19.B mass of neutrons 20.B Centrifugal force 21.B mv^2/r 22.C -1
23.B Electrovalent bonding 24.B Shared between the atoms 25.A Tetrachlorate (vii)
26.C $SnCl_2$ (Stannous chloride). For Stannic chloride, we have $SnCl_4$
27.C ***Working:*** Given NH_3, we noticed that;
1 N atom x 5 valence electrons = $5e^-$
3 H atoms x 1 valence electron = $3e^-$
Total = $8e^-$; Now, we distribute the $8e^-$ around NH_3

i.e
; ***thus***, the **Correct Option is C**

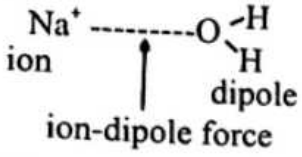
28.B 4/3. this is a repeated question, see previous workings for the solution. (***Get Serious***)
29.D $HC\equiv CH<H_2C=CH_2<H_3C-CH_3$. Generally, bond length for a single bond (-C-C-) is higher than that of a double bond (-C=C-) and that of a double bond is higher than that of a tripple bond (-C≡C-). ***hence***, the bond length increases in the order of $HC\equiv CH<H_2C=CH_2<H_3C-CH_3$
30.C CO_2 and NO_3^{2-} 31.B PF_5 32.C $^1H_1$
33.A ***Working:***
Observe $29^1H_1 + 36^1n_0 \rightarrow {}_{29}Cu^{65}$; By formula, $\Delta m = M_p + M_n - M$
Where $M_p = 29(1.007272) = 29.210888$, $Mn = 36(1.008668) = 36.312048$, $M = 65$
∴ $\Delta m = 29.210888 + 36.312048 - 65 = 0.522936$g/mole => A
34.C ***Working:*** From Q33 above, $\Delta m = 0.522936$g/mole.
By definition, Binding energy, $B.E = \frac{\Delta m}{\text{Mass No}} = 0.522936 = 8.045169231\times10^{-3}$g/mole
But $1g = 9\times10^{13}$J, ***therefore***, binding energy $= 8.045169231\times10^{-3}\times9\times10^{13} = 7.24\times10^{11}$J/mole
35.D $^{31}X_{16}$, $^{41}P_{26}$ 36.A $^{131}I_{53}$ 37.C Nuclear fusion
38.C $^{226}Ra_{88}$. Generally, Radium decays by alpha particle emission to form Radon
i.e $^{226}Ra_{88} \rightarrow {}^{222}Rn_{86} + {}^4He_2$
39.D ***Working:*** Equation of Reaction $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$
From equation: 16g/mole of CH_4 = 44g/mole of CO_2
∴ 8g of $CH_4 = \frac{44\text{g/mole} \times 8\text{g}}{16\text{g/mole}} = 22.0$g => D
40.B Neutron capture. Neutron capture is a nuclear reaction in which an atomic nucleus and one or more neutrons collide and merge to form a heavier nucleus. e.g $^{59}Co_{27} + {}^1n_0 \rightarrow {}^{60}Co_{27}$
41.A Energy released when atom disintegrate. Binding energy is the energy required to disassemble a whole system into separate parts. Often this means that energy is released upon the creation of a bound state. **Option A is Correct.**
42.C $F^-<O^{2-}<N^{3-}$. Generally, as one moves from left to right across a period in the periodic table, there is a decrease in the atomic radius WHILE down the group, atomic radius increases.
43.A This is a repeated Question. Go to Q26 (2013) Session for the working.
44.D S, Te. Since S and Te are in the same groups, they have similar chemical properties. **Option D is Correct** 45.D Li
46.D Tightly bound valence electrons
47.C Sulphur
48.B Group IVB and Period 6
49.B d block
50.(-). ***Answer*** = I, K, Li, C, F (or I<K<Li<C<F)

49. The block of elements to which the element number 27 belong is_____ a. s block b. d block c. p block d. f block e. none of the above

50. Arrange the following sets of elements in order of increasing electron affinities a. Li, K, C, F and I b. K, Li, C, I, F c. F, I, C, Li, K d. C, Li, K, F, I e. Li, C, K, I, F

Answers to 2015 ICH111 For Unizik Students - By Mr Ohms

1.A Ion-dipole force. Ion-dipole force is an intermolecular attraction between an ion (Na^+) and a polar molecule (dipole)like H_2O. e.g the force of attraction between Na^+ and H_2O molecule. i.e



2.B Valence electrons 3.C Valence theory and Molecular theory 4.C 109.5° 5.D One

6.A $FeCl_2$

Working: Given Fe^{2+} and Cl^-, we have Fe Cl ; ***therefore***, formula = $FeCl_2$. **Option A is Correct.**

7.A Copper (ii) Chloride and Iron (ii) Chloride

8.C ***Working:*** Observe PH_4^+, ***thus***;

1 P atom has 5 valence electrons = $5e^-$

4 H atoms have 1 valence electron = $4e^-$

-1 positive charge = $-1e^-$

Total = $8e^-$

therefore, the total number of valence electrons in PH_4^+ is 8. **Option C is Correct.**

9.D None of the above. All the **Options** from A to C are types of intermolecular forces.

10.B ***Working:*** Given N_2, since nitrogen molecule has 10 valence electrons, its Lewis structure is :N:::N: By formula, bond order = $\frac{\text{Number of shared pairs}}{\text{Number of linkages}} = \frac{3}{1} = 3 \Rightarrow B$

11.(-) All the options mention above are exceptions to the octet rule. An octet rule is the tendency of atoms to be stable with eight electrons in the outer most shell. There are three general exceptions to the octet rule. They are (i). Molecules such as NO, NO_2, N_2O with odd number of electrons (ii). Molecules in which one or more atoms possess more than eight electrons such as SF_6, PCl_5 and (iii). Molecules such as BeH_2, $BeCl_2$ and BF_3 in which one or more atoms possess less than eight electrons.

12.E William Ramsay

13.C ***Working:*** Observe $e = 9.1093897\times10^{-31}kg$, $p = 1.6726231\times10^{-27}kg$; ***thus***, the ratio of mass of electron to that of proton = $\frac{9.1093897\times10^{-31}}{1.6726231\times10^{-27}} = 5.446169971\times10^{-4} : 1$

Dividing through by 5.446169971×10^{-4} we have $1 : 1836.15 = 1 : 1836 \Rightarrow C$

14.B 0.53nm. According to 2010 CODATA, the Bohr radius has a value of $5.2917721092\times10^{-11}m$ (i.e approximately 53ρm or 0.53nm). **Option B is Correct.** 15.D Zero (0)

16.D Na, Cl, F, H (Increasing order of electronegativity). Electronegativity generally increases across the periodic table and decreases down the group. 17.A Principal quantum number

18.C ***Working:*** **Step 1:** Observe $CaCO_3 \rightarrow CaO + CO_2$; ***From equation:***

100g/mole of $CaCO_3$ = 44g/mole of CO_2

∴ 25g of $CaCO_3 = \frac{44g/mole}{100g/mole} \times \frac{25g}{1} = 11g$ of CO_2

Step 2: $CO_2 \rightarrow C + \frac{1}{2}O_2$; From equation 44g/mole of CO_2 = 12g/mole of C

∴ 11g of $CO_2 = \frac{12g/mole}{44g/mole} \times \frac{11g}{1} = 3g$ of carbon

tetraoxochlorate (v) d. tetraoxochlorate (vii)

26. The formular of stannous chloride is a. SnCl b. $SnCl_3$ c. $SnCl_2$ d. $SnCl_4$

27. The Lewis structure for NH_3 is a. b. c. d. 

28. Calculate the bond order of CO_3^{2-} a. 3 b. 4/3 c. 2/3 d. 2

29. Rank the following bonds in the order of increasing bond length HC≡CH, H_3C-CH_3, H_2C=CH_2 a. HC≡CH < H_3C-CH_3 < H_2C=CH_2 b. H_2C=CH_2 < H_3C-CH_3 < HC≡CH c. HC≡CH > H_2C=CH_2 > H_3C-CH_3 d. HC≡CH < H_2C=CH_2 < H_3C-CH_3

30. One of these is not examples of molecules with trigonal planar arrangement a. SO_3 and BF_3 b. NO_3^- and CO_3^- c. CO_2 and NO_3^{2-} d. BF^3 and CO_3^{2-}

31. One of this compound is an example of sp^3d hybridization a. PF_4 b. PF_5 c. PF_6 d. PF_3

32. What is the missing symbol in the nuclear equation: $^{23}Na_{11} + ? \rightarrow {}^{23}Mg_{12} + {}^{1}n_0$ a. $^{0}y_0$ b. $^{0}e_1$ c. $^{1}H_1$ d. $^{0}B_{-1}$

33. If, p = 1.007272, n = 1.008668. Calculate the mass defect in $^{65}Cu_{29}$ atom_____ a. 0.522936g b. 0.422936g c. 0.622936g d. 0.81436g e. none of the above

34. Also, the binding energy in $^{65}Cu_{29}$ is _____ a. 4.706×10^{15}J b. 4.706×10^{13}J/g c. 7.2406×10^{11}J/mole d. 4.706×10^{13}KJ/mole e. 1.66×10^{19}g

35. Which of the following set are isotones a. $^{23}X_{11}$, $^{40}P_{20}$ b. $^{31}X_{16}$, $^{43}P_{21}$ c. $^{12}X_6$, $^{24}P_{12}$ d. $^{31}X_{16}$, $^{41}P_{26}$ e. $^{16}X_8$, $^{17}P_8$

36. Which of the following radio nuclide has medical application a. $^{131}I_{53}$ b. $^{35}S_{16}$ c. $^{14}C_6$ d. $^{235}P_{92}$ e. $^{39}K_{19}$

37. The equation $^{2}H_1 + {}^{3}H_1 \rightarrow {}^{4}H_2 + {}^{1}n_0$ + energy represents a. nuclear fission b. electron capture c. nuclear fusion d. bombardment reaction e. none of the above.

38. Which of the following nuclide will decay by emitting alpha particle a. $^{17}N_7$ b. $^{39}K_{19}$ c. $^{226}R_{88}$ d. $^{142}Ba_{56}$ e. none of the above

39. What mass of CO_2 can be produced by reaction of 8.0g of CH_4 with 48g of O_2 a. 27.00g b. 30.10g c. 19.30g d. 22.0g e. 11.23g

40. The equation $^{142}Nd_{60} + {}^{1}n_0 \rightarrow {}^{143}Pm_{60} + {}^{0}B_{-1}$ are equation of a. gamma emission b. neutron capture c. neutron bombardment d. electron capture e. none of the above

41. Binding energy of an atom is _____ a. energy released when atom disintegrate b. energy released when two molecules bind c. energy absorbed when two molecules bind d. energy released when proton and neutron fuse together e. None of the above

42. Arrange these ions in order of increasing ionic radius O^{2-}, N^{3-}, F^-? a. O^{2-}<N^{3-}<F^- b. N^{3-}<F^-<O^{2-} c. F^-<O^{2-}<N^{3-} d. N^{3-}<O^{2-}<F^- e. F^-<N^{3-}<O^{2-}

43. The number of electrons in H^+, H and H^- are _____, _____ and _____ a. 0,1,2 b. 2,0,1 c. 0,2,1 d. 1,0,2

44. In which of the following pairs are the elements most similar chemically a. Li, C b. P, Al c. F, C d. S, Te e. P, S

45. From the following atoms: Ca, K, Be, Na & Li, which has the lowest ion ionization potential a. Ca b. Be c. Na d. Li e. K

46. Atoms with high first ionization energies always have a. low electron affinity b. large atomic radii c. Metallic properties d. tightly bound valence electrons e. None of the above

47. Which of the following has the largest radius? a. N b. Cl c. S d. F e. O

48. An atom with the valence shell configuration $6s^2$, $6p^2$ would be in a. Group VIA and period 4 b. Group IVB and period 6 c. Group IVA and period 4 d. Group VIB and period 6 e. Group IVA and period 6

