



Taibah University

Deanery of Academic Services

Unified Scientific Track

Answer Key

Mock Test For

Final Exam

Introduction to Chemistry (CHEM 101)

(Chapters 3, 4, 5 & 7)

Topics 08 – 17 & 19 – 21

For

Unified Scientific Track Students

(All Campuses)

1st Semester

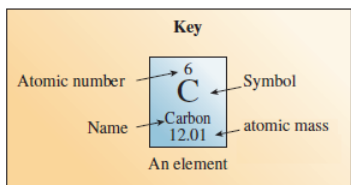
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2019 – 2020

▲ Periodic Table of the Elements

Period number	Main group										Transition metals										Main group					
	1A	2A									3B	4B	5B	6B	7B	8	9	10	11	12	3A	4A	5A	6A	7A	8A
1	1 H Hydrogen 1.008																								2 He Helium 4.003	
2	3 Li Lithium 6.941	4 Be Beryllium 9.012																		5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18	
3	11 Na Sodium 22.99	12 Mg Magnesium 24.31																		13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95	
4	19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.41	31 Ga Gallium 69.72	32 Ge Germanium 72.64	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80								
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3								
6	55 Cs Cesium 132.9	56 Ba Barium 137.3	57 La Lanthanum 138.9	72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)								
7	87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (272)	108 Hs Hassium (270)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (293)	117 Ts Tennessine (293)	118 Og Oganesson (294)								



Lanthanides 6	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium 150.4	63 Eu Europium 152.0	64 Gd Gadolinium 157.3	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.0
Actinides 7	90 Th Thorium 232.0	91 Pa Protactinium 231.0	92 U Uranium 238.0	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

▲ CHEM 101 Supplemental Information

$d = \frac{m}{V}$	$^{\circ}\text{C} = \frac{(^{\circ}\text{F} - 32)}{1.8}$	$^{\circ}\text{F} = 1.8 (^{\circ}\text{C}) + 32$	$^{\circ}\text{C} = K - 273$	$K = (^{\circ}\text{C}) + 273$
$M = \frac{n}{V}$	$M_1 V_1 = M_2 V_2$	$K_w = [\text{H}_3\text{O}^+] \times [\text{OH}^-] = 1 \times 10^{-14}$		$\text{pH} = -\log [\text{H}_3\text{O}^+]$
Molecular formula = empirical formula $\times n$ $n = \frac{\text{molar mass of molecular formula}}{\text{molar mass of empirical formula}}$	% mass of element X = $\frac{\text{mass of element X in 1 mol of compound}}{\text{mass of 1 mol of the compound}} \times 100\%$		% yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$	
$q = C \times \Delta T$	$w = -P\Delta V$	$q = m \times C_s \times \Delta T$	$1 \text{ L.atm} = 101.3 \text{ J}$	Avogadro's No. = 6.022×10^{23}
Atomic mass = $\sum_n (\text{fraction of isotope } n) \times (\text{mass of isotope } n)$ = (fraction of isotope 1 \times mass of isotope 1) + (fraction of isotope 2 \times mass of isotope 2) + ...	Mole Conversions: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px;">Grams of Substance</div> <div style="text-align: center;"> \div Molar Mass \times Molar Mass </div> <div style="border: 1px solid black; padding: 5px;">Moles of Substance</div> <div style="text-align: center;"> \times Avo. Number \div Avo. Number </div> <div style="border: 1px solid black; padding: 5px;">Number of Atoms or Molecules</div> </div>			

Answer The Following Questions:

1. Which type of chemical formulas gives only the relative number of atoms of each element in a compound?

- a. Molecular formula b. Empirical formula
 c. Structural formula d. Ball-and-stick model
-

2. If we have 9.03×10^{24} aluminum atoms, how many moles of aluminum do we have?

- a. 5.4 mol b. 10 mol c. 15 mol d. 2.7 mol
-

3. The systematic name of CuNO_2 is

- a. copper(II) nitrate b. copper(I) nitrate
 c. copper(I) nitrite d. copper(II) nitrate
-

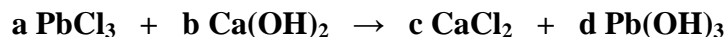
4. What is the formula for the ionic compound formed by barium and phosphate ions?

