

King Abdulaziz University

Faculty of Science - Chemistry Department

Chem-110,

Time: 90 minutes

Name:	Number:	Section:
<p style="text-align: center;">Useful information</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Speed of light,</p> <p>Planck's const.,</p> <p>Avogadro's No.,</p> <p>Energy const. for H atom</p> <p>Frequency const. for H atom</p> <p>Mass of the electron,</p> <p>Gas constant,</p> </div> <div style="width: 50%;"> <p>$c = 3.0 \times 10^8 \text{ m/s}$</p> <p>$h = 6.626 \times 10^{-34} \text{ J.s}$</p> <p>$N_{av} = 6.022 \times 10^{23} \text{ mol}^{-1}$</p> <p>$H \text{ atom } B = 2.179 \times 10^{-18} \text{ J}$</p> <p>$B/h = 3.289 \times 10^{15} \text{ s}^{-1}$</p> <p>$m_e = 9.11 \times 10^{-31} \text{ kg}$</p> <p>$R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1} = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$</p> </div> </div>		

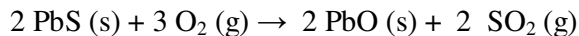
1 H Hydrogen 1	PERIODIC TABLE Relative atomic mass to nearest whole number																4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> Key <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;">12 C Carbon 6</div> <div style="margin-right: 5px;">→</div> </div> <div>Symbol</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;">6</div> <div style="margin-right: 5px;">→</div> </div> <div>Atomic number</div> </div>										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Flourine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											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
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	70 Ga Gallium 31	72.5 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
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

(Choose and mark the correct answer)

- 1- The letter A in the chemical symbol (${}^A_ZX_f^c$) represents:
- a- Atomic number b- mass number c- charge d- frequency
- 2- The unit of force Newton (N) is:
- a- m s^{-2} b- $\text{kg m}^2 \text{s}^{-2}$ c- m s^{-1} d- kg m s^{-2}
- 3- 1.27 \AA is equal to:
- a- $1.27 \times 10^{-10} \text{ m}$ b- $1.27 \times 10^{-3} \text{ mm}$ c- $1.27 \times 10^{+3} \text{ pm}$ d- $1.27 \times 10^{-2} \text{ m}$
- 4- Cesium atoms are the largest naturally occurring atom. The radius of cesium atom is 2.62 \AA . How many cesium atoms would have to be laid side by side to give a row of cesium atoms 2.54 cm long? Assume the atoms are spherical.
- a- 4.85×10^7 b- 1.91×10^7 c- 3.82×10^7 d- 5.73×10^7
- 5- The international prototype of the kilogram is a cylinder made from an alloy that is 90.000% platinum and 10.000% iridium. How many moles of Pt are in the cylinder?
- a- 4.62 b- 0.52 c- 3.133×10^{23} d- 2.78×10^{24}
- 6- The number of neutrons (n) and protons (p) in the element zinc (${}^{65}_{30}\text{Zn}^{2+}$) is:
- a- 30 n, 28 p b- 35 n, 30 p c- 31 n, 30 p d- 35 n, 28 p
- 7- Silver occurs in nature as a mixture of two isotopes: ${}^{107}_{47}\text{Ag}$ and ${}^{109}_{47}\text{Ag}$. The number of protons in both isotopes (${}^{107}_{47}\text{Ag}$ and ${}^{109}_{47}\text{Ag}$) is:
- a- the same b- bigger in isotope ${}^{107}_{47}\text{Ag}$
c- smaller in isotope ${}^{107}_{47}\text{Ag}$ d- none of the above
- 8- How many moles of sulfur are there in 3.07×10^{23} sulfur-atoms?
- a- 0.50 mol b- 1.0 mol c- 1.5 mol d- 2.0 mol
- 9- Sodium hydrogen carbonate, commonly called "bicarbonate of soda," is used in many commercial products to relieve an upset stomach. It has the simplest formula NaHCO_3 . The percentage composition of sodium is:
- a- 27.38% b- 1.20% c- 14.29% d- 57.14%

- 10- For the reaction:



If 5.30 mol of PbS reacts with oxygen, how many moles of oxygen are needed?

