

GUTHM 101

UNIVERSITY OF AGRICULTURE, ASEOKUTA
DEPARTMENT OF CHEMISTRY
First Semester Continuous Assessment Test

Time: 30 minutes
Date: 25/11/2020
Page No. 2

1. Introductory Physical Chemistry I

Action: Answer all the Questions.

Useful constants: Planck constant, $h = 6.626 \times 10^{-34} \text{ Js}$, 1 atm = $1.013 \times 10^5 \text{ Nm}^2$, mass of particles (m) = $9.11 \times 10^{-31} \text{ kg}$, $10^{-8} \text{ cm} = 10^{-10} \text{ m}$, mass of electron (m_e) = $1.602 \times 10^{-19} \text{ kg}$, speed of light = $3.0 \times 10^8 \text{ m/s}$, Bohr radius, $a_0 = 8.854 \times 10^{-11} \text{ m}$, $R_e = 109829 \text{ cm}$, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$, Mg = 24.31, Hg = 200.59g, Cu = 63.55g, 12.00g, O = 16.00g, N = 14.01, Ca = 40.00 Al = 27

Mat. No:

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

2. Which of the following is not true of kinetic theory of gases: (a) molecules of a gas are in constant motion moving in straight line unless they collide with the walls of the container or with another molecule (b) as the molecules collide with the walls of the container, they exert a pressure on the container (c) If the volume of the container is decreased, the molecules collide more frequently with the container and pressure increases. (the reverse is the case if the volume of the container is increased) (d) none of the above

Use the notation ${}_Z {}^A X$ to answer questions 3 – 5.

3. A and Z respectively are (A) atomic number and mass number (B) proton number and mass number (C) mass number and atomic number (D) mass number and neutron number

The difference between A and Z ($A - Z$) will give (A) Number of proton (B) Number of neutron (C) Number of electron (D) mass of the nucleus

${}^A X$ is made up of (A) proton and neutron (B) proton and electron (C) nucleus and electron (D) neutron and electron.

5. The region outside the nucleus, where there is highest probability of finding electrons is known

6. (A) path length (B) wavelength (C) orbits (D) suborbital

5. The following are the trends observed in the periodic table of elements except (A) atomic radii increase down the group (B) atom size decreases across the period (C) ionization energies increase across the period (D) atomic size increase across the period.

8. The electronic configuration of Ca^{2+} and Cl are (A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ and $1s^2 2s^2 2p^6 3s^2 3p^5$ (B) $1s^2 2s^2 2p^6 3s^2 4s^2 3p^6$ and $1s^2 2s^2 2p^6 3s^2 3p^5$ (C) $1s^2 2s^2 2p^6 3s^2 3p^6$ and $1s^2 2s^2 2p^6 3s^2 3p^5$ (D) $1s^2 2s^2 2p^6 3s^2 3p^6$ and $1s^2 2s^2 2p^6 3s^2 3p^5$

The degeneracy of the d – orbital is (A) 2 (B) 4

10. The specific heat capacity of benzene is $2.41 \text{ J/g}^\circ\text{C}$. Calculate the temperature change when 1025J is added to 75g of benzene initially at 25°C (a) -25°C (b) $+50^\circ\text{C}$ (c) -9°C (d) 298°C

11. If the heat absorbed by 50g of NH_3 gas from the surrounding at 30°C was 50 at constant pressure. Determine the enthalpy change of the chemical

12. Electron in the energy level of 3 will have the following quantum numbers except (A) $l = 0, 1, 2$ (B) $m_l = -3, -2, -1, 0, 1, 2, 3$ (C) $m_s = \pm \frac{1}{2}$ (D) $m_l = -1, 0, 1$

13. Determine the volume of ozone formed on converting 9.0 m^3 of oxygen containing 0.3mol oxygen at 1 atm and 250°C to ozone at the same temperature and pressure (a) 6.0 m^3 (b) 9.0 m^3 (c) 2.7 m^3 (d) 25.0 m^3

14. Determine the heat absorbed by 250g of water heated for 20mins and had a temperature increase of 45°C (specific heat capacity of water = $4.184 \text{ J/g}^\circ\text{C}$) (a) $47,070 \text{ J}$ (b) 25500 J (c) $30,500 \text{ J}$ (d) 101151 J

15. Determine the change in internal energy (ΔU) of a chemical system undergoing an exothermic process with a heat flow of 10.5J and the work done by the system is 200J (a) $+210.5 \text{ J}$ (b) $+189.5 \text{ J}$ (c) -210.5 J (d) -189.5 J

16. Carbon occurs in nature as a mixture of ${}^{12} \text{C}$ and ${}^{13} \text{C}$, if the atomic mass of ${}^{12} \text{C}$ is exactly 12.0 u,

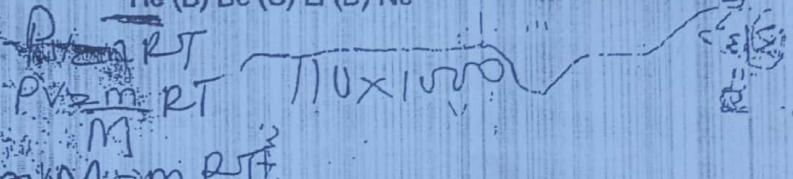
- ${}^{13} \text{C}$ is 13.003 u and the relative atomic mass of Carbon is 12.011 u. The % compositions of ${}^{12} \text{C}$ and ${}^{13} \text{C}$ isotopes in carbon atoms are respectively (A) 95.6 and 4.4 (B) 97.3 and 3.7 (C) 98.9 and 1.1 (D) 99.8 and 0.2

17. Calculate the work done associated with expansion of ammonia gas cylinder from 20 cm^3 to 50 cm^3 at a constant external pressure of 20 N/m^2 (a) -600 Nm (b) 600 Nm (c) 270 Nm (d) -270 Nm

18. Calculate the molar mass of a gas with a density of 2.5 g/dm^3 at 298 K and 110 KN/m^2 ($R = 8.314 \text{ J/Kmol}$) (a) 58.3 g/mol (b) 101 g/mol (c) 5.6 g/mol (d) 20.5 g/mol

19. Calculate the mean square velocity of a 50 g molecule at a pressure of 105 N/m^2 given that the volume of gas and number of molecules are 10 m^3 and 75 m^3 respectively 5.6 m/s (b) 4.2 m/s (c) 5.5 m/s (d) 0.5 m/s

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



15. Breathlayers determine alcohol content by redox reaction: $\text{Cr}_2\text{O}_7 + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{Cr}^{3+} + \text{C}_2\text{H}_4\text{O}_2$. Which substance is a reductant and which is an oxidant? (A) $\text{C}_2\text{H}_5\text{OH}$, reductant; no oxidant (B) $\text{C}_2\text{H}_5\text{OH}$, reductant; $\text{Cr}_2\text{O}_7^{2-}$, oxidant (C) $\text{C}_2\text{H}_5\text{OH}$, oxidant; Cr^{3+} , reductant (D) $\text{C}_2\text{H}_5\text{OH}$, 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). electrons 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.

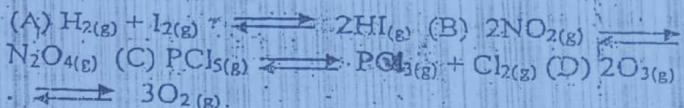
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20. One reason the Bohr model of the atom failed was because it did not explain why (A). accelerating electrons do not emit electromagnetic radiation. (B). moving electrons have a greater mass. (C). electrons in the orbits of an atom have negative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

DEPARTMENT OF CHEMISTRY

Federal University of Agriculture, Abeokuta,
CHM 101 C.A.T. (2011/2012)

INSTRUCTION: Attempt all questions.
Duration: 30 mins



1. What is the density of methane, CH_4 , at $20^\circ C$ and 2.00 atm ? (A) 0.133 g/L (B) 1.33 g/L (C) 0.33 g/L (D) 13.33 g/L

2. The vapor pressure of water at $25^\circ C$ is 23.8 torr. Express this in atm; kPa. (A) 0.0313 atm ; 3.17 kPa (B) 3.17 atm ; 0.313 kPa (C) 0.313 atm ; 31.70 kPa (D) 31.70 atm ; 0.313 kPa