- a. $\text{Ba}_2(\text{PO}_4)_3$ b. $\text{Ba}_3(\text{PO}_4)_2$ c. $\text{Ba}_3(\text{PO}_3)_2$ d. BaPO_4
-

5. How many grams are in a sample containing 2.71×10^{24} atoms of iron?

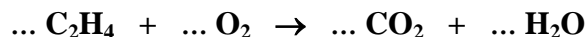
- a. 160.2 g b. 251.3 g c. 449.9 g d. 292.2 g
-

6. What are the coefficients (a, b, c and d) needed to balance the following equation?



- a. 3, 2, 2, 2 b. 2, 3, 3, 2 c. 4, 2, 2, 4 d. 4, 3, 3, 2
-

7. When the following equation is balanced, the coefficient of O_2 would be



- a. 1 b. 2 c. 3 d. 4
-

8. What is the mass percent of calcium in calcium acetate, $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$?

- a. 34.6% b. 25.3% c. 41.1% d. 35.2%
-

9. The correct chemical formula for iron(II) oxide is

- a. Fe_2O_3 b. Fe_2O c. FeO_2 d. FeO
-

10. Calculate the molar mass of aluminum tartrate, $\text{Al}_2(\text{C}_4\text{H}_4\text{O}_6)_3$.

- a. 59 g/mol b. 71 g/mol c. 119 g/mol d. 498.1 g/mol
-

11. How many covalent bonds will a nitrogen atom normally make?

- a. 1 b. 2 c. 3 d. 0
-

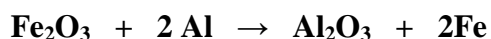
12. Group 1A metals always have an oxidation state of in their compounds.

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

13. The oxidation number of nitrogen in $\text{Ca}(\text{NO}_3)_2$ is

- a. +6 b. +5 c. +3 d. -3
-

14. Identify the reducing agent in the following reaction:



- a. Fe_2O_3 b. Al c. Al_2O_3 d. Fe
-

15. The oxidation number of bicarbonate ion in its compounds is

- a. -1 b. -2 c. -3 d. +1
-

16. What is the empirical formula of glycolylurea which has the molecular formula $\text{C}_3\text{H}_4\text{N}_2\text{O}_2$?

- a. CH_2NO b. $\text{CH}_4\text{N}_2\text{O}$ c. $\text{C}_3\text{H}_4\text{N}_2\text{O}_2$ d. $\text{C}_2\text{H}_2\text{NO}$
-

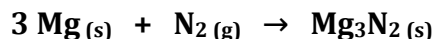
17. If the empirical formula of a compound is C_2HCl and its molar mass is 181.44 g/mol, what is the molecular formula of this compound?

- a. $\text{C}_4\text{H}_3\text{Cl}_3$ b. $\text{C}_5\text{H}_3\text{Cl}_3$ c. $\text{C}_6\text{H}_4\text{Cl}_4$ d. $\text{C}_6\text{H}_3\text{Cl}_3$
-

18. A compound contains 74.03 % C, 8.70 % H, and 17.27 % N. What is the empirical formula of this compound?

- a. $\text{C}_5\text{H}_7\text{N}$ b. $\text{C}_4\text{H}_8\text{N}_2$ c. $\text{C}_6\text{H}_9\text{N}_3$ d. $\text{C}_4\text{H}_7\text{N}$
-

19. How many moles of magnesium nitride, Mg_3N_2 , would be produced when 3 g of magnesium completely react with excess N_2 according to the following equation?

