Pakistan School
Kingdom of Bahrain

Grade :9th

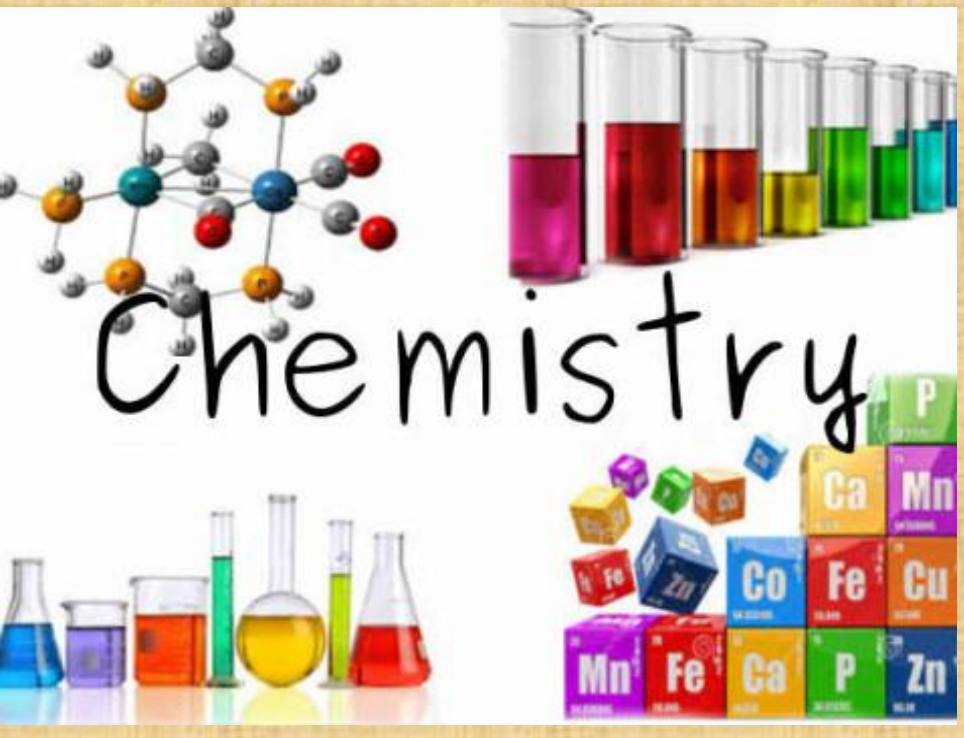
Subject: Chemistry

Welcome to
E-Learning

ImaanBoosters

#seekingknowledge


CHEMISTRY
ommunity
ealth
nvironment
edicine
ndustry
cience
echnology
esearch
ou



Periodic Table of the Elements

1												13	14	15	16	17	18
1 H 1.01	2																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30	3	4	5	6	7	8	9	10	11	12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 30.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (97.91)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (208.98)	85 At (209.99)	86 Rn (222.02)
87 Fr (223.02)	88 Ra (226.03)	89 Ac (227.03)	104 Rf (261.11)	105 Ha (262.11)	106 Sg (263.12)												

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (144.91)	62 Sm 150.36	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237.05)	94 Pu (244.06)	95 Am (243.06)	96 Cm (247.07)	97 Bk (247.07)	98 Cf (251.08)	99 Es (252.08)	100 Fm (257.10)	101 Md (258.10)	102 No (259.10)	103 Lr (262.11)

Virtual Classroom Rules

Select a quiet place to study.

Be on time.

Come to class prepared in every way to learn and participate.

Virtual Classroom Rules

Be respectful.

Listen to & follow directions.

Turn off your video before joining the class.

I hope you will follow all the above mentioned rules to make your dear teacher happy.