3. What is the volume of 1.216 g of $SO_2(g)$ at $18^\circ C$ and 755 torr? (A) 4.56 cm^3 (B) 45.60 cm^3 (C) 456 cm^3 (D) 4560 cm^3

4. Compute the molar mass of a gas whose density at $40^\circ C$ and 785 torr is 1.286 kg/m^3 . (A) 0.32 g/mol (B) 3.20 g/mol (C) 32.00 g/mol (D) 320.00 g/mol

5. A rigid plastic container holds 35.0 g of ethylene gas (C_2H_4) at a pressure of 793 torr. What is the pressure if 5.0 g of ethylene is removed at constant temperature? (A) 1.14 torr (B) $1.14 \times 10^5\text{ Nm}^2$ (C) 14.19 torr (D) 141.90 torr

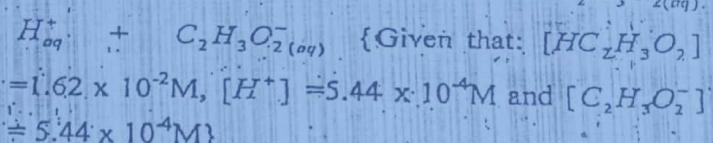
Consider this reaction: $xP + yQ \rightleftharpoons R + nS$, expression for the equilibrium constant for the reaction above is (A) $K[P]^x[Q]^y$ (B) $\frac{[R]^n[S]^y}{[P]^x[Q]^y}$

$$(D) \frac{m[R]n[S]}{x[P]y[Q]}$$

Consider a reaction: $A + B \rightleftharpoons C + D$, more D is formed (C) if the concentration of A is (A) if the concentration of B is reduced (C) continuously removed from the reaction mixture (C) if D is continuously added to the reaction mixture.

Which of the following equilibria is shifted to the right as a result of increase in pressure?

9. Calculate K_c for this reaction: $HC_2H_3O_2 \rightleftharpoons$



$$(A) 2.79 \times 10^{-5} \quad (B) 1.79 \times 10^{-5} \quad (C) 1.87 \times 10^{-3} \quad (D) 1.07 \times 10^{-5}$$

10. In the synthesis of Ammonia from Nitrogen and Hydrogen, $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$, $K_c = 0.5$ at $400^\circ C$ ($R = 0.0821\text{ atm L K}^{-1}\text{ mol}^{-1}$), the K_p for the reaction at this temperature is (A) 1.64×10^{-4} (B) 4.11×10^{-2} (C) 16.42 (D) 2.30×10^{-2} .

11. In the reaction: $Zn(s) + 2HCl \rightarrow ZnCl_2(aq) + H_2(g)$, (A) zinc is oxidized (B) the oxidation number of chlorine remains unchanged (C) the oxidation number of hydrogen changes from $+1$ to 0 (D) all are correct.

12. When this redox reaction: $PbO + [Co(NH_3)_6]^{3+} \rightarrow PbO_2 + [Co(NH_3)_6]^{2+}$, is balanced in a basic solution; (A) reactants include $2OH^-$, products include $2H_2O$ (B) reactants include $2OH^-$, products include $2Co(NH_3)_6^{2+}$ (C) reactants include $2H_2O$, products include $2OH^-$ (D) products include $2OH^-$ and $[Co(NH_3)_6]^{2+}$

13. Complete and balance the following equation. (All stoichiometric coefficients must be integers) $MnO_4(aq) + Cl(aq) \rightarrow Mn^{2+}(aq) + Cl_2(g)$ (acidic solution). (A) 16, on the left (B) 8, on the left (C) 4, on the left (D) 4, on the right

14. What occurs when an atom is oxidized in a chemical reaction? (A) a loss of electrons and a decrease in oxidation number (B) a loss of electrons and an increase in oxidation number (C) a gain of electrons and a decrease in oxidation number (D) a gain of electrons and an increase in oxidation number

UNIVERSITY OF AGRICULTURE, CALABAR
COLLEGE OF NATURAL SCIENCES
CHEMISTRY DEPARTMENT
CONTINUOUS ASSESSMENT TEST (CAT)

CHIM 101: Introduction to Physical Chemistry I
Candidate Name _____
College _____

TIME: 45 min

Mat.No.: _____

Department: _____

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): $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ 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) 25% (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? ($\text{Cu}=63.5$, $\text{Zn}=65.5$) (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 250cm³. A 25.0cm³ portion of this solution was titrated against hydrochloric acid, using a suitable indicator. The endpoint was reached after 18.7cm³ of acid had been added. Calculate the concentration of the acid. ($\text{Na}=23$, $\text{Cl}=35.5$, $\text{C}=12$) (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 ? ($\text{Mg}=24$, $\text{N}=14$) (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? ($\text{Li}=6.9$) (A) 4.59 g (B) 5.49 g (C) 45.9 g (D) 54.9 g

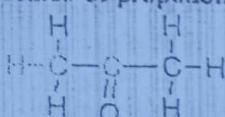
6. Iron (II) sulfate is oxidized by potassium permanganate in acid solution. The overall ionic equation is

$5\text{Fe}^{2+}(\text{aq}) + \text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l}) + 5\text{Fe}^{3+}(\text{aq})$ What volume of 0.010moldm⁻³ iron(II) sulfate will be oxidized by 25.00cm³ of 0.020moldm⁻³

permanganate solution? (A) 25 cm³ (B) 250 cm³ (C) 2.5 cm³ (D) 2500 cm³

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



(A) No, because hydroxyl group (B) Yes, intramolecular O and H groups (C) No, because 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 (5.00×10^6 g) of sulfur in the sequence of reactions: $\text{S}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g})$; $\text{S} + 1/2\text{O}_2(\text{g}) \rightarrow \text{SO}_3(\text{g})$; $\text{SO}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$. (A) 1.53×10^7 g (B) 1.35×10^7 g (C) 5.3×10^6 g (D) 10^6 g

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

11. A polar substance dissolves in ---- solvent and a substance dissolves in ---- solvent..

(a) like poles, unlike poles (b) non-polar, polar non-polar (d) unlike poles, like poles.

12. The solubility of silver chloride is 1.8×10^{-5} g of 1000g of saturated AgCl solution at 25°C. The solubility in mol of AgCl per dm³ of AgCl solution. (a) 1.3×10^{-2} mol dm⁻³ (b) 1.3×10^{-4} mol dm⁻³ (c) 1.3×10^{-3} mol dm⁻³ (d) 1.3×10^{-5} mol dm⁻³

13. Conversion of water vapour to liquid involves --- process while converting the liquid to solid involves --- process.

(a) Condensation, Freezing (b) Condensation, M Evaporation, Condensation (d) Evaporation, Freez

14. Gas laws are combinations of ----- law, ----- law, ----- law and ----- law

(a) Boy's, Avogadro's, Partial's, Gay Lussac's (b) Charles' Avogadro's and Dalton's. (c) Boy's, Charles' Dalton's (d) Boyle's, Charles', Partial, Da

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

16. Calculate the number of molecules of methane of the gas at a pressure of $2.0 \times 10^2 \text{ kPa}$ and a temp exactly 300K.

(a) 1.2×10^{25} (b) 3.6×10^{25} (c) 2.4×10^{25} (d) 4.8×10^{25}

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1. If 1.0000 mol of gas at exactly 20°C at a pressure of 1.55dm^3 (c) 224.055dm^3 (d) 24.055dm^3
 2. A substance that sticks to is called _____
 3. It sticks to is called _____
 4. Sorbent (b) Adsorb, Adsorber (c) Adsorbate, Adsorb, Absorbent

5. In the reaction $2\text{NO}_{(g)} \rightleftharpoons \text{N}_{2(g)} + \text{O}_{2(g)}$ is considered to be at equilibrium (a) the concentration of N_2 and O_2 are equal (b) the concentration of NO is twice that of either N_2 or O_2 (c) the concentration of NO is equal to the combined concentration of N_2 and O_2 (d) the rate of decomposition of NO is equal to its rate of formation.

6. Solubility of CuBr at 25°C is found to be $2.0 \times 10^{-4} \text{ mol}^2\text{L}^{-2}$. The value is (a) $4.0 \times 10^{-8} \text{ mol}^2\text{L}^{-2}$ (b) $2.0 \times 10^{-3} \text{ mol}^2\text{L}^{-2}$ (c) $6.0 \times 10^{-4} \text{ mol}^2\text{L}^{-2}$ (d) $8.0 \times 10^{-4} \text{ mol}^2\text{L}^{-2}$.

