Practice for Final Exam

Chemistry 101

Ch 2, 3, 4, 5, 6 & 7

اسئلة تدريبية فى مادة الكيمياء

السنة التحضيرية

الفصول ٢و ٣ و ٤ و ٥ و ٦ و ٧

– لا تغنى عن الكتاب

اهم القوانين

1. 1mole = 6.02×10^{23} (عدد افوجادرو= ١ مول)
2. n (عدد المولات) = m (كتلة المادة)/mm (الكتلة المولية)
3. Mass % = (MM of element/ MM of compound) x 100

   (نسبة الكتلة = كتلة العنصر/ كتلة المركب مضروب ١٠٠)
4. % yield = actual yield/ theoretical yield $\times 100$
5. Molarity (M)= $\dfrac{\textit{amount of solute (in mol)}}{\textit{volume of solution (in L)}}$
6. Dilution equation: $M_1 \cdot V_1 = M_2 \cdot V_2$
7. K = $\dfrac{[C]^c\ [D]^d\ \textit{(products)}}{[A]^a\ [B]^b\ \textit{(reactants)}}$

$pH = -\log[H_3O^+]$

8. In pure water, $K_w = [H_3O^+]\ [OH^-] = 1.0 \times 10^{-14}$

1. **Formula mass =** (no. of atoms of 1st element × atomic mass of 1st element) + (no. of atoms of 2nd element × atomic mass of 2nd element) + ...

2. **Mass percent of element X =** $\dfrac{\text{mass of element } \boldsymbol{X} \text{ in 1 mol of compound}}{\text{mass of 1 mol of compound}} \times 100\%$

3. **Multiplying factor; n =** $\dfrac{\text{molar mass of molecular formula}}{\text{molar mass of empirical formula}}$

4. **PE + KE = Internal energy (*E*)**

5. $\Delta E = E_{final} - E_{initial}$

6. $\Delta E = q + w \rightarrow w = -P\Delta V$

7. $q = C \times \Delta T \rightarrow C = q / \Delta T = J/ {}^{0}C$

8. $\Delta H = \Delta E + P\Delta V$

9. $\Delta H = H_{final} - H_{initial}$

10. $\Delta H^{\circ}_{rxn} = \Sigma n\, \Delta H^{\circ}_{f}(products) - \Sigma m\, \Delta H^{\circ}_{f}(reactants)$

لتحويل اللتر ضغط جوى الى جول ←→ (101.3 J = 1L.atm)

Rules for Assigning Oxidation States: قواعد حالات الاكسدة و الاختزال			
1	An atom in an element is zero	Element: 0	$Na_{(s)}$, $H_{2(g)}$, $Hg_{(l)}$
2	A monatomic ion is the same as its charge	Monatomic ion: charge of ion	Na^+, Cl^-
3	Fluorine is $^-1$ in its compounds	Fluorine: -1	HF, PF_3
4	Oxygen is usually $^-2$ in its compounds	Oxygen: -2	H_2O, CO_2
	Exception: peroxides (containing O_2^{2-})	Oxygen: -1	H_2O_2
5	Hydrogen is $^+1$ in its covalent compounds	Hydrogen: +1	H_2O, HCl, NH_3

Oxidation	Reduction
loss of electrons	gain of electrons
reducing agent	oxidizing agent
is oxidized	is reduced
increase of oxidation number	decrease of oxidation number

	Property/ definition	Acid الحمض	Base القاعدة
1	Taste	sour	bitter
2	litmus	turns red	turns blue
3		neutralizes bases	neutralizes acids
4	Arrhenius	produces H^+	produces OH^-
5	Bronsted-Lowry	donates proton	accepts proton
6	Lewis	accepts pair of electrons	donates pair of electrons

			DNA	RNA
nucleotide	nucleoside	Pentose Sugar	Deoxy-ribose	D-ribose
		Nitrogen base	thymine	uracil
			Adenine, guanine, cytosine	Adenine, guanine, cytosine
	Phosphate group		PO_4^{---}	PO_4^{---}

Q1. Determining the charge of the nucleus is achieved by:

A). Thomson's works B). Rutherford's works

C). Bohr's works D). Millikan's works

Q2. The subatomic particles that indicate the type of ion of an element are called:

A). protons B). neutron C). electron D). all of them

Q3. The symbol of an element has 13 protons, 10 electrons and 14 neutron is:

A). $^{25}Mg_{12}^{2+}$ B). $^{23}Mg_{12}^{2-}$ C). $^{27}Al_{13}^{3+}$ D). $^{24}Al_{13}^{3-}$

Q4. Isotopes are atoms that have the same number of …. But different number of….. .

A). protons& electrons B). protons& neutrons

C). neutrons & neutrons D). protons& electrons

Q5. The number of protons & neutrons of an atom is called:

A). the atomic number B). the mass number

C). the oxidation number D). Avogadro's number

Q6. Removing two electron from an atom gives a(an):

A). anion with a 2^- charge B). anion with a 2^+ charge

C). cation with a 2^- charge D). cation with a 2^+ charge

Q7. Atoms of sodium element has a great metallic character than:

A). calcium atoms B). potassium atom

C). barium ions D). lithium atom

Q8. A nitrogen element has a highest ionization energy than:

A). helium B). neon C). oxygen D). Fluorine

Q9. The inner transition metals in period 7 are known as:

A). alkaline earth metals
C). chalcogens
B). actinides
D). lanthanides

Q10. An ion with a positive charge is called:

A. cation
B. anion
C. radioactive
D. abundant

Q11. Which of the following elements is less ionization energy?

a). Al
b). Ga
c). Na
d). Kr

Q12. A 5 moles of carbon-13 contains :

A). 18 g of mass
B). 30 g of mass
C). 60 g of mass
D). 65 g of mass

Q13. The particles of an atom that determine the types of isotopes are called:

A). protons B). Electrons C). Neutrons D). all of the above

Q14. The outermost orbital of halogen elements is:

A). s orbital B). p orbital

C). d orbital D). f orbital

Q15. The electron configuration [Ar] $4S^2 4p^5$ is represents an element called:

A). B B). Be C). Br D). Ba

Q16. Which pair of elements have a greatest similarity in their physical and chemical properties?

A). O,S B). C,N C). K,Ca D). H,He

Q17. The chemical properties of sodium metal are similar to:

A). potassium element
B). carbon element
C). calcium element
D). iron element

Q18. The element which has a lowest atomic radius is:

A). Na
B). Al
C). Br
D). He

Q19. The element which represents a noble gas is:

A). Al
B). Ar
C). Au
D). Ac

Q20. A group of elements which have very reactive metals are called:

A). alkali metals
B). chalcogens
C). halogens
D). alkaline earth metals

Q21. The number of atoms in 7.0 gram of boron-11 is:

A). 6.025×10^{23} atoms B). 6.6×10^{24} atoms

C). 3.8×10^{23} atoms D). 4.2×10^{24} atoms

Q22. How many moles & how many atoms in 32.7 g of zinc?

A). 1.5 mol, 9.03×10^{23} B). 0.5 mol, 3.01×10^{23}

C). 0.5 mol, 9.03×10^{23} D). 1.5 mol, 6.02×10^{23}

Q23. Which of the following is a heat conductor?

A). sulfur B). carbon C). phosphorus D). aluminum

Q24. The *d* sublevel has a …… orbitals and …… electron.

A). 3 & 6 B). 5 & 10 C). 7 & 14 D). 10 & 5

25. The element that has a lower electronegativity is:

A). Boron B). Carbon C). Fluorine D). Chlorine

Q26. Which of the following elements has a mass number of 40?

A) K B) Ca C) Fe D) Br

Q27. The element in the third period of the periodic table and has a $3p^5$ electrons is:

A). Cl B). Cr C). Se D). Br

Q28. Magnesium cation is formed due to:

A). lose 2 electrons. B). Lose 2 protons.

C). gain 2 electrons D). lose one electron.

Q29. Among the following substances, the one that is not a compound is:

A) H_2O B) Cl_2 C) MnO_2 D) CO_2

Q30. Which of the following is true about a neutron?

A) It has a positive charge

B) It has a neutral charge .

C) It has a negative charge .

D) It is a lowest atomic particle in mass.

Q31. What is the chemical symbol for silver?

A) Ag B) S C) S_4 D) S_8

Q32. Cations are formed when atoms

A) Gain of protons.

B) Lose of neutrons.

C) Gain of electrons.

D) Lose of electrons.

Q33. The ion which has 20 protons and 18 electrons is:

A) Cl^- B) K^+ C) Mg^{+2} D) Ca^{+2}

Q34. Which one of the following species has the same electron configuration as the Al^{3+} cation?

A) S^{2-}. B) Cl^{-}. C) F. D) Na^{+}.

Q35. Unknown element Z has TWO energy levels, FOUR valence electrons, and is a nonmetal. What is element Z?

A) H B) Be C) He D) C.

Q36. Who in 1909 showed the charge on the electron, by oil drop experiment?

A) Ernest Rutherford. B) Niels Bohr.

C) John Dalton. D) Robert A. Millikan.