NNAMDI AZIKIWE UNIVERSITY, AWKA
DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY 2014/2015 EXAMINATION
ICH 111: GENERAL BASIC INORGANIC CHEMISTRY:
INSTRUCTION: Answer All Questions. Write your registration number on your question paper and Submit both the OMR and the Question paper together. Indicate your question type. D

1. A type of force that result when an ion and polar molecule (dipole) attract each other is a. ion-dipole force b. ion-dispersion force c. dipole-dipole force d. Van der Waal force
2. The electrons which are involved in bond formation are found in the outermost shell of the neutral atoms are called a. Orbital electrons b. Valence electrons c. Octet electrons d. Bonding electrons
3. The two main theories of chemical bonding are a. Nuclear theory and Valence bond theory b. Atomic bond theory and Molecular orbital b. Valence bond theory and Molecular orbital theory d. Quantum theory and Valence bond theory.
4. The bond angle in SP^3 hybridization a. 120° b. 104.5° c. 109.5° d. 107.3°
5. In this equation $Cl + e^- \rightarrow Cl^-$, chlorine atom gains how many electrons to complete the octet structure a. two b. three c. 0 d. one
6. Write the correct formula of compound formed by combination of these ions Fe^{2+} and Cl^- a. $FeCl_2$ b. Fe_2Cl c. FeCl d. $FeCl_3$
7. The systematic names for cupric chloride and ferrous oxide are a. Copper (ii) chloride and ion (ii) chloride b. Copper (i) chloride and iron (ii) chloride c. Copper (ii) chloride and iron (I) chloride d. Copper (iii) chloride and iron (ii) chloride
8. The total number of valence electrons in PH_4^+ is a. 16 b. 18 c. 8 d. 32
9. All are intermolecular forces except a. London force b. dipole-dipole attraction c. hydrogen bond d. none of the above
10. The bond order of nitrogen molecule is a. 2 b. 3 c. 4 d. 1
11. One of these molecules is an exception to octet rule a. PCl_5 b. NO_2 c. BF_3 d. BeH_2
12. The following contributed to classification of elements except a. Prouts b. J. Newman c. Dobereinier d. Moseley e. William Ramsay
13. The ratio of mass of electron to mass of proton is a. 1:1 b. 1:2 c. 1:1836 d. 1:1000 e. 2:5
14. The distance of the 1st orbital from the nucleus is a. $10^2 \times 10^4$nm b. $10^1 \times 0.0532$nm c. 2.1×10^2nm d. 2.5nm e. 3.0×10^2nm
15. The number of electrons in the valence shell of the Na^+ is a. 1 b. 2 c. 8 d. 0 e. 10
16. The elements in increasing order of electronegativity is a. Na, H, Cl, F b. F, Cl, H, Na c. H, Na, Cl, F d. Na, Cl, F, H e. H, Na, Cl, F
17. The major energy level to which an electron in an atom belongs is determined by a. Principal quantum number b. Azimuthal quantum number c. Spin quantum number d. $E = mc^2$ e. Magnetic force.
18. 25g sample of pure Calcium carbonate contains-----g of Carbon a. 25 b. 3 c. 5 d. 6 e. 12
19. Isotopes arise as a result of differences in a. mass of protons b. mass of neutrons c. mass of electrons d. mass of orbital e. charge to mass ratio
20. As the electrons orbit the nucleus, the force that pulls the electron towards the nucleus is a. centrifugal force b. circular force c. gravitational force d. force of acceleration e. Coulmbic force
21. The centrifugal force on the electron is given by a. mvr b. mv^2/r c. nh^2 d. mr^2 e. mr^2v
22. The valency of Iodine, ordinarily is a. 0 b. 1 c. -1 d. -3 e. -2
23. $Na^+ + Cl^- \rightarrow Na^+Cl^-$, this reaction is a good example of a. covalent bonding b. electrovalent bonding c. dative bonding d. co-ordinate bonding
24. In covalent bonding, electrons are a. transferred from one electron to another b. shared between the atoms involved c. transferred and shared among the atoms c. none of the above
25. The IUPAC nomenclature for ClO_4^- is a. tetraoxochlorate (vii) b. tetraoxochlorate (vi) c.

thus, from equation (1), $4 = 14x2^{\frac{-t}{5730}}$; Solving, t = 10356years => A

30.B ***Working:***
Observe ½ - life = h = 28yrs, N_o = No, N_t = 10% of N_o = 10%N_o, t = time = ?

By formula, $N_t = N_o.2^{\frac{-t}{h}}$; $10\%N_o = N_o x 2^{\frac{-t}{28}}$; $0.1 = 2^{\frac{-t}{28}}$; Solving, t = 93years => B

31.C Valence electrons 32.B -3 33.B Electrovalent bonding 34.B X_1Y_2

35.D Conduct electricity when in molten form and crystalline compound

36.B Dative covalent bonding 37.A Cupper (i) chloride

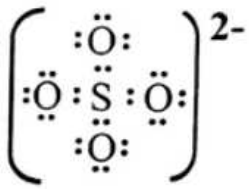
38.B ***Working:***
Observe $K_2Cr_2O_7$
Let the oxidation state (number) of Cr = x; i.e $2(+1) + 2x + 7(-2) = 0$; Solving, $x = 6$
therefore, the oxidation state (number) of chromium in $K_2Cr_2O_7$ is 6 => B

39.A $BaCrO_4$

40.A ***Working:***
Given SO_2, ***thus***,
1 S atom has 6 valence electrons = $6e^-$
2 O atom has 6 valence electrons = $12e^-$
Total = $18e^-$
therefore, the total valence electrons in SO_2 molecule is 18 => A

41.D None of the above, Since SO_2 displays the property of resonance, it doesn't have a true structure. **Option D is correct**. 42.B 3

43.C ***Working:*** Given So42-, its Lewis structure is



From the above structure, the number of share pairs (i.e bonded pairs) = 4 and the number o linkages (i.e number of oxygen atom that is connected to sulphur atom) = 4.
By formula, Bond Order = $\frac{\text{Number of share pairs}}{\text{Number of linkages}} = \frac{4}{4} = 1$ => C

44.C Odd system

45.C H-F < H-Cl < H-Br

46.C 180°

47.A PCl_5

48.B SP^3d

49.C Cl_2 and F_2

50.D Dipole-dipole force.

therefore, the answer = 2.2×10^{9}m/s and 5.5×10^{5}Volts.

12.B Wave velocity

13.(-) ***Working:***

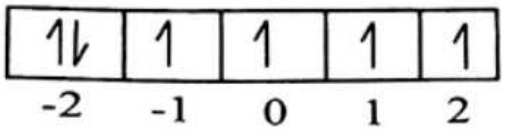
Observe that from 3rd lit e of Balmer series to 2nd line of Pfund series, n1 (3rd line of Balmer series) = 5 and n2 (2nd line of Pfund series) = 7.

By formula, $\frac{1}{\lambda} = \bar{V} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) = 10967900cm^{-1}\left(\frac{1}{5^2} - \frac{1}{7^2}\right) = 214970.84cm^{-1} \Rightarrow (-)$

Where $\bar{V}$ = wave number.

4.C ***Working:***

Observe $4d^6$



i.e $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 4S^2\ 3d^{10}\ 4P^6\ 5S^2\ 4d^6$.

From the above electronic configuration, the atomic number is 44 and the number of unpaired electrons is 4. ***Hence***, the number of paired electrons is (44-4)/2 = 20. ***therefore***, the number of paired electrons is 20 while the number of unpaired electrons is 4. ***thus***, the correct option is C.

15.A 44. The number of protons is also called atomic number. this occurs when the atom is electrically neutral. 16.C Hydrogen

17.D $Al^{3+} < Ca^{2+} < K^{+}$. **Option D is correct**. this is so because as one move across the period in the periodic table, there is a regular decrease in atomic radii.

18.(-) F < O < B < Na (Decreasing order)

19.D ***Working:***

Given $^{56}_{26}Fe^{3+}$, ***thus***, P = 26, n = 56-26 = 30, e = P - 3 = 26-3 = 23.***therefore***, answer = 26, 30 and 23. **Option D is correct**. 20.C 3rd orbit

21.C ***Working:***

Given $T^{½}$ = half-life = 192hrs = (192x60x60) = 691200secs

By formula, $T^{½} = \frac{0.693}{\lambda}$; Where λ = decay constant

thus, $\lambda = \frac{0.693}{T^{½}} = \frac{0.693}{691200sec} = 1.00\times10^{-6}sec^{-1} \Rightarrow C$

22.A ***Working:***

Observe $T^{½} = h = 14.3d$, N_t = final activity = 28.3μCi, N_o = initial activity = ?, t = 26days.

By formula, $N_t = N_o\,2^{\frac{-t}{h}}$; $28.3 = N_o.2^{\frac{-26}{14.3}}$; Solving, we have $N_o = 99.79\mu Ci$

thus, $N_o = 9.98\times10^{-5}Ci \Rightarrow A$

23.A ***Working:***

Observe $_{12}Mg + {}^{1}_{1}P \rightarrow {}^{2}_{2}He + {}^{a}_{a}X$

From the equation above, 12 + 1 = 2 + a, i.e a = 13 - 2 = 11. ***thus***, $_aX = {}_{11}X = Na \Rightarrow A$

24.A Decay constant 25.B Antoine-Henri Becquerel

26.B Ejection of electron from the nucleus 27.D In any medium 28. Affected by temperature

29.A 10356years

Working:

By formula, $N_t = N_o.2^{\frac{-t}{h}}$ _____ (1): Where h = ½-life = 5730years, N_o 14dpm, N_t = 4dpm, t = time = ?

36. The type of bonding in $[Cu(NH_4)^4]^{3+}$ is A. Covalent bonding B. dative covalent bonding C. ionic bonding D. metallic bonding.
37. The systematic names of Cuprous chloride is A. Cupper (i) chloride B. Cupper (ii) chloride C. Cupper (iii) chloride D. Cupper chloride.
38. The oxidation state of chromium in $K_2Cr_2O_7$ is A. 5 B. 6 C. 7 D. 9
39. The formula of Barium Chromate is A. $BaCrO_4$ B. BaCrO C. $BaCrO_2$ D. $BaCrO_5$
40. In drawing Lewis structure for SO_2 the total valency electrons in this compound is A. 18 B. 14
C. 20 D. 12
41. The structure of the SO_2 is A. O-S-O B. O=S-O C. O=S=O D. none of the above.
42. How many resonance hybrid will result in the structure of CO_3^{2-} A. 2 B. 3 C. 1 D. 4
43. What is the bond order in SO_4^{2-} A. 4 B. 2 C. 1 D. 3
44. One of the following is not an exception to octet rule A. electron deficient molecules B. odd-electron molecule C. odd system.
45. Arrange the following in the order of increasing bond strength H-Br, H-F, H-Cl A. H-Br < H-F < H-Cl B. H-Cl < H-F < H-Br C. H-F < H-Cl < H-Br D. H-Br<H-Cl<H-F
46. The bond angle in $BeCl_2$ is A. 90° B. 120° C. 180° D. 110.5°
47. Example of compound with Trigonal Biparamidal shape is A. PCl_5 B. BF_3 C. ClO_3 D. H_2O
48. PF_5 compound is an example of A. SP^3 B. SP^3d C. SP^3d^2 D. none of the above.
49. Non polar covalent molecules are A. HCl and F_2 B. HF and Cl_2 C. Cl_2 and F_2 D. Br & HF
50. The electrostatic attraction between molecules that are polar is A. ion-dipole B. Van der Waal force C. Dispersion force D. Dipole-dipole force.

