

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE
B.Sc. Degree (Chemistry) Examination
Rain Semester 2021/2022 Session
CHM 102: Introductory Chemistry II
June, 2023 Time Allowed: 2 Hr

Instructions:

1. Write your SURNAME and initials and shade appropriately
2. Write your University registration number and shade.
3. Write the Question paper type on top of the OMR Sheet and Shade the space provided for Question paper type
4. Shade the alphabet corresponding to your correct option horizontally (block) within the space provided

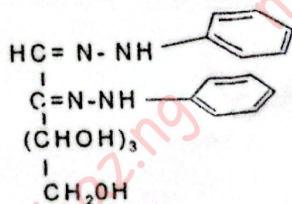
Type 4

1. Assign True(T) or False(F) to the following statements about the group VI elements; in the order i, ii, & iii, below; which of the combination of T and F options is correct?
 - i. Non-metallic character decreases down the group.
 - ii. Tellurium exists in two forms α and β (Both metallic)
 - iii. The oxides of the elements in the same oxidation states become less acidic as we go down the group.(a) TTF (b) TTT (c) TFF (d) TFT
2. Arrange the hydrides of group VI elements, H_2O , H_2S , H_2Se , H_2Te , in increasing order of boiling points
(a) $H_2O < H_2S < H_2Se < H_2Te$ (b) $H_2Te < H_2Se < H_2S < H_2O$
(c) $H_2S < H_2O < H_2Se < H_2Te$ (d) $H_2S < H_2Se < H_2Te < H_2O$
3. The following statements are true about allotropes of group VI elements except:
 - (a) The stable forms of selenium and tellurium are semiconductors
 - (b) Selenium has two forms, red (non-metallic), and grey (metallic)
 - (c) The non-metallic allotrope of Tellurium is more stable than the metallic form.
 - (d) Sulphur has many allotropes, all of which are insulators.
4. The ionization energy of the group VI elements decreases down the group. This is due to
 - (a) increase in nuclear charge.
 - (b) increase in nuclear charge and decrease in shielding
 - (c) Increase in atomic size and decrease in shielding
 - (d) Increase in atomic size and increase in shielding.
5. The element of group VII with the highest electron affinity is
(a) Cl (b) F (c) I (d) Br
6. Which of the following statements about interhalogens compounds are correct?
 - i. They are more polar than the halogens
 - ii. They are more reactive than F_2 .
 - iii. They are more reactive than the halogens
 - iv. They are binary compounds of two different halogen atoms(a) i, ii, iii, & iv (b) i, iii, & iv only (c) ii, iii, & iv only (d) i, ii, & iii only
7. Which of the following oxy acids is in decreasing order of acid character?
 - (a) $HClO_4 > HClO_3 > HClO_2 > HClO$ (b) $HClO > HClO_2 > HClO_3 > HClO_4$
 - (c) $HClO_4 > HClO_3 > HClO > HClO_2$ (d) $HClO > HClO_2 > HClO_4 > HClO_3$

8. Which of these statements best describe amylopectin?

- (a) Amylopectin is a highly branched polymer in which glucose units are joined by both α -1, 4 and 1,6 glycosidic bonds
- (b) Amylopectin is linear polymer in which glucose units are joined by α -1, 4 glycosidic bonds
- (c) Amylopectin is a rigid polymer in which glucose units are joined together by α -1,6 glycosidic bonds only.
- (d) Amylopectin is an amorphous granule which makes starch insoluble in water due to the presence of hydrogen bonds

9. Which of the options below provides the name the compound given below and the number of moles of phenylhydrazine required to produce one mole of the compound?



