RTMENT OF CHEMISTRY, FUNAAB
CHM 101 C.A.T. (2013/2014)
STRUCTION: Attempt ALL questions (30min).

1. Rutherford's experiment on scattering of a-particles showed for the first time that the atom has (A) electrons (B) proton (C) nucleus (D) neutrons
2. What mass of KOH is present in 250 ml of its 0.2M solution (A) 0.7g (B) 1.4g (C) 2.1g (D) 2.8g.
3. Any p-orbital can accommodate up to (A) four electrons (B) six electrons (C) two electrons with parallel spins (D) two electrons with opposite spins.
4. Theoretical yield is the same as... (A) actual yield (B) Product yield (C) definite yield (D) calculated yield
5. The principal quantum number of an atom is related to the (A) size of the orbital (B) spin angular momentum (C) orbital angular momentum (D) orientation of the orbital in space.
6. A covalent bond which has a +ve end and a -ve end is called (A) dipole moment (B) covalent bond (C) electro negativity (D) polar covalent bond.
7. A balloon, inflated outside on a hot day when the temperature is 40°C, has a volume of 5.0 L. What would the volume of the balloon be when it is placed in a cool store at 5°C, assuming the pressure remains constant? (A) 33.75L (B) 2.37L (C) 44.40L (D) 4.40L.
8. The ratio of the energy of a photon of 2000Å wavelength radiation to that of 4000Å radiation is: (A) 4 (B) 4 (C) ½ (D) 2
9. The wavelength of a spectral line for an electronic transition is inversely related to: (A) The number of electrons undergoing the transition (B) The nuclear charge of the atom. (C) The difference in the energy of the energy levels involved in the transition (D) The velocity of the electron undergoing the transition.
10. Which of the following does not characterize X-rays? (A) The radiation can ionize gases (B) It causes ZnS to fluoresce (C) Deflected by electric and magnetic fields (D) Have wavelengths shorter than ultraviolet rays.
11. Which of the following relates to photons both wave motion and as a stream of particles? Inference (B) $E = mc^2$ (C) Diffraction (D) $E = h\nu$.
12. The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$. This represents its (A) exciter state (B) ground state (C) cationic form (D) anionic form.
13. When a metal and non-metal combine they form compound bonded together by (A) covalent bon (B) electrovalent bond (C) partly covalent and partl electrovalent bond (D) dative bond.
14. The vapor pressure of water at 25°C is 23.8 for Express this in kPa; atm (A) 3.17kPa; 0.0313atm (0.0313kPa; 3.17kPa (C) 31.70kPa; 31.3atm (31.3kPa; 31.7atm.
15. Heat decomposes calcium carbonate into CaO a CO_2. What weight of CaO is obtained when 37.5g calcium carbonate are completely decomposed? (C 40, C = 12, O = 16). (A) 56 (B) 28g (C) 100g (D) 21
16. Fluorine attracts electrons in a covalent bond m more than hydrogen because (A) fluorine is m electro positive (B) fluorine is more electronega (C) hydrogen is more electronegative (D) hydroge neutral.
17. The decomposition of ammonia to its eleme components is the reverse of its formation, wh the value of K_3. (A) 2.81×10^{-7} (B) 1.49×10^{-11} (C) $\times 10^{-7}$. (D) 2.81×10^{-6}
18. When the reactant and product are nc equilibrium, it is convenient to calculate ------ Equilibrium constant (B) Equivalent point Reaction Quotient (D) Endpoint.
19. An aqueous solution of ethanol and acetic acic initial concentration of 0.810M is heated to 10 equilibrium, the acetic acid concentration is 0 Calculate K for the re $C_2H_5OH(aq) + CH_3COOH(aq) \rightleftharpoons CH_3CO_2C_2H_5(aq)$ (A) 9.02 (B) 0.11 (C) 1.1 (D) 1.01
20. Suppose a tank initially contains H_2S at a pres 10.0Atm and a temperature of 800K. wh reaction; $2H_2S(g) \rightleftharpoons 2H_2(g)$

15. Breathlayers determine alcohol content via the redox reaction: $Cr_2O_7 + C_2H_5OH \rightarrow Cr^{3+} + C_2H_4O$. Which substance is a reductant and which is an oxidant? (A) C_2H_5OH, reductant; no oxidant (B) C_2H_5OH, reductant; $Cr_2O_7^{2-}$, oxidant (C) C_2H_5OH, oxidant; Cr^{3+}, reductant (D) C_2H_5OH, reductant; Cr^{3+}, oxidant

16. The Bohr model of the atom was able to explain the Balmer series because (A). larger orbits required electrons to have more negative energy in order to match the angular momentum. (B). differences between the energy levels of the orbits matched the difference between energy levels of the line spectra. (C). electons were allowed to exist only in allowed orbits and nowhere else. (D). none of the above.

17. The modern periodic law is based on: (A). atomic number. (B). atomic mass. (C). atomic weight. (D). chemical activity.

18. A hydrogen atom has an electron in the sixth excited state so the principal quantum number of this electron is; (A). 7. (B). 6. (C). 5. (D). 4.

19. An atom of an element belonging to the alkali metal family has; (A). one outer shell electron. (B). two outer shell electrons. (C). all outer shell electrons but one. (D). all outer shell electrons.

20. One reason the Bohr model of the atom failed was because it did not explain why (A). accelerating electrons do not emit electromagnetic radiation. (B). moving electrons have a greater mass. (C). electrons in the orbits of an atom have negative energies. (D). electrons in greater orbits of an atom have greater velocities.

NAME: .....

MATRIC No: .....

DEPT: .....

COLLEGE: .....

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Opeoluwa

UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF NATURAL SCINCES
CHEMISTRY DEPARTMENT
2001/2002 FIRST SEMESTER EXAMINATION
CHM 101: INTRO. PHYSICAL CHEMISTRY 1

TIME: 1 Hour

INSTRUCTIONS: Answer ALL Questions.

Useful Constants.
R = 0.08206L-atm/mol-K.
H_2 = 2.01588 g/mole
O_2 = 31.9988g/mole
He = 4.003g/mol.

1. Calculate the total pressure of a gas mixture that contain 2.5g of O_2, 4.5g of H_2 and 5.0g of He in a 25.00L gas cylinder at 25°C.
   (a) 3.00 atm (b) 4.00 atm (c) 4.48 atm (d) 3.48 atm.

2. On decomposing a 25.0m^3 NH_3 gas according to the equation below in a cylinder with piston.
   $NH_3(g) \rightarrow N_2(g) + H_2(g)$

   It was found that the volume of the cylinder and piston increased to 100.0m^3 at 50N/m^2. what is the work done by the system?
   (a) 3750N-m (b) -3057N-m (c) -3750N-m (d) 3057Nm.

3. Calculate the enthalpy of reaction for the reaction below $2B_5H_9 + 12O_2 \rightarrow 5B_2O_3 + 9H_2O$ given that ΔH°_f B_5H_9 = 75.0; B_2O_3 = -1300; O_2 = 0; H_2O = -250KJ/mol.
   (a) -8686KJ (b) 8686KJ (c) 8900KJ (d) -8900KJ.