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

8. Given that $P = 2.5 \times 10^3 \text{ Nm}^{-2}$ and the % dissociation of NOBr is 45%, the value of K_p for the reaction: $2\text{NOBr}_{(g)} \rightleftharpoons 2\text{NO}_{(g)} + \text{Br}_{2(g)}$ at 50°C is (a) 938.5 Nm^{-2} (b) 745 Nm^{-2} (c) 1013 Nm^{-2} (d) 1128 Nm^{-2}

9. During the reaction $\text{H}_{2(g)} + \text{I}_{2(g)} \rightleftharpoons 2\text{HI}_{(g)}$ 0.5 mole each of H_2 and I_2 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

10. The K_c for the reaction $\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO}_{(s)} + \text{CO}_{2(g)}$ is (a) $K_c = \frac{[\text{CaO}][\text{CO}_2]}{[\text{CaCO}_3]}$ (b) $K_p = P_{\text{CO}_2}$ (c) $P = K_c$ (d) $K_c = \frac{[\text{CaCO}_3]}{[\text{CaO}][\text{CO}_2]}$ (e) $K_p = [\text{CO}_2]$

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11. The value of K_p at 500°C for the reaction $3\text{H}_{2(g)} + \text{N}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$ 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} .

12. 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}C .

13. Electronic configuration of Cl and Cl^- respectively are (a) $1s^2 2s^2 2p^5$ and $1s^2 2s^2 2p^6 3s^2 3p^6$ (b) $1s^2 2s^2 2p^6 3s^2 3p^6$ and $1s^2 2s^2 2p^5$ (c) $1s^2 2s^1 2p^3 3s^1 3p^6$ and $1s^2 2s^1 2p^6 3s^2 3p^6$ (d) $1s^2 2s^2 2p^5$ and $1s^2 2s^2 2p^6$.

14. One atom of silver has atomic weight of 106.911 and the relative atomic mass of silver is 107 the % isotopes respectively are (a) 6.45 and 93.55 (b) 5.55 and 94.45 (c) 6.45 and 93.55 (d) 95.55 and 4.45

**UNIVERSITY OF AGRICULTURE, ABEOKUTA
COLLEGE OF NATURAL SCIENCES
CHEMISTRY DEPARTMENT**

B.Sc Chemistry First Semester Continuous Assessment Test

CHM 101: Introductory Physical Chemistry I

Time: 30 minutes

Instruction: Answer all the Questions.

Useful constants: Planck constant, $h = 6.626 \times 10^{-34}$ Js, $1 \text{ atm} = 1.013 \times 10^5 \text{ Nm}^2$, mass of particles (m) = 9.11×10^{-31} , $1\text{\AA} = 10^{-8} \text{ cm} = 10^{-10} \text{ m}$, mass of electron (m_e) = 1.602×10^{-19} , speed of light = $3.0 \times 10^8 \text{ m s}^{-1}$, Bohr radius $a_0 = 8.854 \times 10^{-11} \text{ m}$, Relative Permittivity = $\epsilon_0 = 8.845 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, $R_H = 109629 \text{ cm}^{-1}$, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$, $Mg = 24.31$, $Hg = 200.59 \text{ g}$, $Cu = 63.55 \text{ g}$, $C = 12.00 \text{ g}$, $O = 16.00 \text{ g}$, $N = 14.01$, $Ca = 40.00$, $Al = 27$

- 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%
- 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
- Alpha particle has properties similar to that of (A) He (B) Be (C) Li (D) Ne
- Balancing of chemical equation is based on the law of: (A) Definite proportion (B) multiple proportion (C) conservation of matter (D) conservation of energy
- $\text{CH}_3\text{COOH}_{(aq)} \rightleftharpoons \text{CH}_3\text{COO}_{(aq)}^- + \text{H}^+_{(aq)}$, [Given that $K = 1.8 \times 10^{-5}$]: Calculate $[\text{H}^+]$ 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} .
- 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) $\frac{m[R]n[S]}{x[P]^y[Q]}$

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

Which compound does Cl have the highest oxidation numbers (A) KClO_4 (B) KClO_3 (C) KClO_2 (D) KClO

It is 40% dissociated at 25°C and 1 atm, the K_p is (A) 0.76 atm (B) 0.57 atm (C) 0.27 atm

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10. One mole of a chemical substance contains: (A) Faraday numbers of particles (B) Quantum number of particles (C) atomic number of particles (D) Avogadro's number of particles
11. Statements of Dalton atomic theory include the following except; (A) atom of each element are identical (B) atom of different elements are similar (C) chemical combination of atoms 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 is the electrochemical equivalent of the reaction. (A) 21.58g (B) 18.25g (C) 0.001g (D) 0.0009g
14. the number of mole of sodium carbonate in 8.5g of the salt is: (A) 0.28 (B) 0.08 (C) 2 (D) 18
15. The oxidation number of Cr in $\text{Cr}_2\text{O}_7^{2-}$ is (A) +2 (B)+7 (C) +6 (D) +5
16. The percentage composition of Sulphur (S) in $\text{FeSO}_4 \cdot 10\text{H}_2\text{O}$ is (A) 6.9% (B) 5.6% (C) 9.6% (D) 5.8%
17. The region outside the nucleus, where there is highest probability of finding electrons is 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 a 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) Paschen (C) Lyman (D) Pfund
20. Which of these is a reference electrode (A) Daniel cell (B) Leclanche cell (C) Standard hydrogen electrode (D) Lead acid accumulator

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CHEMISTRY DEPARTMENT

UNIVERSITY OF AGRICULTURE, ABEOKUTA

CAT: INTRODUCTORY PHYSICAL CHEMISTRY CHM 101 2006/2007 SESSION. TIME ALLOWED: 20mins
Instruction: Answer all questions. Shade the correct answers in the spaces in the answer sheet.

Dopt-----

1. A characteristic of ionic solids is that they -----

- (a) have high melting points
- (b) have low boiling points
- (c) conduct electricity
- (d) are noncrystalline.

2. Two atoms of element A unite to form a molecule with the formula A_2 . The bond between the atoms in the molecule is

- (a) electrovalent
- (b) ionic
- (c) nonpolar covalent
- (d) polar covalent

3. The forces of attraction that exist between nonpolar molecules are called

- (a) Vander Waals
- (b) ionic
- (c) covalent
- (d) electrovalent

4. NaCl is an ionic crystal with ----- coordination number

- (a) Tetrahedral
- (b) Octahedral
- (c) Face centered cubic
- (d) none

5. Which of all the following statements is/are correct about state of matter?

- (a) Solids have high kinetic energy for the particles
- (b) Melting point is a measure of the reactivity of a substance
- (c) Evaporation increases with decrease in temperature
- (d) Liquid evaporates when its energetic particles leaves the surface of the liquid

6. How many moles of an ideally behaving gas can occupy 400 litres at 0.821 atm and $-73^\circ C$?

- (a) 5.20 moles
- (b) 2.05 moles
- (c) 2.20 moles
- (d) 3.0 moles

Under the same condition of temperature and pressure, hydrogen and nitrogen gases diffuse through a porous partition. What is the relative

7. What is the maximum no. of electrons in the orbital that has the following quantum nos? $n = 1$, $l = 1$, $m_l = -1$ (a) 14 (b) 6 (c) 10 (d) 2

8. Which of the following is not an allowed combinations of n , l and m_l quantum nos when $n = 27$? (a) 2, 0, 1 (b) 2, 1, 1 (c) 2, 1, +1 (d) 2, 1, 0

Matric No.-----

rate of diffusion of hydrogen to nitrogen gas?

