



King Abdulaziz University

Faculty of Science - Chemistry Department

Chem-110, Second Exam

Thursday 24 /06 /1435 H

Time: 90 minutes

Name: _____ Number: _____ Section: _____

Useful information:

Speed of light, $c = 3.0 \times 10^8$ m/s
Planck's const., $h = 6.626 \times 10^{-34}$ J.s
Avogadro's No., $N_A = 6.022 \times 10^{23}$ mol⁻¹
Rydberg const. for H atom $R_H = 2.18 \times 10^{-18}$ J
Mass of the electron, $m_e = 9.11 \times 10^{-31}$ kg
Gas constant, $R = 0.082$ L atm K⁻¹ mol⁻¹

1

H

Hydrogen

1

7

Li

Lithium

3

9

Be

Beryllium

4

23

Na

Sodium

11

24

Mg

Magnesium

12

39

K

Potassium

19

40

Ca

Calcium

20

45

Sc

Scandium

21

48

Ti

Titanium

22

51

V

Vanadium

23

52

Cr

Chromium

24

55

Mn

Manganese

25

56

Fe

Iron

26

59

Co

Cobalt

27

59

Ni

Nickel

28

63.5

Cu

Copper

29

65

Zn

Zinc

30

85.5

Rb

Rubidium

37

86

Sr

Strontium

38

89

Y

Yttrium

39

91

Zr

Zirconium

40

93

Nb

Niobium

41

96

Mo

Molybdenum

42

(96)

Tc

Technetium

43

101

Ru

Ruthenium

44

103

Rh

Rhodium

45

106

Pd

Palladium

46

108

Ag

Silver

47

112

Cd

Cadmium

48

115

In

Indium

49

119

Sn

Tin

50

122

Sb

Antimony

51

128

Te

Tellurium

52

127

I

Iodine

53

131

Xe

Xenon

54

133

Cs

Cesium

55

137

Ba

Barium

56

139

La

Lanthanum

57

178.5

Hf

Hafnium

72

181

Ta

Tantalum

73

184

W

Tungsten

74

186

Re

Rhenium

75

190

Os

Osmium

76

192

Ir

Iridium

77

195

Pt

Platinum

78

197

Au

Gold

79

201

Hg

Mercury

80

204

Tl

Thallium

81

207

Pb

Lead

82

209

Bi

Bismuth

83

(210)

Po

Polonium

84

(210)

At

Astatine

85

(222)

Rn

Radon

86

(223)

Fr

Francium

87

(226)

Ra

Radium

88

(227)

Ac

Actinium

89

(261)

Rf

Rutherfordium

104

(262)

Db

Dubnium

105

(266)

Sg

Seaborgium

106

(264)

Bh

Bohrium

107

(265)

Hs

Hassium

108

(268)

Mt

Meitnerium

109

140

Ce

Cerium

58

141

Pr

Praseodymium

59

144

Nd

Neodymium

60

145

Pm

Promethium

61

150

Sm

Samarium

62

152

Eu

Europium

63

157

Gd

Gadolinium

64

159

Tb

Terbium

65

162.5

Dy

Dysprosium

66

165

Ho

Holmium

67

167

Er

Erbium

68

169

Tm

Thulium

69

173

Yb

Ytterbium

70

175

Lu

Lutetium

71

232

Th

Thorium

90

231

Pa

Protactinium

91

238

U

Uranium

92

237

Np

Neptunium

93

244

Pu

Plutonium

94

(243)

Am

Americium

95

(247)

Cm

Curium

96

(247)

Bk

Berkelium

97

(251)

Cf

Californium

98

(252)

Es

Einsteinium

99

(257)

Fm

Fermium

100

(258)

Md

Mendelevium

101

(259)

No

Nobelium

102

(262)

Lr

Lawrencium

103

4

He

Helium

2

11

B

Boron

5

12

C

Carbon

6

14

N

Nitrogen

7

16

O

Oxygen

8

19

F

Fluorine

9

20

Ne

Neon

10

27

Al

Aluminum

13

28

Si

Silicon

14

31

P

Phosphorus

15

32

S

Sulfur

16

35.5

Cl

Chlorine

17

40

Ar

Argon

18

Key

12

C

Carbon

6

Relative atomic mass to nearest whole number

Symbol

Atomic number

C

Choose the correct answer

C-1 What process will be observed in a hydrogen atom when its electron drops from the $n = 6$ state to the $n = 3$ state.

- a) A photon with energy 3.53×10^{-19} J will be absorbed.
- b) A photon with energy 3.53×10^{-19} J will be emitted.
- c) A photon with energy 1.80×10^{-19} J will be absorbed.
- d) A photon with energy 1.80×10^{-19} J will be emitted

C-2 Calculate De Broglie wavelength of a proton; having a velocity equal to 200 m/s and a mass of 1.67×10^{-24} g?

- a) 7.94×10^{-5} m
- b) 1.98×10^{-9} m
- c) 5.53×10^{-53} m
- d) 1.98×10^{-12} m

C-3 What set of quantum numbers is most likely to be associated with the last electron in Aluminum element?