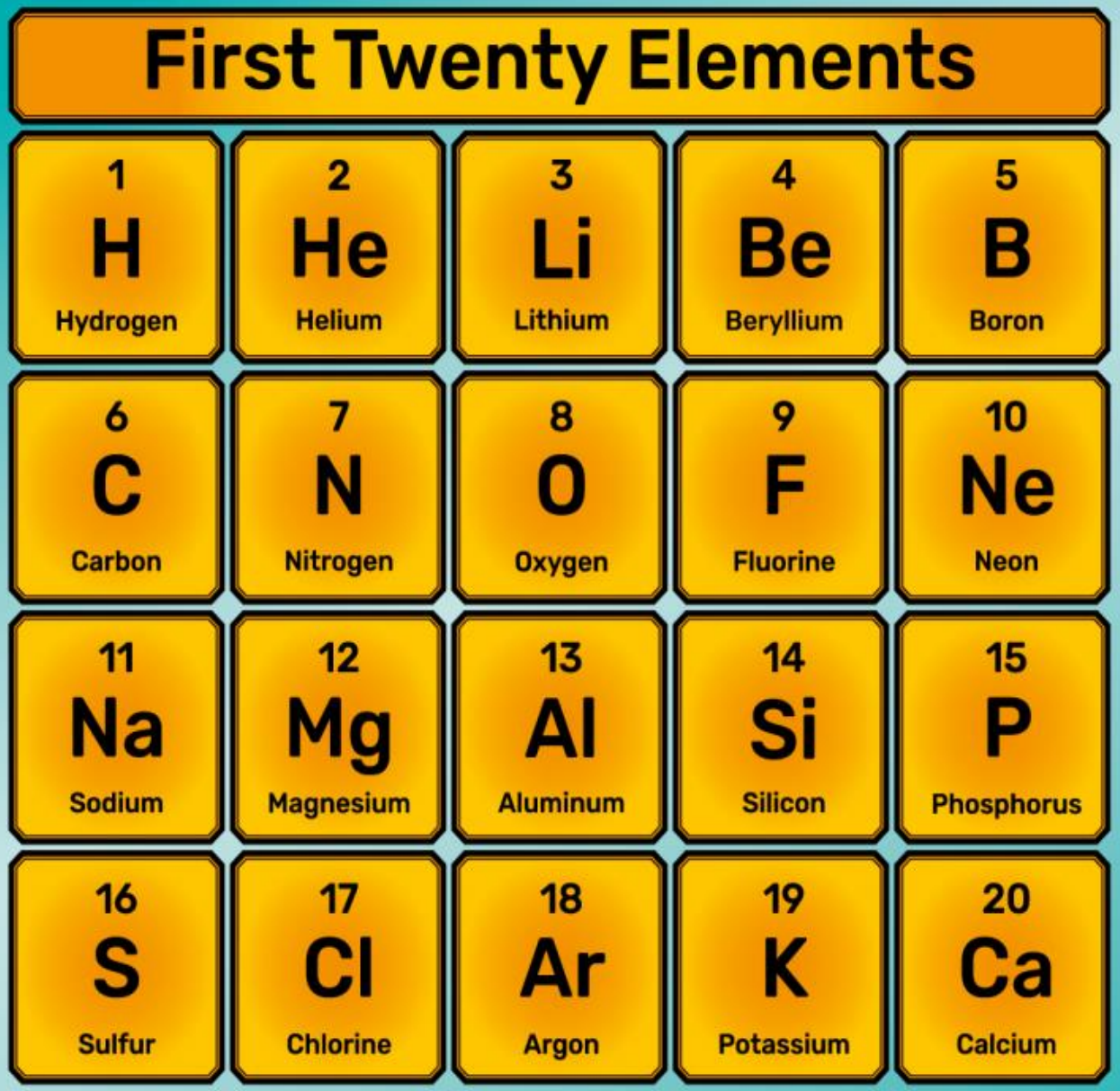
REVISION

CHEMICAL CALCULATIONS

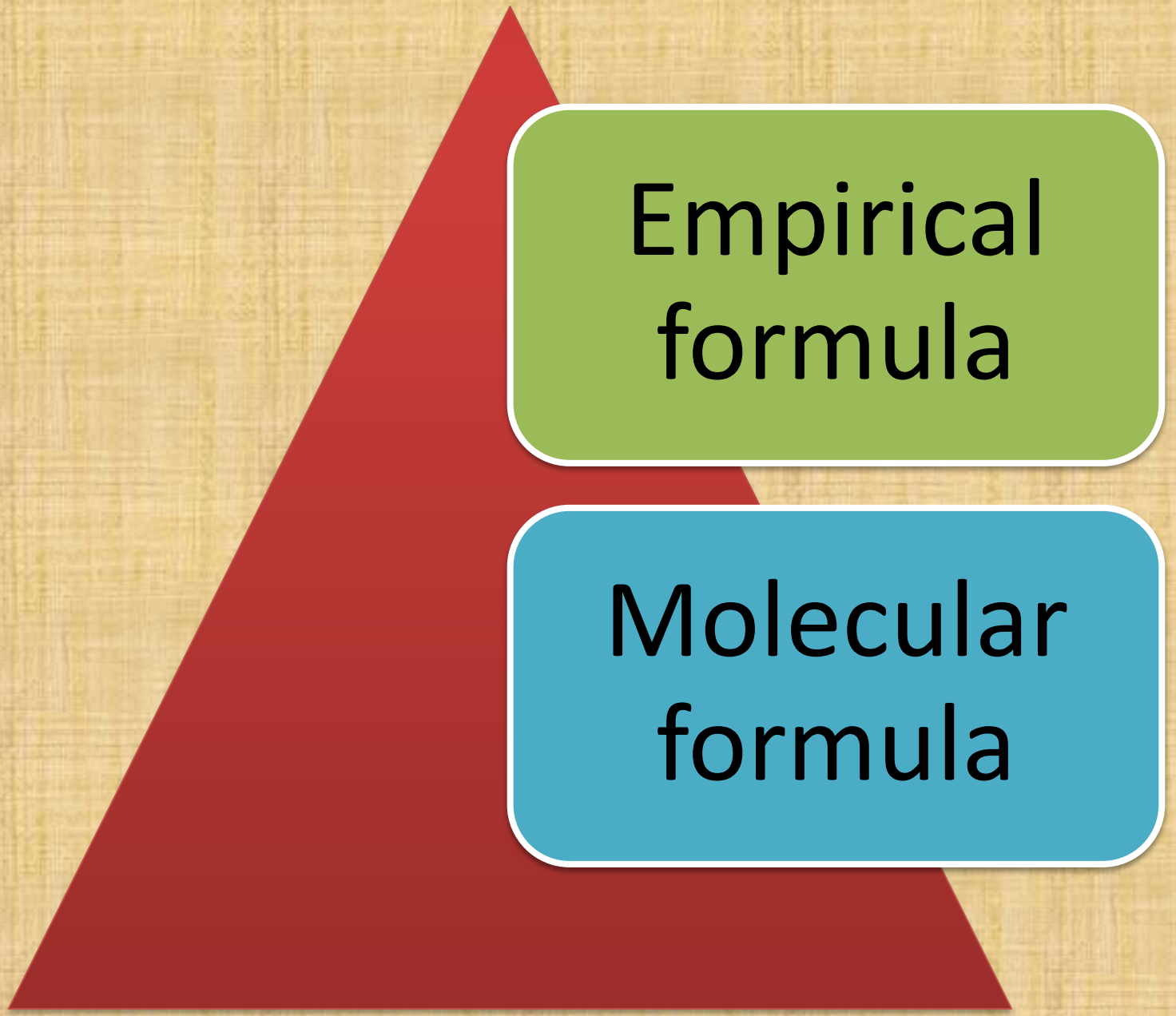
Lesson Objectives:

- **By the end of this lesson, students will be able to:**

- **Differentiate between Empirical formula & Molecular formula.**
- **Distinguish between Atom & Ion.**
- **Solve problems involving Mole-Particles Calculation.**


First Twenty Elements
1
H
Hydrogen
2
He
Helium
3
Li
Lithium
4
Be
Beryllium
5
B
Boron
6
C
Carbon
7
N
Nitrogen
8
O
Oxygen
9
F
Fluorine
10
Ne
Neon
11
Na
Sodium
12
Mg
Magnesium
13
Al
Aluminum
14
Si
Silicon
15
P
Phosphorus
16
S
Sulfur
17
Cl
Chlorine
18
Ar
Argon
19
K
Potassium
20
Ca
Calcium
sciencenotes.org

Element name	Atomic number	Atomic mass	Element name	Atomic number	Atomic mass
Hydrogen	1	1	Sodium	11	23
Helium	2	4	Magnesium	12	24
Lithium	3	7	Aluminium	13	27
Beryllium	4	9	Silicon	14	28
Boron	5	11	Phosphorus	15	31
Carbon	6	12	Sulphur	16	32
Nitrogen	7	14	Chlorine	17	35.5
Oxygen	8	16	Argon	18	40
Fluorine	9	19	Potassium	19	39
Neon	10	20	Calcium	20	40


Empirical formula
Molecular formula

Empirical Formula

- The empirical formula of a compound is the chemical formula that gives the simplest whole number ratio of atoms of each element.
- A formula which represent the simplest whole number ratio of atoms in a compound.
- Example: CH_2O and CH are empirical formula of glucose & benzene respectively.

Molecular Formula

- A molecular formula gives the actual whole number ratio of atoms of each element present in a compound.
- A formula which represent the actual number of atoms of elements in a compound.
- Example:$C_6H_{12}O_6$ and C_6H_6 are molecular formula of glucose and benzene respectively.

Name of compound	Empirical formula	Molecular formula
Hydrogen peroxide	HO	H_2O_2
Water	H_2O	H_2O
Glucose	CH_2O	$C_6H_{12}O_6$
Oxalic acid	HCO_2	$H_2C_2O_4$
Ethanol	C_2H_6O	C_2H_6O
Ethane	CH_3	C_2H_6
Ethylene	CH_2	C_2H_4
Caffeine	$C_4H_5N_2O$	$C_8H_{10}N_4O_2$

Write empirical and molecular formula of the following:

Substance	Molecular Formula
Benzene	C_6H_6
Acetylene	C_2H_2
Glucose	$C_6H_{12}O_6$
Water	H_2O

Calculate Formula Mass:

Self-Assessment Exercise:1.4

- **Q:Potassium Chloride ($KClO_3$) is used commonly for the laboratory preparation of oxygen gas. Calculate its formula mass:**
- **Solution:**

($KClO_3$)

=(39)+(35.5)+3(16)

=39+35.5+48

=122.5 amu

Result:

Formula mass of Potassium chloride =122.5 amu

2) When baking soda, ($NaHCO_3$) is heated carbon dioxide is released, which is responsible for the rising of cookies and bread,Determine the formula mass of baking soda.

