END-OF-TERM 1 EXAM · STRUCTURE REVIEW

Exam Structure Review

Grade 10 Advanced · Term 1

30	260	30	120
exam items	practice questions	MCQ in the exam	minutes · 100 marks

For every exam item: read the **learning outcome**, study the **explanation**, then answer the **practice questions**.

Answers are at the end of the file — check yourself only after answering.

Units: Electrons in Atoms · Ionic Compounds and Metals · Covalent Bonding · The Periodic Table and Periodic Law · States of Matter

1 Differentiate between the ground and excited states of an atom

2 Relate the principal quantum number to the total number of orbitals of the principal energy ...

3 Explain the Aufbau principle, the Pauli exclusion principle, and Hund's rule

4 Write the electron configuration, orbital diagram, and noble gas notation of different eleme...

5 Represent the electron dot structure of atoms

6 List the different families in the periodic table with the identification of the group numbe...

7 Differentiate between representative elements and transition elements

8 Use the electron configuration notation, orbital notation, and noble gas notation of an elem...

9 The electron configuration, filling sublevels

10 Explain the trend of first ionization energy across a period (Exceptions between Groups 2 & ...

11 predict the periodic trend of electronegativity across a period and down a group of the peri...

12 · 15 Describe how ions (cations and anions) form to fulfill the octet rule

14 Ion formation

16 · 17 Explain the physical properties of ionic compounds as melting point and boiling point, condu...

18 · 19 Write the chemical formula (using the stock method) of an ionic compound containing monoatom...

20 Describe the formation of metallic bonds

21 Explain some physical properties of metals (Melting and boiling points, Thermal and electric...

22 Define, using energy diagram, covalent bond

23 Differentiate between sigma and pi bonds

24 Identify the relationship between the type of covalent bonds (single, double and triple) and...

25 Name a binary molecular compound based on its molecular formula

26 · 27 Determine the chemical formula of a compound from its name

28 Draw Lewis structures for a number of covalent compounds with single and multiple bonds

29 Identify some combinations of resonance (O_3, NO_3^-, NO_2^-, SO_3^{2-} and CO_3^{2-})

30 Determine the exception of the octet rule (odd number of

Item 1 — Textbook p. 13

Differentiate between the ground and excited states of an atom

EXPLANATION

Ground state = the lowest allowed energy. **Excited state** = the electron absorbed energy and jumped to a higher level; falling back releases a photon.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q30

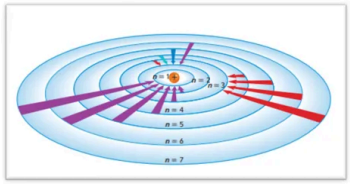
1. Which correctly describes an electron in a hydrogen atom according to Bohr's model?

A. It moves around the nucleus in only certain allowed circular orbits
B. It is stationary around the nucleus in only certain allowed circular orbits
C. It moves around the nucleus in unspecified circular orbits
D. It is stationary around the nucleus in unspecified circular orbits

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q29

2. What explains the emission of the radiation series shown in the figure (hydrogen atom, levels n = 1 to 7)?

What explains the **emission of the radiation series** in the figure below? ما الذي يُفسر انبعاث سلاسل الأشعة في الشكل أدناه؟



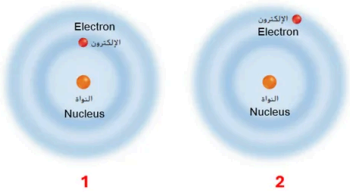
A. The electron drops from a higher energy level to a lower energy level
B. The electron moves from a lower energy level to a higher energy level
C. The electron moves around the nucleus at the same energy level
D. The hydrogen atom is in its ground state

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q28

3. What is the state of a hydrogen atom called when its electron moves from the first energy level (state 1) to a higher level (state 2)?

What is the state of a hydrogen atom called when an electron moves from the first energy level in state 1 to a higher level in state 2?

ماذا تُسمى حالة ذرة الهيدروجين عند انتقال إلكترون من مستوى الطاقة الأول في الحالة رقم 1 إلى مستوى أعلى كما في الحالة رقم 2؟



A. Excited state
B. Ground state
C. Atomic state
D. Wave state

4. In Bohr's model, electrons are not allowed to occupy... (Booklet Q8)

A. spaces between the orbits
B. any orbit
C. the nucleus
D. the ground state

5. What is the ground state of the hydrogen atom in Bohr's model? (Booklet Q5)

A. Electron in the orbit farthest from the nucleus
B. Electron in the orbit closest to the nucleus
C. Electron in any orbit
D. Electron outside the nucleus

6. What did Bohr assign to each orbit in his model? (Booklet Q10)

A. A color
B. A quantum number (n)
C. A mass
D. A charge

7. What happens to electrons in Bohr's model when energy is added? (Booklet Q7)

A. They move to different (higher) orbits
B. They stay in the same orbit
C. They disappear
D. They merge with the nucleus

8. What is the ground state of an atom? (Booklet Q11)

A. The lowest allowable energy state
B. The highest allowable energy state
C. An intermediate energy state
D. A state with no energy

9. According to newer evidence, electrons around the nucleus... (Booklet Q23)

A. move in circular orbits
B. move in elliptical orbits
C. move in fixed paths
D. do not move in circular orbits — only their probable location (cloud) can be known

10. What happens when an atom gains energy? (Booklet Q12)

A. It moves to a lower energy state
B. It remains in the ground state
C. It moves to an excited state
D. It loses electrons

Item 2

Textbook p. 22

Relate the principal quantum number to the total number of orbitals of the principal energy levels and the number of orbitals in sub-energy levels

EXPLANATION

Level **n** has **n** sublevels, $\mathbf{n^2}$ orbitals and holds $\mathbf{2n^2}$ electrons (n = 3 → 3 sublevels, 9 orbitals, 18 e^-). s = 1, p = 3, d = 5, f = 7 orbitals.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q27

11. How many energy sublevels does the n = 4 principal energy level have?

A. 4
B. 2
C. 3
D. 1

12. As n increases, the orbital... (Booklet Q38)

A. becomes smaller
B. disappears
C. stays the same size
D. becomes larger

13. The ‘math rule’ for the total number of orbitals in a main energy level is... (Booklet Q61)

A. n
B. 2n
C. n^2
D. $2n^2$

14. Using $2n^2$ for each level, what is the total maximum number of electrons that the first three principal energy levels can hold together?

A. 18
B. 28
C. 14
D. 36

15. As n increases, the atom’s energy... (Booklet Q39)

A. decreases
B. stays the same
C. increases
D. fluctuates

16. The ‘math rule’ for the number of sublevels in a main energy level n is... (Booklet Q47)

A. n
B. 2n
C. n^2
D. $2n^2$

17. The lowest principal energy level is... (Booklet Q40)

A. n = 0
B. n = 1
C. n = 2
D. n = 3

18. The ‘math rule’ for the maximum number of electrons in a main energy level is... (Booklet Q62)

A. n
B. 2n
C. n^2
D. $2n^2$

19. How many orbitals are in an f sublevel? (Booklet Q53)

A. 1
B. 3
C. 5
D. 7

20. How many electrons are needed to completely fill the third energy level?

A. 3
B. 9
C. 18
D. 27

Item 3

Textbook p. 23, 24

Explain the Aufbau principle, the Pauli exclusion principle, and Hund's rule

EXPLANATION

Aufbau: lowest energy first. **Pauli**: max 2 e^- per orbital, opposite spins. **Hund**: one electron in each equal-energy orbital before pairing.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q26

21. Which electron configuration violates (does not comply with) the aufbau principle?

A. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$
B. $1s^2\ 2s^2\ 2p^6\ 3s^2$
C. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$
D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q25

22. Which orbital diagram (2s | 2p) violates the Pauli exclusion principle?

A. [↑↑] [↑][↑][↑]
B. [↑↓] [↑↓][ ][ ]
C. [↑↓] [↑][↑][↑]
D. [↑] [↑][↑][↑]

23. Which orbital diagram for $2p^3$ obeys Hund's rule?

A. [↑↓][↑][ ]
B. [↑][↑][↑]
C. [↑][↓][↑↓]
D. [↑↓][↑↓][↑↓]

24. States that each electron occupies the lowest energy orbital available.

A. Pauli exclusion principle
B. Heisenberg uncertainty principle
C. Hund's rule
D. Aufbau principle

25. "Electrons occupy orbitals of lowest energy first" is which rule?

A. Hund's rule
B. Aufbau principle
C. Pauli exclusion principle

26. States that single electrons with the same spin must occupy each equal-energy orbital before additional electrons with opposite spins can occupy the same orbital.

A. Hund's rule
B. Aufbau principle
C. de Broglie equation
D. Pauli exclusion principle

27. Which principle states that each electron occupies the lowest-energy orbital available?

A. Pauli exclusion principle
B. Heisenberg uncertainty principle
C. Hund's rule
D. Aufbau principle

28. States that a maximum of two electrons can occupy a single atomic orbital but only if they have opposite spins.

A. Hund's rule
B. Pauli exclusion principle
C. Heisenberg uncertainty principle
D. Aufbau principle

29. Which principle states that it is not possible to know precisely both the velocity and the position of a particle at the same time?

