



Grade 8 MYP Yr. 3

Unit 3: Everyday Acids and Bases

Practice booklet #1

Key concept: **Change**

Related concepts: **Environment, Interaction**

Global Context: **Globalization and Sustainability – Natural Resources and Public Goods.**

Statement of Inquiry:

The **interactions** of different substances may **change natural resources and goods** in the **environment**.

ATL Skills:

Thinking – Creative thinking:

- Use brainstorming and visual diagrams to generate new ideas and inquiries. (Ai, Bi, Bii)
- Consider multiple alternatives, including those that might be unlikely or impossible. (Aii)

Thinking - Critical Thinking:

- Interpret data (Aiii, Ci, Cii)
- Test generalizations and conclusions (Bii, Biii, Biv)
- Evaluate evidence and arguments (Ciii, Civ, Cv)

IBLP: Thinker / Inquirer

Academic Excellence



Digital Citizenship

Digital citizenship at Amman Academy is defined as a framework that helps instil in students a sense of digital ethics, digital literacy, online safety, and digital health and wellbeing so that they become digitally responsible, tolerant individuals that embrace differences within a diverse digital community.

Global Citizenship

Global Citizenship at Amman Academy is defined as students' engaged participation in an international curriculum and diverse experiences that allow them to cross national, cultural, socio-economic, racial, religious, and political boundaries to acknowledge similarities and to understand and learn from differences. Global citizenship does not stop at gaining knowledge, but also works to create a sense of responsibility towards one's local and global community and to find ways to contribute towards the betterment of the human experience.

Students' name: **Model answer**

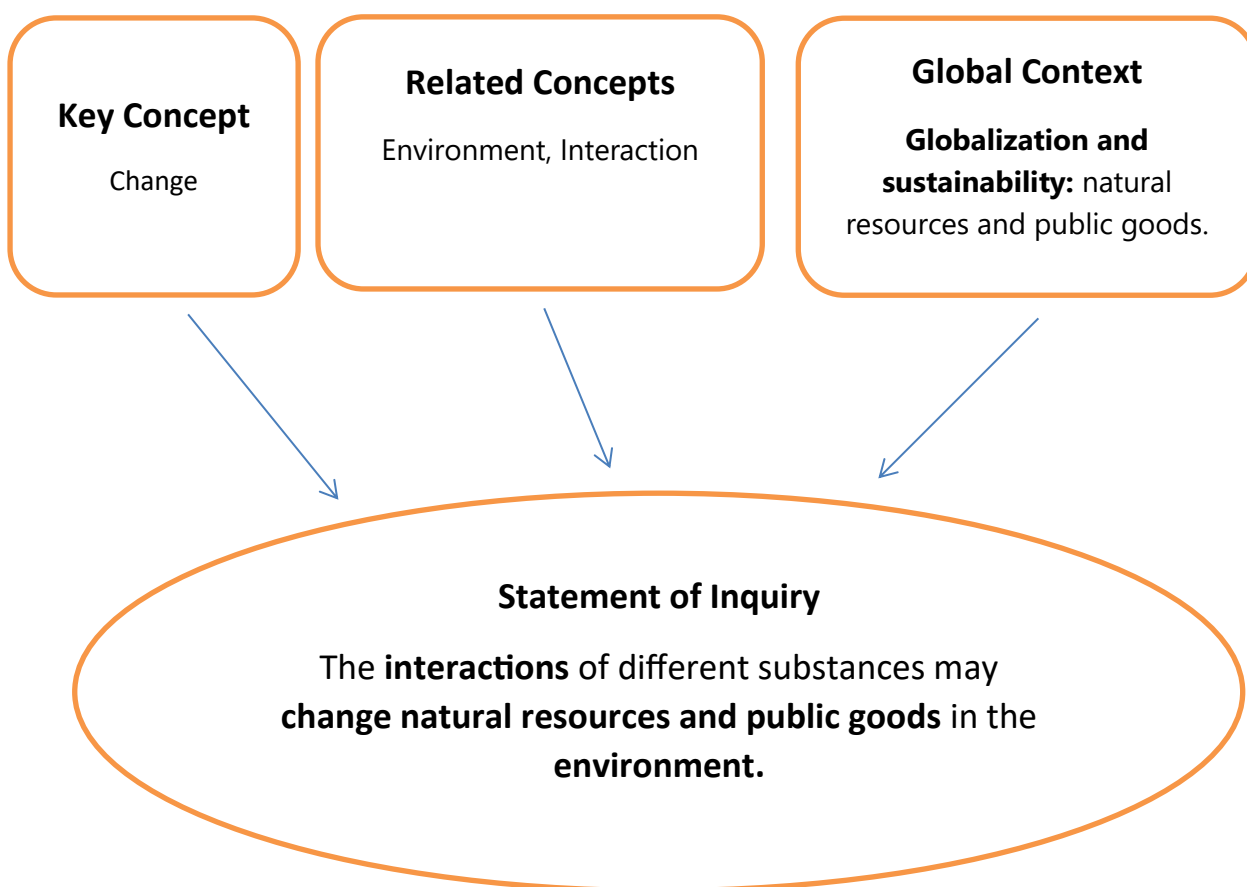
Section: _____



Unit Overview

MYP Year 3 (Grade 8)

Unit Title: Everyday acids and bases





Inquiry Questions

Factual:

- 1- What are atomic number and atomic mass?
- 2- What are the properties of groups and periods in the periodic table?
- 3- What are the charges of elements according to their group number?
- 4- How to name polyatomic anions along with their charges?
- 5- What is the chemical formula for compounds?
- 6- What is reactivity series?
- 7- How do single displacement reactions work?
- 8- How to balance chemical equations?
- 9- How do double displacement reactions work?
- 10- What is the electronic configuration for both atoms and their corresponding ions?
- 11- What is an acid and what are its key properties?
- 12- How does acid rain form and what are its consequences?
- 13- What is a base and what are its key properties?
- 14- What is an alkali and what is an alkaline solution?
- 15- What are the safety precautions that should be taken when handling acids and bases?
- 16- What is the pH scale and how is it used to measure the acidity of substances?
- 17- What is an indicator and what are commonly used indicators?
- 18- What are the characteristics of solutions?
- 19- What are solutes and solvents in a solution.?
- 20- What is the classification of solutions in terms of their concentration?
- 21- How to calculate the concentration of solutions?
- 22- How to compare the solubility of solutes?
- 23- How does temperature and pressure affect solubility?
- 24- What are the factors that affect how fast a solid solute dissolves in a liquid solvent?
- 25- What is the difference between concentrated and dilute acids.
- 26- What is neutralization?
- 27- How do acids affect life; for example, acid erosion of teeth, use of acids in swimming pools?
- 28- What are the reactions that acids undergo and what are some of the observations that could be made for each?

Conceptual:

- 1- How do the interactions of materials change the natural resources in the environment?
- 2- How do changes in acids and bases cause different interactions?

Debatable:

- 1- To what extent do human interactions with material cause changes on the natural good in the environment?
- 2- What is the role of humans in managing the material interactions to cause positive change in natural goods and resources?

