

FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA

INTRODUCTORY PHYSICAL CHEMISTRY 1 PAST QUESTION (CHM 101)

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, $h = 6.626 \times 10^{-34} \text{ Js}$, $1 \text{ atm} = 1.013 \times 10^5 \text{ Nm}^{-2}$, 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 = $3.0 \times 10^8 \text{ m}$ Bohr radius $a_0 = 8.854 \times 10^{-11}$, Relative Permittivity = $\epsilon_0 = 8.845 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, $R_H = 109629 \text{ cm}^{-1}$, $R = 8.314 \text{ Jmol}^{-1} \text{ K}^{-1}$, $Mg = 24.31$, $Hg = 200.59 \text{ g}$, $Cu = 63.55 \text{ g}$, $C = 12.00 \text{ g}$, $O = 16.00 \text{ g}$, $N = 14.01$, $Ca = 40.00$, $Al = 27$

- 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) $K \frac{[P]^x [Q]^y}{[R]^m [S]^n}$ (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
- 40% dissociated at 25°C and 1 atm, the K_p is (A) 0.76 atm (B) 0.57 atm (C) 0.27

region of space is (a) unknown (b) orbital (c) orbital (d) orbital

30. Light scattering experiment was conducted by (a) Schrodinger (b) Louis de Broglie (c) Ernest Rutherford (d) Schrodinger

Name _____ Dept. _____

23. The substance that sticks is called (a) Adsorbent (b) Adsorb (c) Adsorbent (d) Adsorbate

24. The reaction $2\text{NO}_{(g)} \rightleftharpoons \text{N}_{2(g)} + \text{O}_{2(g)}$ 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 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

25. The solubility of CuBr at 25°C is found to be $2.0 \times 10^{-4} \text{ mol L}^{-1}$. The K_{sp} is (a) $4.0 \times 10^{-8} \text{ mol}^2 \text{L}^{-2}$ (b) $2.0 \times 10^{-8} \text{ mol}^2 \text{L}^{-2}$ (c) $6.0 \times 10^{-8} \text{ mol}^2 \text{L}^{-2}$ (d) $8.0 \times 10^{-8} \text{ mol}^2 \text{L}^{-2}$

26. 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) $K_c = K_p (RT)^{\Delta n}$

27. Given that $P = 2.5 \times 10^5 \text{ Nm}^{-2}$ 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 25°C is (a) 938.5 Nm^{-2} (b) 745 Nm^{-2} (c) 1013 Nm^{-2} (d) 1128 Nm^{-2}

28. 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 0.03 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

29. The K_p for the reaction $\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO}_{(s)} + \text{CO}_{2(g)}$ is P_{CO_2} . The K_c is (a) $\frac{[\text{CaO}][\text{CO}_2]}{[\text{CaCO}_3]}$ (b) $K_p = P_{\text{CO}_2}$ (c) $K_c = \frac{[\text{CaCO}_3]}{[\text{CaO}][\text{CO}_2]}$ (d) $K_c = [\text{CO}_2]$

30. 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^{-2} , 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}

31. 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) $1\text{amu} = \frac{1}{12}$ of the mass of one atom of $^{12}_6\text{C}$

32. 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) $1s^2 2s^2 2p^6 3s^2 3p^4$ and $1s^2 2s^2 2p^6 3s^2 3p^5$ (d) $1s^2 2s^2 2p^6 3s^2 3p^5$ and $1s^2 2s^2 2p^6 3s^2 3p^6$

33. The atomic weight of silver is 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 and 94.45 (c) 6.45 and 93.55 (d) 95.55 and 4.45

	a	b	c
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13	a		
14			
15	b		
16			
17	c		
18			
19			
20			
21	d		
22			
23			
24			
25			
26			
27			
28			
29	c		
30	d		

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Handwritten notes: $K_p = K_c (RT)^{\Delta n}$, $1-0-34$, 540 , 273 , 773 , 106.911 , 107 , 6.45 , 93.55 , 95.55 , 4.45 , 106.911 , 107 , 6.45 , 93.55 , 95.55 , 4.45 .