A. Hund's rule
B. Pauli exclusion principle
C. Heisenberg uncertainty principle
D. Aufbau principle

30. According to the Pauli exclusion principle, how many electrons can occupy a single atomic orbital? (Booklet Q83)

A. One
B. Two, with the same spin
C. Two, with opposite spins
D. Four

Item 4

Textbook p. 25, 26

Write the electron configuration, orbital diagram, and noble gas notation of different elements

EXPLANATION

Order: 1s 2s 2p 3s 3p **4s 3d** 4p … Noble-gas notation: Na = [Ne] $3s^1$. Exceptions: **Cr [Ar] $4s^1$ $3d^5$**, **Cu [Ar] $4s^1$ $3d^{10}$**.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q24

31. Using noble-gas notation, which represents the ground-state electron configuration of silicon (Si)?

A. [Ne]$3s^2 3p^2$
B. [Ne]$3s^2 3p^4$
C. [Ar]$4s^2 3d^2$
D. [He]$2s^2 2p^2$

32. Which orbital is filled after 2p? (Booklet Q70)

A. 3s
B. 3p
C. 3d
D. 2d

33. What must be true for two electrons to occupy the same orbital? (Booklet Q84)

A. Same spin
B. Opposite spins
C. Different energy levels
D. Different sublevels

34. Which orbital is filled after 4s? (Booklet Q71)

A. 4p
B. 3d
C. 4d
D. 5s

35. According to Hund's rule, electrons in orbitals of equal energy... (Booklet Q88)

A. occupy each orbital singly before any orbital gets a second electron
B. pair up before moving to the next orbital
C. fill the lowest energy orbitals first
D. fill the highest energy orbitals first

36. Which orbital is filled after 6s? (Booklet Q72)

A. 6p
B. 5d
C. 4f
D. 7s

37. In a set of p orbitals, how are electrons distributed according to Hund's rule? (Booklet Q92)

A. One electron in each orbital with parallel spins before pairing
B. Two electrons in one orbital before the next
C. Randomly
D. Opposite spins first

38. The orbital related to the 4s sublevel has... (Booklet Q82)

A. lower energy than the 3d orbitals
B. higher energy than the 3d orbitals
C. the same energy as the 3d orbitals
D. no relation to 3d

39. Light below the threshold frequency shines on a metal for a long time. What happens?

A. Electrons are ejected after a while
B. No photoelectrons are ejected
C. More electrons are ejected if the light is brighter
D. The metal emits photons of higher frequency

40. Which symbol represents an orbital with one electron? (Booklet Q86)

A. [↑↓]
B. [↑]
C. [ ]
D. [↓↓]

Item 5

Textbook p. 28, 29

Represent the electron dot structure of atoms

EXPLANATION

Electron-dot structure shows **valence electrons only** (outer s and p): place dots singly on four sides, then pair. N → 5 dots, Cl → 7 dots.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q23

41. Which of the following atoms contains 7 valence electrons? (Cl 17, Na 11, Mg 12, O 8)

A. Chlorine (Cl)
B. Sodium (Na)
C. Magnesium (Mg)
D. Oxygen (O)

42. What is an electron dot structure?

A. A diagram that shows the symbol of an element surrounded by dots representing its valence electrons
B. A diagram that shows all the electrons of an atom as dots
C. A diagram showing the protons and neutrons in the nucleus
D. A list of an atom's energy levels and sublevels

43. A solid found in emeralds with the dot structure ·X· is... (Practice 26)

A. carbon
B. sulfur
C. beryllium
D. cesium

44. What does each dot in the electron cloud represent? (Booklet Q33)

A. A location where the electron could be at a given moment
B. The exact position of an electron
C. The energy of an electron
D. The velocity of an electron

45. A gas from the list H, He, N, O, F, Cl, Ne with the dot structure ·X· is... (Booklet Q115)

A. hydrogen
B. helium
C. nitrogen
D. neon

46. Which atom is usually the central atom in a Lewis structure?

A. The atom with the least attraction for shared electrons
B. The atom with the most electrons
C. Always hydrogen
D. The atom closest to fluorine

47. Consists of an element's symbol (nucleus and inner electrons) surrounded by dots representing the atom's valence electrons.

A. energy sublevel
B. photon
C. quantum
D. electron-dot structure

48. What does each dot in an electron-cloud diagram represent?

A. A location where the electron could be at a given moment

B. The exact position of an electron

C. The energy of an electron

D. The velocity of an electron

49. How many hydrogen atoms are in a molecule of phosphine, PH_3? (Booklet Q44)

A. 1 **B.** 2

C. 3 **D.** 4

50. The molecular formula of a compound tells you...

A. the type and number of each atom in a molecule

B. the shape of the molecule

C. where the lone pairs are

D. the bond lengths

Item 6

Textbook p. 40, 41

List the different families in the periodic table with the identification of the group number and the elements present

EXPLANATION

Families: group 1 alkali metals, 2 alkaline-earth metals, 17 halogens, 18 noble gases. Representative group number ↔ valence e^- (group 13 → 3, group 16 → 6).

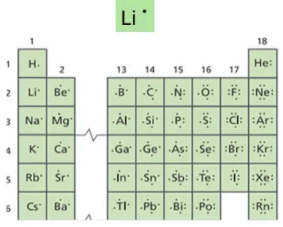
PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q21

51. Lithium (Li) has the electron-dot structure Li·. Using the periodic table, what is an expected property of this element?

Lithium element (Li) has the following Electron–dot structure. Using the periodic table below, what are the expected chemical and physical properties for this element?

عنصر **الليثيوم (Li)** له الترميز النقطي التالي. باستخدام الجدول الدوري أدناه، ما الخواص الكيميائية والفيزيائية المتوقعة لهذا العنصر؟



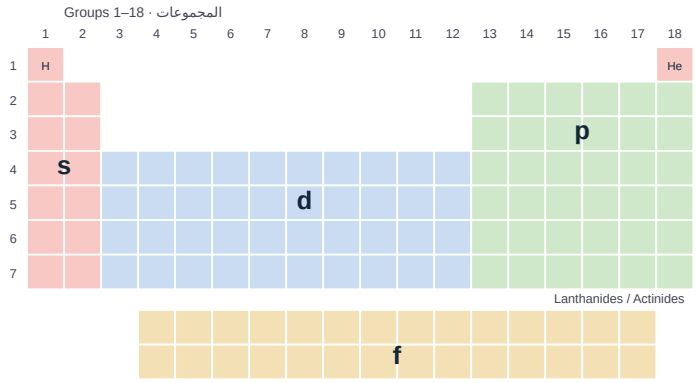
A. Highly chemically reactive

B. Strong and lightweight

C. Brittle and dull

D. Poor conductor of heat and electricity

52. Which periodic table group has 2 electrons in its outermost energy level?



Blocks of the periodic table · فئات الجدول الدوري

A. group 1 (alkali metals)

B. group 17 (halogens)

C. group 16 (oxygen family)

D. group 2 (alkaline earth metals)

53. Which of the following elements has the lowest electronegativity value?

A. Cesium

B. Sodium

C. Potassium

D. Francium

54. An element has the noble-gas notation $[Ar]4s^23d^6$. It is...

A. a representative element in group 6

B. a noble gas

C. a transition element in period 4

D. an inner transition element

55. Each family in the periodic table has its own characteristic properties based on the number of:

Use the figure above

A. neutrons

B. valence electrons

C. protons

D. ions

56. The element boron is directly above aluminum in the periodic table. Which statement about boron is true?

Use the figure above

A. Boron is in the same period as aluminum.

B. Boron is in the same group as aluminum and has 5 valence electrons.

C. Boron has 5 valence electrons and is in the same period as aluminum.

D. Boron is in the same group as aluminum and has 3 valence electrons.

57. Which statement correctly compares representative and transition elements?

A. Representative elements are all in the d-block

B. Transition elements include the noble gases

C. Both groups contain only metals

D. Representative elements include metals, nonmetals and metalloids; transition elements are all metals

58. Each family in the periodic table has its own characteristic properties based on its number of valence electrons.

Use the figure above

A. True

B. False

59. Without looking at a periodic table, what is the expected outer electron configuration of the element in group 7, period 4?

Use the figure above

A. $4s^2 3d^5$

B. $4s^2 4p^5$

C. $4s^2 3d^7$

D. $4s^1 3d^6$

60. The oxidation number of an element in an ionic compound equals...

A. the number of electrons transferred from the atom to form the ion

B. the number of protons

C. the group number always

D. the number of energy levels

Item 7

Textbook p. 40

Differentiate between representative elements and transition elements

EXPLANATION

Representative elements: groups 1, 2, 13–18 (s- and p-block). **Transition** elements: groups 3–12 (d-block); inner transition = f-block.

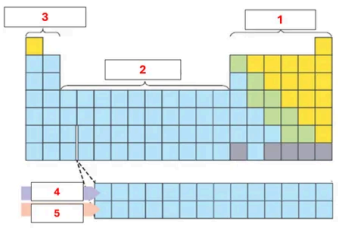
PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q22

61. What elements are represented by the area labelled 4 in the figure?

What elements are represented by the area labelled 4 in the figure below?

ما هي العناصر التي تُمثّلها المنطقة المشار إليها بالرقم 4 في الشكل أدناه؟



A. Lanthanide series
B. Alkaline earth metals
C. Actinide series
D. Halogens

62. As an electron moves from n = 1 to n = 4, energy is...

A. absorbed
B. released

63. Iron (Fe) is classified as...

A. a transition metal
B. a metalloid
C. a representative element
D. a noble gas

64. As an electron moves from n = 4 to n = 1, energy is...

A. absorbed
B. released

65. Which element is a representative element?

A. Zinc (Zn)
B. Calcium (Ca)
C. Copper (Cu)
D. Chromium (Cr)

66. Electrons can exist in between energy levels.

A. True
B. False

67. The inner transition metals (lanthanides and actinides) belong to the...

A. p-block
B. s-block
C. d-block
D. f-block

68. Which electron jump gives the more energetic light?

A. 5th to the 2nd energy level
B. 3rd to the 2nd energy level

69. A representative element has three valence electrons. In which group is it located?

A. Group 1
B. Group 13
C. Group 3
D. Group 15

70. Which strong, light transition metal is used to make frames of bicycles and eyeglasses?

A. Iron (Fe)
B. Titanium (Ti)
C. Copper (Cu)
D. Zinc (Zn)

Item 8

Textbook p. 44, 45, 46, 48

Use the electron configuration notation, orbital notation, and noble gas notation of an element (Z 1 - 36) to identify the location of an element in the periodic table (period, group and block)

EXPLANATION

Read the position from the configuration: **period** = highest n; **block** = last sublevel filled; **group** from valence e⁻ ($3s^2\ 3p^5$ → period 3, group 17).