Approaches to learning:

* Skills needed to solve questions included in worksheets and exams:

ATL Cluster	ATL Specific Skill
Creative Thinking	<ul style="list-style-type: none"> Use brainstorming and visual diagrams to generate new ideas and inquiries. (Ai)
	<ul style="list-style-type: none"> Consider multiple alternatives, including those that might be unlikely or impossible. (Aii)
Critical Thinking	<ul style="list-style-type: none"> Interpret data. (Aiii)

* Skills needed to lab research report:

ATL Cluster	ATL Specific Skill
Creative Thinking	<ul style="list-style-type: none"> Use brainstorming and visual diagrams to generate new ideas and inquiries. (Bi, Bii)
Critical Thinking	<ul style="list-style-type: none"> Interpret data (Ci, Cii)
	<ul style="list-style-type: none"> Test generalizations and conclusions (Bii, Biii, Biv)
	<ul style="list-style-type: none"> Evaluate evidence and arguments (Ciii, Civ, Cv)

Summative Assessments:

Criterion A: Knowing and understanding.

Learners will be able to:

- i. Describe scientific knowledge.
- ii. Apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations.
- iii. Analyse information to make scientifically supported judgments.

Criterion B: Inquiring and designing.

Learners will be able to:

- i. Describe a problem or question to be tested by a scientific investigation.
- ii. Outline a testable hypothesis and explain using scientific reasoning.
- iii. Describe how to manipulate the variables, and describe how data will be collected.
- iv. design scientific investigations.

Criterion C: Processing and evaluating.

Learners will be able to:

- i. Present collected and transformed data.
- ii. Interpret data and describe results using scientific reasoning.
- iii. Discuss the validity of a hypothesis based on the outcome of the scientific investigation.
- iv. Discuss the validity of the method.
- v. Describe improvements or extensions to the method.

Timeline:

Week No. Date	Topic(s)
Week 1 7-11/1	<ul style="list-style-type: none"> Atomic Structure and Periodic Table Periodic Table, Metals, Non-metals.
Week 2 14-18/1	<ul style="list-style-type: none"> Ionic Charges and Types of Reactions Naming Ionic Compounds
Week 3 21-25/1	<ul style="list-style-type: none"> Single and Double Displacement reactions Solutions, Colloids, Suspensions.
Week 4 28/1-1/2	<ul style="list-style-type: none"> Concentration. Factors affecting solubility.
Week 5 4-8/2	<ul style="list-style-type: none"> Arrhenius Acid and Base. Bronsted-Lowry Acids and Bases.
Week 6 11-15/2	<ul style="list-style-type: none"> Naming Acids and Bases Properties of Acids, Bases and Salts.
Week 7 18-22/2	<ul style="list-style-type: none"> pH Scale and Acid Base Indicators Reactions of acids and bases.
Week 8 25-29/2	<ul style="list-style-type: none"> Simple Titration. Unit Action.

Table of Topics:

1. Atoms, Periodic Table

- 1.1. Atomic Structure and Bohr's Model
- 1.2. Periodic Table (Groups and Periods)
- 1.3. Metals, Metalloids and Non-metals.

2. Ionic Compounds

- 2.1. Ionic Charges.
- 2.2. Naming Ionic compounds.
- 2.3. Naming polyatomic ions.

3. Single and Double Displacement reactions

- 3.1. Reactivity Series.
- 3.2. Balancing Chemical Equations.
- 3.3. Single Displacement reaction.
- 3.4. Double Displacement reaction.

4. Solutions

- 4.1. Properties of Solutions.
- 4.2. Colloids and Suspensions.
- 4.3. Concentration and Calculations.
- 4.4. Factors Affecting Rate of Dissolving.
- 4.5. Factors Affecting Solubility.

5. Acids and Bases

- 5.1. Arrhenius Acids and Bases.
- 5.2. Bronsted-Lowery Acids and Bases.
- 5.3. Naming Acids and Bases.
- 5.4. Strong Acids and Bases.
- 5.5. Properties of Acids and Bases.
- 5.6. pH Scale and Acid-Base indicators.

6. Acid-Base Reactions and Titration

- 6.1. Acid Reactions.
- 6.2. Base Reactions.
- 6.3. Titration of strong acid with strong base.



Atomic Structure and Bohr's Model

Elicit: (Class Discussion)

Q1) Recall the parts of an atom. (Ai 1-2)

(Recall: Remember or recognize from prior learning experiences)

Part of the atom	Location in the atom	Electric Charge	Relative Mass
Proton	Nucleus	Positive (+)	Approximately 1 atomic mass unit (amu)
Neutron	Nucleus	Neutral (0)	Approximately 1 atomic mass unit (amu)
Electron	Electron Cloud	Negative (-)	Very small compared to protons and neutrons

Engage: (Individual work)

Q2) Sketch how do you think an atom look like.

(Sketch: Represent by means of a diagram or graph (labelled as appropriate). The sketch should give a general idea of the required shape or relationship and should include relevant features.)

Explore: (Video – Pair work)

Watch the following video and answer the following questions:

[GCSE Chemistry - History of the Model of the Atom #7](#)

Q3) State the name of the atomic models and **outline** the key features for each. (Ai 5-6).

(State: Give a specific name, value or other brief answer without explanation or calculation).

(Outline: Give a brief account or summary)

Scientist	Atomic Model	Key Features
John Dalton	Solid Sphere	<ol style="list-style-type: none"> 1. Atoms are indivisible and indestructible. 2. Atoms of the same element are identical. Atoms of different elements are different.
J.J. Thomson	Plum Pudding	- Atoms contain electrons embedded in a positive.
Ernest Rutherford	Nuclear model	<p>The atom has a central nucleus: Most of the mass of an atom is concentrated in a tiny, dense nucleus at its center. The nucleus is positively charged. Electrons are located in the electron Cloud: The electrons are negatively charged.</p>
Niels Bohr	Nuclear model	Electrons orbit the nucleus in well-defined orbits. These orbits have specific energy levels, and electrons can only occupy these discrete orbits.
James Chadwick	Nuclear model	Chadwick discovered the neutron, a subatomic particle with no electric charge located in the nucleus.

Q4) Recall the following terms (Ai 1-2)

(Recall: Remember of recognize from prior learning experiences.)

Factual:

What are atomic number and atomic mass?

a) Atomic Number.

The atomic number of an element is the **number of protons found in the nucleus of an atom** of that element. The atomic number determines the element's identity.