- (a). glucosazone; 3 moles
 - (b) phenylhydrazone ; 2 moles
 - (c). glucoxime ; 2 moles
 - (d) glucitol; 3 moles
10. The name of the products formed when glucose undergoes reaction with bromine water and conc. Nitric acids respectively are;
- (a) gluconic acid and glucaric acid
 - (b) glucitol and glucoxime
 - (c) glucaric acid and glucitol
 - (d). glucaric and glucuronic acid
11. The monomer unit that makes up cellulose is
- (a) α - fructose
 - (b) β - D-glucose
 - (c) α - D -glucose
 - (d) β - L- glucose
12. When starch is heated in the presence of water, it becomes hydrated and losses its crystalline structure irreversibly, the process is called
- (a) saponification
 - (b) retrogradation
 - (c) gelatinization
 - (d) hydrogenation
13. When a reducing sugar undergoes hemiacetal reaction using its carbonyl carbon, two products are formed. What is the name given to these products?
- (a) Epimers
 - (b) Anomers
 - (c). monomers
 - (d) tautomers
14. When glucose is dissolved in water, it moves via a cyclic form from α - anomer to β - anomer until equilibrium is reached. What is the name given to this reaction?
- (a) Optical Isomerism
 - (b) Mutarotation
 - (c) Epimerization
 - (d) α - and β - isomerism

15. Which of the listed halogens Cl, I and Br does not exist in +7 oxidation state

- (a) Cl
- (b) Br.
- (c) I
- (d) Both Cl and Br

16. A Statement I is given, and a corresponding Statement II is also given below it. Mark the correct answer as:

STATEMENT I: Halogens are all strong oxidizing agents

STATEMENT II. Halogens have a strong tendency to accept one electron to attain the next noble gas configuration

- (a) If both Statement I and Statement II are true but Statement II is the correct explanation of Statement I.
- (b) If both Statement I and Statement II are true, but Statement II is not the correct explanation for Statement I.
- (c) If Statement I is true, and Statement II is false, but Statement II is the correct explanation of Statement I
- (d) If Statement I is false and Statement II is true, but Statement I is the correct explanation of Statement II

17. A first-row transition metal has atomic number 27. What will be its electronic configuration after the loss of 2 electrons?

- (a) $[\text{Ar}] 4s^2 3d^5$
- (b) $[\text{Ar}] 4s^0 3d^7$
- (c) $[\text{Ar}] 4s^1 3d^6$
- (d) $[\text{Ar}] 4s^2 3d^6$

18. Which of the following set of ionic species will not impact colour in an aqueous solution?
(Ti = 22, Cr = 24, Cu = 29, Zn = 30).

i. Ti^{4+} ii. Cr^{3+} iii. Cu^+ iv. Zn^{2+}

(a) i & ii only (b) ii & iv only (c) i, iii & iv only (d) ii, iii & iv only

19. What is the systematic name of the complex: $[Cr(H_2O)_4Cl_2]Cl$

(a) Tetraaquadichlorochromate(III) chloride (b) Dichlorotetraaquachromium(III) chloride
(c) Dichlorotetraaquachromate(III) chloride (d) Tetraaquadichlorochromium(III) chloride

20. Which of the following statements about first-row transition metals is/are true?

i. Transition metals exhibit variable oxidation states in their compounds
ii. The stability of the +2 oxidation state increases across row
iii. characteristic properties arise from an incomplete d-subshell in atoms or ions.
(a) i & iii only (b) ii & iii only (c) I and ii only (d) i, ii & iii

21. Which of the following about the magnetic properties of transition metals is/are correct?

i. In para magnetism, the magnetic lines of force pass through the vacuum rather than through a substance
ii. In diamagnetism, the magnetic lines of force pass through the substance rather than through the vacuum
iii. a diamagnetic substance is repelled by a magnetic field and hence tends to set itself at right angles to the field.

(a). i & ii only (b). iii only (c). i only (d). ii only

22. What shapes are associated with sp^3d and sp^3d^2 hybrid orbitals, respectively?

(a). Tetrahedral & linear (b). Trigonal bipyramidal & octahedral
(c). Octahedral & pentagonal bipyramidal (d). Trigonal bipyramidal & Tetrahedral

23. Which of the noble gases is used by divers and Why?

(a) Helium, due to low solubility of He in fluids, including blood.
(b) Argon, due its low solubility in fluids.
(c) Helium, due to high solubility of He in fluids, including blood.
(d) Helium, due to its unreactive nature.