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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%

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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. $\text{CH}_3\text{COOH}_{(\text{aq})} \rightleftharpoons \text{CH}_3\text{COO}^{-}_{(\text{aq})} + \text{H}^{+}_{(\text{aq})}$, [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^{-5} (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) $\frac{[P]^x [Q]^y}{[R]^m [S]^n}$ (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_3 (C) KClO_2 (D) KClO

9. N_2O_4 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 (D) 1.4 atm

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11. In the compound SH_4 , the central atom S, has bonding electrons in four molecule as predicted by VSEPR is:

- (a) Linear (b) Trigonal planar (c) Tetrahedral (d) None

12. Which of the following compounds does not obey octet rule?

- (a) CH_4 (b) NH_3 (c) SO_2 (d) BF_3

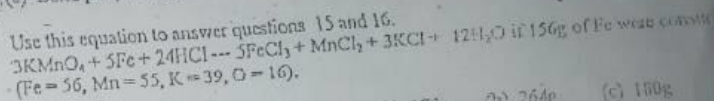
13. The following arise as a result of permanent dipole in a molecule except:

- (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.



15. What mass of KMnO_4 is consumed? (a) 170g (b) 264g (c) 180g

16. How many grams of MnCl_2 are produced? (a) 60.4g (b) 56.6g (c) 70.7g

Use this to answer questions 17 and 18. Gold is attacked by very few chemicals. Au and HNO_3 and HCl , called aqua regia, however dissolves gold by the following equation.

$$\text{Au(s)} + 3\text{HNO}_3(\text{aq}) + 4\text{HCl}(\text{aq}) \rightarrow \text{HAuCl}_4(\text{aq}) + 3\text{NO}_2(\text{g}) + 3\text{H}_2\text{O}$$

If 22.4g of Au is used in this reaction, (Au = 197).

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

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) 72.6

A solution contains 5.0×10^{-3} moles of H_2SO_4 dissolved in 750ml 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

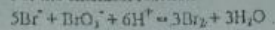
22. The half-life period for the decomposition of radium is 1,590 years. Calculate the Sec^{-1} .

- (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) $5.83 \times 10^{-11} \text{ Sec}^{-1}$

$\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$
1 mol $\rightarrow 2 \text{ mol H}^+$
 $\therefore \frac{1}{2} \times 2.00 \text{ mol}$

23. Two abundant isotopes of an element are ^{35}S and ^{32}S .

Use this information for question 23 - 25.
For the chemical reaction



the rate expression is given as

$$\text{Rate} = k[\text{Br}^-][\text{BrO}_3^-][\text{H}^+]^2$$

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 1.71 ml after 9 minutes the volume became. Calculate the rate constant if the infinity reading is 15.5 dm³.

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

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) $1.82 \times 10^{-4} \text{ Sec}^{-1}$
(b) $1.99 \times 10^{-4} \text{ Sec}^{-1}$
(c) $1.79 \times 10^{-4} \text{ Sec}^{-1}$
(d) $1.63 \times 10^{-4} \text{ Sec}^{-1}$

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28. What is the general form of a rate law?

- (a) $\text{Rate} = k[\text{A}]^m[\text{B}]^n$
(b) $\text{Rate} = k[\text{A}]^m$
(c) $\text{Rate} = \frac{[\text{A}]^m[\text{B}]^n}{[\text{C}]^p}$
(d) $\text{Rate} = k[\text{A}]^m$

29. What is the relationship between specific rate constant and half life.

- (a) $t_{1/2} = \frac{0.693}{k}$ (b) $t_{1/2} = \frac{2.303}{k}$ (c) $t_{1/2} = \frac{0.693}{k}$ (d) $k = \frac{2.303}{t_{1/2}}$

Use this information to answer questions 30 - 32.

The decomposition of acetaldehyde and acetone-dicarboxylic acid yielded results when against $1/T$ gave straight lines with slopes, (a) -2920 and (b) -5070 respectively.