- **Solution:**

($NaHCO_3$)

=(23)+(1)+(12)+3(16)

=23+1+12+48

=84 amu

Result:

Formula mass of Baking Soda =84 amu

3) Following compounds are used as fertilizers. Determine their formula masses.

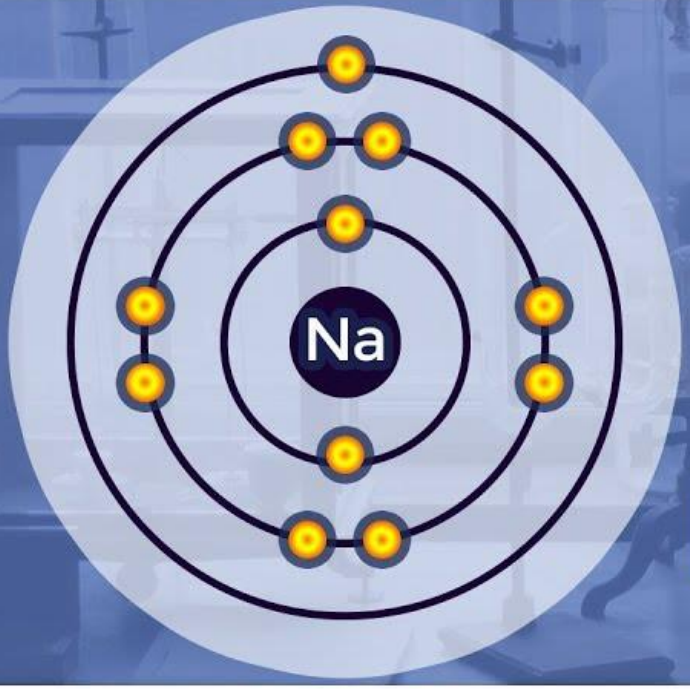
(i) Urea $(NH_2)_2CO$

(ii) Ammonium Nitrate , NH_4NO_3

- **Solution:**

(i) Urea $(NH_2)_2CO$	(ii) Ammonium Nitrate , NH_4NO_3
➢ $(NH_2)_2CO$ = 2(14) + 4(1) + (12) + (16) = 28 + 4 + 12 + 16 = 60 amu **Result:** Formula mass of Urea = 60 amu	➢ NH_4NO_3 = (14) + 4(1) + (14) + 3(16) = 14 + 4 + 14 + 48 = 80 amu **Result:** Formula mass of Ammonium nitrate = 80 amu