PRACTICE QUESTIONS

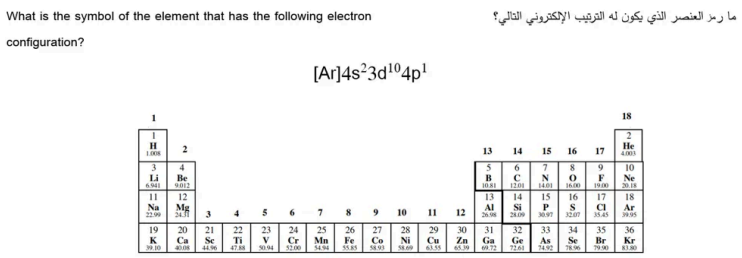
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71. To which period, group and block does the element $[Ar]4s^23d^{10}4p^4$ belong?

A. Period 4 · group 16 · p-block
B. Period 5 · group 12 · d-block
C. Period 4 · group 6 · p-block
D. Period 5 · group 16 · d-block

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q19

72. What is the symbol of the element with the electron configuration $[Ar]4s^23d^{10}4p^1$?



A. Ga
B. Al
C. Si
D. Ge

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q18

73. An element is in group 17, period 4. What is its electron configuration?

A. $[Ar]4s^23d^{10}4p^5$
B. $[Ar]4s^23d^{10}4p^6$
C. $[Ar]4s^23d^{10}4p^3$
D. $[Ar]4s^23d^5$

74. What is the noble-gas shorthand for a sulfur atom?

A. [Ar] $3p^4$
B. [He] $3s^2\ 3p^4$
C. [Ne] $3s^2\ 3p^4$
D. [Na] $3s^2\ 3p^4$

75. An element has the electron configuration [Ne]$3s^2 3p^4$. Give its group, period and block.

A. Group 16, period 3, p-block
B. Group 6, period 3, p-block
C. Group 16, period 4, p-block
D. Group 14, period 3, s-block

76. An element has the electron configuration [Xe]$6s^2 4f^{14} 5d^{10} 6p^5$. Give its group, period and block.

A. Group 17, period 6, f-block
B. Group 7, period 6, p-block
C. Group 17, period 6, p-block
D. Group 15, period 6, p-block

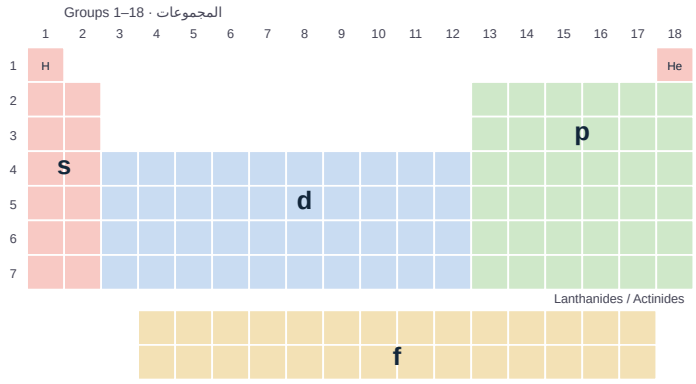
77. Which statement is true about electronegativity?

A. It decreases across a period from left to right.
B. It is a measure of an atom's ability to attract electrons in a chemical bond.
C. It is the same for all elements.
D. It is measured in kilojoules per mole (kJ/mol).

78. An element has the electron configuration [Kr]$5s^2 4d^1$. Give its group, period and block.

A. Group 2, period 5, s-block
B. Group 3, period 5, d-block
C. Group 3, period 4, d-block
D. Group 13, period 5, p-block

79. In the periodic table, the vertical columns are called:



Blocks of the periodic table · فئات الجدول الدوري

A. groups
B. periods
C. rows
D. blocks

80. An element has the electron configuration [Ar]$4s^2 3d^{10} 4p^3$. Give its group, period and block.

A. Group 5, period 4, d-block
B. Group 15, period 3, p-block
C. Group 15, period 4, p-block
D. Group 13, period 4, p-block

Item 9

Textbook p. 46

The electron configuration, filling sublevels

EXPLANATION

Sublevel capacity: s 2 · p 6 · d 10 · f 14. Follow the diagonal rule — 4s fills before 3d, 5s before 4d.

PRACTICE QUESTIONS

81. Ground-state configuration of bromine (Practice 19a):

A. [Ar] $4s^2$ $3d^{10}$ $4p^5$
B. [Ar] $4s^2$ $4p^5$
C. [Kr] $4p^5$
D. [Ar] $3d^{10}$ $4p^7$

82. Which sublevels of the 3rd energy level are filled in krypton? (Booklet Q106b)

A. 3s only
B. 3s and 3p
C. 3s, 3p and 3d
D. none

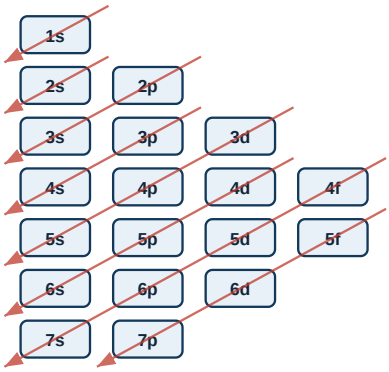
83. Why is Cd^{2+} stable even though it does not have a noble-gas configuration?

A. It gained two electrons
B. It has a half-filled d sublevel
C. It has 8 electrons in its d sublevel
D. Its outer s, p and d sublevels are completely filled (18 electrons)

84. Ground-state configuration of strontium (Practice 19b):

A. [Ar] $5s^2$
B. [Kr] $5s^2$
C. [Kr] $4d^2$
D. [Xe] $5s^2$

85. According to the aufbau diagram, which sublevel is filled after 2p?



Follow the arrows · اتبع الأسهم
1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d …

A. 2d
B. 3s
C. 3p
D. 2s

86. According to the aufbau diagram, which sublevel is filled after 6s?

Use the figure above

A. 6p
B. 5d
C. 4f
D. 7s

87. Ground-state configuration of titanium (Practice 19f):

A. [Ar] $4s^2$ $3d^2$
B. [Ar] $3d^4$
C. [Ar] $4s^2$ $4p^2$
D. [Ne] $4s^2$ $3d^2$

88. According to the aufbau diagram, which sublevel is filled after 4s?

Use the figure above

A. 4p
B. 3d
C. 4d
D. 5s

89. Which sublevels of the 3rd energy level are filled in the element krypton (Z = 36)?

A. 3s and 3p only
B. 3s, 3p and 3d
C. 3s only
D. 3d only

90. The correct ground-state configuration of chromium is...

A. [Ar] $4s^2$ $3d^4$
B. [Ar] $4s^1$ $3d^5$
C. [Ar] $3d^6$
D. [Ar] $4s^2$ $4p^4$

Item 10

Textbook p. 54

Explain the trend of first ionization energy across a period (Exceptions between Groups 2 & 3 and 5 & 6 are included), and down a group of the periodic table

EXPLANATION

First ionization energy **increases across** a period and **decreases down** a group. Exceptions: group 2 > group 13 and group 15 > group 16.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q17

91. Which describes the trends in atomic radii correctly?

A. Across a period: generally decrease · Down a group: generally increase
B. Across a period: generally increase · Down a group: generally increase
C. Across a period: generally decrease · Down a group: generally decrease
D. Across a period: generally increase · Down a group: generally decrease

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q16

92. Which of the following explains the general decrease in first ionization energy as you move down a group?

A. Atomic size increases as you move down the group
B. The nuclear charge decreases drastically
C. More energy is required to remove valence electrons farther from the nucleus
D. Atoms lose protons as they move down the group

93. Which element would have the highest ionization energy in Period 3?

A. Sodium (Na)
B. Magnesium (Mg)
C. Aluminum (Al)
D. Argon (Ar)

94. As you move from left to right across a period, the ionization energy:

A. Decreases
B. Fluctuates
C. Remains the same
D. Increases

95. A new element has ionization energies IE1 127, IE2 287, IE3 625, IE4 2651, IE5 3540 kJ/mol. Which group does it belong to?

A. Group 1
B. Group 2
C. Group 13
D. Group 15

96. As you move down a group, the ionization energy:

A. Decreases
B. Increases
C. Remains the same
D. Fluctuates

97. Electronegativity is measured on a relative scale. What is the highest value on this scale?

A. 3.98
B. 4.00
C. 2.55
D. 1.00

98. Which element would have the lowest ionization energy in Group 1?

A. Lithium (Li)
B. Sodium (Na)
C. Potassium (K)
D. Cesium (Cs)

99. Why does ionization energy increase across a period from left to right?

A. The number of protons in the nucleus increases
B. The number of protons in the nucleus decreases
C. The atomic radius increases
D. The number of neutrons in the nucleus increases

100. Which period-3 element has the highest first ionization energy?

A. Na
B. Al
C. P
D. Cl

Item 11

Textbook p. 56, 57

predict the periodic trend of electronegativity across a period and down a group of the periodic table

EXPLANATION

Electronegativity **increases across** a period and **decreases down** a group; fluorine is the highest (3.98).

PRACTICE QUESTIONS

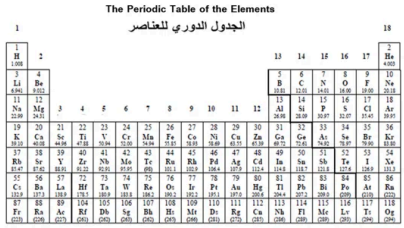
★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q15

101. What is the correct order of K, Br, Se and Ca by increasing electronegativity (lowest to highest)?

What is the **correct ascending** order of the following elements according to **increasing electronegativity** (from lowest to highest)?