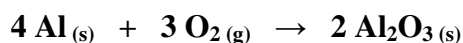


- a. 4.11 mol b. 0.041 mol c. 3.21 mol d. 14.02 mol
-

20. How many grams of K_2CO_3 are needed to prepare 200 mL of 0.150 M solution?

- a. 4.14 g b. 10.4 g c. 13.8 g d. 2.07 g
-

21. Consider the following reaction, if the reaction of 2.5 g of Al with 2.5 g of O₂ produced 3.5 g of Al₂O₃. The % yield equals



- a. 74 % b. 37 % c. 47 % d. 66 %
-

22. To what volume (in mL) shall we dilute 50.0 mL of a 12 M stock HNO₃ solution to obtain a 0.10 M HNO₃ solution?

- a. 416 mL b. 6000 mL c. 3200 mL d. 2.45 mL
-

23. What is the final molarity of an HCl solution, if 40 mL of a 2.5 M HCl solution were diluted to a final volume of 500 mL?

- a. 5.0 M b. 31.25 M c. 0.20 M d. 2.45 M
-

24. What mass (g) of NaF is contained in 0.35 L of a NaF solution that has a molarity of 2.20 M?

- a. 32.34 g b. 25.41 g c. 0.77 g d. 7.70 g
-

25. The Lewis dot structure for nitrogen molecule is

- a. $\text{:N}::\text{N:}$ b. $\text{:}\ddot{\text{N}}\cdot\cdot\ddot{\text{N}}\text{:}$ c. $\text{:}\ddot{\text{N}}::\ddot{\text{N}}\text{:}$ d. $\text{:}\ddot{\text{N}}::\ddot{\text{N}}\text{:}$
-

26. The Lewis dot structure of H₂S molecule has bonding pairs and lone pairs of electrons.

- a. 2, 4 b. 2, 2 c. 4, 2 d. 4, 4
-

27. What is the [OH⁻] in a solution that has a [H₃O⁺] = 1.0 × 10⁻³ M?

- a. 1.0 × 10⁻³ M b. 1.0 × 10⁻⁶ M c. 1.0 × 10⁻⁸ M d. 1.0 × 10⁻¹¹ M
-

28. Calculate the pH of a solution that has [H₃O⁺] = 2.33 × 10⁻⁹ M.

- a. 2.67 b. 6.81 c. 8.63 d. 4.34
-

29. The compound HF is

- a. a strong acid b. a weak base c. a weak acid d. an ionic compound
-

30. Which of the following substances would give a solution that does not conduct electricity, when dissolved in distilled water?

- a. Ca(NO₂)₂ b. NaOH c. NH₄OH d. C₆H₁₂O₆
-

31. A strong electrolyte solution will be formed when is dissolved in water.

- a. $\text{Mg}(\text{NO}_2)_2$ b. CH_3COOH c. NH_4OH d. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
-

32. Which of the following acids will partially dissociates in aqueous solutions?

- a. H_2SO_4 b. HCl c. CH_3COOH d. HNO_3
-

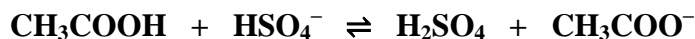
33. Which of the following substances is a Lewis acid?

- a. NH_3 b. CO_2 c. H_2O d. F^-
-

34. Which of the following pairs of species is NOT a conjugate acid-base pair?

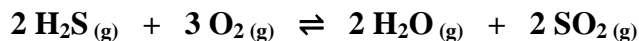
- a. $\text{H}_2\text{O}/\text{OH}^-$ b. $\text{HSO}_4^-/\text{SO}_4^{2-}$ c. $\text{H}_2\text{SO}_4/\text{HSO}_4^-$ d. $\text{H}_2\text{SO}_4/\text{SO}_4^{2-}$
-

35. Identify the Bronsted-Lowry conjugate acid in the following reaction:



- a. H_2SO_4 b. CH_3COOH c. HSO_4^- d. CH_3COO^-
-

36. Consider the following reaction at equilibrium. What is the effect of increasing the pressure of the reaction mixture?