Q37. The electron configuration of Ne is:

A) $1S^2\ 2S^2\ 2P^5$ B) $1S^2\ 2S^2\ 2P^6$

C) $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 4S^2$ D) $1S^2\ 2S^2\ 2P^3$

Q38. How would you describe the atom?

A) Dense, positively charged B) Tiny, negatively charged
C) Mostly empty space, neutrally charged
D) Dense, negatively charged

Q39. Cesium is an example of a(n):

A) noble Gas B) halogen
C) alkali Metal D) alkaline Earth Metal

Q40. Which one of the following elements is a poor conductor of heat and electricity?

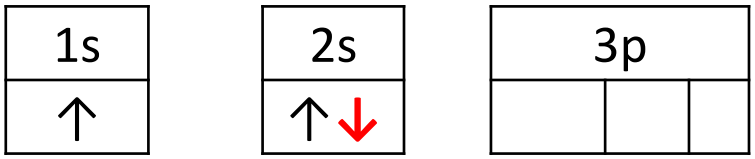
A) copper B) sulfur C) iron D) lead

Q41. How many grams are in a sample containing 2.71 x 10^{24} atoms of iron, atomic mass of Iron is 55.846 g/mol?

A) 160.22 B) 251.33 C) 449.94 D) 292.27

Q 42. Which electron configuration represents a violation (انتهاك) of the Pauli exclusion principle?

A)



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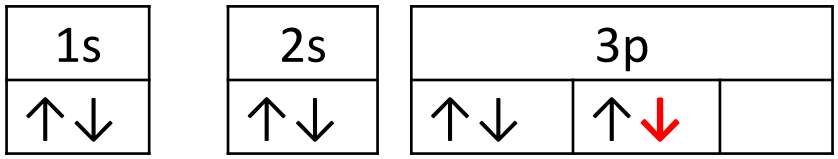

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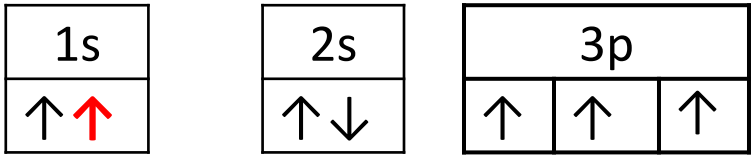

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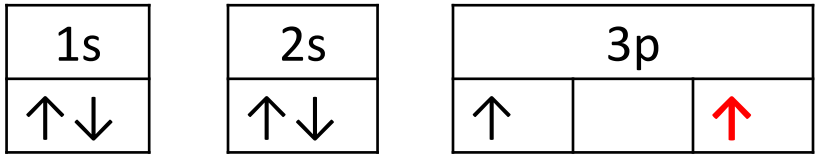


Q 43. Electron affinity generally decreases as we move _____.

A) down a group and from right to left across a period

B) up a group and from left to right across a period

C) down a group and from left to right across a period

D) up a group and from right to left across a period

Q44. Which of the following is correct about metals?

A) They typically have a low boiling point.
B) They are found at the right-hand side of the periodic table.
C) They are good conductors of electricity.
D) Some are colorful.

Q45. The most stable isotope of silver is given by $^{107}_{47}Ag$ How many protons, neutrons, and electrons does it have?

a) 107, 47, 47
b) 60, 47, 60
c) 47, 47, 60
d) 47, 60, 47

Q46. Which of the following determines the identity of an atom?

A) Number of protons
B) Number of electrons
C) Number of neutrons
D) Total number of protons and neutrons

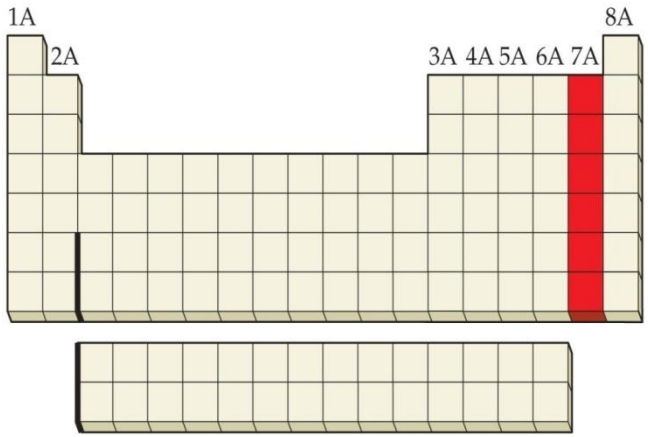
Q47. What group of elements does the shaded area in the following periodic table indicate?

a) Alkali metals

b) Alkaline earth metals

c) Halogens

d) Noble gases



Q48. Which of the following elements is an alkali earth metal?

A) Li

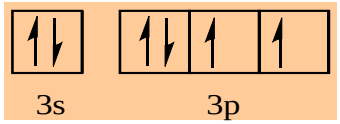
B) Fe

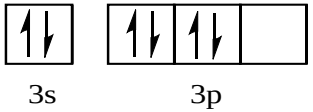
C) Ca

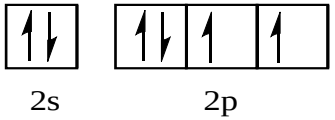
D) Ge

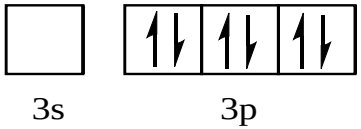
Periods	Main-group elements 1A (1)	Group number 2A (2)	Transition elements 3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	8B (9)	8B (10)	1B (11)	2B (12)	Main-group elements 3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (18)
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113	114 Fl	115	116 Lv	117	118

Q49. The correct form of the valence electron configuration of sulfur is:

a) 

b) 

c) 

d) 

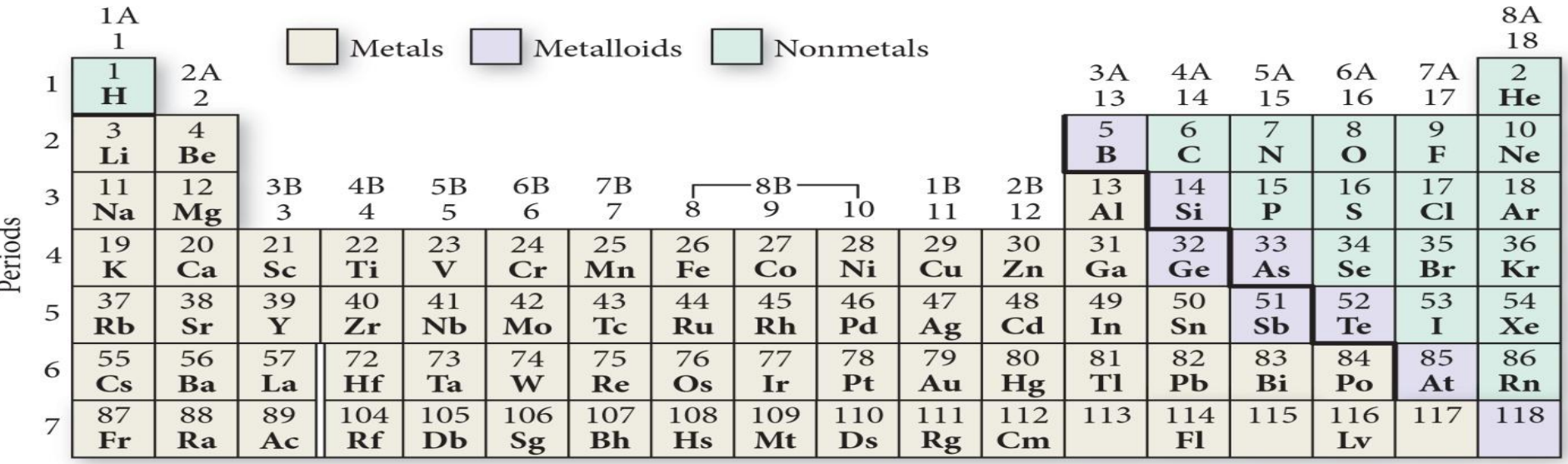
Q50. Which of the following is the correct electron configuration for bromine?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

D. $1s^2 2s^2 2p^6 3s^2 3p^6\ 4s^2 3d^{10} 4p^5$

E. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6$



Q51. The mass percent of hydrogen in a C_2H_5OH is:

A). 52.17 % B). 34.78 % C). 26.09 % D). 13.04 %

32. The molecular formula of sulfur element is:

A). S B). S_2 C). S_4 D). S_8

Q52. The oppositely charged ions are then attracted to each other, resulting in …

A: an ionic bond B: hydrogen bond

C: Covalent bond D: Metallic bond

Q53. In the ionic compound, the ions are arranged in a three dimensional pattern called…

A: a crystal lattice B: lattice energy

C: Hydrogen bond D: Ionic bond

Q54. The compound which has both molecular and empirical formula is:

A). H_2O B). H_2O_2 C). S_8 D). P_4

Q55. The molecular formula of H_2CO_3 gives the actual number of atoms of:

A). carbon only B). hydrogen only

C). oxygen only D). whole of the compound

Q56. A formula of ionic compound which composed of sodium and phosphorus is:

A). Na_3P_2 B). Na_3P C). Na_2P_3 D). NaP_3

Q57. A formula of dinitrogen tetraoxide compound is:

A). N_2O_4 B). N_4O C). NO_4. D). N_4O_2

Q58. The systematic name of $Cu(NO_3)_2$ compound is called:

A). Copper nitrate
B). Copper dinitrate
C). Copper(II) nitrate
D). dicopper nitrate

Q59. Chlorine is considered which of the following?