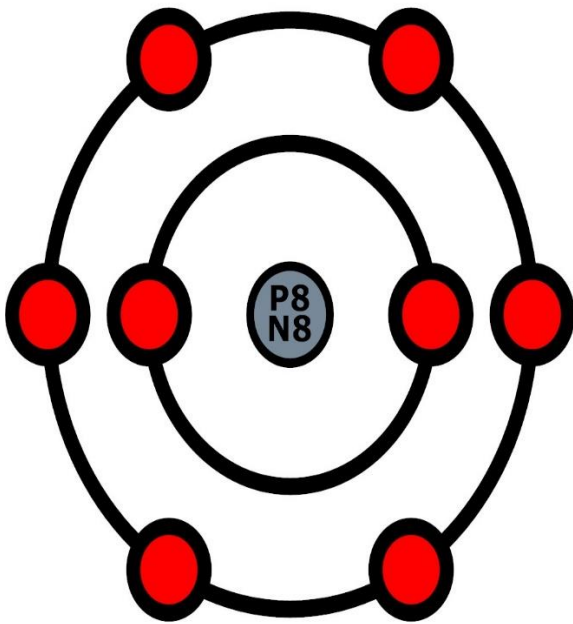
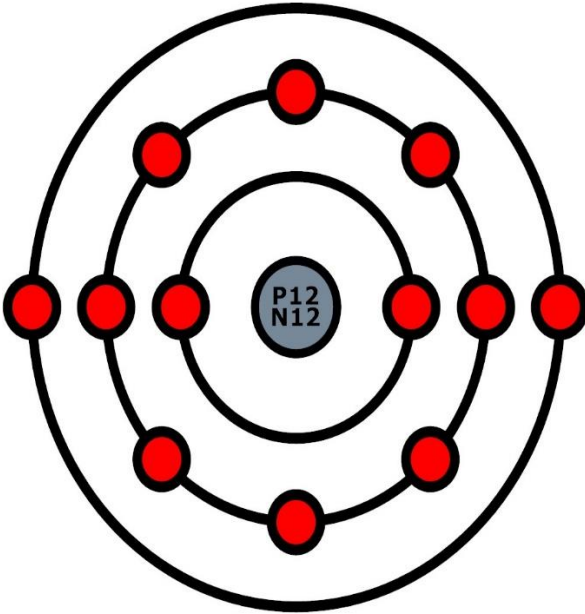
b) Atomic Mass:

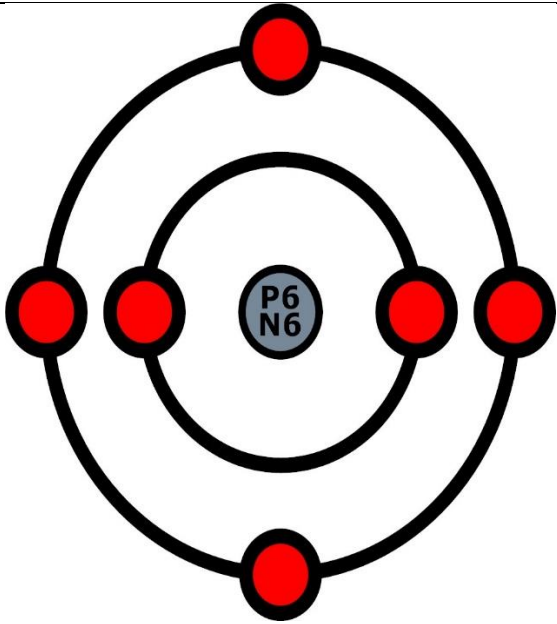
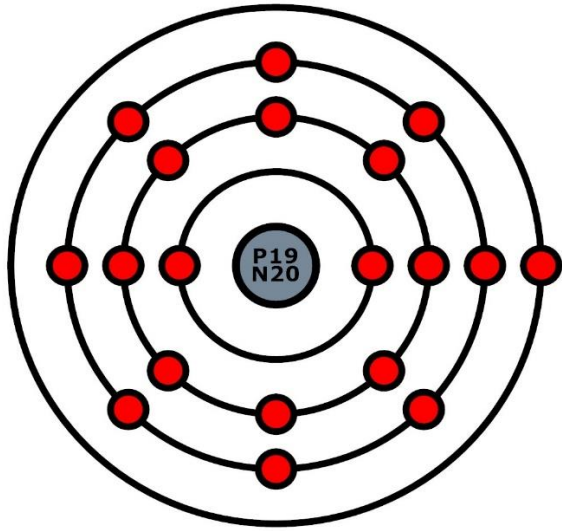
The mass number represents the total number of protons and neutrons present in the nucleus of an atom. It is used to characterize different isotopes of an element. To calculate the number of neutrons in an atom, you can subtract proton number from the mass number.

Explain: (Individual work – Class Discussion)

Q5) Draw Bohr's model for the following atoms. (Ai 3-4)

(Draw: Represent by means of labelled, accurate diagram or graph, using a pencil. A ruler (straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted (if appropriate) and joined in a straight line or smooth curve).

Oxygen atom		Magnesium atom	
			
Valence electron: 6	Group #: 6 Period #: 2	Valence electron: 2	Group #: 2 Period #: 3

Number of Energy Level: 2		Number of Energy Level: 3	
Carbon atom		Potassium atom	
			
Valence electron: 4 Number of Energy Level: 2	Group #: 4 Period #: 2	Valence electron: 1 Number of Energy Level: 4	Group #: 1 Period #: 4

Elaborate: (Individual – Class discussion)

Q6) State the electron configuration for the following elements. (Ai 3-4)
(Give a specific name, value or other brief answer without explanation or calculation.)

Sodium (Na): 2,8,1

Boron (B): 2,3

Calcium (Ca): 2,8,8,2

Silicon (Si): 2,8,4

Nitrogen (N): 2,5

Chlorine (Cl): 2,8,7

Neon (Ne): 2,8

Extend: (Pair work – Submitted on Managebac)

Group A: Research anti-matter and outline the differences and similarities between matter and anti-matter. (Present your work in a poster)

Group B: Research Rutherford's experiment and outline the set up and results that led to the discovery of the atom's nucleus. (Present your work in a poster).

Group C: Research the impact of James Chadwick discovery of the Neutrons on the development of nuclear energy. (Present your work in a leaflet.)

Factual:

What are the properties of groups and periods in the periodic table?

Periodic Table

Elicit: (Class discussion)

Q1) Recall the way the elements are organized in the periodic table. (Ai 1-2)

(Recall: Remember or recognize from prior learning experiences).

Rows: (**periods**)

which contain elements arranged in the order of increasing atomic number.

Columns: (**Groups**)

contain elements in the same family that have the same number of valence electrons.

Engage: (Individual)

Q2) Apply scientific knowledge to **identify** how elements are arranged in the periodic table by shading all metals blue, nonmetals purple and metalloids orange. (Aii 1-2)



(Identify: Provide an answer from a number of possibilities. Recognize and state briefly a distinguishing fact or feature).