- (a) 1:1
- (b) 2:1
- (c) 4:2
- (d) 4:1

9. When the vapour pressure of a liquid in an open container equals the atmosphere pressure, the liquid will ----- (a) Freeze (b) Crystallize (c) Melt (d) Boil

10. The boiling point of water at standard pressure is ----- (a) 0.000K (b) 100.0K (c) 273K (d) 73K

11. Which of the following solids consists of atoms or molecules held together only by Van der Waals forces? (a) Cu (b) CO_2 (c) H_2O (d) MgO

12. Which element consists of positive ions immersed in a sea of delocalised mobile electrons? (a) S (b) Ca (c) N (d) Cl

13. In the graphite lattice, the crystals consist of several ----- joined together (a) molecules (b) ions (c) layers (d) none

14. At constant pressure, $50cm^3$ of a gas at $20^\circ C$ is heated to $30^\circ C$. The new volume of the gas is (a) $52cm^3$ (b) $45cm^3$ (c) $54cm^3$ (d) $75cm^3$

15. What is the volume of gas with its final temperature double if the initial volume is $20cm^3$? (a) $40cm^3$ (b) $20cm^3$ (c) $10cm^3$ (d) $30cm^3$

16. BF_3 is planar in shape with 120° bond angle whereas NiI_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 bond polarity (c) difference in the bond angle (d) difference in the electron types around the central atom.

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

20. Which of the following molecules violate octet rule? (a) NH_3 (b) CH_4 (c) H_2O (d) BF_3

21. Molecular geometry depends on the following except? (a) the bond length (b) the nature of the central atom (c) the bonding electrons (d) the lone pairs around the central atom.

22. The strength of metallic bond depends on (a) atomic no of the element (b) electropositivity of the element (c) no. of valence electrons/metal atom (d) ability to conduct electricity.

23. Which of the following element will have negative electron affinity? (a) II (b) S (c) P (d) O

24. Which of the following energy terms always have a negative value? (a) Ionization energy (b) Electron affinity (c) Lattice energy (d) Atomization energy

25. For a molecule to have trigonal bipyramidal shape, there must be.....
(a) 5 bond pairs alone around the central atom
(b) 4 bond pairs and 1 lone pair around the central atom (c) 6 bond pairs alone around the central atom (d) 5 bond pairs alone around the central atom

26. In a molecule, there are types of electrons. (a) 3 (b) 1 (c) 2 (d) 4

27. An element Y₂ has 6 valence electrons and forms a homonuclear diatomic molecule, Y₂. What is the bond order of Y₂? (a) 2 (b) 3 (c) 1 (d) 4

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

29. All chemical bonds involve (a) centrifugal force (b) centripetal force (c) gravitational attraction (d) electrostatic attraction.

ANSWER

UNIVERSITY OF AGRICULTURE, ABEOKUTA
DEPARTMENT OF CHEMISTRY
2005/2006 1ST SEMESTER EXAMINATION

CHM 101

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

- (1) What is the maximum number of electrons in the orbital that has the following quantum numbers, $n=3$, $l=0$, $m=0$?
 (a) 6 (b) 2 (c) 10 (d) 14
- (2) For the shell $n=3$, the possible values of l are
 (a) 1, 2, 3 (b) 2, 1, 1 (c) 0, 1, 2
 (d) 3, 2, 1.
- (3) Which of the following is a possible set of quantum numbers for a $3p$ electron?
 (a) 3, 0, 0, +1/2 (b) 3, 0, 1, +1/2
 (c) 3, 0, 1, -1/2 (d) 2, 1, 0, -1/2
- (4) Which of the following is not an allowed combinations of n , l and m quantum numbers when $n = 3$?
 (a) 3, 1, -1 (b) 3, 1, 0 (c) 3, 1, +1
 (d) 3, 0, 1.
- (5) Which of the following is an allowed combination 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.
- (6) 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
- (7) Which of the hydrogen atom emission spectrum corresponds to the ultraviolet region of the emm?
 (a) Lyman series (b) Balmer series
 (c) Paschen series (d) Pfund series
- Electron has dual nature because it possesses
 (a) mass and wavelength (b) mass and volume (c) weight and density
 (d) fluidity and frequency.
- The wave nature of electron gives rise to the concept of
 (a) mole (b) orbital
- (c) hybridization (d) equivalence
- (10) "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.
- (11) 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
- (12) 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.
- (13) 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.
- (14) 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.

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- (15) An element Y₂ has 5 valence electrons and forms a molecule Y₂. What is the bond order of the Y₂ molecule?
 (a) 1 (b) 3 (c) 2 (d) 4
- (16) In which of the following compounds is hydrogen bonding most likely to be least?
 (a) HF (b) H₂O (c) NH₃
 (d) PH₃
- (17) All chemical bonds involved
 (a) Centrifugal force
 (b) electrostatic attraction
 (c) Centripetal force
 (d) gravitational force.
- (18) 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.
- (19) The type of dipole that exists in HCl molecule is known as
 (a) instantaneous (b) permanent
 (c) induced (d) temporary
- (20) Given the following information, calculate the lattice energy of MgCl_(s)
 $Mg_{(s)} + \frac{1}{2} Cl_{(g)} \rightarrow MgCl_{(s)}$
 $\Delta H^\circ_f = -128 kJ mol^{-1}$
 $\Delta H^\circ_{atom}[\frac{1}{2} Cl_{(g)}] = +121 kJ mol^{-1}$
 $\Delta H^\circ_{atom}[Mg_{(s)}] = -150 kJ mol^{-1}$
 $\Delta H^\circ_{LE}[Mg_{(g)}] = +736 kJ mol^{-1}$
 $\Delta H^\circ_{EA}[Cl_{(g)}] = -364 kJ mol^{-1}$
 (a) -771 (b) -862 (c) 647 (d) 537
- (21) In a molecule, there are – types of electrons
 (a) 3 (b) 4 (c) 2 (d) 5
- (22) 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
- (23) For a molecule to have trigonal planar shape there must be
 (a) 2 bond pairs alone around the central atom
 (b) 3 bond pairs alone around the central atom
- (24) A element X has 5 valence electrons and forms a homonuclear diatomic molecule X₂. What is the bond order of X₂?
 (a) 2 (b) 3 (c) 1 (d) 5
- (25) Which of the following molecules violates octet rule?
 (a) HF (b) H₂O (c) NH₃
 (d) BF₃
- (26) 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
- (27) 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
- (28) 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) $144.4 s^{-1}$ (d) $20 s^{-1}$ (e) $22 s^{-1}$
- (29) 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.
- (30) 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.
- (31) How can the rate of reaction be represented with respect to reactant as well as each product for this reaction?



~~N~~

$$\frac{R = -\frac{1}{2} \frac{d[\text{N}_2\text{O}_5]}{dt}}{dt} = \frac{\frac{1}{2} \frac{d[\text{NO}_2]}{dt}}{dt}$$

(b) $R = -2 \frac{d[\text{N}_2\text{O}_5]}{dt} = 4 \frac{d[\text{NO}_2]}{dt} =$

(c) $R = -2 \frac{d[\text{N}_2\text{O}_5]}{dt} = \frac{d[\text{NO}_2]}{dt} =$

(d) $R = -\frac{1}{2} \frac{d[\text{N}_2\text{O}_5]}{dt} = 4 \frac{d[\text{NO}_2]}{dt} =$

(e) None of the above

(32) A second order reaction is $2\text{A} \rightarrow \text{Product}$.

What is the rate equation?

- ~~(a)~~ $R = k_2[\text{A}]^2$ (b) $R = k_2[2\text{A}]$ (c) $R = k_2[\frac{1}{2}\text{A}]$ (d) $R = k_2[\text{A}_2]$ (e) None of the above

(33) 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.

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

(35) A first order reaction is 25% complete in 30s. Calculate the rate constant k
 (a) $9.59 \times 10^{-3} \text{ s}^{-1}$ (b) 72.2 s^{-2}
 (c) 144.2 s^{-1} (d) 30 s^{-1} (e) 28 yr^{-1}

(36) 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.

(37) For the reaction $\text{FeO}_{(s)} + \text{CO}_{(g)} = \text{Fe}_{(s)} + \text{CO}_{2(g)}$ 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

(38) Give the molecularity of the elementary reaction below



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

(39) For the chemical reaction $\text{A} \rightarrow \text{G}$, 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

(40) 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

(41) For the reaction $\text{FeO}_{(s)} + \text{CO}_{(g)} = \text{Fe}_{(s)} + \text{CO}_{2(g)}$. If at 298K the equilibrium amount present are 2.5 mol FeO, 0.2 mol Fe, 3.0 mol CO₂ and 4.0 mol CO. Calculate the equilibrium constant for the reaction.