A) atomic element
C) molecular element
B) molecular compound
D) ionic compound

Q60. What is correct name of the compound whose formula is P_4O_6?

A) Phosphorous oxide
C) Tetra phosphorous oxide
B) Phosphorous hexoxide
D) Tetra phosphorous hexoxide

Q61. Calculate the molar mass of sodium sulphate Na_2SO_4.

A) 59 g/mol B) 71 g/mol C) 119 g/mol D) 142 g/mol

Q62. The resulting bond due to transfer of electron is:

A: covalent B: polar covalent C: ionic bond D: metallic

Q63. The chemical formula for iron(II) oxide is:

A) Fe_2O_3 B) Fe_2O C) FeO_2 D) FeO

Q64. Which of these compounds is most likely to be *ionic*?

A). $CoCl_2$ B). PCl_3 C). SF_4 D). NO_2

Q65. 50) When balanced with the smallest set of whole numbers, the coefficient of H_2O in the following equation is:

__ Al_4C_3 + __ H_2O → __ $Al(OH)_3$ + __ CH_4

A). 4 B). 6 C). 12 D). 24

Q66. The coefficients (a, b, c, d) needed to balance the equation, [a $PbCl_3$ + b $Ca(OH)_2$ → c $CaCl_2$ + d $Pb(OH)_3$] are:

A) 3, 2, 2, 2 B) 2, 3, 3, 2 C) 4, 2, 2, 4 D) 4, 3, 3, 2

Q67. What is the mass percent of calcium in $CaSO_4$?

A) 19.4% B) 29.4% C) 39.4% D) 49.4%

Q68. An example of a molecular compound is:

A) H_2O B) MgO C) Na_2O D) CaF_2

Q69. The bond holding Mg&O atoms together in a molecule is called:

A. covalent bond
B. ionic bond
C. metallic bond
D. no bonding

Q70. The IUPAC name of $Al_2(CO_3)_3$ is:

A. Aluminum (I) carbonate
B. Aluminum (III) carbonate
C. Aluminum (II) carbonate
D. Aluminum carbonate

Q71. How many <u>total atoms</u> are there in one formula unit of $Ca_3(PO_4)_2$?

A. 8 B. 10 C. 13 D. 26

Q72. Which of the following is an molecular element?

A. Bromine B. Aluminum C. Lithium D. Magnesium

Q73. What is the IUPAC name of the compound SF_2?

A. monosulfur difluoride
C. sulfur difluoride
B. sulfur fluoride
D. monosulfur fluoride

Q74. What is the molar mass of 0.5 mole butyric acid [CH_3-CH_2-CH_2-COOH]?

A. 44 g/mol B. 72 g/mol C. 88 g/mol D. 124 g/mol

Q75. **$Ba(NO_3)_2$ is considered as a(n)**

A. Molecular compound B. Ionic Compound

C. Atomic Element D. Ionic Element

Q76. **In propanal (C_2H_5CHO), the mass-ratio of oxygen is:**

A. 18.2 % B. 27.3% C. 32.4% D. 62.1%

Q77. **A compound has a composition by mass of 76.0% C, 12.8% H and 11.2% O. Its <u>empirical formula</u> is:**

A. $C_9H_{18}O$ B. $C_6H_{12}O$ C. $C_6H_{13}O$ D. none of them

Q78. **A compound of an empirical formula CH_2O has a molar mass of 60.0 g/mol. What is the molecular formula of this compound?**

A. CH_2O B. $C_2H_4O_2$ C. C_2H_4O D. C_3H_8O

Q1. The number of moles of CO_2 yields from 4 moles of octane that burns in excess of oxygen as the following;

$2C_8H_{16} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$ are:

A).16 moles
B). 32 moles
C). 8 moles
D). 64 moles

Q2. The reactant which doesn't limits the products is called:

A). reactant in excess
B).limiting reactant
C). actual yield
D). theoretical yield

Q3. The amount of product that independent on limiting reactant is called:

A). reactant in excess
B). limiting reactant
C). actual yield
D). theoretical yield

Q4. The minor component in the solution is called:

A). reactant B). solvent

C). solute D). stock solution

Q5. To prepare 0.5 L of 0.25 M H_2SO_4 solution, how many ml of 3 M H_2SO_4 solution should be used?

a. 21.8 ml b. 41.6 ml c. 25.0 ml d. 15.0 ml

Q6. If 2.5 g of Al produces 4.74 g of Al_2O_3; as a chemical equation; $4Al_{(s)} + 3O_{2(g)} \rightarrow 2\ Al_2O_{3(s)}$

The % yield of this reaction if 3.5 g of Al_2O_3 is produced is:

a. 74.0 % b. 37.0 % c. 47.0 % d. 66.0 %

Q7. The number of nonbonding pairs (lone pairs) in the ammonia (NH_3) molecule is _____.

A) one B) two C) three D) four

Q7b. Basic substance has _____ taste.

A) bitter B) sweet C) salty D) sour

Q8. A form of ion that formed due to the association of proton and water is:

A) H^+ B) OH^- C) H_3O^+ D) NH_4^+

Q9. Which of the following is a precipitate reaction:

A: $2NO_{(g)} + 5\ H_{2(g)} \rightarrow 2\ NH_{3(g)} + 2\ H_2O_{(l)}$

B: $2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

C: $H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$

D: $K_2CrO_{4(aq)} + Ba(NO_3)_{(aq)} \rightarrow BaCrO_{4(s)} + 2KNO_{3(aq)}$

Q10. An unknown substance is added to a solution and the pH doesn't change. The substance is best described as:

a). an acid
b). a base
c). an amphoteric (مادة مذبذبة)
d). neutral (متعادلة)

Q11.Which of the following is the strongest acid?

a). NH_4^+ b). HCl c). H_2CO_3 d). NaOH

Q12.Which of the following is the weakest base?

a). $Ca(OH)_2$ b). NaOH c). LiOH d). NH_3

Q13. A weak electrolyte is one that ___ completely in solution.

a). ionizes b). reacts c). dissociates d). not ionizes

Q14. Which one of the following is not considered to be a Lewis base?

A) H_2O B) NH_3 C) CO D) NH_4^+

Q15. Most molecular compounds dissolve in water as:

A: positive ions B: negative ions

C: spectator ions D: intact molecules

Q16. A BrØnsted-Lowry base is defined as a substance that:

A) increases K_a when placed in H_2O

B) increases $[OH^-]$ when placed in H_2O

C) acts as a proton donor D) acts as a proton acceptor

Q16b. In the Fe_2S_3 compound: the charge of the <u>iron ion</u> is:

A. +3 B. -3 C. -1 D. +1

Q19. What is the correct form for the equilibrium constant for this reaction?

$H_2\,(g) + F_2\,(g) \rightleftharpoons 2\,HF\,(g)$

A	$\frac{[HF]}{[H_2][F_2]}$	**B**	$\frac{[HF]^2}{[H_2][F_2]}$	**C**	$\frac{[H_2][F_2]}{[HF]}$	**D**	$\frac{[H_2][F_2]}{[HF]^2}$

Q20. For the reaction of carbon with carbon dioxide to make carbon monoxide, the reaction is as follows.

$C(s) + CO_2(g) \rightleftharpoons 2CO\,(g)$, Write the form of the K_c.

A	$\frac{[CO]}{[CO_2]}$	**B**	$\frac{[2CO]^2}{[CO_2]}$	**C**	$\frac{[CO]^2}{[CO_2]}$	**D**	$\frac{[CO]^2}{[C]\,[CO_2]}$

Q20b. If $CaCO_3$ (solid) is added to the following reaction:, $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2\,(g)$, the reaction equilibrium would:

A) have no effect

B) shift to left

C) shift to right

D) increase K_c

Q21. The component of a solution that doesn't change its state is called a:

A: solvent
B: Solute
C: Solution
D: Homogenous solution

Q22. Bases that not disassociate virtually 100% are called:

A) strong bases.
B) weak bases
C) unionized bases
D) weak acids

Q23. Substances that partially dissociate into ions when dissolved in water are called …..

A: strong electrolyte.
B: weak bases
C: weak electrolyte
D: non electrolyte

Q24. The unequally sharing of atoms are then attracted to each other, resulting in …

A: an ionic bond
B: polar covalent bond
C: Covalent bond
D: Metallic bond

Q25. The resulting bond due to sharing of electrons is:

A: an ionic bond
B: polar covalent bond
C: covalent bond
D: metallic bond

Q26. Substance that donates H^+ (Bronsted-Lowry) is called:

A: acid
B: base
C: solution
D: antacid

Q27. Substance that produces OH^- is called:

A: acid
B: base
C: solution
D: antacid

Q28. Which of the following is the weak acid?

a) HNO_3 b) HF c) HBr d) HCl

Q29. An Arrhenius base is that:

A: produces H^+ B: produces OH^-

C: accepts proton D: donates electrons pair

Q30. Acetic acid can be classified as a (an) --------.

a) Binary acid b) Carboxylic acid

c) strong electrolyte d) Polyprotic acid

Q31. Which of the following is a Lewis base?

a) AlF_3 b) NH_3 c) SiF_4 d) H_2O e) CO_2

Q32. Sodium chloride solution can be classified as a (an) ----.

a) gas b) weak electrolyte c) solid d) strong electrolyte

Q33. What is the pH and $[OH^-]$ concentration of a solution that has a $[H_3O^+] = 1.0 \times 10^{-6}$ M?

