**King Abdulaziz University**

Faculty of Science - Chemistry Department

Summer semester: 1431H 04/09/1431 H A

Chem-110, Final Exam

Time: 120 minutes

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| Name: Number: Section: |
| **Useful information**    Speed of light, c = 3.0×108 m/s  Planck’s const., h = 6.63×10-34 J.s  Avogadro’s No., Nav = 6.022×1023 mol-1  Rydberg const. for H atom, RH = 2.18×10-18 J  Gas constant, R= 0.082 L atm K-1 mol-1 |

**(Choose and mark the correct answer)**

1. The SI prefixes *milli* and *mega* represent, respectively: 

(A) 106 and 10-6.

(B) 10-3 and 106.

(C) 103 and 10-6.

(D) 10-3 and 109.

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2. The nucleus of a radon atom (22286Rn) contains:

(A) 222 protons and 222 neutrons

(B) 86 protons and 136 neutrons

(C) 86 protons and 86 electrons

(D) 86 neutrons and 86 electrons

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3-There are three isotopes of hydrogen, differing with respect to

1. mass number
2. atomic number
3. number of electron
4. number of protons

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4- Scandium (21Sc) element is:

1. a metal
2. found in groups B
3. found in a period 4
4. all (A, B, C) are true

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5. The Stock system name for CrSO3 is

(A) chromium sulfate

(B) chromium(I) sulfate

(C) chromium(II) sulfite

(D) chromium(III) sulfite

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6. The molarity of a solution is defined as:

* + - 1. number of moles of solute per kilogram of solution.
      2. number of grams of solute per liter of solution.
      3. number of moles of solute per liter of solution.
      4. number of moles of solute per kilogram of solvent.

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7. The correct coefficients for the balanced equation below are:-

*Mg + H3PO4 → Mg3(PO4)2 + H2*

* + - 1. 1,2,2,3
      2. 3,2,1,3
      3. 2,3,1,3
      4. 3,1,3,3

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8. Calculate the number of moles of H2O formed when 0.200 mole of Ba(OH)2 is treated with 0.500 mol of HClO3 according to the chemical reaction shown below.

*Ba(OH)2 + 2 HClO3 → Ba(ClO3)2 + 2 H2O*

1. 0.400 mol
2. 0.600 mol
3. 0.500 mol
4. 1.00 mol

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9. Which of the following has a greater mass:

(A) 2 atoms of potassium (K)

(B) 5.1 x 10-23 mole of helium (He)

(C) 1 mole of magnesium (Mg)

(D) all of the elements are equal in masses

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10. How many milliliters would you need to prepare 60.0 mL of 0.200 *M* HNO3 from a stock solution of 4.00 *M* HNO3?

1. 3 mL
2. 60 mL
3. 24 mL
4. 1000 mL

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11. If the pH of a solution is 7, the solution will be:

* + 1. Acidic
    2. Neutral
    3. Alkaline
    4. Non of these

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12. Calculate the concentration of H+ ions in a 0.83 *M* NaOH solution?

(A) 0.83 M

(B) 8.3 x 10-13 M

(C) 1.2 x 10-14 M

(D) 8.3 x 1015 M

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 13. Which of these is the systematic name for the compound represented below?  
  
                

(A) 2,3-dibromopentane

(B) 1,2-dibromopentane

(C) 2,3-dibromopropane

(D) 1,2-dibromopropane

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 14. The two molecules represented below are examples of  
                        

(A) isomers

(B) isotopes

(C) alcohols

(D) carboxylic acids

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15. A protein is

1. a polymer of ester.
2. a polymer of amino acids.
3. an aromatic hydrocarbon.
4. None of these.

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16. The functional group in this compound CH3CH2CH2CH2NH2 is

1. Ketone
2. Aldehyde
3. Amine
4. Ether

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17. The general formula of an *alkane* is   
(A) CnH2n+2

(B) C2nH2n

(C) CnH2n

(D) CnH2n-2

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18. Group the following elements in pairs that you would expect to show similar chemical properties: K, F, P, Na, Cl, and N.

* 1. K/N; F/Na; Cl/N
  2. K/Na; F/Cl; P/N
  3. K/F; P/Na; Cl/N
  4. K/P; F/Na; Cl/N

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19. A 0.271 g sample of an unknown vapor occupies 294 mL at 140°C and 847 mmHg. The empirical formula of the compound is CH2. What is the molecular formula of the compound? 

(A) CH2

(B) C2H4

(C) C3H6

(D) C4H8

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20. Caculate the volume occupied by 3.0 moles of nitrogen, N2, at 288 K and 735 mmHg of pressure.

1. 
2. 
3. 
4. 