Answers to 2014 ICH 111 - By Mr Ohms:

1.D All of the above 2.D atom 3.D neutrinos
4.B $1.67x10^{-27}$kg. Generally, 1amu is equivalent to $1.67x10^{-24}$g, converting to kg, we have $1.67x10^{-27}$kg. **Option B is correct.**
5.C Isotopes
6.D ***Working:***
Let the % abundance of $Cl^{37} = x\%$ and that of $Cl^{35} = (100-x)\%$
i.e

Cl^{35} ,	Cl^{37}
$(100-x)\%$	$x\%$

But relative atomic mass of Cl = 35, this implies that $35.5 = \left(\frac{100-x}{100}\right) \times 35 + \left(\frac{x}{100}\right) \times 37$

thus, $x = 25\%$

therefore, the % abundance of Cl^{37} is 25%. ***hence***, the correct option is D.
7.B 24 8.C Thomson 9.C Fractional distillation
10.B Isotones. Isotones are atomic species having the same neutron number but different mass number. (or nucleon number). E.g $_{14}Si^{30}$, $_{15}P^{31}$, $_{16}S^{32}$

11.B ***Working:***
Observe e/m = $1.76x10^8$C/g, magnetic field strength, B = 2.5T, r = radius = 0.05m = 5cm.
From the relation, $\frac{e}{m} = \frac{E}{B^2r}$; .i.e $E = \frac{e}{m} \times B^2r = 1.7x10^8 \times (2.5)^2 \times 5 = 5.5x10^9$Volts
Also, by formula $V = \frac{E}{B} = \frac{5.5x10^9}{2.5} = 2.2x10^9$m/s

series ($R_H = 109679m^{-1}$) is A. $3805.86cm^{-1}$ B. $38058.6cm^{-1}$ C. $380586cm^{-1}$ D. $6250cm^{-1}$

14. An element has last orbital designated as $4d^6$, the number of paired and unpaired electrons are respectively A. 22 & 4 B. 21 & 4 C. 20 & 4 D. 22 & 2

15. The number of protons in the element with last orbital designated as $4d^6$ is A. 44 B. 42 C. 46 D. 48

16. William Prout 1785-1850 stated that all elements were made from whole number of _____ atom. A. Helium B. Lead C. Hydrogen D. none of these.

17. Arrange the following ions in order of increasing atomic radii K^+, Ca^{2+} & Al^{3+} A. $K^+ > Ca^{2+} > Al^{3+}$ B. $K^+ < Ca^{2+} < Al^{3+}$ C. $Al^{3+} > Ca^{2+} > K^+$ D. $Al^{3+} < Ca^{2+} < K^+$

18. Arrange the following in order of decreasing electronegativity B, Na, F & O A. B<Na<F<O B. B>Na>F>O C. Na<B<O<F D. Na>B>O>F

19. The number of protons, neutrons & electrons for the element 5626Fe3+ are respectively A. 30, 26 and 3 B. 56, 26 & 3 C. 26, 30 & 3 D. 26, 30 & 23.

20. A line in Paschen series is obtained when an electron in higher energy level returns to A. 1st orbit B. 2nd orbit C. 3rd orbit D. 4th orbit.

21. Calculate the decay constant of I-131 if the half-life is 192hours A. $3.61x10^{-3}s^{-1}$ B. $4.18x10^{-8}s^{-1}$ C. $1.00x10^{-6}s^{-1}$ D. $3.61x10^{-6}s^{-1}$.

22. Phosphorus-32, whose half-life is 14.3days, was found to have activity of 28.3μCi after 26days. Calculate its original activity. A. $9.98x10^{-6}$Ci B. $9.76x10^{-6}$Ci C. $9.98x10^{-6}$μCi D. $9.76x10^{-6}$μCi.

23. $Mg + {}^{1}_{1}P \rightarrow He + X$ A. Na B. Al C. C D. S

24. The decay rate of a radioactive sample is also known as it's A. decay constant B. amount of radioactive material C. half-life D. activity.

25. Radioactivity was first discovered by A. Marie Curie B. Antoine-Henri Becquerel C. Arrhenius D. Rutherford.

26. Beta-decay occurs as a result of one of these A. expulsion of a b-particle in the nucleus B. ejection of electron from the nucleus C. conversion of a neutron into a proton D. ejection of electron from the shell.

27. The unit of Roentgen is used for the following except A. measure exposure B. -rays C. X-rays D. in any medium.

28. Artificial radioactivity is not A. a nuclear reaction B. spontaneous C. accompanied by large energy changes D. affected by temperature.

29. A sample of 14 carbon, whose half-life is 5730 years has activity of 14 disintegration per minute (dpm), per gram of natural carbon. An artefact is found to have radioactivity of 4dpm per gram of its present carbon, how old is the artefact? A. 10358years B. 10258years C. 11360years D. 11358years.

30. Strontium-90 has half-life of 28years. What time is needed for the activity to fall to 10% of the original A. 121years B. 93years C. 96years D. 123years.

31. The electron which are involved in bond formation between atoms are found in the outermost shell of the atom and these are called A. bonding electrons B. lone pair electrons C. valence electrons D. valency number.

32. What is the valency number of this element with electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$. A. +3 B. -3 C. +5 D. -5

33. An atom with valency number +2 react with another atom Y that is having -1 as valency number. What type of bonding is formed. A. covalent bonding B. electrovalent bonding C. dative bonding D. hydrogen bonding.

34. The chemical formula of the compound formed in question 33 is A. X_2Y_1 B. X_1Y_2 C. XY D. X_2Y_3.

35. One of these is not a characteristic of covalent compound. A. low boiling point and melting point B. non conductors of electricity and low melting point C. low boiling point and amorphous compound D. conduct electricity when in molten form and crystalline compound

34 D ***Working:***
Observe $N_o = 100\%$, $N_t = 62.0\%$, ½ - life = h = 5730years, t = ?

By formula, $N_t = N_o \cdot 2^{\frac{-t}{h}}$; $62\% = 100\% \times 2^{\frac{-t}{5730}}$; $0.62 = 2^{\frac{-t}{5730}}$

Taking log of both sides, we have t = 3950yrs => D

35.A ***Working:***
Observe $^{59}Co_{27} + {}^{1}n_0 \rightarrow {}^{25}Mn_{56} + {}^{4}He_2$

Hence, the neutron bombardment of Co-59 produces Mn-56. ***thus***, the correct option is A

36.A Alpha decay

37.A The Curie. Generally, the unit of radioactivity is the Curie which is defined as the quantity of any radioactive isotope in which the number of disintegrations is 3.7×10^{10} per second.

38.B Electrovalent bond 39.B Shared between the atoms involved 40.A Tetraoxochlorate (vii)

41.C $SnCl_2$ (Stannous chloride) 42.C CO_2 and NO_3^{2-} 43.B PF_5 44.A ion-dipole force

45.B ***Working:***
Observe n = 3
By formula, the maximum number of electrons in each shell = $2n^2$
Now, for n = 1, we have $2n^2 = 2(1)^2 = 2$
For n = 2, $2n^2 = 2(2)^2 = 8$; For n = 3, $2n^2 = 2(3)^2 = 18$.
therefore, the maximum number of electrons in the atom is 2 + 8 + 18 = 28 electrons => B

$Bc = \frac{mv}{r}$

NNAMDI AZIKIWE UNIVERSITY, AWKA.
PURE AND INDUSTRIAL CHEMISTRY DEPARTMENT. FIRST SEMESTER 2013/ 2014 EXAMINATION: BASIC INORGANIC CHEMISTRY: COURSE CODE: ICH 111: PAPER TYPE D: ANSWER ALL QUESTIONS: SUBMIT BOTH YOUR QUESTION PAPER & OMR SHEET: TIME: IHR.

Name: _____ **Reg No:** _____ **Dept:** _____

1. Chemistry deals with the study of A. matter B. atoms C. elements D. all of the above.
2. The basic structural unit of an element is A. proton B. neutron C. electron D. atom
3. Which of the following is a non fundamental particle of an atom A. proton B. neutron C. electron D. neutrinos.
4. One atomic mass unit (amu) is equivalent to _____ A. 1.67×10^{-21}Kg B. 1.67×10^{-27}kg C. 1.67×10^{-23}kg D. 1.67×10^{-24}kg.
5. Elements with different neutron numbers but same protonic number are called A. isobars B. isotones C. isotopes D. isomers
6. Chlorine contains two isotopes with mass number 35 and 37 with relative atomic mass of 35.5. The % abundance of ^{37}Cl is A. 75 B. 35 C. 45 D. none of the above
7. All the following are proton magic numbers except A. 20 B. 24 C. 28 D. 50
8. _____ was the first person to perform experiment on positive rays between 1910 and 1912 A. Rutherford B. Einstein C. Thompson D. none of the above.
9. The isotopes D_2O & H_2O can be separated by A. thermal diffusion B. electromagnetic separation C. fractional distillation D. gaseous diffusion
10. Elements with the same number of neutrons but different nucleon numbers are A. isobars B. isotones C. isotopes D. isomers.
11. If the e/m = 1.76x108C/g with magnetic field strength of 2.5T and radius of the circular path is 0.05m, the velocity and electric field strength are respectively A. 5.5×10^9m/s & 2.2×10^9V B. 2.2×10^9m/s & 5.5×10^9V C. 2.2×10^7m/s & 5.5×10^9V D. 5.5×10^9m/s & 2.2×10^7V.
12. The wave motion of electrons emitted from heated surfaces is characterized by A. atomic number B. wave velocity C. protonic number D. nucleon.
13. The wave number of an electron excited from 3rd line of Balmer series to 2nd line of Pfund

The electronic configuration of the element is $1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^{10}, 4P^6, 5S^2, 4d^5$. ***thus,*** atomic mass of the element is 47.

14 C ***Working:***
By formula, magnetic moment = $\sqrt{n(2n+1)}$
Where n = number of unpaired electrons = 1

therefore, Magnetic Moment = $\sqrt{1[2(1)+1]}$ = 1.732BM => C

15.B ***Working:***
Number of electrons in the penultimate shell is 17 (i.e $4S^2, 4P^6, 4d^9$) => B

16 A Li, Na, K, Rb

17 C

18 C Electron is added to a more stable orbital in N than in P

19 D Difference in nuclear charge

20 D High

21 D P^{3-}

22 D S, Te

23 B Cl, Ca^{2+}, K^+, Au

24 D William Ramsay

25 D 12

26 D ***Working:***
Observe H^+, H, H^- ≡ $^1_1H^+$, ^1_1H, $^1_1H^-$
For $^1_1H^+$, e = 1-1 = 0 ; For ^1_1H, e = P = 1 ; For $^1_1H^-$, e = 1+1 = 2
thus, we have **0, 1, 2** as the ***answer*** => C

27 D 14

28 A The rate of reaction is increased by increase in temperature

29 D Fusion

30 C ***Working:***
Given, ½ - life = h = 28yrs, $N_o = N_o$, N_t = 10% of N_o = 10%N_o, t = ?

By formula, $N_t = N_o.2^{\frac{-t}{h}}$; $10\%N_o = N_o.2^{\frac{-t}{28}}$; $0.1 = 2^{\frac{-t}{28}}$
Taking log of both sides, we have t = 93yrs => C

31 D ***Working:***
Given $N_o = 2.5x10^9$d/s, N_t = ?, t = 2weeks = 14days = (24x14)hrs = 336hrs, h = 15hrs

By formula, $N_t = N_o.2^{\frac{-t}{h}} = 2.5x109 \times 2^{\frac{-336}{15}} = 4.5x10^2$d/s => D

32 C ***Working:***
N_o = 100mCi, N_t = ?, ½ - life = h = 14.3days, time = t = July2 to July 28 = 26days.

By formula, $N_t = N_o.2^{\frac{-t}{h}} = 100mCi \times 2^{\frac{-26}{14.3}} = 28.3mCi = 28.3\mu Ci$ => C

33 A ***Working:***
By formula, $T^{½} = \frac{0.693}{\lambda}$

But $T^{½}$ = 5730yrs, converting $T^{½}$ = 5730yrs to seconds, we have
(5730 x 365 x 24 x 60 x 60)seconds = 1.8070128×10^{11}secs

=> $\lambda = \frac{0.693}{1.8070128x10^{11}secs} = 3.835x10^{-12}$per sec => A

Let the % of isotope 37 = x% and that of isotope 35 = (100-x)%
i.e

Cl^{35} , Cl^{37}
(100-x)% x%

thus, RAM = $\left(\frac{100-x}{100}\right) \times 35 + \left(\frac{x}{100}\right) \times 37$; $35.5 = \frac{3500 - 35x + 37x}{100}$

i.e $x = 25$
therefore, ratio of 35 to 37 is 75% : 25% = 3:1 => D.