A. pH= 11 and $[OH^-] = 1.0 \times 10^{-3}$ M
B. pH= 8 and $[OH^-] = 1.0 \times 10^{-6}$ M
C. pH= 6 and $[OH^-] = 1.0 \times 10^{-8}$ M
D. pH= 3 and $[OH^-] = 1.0 \times 10^{-11}$ M

Q34. Substance that acts as the solvent in an aqueous solution is:

A) water B) nitrogen C) salt D) air

Q35. Which of the following pairs form nonpolar covalent bond?

A. Fe & Cl B. H & F C. H & H D. Au & Pd

Q36. The ionic character is determined by:

a. electronegativity differences b. dipole moment

c. electron affinity d. ionization energy

Q37. The energy released when cations and anions form the solid is:

A. Lattice energy B. Bond length

C. Bond energy D. Ionization energy

Q38. The bond holding Na atoms of sodium element is:

A. covalent bond B. metallic bond

C. ionic bond D. amide bond

Q39. Metals are highly conductors because of their:

a. electron affinity b. electrons are free

c. electron sharing d. electron transfer

Q40. For a given arrangement of ions, the lattice energy increases as ionic radius …. and as ionic charge …. .

A) decreases, increases

B) decreases, decreases

C) increases, decreases

D) increases, increases

Q41. Which solution below has the <u>lowest</u> concentration of hydronium ions [H_3O^+]?

A) pH = 3.21

B) pH = 12.49

C) pH = 7.0

D) pH = 10.12

Q42. Which of the changes below will shift the equilibrium to the *left* (backward) for the following reaction?

$$SO_{3(g)} + NO_{(g)} + \text{heat} \leftrightarrow SO_{2(g)} + NO_{2(g)}$$

A) An increase of [SO_3]

B) An increase of [SO_2]

C) An increase of temperature

D)A decrease of volume

Q43. An unknown substance is added to a solution and the pH decreases. The substance is best described as:

مادة مجهولة اضيفت لمحلول فانخفض الاس الهيدروجينى. افضل وصف للمادة هو

a). an acid

b). a base

c). neutral (متعادلة)

d). an amphoteric (مادة مذبذبة)

Q44. Which one of the following is characteristic of a base?

A) produces H_3O^+ in water

B) has a sour taste

C) accepts proton

D) turns blue litmus to red

Q45.Which of the following is not the strongest acid?
اى من التالى هو ليس حمض قوى

a). NH_4^+ b). H_2CO_3 c). NaOH d). HCl

Q46. Which of the following is not the strongest base?
اى من التالى هو ليس قاعدة قوية

a). $Ca(OH)_2$ b). NaOH c). LiOH d). NH_3

Q47. A BrØnsted-Lowry base is defined as a substance that:
قاعدة برونستيد - لورى تعرف بانها المادة التى:

A) increases K_a when placed in H_2O
B) increases $[OH^-]$ when placed in H_2O
C) acts as a proton donor
D) acts as a proton acceptor

Q48. Substance that can act (تعمل) as acid or base is called:

A) amphoteric (متذبذبة)
B) a protic (يحوى بروتون)
C) nonprotic (لا يحتوى بروتون)
D) polyprotic (متعدد البروتونات)

Q49. What is the term for a substance that releases hydrogen ions in water?

ما المصطلح (التعبير) عن المادة التى تحرر (تطلق) ايونات الهيدروجين فى الماء

A) Arrhenius acid
B) Arrhenius base
C) Brønsted-Lowry acid
D) Brønsted-Lowry base

Q50. Which of the following solutions is the most acidic?

اى من المحاليل التالية هو اقصى حامضية

A) a solution with a pH = 14
B) a solution with a pH = 10
C) a solution with a pH = 7
D) a solution with a pH = 4

Q51. For the reaction: $NH_4^+ + OH^- \leftrightarrow H_2O + NH_3$, the correct statement is:

A) NH_4^+ is an acid and OH^- is its conjugate base

B) NH_4^+ is a base and NH_3 is its conjugate acid

C) OH^- is an a base and H_20 is its conjugate acid

D) NH_3 is an acid and H_20 is its conjugate base

Q52. lowering the temperature of an exothermic reaction would: (انخفاض درجة الحرارة لتفاعل طارد للحرارة سوف)

A). Shift the reaction to forward direction

B). Shift the reaction to reverse direction

C). Decrease the value of equilibrium constant

D). increase the value of equilibrium constant

E). Both A& D are correct

F). Both B& C are correct

Q53. Substance that donates [H^+] (تمنح ايون الهيدروجين) is called:

A: Bronsted-Lowry acid B: base C: solution D: Lewis acid

Q54. Substance that produces OH^- is called:

A: acid B: Arrhenius base C: salt D: Lewis base

Q55. Which solution below has the highest concentration of hydroxide ions [OH^-]?

A) pH= 3.5 B) pH= 13.5 C) pH= 6.7 D) pH= 11.3

Q56. According to the following reaction, which molecule is acting as an acid?

$$H_2O + H_2SO_4 \rightarrow H_3O^+ + HSO_4^-$$

A) H_2SO_4 B) H_2O C) H_3O^+ D) HSO_4^-

Q57. Which of the following is the weak acid?

a) HNO_3 b) HF c)HBr d) HCl

Q58. Acetic acid can be classified as a (an) --------.

a) Binary acid b) Carboxylic acid
c) Amphoteric substance d) Polyprotic acid

Q59. Which of the following is a Lewis base?

a) AlF_3 b) NH_3 c) SiF_4 d) H_2O e) CO_2

Q60. According to the Bronsted-Lowry definition,

A) an acid is a proton acceptor.
B) a base produces H^+ ions in aqueous solutions.
C) a base is a proton donor.
D) a base is a proton acceptor.

Q61. A chemical reaction has reached equilibrium when

A) the rate of the forward reaction equals the rate of the reverse reaction.

B) the concentrations of reactants and products are equal.

C) all reactants have been converted to products.

D) all products have been removed from the reaction mixture.

Q62. What is the equilibrium constant expression for the following reaction?

$$2\ CH_4(g) + O_2(g) \rightleftharpoons 2\ CO(g) + 4\ H_2(g)$$

A) $K_c = [CH_4]\,[O_2] / [CO]\,[H_2]$

B) $K_c = [CO]^2\,[H_2]^4 / [CH_4]^2\,[O_2]$

C) $K_c = [CH_4]^2\,[O_2] / [CO]^2\,[H_2]^4$

D) $K_c = [CO]\,[H_2] / [CH_4]\,[O_2]$

Q1. The first law of thermodynamics is also called the law of

A) conservation of mass.

B) conservation of energy.

C) creation of energy.

D) destruction of energy.

Q2. Define kinetic energy. (عرف طاقة الحركة)

A) energy associated with the temperature of an object

B) energy associated with the motion of an object

C) energy associated with the force of an object

D) energy associated with the gravity of an object

Q3. Define potential energy. (عرف طاقة الوضع)

A) energy associated with the temperature of an object

B) energy associated with the motion of an object

C) energy associated with the force of an object

D) energy associated with the position or composition of an object

Q4. The SI unit of energy is the

A) joule. B) calorie. C) gram. D) watt.

Q5. Define heat capacity (C). (عرف السعة الحرارية)

A) the quantity of heat required to lower the temperature of 1 mole of a substance by 1°C

B) the quantity of heat required to change a system's temperature by 1°C

C) the quantity of heat required to lower the temperature of 1 gram of a substance by 1°C

D) the quantity of heat required to raise the temperature of 1 g of a substance by 1°F

Q6. If a balloon is inflated (انتفخ)from a volume of 9 L to 10 L against an external pressure of 1.0 atm, how much work is done? [w= -P.ΔV]

A) – 0.8 L.atm

B) – 1 L.atm

C) – 0.4 atm

D) -0.1.2 J

Q7. Identify what a bomb calorimeter measures.

(حقق ما يقيسه المسعر الحرارى)

A) measures ΔH for aqueous solutions

B) measures ΔE for combustion reactions

C) measures ΔH for reduction solutions

D) measures ΔT for aqueous solutions

Q8. Enzymes are:

A. mechanical Catalysts

B. biological catalysts

C. automobile Catalysts

D. metallic catalysts

Q9. A catalyst increases the rate of reaction by decreasing the ……. Energy.