1
IA
1A

2
IIA
2A

3
IIIB
3B

4
IVB
4B

5
VB
5B

6
VIB
6B

7
VIIB
7B

8
VIII
8

9
VIII
9

10
VIII
10

11
IB
1B

12
IIB
2B

13
IIIA
3A

14
IVA
4A

15
VA
5A

16
VIA
6A

17
VIIA
7A

18
VIIIA
8A

1
H
Hydrogen
1.008

3
Li
Lithium
6.941

11
Na
Sodium
22.990

19
K
Potassium
39.098

37
Rb
Rubidium
85.468

55
Cs
Cesium
132.905

87
Fr
Francium
223.020

4
Be
Beryllium
9.012

12
Mg
Magnesium
24.305

20
Ca
Calcium
40.078

38
Sr
Strontium
87.62

56
Ba
Barium
137.328

88
Ra
Radium
226.025

5
B
Boron
10.811

13
Al
Aluminum
26.982

21
Sc
Scandium
44.956

29
Cu
Copper
63.546

37
Ag
Silver
107.868

45
Au
Gold
196.967

53
Tl
Thallium
204.383

61
Tb
Terbium
158.925

69
Tm
Thulium
168.934

77
Lu
Lutetium
174.967

6
C
Carbon
12.011

14
Si
Silicon
28.086

22
Ti
Titanium
47.88

30
Zn
Zinc
65.38

38
Cd
Cadmium
112.414

46
Pd
Palladium
106.42

54
Xe
Xenon
131.294

62
Dy
Dysprosium
162.500

70
Yb
Ytterbium
173.055

78
Er
Erbium
167.259

86
Rn
Radon
222.0175

94
Pu
Plutonium
244.064

102
No
Nobelium
259.101

110
Ds
Darmstadtium
271

118
Og
Oganesson
294

7
N
Nitrogen
14.007

15
P
Phosphorus
30.974

23
V
Vanadium
50.942

31
Ga
Gallium
69.723

39
Y
Yttrium
88.906

47
Nb
Niobium
92.906

55
Re
Rhenium
186.207

63
Eu
Europium
151.964

71
Ho
Holmium
164.930

79
Ir
Iridium
192.222

87
Au
Gold
196.967

95
Am
Americium
243.061

103
Lr
Lawrencium
262

8
O
Oxygen
15.999

16
S
Sulfur
32.066

24
Cr
Chromium
51.996

32
Ge
Germanium
72.631

40
Zr
Zirconium
91.224

48
Mo
Molybdenum
95.95

56
Ba
Barium
137.328

64
Gd
Gadolinium
157.25

72
Hf
Hafnium
178.49

80
Hg
Mercury
200.59

88
Po
Polonium
209

96
Cm
Curium
247.07

104
Fm
Fermium
257.095

112
Cn
Copernicium
285

120
Ubn
Unbinilium
289

9
F
Fluorine
18.998

17
Cl
Chlorine
35.453

25
Mn
Manganese
54.938

33
As
Arsenic
74.922

41
Nb
Niobium
92.906

49
In
Indium
114.818

57
La
Lanthanum
138.905

65
Tb
Terbium
158.925

73
Tm
Thulium
168.934

81
Lu
Lutetium
174.967

89
Ac
Actinium
227.028

97
Bk
Berkelium
247.07

105
Md
Mendelevium
258.1

113
Nh
Nihonium
286

121
Ubn
Unbinilium
289

10
Ne
Neon
20.180

18
Ar
Argon
39.948

26
Fe
Iron
55.845

34
Se
Selenium
78.971

42
Ru
Ruthenium
101.07

50
Sn
Tin
118.711

58
Ce
Cerium
140.116

66
Dy
Dysprosium
162.500

74
Ho
Holmium
164.930

82
Er
Erbium
167.259

90
Th
Thorium
232.038

98
Cf
Californium
251.08

106
Lv
Livermorium
293

114
Fl
Flerovium
289

122
Ubn
Unbinilium
289

1
H
Hydrogen
1.008

2
He
Helium
4.003

10
Ne
Neon
20.180

18
Ar
Argon
39.948

26
Fe
Iron
55.845

36
Kr
Krypton
84.798

44
Ru
Ruthenium
101.07

52
Te
Tellurium
127.6

60
Nd
Neodymium
144.243

68
Er
Erbium
167.259

76
Ho
Holmium
164.930

84
Po
Polonium
209

92
U
Uranium
238.029

100
Fm
Fermium
257.095

108
No
Nobelium
259.101

116
Lv
Livermorium
293

124
Ubn
Unbinilium
289

Atomic Number

Symbol

Name

Atomic Mass

57
La
Lanthanum
138.905

58
Ce
Cerium
140.116

59
Pr
Praseodymium
140.908

60
Nd
Neodymium
144.243

61
Pm
Promethium
144.913

62
Sm
Samarium
150.36

63
Eu
Europium
151.964

64
Gd
Gadolinium
157.25

65
Tb
Terbium
158.925

66
Dy
Dysprosium
162.500

67
Ho
Holmium
164.930

68
Er
Erbium
167.259

69
Tm
Thulium
168.934

70
Yb
Ytterbium
173.055

71
Lu
Lutetium
174.967

89
Ac
Actinium
227.028

90
Th
Thorium
232.038

91
Pa
Protactinium
231.036

92
U
Uranium
238.029

93
Np
Neptunium
237.048

94
Pu
Plutonium
244.064

95
Am
Americium
243.061

96
Cm
Curium
247.07

97
Bk
Berkelium
247.07

98
Cf
Californium
251.08

99
Es
Einsteinium
[254]

100
Fm
Fermium
257.095

101
Md
Mendelevium
258.1

102
No
Nobelium
259.101

103
Lr
Lawrencium
[262]

Explore:

Watch the following video:

[GCSE Chemistry - Metals and Non-metals #10](#)

Q3) List 4 properties of each type of elements in the table below. (Ai 3-4)

(List: Give a sequence of brief answers with no explanation).

Metals	Non-Metals
Ductile	Dull
Malleable	Brittle
Lustrous	Poor conductor of heat
Conducts heat and electricity	Poor conductor of electricity

Q4) List the properties of metalloids. (Ai 3-4).

(List: Give a sequence of brief answers with no explanation).

- 1) Shiny
- 2) Brittle
- 3) Relatively good conductors of electricity
- 4) Solids at room temperature.

Explain: **(Laboratory Experiment – Group work)**

Q5) Apply scientific knowledge to predict and **suggest** the properties of the following elements. **Verify** your suggestions with scientific experiments. (Aii 5-6)

(Suggest: Propose a solution, hypothesis or other possible answer).

(Verify: Provide evidence that validate the result).

Element	Prediction		Observation	
	Appearance	Conductivity	Appearance	Conductivity
Copper			Reddish brown metal	Excellent transmitting of heat and electricity
Silicon			Hard dark grey solid	Semi-conductor
Magnesium			Silvery white metal	Conducts
Carbon			Black powder	Mainly poor conductor, except graphite conducts
Nickel			Silvery white	Conductor
Aluminium			Silvery white	Conductor
Sulphur			Pale yellow	Poor conductor



Element	Prediction		Observation	
	Malleability	Reactivity with HCl	Malleability	Reactivity with HCl
Copper			Capable of being shaped or bent	No reaction
Silicon			Not malleable	Reacts
Magnesium			Capable of being shaped or bent	Reacts
Carbon			Not malleable	Don't react
Nickel			Malleable	Reacts
Aluminium			Malleable	Reacts
Sulphur			Not malleable	No Reaction

Criterion A: Knowing and Understanding	(Ai) Describe scientific knowledge
ATL Cluster	Thinking – Creative Thinking
ATL specific indicator	Use brainstorming and visual diagrams to generate new ideas and inquiries. (Ai)
The skill strategy that will be explicitly taught and practiced is:	Criteria based experiment.
The Formative assessment	Describe scientific knowledge.