4. For the shell n = 4, the possible values of l are:
   (a) 1,2,3,4. (b) 2,3,4,5. (c) 0,1,2,3 (d) 4,3,2,1.

5. What are the possible values of m for a subshell with l = 1.
   (a) 0,1,2 (b) -1,0,1 (c) 1,2,3 (d) -1,2,1.

6. A possible value of spin quantum no is: (a) ½ (b) 1 (c) 0 (d) 2

7. How many orbitals are found in a d-subshell? (a) 3 (b) 4 (c) 5 (d) 6.

8. Which of the following is a possible set of quantum numbers for a 2p electron?
   (a) 1, 0, 0, -½. (b) 2, 0. 0. + ½ (c) 2, 0, 1, -½. (d) 2, 1, 0, -½.

9. Which of the following gives a 3-dimensional model of the atomic structure.
   (a) Bohr (b) Rutherford (c) Schrodinger (d) Mendeleev.

10. The type of intermolecular interaction involving KCl is:
    (a) Dipole – Dipole (b) Hydrogen bonding (c) Interatomic forces (d) Ion-dipole.

11. In the compound, SH_2, the central atom S, has bonding electrons in four
molecule as predicted by VSEPR is:
(a) Linear (b) Trigonal planar (c) Tetrahedral (d)

12. Which of the following compounds does not obey octet rule?
(a) CH_4 (b) NH_3 (c) SO_2 (d) BF_3

13. The following arise as a result of permanent dipole in a molecule except
(a) Interatomic forces (b) Dipole-Dipole interactions
(c) Ion-dipole interaction (d) Hydrogen Bonding.

14. In which of the following repulsion is greatest
(a) Lone pair, bond pair (b) Lone pair, lone pair
(c) Bond pair, bond pair (d) None.

Use this equation to answer questions 15 and 16.
$3KMnO_4 + 5Fe + 24HCl \rightarrow 5FeCl_3 + MnCl_2 + 3KCl + 12H_2O$ if 156g of Fe were
(Fe = 56, Mn = 55, K = 39, O = 16).

15. What mass of $KmnO_4$ is consumed? (a) 170g (b) 264g (c) 160g

16. How many grams of $MnCl_2$ are produced? (a) 66.4g (b) 56.6g (c) 70.2g

Use this to answer questions 17 and 18. Gold is attacked by very few chemicals.
HNO_3 and HCl, called aqua regia, however dissolves gold by the following equat
$Au(s) + 3HNO_3(aq) + 4HCl(aq) \rightarrow HAuCl_4(aq) + 3NO_2(g) + 3H_2O$. If 28.4g of
this reaction, (Au = 197).

17. What is the minimum volume, in ml, of 12.0MHCl needed?
(a) 48.0 (b) 60.2 (c) 42.3 (d) 30.6.

18. If 16.0MHNO$_3$ were used, what is the minimum volume in ml, required?
(a) 28.5 (b) 27.0 (c) 30.2 (d) 48.0.

19. The total volume, in ml, of aqua regia needed for the reaction is:
(a) 75.0 (b) 87.2 (c) 73.0 (d) 78.6.

A solution contains 5.0×10^{-3} moles of H_2SO_4 dissolved in 250ml of solution

20. What is the molarity of the solution
(a) 0.04M (b) 0.02M (c) 0.03M (d) 0.025M

21. The molarity of H^+ ions in the solution is:
(a) 0.04M (b) 0.02M (c) 0.03M (d) 0.025M.

22. The half-life period for the decomposition of radium is 1,590 years. Calculate t
Sec^{-1}?

(a) 5.83×10^{-10} Sec^{-1}
(b) 2.58×10^{-11} Sec^{-1}
(c) 1.382×10^{-11} sec^{-1}
(d) 5.83×10^{-11} Sec^{-1}

Use this information for question 23 - 25.
For the chemical reaction
$5Br^- + BrO_3^- + 6H^+ \rightarrow 3Br_2 + 3H_2O$.
the rate expression is given as
$Rate = K[Br^-][BrO_3^-][H^+]^2$
What is the molecularity and the order of each reactant?

23. Reactant Br^-:
(a) 5 and 1 (b) 2 and 5 (c) 3 and 1 (d) 1 and 4.

24. Reactant BrO_3^-:
(a) 2 and 1 (b) 1 and 3, (c) 3 and 2, (d) 1 and 1.

25. Reactant H^+:
(a) 6 and 1, (b) 6 and 2, (c) 6 and 3, (d) 4 and 2.

26. A first order reaction has an initial volume of 1.71ml after 9 minutes the volume Calculate the rate constant if the infinity reading is 15.98ml.

(a) $1.41 \times 10^{-2}\ min^{-1}$
(b) $2.41 \times 10^{-2}\ min^{-1}$
(c) $3.41 \times 10^{-2}\ min^{-1}$
(d) $2.54 \times 10^{-2}\ min^{-1}$.

27. A first order reaction is 40% percent complete at the end of 50 mins.
What is the value of the rate constant in Sec^{-1}.
(a) $1.82 \times 10^{-4}\ Sec^{-1}$
(b) $1.90 \times 10^{-4}\ Sec^{-1}$
(c) $1.70 \times 10^{-4}\ Sec^{-1}$
(d) $1.63 \times 10^{-4}\ Sec^{-1}$.

28. What is the general form of a rate law?
(a) $Rate = K[A]^n[B]^m$
(b) $Rate = KAnBm$
(c) $Rate = [K]^n[K]^m$
(d) $Rate = R[A\ B]^{nm}$

29. What is the relationship between specific rate constant and half life.
(a) $t_{\frac{1}{2}} = \frac{8.314}{K}$ (b) $t_{\frac{1}{2}} = \frac{95.00}{K}$ (c) $t_{\frac{1}{2}} = \frac{0.693}{K}$ (d) $K = \frac{2.303}{t_{\frac{1}{2}}}$

Use this information to answer questions 30 – 32.

The decomposition of acetaldehyde and acetine-dicarboxylic acid yielded results against 1/T gave straight lines with slopes. (a) = -9920 and (b) –5070 respectively

30. Calculate the activation energy of the first
(a) 54,394 Kcal mol^{-1} (b) 43,394 Kcal mol^{-1} (c) 54,382 Kcal mol^{-1} (d) 63,20

31. What is the activation energy of the second?
(a) 15,000 Cal mol^{-1} (b) 17,060 cal mol^{-1} (c) 10,000 Cal

UNIVERSITY OF AGRICULTURE ABEOKUTA
COLLEGE OF NATURAL SCIENCES
CHEMISTRY DEPARTMENT
CONTINUOUS ASSESSMENT TEST (CAT)
TIME: 45 min

CHM 101: Introduction to Physical Chemistry I

Mat.No.:_____

CandidateName_____ Department:_____

College_____

Instruction: Answer all the questions in the space provided

1. Methane is converted to carbon dioxide and water when burned in a plentiful supply of oxygen (*complete combustion*): $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ If 10 g of CO_2 were obtained when 16 g of CH_4 were burned in a limited supply of oxygen gas, what would be the percentage yield of carbon dioxide? (A) 23% (B) 2.3% (C) 11.5% (D) 62.5%