A) activation B) internal C) Kinetic D) Potential

Q10. A mechanism of a reaction with catalyst is proceeds:

A. fast with lower activation energy

B. fast with higher activation energy

C. slow with lower activation energy D. all of them

Q11. *The total energy of the universe is:*

a. created b. destroyed c. changed d. constant

Q12. The Internal energy of a system is:

a. the sum of the kinetic and potential energies.

b. the average kinetic energies. c. the average potential energies

d. the difference between the kinetic and potential energies.

Q13. The potential energy of a motionless body has due to virtue of :

a. its position *b. its movement* *c. its state* *d. both a & b.*

Q14. A state function is that depends only on:

a. the value of the initial values
b. the value of the final values
c. the sum of the initial and the final values
d. the difference between the initial and the final values.

Q15. A 155-g sample of an unknown substance was heated from 25.0°C to 40.0°C. If the substance absorbed 5696 J of energy. What is the specific heat of the substance?

A. *2.45 J/(g.°C)*
B. 0.45 J/(g.°C)
C. 0.84J/(g.°C)
D. 4.18 J/(g.°C

Q16. The internal energy change of a chemical system is the value of:

a. the potential energy *b. the kinetic energy.*
c. the sum of the potential and the kinetic energies
d. the difference between the products and the reactants

Q17. Calculate ΔE for a system undergoing an endothermic process in which 15.6 kJ of heat flows and where 1.4 kJ of work is done on the system.

A. 14.2 kJ *B. 17 kJ* *C.21.84 kJ* *D. 11.14 kJ*

Q18. If the temperature of 34.4 g of ethanol increases from 25.0°C to 78.8°C, how much heat has been absorbed by the ethanol ($C_{ethanol}$ = 2.44 J/(g·°C)?

A. 45.16 J *B. 4.516 KJ* *C. 34.4 KJ* *D. 78.8 KJ*

Q19. The temperature of a sample of iron with a mass of 10.0 g changed from 50.4°C to 25.0°C with the release of 114 J. What is the specific heat of iron?

A. *0.45 J/(g.°C)*
B. *10.0 J/(g.°C)*
C. *25.0 J/(g.°C)*
D. *50.4 J/(g.°C)*

Q20. If a balloon is inflated from a volume of 0.100 L to 1.85L against an external pressure of 1 atm, how much work is done in joules?

A. *-17.7J* ***B.*** *+17.7J* ***C.*** *+177J* ***D.*** *-177J*

Q21. The units of specific heat (الحرارة النوعية) is:

A. J/ mol-°C
B. J/ mol-K
C. J/ g-°C
D. J/ °C

Q22. The enthalpy(H) [المحتوى الحراري] of a chemical system is the value of:

a. the internal energy of the reaction (E)

b. the product of its pressure and volume (PV)

c. the sum (a) and (b) *d. the difference between (a) and (b)*

Q23. The enthalpy(H) of a chemical system is the value of:

a). a state function (independent of pathway)

b). a negative sign of an exothermic reaction

c). a positive sign of an endothermic reaction

d). Any of the above

Q24. As Hess's law; The enthalpy of a reaction (ΔH_{rxn}) is:

a). ΔH along products *b). ΔH along reactants*

c). the difference between Σ(a) and Σ (b)

d). the sumΣ (a) and Σ (b)

Q25. The negative sign for energy exchange indicates:

a. a work done on the system

b. an endothermic reaction

c. a system gains thermal energy

d. a work done by the system

***Q26.* For the reaction:**

$$NO_{2(g)} + O_{3(g)} + O_{(g)} \rightarrow NO_{2(g)} + 2O_{2(g)}$$

Which species is a catalyst?

A) homogeneous catalyst $NO_{2(g)}$

B) $O_{3(g)}$ C) $O_{2(g)}$

D) heterogeneous catalyst $NO_{2(g)}$

Q27. Substances that affect the rate of a reaction without being consumed are called:

A. amphoteric B. catalyst C. enthalpy D. adduct

1. Hydrocarbons compounds are composed of:

A. carbon and oxygen atoms
B. Carbon and hydrogen atoms
C. hydrogen and oxygen atoms
D. only carbon atoms

2. Saturated hydrocarbons are called:

A. alkanes
B. alkenes
C. alkynes
D. aromatic

3. The insolubility of hydrocarbons in water due to they are:

A. relatively polar
B. relatively nonpolar
C. completely nonpolar
D. completely polar

4) Which from the following is not organic molecule?

A) methane

B) octane

C) glucose

D) carbon monoxide

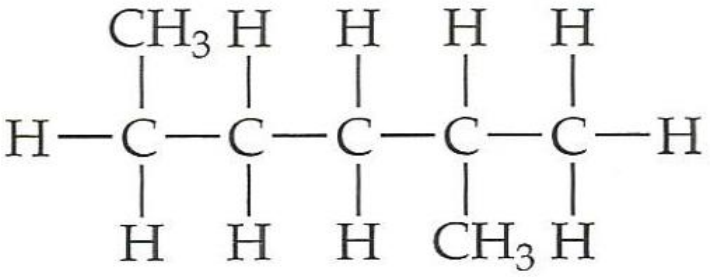
5) Give the name for the following structural formula:

A) 1,4-dimethyl pentane

B) 2-methyl hexane

C) 2,5-dimethyl pentane

D) n-heptane



6) The geometric isomerism is possible for:

A) alkane

B) alkene

C) alkyne

D) all of them

7) The halo-alkane is formed from alkanes by:

A) substitution reactions

B) addition reactions

C) removing reactions

D) condensation reactions

8) The insertion of a Carbon Monoxide molecule between CH_3&OH is called:

A) addition

b) saponification

C) carbonylation

D) condensation

9) The hydrolysis of an ester in a base is called:

A) addition

b) saponification

C) carbonylation

D) condensation

10) all proteins being composed of smaller molecules called:

A) carboxylic acids

b) nucleic acids

C) amino acids

D) fatty acids

11) The monosaccharide fructose is composed of:

A) a five –carbon aldehyde sugar

b) a five –carbon ketone sugar

C) a six –carbon aldehyde sugar

D) a six –carbon ketone sugar

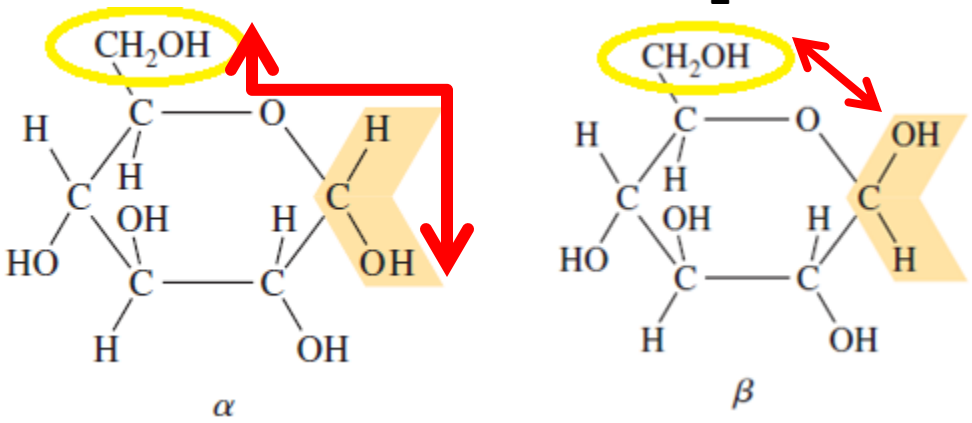
12) The monosaccharide which has an OH group in C1 and CH_2OH group in C5 in same direction is:

A) α-glucose

b) β-glucose

C) L-glucose

D) D-glucose



13. What is the chemical formula of the butyl group?

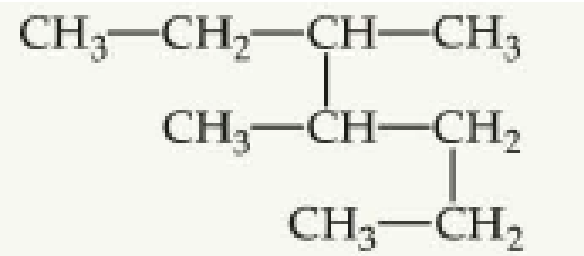
A). CH_3 -

B). CH_3CH_2-

C). $CH_3CH_2CH_2$-

D).$CH_3CH_2CH_2CH_2$-

14. Give the systematic name for the following alkane:



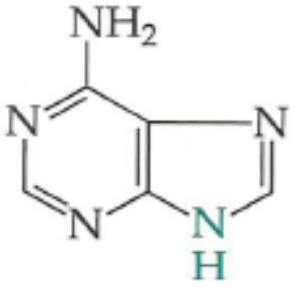
A). 4,5-dimethylheptane.

B). 3,4-dimethylheptane.

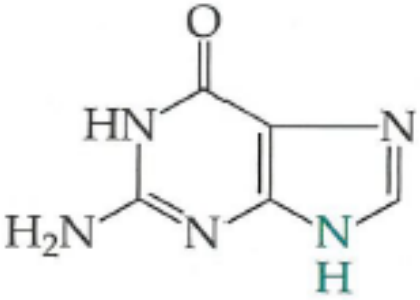
C). 2-propyl4, 2- ethylbutane.

D). 3-methy,4-methylheptane.