6C ***Working:***
Let Cu^{65} = x% and Cu^{63} = (100-x)%

thus, RAM = $\left(\frac{100-x}{100}\right) \times 63 + \left(\frac{x}{100}\right) \times 65$; $63.54 = \frac{6300 - 63x + 65x}{100}$

i.e $x = 27$
thus, Cu^{65} = 27% and Cu^{63} = 100 - 27 = 73%. ***therefore***, **answer = 27 & 73** => C

7. Bonus, ***no answer***. All the **options** above are method/ways of separation of **isotopes**.

8.C Isotones

9.C ***Working:***
Observe $29^1H_1 + 35^1n_0 \longrightarrow {}_{29}Cu^{64}$
By formula, $\Delta m = M_p + M_n - M$
Where $M_p = 29(1.0075) = 29.2175$, $M_n = 35(1.0089) = 35.3115$, $M = 63.55$
∴ $\Delta m = 29.2175 + 35.3115 - 63.55 = 0.979$g/mole
By definition, B.E = $\frac{\Delta m}{\text{Mass number}} = \frac{0.979}{64} = 1.53\times10^{-2}$g/mol
But 1g = 9×10^{13}J
therefore, Binding energy/nucleon = $1.53\times10^{-2} \times 9\times10^{13} = 1.37\times10^{12}$J/mol => C

10.D ***Working:***
Observe $\frac{e}{m} = 1.76\times10^{8}$c/g ; But B = 2.5T, r = 0.05m = 5cm
By formula, $\frac{e}{m} = \frac{E}{B^2r}$; Making E the subject formula, we have $E = B^2\frac{e}{m}r = 2.5^2 \times 1.76\times10^{8} \times 5$

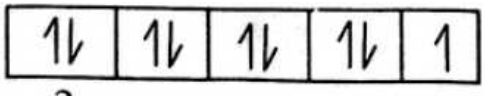
therefore, E = 5.5×10^{9}volts => D

11.B ***Working:***
From 2nd line of Balmer series to 1st line of Brackett series, we have $n_1 = 4$, $n_2 = 5$ respectively.

By formula, $\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$; $\frac{1}{\lambda} = 109737\left(\frac{1}{4^2} - \frac{1}{5^2}\right)$; ***therefore***, $\lambda = 4.05\times10^{-4}$m => B

12.A ***Working:***
Given

$4d^9$



From the diagram above, the number of unpaired electrons is 1(one).

13.C ***Working:***

Cl^-, Ca^{2+}, K^+, Au C. Ca^{2+}, Au, K^+, Cl^- D. Ca^{2+}, Cl^-, Au, K^+

24. The following contributed to classification of elements except A. Prouts B. Newland C. Moseley D. William Ramsay.

25. The lightest atom having the ground state EC n-1(d^8) ns^2 would be found in group _____ of the periodic table. A. 2 B.3 C. 10 D. 12

26. The number of electrons in the species; Hb, H and H- are _____, _____ and _____ respectively. A. 2, 1, 2 B. 2, 0, 1 C. 0, 1, 2 D. 0, 2, 0

27. The maximum number of electron that can be accommodated in a sub shell for which L=3 is _____ A. 2 B. 10 C. 6 D. 14

28. Nuclear reactions involve all except one of theses. A. the rate of reaction is increased by increase in temperature B. redistribution of nuclear particles C. release of great amount of energy D. formation of new elements.

29. Non-radioactive products are formed during A. fission B. chain reaction C. alpha decay D. fusion

30. Strontium-90 has a half-life of 28years. Calculate the time needed for the activity to fall to 10% of the original. A. 121years B. 24years C. 93years D. 105years.

31. If a patient is injected with $^{24}NaCl$ solution having activity of 2.5×10^9d/s, how much of the activity is present in the patient's body and excreted fluids after two weeks. Half-life of ^{24}Na is 15hours. A. 3.0×10^7d/s B. 3.5×10^2d/s C. 4.5×10^7d/s D. 4.5×10^2d/s

32. A solution containing Phosphorus-32 has activity of 100mCi on July 2, how much activity remains on July 28 if the half-life of phosphorus-32 is 14.3days. A. 27.3μCi B. 26.3μCi C. 28.3μCi D. 25.3μCi

33. Carbon-14 has a half-life of 5730years. Find the decay constant for this element. A. $3.836\times10^{-12}s^{-1}$ B. $3.836\times10^{-13}s^{-1}$ C. $1.209\times10^{-4}s^{-1}$ D. $2.502\times10^{-4}s^{-1}$.

34. A sample has a carbon-14 activity of 62.0% that of carbon-14 in living plants. Assuming that abundance of carbon-14 had been constant for the past few years, how old is the sample? (half life of carbon-14 is 5730years). A. 4000years B. 4105years C. 3905years D. 3950years.

35. Neutron bombardment of Co-59 produces A. Mn-56 B. Mg-56 C. C-14 D. C-12.

36. The Co-59 that was bombarded is said to have had A. alpha decay B. beta-decay C. gamma-decay D. neutron decay.

37. The SI unit of radioactivity is A. the Curie B. the Becquerel C. disintegration per minute D. micro Curie.

38. $Na^+ + Cl^- \rightarrow Na^+Cl^-$, this reaction is a good example of A. covalent bonding B. electrovalent bonding C. dative bonding C. co-ordinate bonding.

39. In covalent bonding, electrons are A. transferred from one atom to another B. shared between the atoms involved C. transferred and shared among the atoms D. none of the above.

40. The IUPAC nomenclature for ClO_4^- is A. tetraoxochlorate (vii) B. tetraoxochlorate (vi) C. tetraoxochlorate (v) D. tetraoxochlorite (vii).

41. The formula of stannous chloride is A. SnCl B. $SnCl_3$ C. $SnCl_2$ D. $SnCl_4$.

42. One of these are not examples of molecules with trigonal planar arrangement. SO_3 and BF_3 B. NO_3^- and CO_3^- C. CO_2 and NO_3^{2-} D. BB_3 and CO_3^{2-}.

43. One of this compound is an example of SP^3d hybridization A. PF_4 B. PF_5 C. PF_6 D. PF_3.

44. A type of force that result when an ion and polar molecule (dipole) attract each other is A. ion-dipole force B. ion-dispersion force C. dipole-dipole force D. Van der Waal force.

45. What is the maximum number of electrons in an atom with highest principal quantum number 3. A. 82 B. 28 C. 32 D. 23

NNAMDI AZIKIWE UNIVERSITY, AWKA
PURE AND INDUSTRIAL CHEMISTRY DEPARTMENT: FIRST SEMESTER 2012/2013 EXAMINATION: SHADE YOUR PAPER TYPE: TYPE: TYPE A: COURSE TITTLE: BASIC INORGANIC CHEMISTRY: COURSE CODE: ICH 111.
ANSWER ALL QUESTIONS: SUBMIT BOTH YOUR QUESTION PAPER & OMR SHEET: TIME: 1HR
Name: _____ **Reg No:** _____ **Dept:** _____

1. An element is a pure homogeneous substance which is made up of only one type of A. electron B. neutron C. proton D. atom
2. Which of the following is not a fundamental component of atom. A. proton B. neutron C. electron D. none of theses.
3. The number of neutrons, electrons and protons in $^{1}H_{1}$ are respectively A. 1, 1 & 1 B. 1, 0 & 1 C. 1, 1 & 0 D. 0, 1 &1
4. Which of the following is not an isotope of hydrogen A. deuterium B. proton C. protium D. tritium
5. Chlorine contains two isotopes with mass numbers 35 & 37 with relative atomic mass of 35.5, the ratio of the percentage of the isotopes 35 & 37 in the sample are respectively A. 25:1 B. 1:25 C. 1:3 D. 3:1
6. If the relative atomic mass of natural copper is 63.54, the relative abundances of the isotope $^{65}Cu_{29}$ and $^{63}Cu_{29}$ are respectively A. 63 & 65 B. 65 & 63 C. 27 & 73 D. 73 & 27
7. All the following are ways of separation of isotope Except A. gaseous diffusion B. thermal diffusion C. fractional diffusion D. electrolysis
8. The existence of two or more elements with the same neutron number but different nucleon number is A. isotope B. isobar isotone D. isoelectronic
9. _____ is the binding energy in S.I unit per nucleon for $^{64}Cu_{29}$ given that Cu = 63.55g/mol, proton = 1.0075g/mol, neutron = 1.0089g/mol & 1g = binding energy of $9x10^{13}$J. A. $1.53x10^{-2}$J/mol B. $9.79x10^{-2}$J/mol C. $1.37x10^{12}$J/mol D. $1.53x10^{1}$J/mol
10. If the e/m = 1.76x10bC/kg, the magnetic field strength is 2.5T and the radius of circular path described by the electron in the magnetic field is 0.05m, the electric field strength is A. $5.5x10^{6}$V B. $5.5x10^{-6}$V C. $5.5x10^{-9}$V D. $5.5x10^{9}$V.
11. The wavelength of an electron excited from the second line of Balmer to first line of Brackett series from hydrogen spectrum is _____ . Where R_H is 109737cm^{-1}. A. $4.05x10^{-4}$m B. $4.05x10^{-6}$m C. $4.05x10^{-2}$m D. $4.86x10^{-5}$m.

Use the information below to answer questions 12-15:
The last shell of a given element has orbital designate $4d^9$.

12. How many unpaired electrons are present in the element. A. 1 B. 2 C. 3 D. 4
13. What is the atomic mass of the element. A. 45 B. 46 C. 47 D. 48
14. What is the magnetic moment. A. 2.0BM B. 3.16BM C. 1.73BM D. 6.0BM
15. How many electrons are in the penultimate shell? A. 9 B. 17 C. 10 D. none of these.
16. Arrange these elements in order of decreasing ionization energy. A. Li, Na, K, Rb B. Rb, Na, K, Li C. K, Li, Na, Rb D. Na, Li, K, Rb
17. The effective nuclear charge for the 2p valence electron in oxygen is A. 4.55 B. 3.45 C. 1.75 D. 1.70
18. The electron affinity of the N atom is more than the P atom because A. electron is added to a stable orbital in P than in N atoms B. electron is added to ionic orbital in P than in N C. electron is added to a more stable orbital in n than in P D. orbitals of P and N have different sizes but of equal stability.
19. The difference in the sizes of Be^{2+} and Li^{+} is due to A. difference in $1s^2$ electrons B. difference in electronic configuration C. difference in shielding D. difference in nuclear charge.
20. Ionic bond forms when difference in electronegativity of the combining elements is _____ A. equal B. low C. unequal D. high
21. The following species are isoelectronic except, P^{3+}, S^{2-}, Cl^{-}, Ar, K^{+}, Ca^{2+} A. Ar B. S^{2+} C. Cl^{-} D. P^{3+}
22. In which of the pair are the elements most similar chemically A. Li, C B. P, Al C. F, C D. Si, Te
23. Arrange the following in order of increasing size; Ca^{2+}, K^{+}, Au and Cl^{-} A. Cl^{-}, Au, K^{+}, Ca^{2+} B.