2. Zinc reacts with heated copper(II) oxide to form zinc oxide and copper metal. If 3.0 g of zinc are reacted with 3.0 g copper(II) oxide, which is the excess reagent? What is the mass of copper metal formed? (Cu=63.5, Zn=65.5) (A) Zn, 0.045g (B) CuO, 2.91g (C) CuO, 2.4g (D) Zn, 2.4g

3. A standard solution was prepared by dissolving 2.6061 g of anhydrous sodium carbonate in deionized water and the solution diluted to 250cm^3. A 25.0cm3 portion of this solution was titrated against hydrochloric acid, using a suitable indicator. The endpoint was reached after 18.7cm^3 of acid had been added. Calculate the concentration of the acid.(Na=23, Cl=35.5, C=12) (A) 0.098M (B) 0.263M (C) 0.131M (D) 0.98M

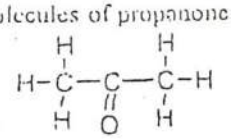
4. How many moles of Mg_3N_2 will be produced by reaction of 1.50 mol of Mg with excess N_2? (Mg = 24, N = 14) (A) 0.100 mol (B) 0.200 mol (C) 0.400 mol (D) 0.500 mol

5. What mass of Li_3N will be produced by the reaction of 2.75 g of lithium metal with excess nitrogen gas? (Li = 6.9) (A) 4.59 g (B) 5.49 g (C) 45.9 g (D) 54.9 g

6. Iron (II) sulfate is oxidized by potassium permanganate in acid solution. The overall ionic equation is
$5Fe^{2+}(aq) + MnO_4^-(aq) + 8H^+(aq) \rightarrow Mn^{2+}(aq) + 4H_2O(l) + 5Fe^{3+}(aq)$ What volume of 0.010moldm^{-3} iron(II) sulfate will be oxidized by 25.00cm^3 of 0.020moldm^{-3} permanganate solution?(A) 25 cm^3 (B) 250 cm^3 (C) 2.5 cm^3 (D) 2500 cm^3

7. In the series of ionic chlorides: LiCl, NaCl and KCl, which compound would have the most covalent character?
(A) LiCl (B) NaCl (C) KCl (D) LiCl and KCl

8. Propanone (old name *acetone*) has the structure below. Is it possible for molecules of propanone to hydrogen bond together in the liquid state?



(A) No, because hydroxyl group (B) Yes, be intramolecular C and H groups (C) No, becau liquid state) (D) None of the above

9. Calculate the mass of sulfuric acid (the chemical in the largest tonnage in the world) produced by the of 5.00 metric tons (5.00 x10^6 g) of sulfur in the sequence of reactions: $S(s) + O_2(g) \rightarrow SO_2(g)$; $1/2O_2(g) \rightarrow SO3(g)$; $SO_3(g) + H_2O(l) \rightarrow H_2SO_4(l)$ (S =16) (A) 4.53 x 10^7 g (B) 1.35 x 10^7 g (C) 5.3 x 10^6 x 10^6 g

10. Why does sodium not form the Na^{2+} ion in its com (A) Because of low 1st Ionization Energy (B) Bec high electropositivity (C) Because of high 2nd Ion Energy (D) All of the above

11. A polar substance dissolves in ----- solvent and a no substance dissolves in-----solvent..
(a) like poles, unlike poles (b)non-polar, polar (c) non-polar (d)unlike poles, like poles.

12. The solubility of silver chloride is 1.8 x 10^{-3}g of Ag 1000g of saturated AgCl solution at 25^{0}C. Expre solubility in mol of AgCl per dm^{-3} of AgCl solution.
(a) 1.3 x 10^{-2}moldm^{-3} (b) 1.3 x 10^{-4}moldm^{-3}
(c) 1.3 x 10^{-3}moldm^{-3} (d) 1.3 x 10^{-5}moldm^{-3}

13. Conversion of water vapour to liquid involves -------- process while converting the liquid to solid involve ---------- process.
(a) Condensation, Freezing (b) Condensation, Melti Evaporation, Condensation (d) Evaporation, Freezing

14. Gas laws are combinations of ---------- law, ------- law, ---------- law and ----------law.
(a)Boy's, Avogdro's, Partial's, Gay Lusaes (b) Bo Charles' Avogadro's and Dalton's. (c)Boy's, Gaylu Charles' Dalton's (d)Boyle's, Charles', Partial, Dalton

15. For an ideal gas equation, T = ----------
(a) Pn/VR (b) PV/nR (c) Vn/PR (d) PVn/R

16. Calculate the number of molecules of methane in 0. of the gas at a pressure of 2.0x10^{2}KPa and a temperatu exactly 300k.
(a) 1.2 x 10^{25} (b) 3.6 x 10^{25} (c) 2.4 x 10^{25} (d) 4.8 x 10^{25}

... 12.055dm³ (c) 224.055dm³ (d) 1.055dm³

... the substance that sticks is called _____
... which it sticks to is called _____
... Absorbent (b) Adsorb, Adsorber (c) Adsorbate, Adsorber, Absorbent

... equilibrium $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$ is considered to be at ... when (a) the concentration of N_2 and O_2 are equal ... concentration of NO is twice that of either N_2 or O_2 (c) ... concentration of NO is equal to the combined ... tration of N_2 and O_2 (d) the rate of decomposition of ... equal to its rate of formation.

... solubility of CuBr at 25°C is found to be 2.0×10^{-4} mol²L⁻². ... value is (a) 4.0×10^{-8} mol²L⁻² (b) 2.0×10^{-8} mol²L⁻² (c) $6.0 \times$ mol²L⁻² (d) 8.0×10^{-8} mol²L⁻²

... The relationship between the K_c and K_p is (a) $K_c = K_p(RT)^{\Delta n}$ (b) $K_c = K_p(RT)$ (c) $K_c = K_p$ (d) $K_c = K_p/(RT)^{\Delta n}$

... Given that $P = 2.5 \times 10^5 Nm^{-2}$ and the % dissociation of NOBr ... 40%, the value of K_p for the reaction: $2NOBr_{(g)} \rightleftharpoons 2NO_{(g)} + Br_{2(g)}$ at ... K is (a) 938.5Nm⁻² (b) 745Nm⁻² (c) 1013Nm⁻² (d) 1128Nm⁻²

... During the reaction $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ 0.5 mole each of H_2 and ... were placed in a 1L vessel at 425°C until the equilibrium was attained. The vessel was found to contain 0.44 mole of HI and 0.059 mole each of H_2 and I_2, the value of K_c is (a) 54.9 (b) 72.0 (c) 10.6 (d) 87.2

... The K_c for the reaction $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$ is

(a) $K_c = \frac{[CaO][CO_2]}{[CaCO_3]}$ (b) $K_c = P_{CO_2}$

(c) $K_c = \frac{[CaCO_3]}{[CaO][CO_2]}$ (d) $K_c = [CO_2]$

... The value of K_p at 500°C for the reaction $3H_{2(g)} + N_{2(g)} \rightleftharpoons 2NH_{3(g)}$ is 1.50×10^{-5}, the value of K_c is (a) 6.02×10^{-2} (b) 4.8×10^{-3} (c) 8.01×10^{-2} (d) 2.1×10^{-2}.