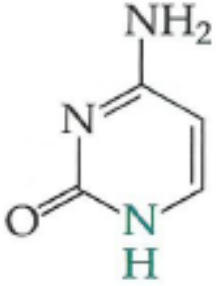
15. The nitrogen containing bases which occur only in RNA is:



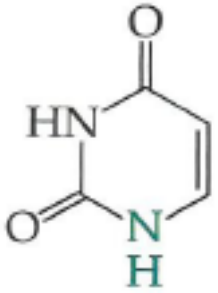
A) adenine



B) guanine

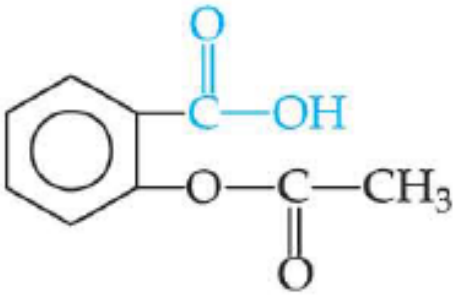


C) cytosine



D) uracil

16. The following structural formula is refer to:



A). aspirin

B). formic *acid*

C). citric acid

D). benzoic acid

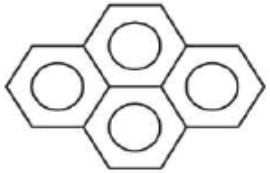
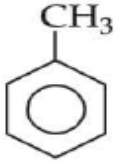
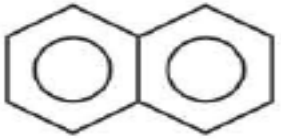
17. Substance that catalyzes the hydrolysis of starch to glucose is :

A). aspirin B). enzyme C). aniline D). cholesterol

18. Which of the following does contain a carbonyl group?

A) an alcohol B) an alkane C) an amide D) an ether

19. The structural formula of toluene is:

A	B	C	D
			
pyrene	tolune	anthracene	naphthalene

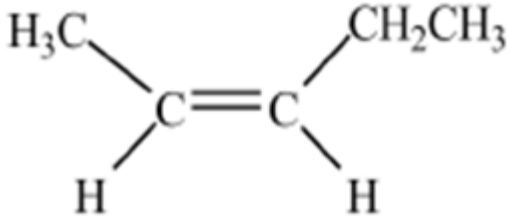
20. Which of the following is <u>NOT</u> part of a nucleoside?

A) nitrogen base B) a sugar C) phosphate group D) all of them

21. Hydrocarbons containing only single bonds between carbon atoms are called:

A. alkanes B. alkenes C. alkynes D. aromatics

22. What type of hydrocarbon compound is shown here?



A. alkanes B. alkenes C. alkynes D. aromatics

23. Which of these molecules is *an alkene*? C_nH_{2n}

A. C_3H_6 B. C_2H_6 C. C_5H_{12} D. C_4H_{10}

24. The compound that formed between a carboxylic acid and an alcohol is called an:

A) aldehyde B) amide C) aromatic D) an ester

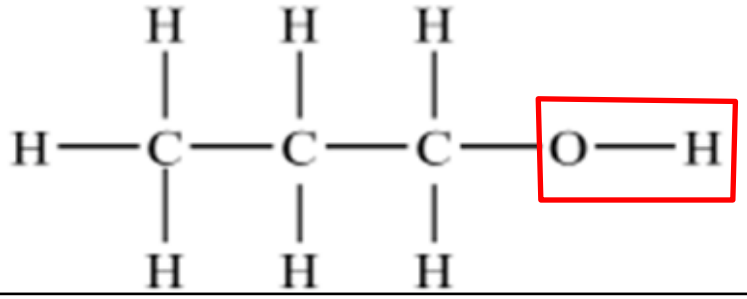
25. What is the name of two or more compounds with the same molecular formula but with different structure?

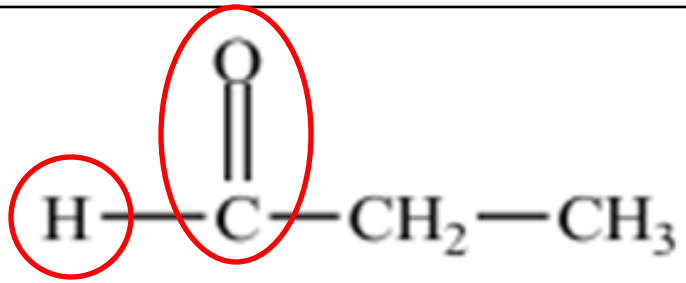
A) alcohols B) amide C) aromatic D) isomer

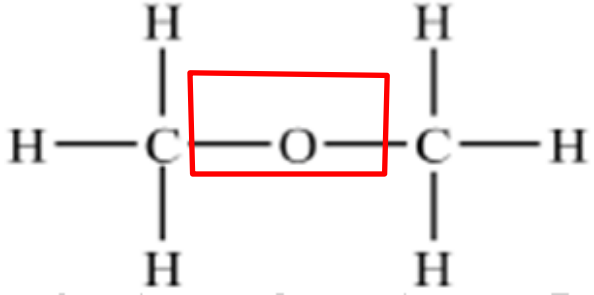
26. The value of all bond angles of an alkene is approximately:

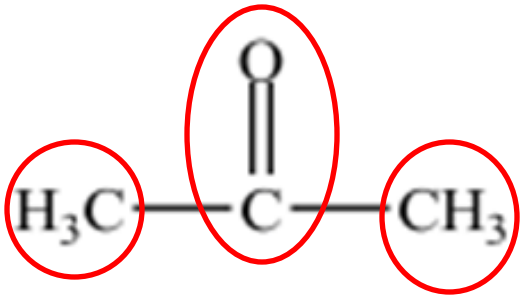
A) 109.5° B) 122 ° C) 120 ° D) 180 °

27. Which compound is an aldehyde?

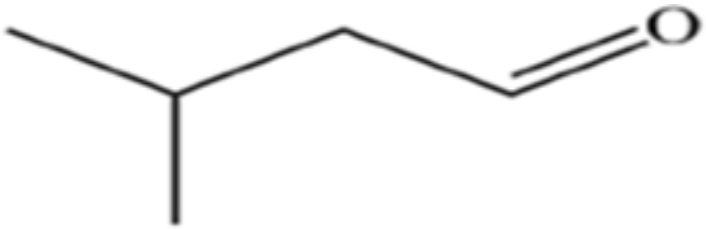
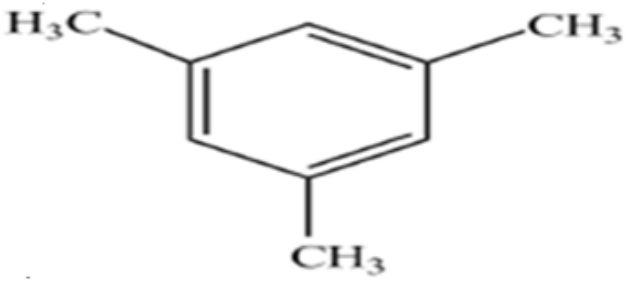
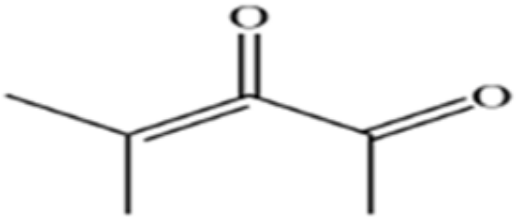
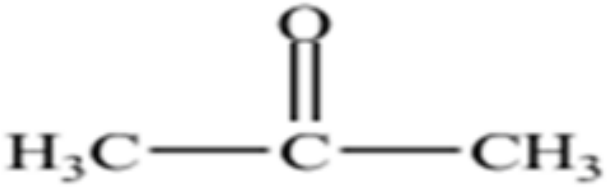
A: 

B: 

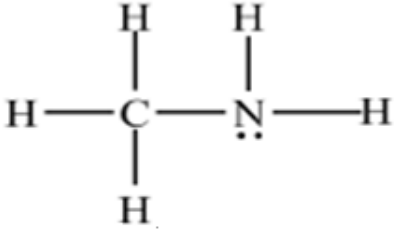
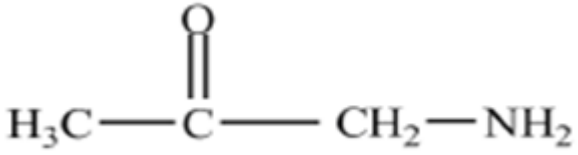
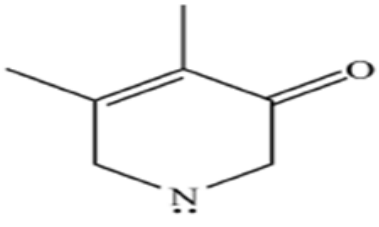
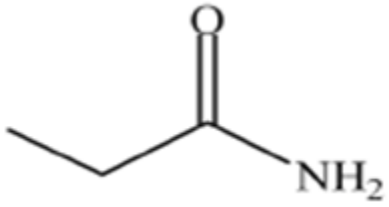
C: 

D: 

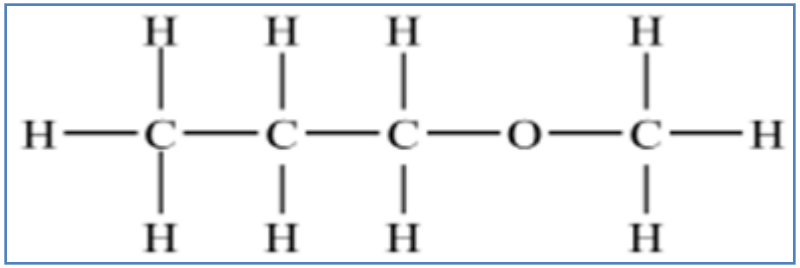
28. Which structure is not possible?