Where n = 4 (i.e number of unpaired electrons)

=> Magnetic Moment = $\sqrt{4(2(4)+1)}$ = 6.00 => B

33.A Lyman

35.A H atom

36.A $2n^2$

37.A 1

38.C Hund's rule

39.B 3

40.C J. J Thomson

41.A Same

42.B Isobars

43.B Na^+, Mg^{2+}, Al^{3+}

44.B Isobars

45.D All

46.C Tritium

Working:

Tritium = $^3H_1$, ***thus***, p = 1, n = 3-1 = 2

Hence, the difference between the number of neutrons and protons = 2-1 = 1 (i.e +ve)

47.D ***Working:***

By formula, $\Delta x.\Delta p = \frac{h}{2\pi}$; => $\Delta p = \frac{h}{\Delta x.2\pi} = \frac{6.62 \times 10^{-34}}{10^{-6} \times 2 \times 3.142}$

$= 1.05 \times 10^{-28}$Ns => D

48.D Same

49.D ***Working:***

By formula, $\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

But $n_1 = 2$, $n_2 = 3$

therefore, $\frac{1}{\lambda} = 109677\left(\frac{1}{2} - \frac{1}{3}\right)$

thus, $= 5.46 \times 10^{-5}$cm => D

50.A ***Working:***

Observe $2^1H_1 + 2^1n0 \longrightarrow {}^4H_2$

By formula, $\Delta m = M_p + M_n - M$

Where $M_p = 2(1.0081) = 2.0162$, $M_n = 2(1.0089) = 2.0178$, M = 4.0026

therefore, $\Delta m = 2.0162 + 2.0178 - 4.0026 = 0.0314$amu

Hence, binding energy = 0.0314 x 931 = 29.2334Mev

i.e the ***answer*** = 0.0314amu and 29.2334Mev. ***thus***, the correct option is A.

4.D Atomic mass to decrease by 4

5.A Does not occur spontaneously

6.B ***Working:***

Observe $^{59}Co_{27} + {}^{1}n_{0} \longrightarrow {}^{56}Mn_{25} + {}^{4}He_{2}$

thus, the answer is alpha particle => B

7.D None of the above

8.A Working:

By formula, $T^{1/2} = \frac{0.693}{\lambda}$

But $T^{1/2}$ = 5730yrs, converting $T^{1/2}$ = 5730yrs to seconds, we have

(5730 x 365 x 24 x 60 x 60)seconds = 1.8070128×10^{11}secs

$\Rightarrow \lambda = \frac{0.693}{1.8070128 \times 10^{11}\text{secs}} = 3.835 \times 10^{-12}$per sec

9.D Decay constant

10.A Curie

11.B S-F < S-C < S-Br

12.A 180^{0}

13.B C_2H_4

14.B HF and Hcl

15.E None of the above

16.D ClO_4^-

17.A 26

18.C 3

19.D Dinitrogen (iv) oxide

20.B M_2X_3

21.A Ba < Ca < Mg < Be

22.D H^-

23.C F^-, Cl^-, Br^-, I^-

24.B Na

25.C Mg

26.D Greater repulsion between P-electrons and stability of half filled P

27.C 32

28.(-)

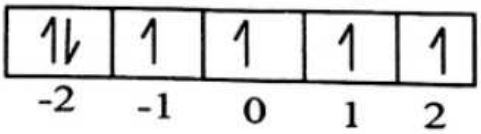
29.A Sb

30.A Moseley H.G.J law

31.B ***Working:***

Observe

$5d^6$



i.e $5d^6 = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}, 5p^6, 6s^2, 4f^{14}, 5d^6$

From the above, the atomic number is 76 and the number of unpaired electrons is 4.

therefore, the number of paired electrons is (76-4)/2 = 36

32.(-)

33.B ***Working:***

Magnetic moment = $\sqrt{n(2n+1)}$

45. Which of the following is isoelectronic with Cl^- A. S^{2-} B. P^{3-} C. K^+ D. All

46. The difference between the number of neutrons and protons is positive for A. hydrogen atom B. deuterium C. tritium D. all

47. Calculate the uncertainty in the momentum of electron, if the uncertainty in the position is 10^{-6}m ($h = 6.624 \times 10^{34}$Jsec, $Me = 9.1 \times 10^{-31}$kg). A. 5.27×10^{-28}Ns B. 6.86×10^{-28}Ns C. 2.00×10^{-28}Ns D. none of these

48. The energy of electrons in an atomic orbital is always A. different B. zero C. infinite D. same

49. Calculate the wavelength of the first line in Balmer series of hydrogen spectrum ($R = 109677cm^{-1}$) A. $1215cm^{-1}$ B. $12.15cm^{-1}$ C. $121.5cm^{-1}$ D. none of these

50. The mass defect and the binding energy of $^4He_2$ which has isotopic mass of 4.0026amu are respectively ($^1H_1 = 1.0081$amu, $^1n_o = 0089$amu) A. 0.0314amu & 29.249Mev B. 0.314amu & 29.249Mev C. 0.0314amu & 292.49Mev D. 31.4amu & 29.249Mev

Answers to 2012 ICH 111 (2011/2012 Session) For Unizik Students - Mr. Ohms

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1.A ***Working:***

By formula, $N_t = N_o.^{\frac{-t}{2}}$

Where $N_o = 1.2x10^{12}$d/s, h = ½-life = 20yrs, t = 49yrs, N_t = ?

this implies that, $N_t = 1.2x10^{12} \times 2^{\frac{-49}{29}} = 3.72 \times 10^{11}$d/s => A

2.C ***Working:***

Observe $N_o = 1.00$g, $N_t = 0.786$g, $t = 3.154 \times 10^8$secs, h = ½-life = ?

By formula, $N_t = N_o.\ 2^{\frac{-t}{h}}$, i.e $0.786 = 1x2^{\frac{-3.154x10^8}{h}}$

Taking log of both sides, we have

$\log 0.786 = \log 2^{\frac{-3.154x10^8}{h}}$

therefore, h = 908472727.3secs.

Converting h = 908472727.3secs to yrs, we have $\left(\frac{908472727.3}{60x60x24x365}\right) = 29$yrs => C

3.C ***Working:***

$N_o = 100\%$ or $N_o = N_o$, $N_t = 38\%$ of $N_o = 38\%$No, h = 5730yrs

By formula, $N_t = N_o.^{\frac{-t}{25730}}$

Taking log of both sides,

$\log 0.38 = \log 2^{\frac{-t}{5730}}$

therefore, t = 7996yrs => C

29. Which of the following elements is used as a semi conductor Sb, Ne, Ag, Au. A. Sb B. Ne C. Ag D. Au

30. The square root of the characteristic frequency of X-ray from an element is a linear function of its atomic number. This is known as A. Mosley H.G.D law B. John Newman Law C. D. Mendeleefs Law D. John Deberenier law

An element Y with last orbital designate $5d^6$ has the following characteristic.

31. Y has ----- unpaired electrons A. 3 B. 4 C. 5 D. 6.

32. Y has ----- paired electrons A. 40 B. 44 C. 38 D. 32

33. The magnetic moment of Y in BM is A. 4.58 B. 6.00 C. 3.16 D. 7.42

34. In the spectrum of hydrogen atom the series which falls within the ultraviolent region is A. Lyman B. Balmer C. Paschen D. Brackett

35. The spectrum of hydrogen is expected to be similar to that of A. H atom B. Li atom C. Li^+ ion D. Na^+ ion

36. The maximum no of electrons that can be accommodated in an orbit is A. $2n^2$ B. 2n+1 C. n^2 D. 2n

37. The value of azimuthal quantum number for last electron of N atom is A. 1 B. 2 C. 5 D. 7

38. If the electronic configuration of N atom is $1S^2$, $2S^2$, $2Px^2$, $2Py^1$, it would violate A. Aufbau Principle B. Paulis Exclusion principle C. Hunds rule D. none of these

39. If the value of azimuthal quantum no is one, there will be ------ values of magnetic quantum no. A. 1 B. 3 C. 5 D. 7

40. The charge to mass ratio (e/m) of electron was measured by A. E. Rutherford B. R. A Milikan C. J.J. Thomson D. none of these

41. Isotopes has -------- chemical properties. A. same B. similar C. different D. none of these

42. $^{24}Na_{11}$ and $^{24}Mg_{12}$ are related to each as A. isotopes B. isobars C. isotones D. none of these

43. The set of isoelectronic species is A. Na^+, Ne, Mg^+ B. Na^+, Mg^{2+}, Al^{3+} C. Na^+, K^+, Ne D. Ne, Cl^-, Na

44. The nuclei which is not identical but have the same number of nucleons, are called A. isotopes B. isobar C. isotones D. isoelectronic

13. One of these compounds is not Sp hybridization A. C_2H_2 B. C_2H_4 C. CH_4 D. BeH_2 E. $BeCl_2$.

14. Which of these compounds are polar covalent molecules A. H_2O and Cl_2 B. HF and HCl C. H_2 and HCl D. F_2 and HCl E. H_2O and H_2

15. Which of the following are not in the Lewis structures for exception to octet rule A. electron deficient molecules and odd electron molecules B. odd electron molecules and expanded valence shell C. expanded valence shell and electron deficient molecules D. Expanded valence shell and Resonance E. none of the above.

16. The formula for per chlorate is A. ClO^- B. ClO_2^- C. ClO_3^- D. ClO_4^- E. OCl_2^-

17. The total number of electrons in ClO_3^- A. 26 B. 25 C. 24 D. 22 E. 32 .

18. The number of bonding pairs in N_2 is A. 1 B. 2 C. 3 D. 5 E. 0 .

19. The IUPAC name for N_2O_4 is A. Nitrogen (ii) oxide B. dinitrogen oxide C. nitrogen (iv) oxide D. Dinitrogen (iv) oxide E. Dinitrogen (iii) oxide

20. The formula of a compound form between a metal M with atomic number 13 and non metal X with atomic number 8 is A. $M_{13}X_8$ B. M_2X_3 C. M_3X_2 D. MX E. M_8X_{13}

21. Arrange Be , Ba, Ca, & Mg in order of increasing electronegativity A. Ba, Ca, Mg, Be B. Ba, Be, Ca, Mg, C. Mg, Be, Ba, Ca D. Ba, Ca, Be, Mg.

22. Which of H^+, H and H^- is the largest in size A. None B. H C. H^+ D. H^-

23. Arrange the following sets of anions in order of increasing ionic radii F^-, I^-, Cl^-, Br^- A. I^-, Br^-, Cl^- F^-, B. Cl^-, Br^-, I^-, F^- C. F^-, Cl^-, Br^-, I^- D. I^-, Br^-, F^-, Cl^- .

24. All but one of the following species are isoelectronic, O^{2-}, F^-, Ne, Na, Mg^{2+}, Al^{3+} A. Mg^{2+} B. Na C. F^- D. Al^{3+}.

25. Which of Mg, Al, Ar & Na will have more positive electron affinity A. Al B. Ar C. Mg D. Na .

26. The first ionization energy of group VA elements are higher than group VIA elements in the same period because ____ A. greater attraction of P-electrons B. greater stability of P-electrons C. greater repulsion of half filled P D. greater repulsion between P and P-electrons & stability of half filled P.

27. How many elements make up period 6 A. 18 B. 8 C. 32 D. 14

28. The representative elements (A group) in the periodic table have A. filled highest energy electrons in s & p orbitals B. unfilled d orbital electrons C. completely filled p orbital electrons D. unfilled highest energy occupied in s and p orbitals

NNAMDI AZIKIWE UNIVERSITY, AWKA
PURE & INDUSTRY CHEMISTRY: DEPARTMENT COURSE TITLE: GENERAL BASIC INORGANIC CHEMISTRY, COURSE CODE: ICH 111
FIRST SEMESTER EXAMINATION 2011/2012. SHADE YOUR PAPER TYPE: PAPER TYPE: B
ANSWER ALL QUESTIONS. SUBMIT BOTH YOUR QUESTION & OMR SHEET.
TIME: 1 HR.