- ~~(a)~~ 0.06 (b) 0.6 (c) 6.0
 (d) 2.1×10^{-2} (e) 0

(42) The rate law of a chemical reaction was found to be $R = k[\text{A}]^{2x-1} [\text{B}]^x$. What is the overall order of reaction if $x = 1$.

- (a) $3/2$ (b) 2 (c) $2x-1+x$ (d) $3x-1$
 (e) 3

(43) 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) 2.303 s^{-1} (b) $\log [16/10] \text{ s}^{-1}$
~~(c)~~ 0.0470 s^{-1} (d) 20s (e) 14.74 s^{-1}

(44) Given $\text{HCl}_{(\text{aq})} + \text{NaOH}_{(\text{aq})} \rightarrow \text{NaCl}_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$, $\Delta H = -57 \text{ kJ}$
 Calculate the heat changes which would occur when 50 cm^3 of 0.01 M NaOH solution and 100 cm^3 of 0.01 M HCl.
 (a) -57 J (b) -114 J (c) $+57 \text{ J}$ (d) $+114 \text{ J}$
 (e) none

(45) Determine the ΔH for this reaction
 $2\text{NH}_4\text{NO}_3_{(\text{s})} \rightarrow \text{O}_{2(\text{g})} + 2\text{N}_{2(\text{g})} + 4\text{H}_2\text{O}_{(\text{g})}$
 Given $\Delta H_f(\text{NH}_4\text{NO}_3) = -364.6 \text{ kJ mol}^{-1}$,
 $\Delta H_f(\text{H}_2\text{O}_{\text{g}}) = -286 \text{ kJ mol}^{-1}$,
 (a) $-41.4 \text{ kJ mol}^{-1}$ (b) $+41.4 \text{ kJ mol}^{-1}$ (c) $-414.4 \text{ kJ mol}^{-1}$ (d) $+414.4 \text{ kJ mol}^{-1}$
 (e) none.

(46) 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.

(47) For how long must a current of 0.2 A need to pass through solution of AgNO_3 to deposit 0.5 mole of silver. [Ag = 108, $1 \text{ F} = 96,500 \text{ C}$]
 (a) $38,600 \text{ s}$ (b) 9650 s (c) $96,500 \text{ s}$ (d) $241,250 \text{ s}$

(48) A gas occupies 172 cm^3 at 30°C . At what temperature would the volume of the gas be halved.

- (a) 0.38 K (b) 0.087 K (c) 15 K (d) 152 K
 (e) 15°C

(49) 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

(50) What volume would a gas at s.t.p if at 43°C and 720 mm Hg it occupies 214 cm^3 .

- (a) 528 cm^3 (b) 378 cm^3 (c) 412 cm^3
 (d) 252 cm^3 (e) none

(51) Which of the following contains coordinate covalent bond.

- (a) NH_4^+ (b) Na^+Cl^- (c) CH_4 (d) HCl
 (e) all

(52) ----- 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.

(53) 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.

(54) Nitrogen gas has ----- covalent bond.

- (a) triple bond (b) no bond (c) dative (d) Double bond (e) all of the above

(55) ----- has intermolecular forces called -----.

- (a) $\text{KCl}/\text{van der waal}$ (b) $\text{CO}_2/\text{van der waal}$
 (c) $\text{O}_2/\text{electrostatic force}$
 (d) $\text{Cl}_2/\text{cohesive}$ (e) none.

(56) 0.02 mole of anhydrous NH_4Cl were added to 45 g of H_2O in a polystyrene cup in order to determine the standard enthalpy change of solution of NH_4Cl . (Given $\Delta T = 1.5^\circ \text{C}$, s.h.c. of the H_2O is $4,200 \text{ kJ kg}^{-1} \text{ K}^{-1}$, neglect s.h.c. of the polystyrene).

- (a) $1,000 \text{ kJ/mol}$ (b) 2.8 kJ/mol (c) 0.284 kJ/mol (d) 14.2 kJ/mol (e) none

(57) 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

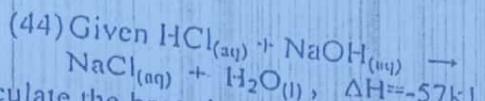
(58) The cohesive forces holding particles in matter together is smallest in

- (a) Gases (b) Solids (c) Liquids
 (d) Vapour. (e) all

(59) A certain mass of a gas at 12°C and 419 mm Hg pressure occupies a cylinder of 480 cm^3 . What volume will it occupy at 24°C and 838 mm Hg .

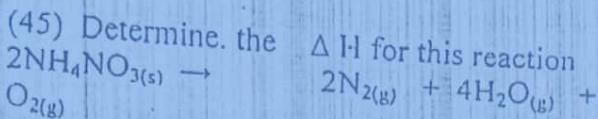
- (a) 200.71 cm^3 (b) 480 cm^3 (c) 250.11 cm^3
 (d) 472.21 cm^3

(60) Use the ideal gas equation to work out the volume that 1 mol of an ideal gas should have at 20°C and pressure of $1.013 \times 10^5 \text{ N m}^{-2}$.



Calculate the heat changes which would occur when 50 cm^3 of 0.01 M NaOH solution and 100 cm^3 of 0.01 M HCl .

- (a) -57 J
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- (c) 15 K
- (d) 15.2 K
- (e) 15°C

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(60) Use the ideal gas equation to work out the volume that 1 mol of an ideal gas should have at 20°C and pressure of $1.013 \times 10^5 \text{ N m}^{-2}$.

UNIVERSITY OF AGRICULTURE, ABOKO PA
DEPARTMENT OF CHEMISTRY
2003/2004 FIRST SEMESTER EXAMINATION
CRM 101: INTRODUCTORY PHYSICAL CHEMISTRY

TIME: 1½ HOURS

INSTRUCTION: Answer ALL Questions by shading appropriately on the answer sheet provided.

1. 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 mol L⁻¹. What is the unit of first order rate constant?

- (a) S⁻¹ (b) L⁻¹ (c) Mol L⁻¹ S⁻¹ (d) k(mol)⁻¹

2. A first order reaction is 25% complete in 36 second. Calculate the rate constant, k.

- (a) 72.2 S⁻¹ (b) 9.596 × 10⁻³ S⁻¹ (c) 144.45⁻¹ (d) 2.303 S⁻¹

3. 2 moles of HI are injected into a box of one dm³ volume at 420°C. If 0.228 mole of the HI disappeared. Calculate the equilibrium constant

- (a) 0.0166 (b) 0.0579 (c) 1.772 (d) 0.228

4. The ideal of surface area becomes insignificant in:

(a) an homogeneous system (b) heterogeneous system (c) a particle with small size (d) a particle with large size.

5. For the chemical reaction A → G, 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

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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

Give the molecularity of the elementary reaction below



- (a) Unimolecular (b) bimolecular (c) trimolecular (d) Pentamolecular

For the reaction $2\text{A} + \text{B} + \text{C} \rightarrow 3\text{D} + \text{E}$, the experimentally determined rate equation is given by Rate = $k[\text{A}]^2[\text{B}]$. Which of the following statement is NOT applicable to this reaction?

- (a) the reaction is first order with respect to A
(b) the reaction is first order with respect to B
(c) the reaction is first order with respect to C
(d) the reaction is second order overall

9. The type of bonding found in NH_3BH_3 is known as
 (a) Covalent (b) ionic (c) Metallic (d) Metallic 8.57
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 10.25
 (d) none of the above
11. In which of the following is hydrogen bonding most likely to be strongest?
 NH₃ (b) H₂O (c) HF (d) HCl $\Delta H = \log f_{\text{eff}}$
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 $V \propto K = T^{\alpha}$
13. In a solid matter, which of the forces predominate?
 (a) Centripetal (b) Disruptive (c) Cohesive (d) Centrifugal $V \propto -$
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) apolar.
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^{-5} 1.465 + 1
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. $\text{K}_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$
19. ~~30cm³~~ of saturated solution of tetroxosulphate (vi) acid at 25°C was diluted to 30cm³ with distilled water, 24.1cm³ of the diluted solution neutralizes 25cm³ of 0.1M sodium hydroxide solution. Calculate the concentration of the diluted tetroxosulphate (vi) acid in moles/dm³.
 (d) 0.0519moles/dm³, (b) 0.519 moles/dm³ (c) 0.00519moles/dm³ (d) 5.19moles/dm³ 2.2.35 + 1
20. 25dm³ of a solution containing 3g of impure sodium hydroxide in 250cm³ was neutralized by 30cm³ of 0.1M tetroxosulphate (vi) acid solution.
 Calculate the concentration of the pure NaOH in moles/dm³.
 Equation: $2\text{NaOH}_{(\text{aq})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \text{Na}_2\text{SO}_{4(\text{aq})} + 2\text{H}_2\text{O}_{(\text{l})}$
 (a) 0.14moles/dm³ (b) 0.20moles/dm³ (c) 0.21moles/dm³ (d) 0.19moles/dm³ Cr Vt Cr VB
- CBV + H₂O \rightarrow Cr Vt Cr VB

30. Calculate the mass of the solute present in the following solution: trioxo-carbonate (IV) in 2dm^3 of 2M solution. (a) 352g (b) 552g (c) 452g (d) 255g

The following are some of the basic postulates of kinetic molecular theory (KMT) of matter except.