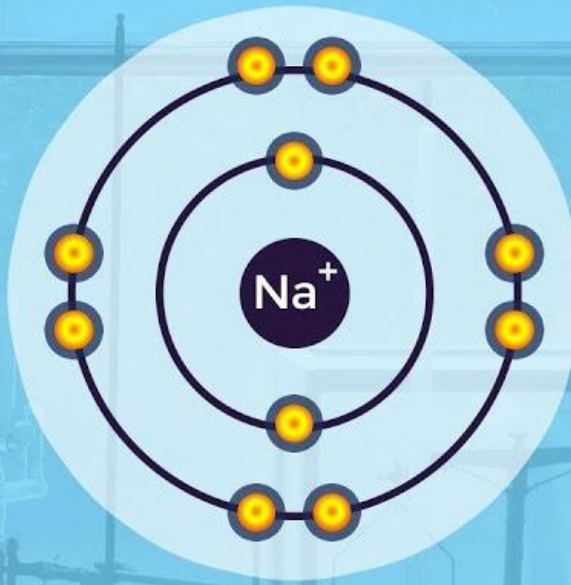
ATOM



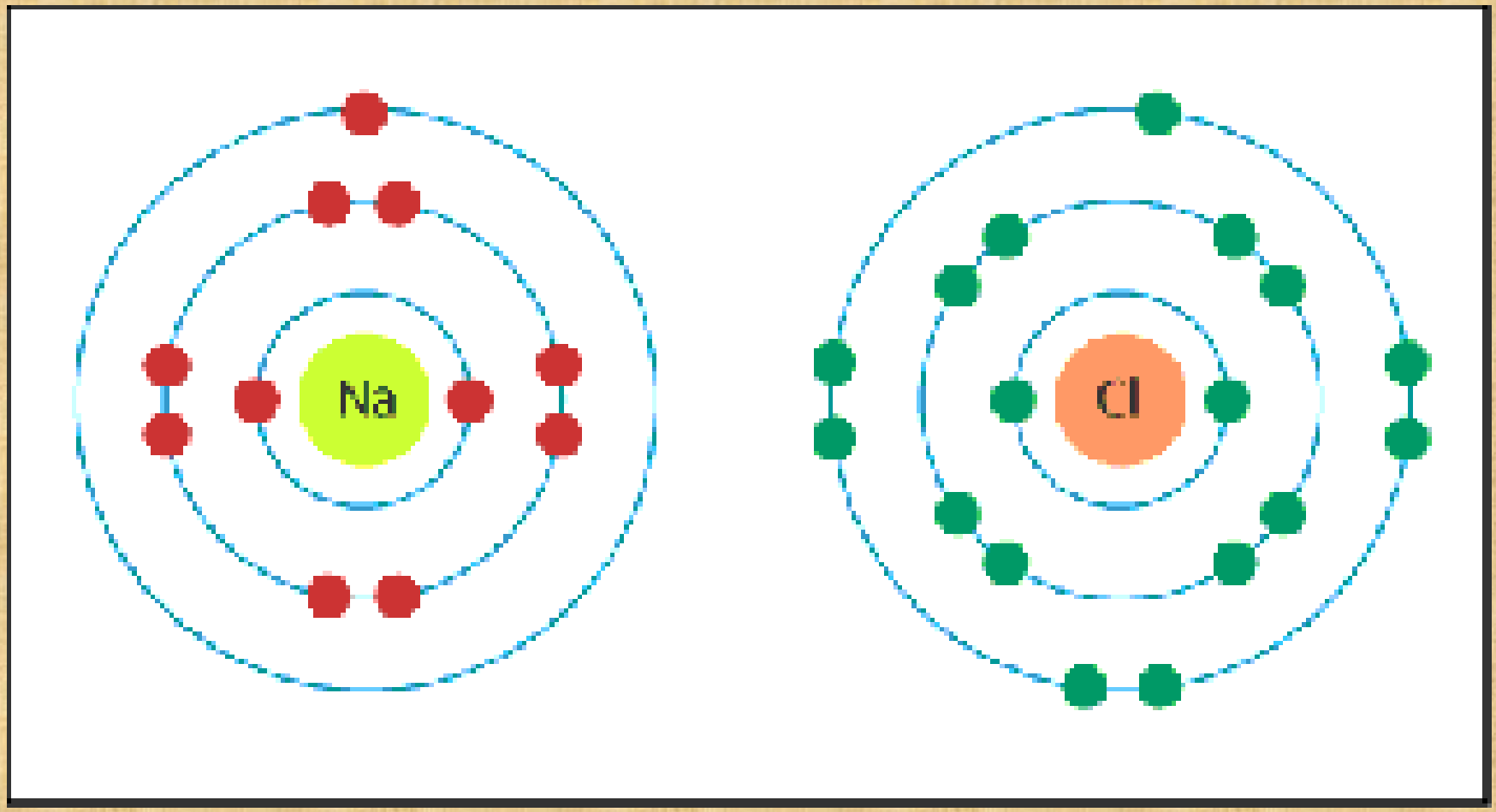
Na

Vs

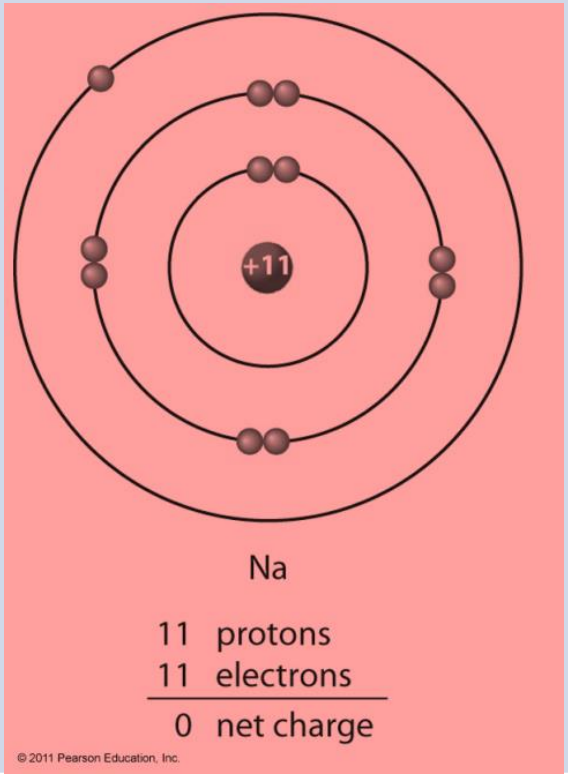
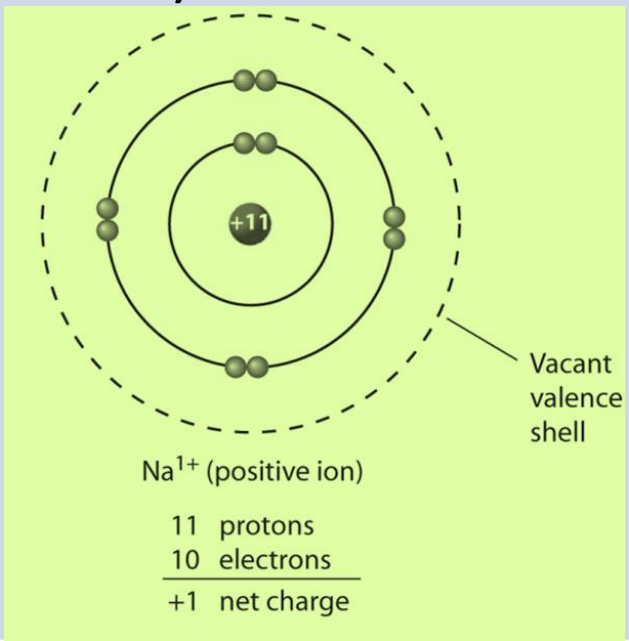
Na^+