1. A sample of strontium -90 has an activity of 1.2×10^{12} d/s. What is its activity after 49 years? ($t_{½}$ of strontium -90 = 29year) A. 3.7×10^{11} d/s B. 2.9×10^{11} d/s C. 4.7×10^{12} d/s D. 3.9×10^{10} d/s

2. If 1.00g of ^{90}Sr diminishes to 0.786g in 3.154×10^{8}s. What is its half-life in years? A. 36 years B. 30 years C. 29 years D. 27 years

3. How old is charcoal that has 38.0% carbon -14 activity found in living plants, if half-life of carbon -14 is 5730 years. A. 4350 years B. 5670 years C. 7996 years D. 3950 years

4. Alpha decay causes A. atomic number to decrease by 4 B. atomic number to increase by 4 C. atomic mass to increase by 4 D. atomic mass to decrease by 4.

5. Natural radioactivity can be described by all except A. does not occur spontaneously B. releases particles and energy C. disintegration of atomic nuclei D. conversion of atoms of one element into atoms of another element.

6. Neutron bombardment of cobalt -59 produces manganese -56 and A. beta particle B. alpha particle C. gamma rays D. x-rays .

7. Nuclear fission and fusion are similar in all these except A. new elements are formed B. energy is involved C. both require a critical mass D. none of the above.

8. Carbon-14 is one of the isotopes of carbon with a half-life of 5730 years find the decay constant for this element A. 3.836×10^{-12} per sec B. 3.056×10^{-12} per sec C. 3.950×10^{-12} per sec D. 2.530×10^{-12} per sec.

9. The fraction of the total number of nuclei present that decays per unit time is called A. activity B. half-life C. mean life time D. decay constant.

10. The S.I unit of radioactivity is A. curie B. radian C. Becquerel D. positrons.

11. Rank the following bonds in order of increasing bond length S-Cl, S-F and S-Br A. S-Cl < S-F < S-Br B. S-F < S-Cl < S-Br C. S-Br<S-F< S-Cl D. S-F< S<Br < S-Cl E. S-Cl< S-F<S-Cl.

12. Linear shape of a molecule has bond angle of A. 180^0 B. 90^0 C. 120^0 D. 45^0 E. 140^0.

Working: Number of electrons = 26 - 3 = 23 ,
number of protons = 26 , number of neutrons = 56-26 = 30

23. ***Answer*** = 5d<4f<4s<3d<3s<2p
24. ***Answer*** = p - block and period 5
25. (-)
26. ***Answer*** = 1.25×10^{-26}g/mol

Working: Given $^{11}B_5$, $\Delta m = 0.08181$amu , converting 0.08181amu to gram, we have:
$\Delta m = 0.08181 \times 1.67 \times 10^{-24} = 1.37 \times 10^{-25}$g (since 1amu = 1.67×10^{-24}g)
By definition, binding energy = $\frac{\Delta m}{\text{mass number}}$

$= \frac{1.37 \times 10^{-25}}{11} = 1.25 \times 10^{-26}$g/mole

27. ***Answer*** = 6 alpha particles and 6 beta particles

Working: $^{230}Th_{88} \longrightarrow {}^{206}Pb_{82} + 6^4He_2 + 6^0e_{-1}$

28. ***Answer*** = 34.9%

Working: By formula, $N_t = N_o.2^{-t/h}$,
Where $N_o = N_o = 100\%$, $N_t = x\%$ of $N_o = x\%N_o$,
h = 5.26yrs , t = 8yrs , $\therefore x\%N_o = N_o \times 2^{-8/5.26}$; $\therefore x = 0.349$.
But $N_t = x\%$ of $N_o = 0.349 \times 100 = 34.9\%$.

therefore, the % left = $\frac{\%N_t}{\%N_o} \times \frac{100\%}{1} = \frac{34.9\%}{100\%} \times 100\% = 34.9\%$

29. ***Answer*** = Alpha rays and gamma rays
30. ***Answer*** = 2^1n_0

Working: $^{249}Cf_{98} + {}^{10}B_5 \longrightarrow {}^{257}Lr_{103} + 2^1n_0$

31. ***Answer*** = $Al^{3+} < Ca^{2+} < K^+$, this is so because atomic radii increases across the period and decrease down the group.
32. Covalent and coordinate covalent bond.
33. Metals and non metals
34. Non metal of thesame atom
35. Beta particles
36. ***Answer:*** t = 82.2days

Working: Given h = ½ - life = 27.4days, $N_o = 5$g ,
$N_t = 0.625$g , t = ?
By definition, $N_t = N_o.2^{-t/h}$,
therefore, $0.625 = 5 \times 2^{-t/27.4}$
Solving , we have t = 82.2days

37. Increase
38. a moderator

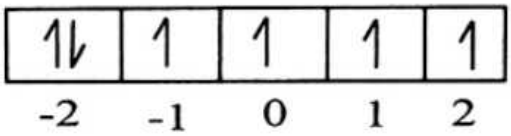
14. ***Answer*** = 5.614165×10^{10}volts and 2.1845×10^{10}cm/sec
Working: B = 2.5T , r = 0.5m = 50cm
From $\frac{e}{m} = \frac{E}{B^2r}$ => $1.7 \times 10^8 = \frac{E}{(2.57)^2 \times 50}$
therefore, E = 5.6144165×10^{10}volts
But by formula , the speed , $V = \frac{E}{B} = \frac{5.614165 \times 10^{10}}{2.57} = 2.1845 \times 10^{10}$cm/sec

15. ***Answer :*** wave number (V) = $2.06 \times 10^4 cm^{-1}$ and wavelength (λ) = 4.85×10^{-5}cm
Working: From Balmer (n_1) to Brackett series (n_2) we have; $n_1 = 2$, $n_2 = 4$
But by ***formula***, wave number (V) = $R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$
$= 109737 \left(\frac{1}{2^2} - \frac{1}{4^2}\right) = 2.06 \times 10^4 cm^{-1}$

By definition $V = \frac{1}{\lambda}$, .: , $\lambda = \frac{1}{V} = \frac{1}{2.06 \times 10^4} = 4.85 \times 10^{-5}$cm

16. ***Working:*** Given $4d^6$, i.e

$4d^6$



thus, $4d^6 = 1S^2, 2S^2, 2P^6, 3S^2, 3P^6, 4S^2, 3d^{10}, 4P^6, 5S^2, 4d^6$,
therefore, from the above electronic configuration, the number of electrons in the outermost shell is 2 . (i.e. the orbital with the highest principal quantum number).
Antepenultimate shell = $3S^2, 3P^6, 3d^{10} = 2 + 6 + 10 = 18$
Penultimate shell = $4S^2, 4P^6, 4d^6 = 2 + 6 + 6 = 14$ electrons
Number of unpaired electrons = 4, number of paired electrons = (44-4)/2 = 20
Magnetic Moment = $\sqrt{n(2n+1)}$,
Where n = 4 (i.e. number of unpaired electrons)
thus, magnetic moment = $\sqrt{4(2(4)+1}$ = 6Bohr magnetons
the block the element belong is d-block , the period is five(5) and the atomic number is 44.

17. ***Answer*** = "*build up*"
18. Pauli Exclusion Principle
19. ***Answer*** = $_{52}Q = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}, 5p^4$
20. ***Answer*** = 3 orbitals
21. ***Answer*** = 28 electrons
Working: given n = 3. By formula, the maximum number of electrons in each shell = $2n^2$,
Now, for n = 1, we have $2n^2 = 2(1)^2 = 2$
For n = 2 , $2n^2 = 2(2)^2 = 8$; for n = 3, $2n^2 = 2(3)^2 = 18$
therefore, the maximum number of electrons is 2 + 8 + 18 = 28 electrons.
22. Answer = 23, 26 and 30.

38. The speed of neutron is reduced by _____ component of the nuclear plant.

Suggested Solutions to 2011 NAU ICH 111 - Mr. Ohms

1. Atom
2. Isotopes
3. ***Answer*** = **12.989**

   Working: % of C^{12} = 1.1%, ***thus*** , % of C^{13} = (100 - 1.1)% = 98.9%

   i.e C^{12} , C^{13}

   1.1% 98.9%

   therefore , the relative atomic mass of carbon is:

   $$\left(\frac{1.1}{100}\right) \times 12 + \left(\frac{98.9}{100}\right) \times 13 = 12.989$$

4. ***Answer*** = 75%

   Working: Let the % abundance of Cl^{35} = x% and that of Cl^{37} = (100 - x)%. i.e

   Cl^{35} , Cl^{37}

   x% (100-x)%

   But R.A.M = 35.5

   $$\Rightarrow 35.5 = \left(\frac{x}{100}\right) \times 35 + \left(\frac{100-x}{100}\right) \times 37$$

   Solving , we have x = 75%. ***therefore***, the % abundance of Cl^{35} is 75%

   NB: % of Cl^{37} = (100 - x)% = 25%
5. J.J Thomson , Aston
6. Fractional Distillation
7. Ions
8. Electrode Potential , Ionization energy and the electron affinity of the element.
9. Isotones
10. ***Answer*** = 32
11. Ca^{2+} = 0, CH_4 = 8 and NO_2^+ = 16
12. ***Answer*** = 7.425×10^{12} $Jmol^{-1}$ and 5.28 $gmol^{-1}$

    Working: $29^1H_1 + 35^1n_0 \longrightarrow {}^{64}Cu_{29}$

    Where : $M_p = 29(1.07) = 31.03$g/mol

    $M_n = 35(1.08) = 37.8$g/mols

    M = Actual mass = 63.55g/mol

    By definition , the calculated mass (Δm) = $M_p + M_n - M$ = (31.03 + 37.8 - 63.55) = 5.28 $gmol^{-1}$

    Again, by formula, B.E = $\frac{\Delta m}{\text{mass number}} = \frac{5.28}{64} = 0.0825$g/mol

    But 1g = 9×10^{13}J

    therefore , binding energy per nucleon = $0.0825 \times 9 \times 10^{13} = 7.425 \times 10^{12}$J
13. *False* , this is so because cathode rays emanate from the cathode and not from the anode.

14. Given e/m = 1.76 x 10^{8}C/g, the magnetic field strength is 2.56T while the radius of the circular path described by the electron is 0.5m, the electric field strength of the electron is _____ while the speed of the electron is _____.

15. _____ is the wave no while _____ is the wave length of an electron which was excited from Balmer series to Brackett series (R = 109737cm^{-1})

16. The orbital designation of the last shell of a given element is **$4d^{6}$**, the number of electrons in the outermost, antepenultimate and penultimate shell are respectively _____, _____ and _____, While the no of unpaired electrons is _____ and the no of paired electrons is _____ and the magnetic moment is _____, the block, period and the atomic number are respectively _____, _____, and _____.

17. **'Aufbau'** is a German word that stands for _____.

18. Two electrons of the same atom in the same orbital must have opposite spin. Which Principle has this implication? _____.

19. An atom is designated as $_{52}$**Q**, the electronic configuration is _____.

20. _____ is the total number of orbitals associated with the principal quantum no, n = 3 (21) _____ is the maximum no of electrons that can be accommodated in a shell with principal quantum no, n = 3. (22) The no of electrons, protons & neutrons in $^{56}Fe_{26}^{3+}$ are respectively _____, _____ and _____ (23) Arrange 4s, 3d, 2p, 3s, 5d, 4f in order of decreasing energy level _____

24. The block and period of the element represented as $_{52}$**Q** are _____ and _____ respectively.

25. Which of the following compounds can you find intermolecular H-bonding, **HCl, NH_3, NH_4^+ & H_2O** _____.

26. What is the binding energy in $^{11}B_5$ nucleus if its mass defect is 0.08181amu _____

27. The no of alpha & beta particles emitted in the conversion of $^{230}Th_{88}$ to $^{206}Pb_{82}$ are _____ and _____ respectively.