- (a) Matter consists of atoms or molecules in continuous rapid and random motion.
(b) The average kinetic energy of the atoms or molecules is indirectly related to the absolute temperature of the system.
(c) The particles attract and repel one another and therefore possess potential energy.
(d) Energy is transferred from one particle to another by collisions, but the collisions are elastic with no net loss of energy.

32. For the reaction $\text{FeO}_{(s)} + \text{CO}_{(g)} \rightleftharpoons \text{Fe}_{(s)} + \text{CO}_2_{(g)}$

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) More of CO_2 is produced.

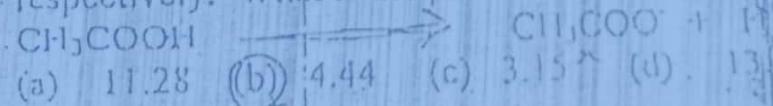
33. Using the same equation as above in the earlier question, if at 298K the equilibrium amounts present are 2.5 mol FeO , 0.2 mol Fe, 3.0 mol CO_2 and 4.0 mol CO. Calculate the equilibrium constant for the reaction.

- (a) 0.06 (b) 0.6 (c) 6.0 (d) 2.1×10^{-4}

34. What is the pH of 0.1M NaOH?

- (a) 1.0 (b) 1.0×10^3 (c) 3.0 (d) 13

35. The dissociation constant of ethanoic acid at 298K is 1.8×10^{-5} . In a buffer solution, the concentration of CH_3COO^- and CH_3COOH are 0.05M and 0.1M respectively. What is the pH of the buffer solution?



36. What is the pH of 10^{-3}M H_2SO_4 ?

- (a) 3.0 (b) 10 (c) 2.70 (d) 2.0

AMBASSADOR

37. After five half-life periods for a first order reaction, what fraction of reactant remains? (a) $1/16$ (b) $1/15$ (c) $1/25$ (d) $1/32$

38. Give the molecularity of the elementary reaction below.



- (a) Unimolecular (b) bimolecular (c) termolecular (d) Pentamolecular

39. For the reaction $2\text{A} + \text{B} + \text{C} \rightarrow 3\text{D}$ the experimentally determined rate equation is given by Rate = $k[\text{A}]^2 [\text{B}]$. Which of the following statement is NOT applicable to this reaction?
(a) the reaction is first order with respect to A

UNIVERSITY OF AGRICULTURE, ABEOKUTA

DEPARTMENT OF CHEMISTRY

2002/2003 FIRST SEMESTER EXAMINATION

CHM 101 (INTRODUCTORY PHYSICAL CHEMISTRY)*

INSTRUCTION: Shade the correct answer into the answer sheet attached to the Question.

TIME: 111

(1) Solid particles cannot overcome the strong forces of attraction holding them together and therefore posses.

- (A) vibrational, rotational and translational motion (B) Vibrational and rotational
 (C) Vibrational and translational (D) Translational and rotational
 (E) Vibrational only

(2) Internal energy, E, is a state function because

- (A) It is the sum of all the energies of all the atomic, molecules or ions within a system which it can have under the specified conditions of state
 (B) It is made up of coulombic energy between the electrons and the nuclei in atoms.
 (C) The change in internal energy (ΔE) during the shift of a system from state I to state II is independent of path followed
 (D) $\Delta E = q + w$
 (E) It is made up of translation energy of molecules.

(3) What is the value of the standard enthalpy of formation, ΔH_f° , of nitrogen at 298K

- (A) zero (B) 298kJ (C) 100kJ (D) -2183kJ (E) -507kJ

(4) The heat content of Z is greater than that of X. Then the reaction $X \rightarrow Z$ is exothermic, (B) endothermic, (C) neither exothermic nor endothermic Activation complex (D) Specific heat capacity.

(5) Given: A + B \rightarrow C + D; $\Delta H^\circ = -10\text{ kJ}$

Calculate ΔH° for the reaction: G + D \rightarrow A + B
 (A) -10kJ (B) -20kJ (C) -203kJ (D) +10kJ (E) 50kJ

(6) What is the relation between ΔH and ΔE for reactions which do not involve gases?

- (A) $\Delta H = \Delta E$ (B) $\Delta V = 0$ (C) $\Delta H = \Delta E + P\Delta V$ (D) ΔV is constant
 (E) ΔV is too small

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(7) What is ΔH_{gas} for the combustion of one mole of tungsten Carbide, WC, when both reactants and product are at 298K?



- (A) 1 (B) $\frac{1}{2}$ (C) $-\frac{3}{2}$ (D) -2 (E) $-\frac{3}{2}$

(8) In which of the following reactions would ΔH be most nearly equal to ΔE ?

- (A) $2\text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(l)}$ (B) $\text{H}_{2(g)} + \text{Cl}_{2(g)} \rightarrow 2\text{HCl}_{(g)}$
 (C) $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightarrow 2\text{NH}_{3(g)}$ (D) $\text{CH}_3\text{COOH}_{(l)} + 2\text{O}_{2(g)} \rightarrow 2\text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)}$
 (E) $\text{Cl}_{2(g)} \rightarrow 2\text{Cl}$

(9) The enthalpy change (ΔH) for the reaction:

- $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightarrow 2\text{NH}_{3(g)}$ is -92.38 kJ at 298K. What is ΔE at 298K? ($R = 8.314\text{ J K}^{-1}$)
 (A) -2.0kJ (B) 4.95kJ (C) -87.43kJ (D) 8.314kJ (E) -168kJ

(10) In general, what happens to the rate of reaction as the reaction progress

- (A) The rate of reaction also increases (B) The rate of reaction is quenched
 (C) Concentration increases (D) The rate of reaction decreases
 (E) All of the above

(11) 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) 2/3 (E) 7

(12) A reaction follows the rate expression

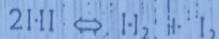
$R = k[A]$. If the rate is expressed in terms of mol L⁻¹ S⁻¹ and the concentration of A is in mol L⁻¹, what is the unit of first order rate constant?

- (A) mol L⁻¹ S⁻¹ (B) k (mol L⁻¹) (C) S (D) S⁻¹ (E) L⁻¹

(13) A first order reaction is 25% complete in 30s. Calculate the rate constant k

- (A) $9.596 \times 10^{-3} \text{ S}^{-1}$ (B) $72.2 \times 10^{-2} \text{ S}^{-1}$ (C) $8.24 \times 10^{-2} \text{ S}^{-1}$ (D) $2.30 \times 10^{-3} \text{ S}^{-1}$ (E) $3.0 \times 10^{-1} \text{ S}^{-1}$

(14) 2 moles of HI are injected into a box of one dm³ volume at 490°C. If 0.228 mole of the HI disappears, calculate the equilibrium constant.



- (A) 1.544 (B) 0.228 (C) 0.167 (D) 0.01 (E) 0.0166

The valence electron of element Y is 6 while that of Z is 1. The two elements combined to form Z₂Y molecule.

(15) What is the occupancy of Z₂Y molecule?