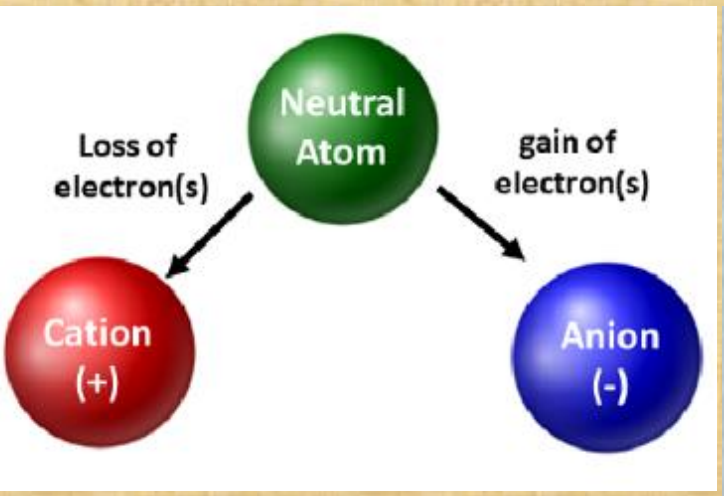


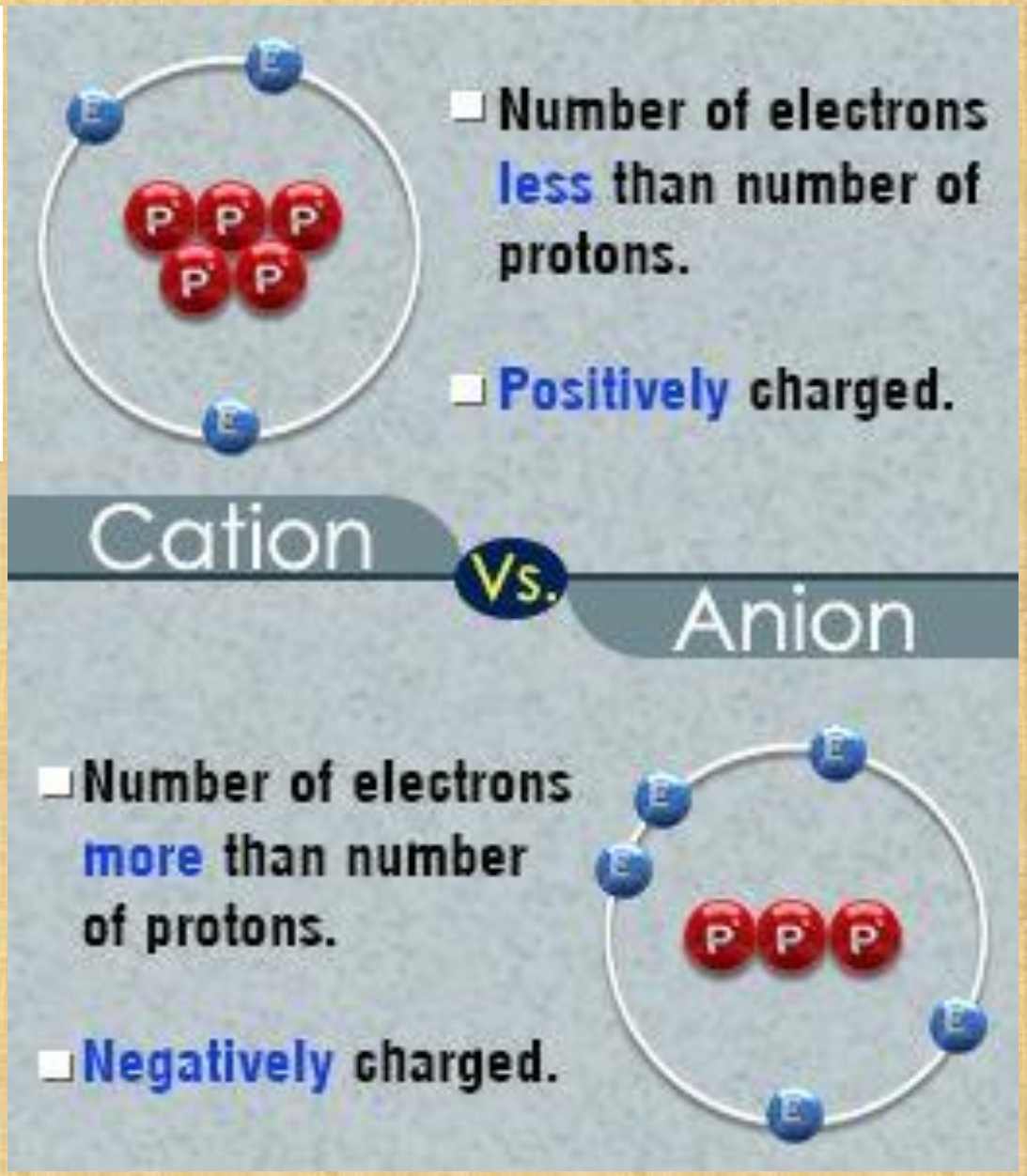
ION


Na
Cl

Atom and Ion

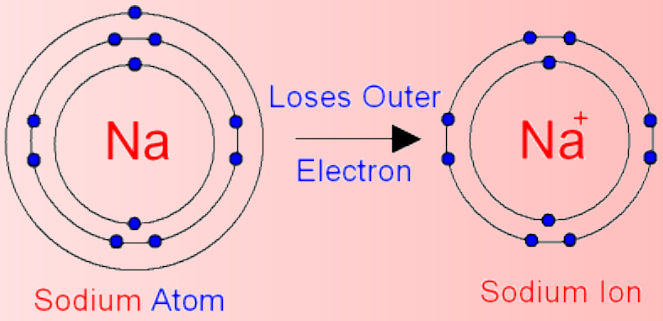
Atom	Ion
Atom is the smallest particle of an element that cannot exist in free state .It is electrically neutral. 	**Ion is a charged species formed from an atom or chemically bonded groups of atoms by adding or removing electrons.** **Types of ions:** **There are two types of ions.** **1) Cations 2) Anions** 


Neutral Atom
Loss of electron(s)
gain of electron(s)
Cation (+)
Anion (-)


Number of electrons less than number of protons.
Positively charged.
Cation
Vs.
Anion
Number of electrons more than number of protons.
Negatively charged.

Cation

- 1) Cations
- An atom or group of atoms having positive charge on it is called cation. Metal atoms generally lose one or more electrons and form cations.
- Examples
- Na form Na^+ by losing one electron, Ca forms Ca^{2+} by losing two electrons.

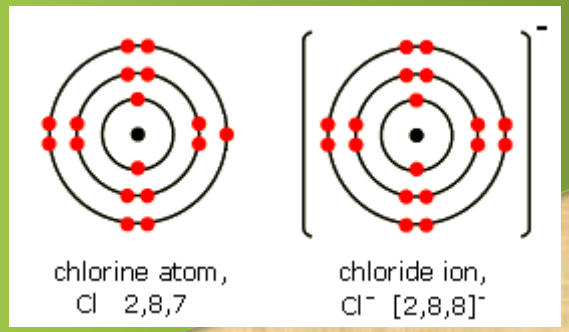


Anion

.An atom or group of atoms having negative charge on it is called anion. Non-metals usually gain one are more electrons and form anions.

Examples

Chlorine atom gains one electron and forms Cl^- ion, O atom gains two electrons and form O^{2-} ion.



Self-Assessment Exercise:1.5

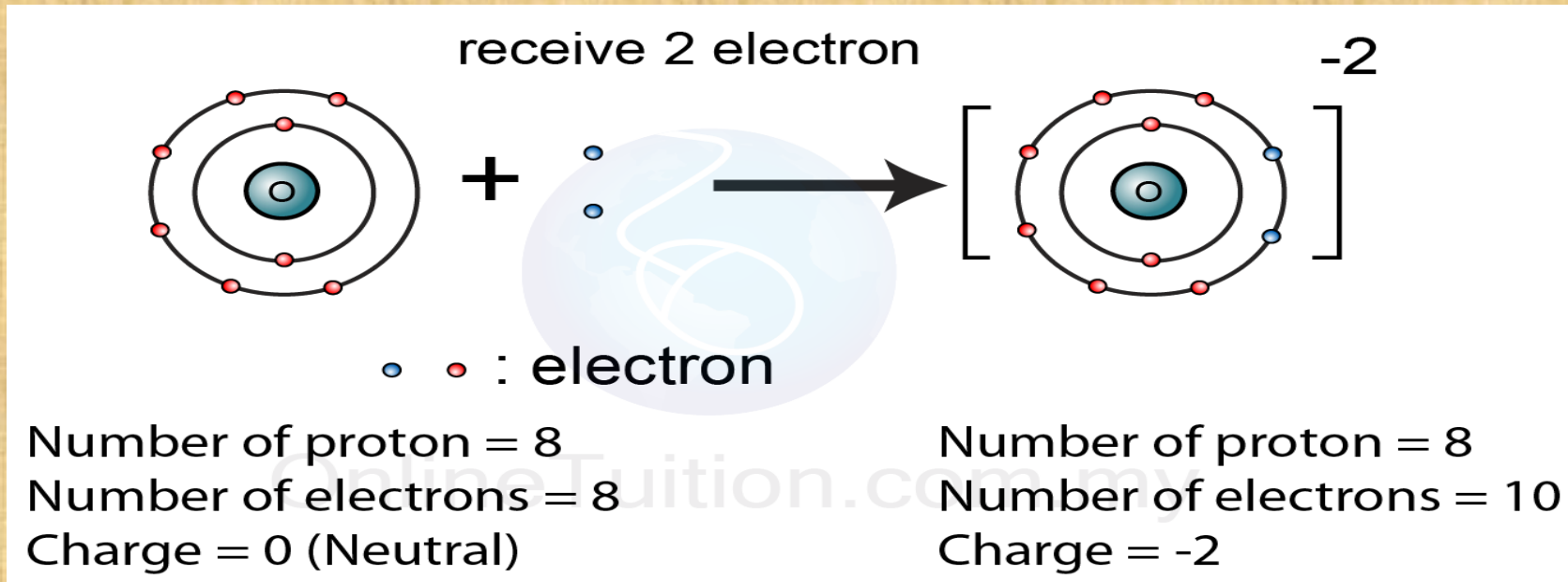
Explain Why?

1) An oxide ion (O^{-2}) has -2 charge.
2) Magnesium ion , (Mg^{+2}) has +2 charge.
3) Sulphide ion, (S^{-2}) has -2 charge.