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21. Which element has the following ground-state electron configuration?  
  
        [Kr]5s24d105p4  

(A) Sn

(B) Bi

(C) Pb

(D) Te

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22. 8. A possible set of quantum numbers for the last electron added to complete an atom of potassium in its ground state is

(A) *n* = 4 , *l* = 1 , *ml* = 0 , *ms* = +½

(B) *n* = 3 , *l* = 1 , *ml* = -1 , *ms* = +½

(C) *n* = 4 , *l* = 0 , *ml* = 0 , *ms* = +½

(D) *n* = 3 , *l* = 2 , *ml* = -1 , *ms* = +½

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23. Calculate the energy of the light emitted by a hydrogen atom when its electron falls from n = 4 to n = 3 principal energy level.

(A) 1.06 × 10-19 J

(B) 2.19 × 105 J

(C) 2.04 × 10-18 J

(D) 3.27 × 10-17 J

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24. The correct order in the first ionization energy is:

(A) N > O > C > Si

(B) Si > O > N > C

(C) O > N > C > Si

(D) C > N > O > Si

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25. Which one of these elements (period 4) is a transition element?

(A) Br

(B) As

(C) Sc

(D) Ca

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26. The cobalt(III) ion, Co3+, has how many 3*d* electrons?

(A) 0

(B) 7

(C) 6

(D) 5

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

(A) CO

(B) ICl

(C) CS2

(D) KF

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28. Which of these elements has the *greatest* electronegativity?

(A) 51Sb

(B) 33As

(C) 31Ga

(D) 55Cs

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29. The Lewis structure for a chlorate ion, ClO3-, should show \_\_\_\_ single bond(s), \_\_\_\_ double bond(s), and \_\_\_\_ lone pair(s). 

(A) 2, 1, 10

(B) 3, 0, 9

(C) 2, 1, 8

(D). 3, 0, 10

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30. Which of the following Lewis structures best represents the bonding in POCl based on minimizing the formal charges of the atoms? (D)



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31. What is the hybridization of As in the AsF4- ion?

(A) *sp*3*d*2

(B) *sp*2

(C) *sp*3

(D) *sp*3*d*

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32. If the type of hybridization on a central atom is sp3, the number of hybrid orbitals will be:

1. 3
2. 4
3. 2
4. 5

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33. The mixing of two or more atomic orbitals to form a new set of hybrid orbitals is called \_\_\_\_\_\_\_\_.

1. Hybridization
2. Emission
3. Absorption
4. None of these

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34. Kp will be equal to Kc if \_\_\_\_\_.

* 1. ∆n = 0
  2. ∆n = 1
  3. RT = 0
  4. ∆n = ∞

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35. The Kc for the following reaction: CO(g) + 2H2(g) rxeq CH3OH(g) is 15.5 at 500 K.

For a system with the concentrations [CO] = 0.170 *M*, [H2] = 0.340 *M*, and [CH3OH] = 0.258 *M* one can conclude that:

* 1. the system is not at equilibrium and the reaction will proceed to the right
  2. the system is at equilibrium and no change will occur
  3. the system is not at equilibrium and the reaction will proceed to the left
  4. the system is not at equilibrium and no change will occur

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36. The equilibrium constant for the following reaction: N2(g) + 3H2(g) rxeq 2NH3(g) is 70 at 350oC. A system at equilibrium has [N2] = 0.100 *M* and [H2] = 0.200 *M*. What is the [NH3]?

* + 1. 0.371
    2. 0.195
    3. 0.237
    4. 0.302

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37. The following reaction is at equilibrium

2SO3(g)   2SO2(g) + O2(g) (ΔHº = +198 kJ/mol)



If the temperature is increased,

(A) more SO3 will be produced.

(B) more O2 will be produced.

(C) no change will occur in Kc .

(D) none of these.

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38. The reaction in which increased pressure has no affect on the equilibrium reaction is

1. N2(g) + 3 H2(g) ⇄ 2 NH3(g)
2. 2 H2(g) + CO(g) ⇄ CH3OH(*L*)
3. CaCO3(s) ⇄ CaO(s) + CO2(g)
4. CO(g) + H2O(g) ⇄ CO2(g) + H2(g)

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39. Name the following molecular compound: P4O10

1. Decaphosphorus pentoxide
2. Tetraphosphorus decoxide
3. Phosphorus decaoxide
4. Tetraphosphorus pentaoxide

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40. Fill in the blanks: 3.00 moles of oxygen gas (O2) have a weight of ---------- g , and occupy volume of ---------- L at STP.

(A) 96.0 g , 1.00 L

(B) 64.0 g , 22.4 L

(C) 64.0 g , 3.00 L

(D) 96.0 g , 67.2 L

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