... Which of the following is false (a) the atom of an element all ... have the same mass number (b) The atoms of an element are ... identical, but different from atoms of other elements (c) mass ... number = atomic number + number of neutrons (d) 1amu = ... one-twelfth of the mass of one atom of $^{12}_{6}C$

... The electronic configuration of Cl and Cl⁻ respectively are (a) ... $1s^2 2s^2 2p^6 3s^2 3p^5$ and $1s^2 2s^2 2p^6 3s^2 3p^6$ (b) $1s^2 2s^2 2p^6 3s^2 3p^6$ and ... $1s^2 2s^2 2p^6 3s^2 3p^5$ (c) $1s^2 2s^2 2p^5 3s^1 3p^6$ and $1s^2 2s^2 2p^6 3s^2 3p^5$ (d) ... $1s^2 2s^2 2p^6 3s^2 3p^5$ and $1s^2 2s^2 2p^6 3p^6$.

... Isotopes of silver has atomic weight of 106.911 and ... the relative atomic mass of silver is 107 the % ... of the isotopes respectively are (a) 6.45 and 93.55 (b) ... 5.55 (c) 6.45 and 93.55 (d) 95.55 and 4.45

29. The probab... region of space is (... (d) orbital.

30. Light scattering exper... Schrödinger (b) Louis de... Ernest Rutherford

Name _____

Dept. _____ Colle...

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UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF NATURAL SCIENCES
CHEMISTRY DEPARTMENT

B.Sc Chemistry First Semester Continuous Assessment Test

Introductory Physical Chemistry I

Instruction: Answer all the Questions.

Useful constants: Planck constant, $h = 6.626 \times 10^{-34}$ Js, 1 atm = 1.013×10^5 Nm^{-2}, mass of electron (m_e) = 9.11×10^{-31} kg, 1 Å = 10^{-8}cm = 10^{-10}m, mass of electron (m_e) = 1.602×10^{-19} Sp, 3.0×10^8m bohr radius $a_o = 8.854 \times 10^{-11}$, Relative Permittivity = $\varepsilon_0 = 8.845 \times 10^{-12}$ C^{2}J^{-1}m^{-1}, 109629cm^{-1} R = 8.314Jmol^{-1}K^{-1}. Mg = 24.31, Hg = 200.59g, Cu = 63.55g, C = 12.00g, O = 16.00g, N = 14.01, Ca = 40.00 Al = 27

1. 10g of a solid is in equilibrium with its own vapour when 1g of a small amount of solid is added. The vapour pressure (A) remain the same (B) drops (C) increases by 99% (D) increases by 1%

2. All redox reactions involve (A) the gain of electrons only (B) both the gain and loss of electrons only (C) the loss of electrons only (D) neither the gain nor loss of electrons only

3. Alpha particle has properties similar to that of (A) He (B) Be (C) Li (D) Ne

4. Balancing of chemical equation is based on the law of: (A) Definite proportion (B) multiple proportion (C) conservation of matter (D) conservation of energy

5. $CH_3COOH_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + H^+_{(aq)}$, [Given that $K = 1.8 \times 10^{-5}$]: Calculate $[H^+]$ when 0.1mol acetic acid was treated with 0.2 mol acetate ion. (A) 1.8×10^{-5} (B) 9.0×10^{-6} (C) 55555.6 (D) 3.6×10^{-5}.

6. Consider this reaction: $xP + yQ \rightleftharpoons mR + nS$, the expression for the equilibrium constant for the reaction above is (A) $K[P]^x[Q]^y$ (B) $\frac{[P]^x[Q]^y}{[R]^m[S]^n}$ (C) $\frac{[R]^m[S]^n}{[P]^x[Q]^y}$ (D) $\frac{m[R]n[S]}{x[P]y[Q]}$

7. If an element X forms the oxides XO and X_2O_3 the oxidation numbers of X are (A) +1, +2 (B) +1,+3 (C) +2,+4 (D) +2,+3

8. In which compound does Cl have the highest oxidation numbers (A) $KClO_4$ (B) KClO (C) $KClO_2$ (D) KClO

9. N_2O_4 is 40% dissociated at 25^{0}C and 1 atm, the K_p is (A) 0.76 atm (B) 0.57 atm (D) 1.4 atm

10. One mole of a chemical substance contains: (A) Faraday numbers of particles (B) Qu number of particles (C) atomic number of particles (D) Avogadro's number of particle

11. Statements of Dalton atomic theory include the following except; (A) atom of each el are identical (B) atom of different elements are similar (C) chemical combiuation of are in simple whole number (D) atom is the discrete particles of an element.

12. The degeneracy of the d – orbital is (A) 2 (B) 4 (C) 5 (D) 7

13. The mass of substance passed through 15A of electricity for 45mins is 38.25g . What i electrochemical equivalent of the reaction. (A) 21.58g (B) 18.25g (C) 0.001g (D) 0.00(

14. the number of mole of sodium carbonate in 8.5g of the salt is: (A) 0.28 (B) 0.08 (C) 2

15. The oxidation number of Cr in $Cr_2O_7^{2-}$ is (A) +2 (B) +7 (C) +6 (D) +5

16. The percentage composition of Sulphur (S) in $FeSO_4.10H_2O$ is (A) 3.9% (B) 5.6% 9.6% (D) 5.8%

17. The region outside the nucleus, where there is highest probability of finding electrons known as (A) path length (B) wavelength (C) orbits (D) orbital

18. The slowest step in an elementary reaction is (A) molecularity of a reaction (B) order of reaction (C) rate-determining step (D) elementary step

19. Which of the following series of spectra line is in the UV region (A) Balmer (B) Pasche (C) Lyman (D) Pfund

20. Which of these is a reference electrode (A) Daniel cell (B)Leclanche cell (C)Standard hydrogen electrodel cell (D)Lead acid accumulator

...UNIVERSITY OF AGRICULTURE, ...BOKUTA
DEPARTMENT OF CHEMI...
2005/2006 1ST SEMESTER EXAMINATION
CHM 101

INSTRUCTION: Shade the appropriate answer in the answer sheet provided.
TIME: 1½hrs

(1) For the reaction $FeO_{(s)} + CO_{(g)} \rightleftharpoons Fe_{(s)} + CO_{2(g)}$ If at 298K, the equilibrium amount present are 2.5 mol FeO, 0.2 mol Fe, 3.0 mol CO_2 and 4.0 mol CO. Calculate the equilibrium constant for the reaction.
(a) 0.06 (b) 0.6 (c) 6.0 (d) 2.1 x [illegible] (e) 0

(2) The rate law of a chemical reaction was found to be $R = k[A]^{x-1}[B]^x$. What is the overall order of reaction if $x = 1$.
(a) 3/2 (b) 2 (c) 2x-1 + x (d) 3x-1 (e) 3