30. Calculate the activation energy of the first.
(a) 54,382 Kcal mol⁻¹ (b) 43,394 Kcal mol⁻¹ (c) 54,382 Kcal mol⁻¹ (d) 63,200 Kcal

31. What is the activation energy of the second?

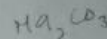
- (a) 15,000 Cal mol⁻¹ (b) 17,000 cal mol⁻¹ (c) 1,000 Cal mol⁻¹ (d) 20,000 Cal

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$$F = \frac{G M m}{r^2}$$

CO₃

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

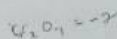


15. The oxidation number of Cr in $\text{Cr}_2\text{O}_7^{2-}$ is (A) +2 (B) +7 (C) +6 (D) +5
16. The percentage composition of Sulphur (S) in $\text{FeSO}_4 \cdot 10\text{H}_2\text{O}$ is (A) 6.9% (B) 5.6% (C) 9.6% (D) 5.8%

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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 cell (D) Lead acid accumulator

Hydrogen	1
Carbon	12
Oxygen	16
Sulphur	32
Iron	56
Chlorine	35.5
Phosphorus	31



$17 = 21 +$

$\frac{38.25}{15 \times 45 \times 60} =$

$2(\text{Cr}) + 7(\text{O}) = -2$
 $2x - 14 = -2$
 $2x = 12$
 $x = 6$

$\frac{27}{32} \times 36 =$
 $\frac{162}{162}$

$56 + 32 + 64(20) + 16(2)$

2

Molecularity of a reaction

- number of atoms reacting together in a single elementary step
- Hydrogen
- Carbon
- Oxygen
- Sulphur
- Iron
- Chlorine
- Phosphorus

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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 L-atm/mol-K
H₂ = 2.01588 g/mole
O₂ = 31.9988 g/mole
He = 4.003 g/mol

0.075125
2.25
1.25

$$P = \frac{nRT}{V} = \frac{2 \times 0.0821 \times 298}{1} = 4.92 \text{ atm}$$

- 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.
NH3(g) -> N2(g) + H2(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 2B2H6 + 12O2 -> 5B2O3 + 9H2O given that
 ΔH_f° : B₂H₆ = -75.0; B₂O₃ = -1300; O₂ = 0; H₂O = -250KJ/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) 4,2,2,1.
- 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) 1/2 (b) 1 (c) 0 (d) 2.
- 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, -1/2 (b) 2, 0, 0, +1/2 (c) 2, 0, 1, -1/2 (d) 2, 1, 0, -1/2.
- Which of the following gives a 3-dimensional model of the atomic structure.
(a) Bohr (b) Rutherford (c) Schrodinger (d) Heisenberg.
- The type of intermolecular interaction involving KCl is:
(a) Dipole - Dipole (b) Hydrogen bonding (c) Interatomic forces (d) Ion-dipole.

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$$-1500 + 2700 - 1500$$

$$3 = \frac{n^2 h^2}{8 \pi^2 m a^2}$$

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

(31) Arrhenius equation is $\frac{d \ln k}{dT} = \frac{E_a}{RT^2}$ 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) slope = $-\frac{E_a}{2.303R}$

- (c) $\frac{2.303}{T}$
 (d) $-\frac{E_a}{2.303R}$

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(32) An aldehyde and a carboxylic acid decomposed and yielded results whose $\log k$ plot against $1/T$ gave straight lines with slope = 5070. Calculate the activation energy.
 (a) 1987 (b) 2303 (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 minutes. R.A.M: H=1.0, O=16.0, S=32.0

- (33) Cathode: (a) 0.0226g (b) 0.0330g
 (c) 0.0446g (d) 0.0550g (e) 0.0110g

- (34) At the Anode: (a) 0.2680g (b) 0.1680g
 (c) 0.3680g (d) 0.4680g (e) 0.0680g

(35) What is the unit of rate constant k for a second order reaction.
 (a) mol dm⁻³s⁻¹ (b) s⁻¹ (c) mol²dm⁻³s⁻¹ (d) mol⁻²dm³s⁻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) 2638 years (b) 3638 years (c) 4638 years
 (d) 1638 years (e) 5600 years

Question 37 & 38.

(37) Find the masses of products formed when dilute sulphuric acid solution is electrolysed with a current of 0.6A for 90 minutes.