ما الترتيب **التصاعدي الصحيح** للعناصر التالية حسب زيادة **السالبية الكهربائية** لكل منها (**من الأقل إلى الأعلى**)؟

K, Br, Se, Ca



A. K < Ca < Se < Br

B. Se < Br < Ca < K

C. Ca < K < Br < Se

D. Br < Se < Ca < K

102. As you move from left to right across a period, electronegativity generally:

A. decreases

B. remains the same

C. increases

D. fluctuates randomly

103. Which one of the following correctly describes the trend in electronegativity?

A. It increases across a period and decreases down a group.

B. It decreases across a period and decreases down a group.

C. It increases across a period and increases down a group.

D. It decreases across a period and increases down a group.

104. Which of the following statements about electronegativity is true?

A. It decreases across a period from left to right.

B. It is a measure of an atom's ability to attract electrons in a chemical bond.

C. It is the same for all elements.

D. It is measured in kilojoules per mole (kJ/mol).

105. How does electronegativity change across a period and down a group?

A. It increases across a period and decreases down a group.

B. It decreases across a period and increases down a group.

C. It increases across a period and down a group.

D. It does not change across a period.

106. As you move down a group, electronegativity generally:

A. decreases

B. remains the same

C. increases

D. fluctuates randomly

107. Across a period, how does the size of the positive ions change, and what happens beginning with group 15 or 16?

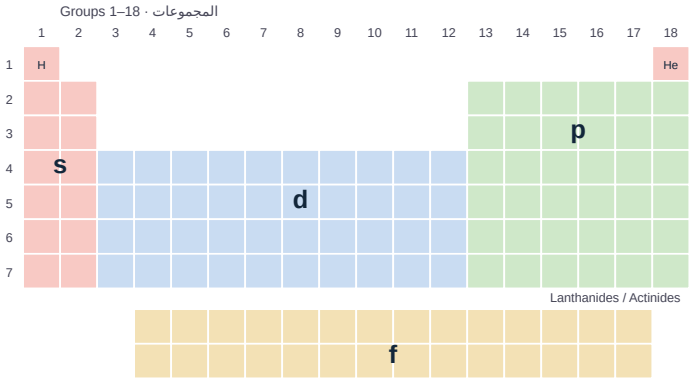
A. Positive ion size decreases gradually; then the much larger negative ions begin and also decrease in size.

B. Positive ion size increases; then the negative ions begin and decrease in size.

C. Positive ion size stays constant; negative ions increase in size.

D. All ions increase in size across the period.

108. As you move down a group in the periodic table, what happens to the atomic radius?



Blocks of the periodic table · فئات الجدول الدوري

A. It decreases.

B. It increases.

C. It remains the same.

D. It first increases, then decreases.

109. What is the electronegativity value assigned to fluorine?

A. 2.98

B. 3.44

C. 3.98

D. 4.00

110. From left to right across a period, how do atomic radius, first ionization energy and electronegativity change?

A. Radius decreases; ionization energy increases; electronegativity increases

B. Radius increases; ionization energy decreases; electronegativity decreases

C. Radius decreases; ionization energy decreases; electronegativity increases

D. Radius increases; ionization energy increases; electronegativity increases

Items 12 · 15

Textbook p. 65, 69

Describe how ions (cations and anions) form to fulfill the octet rule

EXPLANATION

Atoms form ions to reach a stable **octet**: metals **lose** e^- → cations (Na → Na^+); nonmetals **gain** e^- → anions (Cl → Cl^-).

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q13

111. Which correctly explains why sodium forms a cation (Na^+)? $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

A. Sodium loses one electron to attain a stable configuration like neon

B. Sodium gains one electron to achieve an octet

C. Sodium shares one electron with chlorine to achieve an octet

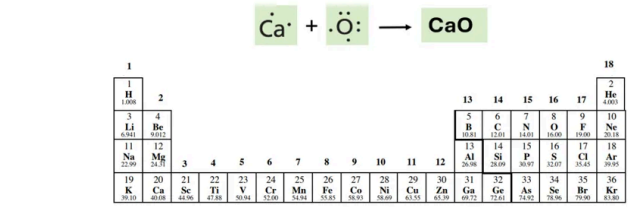
D. Sodium transfers two electrons to chlorine

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q12

112. When calcium reacts with oxygen to form calcium oxide ($Ca\cdot + \cdot\ddot{O}: \rightarrow CaO$), which of the following occurs?

When calcium reacts with oxygen to form **calcium oxide**.
Which of the following **occurs**?

عند تفاعل الكالسيوم مع الأكسجين لتكوين **أكسيد الكالسيوم**.
أي مما يأتي **يحدث**؟



A. The calcium atom loses 2 electrons and attains the electron configuration of argon (Ar)

B. The oxygen atom gains 1 electron and attains the electron configuration of neon (Ne)

C. The calcium atom loses 2 electrons and becomes Ca^{2-}

D. The oxygen atom gains 2 electrons and becomes O^{2+}

113. A pseudo-noble gas configuration is an outer arrangement of...

A. 18 electrons: $ns^2\ np^6\ nd^{10}$

B. 8 electrons: $ns^2\ np^6$

C. 2 electrons: ns^2

D. an empty outer level

114. Zinc forms Zn^{2+}. Which configuration does Zn^{2+} have?

A. $[Ar]4s^23d^8$

B. $[Ar]3d^{10}$

C. $[Ar]4s^2$

D. $[Ne]3s^23p^6$

115. Gallium (Ga, $[Ar]4s^23d^{10}4p^1$) forms Ga^{3+}. Its configuration is...

A. [Ar] — a true noble-gas configuration

B. [Kr]

C. $[Ar]3d^{10}$ — a pseudo-noble gas configuration

D. $[Ar]4s^23d^8$

116. How many electrons are in the outer levels of an ion with a pseudo-noble gas configuration?

A. 8

B. 18

C. 2

D. 10

117. When a transition metal atom forms a positive ion, which electrons are usually removed first?

A. the outer s electrons
B. the 1s electrons
C. the inner p electrons
D. the d electrons

118. Metals form which type of ions?

A. negative
B. anions
C. cations
D. neutral

119. Which ion has a pseudo-noble gas configuration?

A. Cl^-
B. Mg^{2+}
C. Ag^+
D. Na^+

120. Rule 1: in the name of an ionic compound...

A. the anion is named first
B. the cation is named first, followed by the anion
C. the larger ion is named first
D. the order does not matter

Item 13

Textbook p. 66

Describe how ions (cations and anions) form to fulfill the octet rule - the pseudo noble gas configuration

EXPLANATION

Pseudo-noble gas configuration: transition/post-transition metals lose outer s (and p) electrons and keep a full d^{10} — Zn^{2+} [Ar] $3d^{10}$, Ag^+ [Kr] $4d^{10}$.

PRACTICE QUESTIONS

121. Why do atoms form chemical bonds according to the octet rule?

A. To lose electrons and become positively charged.
B. To gain electrons and become negatively charged.
C. To complete their outer shell and attain a noble gas configuration.
D. To increase their atomic number.

122. Booklet Q58–59 (carbonyl group): structure I has 4 lone-pair electrons on O and structure II has 6. Is the number of lone-pair electrons the same?

A. Yes
B. No

123. SF_6 is an example of...

A. an odd number of electrons
B. a noble gas
C. an expanded octet
D. a suboctet

124. A suboctet is...

A. an ion with a negative charge

B. a molecule with resonance

C. a stable configuration with fewer than eight electrons around an atom

D. an atom with more than eight electrons

125. Atoms of most nonmetallic elements achieve noble-gas electron configurations by gaining electrons to become _____, or negatively charged ions.

A. anions

B. cations

C. isotopes

D. neutral atoms

126. How many valence electrons are available in NO_2^-?

A. 16

B. 19

C. 18

D. 17

127. How many valence electrons does NO_2 have?

A. 18

B. 16

C. 15

D. 17

128. Which molecule has an odd number of valence electrons?

A. ClO_2

B. CO_2

C. H_2O

D. CH_4

129. In NO_2, how many electrons are around the central N atom?

A. 10

B. 7

C. 8

D. 6

130. How many electrons does boron share in BH_3?

A. 6

B. 8

C. 3

D. 4

Item 14

Textbook p. 66

Ion formation

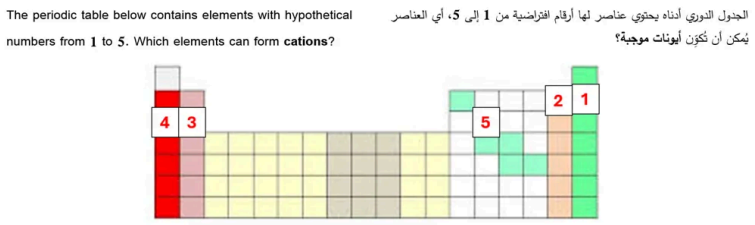
EXPLANATION

Charge from the group: 1 → +1, 2 → +2, 13 → +3, 15 → −3, 16 → −2, 17 → −1.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q14

131. The periodic table contains elements with hypothetical numbers 1 to 5. Which elements can form cations?



A. 3 and 4

B. 1 and 3

C. 2 and 4

D. 2 and 5

132. Which statement about positive ions is INCORRECT?

A. they are also known as cations

B. they are formed when electrons are removed from atoms

C. they are larger than the atom from which they were formed

D. they are smaller than the atom from which they were formed

133. What is the formula of the compound formed between strontium ions and nitrogen ions?

A. SrN

B. Sr_3N_2

C. Sr_2N_3

D. SrN_2

134. What is the electron configuration of the copper(I) ion, Cu^+?

A. $[Ar]3d^{10}$

B. $[Ar]3d^9$

C. $[Ar]3d^{10}4s^1$

D. $[Ar]3d^9 4s^1$

135. Which statement about negative ions is INCORRECT?

A. they are also known as anions

B. they are formed when atoms gain electrons

C. they are larger than the atom from which they were formed

D. they are smaller than the atom from which they were formed

136. Which statement best describes the force of attraction in a chemical bond?

A. It is an attraction between oppositely charged ions, or between nuclei and shared valence electrons.

B. It is an attraction between two nuclei only.

C. It is a repulsion between valence electrons of different atoms.

D. It is an attraction between neutrons and electrons.

137. Which pair of atoms is most likely to form an ionic bond?

A. Na and F

B. C and F

C. N and F

D. O and F

138. How does the reactivity of group 18 elements compare with that of group 17 elements?

- **A.** Group 18 elements are almost unreactive because they have a full octet, while group 17 elements are very reactive because they need only one electron.
- **B.** Group 18 elements are more reactive because they have more valence electrons.
- **C.** Both groups are equally reactive because they are nonmetals.
- **D.** Group 17 elements are unreactive because they have seven valence electrons.

