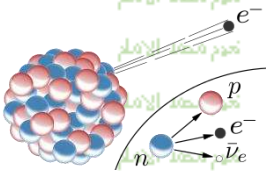
تم تحميل هذا الملف من موقع المناهج الإماراتية

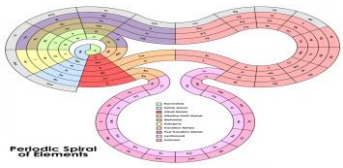
الملف ملخص وأوراق عمل الجدول الدوري Table Periodic
موقع المناهج ⇦ الصف العاشر المتقدم ⇦ كيمياء ⇦ الفصل الأول

روابط مواقع التواصل الاجتماعي بحسب الصف العاشر المتقدم			
			
روابط مواد الصف العاشر المتقدم على تلغرام			
التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف العاشر المتقدم والمادة كيمياء في الفصل الأول	
1	كيمياء ورقة عمل حول تصنيف العناصر
2	كيمياء ملخص كامل(10 صفحات)
3	الكيمياء التوزيع الزمني للخطة الفصلية 20182017
4	كيمياء اول ثلاث دروس
5	الجدول الدوري وتطوره



Worksheets In Chemistry



The Periodic Table and Periodic Law

Grade 10(advanced)
Grade 11(general)

2019/2018

Prepared by :
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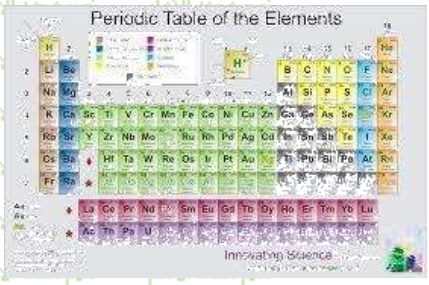

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تمنياتي لجميع الطلبة بالنجاح والتفوق

The Periodic Table and Periodic Law

Section 1 Development of the Modern Periodic

MAIN IDEA :

The periodic Table evolved over time as scientists discovered more useful ways to compare and organize the elements

Dictionary

word	meaning	word	meaning	word	meaning
categories	فئات/اقسام	struck	يصطدم	resin	راتنج
Element	العنصر	brittle	هش	prosthetics	اطراف صناعية
Compound	المركب	dull	غير لامع	fabrication	تصنيع
Atomic mass	الكتلة الذرية	abundant	وفرة	column	عمود
Atomic number	العدد الذري	scientists	العلماء	seemingly	علي مايبدو
Periodic table	الجدول الدوري	submarine	الغواصة	refrence	مرجع
Periodic law	القانون الدوري	metalliods	اشباه الفلزات	Stair step line	علي جانبي الخط المتعرج
contributions	اسهامات/ جهود	extensively	علي نطاق واسع	trend	اتجاه
demostrated	اظهر	chips	رقائق	hampered	يعيق
representative	الرئيسية/ الممثلة	Solar cell	الخلايا الشمسية	Octaves law	قاون الثمانيات
inflammable	قابل للاشتعال	clay	الطين	mercury	الزئبق
malleable	قابل للطرق	duuctile	قابل للسحب	light	خفيف
chalk	طباشير	charcoal	الفحم	lifelike	نابض بالحياه
familiar	مألوف	transition	الانتقالية	Alkali metals	الفزات القلوية
nonmetals	اللافلزات	Noble gases	الغازات الخاملة	halogens	الهالوجينات
emit	يشع/يصدر	lanthanide	اللانثنيدات	actinide	الاكتينيدات
apparent	واضح	several	العديد	properties	خواص
By increasing	بزيادة	repetition	نمطية/ تكرارية	devices	اجهزة

تمنياتي لجميع الطلبة والطالبات بالتفوق والنجاح

أ. نعيم الامام عقل

Item	Definition
Periodic Law	Is periodic repetition of chemical and physical Properties of the elements when they are arranged by increasing atomic number
Representative elements(main group)	That elements in groups 1,2 and13 to18 posses awide range of chemical and physical properties
Transition elements	That elements in group 3 to 12
Metals	Elements that are generally shiny when smooth and clean ,solid at room temperature,and good conductors of heat and electricity
Alkali metals	That elements in group 1 (except hydrogen)
Alkaline earth metals	That elements in group2
Non-metels	Are elements that are generally gases or brittle, dull-lookimg solids
halogens	That elements in group 17, are often part of compound
Noble gases	The extremely un reactive group 18elements
Metalloids(semimetals)	That elements found in bordering the stair step line