1)An oxide ion (O^{-2}) has -2 charge.

Oxygen has a nucleus of 8 protons and 8 neutrons.Thus its nucleus has a total charge of +8 Around the nucleus , in the ion are 10 electrons ,with a total charge of -10

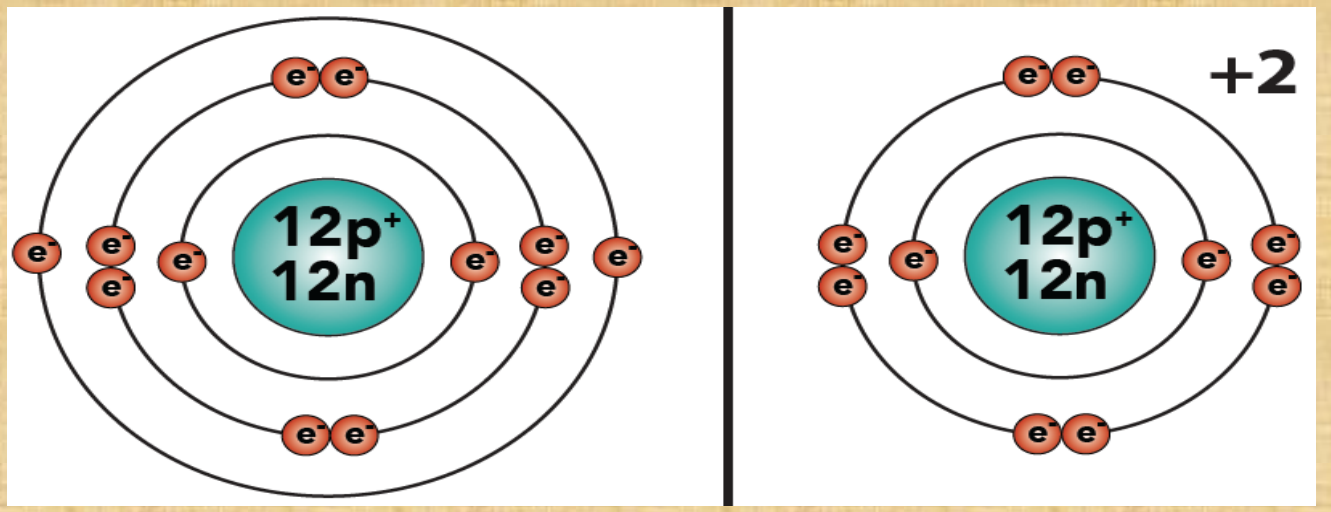
.The charge on the ion is +8 + (-10)= -2 i.e, Oxide ion (O^{-2}) {to complete its octet}



2)Magnesium ion , (Mg^{+2}) has +2 charge.

Magnesium has a nucleus of 12 protons and 12 neutrons.Thus its nucleus has a total charge of +12, Around the nucleus , in the ion are 10 electrons , with a total charge of -10 .

The charge on the ion is +12 +(-10) =+2 i.e Magnesium ion (Mg^{+2}) . {to complete its octet}

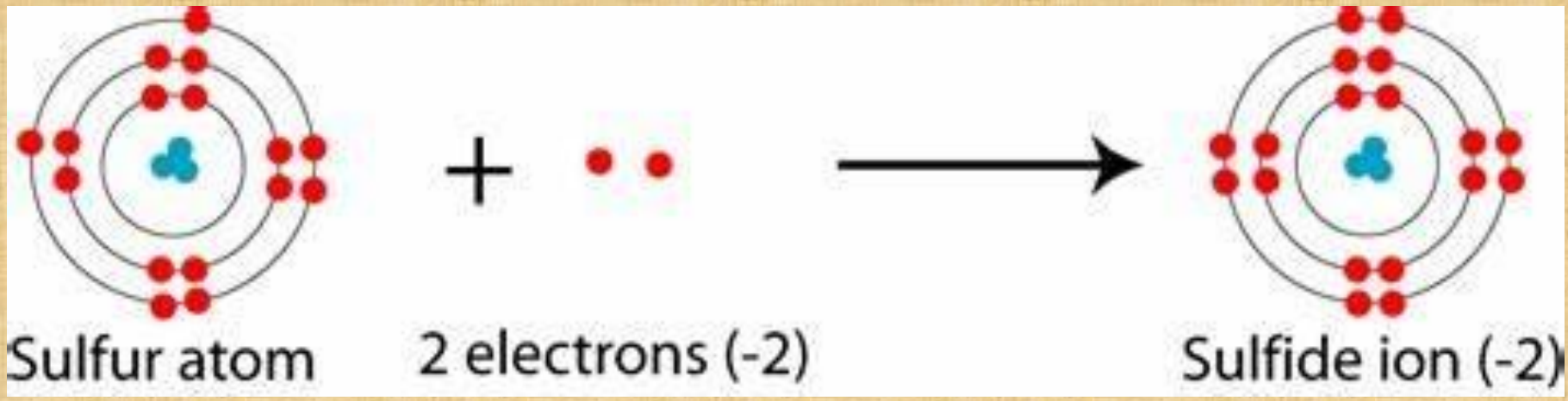


3) An Sulphide ion (S^{-2}) has -2 charge.

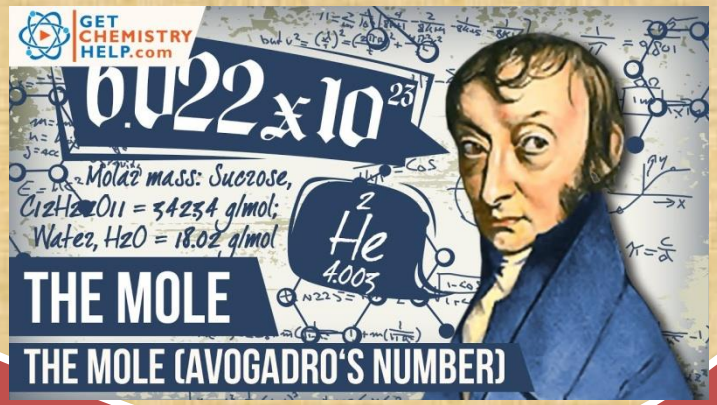
Sulphur has a nucleus of 16 protons and 16 neutrons .

Thus its nucleus has a total charge of +16,Around the nucleus , in the ion are 18 electrons ,with a total charge of -18.