24. The solubilities in g/100g water of the alkali metal fluorides are as follows:

LiF (0.27), NaF (4.22), KF (9.23), RbF (130.6), CsF (366.5). This is because:

(a) Lattice energies of the fluorides increase down the group.
(b) The enthalpies for the formation of the fluorides are zero.
(c) Lattice energies of the fluorides decrease down the group.
(d) Lattice energies of the fluorides and the heats of formation are almost equal.

25. Beryllium and magnesium are both in group II of the periodic table. Beryllium hydroxide, $Be(OH)_2$ and magnesium hydroxide, $Mg(OH)_2$ have different geometrical structures, tetrahedral and octahedral respectively, This is because:

(a) Beryllium is small and magnesium is large. (b) Beryllium can expand its shell and magnesium cannot.
(c) Magnesium is very flexible (d) Magnesium can expand its 3d shell.

26. Lithium in Group IA is the best reducing agent. This is because

(a) It is highly electronegative (b) It has a high hydration energy
(c) It has a low electrode potential value (d) It is very small

27. The geometrical shapes respectively of PF_5 and BrF_5 are:

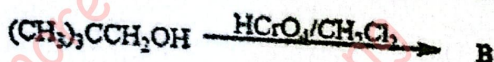
(a) Trigonal and square planar (b) Trigonal bipyramidal and square pyramid;
(c) tetrahedral and square planar. (d) linear and tetrahedral

28. Francium, a natural radioactive element belongs to

(a) Group VIIIA (b) Group IA (c) Group IIIB (d) Group IIA

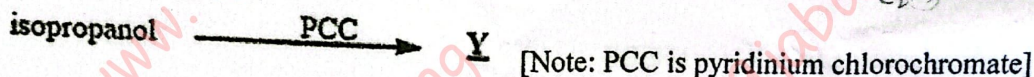
29. Dissolution may result into the followings except:
 (a). Hydration (b). Neutralization (c). Complex ion formation (d). Dehydration;

30. The IUPAC name of compound B formed from the reaction below is;



- (a) 2,2-dimethylpropanoic acid (b) no reaction
 (c) 3,3,3-trimethylpropanal (d) 3,3-dimethyl butanoic acid

31.



- The product (Y) from the oxidation reaction in the equation above is
 (a) propan-2-ol (b) propan-2-one (c) Propanone (d) Propanal

32. Two sample bottles labeled X and Y contains unknown liquids having the formula $\text{C}_3\text{H}_6\text{O}$. X tested positive to DNP (2,4, dinitrophenol) but tested negative to Tollen's reagent. Y tested negative to DNP but produced steamy white fumes when passed over dry PCl_5 . Which functional group is present in X?

- (a) Alkanol (b) Alkanal (c) Alkanone (d) Alkanoic acid

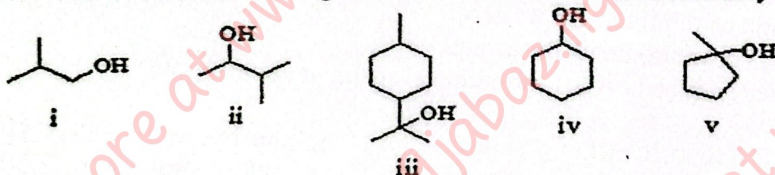
33. The bottle labelled Y in question 3 must contain which functional group and what is the name of the compound in the given options?

- (a) Alkanal; cyclopropanal (b) Alkanol; propanol
 (c) Alkanol; cyclopropanol (d) Alkanol; cyclopropanol

34. The secondary alcohol, butan-2-ol, may be formed from the Grignard reaction involving the following Grignard reagent and carbonyl compound:

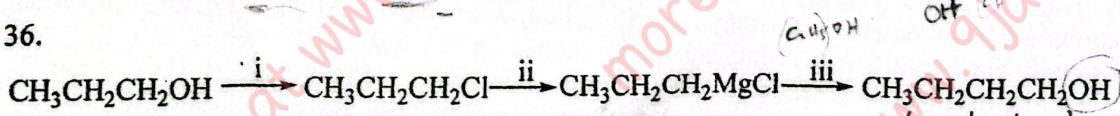
- (a) Methylmagnesium bromide & ethanal (b) Propylmagnesium bromide & ethanal
 (c) Methylmagnesium bromide & propanal (d) Ethylmagnesium bromide & ethanol

35. Which of the following alcohols shown below are secondary alcohols?



- (a) iii and v (b) ii and iv (c) ii, iii and iv (d) iii, iv and v

36.