A		C	
B		D	

29. Which of the following is an amide?

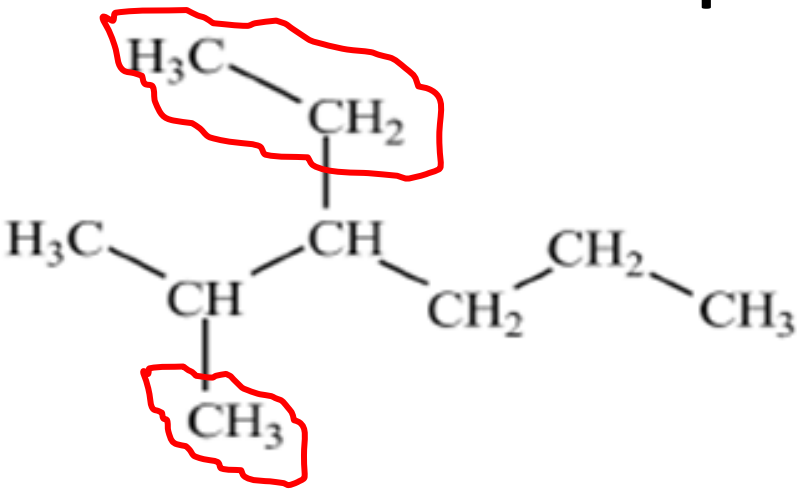
A		C	
B		D	

30. What is the functional group in the compound shown here?



A) carboxyl group B) ether C) ester D) ketone

31. What is the IUPAC name of this compound shown here?



A) 4-propylhexane
B) 3-ethyl-2-methylhexane
C) 2-methyl-3-ethylhexane
D) 4-ethyl-5-methylhexane

32. Which of the following is the type of RNA:

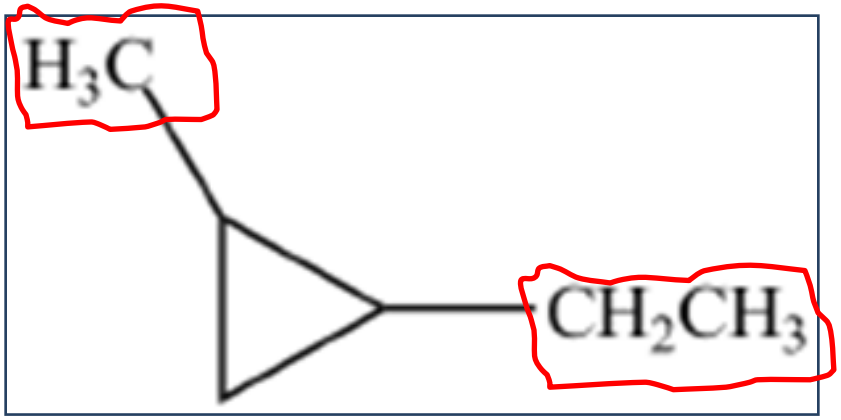
A. ribosomal (rRNA),

B. transfer (tRNA)

C. messenger (mRNA)

D. all of them

33. What is the IUPAC name of this compound?

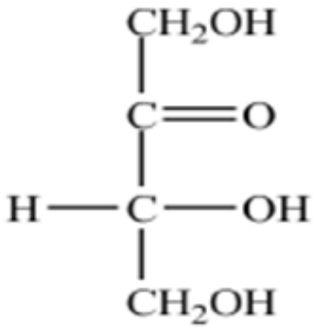
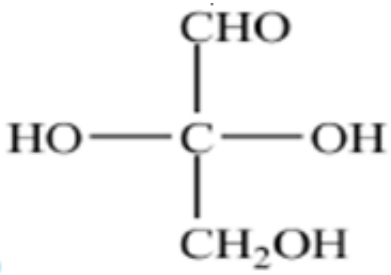
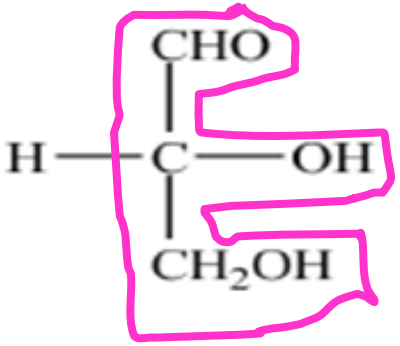
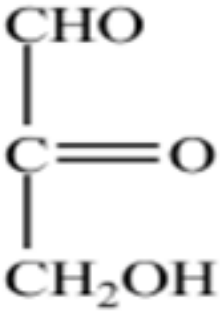


A. ethyl-2-methylcyclopropane
B. ethyl-2-methylcyclobutane
C. 1ethyl-2-methylcyclobutane
D. 1ethyl-2-methylcyclopropane
E. ethyl-2-methylcyclotriane

34. Alkenes and alkynes readily undergo …… reactions to the carbon-carbon multiple bonds.

A. substitution B. addition C. combustion D. reduction

35. Which monosaccharide is an aldotriose?

A		B		C		D	

36. What is the suffix and the general formula for a linear alkane?

A. ene & C_nH_{2n}

B. ane & C_nH_{2n+2}

C. yne & C_nH_{2n-2}

D. ane & C_nH_{2n}

37. The building blocks (monomer)of proteins are:

A) fatty acids B) α-amino acids C) glycerols D) glucose

38. The building blocks of lipids are:

A) fatty acids B) amino acids C) cholesterols D) glucose

39. The building blocks of starch are:

A) fatty acids B) amino acids C) glycerols D) glucose

40. The building blocks of DNA are:

A) nucleosides B) nucleotides C) glycerols D) glycogen

41. Animals store carbohydrates as:

A) cellulose B) starch C) lactose D) glycogen

42. The sugar found in milk is:

A) sucrose B) fractose C) lactose D) glucose

43. The sugar found in DNA is:

A) deoxy ribose B) D-ribose C) lactose D) glucose

44. The sugar found in sucrose is:

A) lactose B) fractose C) glucose D) B&C together

45. The name of table sugar is:

A) deoxy ribose B) D-ribose C) lactose D) sucrose

46. Cellulose is a:

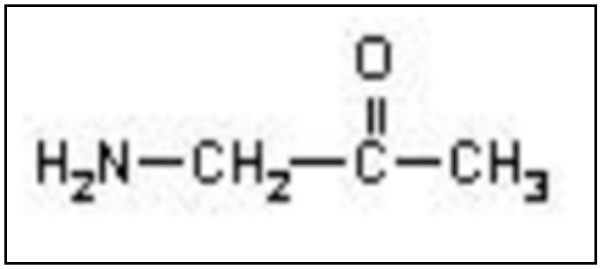
A) polysaccharide B) monosaccharide

C) disaccharide D) polypeptides

47. What class of hydrocarbons has the general formula C_nH_n?

A) alkanes B) alkenes C) alkynes D) aromatics

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



A) amine
B) ketone
C) amine and ketone
D) amine and carboxylic acid

49. The names of compounds with C≡C triple bonds contain the suffix:

A) -ane B) -ene C) -yne D) -one

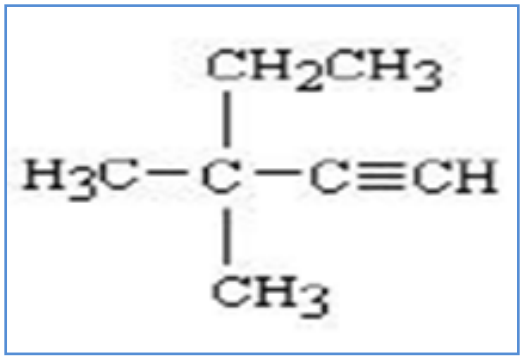
50. What is the name of the following structure?

A) tert-butylethyne

B) 3-ethyl-3-methyl-1-butyne

C) 3, 3-dimethyl-1-pentyne

D) trans-ethylmethylbutyne



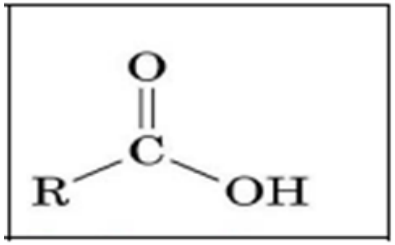
51. What is the name of compound shown to the right ?