HOW TO CREATE INFOGRAPHICS

VISUALIZE

Using geometric shapes, graphs, charts, and diagrams can all help you visualize data in a clean and organized way.

01



BE CREATIVE

Express yourself. Do not neglect using unusual typography, illustrations, icons, and other elements.

02



BE SIMPLE

Knowing your target audience is also very helpful in the process of making infographic designs.

03



BE SMART

Try to make schemes and sketch some drafts including the proper info on the topic.

04



DESIGN SMARTLY

There is room for creativity in creating infographics, so there are no exact design guidelines, of course.

05



BE CLEAR AND HONEST

Give readers the opportunity to find additional information. Provide them with additional links and so on.

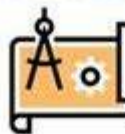
06



BE ACCURATE

Use different shapes and sizes, and combine them with each other to provide the user with the clearest and most memorable visuals.

07



BE RELEVANT

Looking for your own style, don't forget about the matching topic and appearance of your infographic charts.

08



Elaborate: **(Design an infographic).**

You are a scientist who is tasked to **design** an infographic to show the effects of household chemicals on the environment. **Select** a household chemical and **identify** its uses and risks.

(Design: Produce a plan, simulation or model).

(Select: Choose from a list or group).

(Identify: Provide an answer from a number of possibilities. Recognize and state briefly a distinguished fact or feature)



Assessment Rubric

Criterion	Standard				Points
	1-2	3-4	5-6	7-8	
Visualization	No shapes or diagrams used	Few shapes and diagrams are used.	Shapes and diagrams are used with good organization.	Shapes and diagrams are used meaningfully with great organization.	
Creativity	Dull and doesn't contain any self-expression.	Contains some creative parts.	Creative and attract the eye.	Original, highly creative and keep viewers engaged.	
Simplicity	Messy.	Complicated and need guidance to follow.	Easy to follow but some parts are unsuitable.	Info is suitable and easy to follow and learn.	
Clarity	Unclear and ambiguous.	Contain parts that are unclear.	Clear	Clear and easy to reach additional information.	
Accuracy and Honesty	Information is inaccurate and dishonest.	Information contains many inaccuracies.	Information is mainly accurate with few mistakes.	Information is completely accurate and honest.	
Relevance	Information presented is irrelevant.	Information presented is partially relevant	Most information is relevant.	All information is relevant.	
				Total Points	

Assessment Rubric

Criterion	Standard				Points
	1-2	3-4	5-6	7-8	
Visualization	No shapes or diagrams used	Few shapes and diagrams are used.	Shapes and diagrams are used with good organization.	Shapes and diagrams are used meaningfully with great organization.	



Creativity	Dull and doesn't contain any self-expression.	Contains some creative parts.	Creative and attract the eye.	Original, highly creative and keep viewers engaged.	
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Relevance	Information presented is irrelevant.	Information presented is partially relevant	Most information is relevant.	All information is relevant.	
				Total Points	

Reflect on your evaluation of the infographic:

Ionic Charges:

Engage: (Video - class discussion)

Watch the following video:

[What are ions | Properties of Matter | Chemistry | FuseSchool](#)

Factual:

What are the charges of elements according to their group number?

Q1) State the following definitions (Ai 3-4)

(State: give a specific name, value or other brief answer without explanation or calculation).

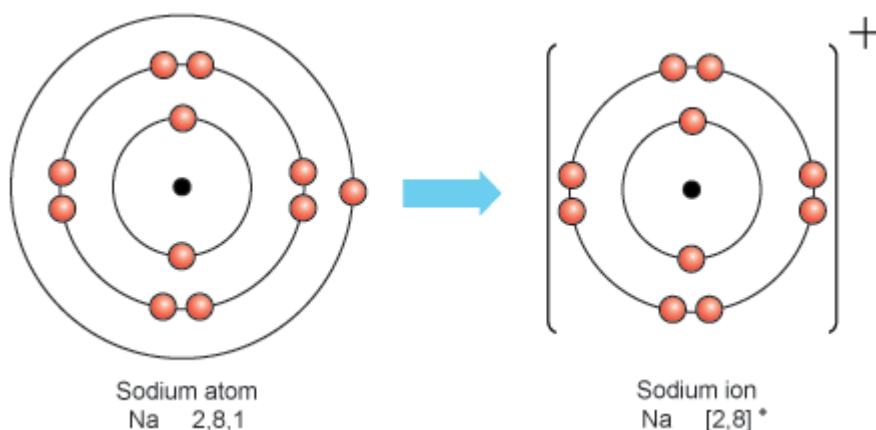
Cation: A cation is a positive ion. Example: an atom that lost its valence electrons.

Anion: an anion is a negative ion. Example: an atom that gained electrons to fill its valence energy level.

Q2) Outline the formation of sodium ion Na^+ . (Ai 5-6)

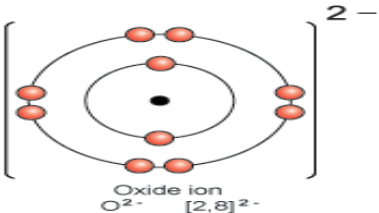
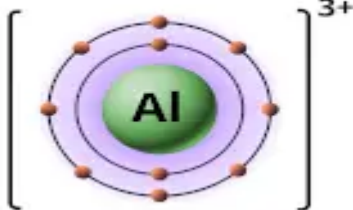
(Outline: give a brief account or summary)

sodium atom loses electron from its outer most layer (valence electron) and becomes a positive ion.



Q3) Draw the ionic structure for the following ions: (Ai 3-4)

(Draw: represent by means of a labelled, accurate diagram or graph)

O^{2-}	Al^{3+}
 <p style="text-align: center;">Oxide ion O^{2-} [2,8]²⁻</p>	

Explore: (class discussion)

Q4) Outline the ionic charges and number of valence electrons for the groups by filling in the table below. **(Ai 5-6)**

(Outline: Give a brief account or summary)

Group	Ionic charge	Number of valence electrons	Example
1	1+	1	Na
2	2+	2	Ca
13	3+	3	Al
14	Share electrons	4	C
15	3-	5	N
16	2-	6	O
17	1-	7	Cl
18	0	8	Ne

Explain: (video – class discussion)

Watch the following video to answer the questions below:

[GCSE Chemistry - Formation of ions #13](#)

Factual:

What is the electronic configuration for both atoms and their corresponding ions?

Q5) Outline the formation of following ions by chemical equation (Ai 5-6)

(Outline: Give a brief account or summary)

a) Calcium ion



b) Chlorine ion





Factual:

How to name
polyatomic anions along
with their charges?