.The charge on the ion is +16 + (-18)= -2 i.e, Sulphide ion (S^{-2}) {to complete its octet}



Avogadro's Number

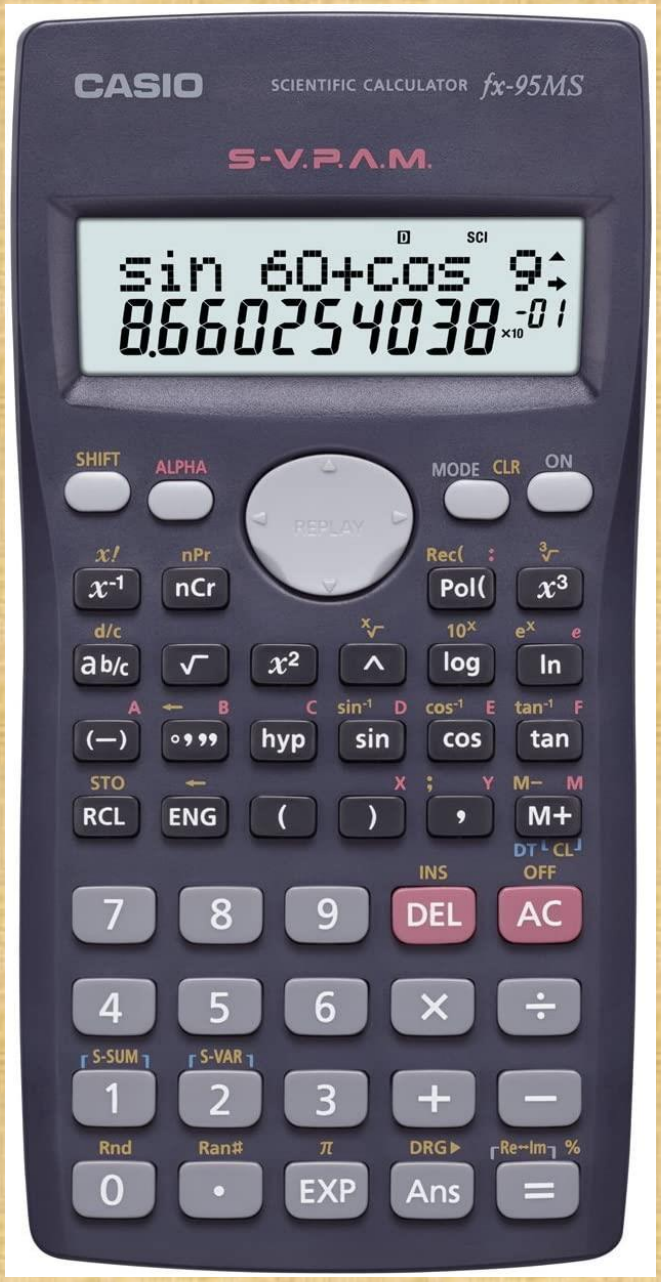


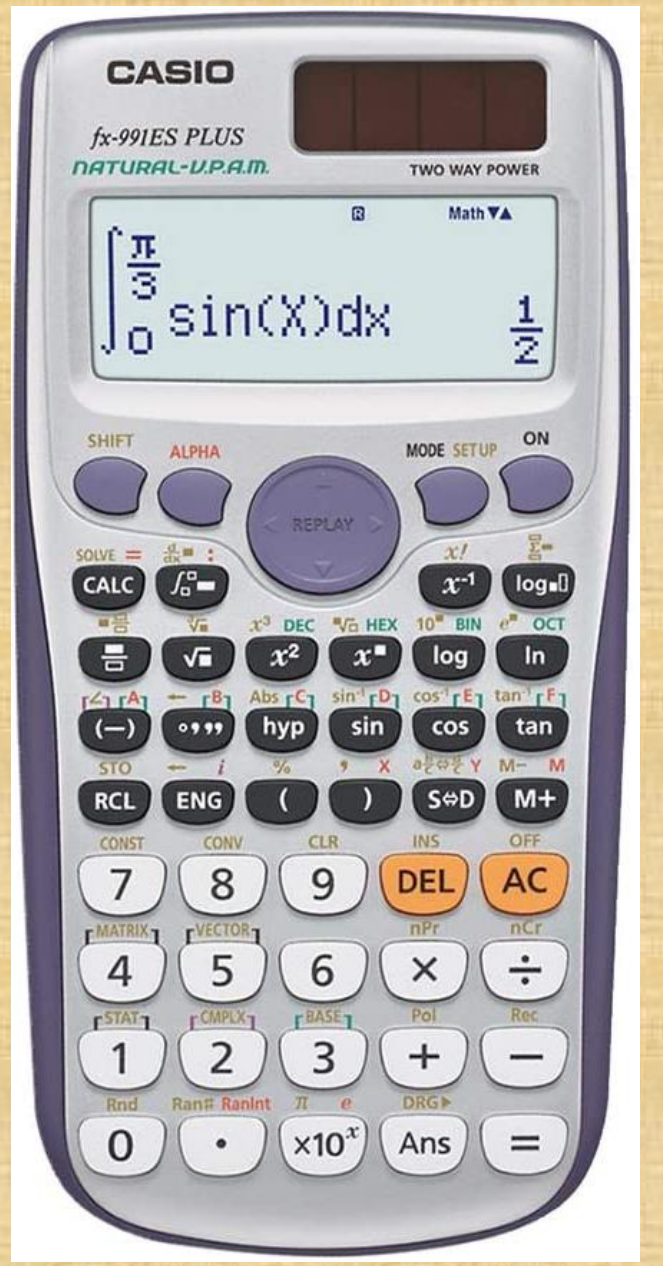
A mole is an amount of a substance that contains (6.022×10^{23}) particles of that substance .This experimentally determined number is known as Avogadro's number.

CHEMICAL CALCULATION

Mole –Particles Calculations

1) CALCULATE THE NUMBER OF ATOMS IN THE GIVEN MOLES:


CASIO
SCIENTIFIC CALCULATOR fx-95MS
S-V.P.A.M.
D SCI
sin 60+cos 9
8.660254038 ×10 -01
SHIFT ALPHA MODE CLR ON
REPLAY
x! nPr Rec(∛
x⁻¹ nCr Pol(x³
d/c √ x² ^ 10^x log e^x ln
a b/c
A B C sin⁻¹ D cos⁻¹ E tan⁻¹ F
(−) °,,, hyp sin cos tan
STO X Y M− M
RCL ENG ( ) , M+
DT CL
INS OFF
7 8 9 DEL AC
4 5 6 × ÷
S-SUM S-VAR
1 2 3 + −
Rnd Ran# π DRG▶ Re↔Im %
0 • EXP Ans =


CASIO
fx-991ES PLUS
NATURAL-V.P.A.M.
TWO WAY POWER
R Math
∫ π/3 0 sin(X)dx 1/2
SHIFT ALPHA MODE SETUP ON
REPLAY
SOLVE = CALC
x! x⁻¹ log
DEC HEX BIN OCT
x² x■ log ln
A B Abs C sin⁻¹ D cos⁻¹ E tan⁻¹ F
(−) °,,, hyp sin cos tan
STO i % , X Y M− M
RCL ENG ( ) S⇔D M+
CONST CONV CLR INS OFF
7 8 9 DEL AC
MATRIX VECTOR nPr nCr
4 5 6 × ÷
STAT CMPLX BASE Pol Rec
1 2 3 + −
Rnd Ran# RanInt π e DRG▶
0 • ×10^x Ans =

Q: Zn is a silvery metal that is used to galvanize steel to prevent corrosion. How many atoms are there in 1.25 moles of Zn?