- a- 0.0525 b- 7.95 c- 1.35 d- 5.30
- 11- Naphthalene, contains only carbon and hydrogen. Combustion of a 1.000 g sample of naphthalene gives 0.562 g of water H₂O. What is the mass percent of hydrogen in 1.000 g naphthalene?
- a- 6.24% b- 93.7% c- 0.0624 d- 0.078
- 12- The molecular weight of the empirical formula of a compound (C₃H₄O₂) is (72 g/mol), if the molecular weight of the compound is (288 g/mol), the molecular formula of the compound is:
- a- C₆H₈O₄ b- C₁₂H₁₆O₈ c- C₉H₁₂O₆ d- C₁₈H₂₄O₁₂
- 13- The number of carbon-atoms in (0.5 mol) of the aminoacid alanine (CH₃CHNH₂COOH) is:
- a- 9.02×10^{23} b- 2.11×10^{24} c- 3.01×10^{23} d- 6.02×10^{23}
- 14- 1.000 milliliter (mL) equals:
- a- 10^{-3} m^3 b- 10^{-4} m^3 c- 10^{-5} m^3 d- 10^{-6} m^3
- 15- The molarity of hydrochloric acid (HCl) prepared by dissolving 18.25 g in 400 mL is:
- a- 1.25 M b- 1.67 M c- 2.50 M d- 5.00 M
- 16- What volume of a 0.05 M HCl solution is required to react with 40.0 mL of a 0.02 M Na₂CO₃ solution according the the following equation:
- $$\text{Na}_2\text{CO}_3 + 2 \text{HCl} \rightarrow 2 \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$$
- a- 32.0 mL b- 16.0 mL c- 8.0 mL d- 24.0 mL
- 17- The number of grams of sodium hydroxide (NaOH) required to prepare a 400 mL of a 0.25 M (NaOH)-solution is:
- a- 4.0 g NaOH b- 3.0 g NaOH c- 2.0 g NaOH d- 1.00 g NaOH
- 18- How many grams of SF₄ (g) can theoretically be prepared from 6.00 g of SCl₂ (g) and 3.50 g of NaF(s)? The equation of reaction is:



- a- 21.0 g SF₄ b- 210 g SF₄ c- 2.10 g SF₄ d- 0.210 g SF₄
- 19- Chalcopyrite, the principal ore of copper (Cu), contains 34.63%Cu by mass. How many grams of Cu can be obtained from 5.11×10^3 kg of the ore?
a- 1.77×10^3 g b- 1.77×10^4 g c- 1.77×10^5 g d- 1.77×10^6 g
- 20- which atom is most likely to form -3 ion?
a- N b- Al c- Ca d- Rb
- 21- What mass of silver iodide (AgI) can be made by the reaction of 10.0 g of silver nitrate (AgNO₃) with 10.0 g of sodium iodide (NaI)? $\text{AgNO}_3 (\text{aq}) + \text{I}^- (\text{aq}) \rightarrow \text{AgI} (\text{s})$
a- 6.91 g b- 20.74 g c- 13.8 g d- 27.65 g
- 22- Iron(II) sulfate (FeSO₄) is prescribed for the treatment of anemia. How many moles of FeSO₄ are present in a standard 300 mg tablet?
a- 1.19×10^{21} Fe²⁺ ions b- 1.97×10^{-3} mol FeSO₄
c- 3.95×10^{-3} mol FeSO₄ d- 2.38×10^{21} Fe²⁺ ions
- 23- Acetic acid (CH₃CO₂H) reacts with isopentyl alcohol (C₅H₁₂O) to yield isopentyl acetate (C₇H₁₄O₂), a fragrant substance with the odor of bananas. If the yield from the reaction of acetic acid with isopentyl alcohol is 45%, how many grams of isopentyl acetate are formed from 3.58 g of acetic acid and 4.75 g of isopentyl alcohol? The reaction is:
- $$\text{CH}_3\text{COOH} + \text{C}_5\text{H}_{12}\text{O} \rightarrow \text{C}_7\text{H}_{14}\text{O}_2 + \text{H}_2\text{O}$$
- a- 3.86 g b- 4.56 g c- 3.2 g d- 2.46 g
- 24- The number of moles of CO₂ resulted from the reaction of 3.5 moles of C₂H₆ with excess oxygen according to the equation $2 \text{ C}_2\text{H}_6 + 7 \text{ O}_2 \rightarrow 4 \text{ CO}_2 + 6 \text{ H}_2\text{O}$ is:
a- 7.0 moles b- 9.0 moles c- 10.5 moles d- 13.5 moles
- 25- The mass of chlorine that reacts with 4.770 g of hydrogen to form hydrogen chloride according the following equation $\text{H}_2 + \text{Cl}_2 \rightarrow 2 \text{ HCl}$ is:

- a- 4.770 g b- 174.1 g c- 84.67 g d- 169.3 g
- 26- How many grams of KOH is required to prepare a 0.25 liter of 0.3 M KOH solution ?
 a- 5.6 g KOH b- 6 g KOH c- 4.2 g KOH d- 12 g KOH
- 27- The molecular formula of a compound having a molecular weight 28 (g/mol) and an empirical formula CH_2 is:
 a- C_6H_6 b- C_6H_{12} c- C_2H_2 d- C_2H_4
- 28- In an experiment, the actual yield was 5.35 g and the theoretical yield was 8.3 g what is the percentage yield of the product?
 a- 52.4% b- 64.5% c- 40.4% d- 76.5%
- 29- The molecular weight of NaOH is:
 a- 56 g/mol b- 63 g/mol c- 16 g/mol d- 40 g/mol
- 30- The element with the number of protons = 20, neutrons = 20, and electrons = 20 is:
 a- Ca b- Se c- K d- Au
- 31- 0.90 g of a sample contains 0.80 g carbon and 0.10 g hydrogen. What is the empirical formula of the compound?
 a- C_2H_3 b- CH_3 c- CH_2 d- CH
- 32- Genes are considered to be composed of a substance known as DNA. In a particular sample, the average mass of a DNA molecule is 1.0×10^{-15} g. Calculate the molecular mass of DNA.
 a- 6.02×10^8 g/mol b- 6.02×10^9 g/mol
 c- 6.02×10^7 g/mol d- 6.02×10^{10} g/mol
- 33- The mass of one argon atom ($^{40}_{18}\text{Ar}$) in grams is:
 a- 2.32×10^{-23} g b- 6.64×10^{-23} g c- 9.30×10^{-23} g d- 1.66×10^{-24} g
- 34- The mass of 10.0 billion SO_2 molecules in grams is:
 a- 1.06×10^{-10} g b- 1.06×10^{-11} g c- 1.06×10^{-12} g d- 1.06×10^{-13} g
- 35- The percentage composition of nitrogen atoms in ammonium sulfate $\{(\text{NH}_4)_2\text{SO}_4\}$ is:

a- 48.48% b- 24.24% c- 21.21% d- 6.061%

36- The number of sulfur atoms in 39.6 g of ammonium sulfate $\{(\text{NH}_4)_2\text{SO}_4\}$ is:

a- 3.61×10^{23} b- 1.44×10^{24} c- 1.81×10^{23} d- 7.23×10^{23}

37- The Analysis of an air pollutant of a sample of pure compound reveals that it contains 57.1% sulfur and 42.9% oxygen by mass. The empirical formula of the pollutant is:

a- SO b- SO_2 c- SO_3 d- S_2O_3

38- A 20.882 gram sample of an ionic compound is found to contain 4.327 g of sodium, Na, 6.020 g of sulfur, S, and 10.535 g of oxygen, O. The empirical formula of the ionic compound is:

a- Na_2SO_3 b- $\text{Na}_2\text{S}_2\text{O}_7$ c- Na_2SO_4 d- $\text{Na}_2\text{S}_2\text{O}_3$

39- What mass of potassium permanganate, KMnO_4 , would contain 18.5 g of manganese, Mn?

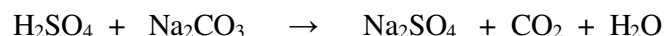
a- 44.53 g KMnO_4 b- 30.2 g KMnO_4 c- 53.1 g KMnO_4 d- 35.9 g KMnO_4

40- Nitric oxide, NO, is produced according to the following equation: $\text{N}_2 + \text{O}_2 \rightarrow 2 \text{NO}$

What mass of oxygen is combined with 2.00 g of nitrogen in NO?

a- 2.29 g oxygen b- 5.71 g oxygen c- 4.57 g oxygen d- 3.43 g oxygen

41- What is the volume of a 0.324 M solution of sulfuric acid, H_2SO_4 , that is required to react with 4.37 g of Na_2CO_3 , according to the equation:



a- 81.3 mL H_2SO_4 b- 78.0 mL H_2SO_4 c- 127.2 mL H_2SO_4 d- 81.3 mL H_2SO_4

42- The mass of nickel sulfate, NiSO_4 , contained in 350 g of a 6.00% NiSO_4 -solution is:

a- 18.0 g NiSO_4 b- 15.0 g NiSO_4 c- 12.0 g NiSO_4 d- 21.0 g NiSO_4

43- The molarity, M, of a solution that contains 365 g of HCl in 2.00 liters of solution is:

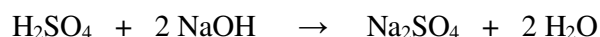
a- 5.0 M b- 0.50 M c- 0.05 M d- 0.005 M

44- The mass of $\text{Ba}(\text{OH})_2$ required to prepare 4.50 liters of a 0.060 molar solution of barium hydroxide is:

a- 15.4 g b- 35.9 g c- 46.2 g d- 25.7 g

- 45- The volume of 18.0 M H_2SO_4 required to prepare 1.00 liter of 0.0090 M solution of H_2SO_4 , is
a- 50.0 mL b- 5.0 mL c- 500 mL d- 0.5 mL

- 46- A 4.36 L sample of a 2.36 M NaOH-solution reacts completely with 3.67 mL of H_2SO_4 -solution. What is the molarity of H_2SO_4 -solution according to the equation:



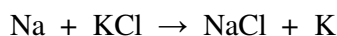
- a- 0.014 M H_2SO_4 b- 0.140 M H_2SO_4 c- 14.0 M H_2SO_4 d- 1.40 M H_2SO_4
- 47- How many moles of solute are contained in 100 g of 0.40% aqueous solution of Na_2S ?
a- 3.85×10^{-3} mol b- 5.13×10^{-3} mol c- 3.21×10^{-3} mol d- 4.49×10^{-3} mol
- 48- How many grams of solute are contained in the solution of question (D18)?
a- 0.35 g Na_2S b- 0.40 g Na_2S c- 0.30 g Na_2S d- 0.25 g Na_2S

- 49- How many grams of water (the solvent) are contained in the solution of question (D18)?
a- 99.75 g H_2O b- 99.70 g H_2O c- 99.60 g H_2O d- 99.65 g H_2O

- 50- The percent yield is 83.2%.for the following reaction: $\text{PCl}_3 + \text{Cl}_2 \rightarrow \text{PCl}_5$ is 83.2%.
What mass of PCl_5 would be expected from the reaction of 64.3 g of PCl_3 with excess Cl_2 ?
a- 71.5 g b- 81.1 g c- 58.9 g d- 96.8 g

- 51- How many grams of the agent Na_3PO_4 , are needed to prepare 125 mL of 0.40 M solution.
a- 32.8 g b- 16.4 g c- 23.0 g d- 8.2 g

- 52- What mass of potassium can be produced by the reaction of 150.0 g of Na with 100.0 g of KCl?



- a- 130.9 g b- 104.7 g c- 78.5 g d- 52.3 g
- 53- Commercial concentrated hydrochloric acid, HCl, is 12.0 M. What volume of concentrated hydrochloric acid is required to prepare 4.50 L of 2.60 M HCl solution?
a- 675 mL b- 37.5 mL c- 750 mL d- 975 mL

54- Calculate the resulting molarity when 200 mL of 6.00 M H₂SO₄ solution is mixed with 245 mL of

3.00 M H₂SO₄.

- a- 4.348 M b- 4.014 M c- 4.5 M d- 4.12 M

55- Which of the following is an element?

- a- polonium b- water c- sugar d- carbon dioxide

56- Which of the following is a compound?

- a- cobalt b- water c- polonium d- gold

57- (Sb) is the chemical symbol for:

- a- bismuth b- tungsten c- antimony d- zinc

58- Measurements show that 1.0 g of iron (Fe) contains 1.1×10^{22} Fe atoms. How many Fe atoms are in 0.0049 g of Fe?

- a- 5.4×10^{22} b- 5.4×10^{20} c- 5.4×10^{21} d- 5.4×10^{19}

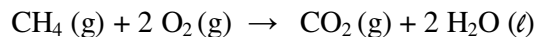
59- A 1.0-mL volume of seawater contains about 3.8×10^{-12} g of gold. The total volume of ocean water is 1.5×10^{21} L. Calculate the total amount of gold (in grams) that is present in seawater

- a- 6.0×10^{12} g b- 6.2×10^{12} g c- 5.9×10^{12} g d- 5.7×10^{12} g

60- Convert 0.106 kg/m³ to g/cm³

- a- 0.106 b- 0.0106 c- 0.000106 d- 0.00106

61- If 10.0 moles of CH₄ are burned in an excess of oxygen, what is the volume of CO₂ (in liters) produced at 23.0°C and 0.985 atm according to the following equation?



- a- 370 L b- 345 L c- 296 L d- 246 L

62- The empirical formula of a compound is CH. If 0.193 g of this compound occupies 97.2 mL at 200°C and a pressure of 0.74 atm. What is the molecular formula of the compound?

- a- C₈H₈ b- C₂H₂ c- C₆H₆ d- C₄H₄