Elaborate:

Polyatomic Ions and Their Charges

Name	Chemical Formula	Ion Charge
Hydroxide	OH^-	1-
Sulfate	SO_4^{2-}	2-
Sulfite	SO_3^{2-}	2-
Nitrate	NO_3^-	1-
Nitrite	NO_2^-	1-
Carbonate	CO_3^{2-}	2-
Hypochlorite	ClO^-	1-
Chlorite	ClO_2^-	1-
Chlorate	ClO_3^-	1-
Perchlorate	ClO_4^-	1-
Chromate	CrO_4^{2-}	2-
Acetate	$\text{C}_2\text{H}_3\text{O}_2^- / \text{CH}_3\text{COO}^-$	1-
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$	2-
Phosphate	PO_4^{3-}	3-
Phosphite	PO_3^{3-}	3-

Q6) Analyse the table above and **determine** the definition of a polyatomic ion. (Aiii 3-4)

(Determine: obtain the only answer)

a molecule made up of 2 or more atoms that bears ionic groups, that is, a molecule with a charge.

Q7) Identify the category of elements that form polyatomic ions. (Aiii 1-2).

(Identify: provide an answer from a number of possibilities. Recognize and state briefly a distinguishing fact or feature).

Nonmetals.



Extend: (Group activity)

Research one of the polyatomic ions and organize your research in the following table.

Polyatomic ion	Sulfate ions (SO_4^{2-})
Common sources in nature	minerals, water bodies, and the Earth's atmosphere
Uses	<p>Agriculture: Sulfates are used as fertilizers, such as ammonium sulfate, to provide essential sulfur and nitrogen to plants, promoting their growth.</p> <p>Construction and Building Materials: Gypsum, a mineral containing sulfate ions, is widely used in the construction industry for making plaster and drywall.</p> <p>Water Treatment: Aluminum sulfate (alum) is employed in water treatment processes to clarify water by causing impurities to clump together for</p>

Reflect on the important of ions and how they can be used in sustainable manner:

Naming Ionic Compounds:

Elicit:

Q1) State the names of three common ionic compounds. (Ai 1-2)
(State: give a specific name, value or brief answer without explanation or calculation).

Sodium chloride

Sodium bicarbonate

Sodium hydroxide

Engage: (Pair work).

Watch the video then answer the following questions:
[GCSE Chemistry - Balancing Chemical Equations #4](#)

Factual:

What is the chemical formula for compounds?

Q2) Describe the formation of ionic compounds. (Ai 7-8)
(Describe: give a detailed account or picture of a situation, event, pattern or process).

Ionic compounds form through the process of ionic bonding, which involves the transfer of electrons between atoms. This typically occurs between a metal and a non-metal. The key steps in the formation of ionic compounds are as follows:

1) Ionization of Metal:

Metals have a few electrons in their outer shell that they can easily lose. This results in the formation of positively charged ions called cations. For example, sodium (Na), a metal, can easily lose its outer electron to become a sodium cation (Na^+).

2) Ionization of Non-Metal:

Non-metals have a tendency to gain electrons to achieve a stable electron configuration. This results in the formation of negatively charged ions called anions. For example, chlorine (Cl), a non-metal, can gain an electron to become a chloride anion (Cl^-).

3) Electron Transfer:



The metal cation and non-metal anion come into close proximity. The metal cation transfers one or more electrons to the non-metal anion. In the case of sodium and chlorine, sodium loses an electron to chlorine. The transfer of electrons results in the formation of oppositely charged ions (Na^+ and Cl^-).

4) Electrostatic Attraction:

The oppositely charged ions are held together by electrostatic forces of attraction, forming an ionic bond. In the case of sodium chloride (NaCl), the positively charged sodium ion (Na^+) is attracted to the negatively charged chloride ion (Cl^-) through electrostatic forces, creating a stable ionic compound.

5) Formation of Crystal lattice:

The ionic compounds typically arrange themselves in a three-dimensional structure known as a crystal lattice. The positive and negative ions are arranged in a repeating pattern, maximizing the attractive forces between them.



Q3) Determine the chemical formula for compounds formed from the following ions. (Ai 1-2)

(Determine: obtain the only answer)

a) Na^+ and Cl^-



b) Ca^{2+} and Cl^-



c) Na^+ and O^{2-}



d) Mg^{2+} and O^{2-}



e) Al^{3+} and O^{2-}



f) Na^+ and NO_3^-



g) K^+ and PO_4^{3-}



h) Fe^{3+} and OH^-





Explore: (Pair work)

Use your laptop to research how to write and name ionic compounds.

Q4) Write down the steps below: (Writing ionic compounds).

1. Step 1: Identify the ions involved.

Determine which element is the metal (cation) and which is the non-metal (anion).

2. Step 2: Determine the charges of the ions.

Metals generally form cations with a positive charge, while non-metals form anions with a negative charge. Use the periodic table to find the charges of the elements.

3. Step 3: Write the chemical formula.

Place the cation first, followed by the anion. The subscripts are adjusted to balance the charges and achieve an electrically neutral compound.

For example, sodium (Na^+) and chloride (Cl^-) form sodium chloride (NaCl) because the charges balance without the need for subscripts.

Q5) Write down the steps below: (Naming ionic compounds).

1. Step 1: Identify the cation and anion. The cation (positive ion) is named first, followed by the anion (negative ion).

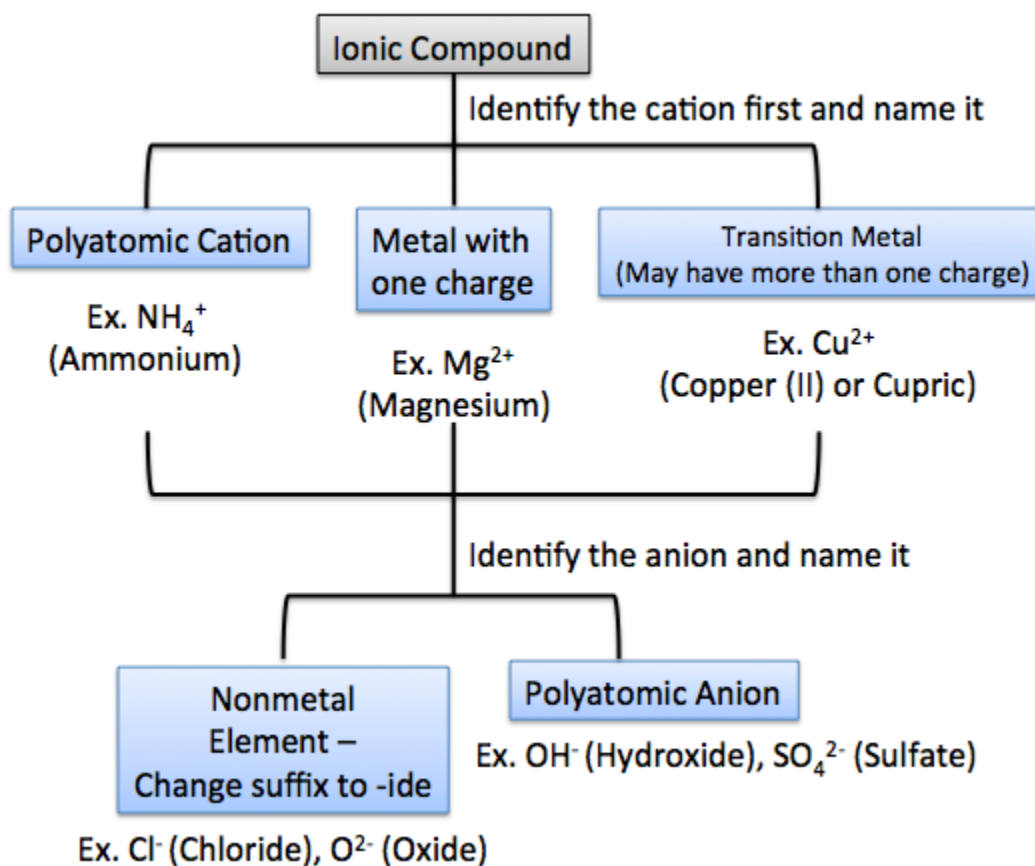
2. Step 2: Use the element name for the cation. If the cation is a metal with a fixed charge, use the element's name as is (e.g., sodium becomes sodium).