- (A) 3 (B) 2 (C) 4 (D) 5

(16) The likely shape of Z₂Y molecule is

- (A) Linear (B) Triangular (C) Planar (D) Tetrahedral

(17) The following are observed in hydrogen atom emission spectrum except

- (A) Lyman series (B) Balmer series (C) Balmer series (D) Pfund series

(18) Which of the hydrogen atom emission spectrum corresponds to the visible region of cmr

- (A) Paschen series (B) Balmer series (C) Brackett series (D) Lyman series

(19) On the hydrogen atom emission spectrum, a drop from higher energy level to n = 4 is designated as

- (A) Brackett series (B) Paschen series (C) Balmer series (D) Pfund series

(20) The dual nature of electron is as a result of its

- (A) mass and volume (B) mass and wavelength
(C) Fluidity and weight (D) density and frequency

(21) In which of the following is repulsion greatest?

- (A) non bonding - non bonding (B) lone pair - lone pair (C) Lone pair - bond pair
(D) bond pair - bond pair

(22) Intermolecular force involved in the dissolution of ionic compounds in water is known as

- (A) Hydrogen bonding (B) Dipole - Dipole interaction (C) Ion - dipole interaction
(D) Induced dipole

(23) In which of the following is hydrogen bonding most unlikely

- (A) H₂O (B) CH₃OH (C) HCl (D) CH₄

(24) An element K, has valence electron configuration of 2s² 2p⁴. What is the bond order of K₂ molecule?

- (A) 1 (B) 3 (C) 2 (D) 4

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

TIME: 1 Hour

INSTRUCTIONS: Answer ALL Questions.

Useful Constants

$$R = 0.08206 \text{ L-atm/mol-K}$$

$$H_2 = 2.01588 \text{ g/mol}$$

$$O_2 = 31.9988 \text{ g/mol}$$

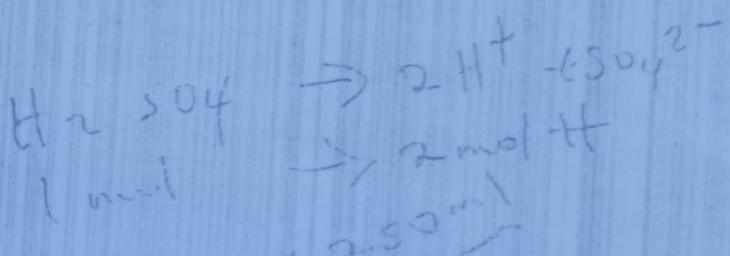
$$He = 4.003 \text{ g/mol}$$

AMBASSA DOP

- Calculate the total pressure of a gas mixture that contain 2.5g of O₂, 4.5g of H₂ 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.
- On decomposing a 25.0m³ NH₃ gas according to the equation below in a cylinder with piston.
 $\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + \text{H}_2(\text{g})$
 It was found that the volume of the cylinder and piston increased to 100.0m³ at 50N/m². what is the work done by the system?
 (a) 3750N-m (b) -3057N-m (c) -3750N-m (d) 3057N-m.
- Calculate the enthalpy of reaction for the reaction below $2\text{B}_5\text{H}_9 + 12\text{O}_2 \rightarrow 5\text{B}_2\text{O}_3 + 9\text{H}_2\text{O}$ given that $\Delta H^\circ_f \text{B}_5\text{H}_9 = -75.0$; $\text{B}_2\text{O}_3 = -1300$; $\text{O}_2 = 0$; $\text{H}_2\text{O} = -250 \text{ KJ/mol}$
 (a) -8686KJ (b) 8686KJ (c) 8900KJ (d) -8900KJ.
- 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.
- 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.
- A possible value of spin quantum no is:
 (a) $\frac{1}{2}$ (b) 1 (c) 0 (d) 1.
- How many orbitals are found in a d-subshell? (a) 3 (b) 4 (c) 5 (d) 6.
- Which of the following is a possible set of quantum numbers for a 2p electron?
 (a) 1, 0, 0, $-\frac{1}{2}$. (b) 2, 0, 0, $+\frac{1}{2}$ (c) 2, 0, 1, $-\frac{1}{2}$. (d) 2, 1, 0, $-\frac{1}{2}$.
- Which of the following gives a 3-dimensional model of the atomic structure.
 (a) Bohr (b) Rutherford (c) Schrodinger (d) Mendeleev.
- The type of intermolecular interaction involving KCl is:
 (a) Dipole-Dipole (b) Hydrogen bonding (c) Intermatomic forces (d) Ion-dipole.

- AMBASSADOR
11. In the compound SH_4 , the central atom S, has bonding electrons in four w
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.
 $3\text{KMnO}_4 + 5\text{Fe} + 24\text{HCl} \rightarrow 3\text{FeCl}_3 + \text{MnCl}_2 + 3\text{KCl} + 12\text{H}_2\text{O}$ if 150g of Fe were consumed
 (Fe = 56, Mn = 55, K = 39, O = 16).
15. What mass of KMnO_4 is consumed? (a) 170g (b) 264g (c) 180g (d)
16. How many grams of MnCl_2 are produced? (a) 60.4g (b) 56.6g (c) 70.2g (d)
- Use this to answer questions 17 and 18. Gold is attacked by very few chemicals. A mix
 HNO_3 and HCl, called aqua regia, however dissolves gold by the following equation.
 $\text{Au}(s) + 3\text{HNO}_3(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{HAuCl}_4(\text{aq}) + 3\text{NO}_2(\text{g}) + 2\text{H}_2\text{O}$. If 28.4g of Au were
 this reaction, ($\text{Au} = 197$).
17. What is the minimum volume, in ml, of 12.0M HCl needed?
 (a) 48.0 (b) 60.2 (c) 42.8 (d) 30.0.
18. If 16.0M HNO_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) 73.6.
- 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 1,690 years. Calculate the rate
 Sec^{-1}

- (a) $5.83 \times 10^{-10} \text{ Sec}^{-1}$
 (b) $2.58 \times 10^{-11} \text{ Sec}^{-1}$
 (c) $1.382 \times 10^{-11} \text{ sec}^{-1}$
 (d) $5.83 \times 10^{-11} \text{ Sec}^{-1}$



**TEAM REJUVENATION CARES
EXAMINATION LIKELY QUESTIONS.**

CHM 101

1. Which of the following series of spectra line is in the UV region?
 (A) Balmer (B) Paschen (C) Lyman (D) P-fund
2. The Region outside the nucleus, where there is highest probability of finding electrons is known as
 (A) Path length (B) Wave length (C) Orbitals (D) Orbitals
3. The electronic configuration of Ca^{2+} and CL are
 (A) $\text{IS}^2\text{S}^2\text{P}^6\text{3S}^2\text{P}^6\text{4S}^2$ and $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{3P}^5$
 (B) $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{4S}^2\text{3P}^6$ and $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{3P}^5$
 (C) $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{3P}^6$ and $\text{IS}^2\text{S}^2\text{3S}^2\text{2P}^6\text{3P}^5$
 (D) $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{3P}^6$ and $\text{IS}^2\text{S}^2\text{2P}^6\text{3S}^2\text{3P}^5$
4. The degeneracy of the d - orbital is
 (A) 2 (B) 4 (C) 5 (D) 4
5. How many orbital are found in a d subshell
 (A) 3 (B) 4 (C) 5 (D) 6
6. Which of the following is a possible set of quantum number for a 2p electron?
 (A) $1,0,0-1/2$ (B) $2,0,0+1/2$ (C) $2,0,1,-1/2$ (D) $2,1,0,-1/2$
7. What is the maximum number of electron in the orbital that has the following quantum numbers $n = 2, l = 0, m_l = 0?$
 (A) 6 (B) 2 (C) 10 (D) 14
8. For the shell $n = 3$, the possible values for L are
 (A) 1,2,3 (B) 2,1,1, (C) 0,1,2 (D) 3,-1
9. Which of the following is an allowed combination of the n, l and m quantum number when $n = 2$?
 (A) 2,-1,+1 (B) 2,0,1 (C) 2,0,0 (D) 2,-1,1
10. Which of the hydrogen atom emission spectrum corresponds to the ultraviolet region of the emi?
 (A) Lyman series (B) Balmer series (C) Paschen series (E) p-fund series
11. The electronic configuration of CL and CL- respectively are
 (A) $\text{IS}^2\text{2S}^1\text{63S}^2\text{23P}^5$ and $\text{IS}^2\text{2S}^2\text{P}^6\text{3S}^2\text{3P}^6$
 (B) $\text{IS}^2\text{2S}^2\text{P}^6\text{3S}^2\text{3P}^6$ and $\text{IS}^2\text{2S}^2\text{P}^6\text{3S}^2\text{3P}^5$
 (C) $\text{IS}^2\text{2S}^2\text{P}^6\text{3S}^1\text{3P}^6$ and $\text{IS}^2\text{2S}^2\text{P}^6\text{3S}^2\text{3P}^6$
 (D) $\text{IS}^2\text{2S}^1\text{63S}^2\text{3P}^5$ and $\text{IS}^2\text{2S}^2\text{P}^6\text{3P}^6$
12. One mole of a chemical substance contains
 (A) Faraday number of particles
 (B) Quantum number of particles
 (C) Atomic number of particles
 (D) Avogadro's number of particles
13. The following are the trends observed in the periodic table of elements except
 (A) Atomic radii increase down the group
 (B) Atomic size decrease across the period