139. The structure normally associated with ionic bonding is...

- **A.** a giant lattice
- **B.** a simple molecule
- **C.** a giant molecule
- **D.** positive ions surrounded by a sea of electrons

140. Why are alkali metals the most reactive metals?

- **A.** They have only one valence electron, which is easily lost to reach a noble-gas configuration.
- **B.** They have seven valence electrons and gain one easily.
- **C.** They have a full octet of valence electrons.
- **D.** They have the highest ionization energies.

Items 16 · 17

Textbook p. 72, 73

Explain the physical properties of ionic compounds as melting point and boiling point, conductivity when solid, molten or aqueous, and its solubility in water

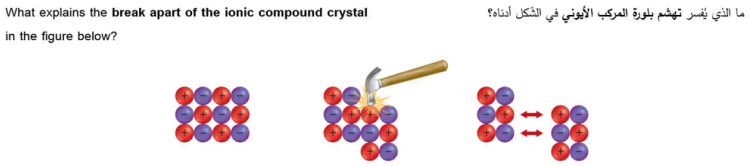
EXPLANATION

Ionic compounds: **high melting and boiling points**, hard and brittle; conduct electricity only when **molten or dissolved** (ions free to move).

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q10

141. What explains the breaking apart of the ionic crystal when struck (figure)?



A. There are strong attractive forces that hold the ions in place, and the applied force is enough to overcome the attraction

B. There are strong attractive forces that hold the ions in place, but the applied force is not enough to overcome the attraction

C. There are weak attractive forces between the ions, and the applied force is enough to overcome the attraction

D. There are weak attractive forces between the ions, and the applied force is not enough to overcome the attraction

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q11

142. Which is correct about the properties of ionic compounds? (1) Ionic crystals are brittle, hard, rigid solids. (2) Their melting and boiling points are high. (3) They conduct electric current when melted or dissolved in water.

A. 1, 2 and 3

B. 1 only

C. 1 and 3

D. 2 only

143. Which compound has the highest melting point?

A. NaCl

B. KBr

C. MgO

D. NaI

144. Predict the physical state of astatine (At_2, below iodine) at room temperature.

A. Solid

B. Gas

C. Liquid

D. Plasma

145. Which property of ionic compounds is caused by applying an external force?

A. brittleness

B. high melting point

C. solubility in water

D. conductivity when molten

146. In a metallic lattice, how many other metal atoms closely surround each metal atom?

A. 2 to 4

B. 4 to 6

C. 8 to 12

D. 20 to 30

147. I can hit a metal with a hammer without it shattering because of its...

A. ductility

B. malleability

C. conductivity

D. luster

148. Why are the melting points of metals less extreme than their boiling points?

- **A.** Cations and electrons are mobile, so moving past each other needs little energy; boiling needs atoms completely separated
- **B.** Metals have no bonds in the liquid
- **C.** Boiling needs less energy than melting
- **D.** All electrons leave the metal when it melts

149. Hardness, boiling point and melting point are _____ properties of ionic compounds.

- **A.** physical
- **B.** chemical
- **C.** nuclear
- **D.** electrical

150. Which metal is a liquid at room temperature and is used in thermometers?

- **A.** Tungsten
- **B.** Mercury
- **C.** Copper
- **D.** Silver

Items 18 · 19

Textbook p. 75, 76, 77, 78, 79, 80

Write the chemical formula (using the stock method) of an ionic compound containing monoatomic and polyatomic ions

EXPLANATION

Write the formula: total charge = 0 → crisscross and reduce. Stock name gives the metal charge: **iron(III) oxide = Fe_2O_3**.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q8

151. What is the correct chemical formula for the ionic compound formed by Ba^{2+} and PO_4^{3-}?

- **A.** $Ba_3(PO_4)_2$
- **B.** $Ba_2(PO_4)_3$
- **C.** Ba_3PO_4
- **D.** $BaPO_4$

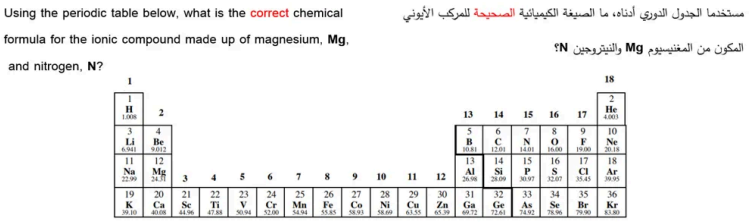
★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q7

152. What is the correct name for the ionic compound $NaIO_4$?

- **A.** Sodium periodate
- **B.** Sodium iodate
- **C.** Sodium iodite
- **D.** Sodium hypoiodite

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q9

153. Using the periodic table, what is the correct chemical formula for the ionic compound made of magnesium (Mg) and nitrogen (N)?



A. Mg_3N_2
B. MgN_2
C. MgN
D. Mg_2N_3

154. When more than one polyatomic ion is needed in a formula, you should...

Common polyatomic ions · أيونات عديدة الذرات الشائعة

Ammonium	NH_4^+	Acetate	CH_3COO^-
Nitrite	NO_2^-	Sulfite	SO_3^{2-}
Nitrate	NO_3^-	Sulfate	SO_4^{2-}
Hydroxide	OH^-	Carbonate	CO_3^{2-}
Cyanide	CN^-	Chromate	CrO_4^{2-}
Permanganate	MnO_4^-	Dichromate	$Cr_2O_7^{2-}$
Hydrogen carbonate	HCO_3^-	Hydrogen phosphate	HPO_4^{2-}
Hypochlorite	ClO^-	Oxalate	$C_2O_4^{2-}$
Chlorite	ClO_2^-	Peroxide	O_2^{2-}
Chlorate	ClO_3^-	Phosphate	PO_4^{3-}
Perchlorate	ClO_4^-	Phosphite	PO_3^{3-}
Dihydrogen phosphate	$H_2PO_4^-$		

A. change the subscripts inside the ion
B. place the ion in parentheses and write the subscript outside
C. write the ion twice
D. add a Roman numeral

155. The formula of the compound formed from ammonium (NH_4^+) and oxide (O^{2-}) is...

A. NH_4O
B. N_2H_8O
C. $(NH_4)_2O$
D. NH_4O_2

156. Book Q36: ion X is 2+ and ion Y is 1−. The formula unit is...

A. XY
B. X_2Y
C. XY_2
D. X_2Y_2

157. Book Q38: name and formula of the compound of sodium ions and nitrite ions

A. sodium nitrate, $NaNO_3$
B. sodium nitrite, $NaNO_2$
C. sodium nitride, Na_3N
D. sodium nitrite, $Na(NO_2)_2$

158. Book Q37: name and formula of the compound formed from Mg and Cl

A. magnesium chloride, $MgCl_2$
B. magnesium chlorine, $MgCl$
C. magnesium dichloride, Mg_2Cl
D. manganese chloride, $MnCl_2$

159. Booklet Q123: in the chemical formula for an ionic compound, which item is written first?

A. positive ion
B. negative ion
C. subscript
D. charge

160. An oxyanion is a polyatomic ion composed of...

Use the figure above

A. a metal bonded to hydrogen
B. an element, usually a nonmetal, bonded to one or more oxygen atoms
C. two metals
D. oxygen only

Item 20 — Textbook p. 82

Describe the formation of metallic bonds

EXPLANATION

Metallic bond: attraction between metal cations and a **sea of delocalized electrons**.

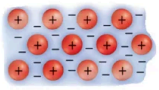
PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q6

161. Regarding the figure (metal cations in a sea of electrons), which is correct? (1) The outer electrons of the bonded metal atoms are held by a specific atom. (2) They are not held by a specific atom. (3) They can move easily from one atom to the next.

Regarding the figure below, which of the following is correct?

فيما يتعلق بالشكل أدناه، أيّ مما يلي صحيح؟



1	ترتبط الإلكترونات الموجودة في مستويات الطاقة الخارجية للذرات الفلزية المترابطة بذرة معينة The electrons present in the outer energy levels of the bonding metallic atoms are held by a specific atom
2	لا ترتبط الإلكترونات الموجودة في مستويات الطاقة الخارجية للذرات الفلزية المترابطة بذرة معينة The electrons present in the outer energy levels of the bonding metallic atoms are not held by a specific atom
3	يمكن للإلكترونات الموجودة في مستويات الطاقة الخارجية للذرات الفلزية الانتقال بسهولة من ذرة إلى أخرى The electrons present in the outer energy levels of the bonding metallic atoms can move easily from one atom to the next

A. 2 and 3
B. 1 and 3
C. 1 only
D. 2 only

162. Metals are malleable because, when struck, one plane of metal atoms...

A. can slide past another plane without breaking bonds
B. cannot easily move out of the way
C. moves in a way that maximizes repulsive forces
D. bonds to the plane directly beneath it

163. The arrangement of valence electrons in a metallic bond is best described as...

A. fixed positions in a lattice
B. a sea of free-moving electrons
C. concentrated electron density around specific atoms
D. electron pairs existing in multiple bonds

164. In metallic bonding...

A. one atom takes the outer-shell electrons from another atom
B. positively charged areas of one atom bond to negatively charged areas of another
C. a couple of atoms share their electrons with each other
D. some electrons are shared by all the atoms in the material

165. Under typical conditions, how many electrons is the maximum gained in the formation of anions?

A. 1
B. 2
C. 3
D. 4

166. An ionic bond is...

A. the electrostatic attraction between oppositely charged ions
B. a shared pair of electrons between two atoms
C. the attraction between two neutral atoms
D. a bond between two metal atoms