28. The half-life of cobalt-60 is 5.26yr. The % left after 8yrs is _____.

29. _____ rays consist of He nuclei, while _____ rays are electromagnetic radiations.

30. When ^{249}Cf is bombarded with ^{10}B, ^{257}Lr is formed. What other particles(s) is / are produced? _____.

31. Arrange the following element in order of increasing ionic radii Ca^{2+}, K^{+} & Al^{3+}. _____

32. The two major types of bonds that exist among the following molecules HF, HCl and H_2O are respectively _____ & _____.

33. Ionic bond is formed between _____ and _____ atoms.

34. Coordinate bond is formed by _____

35. What particle is released when **Ga-75** decays to **Ge-75**? _____

36. The half-life for beta decay of ^{233}Pa is 27.4days. How many days must pass to reduce a 5g sample of it to 0.625g? _____

Observe $CaCO_3 \longrightarrow CaO + CO_2$

From egn:

100g of $CaCO_3$ = 44g/mole of CO_2

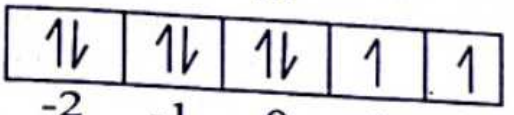
$\therefore$ 10g of $CaCO_3 = \frac{44g/mole}{100g/mole} \times 10g = 4.4g$ of CO_2

But d = M/V , i.e V = M/d = $4.4g/1.97gL^{-1} = 2.23L \Rightarrow A$

50.B ***Working:***

Observe

$4d^8$



thus, $4d^8 = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^8$

therefore , Atomic Number = 46, Number of unpaired electron from diagram = 2

Number of paired electron = (46 - 2)/2 = 22. ***Answer*** = 2 & 22 => B

NNAMDI AZIKIWE UNIVERSTITY, AWKA

Pure & Industry Department First Semester Examination 2010/2011.

COURSE CODE: ICH 111: Course Title: General Basic Inorganic Chemistry:

PROGRAMME: CEP

Instruction: Answer All Questions: Time: 1 hr.

Reg No:_____**Name:** _____**Dept:** _____

1. Matter is composed of discrete particles called _____
2. The existence of an atom with different relative atomic mass but same protonic number is _____
3. The relative atomic mass of carbon with two isotopes ^{12}C (% abundance 1.1%) and ^{13}C is _____
4. Chlorine contains two isotopes ^{35}Cl and ^{37}Cl with relative atomic mass of 35.5, the percentage abundance ^{35}Cl is _____
5. _____ was the first person to perform experiment on positive rays between 1910 and 1912 and this led to the development of the first mass spectrograph by _____ in 1913.
6. water containing D_2O and H_2O can best be separated by _____ method.
7. _____ are electrically charged species formed by lost or gain of electron(s) by neutral parent atoms.
8. The modified Fajan's Rule shows that the ease of formation of ions can be measured by the _____, _____ and _____ of the elements.
9. Elements with different **nucleon** numbers but same **neutron** number exhibit _____
10. The total valence electrons in PO_4^{3-} is _____
11. The total valence electrons that are found in the following species, Ca^{2+}, CH_4, & No_2^+ are respectively _____, _____ and _____
12. _____ is the binding energy in S.I unit per nucleon, while _____ is the calculated mass in grams for $^{64}Cu_{29}$ with mass 63.55g/mol, proton(1.07g/mol), neutron(1.08g/mol) and **1g = 9.0 x 10^{13}J** binding energy.
13. Cathode rays which emanate from the anode produce x-ray when they strike a metallic

32.C Ar 33.D S, Te 34.D $_{52}Te$ 35.B Group IIB 36.B +2 37.A N
38.C Covalent 39.D Proton 40.D Atom

41.B ***Working:***
Observe $H^+ \equiv {}^1H_1^+$. ***thus***, p = 1, n = m - p = 1 - 1 = 0, e = p -1 = 1-1 = 0.
Hence, we have (p, n, e) = (1, 0, 0) => B

42.C ***Working:***
Observe Cl^{35} , Cl^{37}
$x\%$ $(100-x)\%$
Where RAM = 35.5 . ***thus***, $35.5 = \left(\frac{x}{100}\right) \times 35 + \left(\frac{100-x}{100}\right) \times 37$ . .: $x = 75\%$ => C

43.C ***Working:*** C^{12} , C^{13}
98.89% 1.11%.
$RAM = \left(\frac{98.89}{100}\right) \times 12 + \left(\frac{1.11}{100}\right) \times 13 = 12.0111$ amu

But 1 amu = 1.67×10^{-24}g. .:, ***Answer*** = $1.67 \times 10^{-24} \times 12.0111 = 2.0 \times 10^{-23}$g. => C

44.D Na^+, O^{2-}, N^{3-}

45.A ***Working:***
Observe $10{}^1H_1 + 10{}^1n_0 \longrightarrow {}^{21}Ne_{10}$
Where Mp = 10(1.0075) = 10.075, Mn = 11(1.0089) = 11.0979
Actual mass of Ne = 20.183 . By formula, Δm = Mp + Mn - M
= 10.075 + 11.0979 - 20.183 = 0.99g => A

46.B ***Working:***
By formula, Velocity v = E/B
But $E = \frac{B^2 e r}{M} = (2.5)2 \times 1.76 \times 10^8 \times 0.05 = 55000000$volts , B = 2.5T
therefore, $v = \frac{55000000}{2.5} = 2.2 \times 10^7$m/s => B

47.E ***Working:***
By formula, $\Delta x.m\Delta v = \frac{h}{2\pi}$, i.e $\Delta v = \frac{h}{2\pi \Delta x m}$
But $h = 6.6 \times 10^{-34}$, $\Delta x = 2.02 \times 10^{-10}$, $m = 9.1 \times 10^{-31}$
therefore, $\Delta v = \frac{6.6 \times 10^{-34}}{2 \times 3.142 \times 2.02 \times 10^{-10}\ 9.1 \times 10^{-31}} = 5.71 \times 10^7$m/s
But 1m = 100cm,
.: 5.71×10^7m/s $= \frac{100\text{cm}}{1\text{m}} \times 5.71 \times 10^7$m/s $= 5.71 \times 10^9$cm/s => E

48.B ***Working:***
Using; $\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

Where $n_1 = 2$, $n_2 = 4$. :. $\lambda = 4.86 \times 10^{-7}$m => (B)

49A ***Working:***

9.E a and b 10.C Half-lifes
11.D Curie
12. C ***Working:***

$$_{92}U^{235} + {}^{1}_{0}n \longrightarrow {}_{40}S_r^{99} + {}_{52}T_e^{135} + 2{}^{1}_{0}X \text{ . } \textit{thus,}\ X = {}^{1}_{0}n \Rightarrow C$$

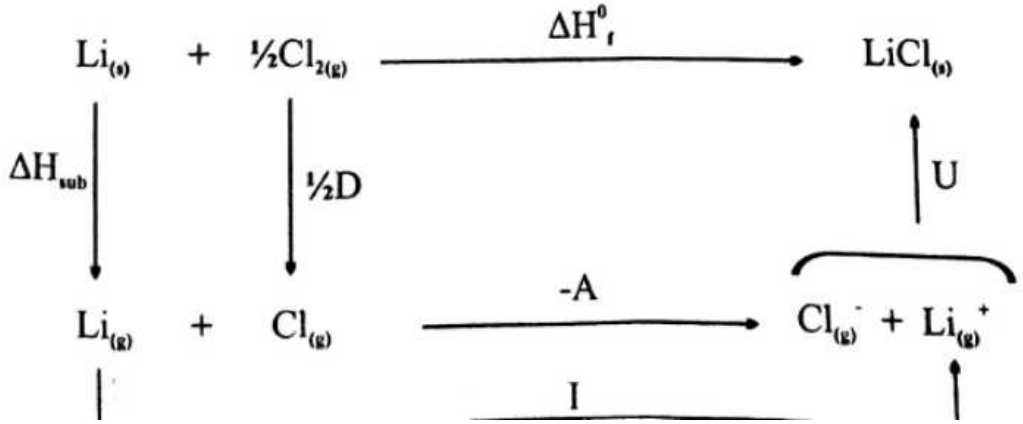
13.B AlF_3 14.B they are mainly amorphous 15.D It has a low melting point
16.C they have low electron affinity.
17.E ***Working:***

H = 1 = 1
C = 4 = 4
O = 6 x 2 = 12
$+e^-$ = 1
18

18. C. ***Working:***

Bond order = $\frac{\text{Number of share pairs}}{\text{Number of linkages}} = \frac{4}{3} \Rightarrow C$

19.C 8 20.C 104.5^0
21.B ***Working:***
Here, we subtract the lattice energy from the solvation energy and then arrange
i.e Solubility = Solvation energy - Lattice energy
So, MX = 780 - 770 = 10kJ/mole
NY= 680 - 500 = 180KJ/mole
PZ = 705 - 100 = 605 KJ/mole
:. Increasing solubility is MX<NY<PZ => B 22.D Na^+
23.B ***Working:***
By Hess law, $\Delta H^0_f = \Delta H_{sub} + \frac{1}{2}D + I + A - U$
Where ΔH^0_f = Standard heat of formation of LiCl = - 402
ΔH_{sub} = Heat of sublimation of $Li_{(s)}$ = 159, ½D = Heat of dissociation of Cl_2 = 121
I = Ionization potential of $Li_{(g)}$ = 520, A = Electron affinity of Cl = -370
.: -402 = 159 + 121 + 520 - 370 - U. thus U = +832KJ/mol => B
The energy cycle of the process is shown below;



1.B ***Working:***

Observe $_{27}Co^{59} + {}^{1}_{0}n \longrightarrow {}_{25}X^{56} + {}^{4}_{2}\alpha$

thus, $X = {}_{25}Mn^{56}$ => (B).

2.B Unstable and radioactive

3.D ***Working:***

If 99% disintegrate, N.=100% - 99% = 1% , N_o = 100%, ½ - life = h = 28.8yrs

By formula, $N_t = N_o .2^{\frac{-t}{h}}$

i.e $1\% = 100\% .2^{\frac{-t}{28.8}}$

$0.01 = 2^{\frac{-t}{28.8}}$

Take log of both sides

$\log 0.01 = \log 2^{\frac{-t}{28.8}}$

therefore, t = 191yrs => (D)

4.B Radioisotopes

5.A ***Working:***

Number of moles (n_1) of Ra^{226} = $\frac{\text{Mass}}{\text{Molar Mass}} = \frac{1.00}{226} = 4.424778761\text{x}10^{-3}$

$(t½)_1$ = 1620yrs = 1620 x 365 = 591300days, $(t½)_2$ = 3.82days ,

n_2 = number of moles of Rn^{222} = ?