(3) In a first order chemical reaction, after 10s, 6 moles from the initial concentration of 16 moles from the initial concentration of 16 moles of the reactant disappeared calculate the rate constant.
(a) $2.303s^{-1}$ (b) log [16/10]s^{-1} (c) $0.0470s^{-1}$
(d) 20s (d) $14.74s^{-1}$

(4) Given $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(s)} + H_2O_{(l)}$ $\Delta H = -57kJ$
Calculate the heat changes which would occur when $50cm^3$ of 0.01M NaOH solution and $100cm^3$ of 0.01M HCl.
(a) -57J (b) -114J (c) +57J (d) +114J (e) none

(5) Determine the ΔH for this reaction
$2NH_4NO_{3(s)} \rightarrow 2N_{2(g)} + 4H_2O_{(g)} + O_{2(g)}$
Given $\Delta H_f(NH_4NO_3) = -364.6kJmol^{-1}$, $\Delta H_f(H_2O_{(g)}) = -286kJmol^{-1}$
(a) $-41.4kJmol^{-1}$ (b) $+41.4kJmol^{-1}$ (c) $-414.4kJmol^{-1}$ (d) $+414.4kJmol^{-1}$ (e) none.

(6) Gas molecules are said to be perfectly elastic because:
(a) the volume occupied by them is negligible
(b) they collide without loss of energy
(c) they move about in straight lines
(d) the distance between them are negligible.

(7) For how long must a current of 0.2A need to pass through solution of $AgNO_3$ to deposit 0.5 mole of silver. [Ag = 108, IF = 96,500C]
(a) 38,600s (b) 9650s (c) 96,500s
(d) 241,250s

(8) A gas occupies $172cm^3$ at 30°C. At what temperature would the volume of the gas be halved.
(a) 0.88K (b) 0.087K (c) 15K (d) 152K
(e) 15°C

(9) What are the relative rates of diffusion of hydrogen to nitrogen gases.
(a) 1:4 (b) 4:1 (c) 8:1 (d) 14:1 (e) 1:14

(10) What volume would a gas at s.t.p if at 47°C and 720mmHg it occupies $214cm^3$.
(a) $528cm^3$ (b) $378cm^3$ (c) $412cm^3$
(d) $252cm^3$ (e) none

(11) Which of the following contains coordinate covalent bond.
(a) NH_4^+ (b) Na^+Cl^- (c) CH_4 (d) HCl
(e) all

(12)---------- and ---------- are examples of ionic crystals and layer crystal respectively.
(a). Graphite and Diamond (b) HCl and Diamond (c) NaCl and Graphite
(d) NaCl and Diamond (e) all of the above.

(13) The following are the properties of ionic compounds except.
(a) Good conductors of heat and electricity
(b) Mostly solids
(c) Low melting and boiling point
(d) Soluble in water.
(e) none.

(14)Nitrogen gas has ---------- covalent bond
(a) triple bond (b) no bond (c) native
(d) Double bond (e) all of the above

(15)---------- has intermolecular forces called ----------
(a) KCl/ van der waal (b) CO_2/van der waal
(c) O_2/electrostatic force
(d) Cl_2/cohesive (e) none.

(16) 0.02mole of anhydrous NH_4Cl were added to 45g of H_2O in a polystyrene cup in order to determine the standard enthalpy change of

solution of NH_4Cl. (Given ΔT = 1.5°C, s.h.c of the H_2O is 4.200kJkg^{-1}K^{-1}, neglect s.h.c. of the polystyrene).
(a) 1,000kJ/mol (b) 2.8kJ/mol (c) 0.284kJ/mol (d) 14.2kJ/mol (e) none

(17) Which of the following is false on melting a solid .
(a) solids will only melt when the forces of vibration overcomes the binding forces.
(b) the presence of impurity in solids will raise the melting point of such solids.
(c) The presence of impurity may cause a solid to have a melting point range than a sharp melting point.
(d). The presence of impurity in solids will lower the melting point of such solids.
(e) None

(18) The cohesive forces holding particles in matter together is smallest in
(a) Gases (b) Solids (c) Liquids
(d) Vapour. (e) all

(19) A certain mass of a gas at 12°C and 419mmHg pressure occupies a cylinder of 480cm^3. What volume will it occupy at 24°C and 838mmHg.
(a) 200.71cm^3 (b) 480cm^3 (c) 250.11cm^3
(d) 472.21cm^3

(20) Use the ideal gas equation to work out the volume that 1mol of an ideal gas should have at 20°C and pressure of $1.013 \times 10^5 Nm^{-2}$.
(a) 100dm^3 (b) 22.41dm^3 (c) 0.00024dm^3
(d) 725.50dm^3

(21).Given that the solubility product constant of silver chloride at 298K is 1.8×10^{-10}mol/dm^3. Calculate the solubility of silver chloride solution in 0.02M sodium Chloride solution at 298K.
(a) 0.5×10^{-5}M (b) 0.6×10^{-6}M (c) 0.7×10^{-8}M (d) 0.8×10^{-10}M (e) 0.9×10^{-8}M.

(22) In the redox reaction, $CuO_{(s)} + CO_{(g)} \rightarrow Cu_{(s)} + CO_{2(g)}$
which of the specie is an oxidizing agent?
(a) CuO (b) CO (c) Cu (d) CO_2
(e) none.

(23) Complex ionic equations in an alkaline (basic medium) are balanced as follows.
(a) To the oxidation half-cell equation add $OH^-_{(aq)}$, $H_2O_{(l)}$ and $H_2O_{(l)}$ to reactants and products.
(b) To the reduction half-cell equ and $OH^-_{(aq)}$, $H_2O_{(l)}$ to reactants a
(c) To the oxidation half-cell equ and OH^-, H_2O to reactants and pr
(d) A & B only
(e). B and C only.

(24) Using the oxidation number method following reaction
$MnO^-_{4(aq)} + Br^-_{(aq)} \rightarrow Mn^{2+}_{(aq)} + Br_{2(g)}$ wi
have a Net Equation with---------- number of Bromide ion and ---------- molecules of water.
(a) 12 and 6 (b) 10 & 8 (c) 12 and 8 (d) 10 and 6 (e) none.

(25)100cm^3 of a gas A diffuses through a small hole in 20 seconds. The same volume of oxygen, under the same conditions, diffused in 80 seconds . Calculate the relative molecular mass of A.
(a) 4 (b) 3 (c) 2 (d) 1 (e) 5

(26) The ideal gas equation shows the relationship.
$PV = nRT$.
If $R = \frac{PV}{nT}$, the unit of R =
(a) Nm mol^{-1}K^{-1} (b) Kmol/NM (c) JK^{-1}mol
(d) A & B (e) a and C

(27) Which of this equation represents Avogadro's law.
(a) V α n T, p constant
(b) V α 1/p n, T constant
(c) V α T n, p constant
(d) V α 1/p . Tn
(e) V = R 1/pTn

Use this information for questions 28 and 29

At 25°C the half-life period for the decomposition of N_2O_5 is 5.7hrs and is independent of the initial pressure of N_2O_5.