167. The attractive forces that hold particles together in ionic, covalent and metallic bonds are called...

A. intramolecular forces
B. intermolecular forces
C. dispersion forces
D. hydrogen bonds

168. Single covalent bonds are also called...

A. pi bonds
B. sigma bonds
C. ionic bonds
D. metallic bonds

169. Why is sugar ($C_{12}H_{22}O_{11}$), a molecular compound, a solid at room temperature? (Booklet Q35)

A. Its large molar mass lets many weak attractions combine
B. It contains ionic bonds
C. It has a sea of electrons
D. It is a covalent network

170. According to the electron sea model, the valence electrons in a metal are:

A. delocalized, moving freely around the metal cations
B. transferred to nonmetal atoms
C. shared in pairs between two neighbouring atoms
D. held tightly in the inner energy levels

Item 21

Textbook p. 83, 84

Explain some physical properties of metals (Melting and boiling points, Thermal and electrical conductivity, Malleability, ductility, durability, Hardness and strength)

EXPLANATION

Metals: high boiling points; **malleable and ductile** (cations slide past each other); good conductors of heat and electricity (mobile electrons). Alloys = mixtures of metals.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q5

171. Which of the following explains the heat and electrical conductivity of metals?

A. The movement of delocalized electrons around positive metallic cations
B. The strong attraction of metallic cations to the delocalized electrons
C. The delocalized electrons interact with light, absorbing and releasing photons
D. The movement of delocalized electrons around negative anions

172. Which property is NOT explained by metallic bonding?

A. electrical conductivity
B. thermal conductivity
C. brittleness
D. ductility

173. What is responsible for the good electrical conductivity of metals?

A. the arrangement of metal atoms in separate layers
B. the high density of metal atoms in the lattice
C. the ability of electrons to move freely about the crystal structure
D. many orbitals separated by small energies

174. In general, what can be said of the melting points of metals?

A. They are low
B. They are high
C. They are lower than nonmetals
D. They do not have melting points

175. Why do solid ionic compounds not conduct electricity, while molten or dissolved ionic compounds do?

A. In the solid, the ions are locked in fixed positions; when melted or dissolved, the ions are free to move.
B. In the solid, the electrons are delocalized; when melted, they become fixed.
C. Solids contain no ions; ions form only when melted.
D. Water molecules carry the electric current, not the ions.

176. What do metals conduct?

A. heat only
B. electricity only
C. both heat and electricity
D. neither

177. Which one of the following is NOT true of metallic bonding?

- **A.** It gives rise to excellent electrical conductivity.
- **B.** Electrons are free to move throughout the structure.
- **C.** The strength of metallic bonds increases down a group.
- **D.** The strength of metallic bonding affects the boiling point of metals.

178. Use Table 12. Which metal has the highest melting point?

- **A.** Lithium (180 °C)
- **B.** Tin (232 °C)
- **C.** Aluminum (660 °C)
- **D.** Copper (1085 °C)

179. Consider the statements: (1) Ionic compounds are electrolytes that conduct electricity in the liquid (molten) state. (2) Ionic compounds are crystalline solids. (3) Ionic compounds are not soluble in water. Which statements are true?

- **A.** 3 only
- **B.** Only 2 and 3
- **C.** Only 1 and 3
- **D.** Only 1 and 2

180. The luster (shine) of metals is caused by...

- **A.** delocalized electrons absorbing and releasing photons
- **B.** cations reflecting heat
- **C.** metal atoms losing protons
- **D.** the metal being an ionic compound

Item 22

Textbook p. 92

Define, using energy diagram, covalent bond

EXPLANATION

Covalent bond: atoms share electron pairs. On the energy diagram the bond forms at the **energy minimum**; energy is released when the bond forms.

PRACTICE QUESTIONS

181. How does water vapor condense on a cold surface? (Booklet Q40)

- **A.** Vapor molecules lose energy to the cold surface, slow down and form hydrogen bonds → liquid
- **B.** The cold surface gives energy to the vapor
- **C.** Water molecules split into H and O
- **D.** The vapor turns into a solid without losing energy

182. Electronegativity is...

A. the energy needed to remove an electron

B. the energy released when an atom gains an electron

C. the size of an atom

D. the relative ability of an atom to attract the electrons in a chemical bond

183. Bond-dissociation energy is always...

A. a positive value

B. a negative value

C. zero

D. equal to the bond length

184. A reaction in which the energy released by forming bonds in the products is greater than the energy needed to break the bonds in the reactants is _____.

A. exothermic

B. endothermic

C. neutral

D. reversible

185. Burning charcoal (Figure 11) is exothermic because...

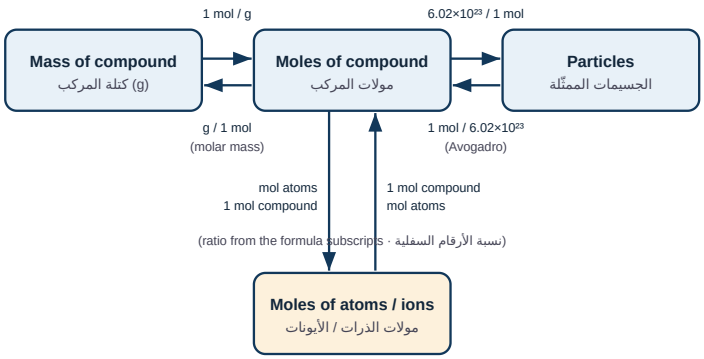


Figure 11 · Mole relationships from a chemical formula · علاقات المول من الصيغة

A. more energy is released forming the bonds in CO_2 than is needed to break C–C and O–O bonds

B. no bonds are broken

C. breaking bonds releases energy

D. charcoal has no bonds

186. Using the bond energy C=O = 799 kJ/mol, what is the total energy needed to break all the bonds in CO_2 (O=C=O)?

A. 1598 kJ/mol

B. 799 kJ/mol

C. 2397 kJ/mol

D. 1197 kJ/mol

187. Why do noble gases seldom form compounds?

A. They have high potential energy

B. They have stable electron arrangements with a full outer energy level

C. They have no electrons

D. They are metals

188. Using the bond energy O–H = 463 kJ/mol, what is the total energy needed to break all the bonds in a water molecule, H–O–H?

A. 926 kJ/mol
B. 463 kJ/mol
C. 1389 kJ/mol
D. 232 kJ/mol

189. Which statement about stability is correct?

A. Higher energy states are more stable
B. Energy is not related to stability
C. Separated atoms always have the lowest energy
D. Lower energy states are more stable

190. What is the relationship between bond length and bond-dissociation energy? (Booklet Q31)

A. Inverse: the shorter the bond, the greater the energy
B. Direct: the longer the bond, the greater the energy
C. No relationship

Item 23

Textbook p. 96, 97

Differentiate between sigma and pi bonds

EXPLANATION

σ bond: head-on overlap (every single bond). **π bond**: side-by-side overlap of parallel p orbitals. Double = 1σ + 1π; triple = 1σ + 2π.

PRACTICE QUESTIONS

191. How many sigma bonds are in a methane molecule, CH_4?

A. 1
B. 2
C. 3
D. 4

192. How many sigma and pi bonds are in the oxygen molecule, O_2? (Booklet Q20)

A. 1 σ and 1 π
B. 2 σ and 0 π
C. 0 σ and 2 π
D. 1 σ and 2 π

193. The numbers of sigma bonds in H_2O and NH_3 are...

A. 1 and 1
B. 2 and 3
C. 2 and 4
D. 3 and 3

194. How many sigma and pi bonds are in the nitrogen molecule, N_2? (Booklet Q23)

A. 1 σ and 1 π
B. 3 σ and 0 π
C. 1 σ and 2 π
D. 2 σ and 1 π

195. Where is the shared electron pair of a pi bond?

A. Directly between the two nuclei
B. Above and below the line joining the two atoms
C. Inside one nucleus
D. Far away from both atoms

196. Which statement correctly compares sigma and pi bonds?

A. A sigma bond forms by head-to-head overlap and is stronger than a pi bond.
B. A sigma bond forms by side-by-side overlap and is weaker than a pi bond.
C. A pi bond forms by head-to-head overlap and is stronger than a sigma bond.
D. Sigma and pi bonds form in the same way and have the same strength.

197. A single covalent bond is...

A. always one sigma bond
B. always one pi bond
C. one sigma + one pi
D. two pi bonds

198. How many sigma and pi bonds are present in an oxygen molecule, O_2?

A. 1 sigma and 1 pi
B. 2 sigma and 0 pi
C. 1 sigma and 2 pi
D. 0 sigma and 2 pi

199. $COCl_2$ has one C=O bond and two C–Cl bonds. It contains... (Booklet Q36)

A. 3 σ and 1 π
B. 2 σ and 2 π
C. 4 σ and 0 π
D. 3 σ and 2 π

200. How many sigma and pi bonds are present in a nitrogen molecule, N_2?

A. 1 sigma and 2 pi
B. 3 sigma and 0 pi
C. 2 sigma and 1 pi
D. 1 sigma and 1 pi

Item 24

Textbook p. 98

Identify the relationship between the type of covalent bonds (single, double and triple) and its bond length, bond strength and bond dissociation energy

EXPLANATION

More shared pairs → **shorter and stronger** bond (higher bond-dissociation energy): C≡C < C=C < C–C in length.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q3

201. The table gives the bond-dissociation energies of N_2 (945 kJ/mol), F_2 (159 kJ/mol) and O_2 (498 kJ/mol). What is the order of the molecules by bond length from shortest to longest?

The following table represents the bond dissociation energy of a number of molecules.
What is the ascending order of the molecules in the table below according to bond length from **shortest** to **longest**?