If the cation is a transition metal or can have multiple charges, indicate the charge using Roman numerals in parentheses (e.g., iron(III) for Fe^{3+}).

3. Step 3: Use the root of the non-metal element name for the anion. Change the ending of the non-metal's name to "-ide." For example, chlorine becomes chloride.

4. Step 4: Combine the names. Combine the name of the cation and the root of the anion's name. Ensure that the overall charge is neutral.

Explain: (Class discussion)



Elaborate: (Group work)

Q6) State the names of following ionic compounds (Ai 3-4)
(State: give a specific name, value or brief answer without explanation or calculation).

a) CaO: **Calcium Oxide**

b) NaF: **Sodium Fluoride**

c) Al₂O₃: **Aluminum Oxide**



- d) MgCl_2 : Magnesium Chloride
e) NaNO_3 : sodium nitrate.
f) CuSO_4 : copper(II) sulfate
g) Mg(OH)_2 : magnesium hydroxide.

Q7) State the chemical formula for the following ionic compounds. (Ai 3-4)
(State: give a specific name, value or brief answer without explanation or calculation).

1. Calcium perchlorate: $\text{Ca(ClO}_4)_2$
2. Sodium Sulfide: Na_2S
3. Lithium Chloride: LiCl
4. Iron (II) Sulphate: FeSO_4
5. Potassium Phosphate: K_3PO_4

Reactivity Series and Balancing Chemical Equations:

Elicit: (Class discussion)

What is a chemical equation?

it is an expression that uses symbols to show the relationship between the starting substances and the substances that are produced by the chemical reaction.

Engage: (Class discussion)

Watch the video to answer the following questions.

[GCSE Chemistry - Balancing Chemical equation #4](#)

Q1) Sodium hydroxide reacts with Iron(II) sulfate to produce Sodium sulfate and Iron(II) hydroxide.

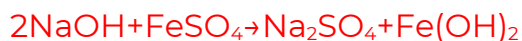
- a) **Write down** the word equation. (Aiii 1-2)
(Write down: obtain the answer, usually by extracting information. Little or no calculation is required. Working doesn't need to be shown).

Sodium hydroxide + Iron(II) sulfate → Sodium sulfate + Iron(II) hydroxide



b) **Write down** the symbol equation. (Aiii 1-2)

(Write down: obtain the answer, usually by extracting information. Little or no calculation is required. Working doesn't need to be shown).



c) **Identify** the reactant and products in the reaction. (Aiii 1-2).

(Identify: provide an answer from a number of possibilities. Recognize and state briefly a distinguishing fact or feature).

Reactants: Sodium hydroxide, NaOH and Iron(II) sulfate, FeSO₄.

Products: Sodium sulfate, Na₂SO₄ and Iron(II) hydroxide, Fe(OH)₂.

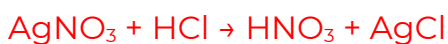
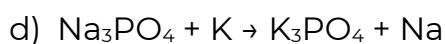
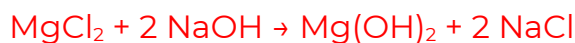
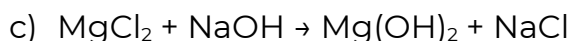
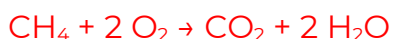
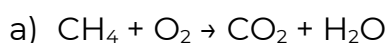
Factual:

How to balance
chemical equations?

Explore: (Individual work – class discussion)

Q2) Find the correct coefficients to balance the following chemical reactions. (Ai 3-4)

(Find: Obtain an answer showing relevant stages in the working).





Explain: (Pair - Lab work)

Q3) Three samples were obtained of sodium, magnesium, iron and copper.

Write down the observation when the metal is added to water.

Metal	Observation when added to water
Sodium	Very quick reaction (large amount of bubble produced).
Magnesium	Quick reaction (bubbles produced).
Iron	Very slow reaction (rust appears in 4-5 days)
Copper	No reaction

Q4) In pairs research the following observation and **suggest** why metals reacted differently with water. (Aiii 3-4)

(suggest: propose a solution, hypothesis or other possible answer.)

Highly reactive: Sodium > Magnesium > Iron > Copper: Low reactivity_



Factual:

What is reactivity series?

Elaborate: (Group discussion)

Watch the video then analyse the diagram below to answer the questions.

[Reactivity Series of Metals | environmental | FuseSchool](#)

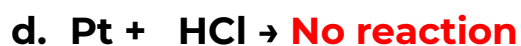
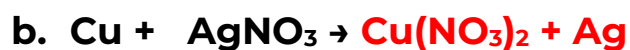
POTASSIUM	MOST REACTIVE	K
SODIUM		Na
LITHIUM		Li
CALCIUM		Ca
MAGNESIUM		Mg
ALUMINIUM		Al
CARBON		C
ZINC		Zn
IRON		Fe
HYDROGEN		H
COPPER		Cu
SILVER		Ag
GOLD	LEAST REACTIVE	Au

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Q5) Describe the products of the following reactions by completing the equations below. **(Ai 7-8)**

(Describe: Give a detailed account or picture of a situation, event, pattern or process)





Extend: Reactivity of halogens (Group 17)

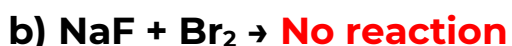
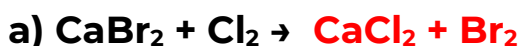
Q6) Research the properties of group 17 and **summarize** the trend in reactivity. (Ai 5-6)

(Summarize: abstract a general theme or major point.)

Group 17 of the periodic table is known as the halogens. This group includes fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At). Halogens have seven electrons in their outermost energy level. Halogens are highly reactive nonmetals. Their reactivity decreases down the group. Fluorine is the most reactive halogen, while astatine is the least reactive.