DATA	DATA
➢ **Given:** Moles of Zn =1.25moles ➢ **Required:** Number of atoms= ? ➢ **Solution:** 1 mol of Zn contains = 6.022×10^{23} atoms 1.25 moles of Zn contain= $6.022 \times 10^{23} \times 1.25 = 7.53 \times 10^{23}$ Zn atoms ➢ **Result:** Number of atoms of Zn= 7.53×10^{23} atoms	➢ **Given:** Moles of Zn =1.25moles ➢ **Required:** Number of atoms= ? **Solution:** Formula: Number of atoms = No. of moles x Avogadro number Number of atoms = $6.022 \times 10^{23} \times 1.25 = 7.53 \times 10^{23}$ Zn atoms ➢ **Result:** Number of atoms of Zn= 7.53×10^{23} atoms

Q:A thin foil of Aluminum (Al) is used as wrapper in food industries. How many atoms are present in a foil that contains 0.2 moles of Aluminium?

DATA	DATA
➢ **Given:** Moles of Al = 0.2 moles ➢ **Required:** Number of atoms = ? ➢ **Solution:** 1 mol of Al contains = 6.022×10^{23} atoms 0.2 moles of Al contain = $6.022 \times 10^{23} \times 0.2 = 1.2044 \times 10^{23}$ atoms ➢ **Result:** Number of atoms of Al = 1.2044×10^{23} atoms	➢ **Given:** Moles of Al = 0.2 moles ➢ **Required:** Number of atoms = ? **Solution:** Formula: Number of atoms = No. of moles x Avogadro number Number of atoms = $6.022X10^{23} \times 0.2 = 1.2044 \times 10^{23}$ atoms ➢ **Result:** Number of atoms of Al = 1.2044×10^{23} atoms

Mole –Particles Calculations

2) :CALCULATE THE NUMBER OF MOLECULES IN THE GIVEN MOLES:

Q: 1) Methane (CH_4) is the major component of natural gas. How many molecules are present in 0.5 moles of a pure sample of methane?

DATA	DATA
➢ **Given:** Moles of methane(CH_4) =0.5moles ➢ **Required:** Number of molecules= ? ➢ **Solution:** 1 mol of (CH_4) contains = 6.022×10^{23} molecules So, 0.5 moles of (CH_4) contain = $6.022 \times 10^{23} \times 0.5$ = 3.011×10^{23} molecules ➢ **Result:** Number of molecules of(CH_4) = 3.011×10^{23} molecules	➢ **Given:** Moles of methane(CH_4) =0.5moles ➢ **Required:** Number of molecules= ? **Solution:** Formula: Number of molecules = No. of moles x Avogadro number Number of molecules = $6.022X10^{23} \times 0.5$ = 3.011×10^{23} molecules ➢ **Result:** Number of molecules of(CH_4) = 3.011×10^{23} molecules

Q: 2) At high temperature hydrogen sulphide (H_2S) given off by a volcano is oxidized by air to sulphur dioxide (SO_2). Sulphur dioxide reacts with water to form acid rain. How many molecules are there in 0.25 moles of SO2?

DATA	DATA
➢ **Given:** Moles of (SO_2) =0.25moles ➢ **Required:** Number of molecules= ? ➢ **Solution:** 1 mol of (SO_2). contains = 6.022×10^{23} molecules 0.25 moles of (SO_2) contain= $6.022 \times 10^{23} \times 0.25 =$ 1.5055×10^{23} molecules ➢ **Result:** Number of molecules of (SO_2) = 1.5055×10^{23} molecules	➢ **Given:** Moles of (SO_2) =0.25moles ➢ **Required:** Number of molecules= ? **Solution:** Formula: Number of molecules = No. of moles x Avogadro number Number of molecules = $6.022 \times 10^{23} \times 0.25 =$ 1.5055×10^{23} molecules ➢ **Result:** Number of molecules of (SO_2) = 1.5055×10^{23} molecules

Mole –Particles Calculations

3) :CALCULATE THE NUMBER OF MOLES IN THE GIVEN NUMBER OF ATOMS:

Q: Titanium is corrosion resistant metal that is used in rockets, aircrafts and jet engines. Calculate the number of moles of this sample containing (3.011×10^{23}) Ti-atoms.

DATA

➢ **Given:**

Number of atoms=(3.011×10^{23}) Ti-atoms.

➢ **Required:**

Number of moles = ?

➢ **Solution:**

6.022×10^{23} Ti atoms = 1 mole of Ti

$$1 \text{ Ti atom} = \frac{1}{6.022 \times 10^{23}} \text{ moles of Ti}$$

$$3.011 \times 10^{23} \text{ Ti atoms} = \frac{1}{6.022 \times 10^{23}} \times 3.011 \times 10^{23} \text{ moles}$$

= 0.5 moles of Ti

➢ **Result:**

moles of Ti= 0.5 moles

DATA

➢ **Given:**

Number of atoms=(3.011×10^{23}) Ti-atoms.

➢ **Required:**

Number of moles = ?

Solution:

Formula:

Number of atoms = No. of moles x Avogadro number

3.011×10^{23} =moles x 6.022×10^{23}

$$\text{Moles} = \frac{3.011 \times 10^{23}}{6.022 \times 10^{23}} = 0.5 \text{ moles of Ti}$$

➢ **Result:**

moles of Ti= 0.5 moles

Mole –Particles Calculations

4) :CALCULATE THE NUMBER OF MOLES IN THE GIVEN NUMBER OF MOLECULES:

Q: Formaldehyde is used to preserve dead animals. Its molecular formula is CH_2O .Calculate the number of moles that would contain $3.011x10^{22}$ molecules of this compound.

DATA

➢ **Given:**

Number of molecules=($3.011x10^{22}$)

➢ **Required:**

Number of moles = ?

➢ **Solution:**

$6.022x10^{23}$ molecules = 1 mole of formaldehyde

1 molecule = $\frac{1}{6.022X10^{23}}$ moles of CH_2O

$3.011x10^{23}$ molecules = $\frac{1}{6.022X10^{23}}$ x $3.011x10^{22}$ moles

= 0.05 moles of CH_2O

➢ **Result:**

moles of CH_2O= 0.05 moles

DATA

➢ **Given:**

Number of molecules=($3.011x10^{22}$)

➢ **Required:**

Number of moles = ?

Solution:

Formula:

Number of molecules = No. of moles x Avogadro number

$3.011x10^{22}$ = moles x $6.022x10^{23}$

Moles= $\frac{3.011x10^{22}}{6.022X10^{23}}$ = 0.05 moles of CH_2O

➢ **Result:**

moles of CH_2O =0.05 moles

Plenary

(i)-Decide whether or not each of the following is an example of empirical formula?

Al_2Cl_6 , Hg_2Cl_2 , NaCl , C_2H_6O

(ii) What is the difference between an atom & ion? Empirical and molecular formula?

(iii) Define: Cation and Anion

Home Work

- Solve :
- Self-Assessment Exercise 1.10,(pg no.26)
- Review Questions: 8,14,15,


Let's Stop COVID-19
Stay
Home
Stay Safe
WORK
FROM HOME


.Allah Hafiz.
خدا حافظ
في أمان الله
May Allah protect you
[ARABIC PHRASE USED BY
WAY OF SAYING GOODBYE]
@TRUSTINC_TRUTHS