A) Alkanes

B) Alkenes

C) Alkynes

D) Carboxylic acids

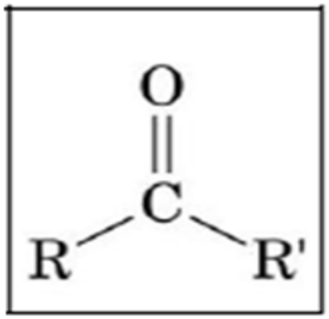


52. Amino acids that are not synthesized in the body and must be obtained from the diet are called

A) non-essential. B) polar. C) essential. D) nonpolar.

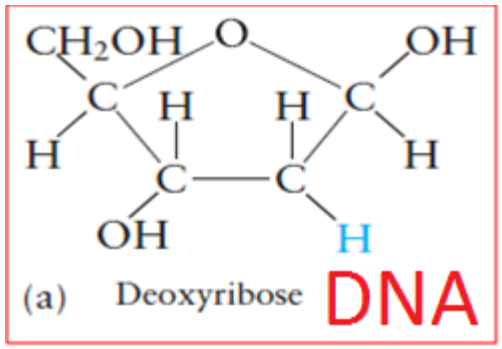
53. What is the name of compound shown to the right?

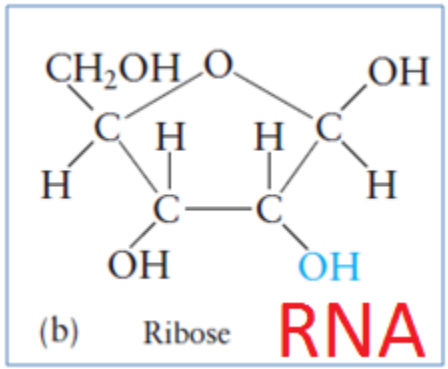
A) Alkanes
B) Carboxylic acid
C) Aldehyde
D) ketone



54. Which of the following will not be found in DNA?

A) adenine
B) guanine
C) thymine
D) Ribose





55. The peptide bonds that link amino acids in a protein are

A) ester bonds.
B) amide bonds.
C) ether bonds.
D) glycosidic bonds

56. A triacylglycerol that is solid at room temperature is called a(n)

A) cholesterol. B) oil. C) fat. D) glycerol

57. Maltose is a

A) monosaccharide.
B) disaccharide.
C) trisaccharide.
D) polysaccharide.

58. Amylose is a

A) monosaccharide.
B) disaccharide.
C) trisaccharide.
D) polysaccharide.

59. Glycogen is a <u>….. saccharide</u>.

A) mono B) di C) tri D) poly

60. Disaccharides & polysaccharides are connected by:

a). an amide link b). a peptide link

c). an ester link d). a glycosidic link

61. Which of these molecules is *a saturated hydrocarbons?*

A. C_3H_6 *B. C_2H_4* *C. C_5H_{10}* *D. C_4H_{10}*

62. Another term for aromatic is

A) alkenes. *C) saturated hydrocarbons.*

B) alkynes. *D) unsaturated hydrocarbons.*

63. What type of compound is formed when two molecules of alcohol splitting out a molecule of water?

A) an aldehyde B) an ether C) an aromatic D) an ester

64. Galactose is an example of:

A. monosaccharide
B. disaccharide
C. trisaccharide
D. polysaccharide

65. Cellulose can be classified as a ……

A) monosaccharide.
C) disaccharide.
B) polysaccharide.
D) none of the them.

66. Which substance is a disaccharide?

A) fructose B) glucose C) glycogen D) lactose

67. Which of the following is NOT part of a nucleotide?

A) nitrogenous base
C) a hexose sugar
B) phosphate group
D) a pentose sugar

PERIODIC TABLE OF THE ELEMENTS

http://www.periodni.com

PERIOD	GROUP 1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 1.0079 **H** HYDROGEN																	2 4.0026 **He** HELIUM
2	3 6.941 **Li** LITHIUM	4 9.0122 **Be** BERYLLIUM											5 10.811 **B** BORON	6 12.011 **C** CARBON	7 14.007 **N** NITROGEN	8 15.999 **O** OXYGEN	9 18.998 **F** FLUORINE	10 20.180 **Ne** NEON
3	11 22.990 **Na** SODIUM	12 24.305 **Mg** MAGNESIUM											13 26.982 **Al** ALUMINIUM	14 28.086 **Si** SILICON	15 30.974 **P** PHOSPHORUS	16 32.065 **S** SULPHUR	17 35.453 **Cl** CHLORINE	18 39.948 **Ar** ARGON
4	19 39.098 **K** POTASSIUM	20 40.078 **Ca** CALCIUM	21 44.956 **Sc** SCANDIUM	22 47.867 **Ti** TITANIUM	23 50.942 **V** VANADIUM	24 51.996 **Cr** CHROMIUM	25 54.938 **Mn** MANGANESE	26 55.845 **Fe** IRON	27 58.933 **Co** COBALT	28 58.693 **Ni** NICKEL	29 63.546 **Cu** COPPER	30 65.38 **Zn** ZINC	31 69.723 **Ga** GALLIUM	32 72.64 **Ge** GERMANIUM	33 74.922 **As** ARSENIC	34 78.96 **Se** SELENIUM	35 79.904 **Br** BROMINE	36 83.798 **Kr** KRYPTON
5	37 85.468 **Rb** RUBIDIUM	38 87.62 **Sr** STRONTIUM	39 88.906 **Y** YTTRIUM	40 91.224 **Zr** ZIRCONIUM	41 92.906 **Nb** NIOBIUM	42 95.96 **Mo** MOLYBDENUM	43 (98) **Tc** TECHNETIUM	44 101.07 **Ru** RUTHENIUM	45 102.91 **Rh** RHODIUM	46 106.42 **Pd** PALLADIUM	47 107.87 **Ag** SILVER	48 112.41 **Cd** CADMIUM	49 114.82 **In** INDIUM	50 118.71 **Sn** TIN	51 121.76 **Sb** ANTIMONY	52 127.60 **Te** TELLURIUM	53 126.90 **I** IODINE	54 131.29 **Xe** XENON
6	55 132.91 **Cs** CAESIUM	56 137.33 **Ba** BARIUM	57-71 **La-Lu** Lanthanide	72 178.49 **Hf** HAFNIUM	73 180.95 **Ta** TANTALUM	74 183.84 **W** TUNGSTEN	75 186.21 **Re** RHENIUM	76 190.23 **Os** OSMIUM	77 192.22 **Ir** IRIDIUM	78 195.08 **Pt** PLATINUM	79 196.97 **Au** GOLD	80 200.59 **Hg** MERCURY	81 204.38 **Tl** THALLIUM	82 207.2 **Pb** LEAD	83 208.98 **Bi** BISMUTH	84 (209) **Po** POLONIUM	85 (210) **At** ASTATINE	86 (222) **Rn** RADON
7	87 (223) **Fr** FRANCIUM	88 (226) **Ra** RADIUM	89-103 **Ac-Lr** Actinide	104 (267) **Rf** RUTHERFORDIUM	105 (268) **Db** DUBNIUM	106 (271) **Sg** SEABORGIUM	107 (272) **Bh** BOHRIUM	108 (277) **Hs** HASSIUM	109 (276) **Mt** MEITNERIUM	110 (281) **Ds** DARMSTADTIUM	111 (280) **Rg** ROENTGENIUM	112 (285) **Cn** COPERNICIUM						

GROUP NUMBERS IUPAC RECOMMENDATION (1985) — GROUP NUMBERS CHEMICAL ABSTRACT SERVICE (1986)

13 IIIA

ATOMIC NUMBER — 5 — RELATIVE ATOMIC MASS (1) 10.811

SYMBOL — B

BORON — ELEMENT NAME

LANTHANIDE

57 138.91 **La** LANTHANUM	58 140.12 **Ce** CERIUM	59 140.91 **Pr** PRASEODYMIUM	60 144.24 **Nd** NEODYMIUM	61 (145) **Pm** PROMETHIUM	62 150.36 **Sm** SAMARIUM	63 151.96 **Eu** EUROPIUM	64 157.25 **Gd** GADOLINIUM	65 158.93 **Tb** TERBIUM	66 162.50 **Dy** DYSPROSIUM	67 164.93 **Ho** HOLMIUM	68 167.26 **Er** ERBIUM	69 168.93 **Tm** THULIUM	70 173.05 **Yb** YTTERBIUM	71 174.97 **Lu** LUTETIUM

ACTINIDE

89 (227) **Ac** ACTINIUM	90 232.04 **Th** THORIUM	91 231.04 **Pa** PROTACTINIUM	92 238.03 **U** URANIUM	93 (237) **Np** NEPTUNIUM	94 (244) **Pu** PLUTONIUM	95 (243) **Am** AMERICIUM	96 (247) **Cm** CURIUM	97 (247) **Bk** BERKELIUM	98 (251) **Cf** CALIFORNIUM	99 (252) **Es** EINSTEINIUM	100 (257) **Fm** FERMIUM	101 (258) **Md** MENDELEVIUM	102 (259) **No** NOBELIUM	103 (262) **Lr** LAWRENCIUM

(1) Pure Appl. Chem., **81**, No. 11, 2131-2156 (2009)
Relative atomic mass is shown with five significant figures. For elements have no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element. However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.