- (a) i = KCl ; ii = Mg ; iii = H_2CO
 (b) i = SOCl_2 ; ii = dry ether; iii = formaldehyde
 (c) i = SOCl_2 ; ii = $\text{Mg}/\text{dry ether}$; iii = ethanol
 (d) i = SOCl_2 ; ii = $\text{Mg}/\text{dry ether}$; iii = H_2CO

37. Which of these carbohydrates will not give positive test with Fehling's solutions?

- (a) Glucose (b) Sucrose (c) Maltose (d) Mannose

38. Which of these statements is true for the reaction of glucose with Tollen's reagent?

- (a) Tollen's reagent is a mild oxidizing agent; it produces brick red precipitate with glucose.
 (b) Tollen's reagent is a reducing agent; its reaction with glucose will produce a deposit of

Silver.

- (c) Tollen's reagent as an oxidizing agent; it will oxidize glucose to produce silver mirror.
(d) Tollen's reagent undergoes condensation reaction with glucose to deposit silver mirror.

39. Which of the following groups of amino acids would form disulphide bonds

- (a) Lysine and Glutamic acid (b) Methionine and Lysine
(c) Phenylalanine and Tyrosine (d) Cysteine and Methionine

40. Which of the followings takes place during the formation of peptide bonds

- (a). Hydrogen atom is lost from the carboxyl group of one amino acid and a hydroxyl group is lost from the amino group of another amino acid
(b) Hydroxyl group is lost from its carboxyl group of one amino acid and a hydroxyl group is lost from its amino group of other amino acid
(c). Hydroxyl group is lost from carboxyl group of one amino acid and a hydrogen ion is lost from the amino group of another amino acid
(d) Hydroxyl group and hydrogen ion are lost from the same amino acid and then joined to another amino acid after elimination of water molecule.

41. The followings are forces of attraction found in three-dimensional structure of tertiary proteins except

- (a) hydrophobic bonds (b) salt bridge (c) disulphide bonds (d) Polypeptide

42. The amino acid that form sodium salt which is used in the formulation of spices is

- (a) Aspartic acid (b) glutamic acid (c) lysine (d) tyrosine

43. All the proteins listed below are classified as conjugated proteins except

- (a) lipoproteins (b) glycoproteins (c) metalloproteins (d) fibrous proteins

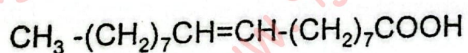
44. Choose the option that best describe a fatty acid represented by C18:0

- (a) Hexadecanoic acid; Palmitic acid (b) Octadecanoic acid; Stearic acid
(c) Octadecenoic acid; Linolenic acid (d) Hexadecenoic acid; Palmitoleic acid

45. Which of the fatty acids is described as Omega 3 fatty acid

- (a) Docosaenoic acid (b) Linoleic acid (c) Palmitic acid (d) oleic acid

46. A triglyceride containing the fatty acid shown can be converted to margarine by which of the process and condition



- (a). Hydrogenation; Nickel catalyst (b). Halogenation; Nickel catalyst
(c) Heating at 200°C; Iron catalyst (d) Hydration; Palladium catalyst

47. The oxidation state of Phosphorus in its hydroxyapatite ore is

- (a) +5 (b) +3 (c) -3 (d) -5

48. Which of the following arrangement of allotropes of Phosphorus is in the correct increasing order of stability?

- (a) Black < Red < White (b) White < Red < Black
(c) Red < White < Black (d) Black < White < Red

49. The arrangement of compounds of antimony, SbCl₃, SbF₃, SbH₃, SbO₃, in an increasing order of their tendency to form ionic bonds is

- (a) SbH₃ < SbO₃ < SbCl₃ < SbF₃ (b) SbF₃ < SbO₃ < SbCl₃ < SbH₃
(c) SbH₃ > SbO₃ > SbCl₃ > SbF₃ (d) SbH₃ < SbCl₃ < SbO₃ < SbF₃

50. Which of the following set of compounds i. NH₃ ii. PH₃ iii. AsH₃ iv. SbH₃ v. BiH₃, will not exhibit hydrogen bonding?