الجدول الآتي يمثل طاقة تفكك الرابطة لعدد من الجزيئات.
ما الترتيب التصاعدي للجزيئات في الجدول أدناه حسب طول الرابطة من **الأقصر** إلى **الأطول**؟

molecule الجزيء	Bond–Dissociation Energy طاقة تفكك الرابطة
N_2	945 kJ/mol
F_2	159 kJ/mol
O_2	498 kJ/mol

A. $N_2 \rightarrow O_2 \rightarrow F_2$
B. $O_2 \rightarrow N_2 \rightarrow F_2$
C. $O_2 \rightarrow F_2 \rightarrow N_2$
D. $F_2 \rightarrow O_2 \rightarrow N_2$

202. Atoms that share two pairs of electrons form... (Booklet Q18)

A. a single covalent bond
B. a double covalent bond
C. a triple covalent bond
D. an ionic bond

203. What is the relationship between the length of a bond and its strength? (Booklet Q28)

A. The shorter the bond, the stronger it is
B. The longer the bond, the stronger it is
C. There is no relationship
D. Length and strength are always equal

204. Atoms that share three pairs of electrons form... (Booklet Q21)

A. a single covalent bond
B. a double covalent bond
C. a triple covalent bond
D. a lone pair

205. In general, the number of valence electrons an atom needs to form an octet equals...

A. the number of covalent bonds it can form
B. its number of protons
C. its number of lone pairs
D. its period number

206. The bond in a nitrogen molecule, N_2, is...

A. single
B. double
C. triple
D. ionic

207. Which description of the Lewis structure of CO_2 is correct?

- **A.** C is central with two C=O double bonds; each O has two lone pairs.
- **B.** C is central with two C–O single bonds; each O has three lone pairs.
- **C.** O is central with one double bond to C and one to O.
- **D.** C is central with one triple bond and one single bond; C has a lone pair.

208. Which atoms often form multiple bonds with other nonmetals?

- **A.** C, N, O and S
- **B.** Na, K and Ca
- **C.** He, Ne and Ar
- **D.** Fe, Cu and Zn

209. Book Q54: Can a binary compound with only sigma (single) bonds display resonance?

- **A.** Only with lone pairs
- **B.** No — resonance needs both single and double bonds
- **C.** Yes, always
- **D.** Only if it is an ion

210. Which elements often form double and triple bonds?

- **A.** C, N, O and S
- **B.** H and F
- **C.** Na and Cl
- **D.** He and Ne

Item 25

Textbook p. 100, 101

Name a binary molecular compound based on its molecular formula

EXPLANATION

Prefixes: mono, di, tri, tetra, penta, hexa, hepta, octa, nona, deca. No *mono* on the first element; second ends in **-ide**: N_2O_4 = dinitrogen tetroxide.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q2

211. What is the name of the covalent compound with the formula N_2O_4?

- **A.** Dinitrogen tetroxide
- **B.** Tetranitrogen dioxide
- **C.** Nitrogen dioxide
- **D.** Nitrogen tetroxide

212. Formula of chlorine trifluoride? (Book Q27)

- **A.** Cl_3F
- **B.** ClF_3
- **C.** ClF
- **D.** Cl_2F_3

213. When writing a formula from the name of a binary molecular compound, the prefixes give...

- **A.** the subscripts
- **B.** the charges
- **C.** the number of bonds
- **D.** the mass

214. Formula of diphosphorus trioxide? (Book Q28)

A. P_3O_2 **B.** PO_3
C. P_2O_5 **D.** P_2O_3

215. Book Q23 (Challenge): general formula for a compound of a group 2 element (M) and a group 17 element (X)

A. MX **B.** M_2X
C. MX_2 **D.** M_2X_3

216. Formula of disulfur decafluoride? (Book Q29)

A. S_2F_{10} **B.** $S_{10}F_2$
C. SF_6 **D.** S_2F_8

217. What is the formula of the compound formed from lithium and oxygen (Q62)?

A. LiO **B.** Li_2O
C. LiO_2 **D.** Li_2O_2

218. How would you name N_2O_4? (Book Q34)

A. dinitrogen tetroxide **B.** nitrogen tetroxide
C. dinitrogen oxide **D.** tetranitrogen dioxide

219. When you write a formula from the name of a binary molecular compound, the prefixes tell you...

A. the charges of the ions
B. the subscripts (number of each atom)
C. which element is the acid
D. the number of bonds

220. Name CO_2. (Book Q14)

A. carbon dioxide **B.** monocarbon dioxide
C. carbon oxide **D.** dicarbon oxide

Items 26 · 27

Textbook p. 102, 103, 104

Determine the chemical formula of a compound from its name

EXPLANATION

Formula from the name: the prefixes are the subscripts — sulfur hexafluoride = **SF_6**, diphosphorus pentoxide = **P_2O_5**.

PRACTICE QUESTIONS

221. What is the formula for diarsenic trioxide? (Book Q18)

A. As_2O_3 **B.** As_3O_2
C. AsO_3 **D.** As_2O

222. The formula unit of magnesium chloride is $MgCl_2$ because the ions exist in a ratio of...

A. 1 : 1 **B.** 2 : 1
C. 1 : 2 **D.** 1 : 3

223. Write the formula: tetraphosphorus decoxide. (Booklet Q41)

A. P_4O_{10} **B.** P_2O_5
C. P_4O_9 **D.** $P_{10}O_4$

224. Write the formula: sulfur hexafluoride. (Booklet Q41)

A. SF_6 **B.** S_6F
C. SF_4 **D.** S_2F_6

225. Write the formula: dinitrogen trioxide. (Booklet Q41)

A. N_2O_3 **B.** N_3O_2
C. NO_3 **D.** N_2O

226. Which cation would form a stronger ionic bond with Cl^-?

A. Na^+ **B.** Ca^{2+}

227. Why is the overall charge of a formula unit zero?

A. It represents the whole crystal, which is electrically neutral
B. Ions lose their charges in a crystal
C. Only cations are counted
D. Electrons are shared

228. What is the formula for the beryllium ion?

A. Be^+ **B.** Be^{2+}
C. Be^{2-} **D.** Be^{3+}

229. What is the formula for the iodide ion?

A. I^+ **B.** I^{2-}
C. I^- **D.** I^{3-}

230. What is the formula for the nitride ion?

A. N^{3-} **B.** N^{3+}
C. N^{2-} **D.** N^-

Item 28

Textbook p. 107, 108, 109, 110

Draw Lewis structures for a number of covalent compounds with single and multiple bonds

EXPLANATION

Lewis steps: count valence e^- → ÷ 2 = pairs → central atom (least electronegative; H is never central) → single bonds → lone pairs → make double/triple bonds if an octet is missing.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q4

231. Which electron configuration represents an element that forms three covalent bonds with other nonmetal atoms?

A. $1s^2\ 2s^2\ 2p^3$
B. $1s^2\ 2s^2\ 2p^6\ 3s^1$
C. $1s^2\ 2s^2\ 2p^5$
D. $1s^2\ 2s^2\ 2p^4$

232. In the Lewis structure of PH_3, the phosphorus atom has...

A. 3 bonding pairs and 1 lone pair
B. 4 bonding pairs
C. 3 bonding pairs and no lone pairs
D. 2 bonding pairs and 2 lone pairs

233. In CO_2, after placing the single bonds and the lone pairs on O, carbon has only 4 electrons. What do you do?

A. Convert a lone pair from each O into a double bond
B. Add more electrons
C. Remove an oxygen
D. Put a lone pair on carbon

234. How many covalent bonds can phosphorus (group 15) usually form?

A. 1
B. 3
C. 5
D. 15

235. A group 1 element (X) bonds with a group 16 element (Y). The general Lewis structure is...

A. X–Y with 3 lone pairs on Y
B. Y–X–Y
C. X=Y
D. X–Y–X with 2 lone pairs on Y

236. How many valence electrons are available for bonding in NF_3?

A. 8
B. 24
C. 26
D. 28

237. In the octet Lewis structure of PO_4^{3-} (four P–O single bonds), how many lone pairs are there in total?

A. 12
B. 8
C. 16
D. 4

238. How many bonding pairs (total pairs) are available in CO_2?

A. 4 **B.** 6
C. 8 **D.** 16

239. How many single covalent bonds does an atom of a group 15 element usually form?

A. 1 **B.** 4
C. 3 **D.** 5

240. How many bonds does krypton (Kr) usually form?

A. 0 **B.** 1
C. 2 **D.** 8

Item 29 — Textbook p. 111, 112

Identify some combinations of resonance (O_3, NO_3^-, NO_2^-, SO_3^{2-} and CO_3^{2-})

EXPLANATION

Resonance: two or more valid Lewis structures that differ only in the position of electrons; the real molecule is the average. Examples: O_3, NO_3^-, NO_2^-, SO_3^{2-}, CO_3^{2-}.

PRACTICE QUESTIONS

★ Past exam · End of Term 1 · 2025–2026 · Grade 10 Advanced · Q1

241. Which of the following is NOT a resonance structure for the nitrate ion NO_3^-?

Which of the following is not a **resonance structure** for the nitrate ion NO_3^-?

أي مما يلي لا يعتبر من **تراكيب الرنين** لأيون النيترات NO_3^-؟

العدد الذري Atomic number	العنصر Element
8	Oxygen (O) الأكسجين
7	Nitrogen (N) النيتروجين

1	
2	
3	

A. 2 only **B.** 1 only
C. 1 and 2 **D.** 2 and 3

242. How many valid resonance structures can be drawn for the nitrate ion, NO_3^-?

A. 2 **B.** 1
C. 4 **D.** 3

243. In the carbonate ion, CO_3^{2-}, the three C–O bonds are...

A. identical, between a single and a double bond in length

B. three double bonds

C. one double and two single bonds of different lengths

D. three single bonds

244. The sulfite ion, SO_3^{2-}, drawn with one S=O double bond, has how many resonance structures?

A. 4 **B.** 1

C. 2 **D.** 3

245. Ozone, O_3, has how many resonance structures?

A. 4 **B.** 2

C. 1 **D.** 3

246. Which species shows resonance?

A. NH_3 **B.** NO_2^-

C. H_2O **D.** CH_4

247. Which statement about resonance structures is correct?

A. The molecule flips quickly from one structure to another

B. Only the positions of electron pairs differ; the atoms stay in place

C. The atoms change positions between structures

D. Each structure has a different number of electrons

248. Which of these does NOT exhibit resonance?

A. CO_3^{2-} **B.** CH_4

C. O_3 **D.** NO_2^-

249. How many resonance structures does the nitrite ion, NO_2^-, have?

A. 4 **B.** 2

C. 3 **D.** 1

250. Which group lists only species that show resonance?

A. HCl, NO_2^-, H_2 **B.** O_3, NO_3^-, CO_3^{2-}

C. O_3, H_2O, CO_3^{2-} **D.** NH_3, NO_3^-, CH_4

Item 30

Textbook p. 112, 113, 114

Determine the exception of the octet rule (odd number of valence electrons, sub octets and

coordinate covalent bonds, expanded octets)

EXPLANATION

Octet exceptions: **odd number** of valence e^- (NO_2, ClO_2, NO); **suboctet** (BF_3, BH_3 — boron has 6); **expanded octet** (PCl_5, SF_6 — period 3 and beyond).