(28). Calculate the specific rate constant?
(a) 0.015hr^{-1} (b) 0.15hr^{-1} (c) 0.013hr^{-1}
(d) 0.12hr^{-1} (e) 0.14hr^{-1}

(29) Calculate the time required for the reaction to go 90% completion.
(a) 19.19 hrs (b) 19.18hrs (c) 19.17hrs
(d) 19.20hrs.

... $\Delta T = 1.5°C$, s.h.c
... neglect s.h.c. of the

... kJ/mol (c)
... mol (e) none

... ing is false on melting

... when the forces of
... binding forces.
... ity in solids will raise
... solids.
... rity may cause a solid
... nge than a sharp

... rity in solids will
... f such solids.

... holding particles in
... t in
(c) Liquids
all

... gas at 12°C and
... pies a cylinder of
... will it occupy at 24°C

... 0cm³ (d) 250.11cm³

... uation to work out the
... deal gas should have at
... 13 x 10⁵ Nm⁻².
... 0.00024dm³

(b) To the reduction half-cell equation add H_2O and $OH^-_{(aq)}$, $H_2O_{(c)}$ to reactants and products
(c) To the oxidation half-cell equ... and OH^-, H_2O to reactants a...
(d) A & B only
(e). B and C only.

(24) Using the oxidation ... following reaction
$MnO^-_{4(aq)} + Br^-_{(aq)} \rightarrow$
have a Net Equation w... Bromide ion and ------ water.
(a) 12 and 6 (b) 1... 10 and 6 (e) none.

(25) 100cm³ of a gas A diff... hole in 20 seconds. The sam... oxygen, under the same condi... 80 seconds. Calculate the relat... mass of A.
(a) 4 (b) 3 (c). 2 (d) 1 (e...

(26) The ideal gas equation shows the relationship.
$PV = nRT$.
If $R = \frac{PV}{nT}$, the unit of R =
(a) $Nm\ mol^{-1}K^{-1}$ (b) Kmol/NM (c) $JK^{-1}mol$...
(d) A & B (e) a and C

(27) Which of this equation represents Avogadro's law.
(a) $V \alpha n$ T, p constant
(b) $V \alpha 1/p$ n, T cons...

(30) First order rate law is expressed as follows.

(a) $K = \frac{2.303}{t} \log \frac{a-x}{a}$ (b) $K = \frac{2.303}{t} \log \frac{a}{a-x}$

(c) $K = \frac{2.303}{t} \log \frac{a}{x}$

(d) $K = \frac{2.303}{t} \log \frac{x}{a}$

(31) Arrhenius equation is $\frac{d\ln k}{dT} = \frac{Ea}{RT^2}$ and this equation is valid and can be tested by plotting log K vs 1/T which will give straight line and the slope therefore will be

(a) slope = $1/T + C$ (b) $\frac{-Ea}{2.303R}$

(c) $\frac{-Ea}{2.303RT}$ (d) $\frac{-Ea}{T} + C$

(e) $\frac{-Ea}{2.303}$. R

(32) An aldehyde and a carboxylic acid decomposed and yielded results whose logK plot against 1/T gave straight lines with slope – 5070.
Calculate the activation energy.
(a) 1.987 (b) 2.303 (c) 23,200 (d) 22.320 (e) 198,700 all in cal mol-1.

Use this for questions 33 and 34
Find the masses of products formed when a dilute sulphuric acid solution is electrolyzed with a current of 0.6A for 90 minute R.a.m: H= 1.0 O= 16.0, S = 32.0)

(33). Cathode: (a) 0.0226g (b) 0.0336g (c) 0.0446g (d) 0.0556g (e) 0.0116g.

(34) At the Anode. (a) 0.2686g (b) 0.1686g (c) 0.3686g (d) 0.4686g (e) 0.0686g

(35) What is the unit of rate constant k for a second order reaction.
(a) mol $dm^{-3} s^{-1}$ (b) s^{-1} (c) $mol^{-1} dm^3 s^{-1}$ (d) $mol^{-2} dm^6 s^{-1}$ (e) none of the above.

(36) The half-life of a radioactive isotope A is 1997 years. How long does it take for a sample of A to decay to 20% of its original radioactivity.
(a) 2638years (b) 3638years (c) 4638years
(d) 1638years (e) 5000 years.

Question 37 & 38.

(37) Find the masses of products formed dilute sulphuric acid solution is electroly with a current of 0.6A for 90 minutes.
(a) mass of H_2 formed is 0.03
(b) mass of Cu formed is 0.03
(c) mass of S formed is 0.033
(d) mass of Fe formed is 0.03
(e) mass of Zn. formed is 0.03

(38) (a) mass of Au formed is 0.26
(b) mass of H_2O formed is 0.26
(c) mass of O_2 formed is 0.268
(d) mass of Cl_2 formed is 0.268
(e) mass of Br_2 formed is 0.2686

(39) 26cm^3 of a solution containing 10.5g impure hydrochloric acid solution in 250c titrated against 25cm^3 of 0.1M sodium trioxocarbonate (iv) solution.
Calculate the concentration of the pure acid mole/dm^3.
(a) 0.2913M (b) 0.3923M (c) 0.1521
(d) 0.1813M (e) 0.1923M.

(40) What is the mas of copper formed at cathode when a current of 0.25A is passed through a copper (II) sulphate solution for hour. (R.a.m: Cu = 63.5).
(a) 0.296g (b) 0.358gs (c) 0.581g (d) 0.159g (e) 0.578g

(41) What is the maximum number of electr in the orbital that has the following quantum numbers, n=3, l=0, m =0?
(a) 0 (b) 2 (c) 10 (d) 14 .

(42) For the shell n = 3, the possible values are
(a) 1,2,3 (b) 2, 1, 1 (c) 0, 1, 2
(d) 3, 2, 1.

(43) Which of the following is a possible se quantum numbers for a 3p electron?
(a) 3,0, 0, -½ (b) 3, 0, 1, + ½ (c) 3,0, 1
(d) 2, 1, 0, -½.

(44) Which of the following is not an allowe combinations of n, l and m quantum numb when n = 3?
(a) 3,1, - 1 (b) 3,1,0 (c) 3, 1, + 1 (d) 3,

(45) Which of the following is an allowed combinations of the n, l, and m quantum numbers when n = 2?

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

(46) On hydrogen atom emission spectrum, a drop from higher energy level to n = 2 is designated as
(a) Lyman series (b) Balmer series (c) Paschen series (d) Pfund series

(47) Which of the hydrogen atom emission spectrum corresponds to the ultraviolet region of the emr?
(a) Lyman series (b) Balmer series
(c) Paschen series (d) Pfund series

(48) Electron has dual nature because it possesses
(a) mass and wavelength (b) mass and volume
(c) weight and density
(d) fluidity and frequency.

(49) The wave nature of electron gives rise to the concept of .....
(a) mole (b) orbital (c) hybridization
(d) equivalence

(50) "No two electrons can have the same value each of the four quantum numbers".
This is known as
(a) Hund's (b) Aufbau Principle
(c) Pauli's exclusion principle
(d) Rutherford Rule.