✓ Development of the periodic table

Scientist	Contributions
Antoine Lavoisier (1743-1794)	➢ **Compiled alist of elements that were known at the time(33elements)** ➢ **Organized elements in 4 groups: gases, metals, nonmetalsand earths**
J.Newlands (1837-1898)	➢ **Arranged elements by increasing atomic mass** ➢ **Noticed the repetition of properties every 8 elements** ➢ **Created the law of octaves**
Lothar meyer (1830-1895)	➢ **Demonstrated a conection between atomic mass and elements properities** ➢ **Arranged the elements in order of increasing atomic mass**
Dmitri mendleev (1834-1907)	➢ **Demonstrated a conection between atomic mass and elements properities** ➢ **Arranged the elements in order of increasing atomic mass** ➢ **Predicted the existence and properities of undiscovered elements** ➢ **Arranged elements with similar chemical properties horizontally .he left empty spaces for elements that were not yet discovered**
Hennery Moseley (1887-1915)	➢ **Discovered that atoms contain aunique number of protons called atomic number** ➢ **Arranged the elements in order of increasing atomic number, which resulted in aperiodic pattern of properties**

✓ The modern periodic table

- Consists of boxes , each containing an element name, chemical symbol,atomic number ,atomic mass and its state.
- Elementa arranged in order of increasing atomic number
- Consistes of 7 periods (horizontall rows) and 18 groups (families)
- Elements are classified as: metals, nonmetals and metalloids
- Alkali metals(group 1) exist as compounds ? because they are reactive

period	group
➢ horizontall rows ➢ periodic table Consistes of 7 periods ➢ different chemical properties	➢ Vertical columns ➢ periodic table Consistes of 18 groups ➢ have the same chemical properties

Metals	Nonmetals
✓ all solids except Hg (Mercury)	✓ Solids – liquid(Br) bromine and gases
✓ Shiny	✓ Dull- brittle
✓ Good conductors of heat and electricity	✓ They ae poor conductors of heat and electricity
✓ Malleable:they can bepounded into thin sheets	✓ Non malleable
✓ Ductile:they can be drawn into wires	✓ Non ductile
✓ Most of representative elements and all transition elements are metals	✓ To the right of the periodic table
High melting points	Low melting points (some are even gases at room temperature)

✓ Metalloids

- They have physical and chemical properties of both metals and non metals
- They are found in the stair step line in periodic table
- They are bordering the stairstep line in periodic table
- Known as semimetals or semiconductors
- Examples: silicon (Si) – germanium (Ge)

Figure 6 Scientists developing submarine technology created this robot that looks and swims like a real fish. Its body is made of a silicon resin that softens in water.

✓ Transition metals

- Divided into transition metals and inner transition metals
- Inner transition metals are two sets: lanthanide series and actinide series

Lanthanide series	actinide series
✓ 14 elements ✓ Found in period6 ✓ From cerium($_{58}$Ce) to lutetium ($_{71}$ Lu) ✓ Used extensively as phosphors substance that emit light when stuck by electrons because it is strong and light	✓ 14 elements ✓ Found in period7 ✓ From thorium($_{90}$Th) to Lawrencium ($_{103}$ Lr) ✓ Radioactive elements
✓ They are located along the bottom of periodic table ✓ They are block F	

✓ Halogens(group17)

- **Very active nonmetals like group1,2**
- **Are often apart of compounds**

✓ Nobel gases(group18)

- **Extremely un reactive elements (stable)that they undergo virtually no chemical reaction**
- **Are used in lasers, avariety of light bulbs and neon signs**

Element/Compound	uses
Sodium Na	One of compound of salt
Lithium Li	Often used in batteries
Ca , Mg	Important for health
Magnesium (Mg)	In fabrication of electronic devices such as laptop because Mg : solid and relative light
Titanium (Ti)	Make frames for bicycles and eye glasses
Compound of Fluorine(F)	Are commonly added to toothpaste and drinking water to prevent tooth decay
Si , Ge	Used in extensively in computer chips and sollar cells
Silicon(Si)	Make prosthetics or in lifelike applications

Notes:

- Periodic law can be used to predict un known elemental properities.
- Mandeleev predict the properties of the yet to be discovered elements sacandium , gallium and germanium
- Newlands noticed that the properties of elements repetated every 8 element, in the same way musical notes repeat every 8 note and form octave