- a) $n=3, l=0, m_l=0, m_s=1/2$
- b) $n=3, l=0, m_l=0, m_s=1$
- c) $n=3, l=0, m_l=1, m_s=1/2$
- d) $n=3, l=1, m_l=-1, m_s=1/2$

C-4 Which of the following elements is a representative element?

- a) Nd
- b) Pd
- c) Au
- d) S

C-5 Which element exists as a diatomic gas?

- a) P
- b) Ca
- c) He
- d) N

C-6 What species is isoelectronic with Mg^{2+} ?

- a) Kr
- b) Na^+
- c) O
- d) P

C-7 The metal with the electronic configuration $[\text{Ar}]3d^5$ is

- a) Mn
- b) Cr^+
- c) Fe^{3+}
- d) Ca^{3+}

C-8 The correct order of radius of the following is

- a) $\text{P}^{3-} < \text{Ar} < \text{S}^{2-} < \text{Ca}^{2+}$
- b) $\text{P}^{3-} > \text{S}^{2-} > \text{Ca}^{2+} > \text{Ar}$
- c) $\text{P}^{3-} < \text{S}^{2-} < \text{Ca}^{2+} < \text{Ar}$
- d) $\text{P}^{3-} > \text{S}^{2-} > \text{Ar} > \text{Ca}^{2+}$

C-9 Which of the following statements is the best definition of valence electrons?

- a) The electrons those are unpaired.
- b) The electrons occupying the highest energy (outermost) level.
- c) The electrons that are paired.
- d) The electrons in the p orbitals

C

- C-10** _____ is the energy liberated when an atom forms a negative ion.
a) Ionization energy b) Electronegativity c) Electron affinity d) Covalent bond
- C-11** Which one of the following elements is a gas under normal atmospheric conditions?
a) Cs b) Be c) Si d) N₂
- C-12** If the volume of N₂ gas is 10 L at 800 torr, what will be its volume at 1000 torr if the temperature is kept constant?
a) 5 L b) 8 L c) 20 L d) 16 L
- C-13** A 1.202 g of gaseous compound occupies 256 mL at 373 K and 750 torr. The molar mass of this compound is:
a) 48.6 g/mol b) 97.1 g/mol c) 145.7 g/mol d) 194.2 g/mol
- C-14** 200 mL of a gas at 303 K and 710 torr is compressed to a volume of 145 mL and the temperature is raised to 400 K. What is the new pressure of the gas?
a) 1500 torr b) 1389 torr c) 1293 torr d) 1209 torr
- C-15** Which one of the following atoms is a p-block element?
a) Li b) Ag c) Ge d) Gd
- C-16** When acting as central atom, which of the following could be an example of incomplete octet?
a) Si b) Be c) F d) C
- C-17** A polar covalent bond would form in :
a) Na—Be b) K—Br c) Li—Li d) H—O
- C-18** What are the standard temperature and pressure (STP)?
a) 0 K, 1 atm b) 0 K, 1 torr c) 273 °C, 1 atm d) 0 °C, 1 atm
- C-19** What is the pressure of 1.0 mole of H₂ when placed in 1.0 L container at 45 °C?
a) 26.1 atm b) 9.9 atm c) 33.2 atm d) 22.24 atm
- C-20** Which of the following pure gases has the greatest density at 1.0 atm and 305 K?
a) NH₃ b) O₂ c) Cl₂ d) C₂H₆
- C-21** For a mixture of N₂ (3 moles) and O₂ (2 moles) in 20L container at 298K, what is the total pressure?
a) 2.4 atm b) 24.57 atm c) 6.12 atm d) 10.24 atm

C

C-22 "The distance between identical points on successive waves." is the definition of:

- a) The Pauli exclusion principle.
- b) Wavelength
- c) Wave
- d) Frequency

C-23 Calculate the energy of a photon with $\lambda = 950\text{nm}$.

- a) $8.3 \times 10^{-19}\text{J}$
- b) $1.2 \times 10^{-19}\text{J}$
- c) $2.09 \times 10^{-19}\text{J}$
- d) $5.8 \times 10^{-29}\text{J}$

C-24 What is the correct Lewis dot symbol for Cl?

- a) $\text{Cl}^{\bullet}$
- b) $\text{:}\ddot{\text{Cl}}\text{:}$
- c) $\text{:}\ddot{\text{Cl}}\text{:}$
- d) $\ddot{\text{Cl}}$

C-25 Which of the following elements has the smallest first ionization energy?

- a) Br
- b) Ga
- c) Kr
- d) As

C-26 What is the total number of valence electrons in NO_2^- ?

- a) 12
- b) 16
- c) 20
- d) 18

C-27 How many bonding electrons around the nitrogen atom in NO_2^- ?

- a) 6
- b) 2
- c) 1
- d) 3

C-28 How many nonbonding electrons around the nitrogen atom in NO_2^- ?

- a) 2
- b) 1
- c) 0
- d) 6

C-29 The formal charge on the nitrogen atom in NO_2^- ?

- a) -1
- b) +1
- c) 0
- d) +2

C-30 Which of the following is an example of diamagnetic element?

- a) Al
- b) Na
- c) Xe
- d) P