- (C) Ionization energies increase across the period.
 (D) Atomic size increase across the period.
14. Why does sodium not form that Na^{2+} ion in compounds?
 (A) Because of low 1st ionization energy
 (B) Because of high electro positivity
 (C) Because of high 2nd ionization energy
 (D) All of the above.
15. How many grams of MnCl_2 are produced?
 (A) 60.4g (B) 56.6g (C) 70.2g (D) 210g
16. Methane is converted to carbon dioxide and water when burned in a plentiful supply of oxygen (complete combustion).
 $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
 If 10g of CO_2 were obtained when 16g of CH_4 were burned in a limited oxygen gas, what would be the percentage yield of carbon dioxide?
 (A) 23% (B) 23% (C) 11.5% (D) 62.5%
17. A standard solution was prepared by dissolving 2.6061g of anhydrous sodium carbonate in deionized water and the solution diluted to 25cm³. A 25cm³ portion of this solution was titrated against hydrochloric acid, using a suitable indicator. The end point was reached after 18.7cm³ of acid had been added. Calculate the conc of the acid (Na = 23, Cl = 35.5, C = 12)
 (A) 0.098 (B) 9.263m (C) 0.13m (D) 0.98m
18. How many moles of Mg_3N_2 will be produced by reaction of 1.50ml of Mg with excess N₂? (Mg = 24, N = 14)
 (A) 0.100mol (B) 0.260mol (C) 0.131mol (D) 0.098mol
19. What mass of Li₃N will be produced by reaction of 2.75g of Lithium metal with excess nitrogen gas? (Li = 6.9)
 (A) 4.5g (B) 5.49g (C) 45.9g (D) 54.9g
20. Calculate the mass of sulphuric acid (The chemical produced) in the largest tonnage in the world produced by the reaction of 5 metric tons (5.00×10^6 g) of sulphur in the following sequence of reaction
 $\text{S(s)} + \text{O}_2(\text{g}) \dots \text{SO}_2(\text{g})$
 $\text{SO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \dots \text{SO}_3(\text{g})$
 $(\text{S} = 32, \text{O} = 16)$
 (a) 1.53×10^7 g (b) 1.35×10^7 g (c) 5.3×10^6 g (c) 3×10^6 g
21. 25dm³g of a solution containing 3g of impure sodium hydrogen in 250cm³ was neutralized by 30cm³ of 0.1m tetraoxosulphate (VI) Acid solution. Calculate the concentration of the pure NaOH in mole / dm³.
 $2\text{NaOH(aq)} + \text{H}_2\text{SO}_4(\text{aq}) \dots \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2(\text{L})$
 (A) 0.14mol/dm³ (B) 0.20mole/dm³

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47. cm^3 of 0.01m NaOH solution and 100cm^3 of 0.01m HCl.

- (A) -57j (B) -114j (C) +57j (D) +114j
(E) None of the above

48. Determine the ΔH for the reaction $2\text{NH}_4\text{NO}_3 \rightarrow 2\text{N}_2(\text{g}) + \text{O}_2(\text{g})$

- (A) -41.4 kJ/mol (B) 41.4 kJ/mol (C) 4.4 kJ/mol (D) 414 kJ/mol (E) None of the above

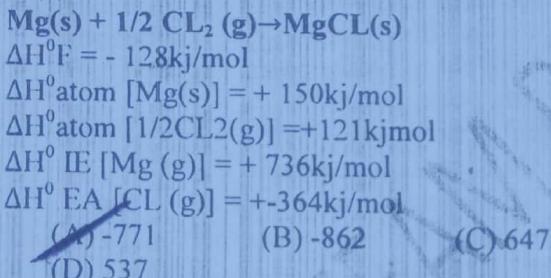
49. 0.02 mole of Anhydrous NH_4Cl was added to 45g of H_2O in a polyserene Cup in order to determine the standard enthalpy change of solution of NH_4Cl (Given $\Delta T = 1.5^\circ\text{C}$, S.H.C of $\text{H}_2\text{O} = 4200 \text{ kJ g}^{-2}\text{K}^{-1}$ neglect S.H.C of the polystyrene)

- (A) 1000 kJ/mol (B) 2.8 kJ/mol (C) 0.284 kJ/mol (D) 14.2 kJ/mol (E) none of the above

50. Which of the following is false on melting a solid?

- (A) Solid will only melt when the forces of vibration overcome the binding force
(B) The presence of impurity in solid will raise the melting point of such solids
(C) The presence of impurity may cause a solid to have a melting point
(D) The presence of impurity in solid will lower the melting point
(E) None of the above

51. Given the information, calculate the lattice energy of MgCl(s) .



52. Solid particle cannot overcome the strong force of attraction holding them together and therefore posses.

- (A) Vibrational, rational and translational motion
(B) Vibration and rational
(C) Vibrational and translational
(D) Vibrational only
(E) Is a state function because

53. Internal energy.

(A) It is the sum of all the energies of all the atoms, molecules or icons with a system which it has under the specific condition of state

(B) It is made of coulomb energy between the electrons and the Nuclei in atoms

(C) The change in internal energy (ΔE during the shift of a system from state I to state II is independent of path followed

$$(D) \Delta E = q=w$$

(E) It is made up of translation energy of

54. The heat content of Z is greater than that of X. In the reaction $X \rightarrow Z$ is

- (A) Exothermic
(B) Endothermic
(C) Neither exothermic nor endothermic
(D) Activation complex
(E) Specific heat capacity

62. Given $A+B \rightarrow C + D \Delta H = -1.0 \text{ kJ}$. Calculate ΔH for the reaction $C+D \rightarrow A+B$

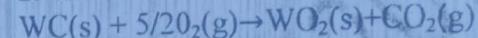
- (A) -10 kJ (B) 20 kJ (C) 503 kJ

$$\cancel{-10 \text{ kJ}}$$

$$10 \text{ kJ}$$

$$50 \text{ kJ}$$

55. What is Δn gas for the combination of one mole of tungsten carbide WC, when both reactants and products are in their standard states?



- (A) 1 (B) 1/2 (C) -3/2
(D) -2 (E) -3/2

56. In which of the following reactions would ΔE ?

- (A) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
(B) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$
(C) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
(D) $\text{CH}_3\text{COOH}(\text{l}) + 2\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

(L)

$$\cancel{\text{CL}_2(\text{g}) \rightarrow 2\text{Cl}(\text{g})}$$

57. The enthalpy change (ΔH) for the reaction $92.38 \text{ KJ} / 298 \text{ K}$. What is ΔE at 298K? ($R=8.31 \text{ J K}^{-1} \text{ J}^{-1}$)

- (A) -2.0 KJ (B) 4.95 KJ (C) -87.43 KJ
(E) 8.31 KJ (D) -168 KJ

For the reaction in question 1 above. What would be effect of increase in pressure on the position of equilibrium? $\text{FeO}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{Fe}_2\text{O}_3(\text{s}) + \text{CO}_2(\text{g})$

- (A) Equilibrium shift to the right
(B) Equilibrium shift to the left
(C) No effect

(D) None of the above

68. The system $2\text{NO}(\text{s}) \leftrightarrow \text{N}_2(\text{g}) + \text{O}_2(\text{g})$ is considered to be at equilibrium when

- (A) The concentration of N_2 and O_2 are equal
(B) The concentration of NO is twice that either

(C) The concentration of NO is to the combined concentration of N_2 and O_2

(D) The rate of decomposition of NO is equal to its rate of formation

58. 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) $k_c = K_p (d)$
(D) $K_c = K_p / (RT)$