PERIODIC TABLE OF THE ELEMENTS

Key: Atomic Number → 1; Symbol → H; 1.008 ← Atomic Mass; Hydrogen ← Name

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H 1.008 Hydrogen																	2 He 4.002602 Helium
3 Li 6.94 Lithium	4 Be 9.0121831 Beryllium											5 B 10.81 Boron	6 C 12.011 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998403163 Fluorine	10 Ne 20.1797 Neon
11 Na 22.98976928 Sodium	12 Mg 24.305 Magnesium											13 Al 26.9815385 Aluminium	14 Si 28.085 Silicon	15 P 30.973761998 Phosphorus	16 S 32.06 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.948 Argon
19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.955908 Scandium	22 Ti 47.867 Titanium	23 V 50.9415 Vanadium	24 Cr 51.9961 Chromium	25 Mn 54.938044 Manganese	26 Fe 55.845 Iron	27 Co 58.933194 Cobalt	28 Ni 58.6934 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.630 Germanium	33 As 74.921595 Arsenic	34 Se 78.971 Selenium	35 Br 79.904 Bromine	36 Kr 83.798 Krypton
37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.90584 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.90637 Niobium	42 Mo 95.95 Molybdenum	43 Tc 98 Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.90550 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.8682 Silver	48 Cd 112.414 Cadmium	49 In 114.818 Indium	50 Sn 118.710 Tin	51 Sb 121.760 Antimony	52 Te 127.60 Tellurium	53 I 126.90447 Iodine	54 Xe 131.293 Xenon
55 Cs 132.90545196 Caesium	56 Ba 137.327 Barium	57/71	72 Hf 178.49 Hafnium	73 Ta 180.94788 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.23 Osmium	77 Ir 192.217 Iridium	78 Pt 195.084 Platinum	79 Au 196.966569 Gold	80 Hg 200.592 Mercury	81 Tl 204.38 Thallium	82 Pb 207.2 Lead	83 Bi 208.98040 Bismuth	84 Po 209 Polonium	85 At 210 Astatine	86 Rn 222 Radon
87 Fr 223 Francium	88 Ra 226 Radium	89/103	104 Rf 267 Rutherfordium	105 Db 268 Dubnium	106 Sg 269 Seaborgium	107 Bh 270 Bohrium	108 Hs 269 Hassium	109 Mt 278 Meitnerium	110 Ds 281 Darmstadtium	111 Rg 281 Roentgenium	112 Cn 285 Copernicium	113 Uut 286 Ununtrium	114 Fl 289 Flerovium	115 Uup 289 Ununpentium	116 Lv 293 Livermorium	117 Uus 294 Ununseptium	118 Uuo 294 Ununoctium

Series															
Lanthanide Series	57 La 138.90547 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.90766 Praseodymium	60 Nd 144.242 Neodymium	61 Pm 145 Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.92535 Terbium	66 Dy 162.500 Dysprosium	67 Ho 164.93033 Holmium	68 Er 167.259 Erbium	69 Tm 168.93422 Thulium	70 Yb 173.054 Ytterbium	71 Lu 174.9668 Lutetium
Actinide Series	89 Ac 227 Actinium	90 Th 232.0377 Thorium	91 Pa 231.03588 Protactinium	92 U 238.02891 Uranium	93 Np 237 Neptunium	94 Pu 244 Plutonium	95 Am 243 Americium	96 Cm 247 Curium	97 Bk 247 Berkelium	98 Cf 251 Californium	99 Es 252 Einsteinium	100 Fm 257 Fermium	101 Md 258 Mendelevium	102 No 259 Nobelium	103 Lr 266 Lawrencium

Section 2 — Classification of the elements

Main idea :

- ✓ elements organized into different blocks in the periodic table according to their electron configurations
- ✓ Chemical elements are identified according to details about the arrangements of their electrons

word	meaning	Word	meaning
fortunately	لحسن الحظ	predictable manner	بطريقة يمكن التنبؤ بها
Electron configuration	التوزيع الالكتروني	synthetized	تم تصنيعها في المختبر
Valence electrons	الكترونات التكافؤ	proceed down	المضي قدما
single	مفرد	orbital	مدار /فلك
block	مجمع	ongoing	جارية/ مستمرة
comprised	يشتمل	partially	جزئيا
span	اتساع	Hold	يمتلأ / يسع
unique	فريد/مميز	outermost	الابعد
undergo	يخضع	virtually	تقريبا

✓ Organizing the elements by electron configuration

- ➢ You can determine an atoms electron configuration and its number valence electrons from its position on the oeriodic table
- ➢ Atoms in the same group have similar chemical properties ? because because they they all have the same number of valance electrons
- ➢ The group 1 elements have similar chemical properties (why?)because they they all have the same number of valance electrons(1 electron)ns^1 or have single electron in their out most orbitals
- ➢ Each group 2 element has avalence electron configuration of ns^2
- ➢ Each groups1,2,and 13 to 18 on the periodic table has its own valence electron configurat

Item	difinetion
Valance electrons	**That electrons in the highest principal energy level of an atom**

✓ Valence electron of representative elements

Group	valence electrons
1	**1e**
2	**2e**
13	**3e**
14	**4e**
15	**5e**
16	**6e**
17	**7e**
18	**8e ethe exception of helium which has only (2) valence electron**

	s-block	p-block	d-block	f-block
group	Two groups :1 ,2	Six groups 13,14,15,16,17,18	Ten groups: 2 → 12	Between3,4
location	Left of periodic table	Right of periodic table	Middle of periodic table	Down of periodic table
Kind of elements	Have representative elements	Have representative elements	Have transition elements	Have inner transition metals
Prop.	✓ Group1:elements have partially filled s orbitals containing one valance electron (ns^1) ✓ Group2:elements have completely filled s orbitals containing 2 valance electron(ns^2)	✓ There are no p-block elements in period 1 because the p sub-level doesn't exist for the first principle energy level(n=1) ✓ The first element in block p is B boron ✓ comprise noble gases which are stable	✓ largest of the blocks ✓ are usually characterized by afilled outer most orbital of energy level (n)and filled or partially filled d orbital of energy level (n-1)	✓ are usually characterized by afilled outer most orbital of energy level (n)and filled or partially filled 4for 5f orbitals ✓ the electrons of f sublevel do not fill their orbitals in apredictable manner

- **The electron dot structures illustrate the connection between group number and number of valence electrons**

The S,P,d,f block elements

- **The periodic table has columns and rows of varing sizes**
- **The periodic table is divided into 4 distinct blocks s,p,d,f**

Because there are 4 different energy sublevels s,p,d,f filled with valene electron

periods	block	elements
Period 1	Contains only S-block elements	2
Period2and3	Contains S-and p-block elements	8
Period4and5	Contains S,pand d-block elements	18
Period6and7	Contains S,p,dand f-block elements	32

Notes:

- ✓ **the p-block span six groups why?because the 3 p orbital can hold asix electros**
- ✓ **the 4S orbital is filled before the 3d orbitals (why)?**
  Because the 4S orbital has alower energy level than the 3d orbitals (Aufbau principle)
- ✓ **the d-block span 10 groups why?because the 5 d orbital can hold atotal of ten electrons**
- ✓ **the f- block spsns 14 columns of the periodic table (why)? Because there 7 f orbitals holding up to maximum of 14 electrons**
- ✓ **the s-p-d and f blocks determine the shap of the periodic table**
- ✓ **The Period in periodic table : the energy level of an element valence electrons**

element	Electron Configurations	Period(principal energy level	(valence elctron)	Group	block	Kind of element
1H هيدروجين	$1s^1$	1	1	1	S	Representative.
2He هيليوم	$1s^2$	1	2	18	P	Represe.
3Li ليثيوم	$1s^2\ 2s^1$	2	1	1	S	Represe.
4Be بريليوم	$1s^2\ 2s^2$	2	2	2	S	Represe.
5B بورون	$1s^2\ 2s^2\ 2p^1$	2	3	13	P	Represe.
6C كربون	$1s^2\ 2s^2\ 2p^2$	2	4	14	P	Represe.
7N نيتروجين	$1s^2\ 2s^2\ 2p^3$	2	5	15	P	Represe.
8O اكسجين	$1s^2\ 2s^2\ 2p^4$	2	6	16	P	Represe.
9F فلور	$1s^2\ 2s^2\ 2p^5$	2	7	17	P	Represe.
10Ne نيون	$1s^2\ 2s^2\ 2p^6$	2	8	18	P	Represe.
11Na صوديوم	[Ne] $3s^1$	3	1	1	S	Represe.
12Mg ماغنيسيوم	[Ne] $3s^2$	3	2	2	S	Represe.
13Al الومنيوم	[Ne] $3s^2\ 3p^1$	3	3	13	P	Represe.
14Si سيليكون	[Ne] $3s^2\ 3p^2$	3	4	14	P	Represe.
15P فوسفور	[Ne] $3s^2\ 3p^3$	3	5	15	P	Represe.
16S كبريت	[Ne] $3s^2\ 3p^4$	3	6	16	P	Represe.
17Cl كلور	[Ne] $3s^2\ 3p^5$	3	7	17	P	Represe.
18Ar ارجون	[Ne] $3s^2\ 3p^6$	3	8	18	P	Represe.
19K بوتاسيوم	[Ar] $4s^1$	4	1	1	S	Represe.
20Ca كالسيوم	[Ar] $4s^2$	4	2	2	S	Represe.
21Sc سكانديوم	[Ar] $4s^2\ 3d^1$	4	-	3	d	transition
22Ti تيتانيوم	[Ar] $4s^2\ 3d^2$	4	-	4	d	transition
23V فانديوم	[Ar] $4s^2\ 3d^3$	4	-	5	d	transition
24Cr كروم	**[Ar] $4s^1\ 3d^5$**	4	-	6	d	transition
25Mn منجنيز	[Ar] $4s^2\ 3d^5$	4	-	7	d	transition
26Fe حديد	[Ar] $4s^2\ 3d^6$	4	-	8	d	transition
27Co كوبلت	[Ar] $4s^2\ 3d^7$	4	-	9	d	transition
28Ni نيكل	[Ar] $4s^2\ 3d^8$	4	-	10	d	transition
29Cu نحاس	**[Ar] $4s^1\ 3d^{10}$**	4	-	11	d	transition
30Zn خارصين	[Ar] $4s^2\ 3d^{10}$	4	-	12	d	transition
31Ga جاليوم	[Ar] $4s^2\ 3d^{10}\ 4p^1$	4	3	13	p	Represe.
32Ge جرمانيوم	[Ar] $4s^2\ 3d^{10}\ 4p^2$	4	4	14	p	Represe.
33As زرنيخ	[Ar] $4s^2\ 3d^{10}\ 4p^3$	4	5	15	p	Represe.
34Se سيلينيوم	[Ar] $4s^2\ 3d^{10}\ 4p^4$	4	6	16	p	Represe.

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اهدي هذا العمل المتواضع الي ابنائي وبناتي
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Section 3

Periodic trends

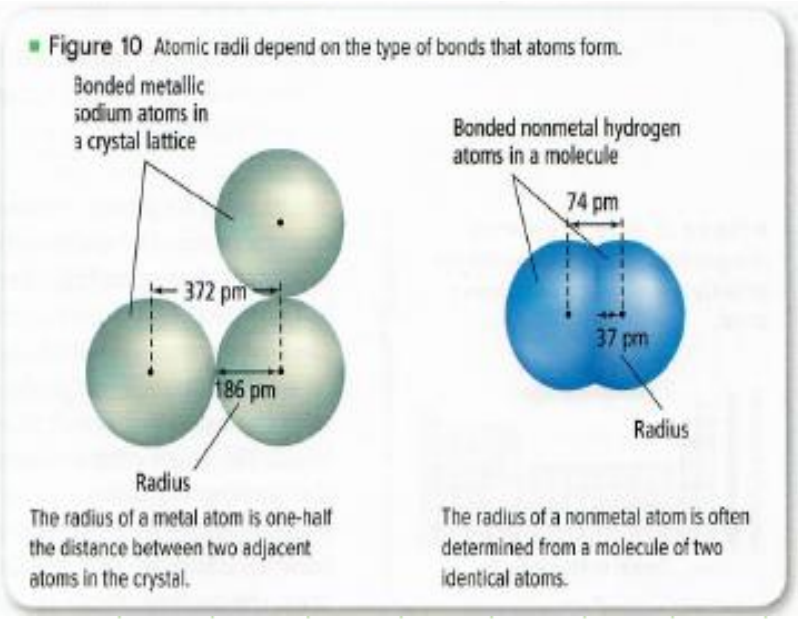
Main idea :trends among elements in the periodic table include their sizes and their abilities to lose or attract electrons

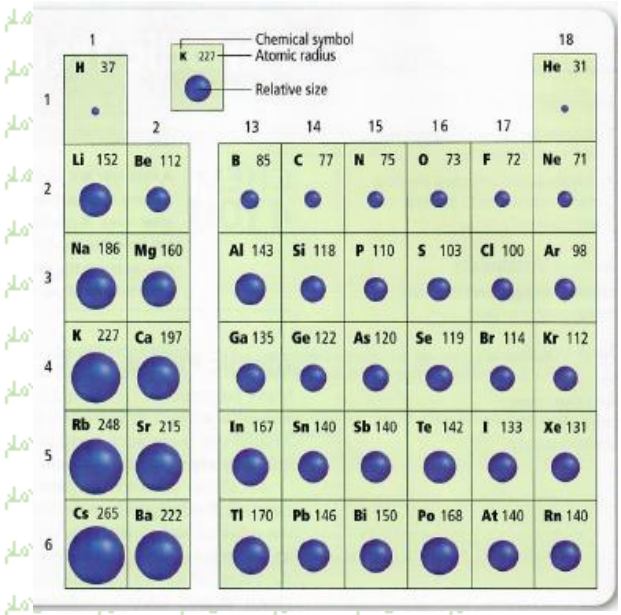
word	meaning	word	meaning	word	meaning
calendar	التقويم	Periodic trends	تدرج خواص العناصر	shield	حاجب/حاجز
Keeping track	تتبعية	lose	يفقد	principal	الرئيسي
Atomic radius	نصف القطر الذري	Further more	علاوة علي ذلك	less likely	اقل احتمالية
aneighboring atom	ذرة مجاورة	Electrostatic repulsion	تنافر الكتروستاتيكي	Octet rule	قاعدة الثمانيات
adjacent	مجاور	corresponding	المقابل	reinforce	يعزز
bonded	المرتبط	offsets	ازاحة	holds onto	يمسك علي
acquire	يتطلب / يكتسب	occupied	مشغول	smoothly	بسلاسة
twofold	ثنائي	closer	متقارب	in similar manner	بطريقة مماثلة
gain	يكتسب	successive	التالي	Electronegativity	السالبية الكهربية

Item	difinetion
Atomic size	Is defined by how closely an atom lies to aneighboring atom
Atomic radius	Half the distance between adjacent nuclei in crystal of the element
ion	Is an atom or abonded group of atoms that have appositive or negative charge.
Ionization energy	The energy required to remove an electron from agaseous atom
The first ionization energy	The energy required to remove the first outermost electron from an atom
Second ionization energy	The energy required to remove asecond electron from +1 ion
third ionization energy	The energy required to remove athird electron from +2 ion
Octet rule	States that atoms tend to gain , lose , or share electrons in order to to acquir afull set of 8 valence electrons
electronegativity	The relative ability of its atoms to attract electrons in achemical bond

