per 100 g of water)	52	72	90	112	136

(i) Plot the solubility of lead nitrate on the grid above. [3]

(ii) Using the graphs, compare the solubilities of potassium nitrate and lead nitrate between 20 °C and 100 °C. [3]

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(b) Lucy wanted to find the solubility of substance **X** at room temperature. She measured 20.0 g of the substance into a conical flask and added 50.0 g of water. She stirred the mixture carefully until no more solid dissolved. She then separated the undissolved solid using a filter paper and dried the paper and solid overnight before weighing.

Her results were as follows.

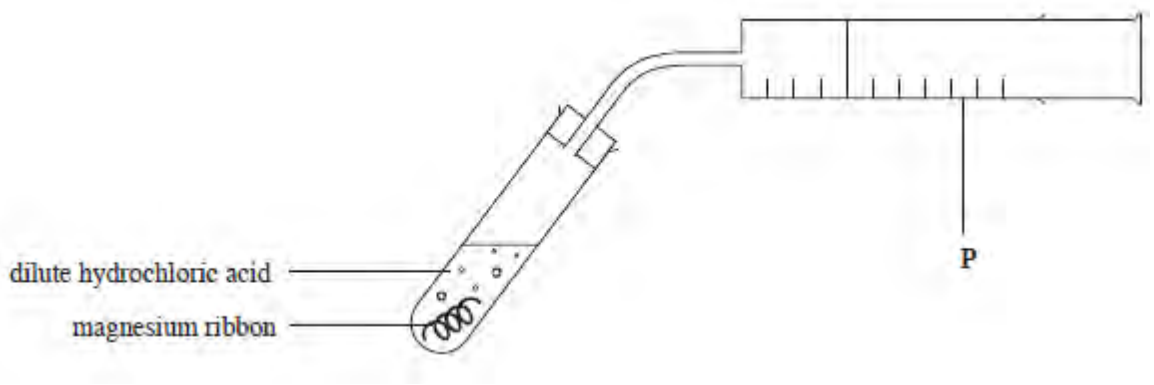
Mass of dry filter paper + substance **X** = 5.1 g
Mass of dry filter paper = 0.2 g

Use this information to calculate the solubility of substance **X** in g per 100 g of water. [3]

solubility = …… g per 100 g of water

9

10. Trystan carried out an investigation into the reaction between dilute hydrochloric acid (HCl) and magnesium ribbon. He reacted the magnesium with five different concentrations of acid and measured the volume of hydrogen gas produced after 30 s using the apparatus below.



(a) Name apparatus **P**. …….. [1]

(b) Trystan's result are shown below.

Concentration of HCl (mol/dm^3)	Volume of H_2 gas produced (cm^3)
0.2	8
0.5	17
1.0	26
1.5	30
2.0	30

(i) State what can be concluded about the effect of concentration of acid on the rate of the reaction. Explain this effect using your understanding of particle theory. [3]

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(ii) Trystan initially measured the volume of gas collected in 60 s. Explain why he amended his plan after making these measurements. [2]

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(iii) State **two** factors other than concentration which could affect the rate of the reaction between hydrochloric acid and magnesium. [2]

Factor 1……

Factor 2……

(c) Limestone is made of calcium carbonate. It reacts slowly with acid rain and is gradually eaten away.

Design an experiment based on this reaction to identify which of three samples of rainwater is the most acidic. [3]

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END OF PAPER

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Avogadro's number, $L = 6 \times 10^{23}$

PERIODIC TABLE OF ELEMENTS

1	2											3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radius	$^{227}_{89}$Ac Actinium															

Key: