

UNIVERSITY IBADAN

Post UTME Past Questions and Answers

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CHEMISTRY

- 200 cm³ of air was passed over heated copper in a syringe several times to produce copper (II) oxide. When cooled, the final volume of air recorded was 158 cm³. Estimate the percentage of oxygen in the air. (A) 31% (B) 27% (C) 21% (D) 19% C
- 30cm³ of oxygen at 10 atmosphere pressures is placed in a 20dm³ container. Calculate the new pressure if temperature is kept constant. (A) 6.7 atm (B) 15.0 atm (C) 60.0 (D) 66.0 B
- Bond dissociation energy of 500 KJ mol⁻¹ may be assigned to (A) ionic bonding (B) covalent bonding (C) hydrogen bonding (D) metallic bonding (E) van-der-waals bonding. A
- A mixture of iron and sulphur can be separated by dissolving the mixture in ___ (A) steam (B) dilute hydrochloric acid (C) dilute sodium hydroxide (D) benzene B
- A mixture of sand, ammonium chloride and sodium chloride is best separated by ___ (A) sublimation followed by addition of water and filtration (B) sublimation followed by addition of water and evaporation (C) addition of water followed by filtration and sublimation (D) addition of water followed by crystallization and sublimation A
- A pure solid usually melts ___ (A) over a wide range of temperature (B) over a narrow range of temperature (C) at a lower temperature than the impure one (D) at the same temperature as the impure one B
- A small quantity of solid ammonium chloride was heated gently in a test tube; the solid gradually disappeared to produce a mixture of two gases. Later a white cloudy deposit was observed on the cooler part of the test tube. The ammonium chloride is said to have undergone ___ (A) distillation (B) sublimation (C) precipitation (D) evaporation B
- CH₄ has this geometry: (A) trigonal (B) planar (C) tetrahedral (D) octahedral (E) linear. C
- Chlorine, consisting of two isotopes of mass numbers 35 and 37, has an atomic mass of 35.5. The relative abundance of the isotope of mass number 37 is ___ (A) 20 (B) 25 (C) 50 (D) 75 B
- Elements P, Q, R, S, have 6, 11, 15 and 17 electrons respectively, therefore (A) P will form an electrovalent bond with R (B) Q will form a covalent bond with S (C) R will form an electrovalent bond with S (D) Q will form an electrovalent bond with S D
- In the oil drop experiment, Millikan determined the (A) charge to mass ratio of the electron (B) mass of the electron (C) charge of the electron (D) mass of the proton C
- One of these atomic shells is the most stable (A) M (B) N (C) K (D) L (E) O C
- Sieving is a technique used to separate mixtures containing 20% oxygen by volume. Which of the reactants was in excess? (A) Carbon (II) oxide (B) Oxygen (C) Carbon (IV) oxide (D) Nitrogen A
- The abnormally high boiling point of water is primarily due to (A) ionic bonding (B) covalent bonding (C) dative bonding (D) coordinate covalent bonding (E) hydrogen bonding. E

15. The energy required to remove an electron from the isolated gaseous atom is known as (A) electron affinity (B) bond energy (C) Ionisation energy (D) electronegativity (E) electrovalency. C
16. The group that oxygen belongs to is collectively called (A) allotropes (B) halogens (C) chalcogens (D) alkenes (E) ozonides. C

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17. The ideal gas equation is ____ (A) $P=nRT$ (B) $PR=nVT$ (C) $PV=gRT$ (D) $V=kT$ (E) $PV=KV$ A
18. The number of atoms in one mole of a substance is equal to (A) the atomic number (B) the Avogadro's number (C) number of neutrons (D) number of electrons (E) gas constant B
19. The number of electrons in the outermost shell of the atom represents its (A) period (B) number of shells (C) group (D) atomic number (E) electronegativity. C
20. The number of protons or electrons of an atom represents its (A) electronegativity (B) period (C) number of shells (D) group (E) atomic number E
21. The partial pressure of oxygen in a sample of air is 500 mmHg. If the total pressure is 780 mmHg, what is the mole fraction of the oxygen? (A) 0.64 (B) 5.73 (C) 1.56 (D) 0.70 (E) 0.54 A
22. The periodic classification of the elements is an arrangement of the elements in order of their (A) atomic weights (B) isotopic weights (C) molecular weights (D) atomic numbers D
23. The process of changing one element into another is called (A) radioisotope (B) radioactivity (C) dating (D) transmutation (E) nuclear reaction. D
24. The shapes of CO_2 , H_2O and CH_4 respectively are (A) bent, linear and tetrahedral (B) bent, tetrahedral and linear (C) tetrahedral, linear and bent (D) linear, bent and tetrahedral D
25. This compound exhibits ionic bonding (A) H_2O (B) H_2 (C) KCl (D) NH_3 (E) HF . C
26. This type of bonding involves overlapping of orbitals during which electrons are shared (A) hydrogen bonding (B) covalent bonding (C) ionic bonding (D) metallic bonding (E) van-der-waals bonding. B
27. Which one of the following changes is physical? (A) Adding iron filings to aerated water (B) Adding sodium metal to water (C) Cooling a solution of iron(II) sulphate to obtain the hydrated salt (D) Cooling water to obtain ice D
28. A side effect of soft water is that (A) it gives offensive taste (B) excess calcium is precipitated (C) it encourages the growth of bacteria (D) it attacks lead contained in pipes D
29. Ammonia is very soluble in water because it is a/an molecule (A) non-polar (B) polar (C) reactive (D) basic (E) acidic B
30. Citrus fruits such as lemon and grape taste sour because they contain (A) ascorbic acid and citric acid (B) citric acid and acetic acid (C) citric acid and dilute HCl (D) citric acid and salicylic acid (E) Sulphuric acid A
31. Soap lather is an example of a colloid in which a (A) liquid is dispersed in gas (B) solid is dispersed in liquid (C) gas is dispersed in liquid (D) liquid is dispersed in liquid C
32. The air around a petroleum refinery is most likely to contain. (A) CO_2 , SO_3 and N_2O (B) CO_2 , CO and N_2O (C) SO_2 , CO and NO_2 (D) PH_3 , H_2O and CO_2 C
33. The difference between colloids and suspensions is brought out clearly by the fact that while colloids (A) do not scatter light, suspensions do (B) can be separated by filtration, suspensions cannot be so separated (C) can be separated by a membrane, suspensions cannot (D) do not settle out on standing, suspensions do D
34. The following substances are non-electrolytes except (A) chloroform (B) sugar cane (C) acetic acid (D) $NaCl$ (E) C and D. E

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35. The hydrolysis of NH_4Cl salt will give (A) acidic solution (B) neutral solution (C) basic solution (D) hot solution (E) all of the above A
36. The pollutants that are likely to be present in an industrial environment are (A) H_2S , SO_2 and oxides of nitrogen (B) NH_3 , HCl and CO (C) CO_2 , NH_3 , and H_2S (D) dust, NO and Cl_2 A
37. What is the basicity of tetraoxosulphate (VI) acid? (A) 2 (B) 1 (C) 3 (D) 4 (E) 0 A
38. Which of the following gases is the most dangerous pollutant? (A) Hydrogen sulphide (B) Carbon (IV) oxide (C) Sulphur (IV) oxide (D) Carbon (II) oxide D
39. Which of the following ions is a pollutant in drinking water even in trace amount? (A) Ca^{2+} (B) Hg^{2+} (C) Mg^{2+} (D) Fe^{2+} B
40. Which of the following is an example of a double salt (A) NH_4Cl (B) alum (C) NaCO_3 (D) AlCl_3 (E) NaCl B
41. 0.16g of methane when burnt increases the temperature of 100g of water by 40°C , what is the heat of combustion of methane if the heat capacity of water is $4.2 \text{ Jg}^{-1}\text{C}^{-1}$? ($\text{CH}_4=16$). (A) $1,160 \text{ kJmol}^{-1}$ (B) $1,180 \text{ kJmol}^{-1}$ (C) $1,560 \text{ kJmol}^{-1}$ (D) $1,600 \text{ kJmol}^{-1}$ (E) $1,680 \text{ kJmol}^{-1}$ E
42. A charged car battery has ___ energy that can be converted into another energy called ___ energy (A) Chemical, electrical (B) mechanical, chemical (C) heat, mechanical (D) light, electrical (E) light, heat A
43. Copper oxide is heated with charcoal to produce carbon monoxide and copper. The reaction is an example of (A) both oxidation and reduction (B) neither oxidation and reduction (C) oxidation only (D) reduction only (E) neutralization A
44. For each oxygen atom in hydrogen peroxide which acts as an oxidant, there is an oxygen atom which acts as a/an (A) Oxidant (B) reductant (C) oxidizing agent (D) catalyst (E) inhibitor B
45. Given the change of phase: $\text{CO}_2(\text{g})$ changes to $\text{CO}_2(\text{s})$, the entropy of the system (A) decreases (B) increases (C) remains the same A
46. In which of the following is the entropy change positive? (A) Reaction between an acid and a base. (B) Addition of concentrated acid to water. (C) Dissolution of sodium metal in water. (D) Thermal dissociation of ammonium chloride. C
47. One of these elements is the best reducing agent. (A) Pb (B) Rb (C) Al (D) In (E) N B
48. The name of the gas driven off at the negative electrode during the electrolysis of brine is ___ (A) hydrogen (B) chlorine (C) oxygen (D) sodium (E) hydrogen chloride B
49. The oxidation state of P in $\text{H}_2\text{P}_2\text{O}_7^{2-}$ is ___ (A) -3 (B) +3 (C) +1 (D) +5 (E) -2 D
50. The oxidation state of S in $\text{Ca}(\text{HSO}_3)_2$ is ___ (A) +2 (B) -2 (C) +4 (D) -4 (E) +6. C
51. The oxidizing agent in the reaction, $3\text{Br}_2 + 6\text{OH}^- = \text{BrO}_3^- + 5\text{Br}^- + 3\text{H}_2\text{O}$ is ___ (A) Br_2 (B) OH^- (C) BrO_3^- (D) e^- (E) H_2O . A
52. When heat is absorbed during a chemical reaction, the reaction is said to be ___ (A) thermodynamic (B) exothermic (C) isothermal (D) endothermic (E) thermostatic D

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53. Given the reaction at equilibrium: $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{CO}_2(\text{g})$ When the reaction is subjected to stress, a change will occur in the concentration of (A) reactants, only (B) products, only (C) both reactants and products (D) neither reactants nor products C
54. Given the reaction at equilibrium: $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{NO}(\text{g})$ as the concentration of $\text{N}_2(\text{g})$ increases, the concentration of $\text{O}_2(\text{g})$ will (A) decrease (B) increase (C) remains the same (D) vanishes (E) pours away A
55. If a reaction is exothermic and there is a great disorder, it means that (A) The reaction is in a state of equilibrium (B) There will be a large increase in free energy (C) There will be a large decrease in free energy (D) The reaction is static. B
56. In the chemical reaction of $\text{A} + \text{B} = \text{C} + \text{D}$, more of D is formed (A) if the concentration of A is reduced (B) if the concentration of B is reduced (C) if the concentration of C is reduced (D) if the concentration of C is increased (E) if it is continuously removed from the reaction mixture E
57. In what way is equilibrium constant for the forward reaction related to that of the reverse reaction? (A) The addition of the two is expected to be one. (B) The product of two is expected to be one. (C) The two equilibrium constants are identical. (D) The product of the two is always greater than one. C
58. In which reaction will the point of equilibrium shift to the left when the pressure on the system is increased? (A) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \leftrightarrow \text{CO}_2(\text{g})$ (B) $\text{CaCO}_3(\text{s}) \leftrightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ (C) $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{MgO}(\text{s})$ (D) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{H}_2\text{O}(\text{g})$ B
59. The furring of kettles is caused by the presence in water of ___ (A) calcium trioxocarbonate (IV) (B) calcium tetraoxosulphate (VI) (C) calcium hydroxide (D) calcium hydrogentrioxocarbonate (IV) D
60. Which is a property of a reaction that has reached equilibrium? (A) The amount of products is greater than the amount of reactants. (B) The amount of products is equal to the amount of reactants. (C) The rate of the forward reaction is greater than the rate of the reverse reaction. (D) The rate of the forward reaction is equal to the rate of the reverse reaction. D
61. Which of the following combination of conditions many increase the rate of a chemical reaction. (A) Decrease in temperature, increase in concentration of the reactant (B) Increase in temperature, addition of a catalyst, decrease in the surface area of the reactant (C) Increase in temperature, increase in concentration, addition of a catalyst and increase in the surface area of the reactant (D) Decrease in temperature, concentration and surface area of the reactants (E) Addition of catalyst and in the absence of light. C
62. "Quicklime" has the formula ___ (A) $\text{Ca}(\text{OH})_2$ (B) CaO (C) CaCO_3 (D) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (E) CaCl_2 B
63. A Transition metal is different from a non-transition metal because (A) it has an octet configuration (B) it is very stable (C) it is coloured (D) it has incomplete outer shell d-electrons (E) it has no electron in the d-orbital. D
64. Chlorine is produced commercially by (A) electrolysis of dilute HCl (B) electrolysis of brine (C) neutralization of HCl (D) heating potassium trioxochlorate (V) (E) action of dilute mineral acids on bleaching powder. B

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65. Chlorine, bromine and iodine resemble one another since they ___ (A) dissolve in alkalis (B) react violently with H_2 without heating (C) displace each other from solutions of their salts (D) are gases (E) are liquids. A
66. Liquid oxygen may be produced by condensation of air using this coolant (A) liquid phosphorus (B) liquid gas (C) liquid paraffin (D) liquid nitrogen (E) butane. D
67. One of these is another form of oxygen (A) hydroxide (B) ozone (C) peroxide (D) sulphoxide (E) water. B
68. One of these metals is not an alkali metal (A) K (B) Cs (C) Sr (D) Rb (E) Fr C
69. One of these reactions represents the laboratory preparation of hydrogen. (A) $C(s) + H_2O(l) \rightarrow CO(g) + H_2(g)$ (B) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ (C) $Cu(s) + H_2O(l) \rightarrow CuO(s) + H_2(g)$ (D) $2Al(s) + 3H_2O(l) \rightarrow Al_2O_3(s) + 3H_2(g)$ (E) $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$ E
70. The formation of ozone by reaction of O_2 with atomic oxygen in UV light occurs in (A) upper atmosphere (B) inner atmosphere (C) stratosphere (D) hemisphere (E) none of these. A
71. The halogen which is chiefly produced commercially from seawater is ___ (A) Fluorine (B) chlorine (C) Bromine (D) iodine (E) Astatine. B
72. The most stable allotropic form of sulphur at normal conditions is ___ (A) monoclinic sulphur (B) rhombic sulphur (C) amorphous sulphur (D) plastic sulphur (E) ordinary sulphur B
73. The products obtained when the following chemical reaction is completed and balanced are... $HNO_3 + Ca(OH)_2 \rightarrow$ ___ (A) $CaNO_3 + H_2O$ (B) $Ca(NO_3)_2 + 2H_2O$ (C) $CaO + 2NO_2 + 3H_2O$ (D) $Ca + 2NO_3 + 2H_2O$ B
74. What is the role of iron and Aluminium oxide in ammonia production? (A) dehydrating agent (B) catalytic agent (C) oxidizing agent (D) bonding agent (E) preservative agent B
75. When carbon IV oxide is bubbled through lime water, the solution becomes milky due formation of (A) $Ca(HCO_3)_2$ (B) $CaCO_3$ (C) $Ca(NO_3)_2$ (D) $CaCl_2$ (E) $CaSO_4$ B
76. Which of the following gases dissolves in water vapour to produce acid rain during rainfall? (A) Oxygen (B) Carbon (II) oxide (C) Nitrogen (D) Sulphur (IV) oxide D
77. Which of the following is not allotope of carbon? (A) diamond (B) graphite (C) buckminsterfullerene (D) all of the above (E) none of the above E
78. Which oxide is amphoteric (amphiprotic)? (A) MgO (B) NaO (C) CaO (D) ZnO (E) BeO D
79. Why will it always be more difficult to extract potassium ions from sea water than to extract magnesium ions? This is because (A) most potassium compounds are less soluble in water (B) most potassium compounds are quite soluble in water (C) presence of other alkali metal ions has great influence on it (D) magnesium ion is an alkaline earth metal ion. (E) None of the above. B
80. _____ can be used to test for reducing sugars: (A) Iodine solution (B) bromine water (C) Fehling's solution (D) de-ionized water C

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81. $2\text{CH}_3\text{COOH} + \text{Zn} \rightarrow ?$ The product of this reaction is: (A) $(\text{CH}_3\text{COO})_2\text{Zn} + \text{Zn}$ (B) $\text{CH}_3\text{COOCH}_3 + \text{Zn}$ (C) $(\text{CH}_3\text{COO})_2\text{Zn} + \text{H}_2$ (D) $\text{CH}_3\text{COOH} + \text{CH}_4$ C
82. A ketone reacts with hydroxylamine to give (A) a hydrazone (B) an alkanonitrile (C) a nitroso compound (D) an oxime D
83. Alkanoic acids are weak acids and ionises in solution to give: (A) $\text{R}^+ + \text{COOH}$ (B) $\text{RCOO}^- + \text{H}^+$ (C) $\text{RCOO}^+ + \text{H}^-$ (D) $\text{RCO}^+ + \text{OH}^-$ B
84. An excess of ethanol heated with concentrated H_2SO_4 at a temperature of 180°C is dehydrated to give mostly: (A) ethane (B) ethene (C) ethanol (D) ethoxyethane B
85. Butene can be distinguished from benzene by reaction with: (A) Hydrochloric acid (B) Bromine water (C) Potassium sulphate (D) Sodium hydroxide B
86. Detergent is more efficient than soap in cleansing clothes and dishes because of the following reasons except that: (A) the corresponding Ca and Mg compound formed is soluble in H_2O (B) detergents are not affected by hardness of water (C) it cleans better than soap (D) it is less expensive D
87. In the manufacture of soap industrially, brine is used to _____ the acid salt. (A) oxidise (B) reduce (C) bleach (D) precipitate D
88. Methane gas can be made from carbon (II) oxide gas according to the equation $2\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{CO}_2(\text{g})$. Calculate the mass of CO required to produce 8.75×10^{25} molecules of CH_4 ? {At masses: C=12.011, H= 1.008, O = 15.999, Avogadro's no: 6.022×10^{23} molecules /mole.} (A) 8140g (B) 4070g (C) 1600g (D) 32.00g (E) 20.35g A
89. Potassium ethanoate is formed when: (A) Methanoic acid reacts with KOH (B) Ethanoic acid reacts with KOH (C) Methanol reacts with KCO_3 (D) Ethanol reacts with CH_3COOH B
90. Saponification is defined as: (A) Acidic hydrolysis of fat or oil (B) Alkali hydrolysis of fat or oil (C) Condensation of two monomer units (D) Mixture of glacial ethanoic acid and excess of simple alkanol B
91. Soaps and detergents have the same basic characteristics except that the carboxyl group of the fatty acid in detergent is replaced by: (A) alcohol (B) sulphate or a sulphonate group (C) ester (D) acids B
92. The relatively high boiling point of alkanols is due to: (A) aliphatic character (B) ionic bonding (C) hydrogen bonding (D) covalent bonding C
93. Two important sources of detergent are: (A) fat/oils and hydrocarbons (B) coal and cement (C) pulp and wood (D) water and gas A
94. What is the process associated with conversion of vegetable oil to soap? (A) Esterification (B) Saponification (C) hydrolysis (D) Acidification B
95. When ethanal vapour is passed over manganese (II) ethanoate (manganese acetate) catalyst in the presence of air, the product is: (A) ethanoate (B) ethanol (C) methanol (D) ethanoic acid D
96. When KOH is used instead of NaOH in the production of soap, it has the following advantages except it gives: (A) softer soap (B) harder soap (C) soap with lower melting point (D) more soluble soap B

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97. When palm wine is left exposed to air for a few days, it goes sour. The bacteria in the air oxidises _____ in palm wine to _____ (A) ethanol, ethanoic acid (B) ethanoic acid, ethanol (C) ester, ethanoic acid (D) ether, ethanol A
98. Which of the following is not true about benzoic acid? (A) It is aromatic in nature (B) It can be manufactured from methylbenzene (C) It has molecular formula C_6H_6COOH (D) It sublimes readily C
99. Which of the following reactions is correct? (A) $C_6H_5COOH + CaO \rightarrow C_6H_5Ca + HCO_3$ (B) $C_6H_5COOH + CaO \rightarrow C_6H_6 + CaCO_3$ (C) $C_6H_5COOH + PCl_5 \rightarrow C_6H_5Cl + H_2PO_4$ (D) $C_6H_5COOH + C_2H_5OH \rightarrow C_6H_6 + C_3H_8COOH$ B
100. Which of these is not a property of ethanedioic acid? (A) It is a stronger acid than ethanoic acid but weaker than inorganic acids (B) It is a reducing agent (C) It is an oxidising agent (D) It is soluble in cold water C