PRACTICE QUESTIONS

251. ClO_2 has 19 valence electrons. Which exception to the octet rule does it show?

A. odd number of valence electrons
B. expanded octet
C. suboctet
D. coordinate covalent bond

252. In PCl_5, phosphorus forms five bonds. Which exception to the octet rule does it show?

A. expanded octet
B. suboctet
C. odd number of valence electrons
D. it obeys the octet rule

253. In BH_3 (and BF_3), boron forms only three bonds. Which exception to the octet rule does it show?

A. suboctet (fewer than eight electrons)
B. expanded octet
C. odd number of valence electrons
D. it obeys the octet rule

254. NO_2 has 17 valence electrons. Which exception to the octet rule does it show?

A. odd number of valence electrons
B. expanded octet
C. suboctet
D. it obeys the octet rule

255. NO has 11 valence electrons. Which exception to the octet rule does it show?

A. odd number of valence electrons
B. expanded octet
C. suboctet
D. it obeys the octet rule

256. PF_5 is an example of...

A. an expanded octet
B. a suboctet
C. an odd number of electrons
D. a coordinate covalent bond

257. In ethylene, C_2H_4 (12 e^-, 6 pairs), the bond between the two carbon atoms is...

A. single
B. double
C. triple
D. ionic

258. In $BH_3 + NH_3 \rightarrow H_3BNH_3$, which atom donates the electron pair?

A. H
B. No atom
C. N
D. B

259. In ball-and-stick and space-filling models, atoms of each element are identified by...

A. a representative colour
B. their mass
C. a number
D. their charge

260. An expanded octet means the central atom has...

A. fewer than eight electrons
B. an odd number of electrons
C. exactly eight electrons
D. more than eight valence electrons

Answer key

Item 1 — Differentiate between the ground and excited states of an atom

1 A | 2 A | 3 A | 4 A | 5 B | 6 B | 7 A | 8 A | 9 D | 10 C

Item 2 — Relate the principal quantum number to the total number of orbitals of the principal energy levels and the number of orbitals in sub-energy levels

11 A | 12 D | 13 C | 14 B | 15 C | 16 A | 17 B | 18 D | 19 D | 20 C

Item 3 — Explain the Aufbau principle, the Pauli exclusion principle, and Hund's rule

21 A | 22 A | 23 B | 24 D | 25 B | 26 A | 27 D | 28 B | 29 C | 30 C

Item 4 — Write the electron configuration, orbital diagram, and noble gas notation of different elements

31 A | 32 A | 33 B | 34 B | 35 A | 36 C | 37 A | 38 A | 39 B | 40 B

Item 5 — Represent the electron dot structure of atoms

41 A | 42 A | 43 C | 44 A | 45 B | 46 A | 47 D | 48 A | 49 C | 50 A

Item 6 — List the different families in the periodic table with the identification of the group number and the elements present

51 A | 52 D | 53 D | 54 C | 55 B | 56 D | 57 D | 58 A | 59 A | 60 A

54. The last electrons enter 3d → d-block (Fe).
57. s- and p-blocks contain all three classes; the d- and f-blocks are metals.

Item 7 — Differentiate between representative elements and transition elements

61 A | 62 A | 63 A | 64 B | 65 B | 66 B | 67 D | 68 A | 69 B | 70 B

63. Fe is in group 8 (d-block).
65. Ca is in group 2 (s-block).
67. Their last electrons fill f orbitals.

Item 8 — Use the electron configuration notation, orbital notation, and noble gas notation of an element (Z 1 - 36) to identify the location of an element in the periodic table (period, group and block)

71 A | 72 A | 73 A | 74 C | 75 A | 76 C | 77 B | 78 B | 79 A | 80 C

Item 9 — The electron configuration, filling sublevels

81 A | 82 C | 83 D | 84 B | 85 B | 86 C | 87 A | 88 B | 89 B | 90 B

83. Cd ([Kr]$5s^2 4d^{10}$) loses $5s^2$ → [Kr]$4d^{10}$: completely filled sublevels are stable.

Item 10 — Explain the trend of first ionization energy across a period (Exceptions between Groups 2 & 3 and 5 & 6 are included), and down a group of the periodic table

91 A | 92 A | 93 D | 94 D | 95 C | 96 A | 97 A | 98 D | 99 A | 100 D

Item 11 — predict the periodic trend of electronegativity across a period and down a group of the periodic table

101 A | 102 C | 103 A | 104 B | 105 A | 106 A | 107 A | 108 B | 109 C | 110 A

Items 12 · 15 — Describe how ions (cations and anions) form to fulfill the octet rule

111 A | 112 A | 113 A | 114 B | 115 C | 116 B | 117 A | 118 C | 119 C | 120 B

113. Many transition and post-transition ions keep a full s, p and d set (18 electrons) instead of a true noble-gas octet.
114. Zn is $[Ar]4s^2 3d^{10}$; it loses the two 4s electrons first, leaving a full $3d^{10}$ (pseudo-noble gas).
115. Ga loses $4p^1$ and $4s^2$ (3 electrons) and keeps the full $3d^{10}$.
116. $s^2 + p^6 + d^{10} = 18$.
117. The highest-numbered s electrons are lost before the d electrons.
119. Ag ($[Kr]5s^1 4d^{10}$) loses $5s^1 \rightarrow [Kr]4d^{10}$, 18 outer electrons. The others reach true noble-gas octets.

Item 13 — Describe how ions (cations and anions) form to fulfill the octet rule - the pseudo noble gas configuration

121 C | 122 B | 123 C | 124 C | 125 A | 126 C | 127 D | 128 A | 129 B | 130 A

Item 14 — Ion formation

131 A | 132 C | 133 B | 134 A | 135 D | 136 A | 137 A | 138 A | 139 A | 140 A

Items 16 · 17 — Explain the physical properties of ionic compounds as melting point and boiling point, conductivity when solid, molten or aqueous, and its solubility in water

141 A | 142 A | 143 C | 144 A | 145 A | 146 C | 147 B | 148 A | 149 A | 150 B

145. Brittleness is the response of the crystal to a mechanical force.

Items 18 · 19 — Write the chemical formula (using the stock method) of an ionic compound containing monoatomic and polyatomic ions

151 A | 152 A | 153 A | 154 B | 155 C | 156 C | 157 B | 158 A | 159 A | 160 B

Item 20 — Describe the formation of metallic bonds

161 A | 162 A | 163 B | 164 D | 165 C | 166 A | 167 A | 168 B | 169 A | 170 A

Item 21 — Explain some physical properties of metals (Melting and boiling points, Thermal and electrical conductivity, Malleability, ductility, durability, Hardness and strength)

171 A | 172 C | 173 C | 174 B | 175 A | 176 C | 177 C | 178 D | 179 D | 180 A

Item 22 — Define, using energy diagram, covalent bond

181 A | 182 D | 183 A | 184 A | 185 A | 186 A | 187 B | 188 A | 189 D | 190 A

182. Definition (do not confuse with electron affinity).
184. Covalent Bonds booklet
186. Covalent Bonds Test – Model 2
188. Covalent Bonds booklet

Item 23 — Differentiate between sigma and pi bonds

191 D | 192 A | 193 B | 194 C | 195 B | 196 A | 197 A | 198 A | 199 A | 200 A

Item 24 — Identify the relationship between the type of covalent bonds (single, double and triple) and its bond length, bond strength and bond dissociation energy

201 A | 202 B | 203 A | 204 C | 205 A | 206 C | 207 A | 208 A | 209 B | 210 A

207. Lewis Structure Test

Item 25 — Name a binary molecular compound based on its molecular formula

211 A | 212 B | 213 A | 214 D | 215 C | 216 A | 217 B | 218 A | 219 B | 220 A

Items 26 · 27 — Determine the chemical formula of a compound from its name

221 A | 222 C | 223 A | 224 A | 225 A | 226 B | 227 A | 228 B | 229 C | 230 A

Item 28 — Draw Lewis structures for a number of covalent compounds with single and multiple bonds

231 A | 232 A | 233 A | 234 B | 235 D | 236 C | 237 A | 238 C | 239 C | 240 A

237. Covalent Bonds booklet

Item 29 — Identify some combinations of resonance (O_3, NO_3^-, NO_2^-, SO_3^{2-} and CO_3^{2-})

241 A | 242 D | 243 A | 244 D | 245 B | 246 B | 247 B | 248 B | 249 B | 250 B

242. The double bond can be placed on any of the three O atoms.
243. The real ion is an average (hybrid) of the three resonance structures.
244. The S=O double bond can be on any of the three O atoms.
245. O=O–O ↔ O–O=O.
246. NO_2^- has one N=O and one N–O that can switch places.
247. Resonance structures differ only in the placement of electron pairs; the actual molecule is a hybrid.
249. The double bond can be on either O atom.
250. O_3, NO_3^- and CO_3^{2-} each have a double bond that can be placed in more than one position.

Item 30 — Determine the exception of the octet rule (odd number of valence electrons, sub octets and coordinate covalent bonds, expanded octets)

251 A | 252 A | 253 A | 254 A | 255 A | 256 A | 257 B | 258 C | 259 A | 260 D