Atomic radius

Trends within periods	Trends within groups
✓ When we move from left to right atomic radius decrease(why?) **because** the positive charge in the nucleus increase with increasing of atomic number and the principal energy level with the period remain the same ✓ Each successive element has one additional proton and electron and each additional electron is added to orbitals corresponding to the same principal energy level ✓ Moving across aperiod ,no additional electrons come between the valence electrons are not shield from the **increased nuclear charge** which pulls the outermost electron closer to the nucleus.	✓ When we move from up to down atomic radius increase(why?) **because** the outermost orbital increases in size along with increasing principal energy level thus atom become larger ✓ By increasing the atomic number nuclear charge increases and electrons are added to orbitals corresponding to successively higher principal energy levels however the increased nuclear charge does not pull the outer electrons toward the nucleus to make atom smaller ✓ The larger orbital means that the outer electrons are farther from the nucleus this increased distsnce offsets the pull of the increased nuclear charge ✓ **The additional orbitals** between the nucleus and the outer electrons are occupied , the electrons shield the outer electrons from the nucleus





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Ionic radius

- ✓ **Formation of ions affects the size of an atoms**
- ✓ **Atoms can gain or lose one or more electrons**

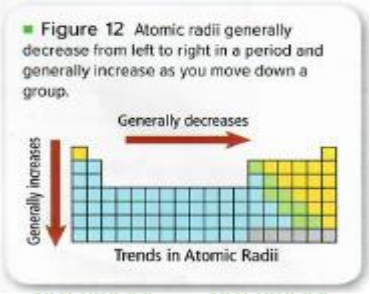
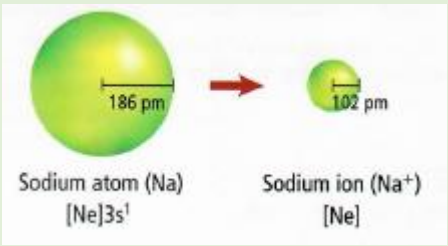
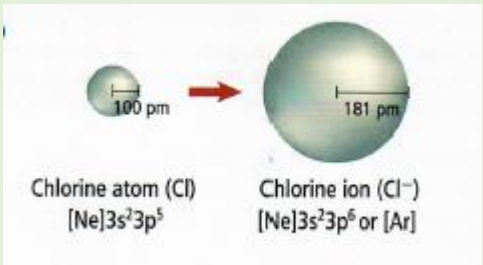


Figure 12 Atomic radii generally decrease from left to right in a period and generally increase as you move down a group.

Formation cation(+)	Formation anion(-)
✓ Atoms lose valance electrons from outer orbital ✓ Result : smaller radius (**why**?) **Because** that experience agreater nuclear charge allowing these remaining electrons to be pulled closer to the positively charged nucleus.  	✓ Atoms gain electrons and form negatively charged ions ✓ Result : larger radius **(why**?) **Because** the addition of an electron to an atom increases the electrostatic repulsion between the atoms outer electrons forcing them to move farther apart the increased distance between the outer electronrns 

Trends within the period	Trends within the group
✓ When we move from left to right across aperiod the size of the positive ions gradually **decreases** ✓ The elements on **the left side** of the table form smaller positive ions ✓ The elements on **the right side** of the table form larger negative ions	✓ When we move down agroup an anions aelectrons are in orbitals corresponding to higher principal energy levels ✓ Resulting in agradual **increase in ionic size** ✓ The ionic radius of positive and negative ions increase

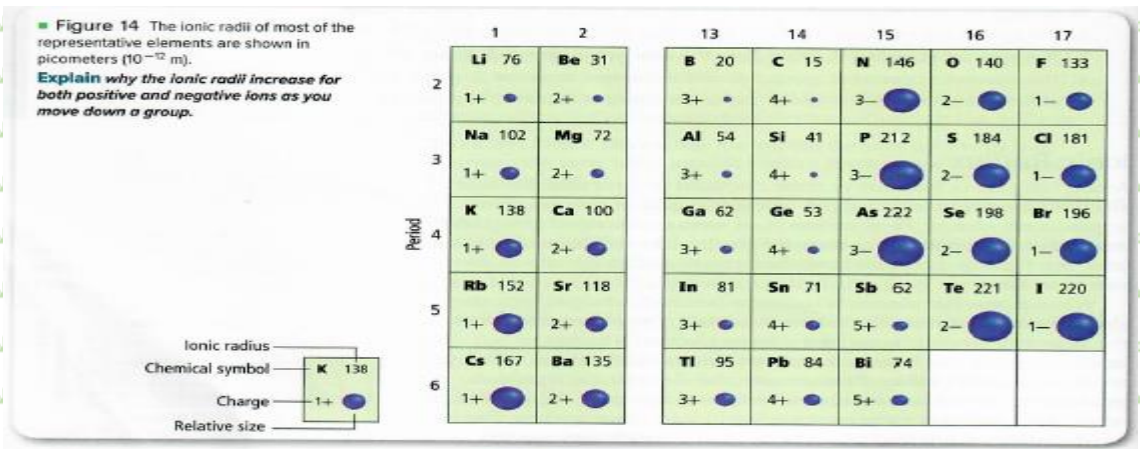


Figure 14 The ionic radii of most of the representative elements are shown in picometers (10^{-12} m).
Explain *why the ionic radii increase for both positive and negative ions as you move down a group.*