- (a) mass of H₂ formed is 0.0330g
 (b) mass of Cu formed is 0.0330g
 (c) mass of S formed is 0.0330g
 (d) mass of Fe formed is 0.0330g
 (e) mass of Zn formed is 0.0330g

- (38) (a) mass of Ag formed is 0.2680g
 (b) mass of H₂O formed is 0.2680g
 (c) mass of O₂ formed is 0.2680g
 (d) mass of Cl₂ formed is 0.2680g
 (e) mass of H₂ formed is 0.2680g

(39) 26cm³ of a solution containing 10.5g of impure hydrochloric acid solution in 250cm³ is titrated against 25cm³ of 0.1M sodium trioxocarbonate (iv) solution. Calculate the concentration of the pure acid in mole/dm³.

- (a) 0.2913M (b) 0.3923M (c) 0.1538M
 (d) 0.1813M (e) 0.1923M

(40) What is the mass of copper formed at the cathode when a current of 0.25A is passed through a copper (II) sulphate solution for 1 hour. (R.A.M: Cu = 63.5).
 (a) 0.296g (b) 0.358g (c) 0.581g (d) 0.159g (e) 0.578g

(41) What is the maximum number of electrons 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 of l 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 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

(44) Which of the following is not an allowed combination of n, l and m quantum numbers when n=3?
 (a) 3, 1, -1 (b) 3, 1, 0 (c) 3, 1, +1 (d) 3, 1, 2

(45) Which of the following is an allowed combination of the n, l, and m quantum numbers when n=3?
 (a) 3, 0, 0 (b) 3, 0, 1 (c) 3, 0, -1 (d) 3, 0, 2

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solution of NH_4Cl . (Given $\Delta T = 1.5^\circ\text{C}$, s.h.c. of the H_2O is $4.200\text{kJ}\cdot\text{g}^{-1}\cdot\text{K}^{-1}$, neglect s.h.c. of the polystyrene).

- (a) 1.000kJ/mol (b) 2.8kJ/mol (c) 0.284kJ/mol (d) 1.12kJ/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

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(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 828mmHg .

- (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 $1.013 \times 10^5\text{Nm}^{-2}$.

- (a) 100dm^3 (b) 22.41dm^3 (c) 0.00024dm^3
(d) 725.80dm^3

(21) Given that the solubility product constant of silver chloride at 298K is $1.8 \times 10^{-10}\text{mol}^2\text{dm}^{-6}$.

Calculate the solubility of silver chloride solution in 0.02M sodium chloride solution at 298K .

- (a) $0.5 \times 10^{-5}\text{M}$ (b) $0.6 \times 10^{-6}\text{M}$ (c) $0.7 \times 10^{-5}\text{M}$
(d) $0.8 \times 10^{-10}\text{M}$ (e) $0.9 \times 10^{-5}\text{M}$

(22) In the redox reaction, $\text{CuO}_{(s)} + \text{CO}_{(g)} \rightarrow \text{Cu}_{(s)} + \text{CO}_{2(g)}$

which of the species 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), $\text{H}_2\text{O}_{(l)}$ and $\text{H}_2\text{O}_{(l)}$ to reactants and products.

(b) To the reduction half-cell equation add OH^- (aq), $\text{H}_2\text{O}_{(l)}$ to reactants and products.

(c) To the oxidation half-cell equation add H^+ (aq), $\text{H}_2\text{O}_{(l)}$ to reactants and products.

- (d) A & D only
(e) B and C only.

(24) Using the oxidation number method, the following reaction

$\text{MnO}_{42(aq)} + \text{Br}^-_{(aq)} \rightarrow \text{Mn}^{2+}_{(aq)} + \text{Br}_{2(l)}$ will 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 $R = \frac{\text{Nm}^{-2} \cdot \text{m}^3}{\text{mol} \cdot \text{K}}$

- (a) $\text{Nm}^{-2}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$ (b) Kmol^2/Nm (c) $\text{J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$
(d) A & B (e) a and C

(27) Which of this equation represents Avogadro's law.