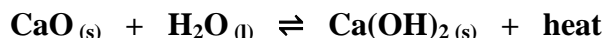


- a. the reaction will shift to the left b. the reaction will shift to the right
 c. the equilibrium constant will decrease d. no effect will be observed
-

37. According to Bronsted-Lowry concept of acids and bases, H_2O can be considered as

- a. a neutral substance b. an acid
 c. a base d. an amphoteric substance
-

38. What is the effect of lowering the temperature on the following exothermic reaction?

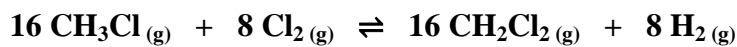


- a. the reaction will shift forward b. the reaction will shift reverse
 c. $\text{Ca}(\text{OH})_2$ will decrease d. no effect will be observed
-

39. are compounds that have the same molecular formula but with different structures.

- a. aromatics b. cycloalkanes c. isotopes d. isomers
-

40. Choose the correct expression for equilibrium constant, K_{eq} , for the following reaction:



a. $K_{eq} = \frac{[\text{CH}_2\text{Cl}_2][\text{H}_2]}{[\text{CH}_3\text{Cl}][\text{Cl}_2]}$

b. $K_{eq} = \frac{[\text{CH}_2\text{Cl}_2]^{16} [\text{H}_2]^8}{[\text{CH}_3\text{Cl}]^{16} [\text{Cl}_2]^8}$

c. $K_{eq} = \frac{[\text{CH}_3\text{Cl}]^{16} [\text{Cl}_2]^8}{[\text{CH}_2\text{Cl}_2]^{16} [\text{H}_2]^8}$

d. $K_{eq} = \frac{[\text{CH}_3\text{Cl}][\text{Cl}_2]}{[\text{CH}_2\text{Cl}_2][\text{H}_2]}$

41. How many hydrogen atoms, H, shall be bonded to the carbon atom marked with (*) in the following compound?



a. 0

b. 1

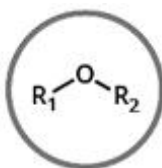
c. 2

d. 3

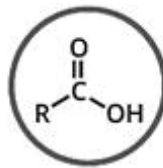
42. Identify the families of the following organic formulas:



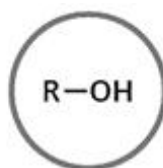
Amine



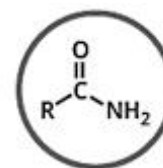
ether



carboxylic acid



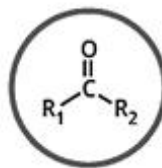
alcohol



amide



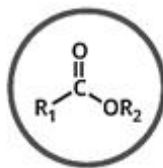
Aldehyde



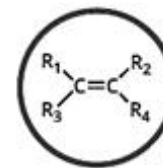
ketone



alkyne



ester



alkene

43. Identify the class of the organic compound whose molecular formula is $\text{C}_{18}\text{H}_{38}$.

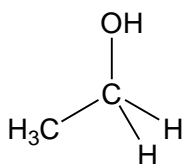
a. Alkane

b. Alkene

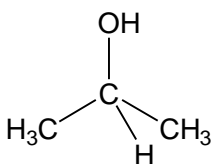
c. Alkyne

d. Cycloalkane

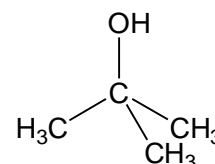
44. Identify the class of each alcohol (primary, secondary, tertiary):



Primary alcohol

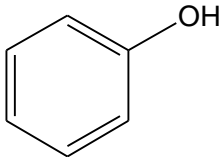
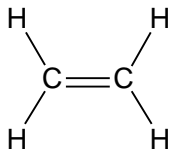


Secondary alcohol

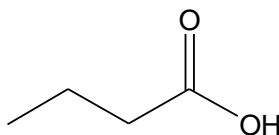


Tertiary alcohol

45. Write both "common" and "IUPAC" names of the following compounds:

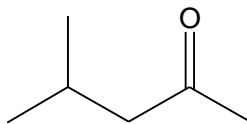
Compound			$\text{H}-\text{C}\equiv\text{C}-\text{H}$
Common name	Phenol	Ethylene	Acetylene
IUPAC name	Hydroxybenzene	Ethene	Ethyne