- (a) ii, iii, iv and v (b) i only (c) iii, iv and v (d) i and ii

51. Under what condition does ammonia act as a mild reducing agent?

- (a) When it is in excess at an elevated temperature
(b) In acidic and neutral solutions

- (c) when it is in excess at a concentration greater than 1M.
 (d) In a basic solution

52. Which of the following acids will not react with Boron?

- (a) HBr (b) H₂SO₄ (c) HNO₃ (d) HF

53. Which of the Group IIIA elements forms a white superoxide that is gelatinous in nature and dissolves in alkali?

- (a) Boron (b) Aluminium (c) Gallium (d) Indium (e) Thallium

54. Diboranes are very reactive and explosive in nature

- (a) as a result of their volatile nature

- (b) Ability to get easily oxidized in air through the removal of hydrogen in the compound.

- (c) Small size and the higher electronegativity of boron as compared to the other members of Group IIIA.

- (d) Deficiency in the number of electrons required for stable bond formation.

55. Arrange the following trihalides of boron in a decreasing order of their expected bond angles.

BCl₃, BBr₃, BF₃ and BI₃

- (a) BI₃ > BBr₃ > BCl₃ > BF₃

- (b) BF₃ > BCl₃ > BBr₃ > BI₃

- (c) BBr₃ > BI₃ > BCl₃ > BF₃

- (d) BF₃ < BCl₃ < BBr₃ < BI₃

56. Using the electronegativity values in the table below: Why does the value increase from Gallium after the initial decrease observed in Aluminium?

Element	B	Al	Ga	In	Tl
Electronegativity	2.0	1.5	1.6	1.7	1.8

- (a) Boron and Aluminium have relatively stable configurations

- (b) Presence of d-orbital electrons that are poor shielders of the nuclear charge thus resulting in a relatively smaller sizes than expected.

- (c) Increase in their reactivity that results in the ease loss of valence electrons

- (d) Presence of d- or f-orbital electrons that are poor shielders of the nuclear charge

57. The boiling point of SnH₄ is greater than that of CH₄ despite the smaller size of carbon than Sn. This is because

- (a) CH₄ is a gas while SnH₄ is a powder at room temperature.

- (b) Increase in the surface area of hydrides down the group leads to an increase in the van-der-waals' forces down the group in hydrides resulting in higher boiling point.

- (c) Higher electronegativity of Sn than that of C resulting in a higher electronegativity difference in the Sn-H bond than the C-H bond that resulted in a higher boiling point.

- (d) Absence of the pπ-pπ double bonds in Sn that resulted in the formation of the stronger and saturated σ-bonds

58. Arrange the following compounds in a decreasing order of thermal stability.

Si₂H₆, Si₆H₁₄, Si₄H₁₀, Si₅H₁₂

- (a) Si₆H₁₄ > Si₅H₁₂ > Si₄H₁₀ > Si₂H₆ (b) Si₂H₆ > Si₄H₁₀ > Si₅H₁₂ > Si₆H₁₄

- (c) Si₆H₁₄ < Si₅H₁₂ < Si₄H₁₀ < Si₂H₆ (d) Si₂H₆ < Si₄H₁₀ < Si₅H₁₂ < Si₆H₁₄

59. GeO₂, SnO₂ and PbO₂ are insoluble in acids except

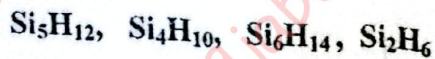
- (a) in the presence of concentrated alkali