Q7) Describe the products of the following reaction by completing the equations below. **(Ai 7-8)**

(Describe: Give a detailed account or picture of a situation, event, pattern or process)



Single and Double Displacement Reactions:

Elicit: (Class discussion)

Q1) Suggest a method to predict if a chemical reaction would occur. (Ai 1-2)

(Suggest: propose a solution, hypothesis or other possible answer).

By using the reactivity series

Engage: (Class discussion)

Q2) Watch the video and **write down** your notes:

[Displacement reactions | environment chemistry | FuseSchool](#)



Explore:

Single and Double Displacement Reactions:

Single Displacement Reaction:

In a single displacement reaction, the element with the higher reactivity replaces the element with lower reactivity per the reactivity series as the figure below:

Single Displacement Reaction



A: is the element with higher reactivity.

B: is the element with lower reactivity.

C: is the companion negative ion.

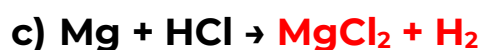
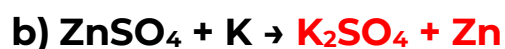
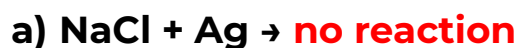
A and **B** are both **positively charged ions** which are **Metals**, **Hydrogen** or **Carbon**.

potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt

Explain:

Q3) Describe the products of the following single displacement reactions by completing the equations below. **(Ai 7-8)**

(Describe: Give a detailed account or picture of a situation, event, pattern or process)



Factual:
How do single displacement reactions work?

Double Displacement Reactions:

In double displacement reactions the (**Metals** or **Hydrogen**) in the ionic compounds displace each other and trade the companion negative ions as the figure shown below:

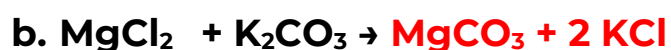
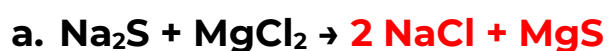


A and C are Cations (Positive Ions)
B and D are Anions (Negative Ions)

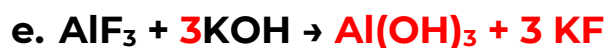
Double Displacement Reaction

Q4) Describe the products of the following double displacement reactions by completing the equations below. **(Ai 7-8)**

(Describe: Give a detailed account or picture of a situation, event, pattern or process)



Factual:
How do double displacement reactions work?

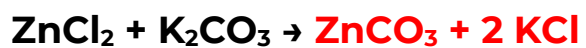


Elaborate:

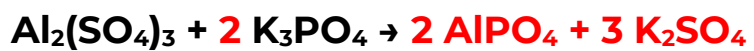
Q5) Describe the products of the following reactions and **state** if each reaction is single or double displacement reaction. **(Ai 7-8)**

(Describe: Give a detailed account or picture of a situation, event, pattern or process)

Reaction	Single / Double displacement
$\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$	Single displacement
$\text{K}_2\text{CO}_3 + \text{BaCl}_2 \rightarrow 2\text{KCl} + \text{BaCO}_3$	Double displacement
$\text{Na} + \text{MgCl}_2 \rightarrow 2\text{NaCl} + \text{Mg}$	Single displacement
$2\text{Al} + 3\text{CuCl}_2 \rightarrow 2\text{AlCl}_3 + 3\text{Cu}$	Single displacement
$2\text{Al} + 3\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{Al}(\text{NO}_3)_3 + 3\text{Pb}$	Single displacement
$2\text{AgNO}_3 + \text{CaBr}_2 \rightarrow 2\text{AgBr} + \text{Ca}(\text{NO}_3)_2$	Double displacement
$\text{Cu} + \text{Ag}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{Ag}$	Single displacement
$\text{CuCl}_2 + \text{K}_2\text{S} \rightarrow 2\text{KCl} + \text{CuS}$	Double displacement



Double displacement

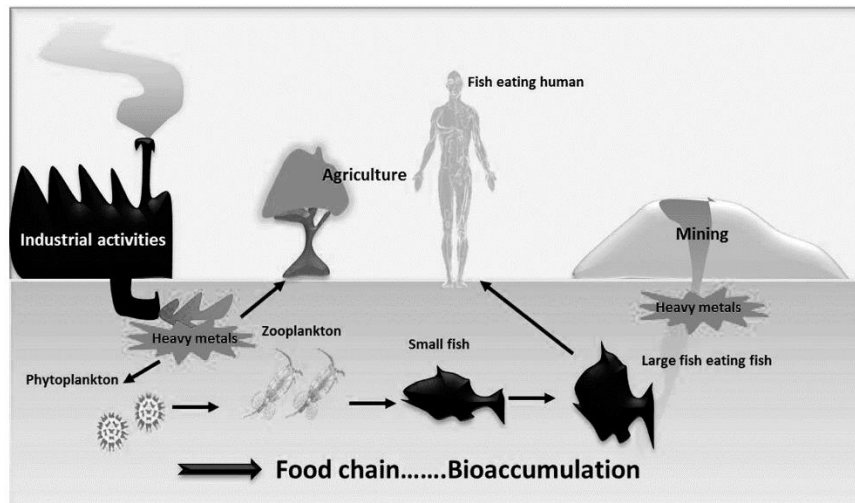


Double displacement

Extend:

Q6) Watch the following video then **describe** how does the human activities affect the natural resources in the fish habitat. **(Aiii 7-8)**

[Heavy Metal Salmon: Sub-lethal toxicity in the Skeena](#) (0:00-4:12)



As heavy metals accumulate in the water, the small organisms that fish feed on and the fish body get filled with heavy metals. The heavy metals affect the fish body and causes the fish behaviour to change. For example causing delay migration and lower avoidance for predators. As the fish spends more time in water in the same location it will consume the natural resources in that area and cause imbalance in the ecosystem. Furthermore, the fish affected by heavy metal toxicity is unfit to be eaten by other fish and human and may lead to death.



Resources:

- 1- GCSE Chemistry – History of the Model of the Atom #7
<https://www.youtube.com/watch?v=sG6QoLxwIw4>
- 2- GCSE Chemistry – Metals and Non-metals #10
<https://www.youtube.com/watch?v=Rc2JBp91V7o>
- 3- What are ions | Properties of Matter | Chemistry | FuseSchool
<https://www.youtube.com/watch?v=900dXBWgx3Y>
- 4- GCSE Chemistry – Formation of ions #13
<https://www.youtube.com/watch?v=PCZtnbxtXqE>
- 5- GCSE Chemistry – Balancing Chemical equations #4
<https://www.youtube.com/watch?v=qquOFYOpdl0>
- 6- Reactivity Series of Metals | Environmental | Chemistry | FuseSchool
<https://www.youtube.com/watch?v=TGPPPFczQj0>
- 7- Displacement reactions | environmental chemistry | FuseSchool
<https://www.youtube.com/watch?v=z4BDT5Xxqqk>
- 8- Heavy Metal Salmon: Sub-Lethal Toxicity in the Skeena
https://www.youtube.com/watch?v=I3OG8F2_iAc