(51) In the compound PCl_5, the central atom P, has only 5 bond pairs of electrons, the shape of the molecule as predicted by VSEPR is
(a) Linear (b) Trigonal bipyramidal
(c) Planar (d) Tetrahedral

(52) BH_3 is planar in shape with 120° as bond angle whereas NH_3 is trigonal pyramidal in shape with 107° bond angle. The difference in shape is as a result of
(a) difference in electronegativity between B and N
(b) difference in the bond angles
(c) difference in electron types around the central atom
(d) difference in bond polarity.

(53) The ammonia molecule, NH_3 can form NH_4^+ because .....
(a) Nitrogen has vacant p – orbitals to accept electrons
(b) Hydrogen can donate electrons to nitrogen
(c) The nitrogen atom has a lone pair of electrons
(d) All of the above.

(54) H_2O is a liquid at room temperature while H_2S is a gas at the same temperature. The difference is as a result of.....
(a) Weaker hydrogen bond in H_2O than H_2S
(b) Stronger hydrogen bond in H_2O than H_2S
(c) Difference in atomic masses
(d) Difference in size of O and S.

(55) An element Y, has 5 valence electrons and forms a molecule Y_2. What is the bond order of the Y_2 molecule?
(a) 1 (b) 3 (c) 2 (d) 4

(56) In which of the following compounds is hydrogen bonding most likely to be least?
(a) HF (b) H_2O (c) NH_3 (d) PH_3

(57) All chemical bonds involved
(a) Centrifugal force (b) electrostatic attraction (c) Centripetal force
(d) gravitational force.

(58) Metallic bond is an attractive force between
(a) Cation and anion (b) metal ions and delocalized electron cloud (c) two dipoles
(d) electropositive and electronegative elements.

(59) The type of dipole that exists in HCl molecule is known as
(a) instantaneous (b) permanent (c) induced
(d) temporary

(60) Given the following information, calculate the lattice energy of $MgCl_{(s)}$
$Mg_{(s)} + \frac{1}{2} Cl_{2(g)} \rightarrow MgCl_{(s)}$
$\Delta H^\circ_f = -128 kJmol^{-1}$
$\Delta H^\circ_{atom} [\frac{1}{2}Cl_2(g)] = +121 kJmol^{-1}$
$\Delta H^\circ_{atom} [Mg_{(s)}] = +150 kJmol^{-1}$
$\Delta H^\circ_{LE} [Mg_{(g)}] = +736 kJmol^{-1}$
$\Delta H^\circ_{EA} [Cl_{(g)}] = -364 kJmol^{-1}$
(a) -771 (b) -862 (c) 647 (d) 537

(61) In a molecule, there are – types of electrons
(a) 3 (b) 1 (c) 2 (d)

(62) In which of the following is repulsion greatest?
(a) bond pair-lone pair (b) bond pair-bond pair (c) lone pair – lone pair
(d) all of the above

...cule to have trigonal planar shape

...

...nd pairs alone around the central atom
...bond pairs alone around the central atom
...2 bond pairs and 1 lone pair around the central atom
(d) 3 lone pairs alone around the central atom.

(64) A element X has 5 valence electrons and forms a homonuclear diatomic molecule X_2. What is the bond order of X_2?
(a) 2 (b) 3 (c) 1 (d) 5

(65) Which of the following molecules violates octet rule?
(a) HF (b) H_2O (c) NH_3 (d) BF_3

(66) The rate law of a chemical reaction was found to be $R = k[A]^{3/2}[B]^2$. What is the overall order of this reaction?
(a) 3/2 (b) 2 (c) 7/2 (d) 7 (e) 1

(67) In a zero order of reaction
(a) the rate of reaction is independent of the concentration of all the reactants
(b) the rate of reaction is dependent of the concentration of the concentration of all the reactants.
(c) the rate of reaction is doubled
(d) None of the above
(e) all of the above

(68) A first-order of reaction is 25% complete in 30s. Calculate the rate constant k.
(a) $9.596 \times 10^{-3} s^{-1}$ (b) $72.2\ s^{-1}$ (c) $144.4s^{-1}$
(d) $20s^{-1}$ (e) $22s^{-1}$

(69) Give the molecularity of the elementary reaction below
$2NO + O_2 \rightarrow 2NO_2$
(a) Unimolecular (b) bimolecular
(c) termolecular (d) second-order
(e) first order.

(70) The ideal of surface area becomes insignificant in
(a) an homogenous system
(b) heterogeneous system (c) particles with small size
(d) particle with large size
(e) all of the above.

(71) How can the rate of reaction be represented with respect to reactant as well as each product for this reaction?
$2N_2O_5 \rightarrow 4NO_2 + O_2$

(a) $R = -\frac{1}{2}\frac{d[N_2O_5]}{dt} = \frac{1}{4}\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$
(b) $R = -2\frac{d[N_2O_5]}{dt} = 4\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$
(c) $R = -2\frac{d[N_2O_5]}{dt} = \frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$
(d) $R = -\frac{1}{2}\frac{d[N_2O_5]}{dt} = 4\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$
(e) None of the above

(72) A second order reaction is $2A \rightarrow$ Product. What is the rate equation?
(a) $R = k_2[A]^2$ (b) $R = k_2[2A]$ (c) $R = k_2[\frac{1}{2}A]$
(d) $R = k_2[A_2]$ (e) None of the above

(73) In a zero order of reaction
(a) the rate of reaction is independent of the concentration of all the reactants
(b) the rate of reaction is dependent of the concentration of all the reactants
(c) the rate of reaction is doubled
(d) None of the above
(e) All of the above.

(74) A reaction follows the rate expression $R = k[A]$. If the rate is expressed in terms of $mol\ l^{-1}\ s^{-1}$ and the concentration of A is in $mol\ l^{-1}$. What is the unit of first order rate constant?
(a) $mol\ l^{-1}\ s^{-1}$ (b) $k(mol\ l^{-1})$ (c) s (d) s^{-1}
(e) s^{-2}

(75) A first order reaction is 25% complete in 30s. Calculate the rate constant k
(a) $9.59 \times 10^{-3} s^{-1}$ (b) $72.2s^{-1}$ (c) $144.2s^{-1}$
(d) $30s^{-1}$ (e) $28yr^{-1}$

(76) The ideal of surface area becomes insignificant in
(a) an homogenous system
(b) heterogeneous system
(c) particles with small size
(d) particles with large size
(e) all of the above.

(77) For the reaction $FeO_{(s)} + CO_{(g)} \rightarrow Fe_{(s)} + CO_{2(g)}$ What would be the effect of increase in pressure on the position of equilibrium?
(a) equilibrium shift to the right
(b) equilibrium shift to the left
(c) No effect
(d) None of the above
(e) All of the above

(78) Give the molecularity of the elementary reaction below

equilibrium shift to the right
equilibrium shift to the left
(c) No effect
(d) None of the above
(e) All of the above

(78) Give the molecularity of the elementary reaction below.

$$2NO + O_2 \longrightarrow 2NO_2$$

(a) unimolecular (b) bimolecular
(c) termolecular (d) first order
(e) second order.