Ionization energy طاقة التأين

- ✓ That energy is needed to overcomr the attraction force between the positive charge of the nucleus and the negative charge of electron
- ✓ **Example:**

$Li_{(g)} + 8.64x10^{-19}\ J \rightarrow Li^{+} + e^{-}$

- ✓ Ionization energy indicate strongly an atoms nucleus holds onto its valence electrons
- ✓ Atoms with large ionization energy values are less likely to form positive ions
- ✓ Alow ionization energy value indicates an atom loeses an outer electron easily
- ✓ Lithium used in computer back up batteries (why?) because lithium s low ionization energy where the ability to lose electrons easily makes abattery that quickly provide alarge amount of electrical power
- ✓ Group (1) metals have alow ionization energy and are likely to form **positive ions**
- ✓ Group (18) noble gases have **high** ionization energy and are unlikely to form ions because **stable** electron configuration greatly limits their reactivity.

➢ Removing more than one electron

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- ✓ The second ionization energy of lithium (7300KJ/mol) much larger than its first ionization energy (520 KJ/mol) this means that alithium atom is likely to lose its first avalence electron but extremely unlikely to lose its second
- ✓ The second ionization energy of element much larger than its first ionization energy **(why?)** Because atoms hold onto their valence electrons

Trends within periods	Trends within groups
✓ When move from left to right atomic ionization energy increase (why?) **because** the increased nuclear charge of each successive element produces an in creased hold on valence electrons	✓ When we move from up to down ionization energy decrease(why?) **because** the atomic size increases ✓ Less energy is required to remove valence electrons farther from the nucleus

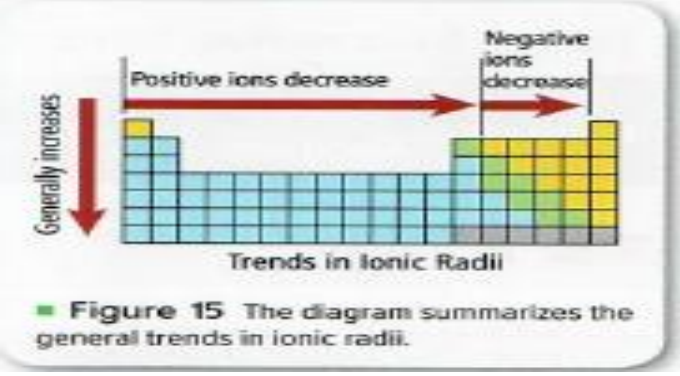

Figure 15 The diagram summarizes the general trends in ionic radii.

Table 5 Successive Ionization Energies for the Period 2 Elements

Element	Valence Electrons	Ionization Energy (kJ/mol)*								
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Li	1	520	7300	11,810						
Be	2	900	1760	14,850	21,010					
B	3	800	2430	3660	25,020	32,820				
C	4	1090	2350	4620	6220	37,830	47,280			
N	5	1400	2860	4580	7480	9440	53,270	64,360		
O	6	1310	3390	5300	7470	10,980	13,330	71,870	84,080	
F	7	1680	3370	6050	8410	11,020	15,160	17,870	92,040	106,430
Ne	8	2080	3950	6120	9370	12,180	15,240	20,000	23,070	115,380

Octet rule

- ✓ The electron configuration of filled s and p orbitals of the same energy level (consisting 8 Valence electrons) is usually stable

➢ Exceptions of octet rule

The first period elements are complete with only (**2e**) valence

➢ Useful of octet rule

- ✓ To determine the type of ions likely to form
- ✓ Elements on the right side of the periodic table tend to gain electrons in order to acquire the noble gase configuration there fore these elements tend to form negative ions
- ✓ Elements on the left side of the periodic table tend to lose electrons and form positive ions

Electronegativity (linus pauling)

- ✓ When move from left to right across aperiod **increase**
- ✓ When we move from up to down decrease
- ✓ Electronegativity values are expressed in terms of anmerical values of 3.98 or less
- ✓ That unit are arbitrary units called paulings
- ✓ Fluorine is the most electronegativity element with value of 3.98
- ✓ Cesium(0.79) and francium (0.7)are the least electronegative elements
- ✓ Noble gases form very few compounds because they don't have electonegativity values

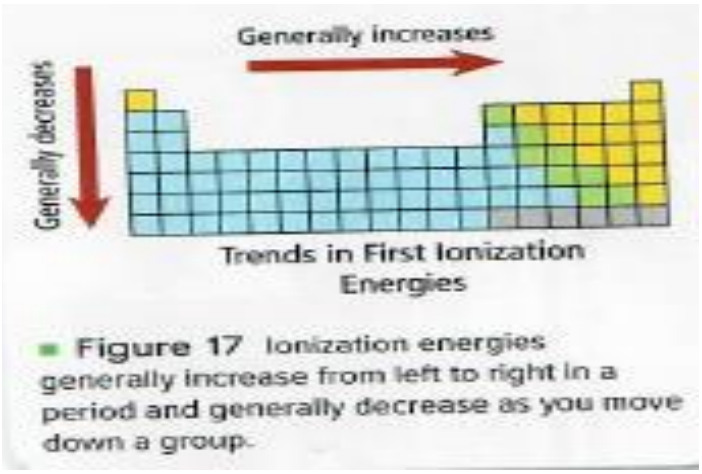

Figure 17 Ionization energies generally increase from left to right in a period and generally decrease as you move down a group.