- (b) at a low temperature and pressure

- (c) in the presence of complexing agents

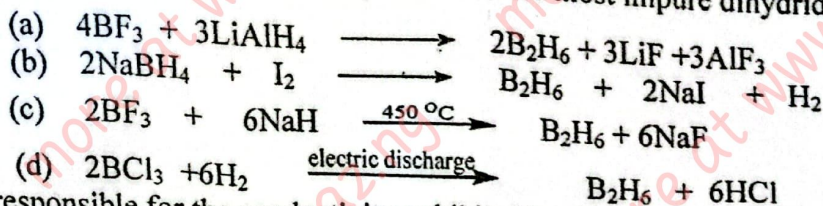
- (d) in the presence of molten alkali

60. Which of the following hydrides of silicon would be the most reactive?



- (a) Si_2H_6 (b) Si_4H_{10} (c) Si_3H_{12} (d) Si_6H_{14}

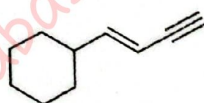
61. The equation which represents the preparation of the most impure dihydride of borane is



62. What is responsible for the conductivity exhibited by the heavier members of Group IV^A?

- (a) Their relatively larger size resulting in loosely held electrons that are easily lost
 (b) Their higher reactivity due to a lower effect of the nuclear charge
 (c) Higher tendency to form ionic compounds due to the ease of losing their valence electrons
 (d) Existence of some of the valence electrons not utilized in metallic bond formation.

63. The double bond equivalence of the compound below is the same as that of

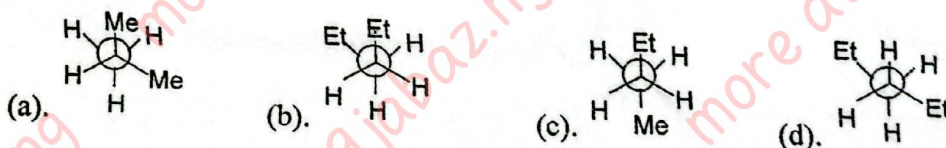


- a. acetone b. cyclohexen-2-one c. benzene d. deca-1,3,5,7,9-pentaene

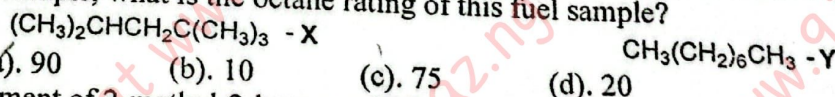
64. The IUPAC nomenclature of $\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_2\text{CH}_3)_2$ is

- (a) diethylbutane (b) 3-ethylhexane (c) 4-ethylhexane (d) 4-propylpentane

65. Looking through the C_3-C_4 bond, which of the following represents the most stable conformation of hexane?



66. For a fuel sample containing only compounds X and Y shown below: If X is nine times the quantity of Y in the sample, what is the octane rating of this fuel sample?

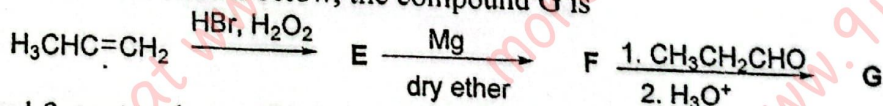


- (a) 90 (b) 10 (c) 75 (d) 20

67. Treatment of 2-methyl-2-butene with hot basic potassium permanganate will give?

- (a) 2,3-dihydroxy-2-methyl-2-butene (b) 2-methyl-2,3-butandiol
 (c) ethanoate + propanone (d) 2,2,3-trimethyloxirane

68. In the synthetic route shown below, the compound G is



- (a) 4-methyl-3-pentanol (b) 3-hexanone (c) propanone (d) 3-hexanol

69. Mercuric sulphate catalyzed hydration of 1-butyne will give?

- a. butanal b. 1-butanone c. 2-pentanone d. 2-butanone

70. Which of the following set of statements about the oxidation state of group VI elements are true

- i. +6 oxidation states decrease down the group
 ii. The stability of -2 oxidation states decrease down the group
 iii. +4 oxidation states increase down the group
 (a) i & ii only (b) ii & iii only (c) i, ii, & iii (d) i & iii only