- (a) $V \propto n$, T , p constant
(b) $V \propto \frac{1}{n}$, T constant
(c) $V \propto T$, n , p constant
(d) $V \propto \frac{1}{p}$, T constant
(e) $V = R \cdot \frac{1}{pTn}$

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.

$$V_1 M_1 = V_2 M_2$$

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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: 1¹ hrs

- (1) For the reaction $\text{FeO}_{(s)} + \text{CO}_{(g)} \rightleftharpoons \text{Fe}_{(s)} + \text{CO}_{2(g)}$. If at 298K, the equilibrium amount present are 2.5 mol FeO, 0.2 mol Fe, 3.0 mol 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^{-2} (e) 0
- (2) The rate law of a chemical reaction was found to be $R = k [\text{A}]^{2x} [\text{D}]^y$. 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 (e) $14.74s^{-1}$
- (4) Given $\text{HCl}_{(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$
 $\Delta H = -57\text{kJ}$
Calculate the heat changes which would occur when 50cm³ of 0.01M NaOH solution and 100cm³ of 0.01M HCl.
(a) -57J (b) -114J (c) +57J (d) +114J (e) none
- (5) Determine the ΔH for this reaction
 $2\text{NH}_4\text{NO}_3 \rightarrow 2\text{N}_2\text{O}_{(g)} + 4\text{H}_2\text{O}_{(g)} + \text{O}_{2(g)}$
Given $\Delta H_f(\text{NH}_4\text{NO}_3) = -364.6\text{kJmol}^{-1}$,
 $\Delta H_f(\text{H}_2\text{O}_{(g)}) = -286\text{kJmol}^{-1}$
(a) -41.4kJmol^{-1} (b) $+41.4\text{kJmol}^{-1}$ (c) -14.4kJmol^{-1} (d) $+14.4\text{kJmol}^{-1}$ (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. [$\text{Ag} = 108$, $F = 96,500\text{C}$]
(a) 38,600s (b) 9650s (c) 96,500s (d) 241,250s
- (8) A gas occupies 172cm³ at 30°C. At what temperature would the volume of the gas be halved.
(a) 0.88K (b) 0.887K (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. of 4.4g and 720mmHg it occupies 214cm³.
(a) 528cm³ (b) 378cm³ (c) 412cm³ (d) 252cm³ (e) none
- (11) Which of the following contains coordinative 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) 1ative (d) Double bond (e) all of the above
- (15) ----- has intermolecular forces called -----
(a) KCl (b) van der waal (c) O_2 (d) van der waal (e) electrostatic force (f) Cl_2 (g) cohesive (h) 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

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Question.

Isotopes	Z	[A-Z]	m.
^1H	1	0	1.007825
^2H	1	1	2.014
^3H	1	2	3.01605
^{35}Cl	17	18	34.968852
^{37}Cl	17	20	36.965903

Use the data in table 2 to calculate the RAM value for naturally occurring Chlorine ($75.77\% - \text{Cl}^{35}$) the percentage of occurrence of chlorine in the atmosphere.

^{35}Cl 75.77%

^{37}Cl 24.23%

$$\left[\frac{75.77 \times 35}{100} \right] + \left[\frac{24.23 \times 37}{100} \right]$$

$$\rightarrow 26.5195 + 8.9651$$

$$\rightarrow 35.4846$$

$$\underline{\underline{\rightarrow 35.48}}$$

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$$\text{Ram of } {}^{35}\text{Cl} = x$$

$$\% \text{ Abundance of } {}^{35}\text{Cl} = 75.77\%$$

$$\% \text{ Abundance of } {}^{37}\text{Cl} = 100.00\% - 75.77\% \\ = 24.23\%$$

$${}^{35}_{17}\text{Cl} \quad 75.77\%$$

$${}^{37}_{17}\text{Cl} \quad 24.23\%$$

$$\text{Ram} = \left(\frac{75.77}{100} \times 35 \right) + \left(\frac{24.23}{100} \times 37 \right)$$

$$= 26.5195 + 8.9651$$

$$= 35.4846$$

$$\approx 35.48$$

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Success ~