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Answer the following question :

1. Rank the following elements by increasing atomic radius: carbon, aluminum, oxygen, potassium.
2. Rank the following elements by increasing electronegativity: sulfur, oxygen, neon, aluminum.
3. Why does fluorine have a higher ionization energy than iodine?
4. Why do elements in the same family generally have similar properties?
5. Indicate whether the following properties increase or decrease from left to right across the periodic table.
   a. atomic radius (excluding noble gases)
   b. first ionization energy
   c. electronegativity
6. What trend in atomic radius occurs across the periodic table? What causes this trend?
7. What trend in ionization energy occurs across a period on the periodic table? What causes this trend?
8. Circle the atom in each pair that has the largest radius.
   a. Al or B
   b. Na or Al
   c. S or O
   d. O or F
   e. Br or Cl
   f. Mg or Ca
   G. Na or Na^{+1}
   H. K^{+1} or Mg^{+2}
   I. O or O^{-2}
   J. Cl^{-1} or Br^{-1}
9. Circle the atom in each pair that has the greater ionization energy.
   a. Li or Be
   b. Ca or Ba
   c. Na or K
   d. P or Ar
   e. Cl or Si
   f. Li or K
10. Define electronegativity.
11. Circle the atom in each pair that has the greater electronegativity.
   a. Ca or Ga
   b. Br or As
   c. Li or O
   d. Ba or Sr
   e. Cl or S
   f. O or S

MULTIPLE CHOICE

1. Elements in the same group of the periodic table have the same
   - **A.** number of valence electrons.
   - **B.** physical properties.
   - **C.** number of electrons.
   - **D.** electron configuration.

2. Which statement is NOT true?
   - **A.** The atomic radius of Na is less than the atomic radius of Mg.
   - **B.** The electronegativity of C is greater than the electronegativity of B.
   - **C.** The ionic radius of Br^- is greater than the atomic radius of Br.
   - **D.** The first ionization energy of K is greater than the first ionization energy of Rb.

3. What is the group, period, and block of an atom with the electron configuration $[Ar]4s^23d^{10}4p^4$?
   - **A.** group 14, period 4, d-block
   - **B.** group 16, period 3, p-block
   - **C.** group 14, period 4, p-block
   - **D.** group 16, period 4, p-block

Use the table below to answer Questions 4 and 5.

Characteristics of Elements

Element	Block	Characteristic
X	s	soft solid; reacts readily with oxygen
Y	p	gas at room temperature; forms salts
Z	—	inert gas

4. In which group does Element X most likely belong?
   - **A.** 1
   - **B.** 17
   - **C.** 18
   - **D.** 4

5. In which block is Element Z most likely found?
   - **A.** s-block
   - **B.** p-block
   - **C.** d-block
   - **D.** f-block

astering Concepts

58. What is ionization energy?

59. An element forms a negative ion when ionized. On what side of the periodic table is the element located? Explain.

60. Of the elements magnesium, calcium, and barium, which forms the ion with the largest radius? The smallest? What periodic trend explains this?

61. Explain why each successive ionization of an electron requires a greater amount of energy.

62. How does the ionic radius of a nonmetal compare with its atomic radius? Explain the change in radius.

63. Explain why atomic radii decrease as you move from left to right across a period.

64. Which element has the larger ionization energy?
   a. Li, N **b.** Kr, Ne **c.** Cs, Li

65. Explain the octet rule. Why are hydrogen and helium exceptions to the octet rule?

Figure 20

66. Use Figure 20 to answer each of the following questions. Explain your reasoning for each answer.
   a. If A is an ion and B is an atom of the same element, is the ion a positive or negative ion?
   b. If A and B represent the atomic radii of two elements in the same period, what is their order?
   c. If A and B represent the ionic radii of two elements in the same group, what is their order?

67. How many valence electrons do elements in group 1 have? In group 18?

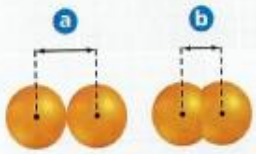

Figure 21

68. Figure 21 shows two ways to define an atomic radius. Describe each method. When is each method used?

69. **Chlorine** The electron configuration of a chlorine atom is $[Ne]3s^23p^5$. When it gains an electron and becomes an ion, its electron configuration changes to $[Ne]3s^23p^6$, or [Ar], the electron configuration for argon. Has the chlorine atom changed to an argon atom? Explain.

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مع تحيات أ. نعيم الامام عقل