By formula, $\frac{n_1}{n_2} = \frac{(t½)_1}{(t½)_2}$; => $n_2 = \frac{n_1 \text{ x } (t½)_2}{(t½)_1} = \frac{4.424778761 \text{ x } 10^{-3} \text{ x } 3.82}{591300}$

$= 2.858558239\text{x}10^{-8}$mole

But 1mole of gas occupies a volume of 22400cm^3 at S.T.P,

.: $2.858558239 \text{ x } 10^{-8}$mole occupies $2.858558239 \text{ x } 10^{-8} \text{ x } 22400 = 6.4\text{x}10^{-4}cm^3$ => A

6.D a and c are correct

7.A they alter the neutron-proton ratio in the nucleus

8.D ***Working:***

N_o = 100% or $N_o = N_o$, N_t = 52% of N_o = 52% N_o, h = 5730yrs

By formula, $N_t = N_o.2^{\frac{-t}{h}}$

$52\% N_o = N_o 2^{\frac{-t}{5730}}$

$0.52 = 2^{\frac{-t}{5730}}$

Take log of both sides

$\text{Log } 0.52 = \log 2^{\frac{-t}{5730}}$

therefore, t = 5404yrs => (D)

$_{30}Zn$ (d) $_{52}Te$ (e) $_{29}Cu$

35. In the periodic table, the highest atoms having ground state electronic configuration of $(n-1)d^8ns^2$ would be found in ---------(a) Group IIA (b) Group IIB (C)Group 8 (d) Group 4 (e) Group 6

36. The electrical charge on the nucleus of magnesium ion Mg^{2+} is---------- (A) 0 (b) +2 (c) -12 (d) +12 (e) +10

37. Which would have more +ve electron affinity? (A) N (b) P (C) Cl (d) All of the above (e) None of the above

38. Elements with low electronegativity difference most probably bond by (a) ionic (b) co-ordinate (c) covalent (d) Hydrogen bond (e) Van der Waals

39. The number of ..... determines the identity & characteristics of an atom (a) nucleon (b) nucleus (c) neutron (d) proton (e) none of these

40. Matter is composed of discrete particles called (a) electron (b) proton (c) neutron (d) atom (e) element

41. The number of proton, neutron & electron in H^+ are respectively (a) 1,1 & 0 (b) 1,0 &0 (c) 0,1,& 1 (d)1,1 & 1 (e) none of these

42. Chlorine contains two isotopes with mass number 35 & 37 and relative atomic mass of 35.5.Calculate the % of ^{35}Cl in the sample (a) 25% (b) 52% (c) 75% (d) 57% (e) 85%

43. Calculate the relative atomic mass of naturally occurring carbon, if 98.89% of the carbon atom is $^{12}C_6$ while 1.11% is for $^{13}C_6$ (1amu =1.67 x 10^{-24}g). (A) 1.0 x 10^{24}g (b) 2.0 x 10^{-24}g c. 2.0 x10^{-23}g (d) 1.0 x10^{-24}g (e) 2.0 10^{-23}g

44. Which of the following exhibit isoelectronic (a) O^{2-}, Cl^- & F^{2-} (b) Ne,Ca^{2+} & P^{3-} c) Ar,P^{3+} & S^{2-} (d) Na^+;O^{2-} &N^{3-} (e) Na^+, Cl^- & S^{2-}

45. Mass of Neon measured in mass spectrometer was 20.183. Determine the mass defect given that the mass of proton, neutron & electron are 1.0075, 1.0089 & 0.006g respectively: (a) 0.99g (b) 21.17g (c) 10.07g (d) 11.09g (e) 20.18g

46. The charge to mass ratio of electron is 1.76C/g. If the magnetic field strength is 2.5T and the radius of the circular path described by the electron is 0.05m, what is the velocity of the electron? (a) 2.2 x 10^9m/s (b) 2.2 x 10^7m/s c) 2.2 x 10^5m/s (d) 2.2 x 10^{11}m/s (e) 2.2 x 10^2m/s

47. The uncertainty in the position of an electron was 2.02 x 10^{-10}m. Determine the uncertainty in the velocity if h = 6.6 x 10^{-34} Kgm^2/s and the mass of electron is 9.1x10^{-31} Kg: (A) 5.7 x 10^2cm/s (b) 5.7 x 10^7cm/s (c) 5.7 x 10^3cm/s (d)5.7 x 10^2cm/s (e) 5.7 x 10^9cm/s

48. What is the wavelength of an electron which was excited from balmer to bracket series (R=109737cm^{-1}) (a) 4.86 x 10^{-5}m (b) 4.86 x 10^{-7}m (c) 8.60 x 10^{-5}m (d).8.60 x 10^5m (e) 8.60 x 10^{-7}m

49. 10g of $CaCO_3$ was heated to give 5.6g of CaO and some Co_2 only. If the CO_2 has a density of 1.97g/L, calculate the volume of CO_2 liberated if Law of conservation of mass was obeyed. (a) 2.23L (b) 8.67L (c) 346.7L (d) 86.78L (e) 3.46L.

50. The last shell of a given element has $4d^8$ orbital. The number of unpaired & paired electrons are respectively (a) 22 & 2 (b) 2 & 22 (c) 24 & 4 (d) 4 & 24 (e) none of these

boiling points (b) they are mainly amorphous (c) they conduct electricity when in solution (d) they are soluble in polar solvents (e) they are Ionic at room temperature

15. One of these is incorrect about sodium chloride crystal (a) it has a coordination number of six (b) the force which holds the ions in sodium chloride is electrostatic (c) a crystal of sodium chloride is electrically neutral (d) it has a low melting point (e) a crystal of sodium chloride has 3-dimensional structure.

16. All are correct about negative ions except (a) they are formed from element on the extreme upper right of the periodic table. (B) they have high ionization energy (c) they have low electron affinity (d) they are formed from non-metal (e) none of the above

17. The total number of valence electron in HCO_2^- is (a) 32 b. 24 c. 26 d. 30 e. 18

18. The bond order for carbonate ion is (a)2 (b)1½ (c) 1 1/3 (d) ½ (e) 0

19. The total number of valence electrons in PH_4^+ is: (a) 16 b. 18 c. 8 d. 32 e. 24

20. The bond angle of water molecule is (a)180^0 b. 109.5^0 c.104.5^0 d. 107.3^0 e.120^0

21. The lattice energies of the a salts MX, NY and PZ are 770, 500 and 100KJ/mol, while the hydration energies are 780, 680 and 705 KJ/mol respectively. The increasing order of solubility of these salts is (a) NY<PZ<MX (b) MX<NY<PZ c. NY<MX<PZ (d) PZ<MX<NY (e) PZ<NY<MX

22. One of these is not a ligand (a) H_2O (b) NH_3 c. CN^- (d) Na^+ (e) Cl^-

23. From the data below, the lattice energy of lithium chloride is:
$Li_{(s)} \longrightarrow Li_{(g)}$, $\Delta H = +159$ kJ/mol: $\frac{1}{2}Cl_{2(g)} \longrightarrow Cl_{(g)}$ $\Delta H = +121$kJ/mol,
$Li_{(g)} \rightarrow Li^+_{(g)} + e^-$, $\Delta H = +520$ kJ/mol $Cl_{(g)} + e^- \longrightarrow Cl^-$ $\Delta H = -370$ KJ/mol.
$Li_{(s)} + \frac{1}{2}Cl_{(g)} \rightarrow LiCl_{(s)}$ $\Delta H = -402$kJ/mol : (a) - 832KJ/mol (b) +832 KJ/mol c . +788 KJ/mol d. -788KJ/mol (e) +28 KJ/ mol

24. The bond angle in Sp^3 hybridization is a. 120^0 b. 104.5^0 c. 109.5^0 d. 107.3^0 e. 180^0

25. All are intermolecular forces except (a) London force (b) dipole-dipole attractions (c) electrostatic force (d) hydrogen bond (e) Van der Waal force

26. When the four electron groups around the central atom is made up of two bonding and two non-bonding groups the shape of the molecules is (a) linear (b) Trigonal (c) V- shaped (d) Tetrahedral (e) Square planar shape.

27. ----------discovered that the property of element is a function of atomic number (a) Wilham Prouts (b)Johann Deberenier (c) John Newman (d) D. Mendeleefs (e) Moseley H.G.J

28. Which has the highest first ionization energy ; Al, Si, S and P (a) sulphur (b) Aluminum (c) Silicon (d) Phosphorus (e)None of the above

29. All the species are isoelectronic except P^{3+},S^{2-},Cl^-,Ar ,K^+, Ca^{2+}? (a) P^{3+} (b) Ar (c) S^{2-} (d) Cl^- and K^+ (e) Ca^{2+}

30. Five elements have atomic numbers 12, 11,10,9 &7, which atomic number element has the second highest ionization energy (A)12 (b)10 (c)9 (d)11 (e)7

31. Arrange these elements in order of increasing electron affinity Li, K,C, F and I (a) K, Li, C, I, F (b) F, I, C, K, Li, c) Li, K, C, F, I (d) C, F, I, K, Li (e) Li, K, C, I, F

32. Which has the lowest atomic radius; Na, Ar, Si P, Al? a. Si b. P c. Ar d. Na e. Al

33. In which of the following pairs are the elements most similar chemically (a) I, C (b) P, Al (C) F, C (d) S, Te (e) P, S

34. Which of the ground state electronic configuration fulfills all the following criterial: three completely filled shells, one or more electron in a total of eleven subshells, 27 orbitals, valency shell of 2 filled orbitals, 2 unpaired electrons (a) $_{18}Ar$ (b) $_{27}Co$ (c)

NNAMDI AZIKIWE UNIVERSITY, AWKA
DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY: Course title: General Basic Inorganic Chemistry: Course Code: ICH 111
Shade the appropriate option in your OMR sheet . Answer all . Time: 1hr 2009/2010 first semester examination . *Write your registration number on the question paper and submit both the question paper and the OMR sheet at the end of the exam.*

1. $^{59}Co_{27} + {}^{1}n_{0} \longrightarrow X + \alpha$, where X is (a) (b) $^{56}Mn_{25}$ (c) $^{56}Fe_{26}$ (d) $^{52}Cr_{24}$ (e) $^{54}Mn_{25}$
2. All nuclei with 84 or more protons are (a) stable and radioactive (b) unstable and radioactive c. very stable and not radioactive (d) unstable but not radioactive (e) none of the above.
3. Strontium-90 is a β-emitter with a half-life of 28.8yrs. How many years will it take for 99.0% of a given sample of 90Sr released in an atomospheric test of an atomic bomb to disintegrate.(a) 210 years (b) 101 years (c) 53 years (d) 191 years (e) 500 years.
4. Radioactive isotopes that are used to monitor the path of an element in a chemical process are know as (a) monitors (b) radioisotopes (c) tracers (d) isotracers (e) chemoisotopes.
5. If Radium -226 of half-life 1620yrs decays to the gas Radon -222 of half-life 3.82 days, calculate the volume of radon gas present in secular equilibrium with 1.00g of Ra at S.T.P (a) $6.49 \times 10^{-4} cm^3$ (b) $5.49 \times 10^{-4} cm^3$ (c) $6.23 \times 10^{-4} cm^3$ (d) $6.18 \times 10^{-3} cm^3$
6. Radioisotopes and non -radioactive isotopes of the same element have (a) same chemical properties (b) different chemical properties (c) identical electron configuration (d) a and c are correct (e) none of the above
7. Gamma rays can be identified with all these properties except (A) they alter the neutron proton ratio in the nucleus (b)are very penetrating (c) are high energy electromagnetic radiation (d) have no charge.(e)have no mass
8. Charcoal got from dump at Onitsha has a carbon-14 activity 52.0% that of carbon -14 in living plants . Assuming that C-14 in the atmosphere is constant, how old is the charcoal?. Half-life of C -14 is 5730 years. (a) 3950 years (b) 2300 years (c) 3000 years (d) 5404 years (e) 5900 years
9. Radioisotopes commonly used in Medicine are a. I-131 b T-99 c Ar d B (e) a & b
10. Radioactive isotopes are characterized by their (a) composition (b) colour (c) half-lives (d) functions (e) electron configuration
11. The number of nuclear disintegrations occurring/second in 1g of Radium is called (a) roentgen (b) rad (c) rem (d) curie (e) nucleon .
12. $^{235}U_{92} + {}^{1}n_{0} \longrightarrow {}^{99}Sr_{40} + {}^{135}Te_{52} + 2X$. X is (a) $^{4}He_{2}$ (b) $^{0}e_{-1}$ (c) $^{1}n_{0}$ (d) $^{1}P_{1}$ (e) $^{2}H_{1}$
13. Covalent bonding occurs in all except (a) $AlCl_3$ (b) AlF_3 c. HCl (d) NH_3 (e) Cl_2
14. Ionic compounds have the following properties except (a) High melting and high

Trust in the lord with all your heart and lean not unto your own understanding (Proverbs 3:5)KJV