46. To which family does this compound belong?



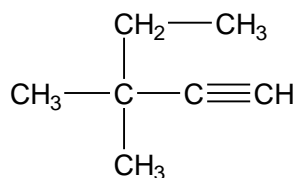
- a. esters
 b. aldehydes
 c. ketones
 d. carboxylic acids

47. What is the family of this organic compound?



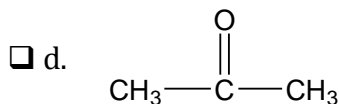
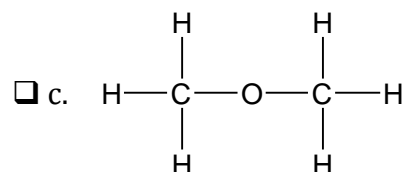
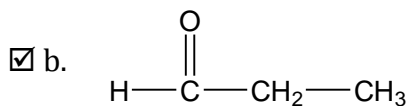
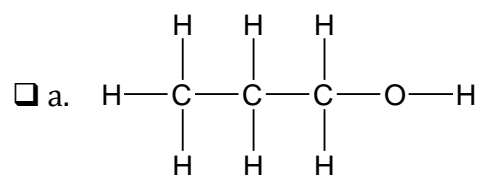
- a. ethers
 b. ketones
 c. esters
 d. carboxylic acids

48. Choose the correct name of the following organic compound?

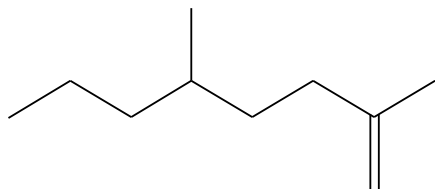


- a. 3,3-dimethyl-4-pentyne
 b. 3,3-dimethyl-1-pentyne
 c. 3-ethyl-3-methyl-1-butyne
 d. 3-methyl-3-ethyl-1-butyne

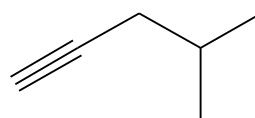
49. Identify the aldehyde:



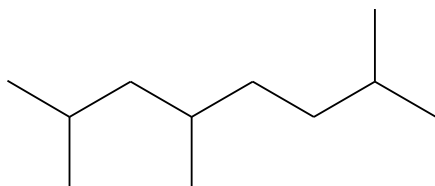
50. Give the IUPAC names for the following organic compounds:



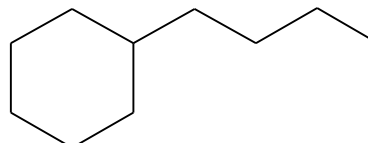
2,5-dimethyl-1-octene



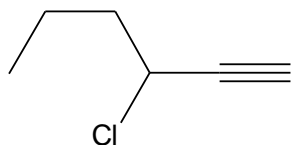
4-methyl-1-pentyne



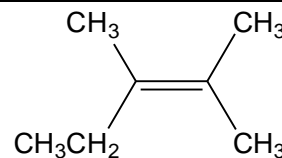
2,4,7-trimethyloctane



Butylcyclohexane



3-Chloro-1-hexyne



2,3-dimethyl-2-pentene

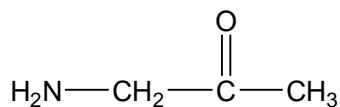
51. Which of the following suffixes refers to an organic compound that includes a $C\equiv C$?

- a. ane b. ene c. yne d. one

52. Which class of hydrocarbons has the general formula C_nH_{2n-2} ?

- a. alkanes b. alkenes c. alkynes d. cycloalkanes

53. What functional group(s) are present in the following compound?



- a. amine b. ketone c. amide d. amine and ketone

Best Wishes

Al-Madinah, 2nd of December, 2019