(79) For the chemical reaction A → C, it is found that the rate of the reaction increases by a factor of 2.25 when the concentration of A is increased by a factor of 1.5. What is the order of A in this reaction?
(a) 0 (b) 1 (c) 2 (d) 3 (e) 4

(80) After five half-life periods for a first order reaction, what fraction of reactant remains.
(a) 1/16 (b) 1/5 (c) 1/25 (d) 1/32 (e) 2

$x+y+z=1$

$x+2y+2z=1$

by sum 2 eq 1 & 2

$\therefore x+y=1$ --- (1)

$x+2y=1$ --- (2)

$y=0$

$x+y=1$ (1)

$x=1$

$(x,y)=(1,0)$

$\therefore$ The point

$(1,0,0)$

$q=i+j+k$

$\vec{b}=i+2j+2k$

$q \times b$

$=(i+j+k) \times (i+2j+2k)$

$=$

$\{0, -j+k\}$

Scalar eqn of plane

$= a(x-x_0)+b(y-y_0)+c(z-z_0)=0$

$\{1, -1, 1\}$

$i+j-k$

Plane

$(a=1 \quad b=-1 \quad c=1)$

$a(x-x_0)+b(y-y_0)+c(z-z_0)=0$

$(x-1)-b(y+1)+c(z-1)$

Plane $(1+j-k$

$a \quad b \quad c$

UNIVERSITY OF AGRICULTURE, ABEOKUTA
CHEMISTRY DEPARTMENT
CAT 1 1ST SEMESTER 2005/2006
CHM 101: INTRODUCTORY PHYSICAL CHEMISTRY
INSTRUCTION: ANSWER ALL QUESTIONS TIME: 25 MINS.

(1) Given that $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O$; $\Delta H = -57kJ$. Calculate the heat changes which occur when the 25cm³ of 0.01M HCl and 50cm³ of 0.1M $Ca(OH)_2$.

(a) -285J (b) -14.25J (c) -2.5J (d) -142.5J (e) -28.5J

(2) Calculate the heat of formation of benzen , $C_6H_6(L)$, from the following information:
$\Delta H^\circ_c(C_6H_6) = -3267.6$ kJmol⁻¹; $\Delta H^\circ_f(H_2O) = -285.9$kJmol⁻¹; $\Delta H^\circ_f(CO_2) = -393.5$kJmol⁻¹

(a) -48.9kJmol⁻¹ (b) +2, 587.6kJmol⁻¹ (c) -2,587.6kJmol⁻¹ (d) +48.9kJmol⁻¹
(e) none.

(3) Arrange the three state of matter in the order of necessary average kinetic energy.
(a) Gas < liquid < solid (b) Liquid < Solid, < gas (c) Solid < Liquid < gas
(d) Liquid < gas < solid (e) Gas < Solid < Liquid

(4) Oxygen diffused through a porous partition in 10s the same volume of a gas z diffused through the same plug in 2.5s under the same condition. Calculate the relative molecular mass of gas z.
(a) 1 (b) 2 (c) 3 (d) 4 (e) none

(5) Which of the following molecules would you expect to show hydrogen bonding
(a) none (b) CH_4 (c) C_6H_6 (d) KCl (e) CH_3OH

(6) The rate law of a chemical reaction was found to be $R = k(A)^x(B)^2$. What is the overall order if $x = 1$?
(a) 1/2 (b) 2 (c) 2x -1 + x (d) 3x-1 (e) 3

(7) For a reaction $A \longrightarrow 2B$
What is the rate in terms of disappearance of reactant
(a) $R = -\frac{d[A]}{dt} = \frac{d[B]}{dt}$ (b) $R = -\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$

(c) $R = \frac{d[A]}{dt} = 2\frac{d[B]}{dt}$ (d) $R = \frac{d[B]}{dt} = -2\frac{d[A]}{dt}$

(e) None of the above

(8) For the same reaction $A \longrightarrow 2B$. What is the rate in terms of appearance of product
(a) $R = \frac{d[B]}{dt} = 2\frac{d[A]}{dt}$ (b) $R = \frac{d[A]}{dt} = 2\frac{d[B]}{dt}$ (c) $R = \frac{d[A]}{dt} = \frac{d[B]}{dt}$
(d) All of the above (e) None of the above

(9) In a first order chemical reaction, after 10s 6 moles of the reactant disappeared. Calculate the rate constant.
(a) 2.303s⁻¹ (b) $\log_{10}(3.0)$ s⁻¹ (c) 0.041 10^{-1} (d) 470s⁻¹ (e) 14.74s

(10) From the above question, calculate the half-life
(a) 13.28s (b) 0.0070s (c) 14.74s (d)

(11) Given that the molar mass of water is 18g how many atoms are there?
(a) 6.02×10^{23} (b) 7.2×10^{24} (c) 3.01×10^{23}
(d) 6.02×10^{-23}

9. The type of bonding found in NH_3BF_3 is known as
(a) Covalent (b) ionic (c) Metallic (d) Dative

10. The following are factors that affect the strength of metallic bond
(a) size of metal atoms (b) No of valence electrons/metal atom (c) a and b
(d) none of the above

11. In which of the following is hydrogen bonding most likely to be strongest?
(a) NH_3 (b) H_2O (c) HF (d) HCl

12. According to KMT of matter, two forces are in operation. These are
(a) centripetal and cohesive (b) Disruptive and centrifugal (c) centripetal and centrifugal (d) Cohesive and Disruptive

13. In a solid matter, which of the forces predominate?
(a) Centripetal (b) Disruptive (c) Cohesive (d) Centrifugal

14. Which force predominates in a liquid matter?
(a) Cohesive (b) Disruptive (c) Centripetal and centrifugal (d) None

15. The force predominating in a gaseous matter is
(a) Centripetal (b) Disruptive (c) Cohesive (d) Centrifugal

16. Molecules with permanent dipole are said to be
(a) non polar (b) bipolar (c) polar (d) aprotic.

17. What is the pH of 0.01M ethanoic acid given that $K_a = 1.7 \times 10^{-5}$
(a) 2.0 (b) 10^{-2} (c) 3.39 (d) 4.12×10^{-4}

18. Which of these are the main use of buffers in the laboratory
(a) Preparation of known solution
(b) Preparation of solutions of constant pH
(c) Preparation of acid-base indicator.
(d) (a) & (b).

19. $30cm^3$ of saturated solution of tetraoxodulphate (vi) acid at 25°C was diluted to $30cm^3$ with distilled water, $24.1cm^3$ of the diluted solution neutralizes $25cm^3$ of 0.1M sodium hydroxide solution. Calculate the concentration of the diluted tetraoxosulphate (vi) acid in moles/dm^3.
(a) 0.0519moles/dm^3, (b) 0.519 moles/dm^3 (c) 0.00519moles/dm^3 (d) 5.19mules/dm^3.

20. $25dm^3$ of a solution containing 3g of impure sodium hydroxide in $250cm^3$ was neutralized by $30cm^3$ of 0.1M tetraoxosulphate(vi) acid solution. Calculate the concentration of the pure NaOH in moles/dm^3.
Equation: $2NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$
(a) 0.14moles/dm^3 (b) 0.20moles/dm^3 (c) 0.2 moles/dm^3 (d) 0.19moles/dm^3.