1. The principal valencies of the element of atomic number 50 are
(1) 1 and 2. (2) 2 and 3. (3) 1 and 3 (4) 2 and 4. (5) 3 and 5.

2. The concentration of a solution is expressed as $1.3X10^{-7}$ mol cm^{-3} in fundamental SI units this concentration is
(1) $1.3X10^{-6}$ mol m^{-3} (2) $1.3X10^{-1}$ mol m^{-3} (3) $1.3X10^{-1}$ mol m^{-3}
(4) $1.3X10^{-2}$ mol l^{-1} (5) $1.3X10^{-1}$ mol l^{-1}

3. Which one of the following equilibria would tend to go to the right when the pressure is increased under constant temperature ?
(1) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ (2) $2H_2(g) + O_2 \rightleftharpoons 2H_2O(g)$
(3) $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$ (4) $S(s) + O_2(g) \rightleftharpoons SO_2(g)$
(5) $C_2H_5OH(g) \rightleftharpoons C_2H_4(g) + H_2O(g)$

4. Consider the following equilibrium. $AB_2(g) + 2AB(g) \rightleftharpoons A_3B_4(g)$
$AB_2(g)$ and $AB(g)$, in the mole ratio of 1:2, are placed inside a closed vessel and allowed to reach equilibrium at a certain temperature. At equilibrium, 50% of AB_2 (g) remains in the gaseous mixture. The mole fraction of A_3B_4 (g) in this mixture is
(1) 1/4. (2) 1/3. (3) 1/2. (4) 1/5. (5) none of the above

5. The number of straight-chain compounds with molecular fomula C_3HF_5 is
(1) 2. (2) 3. (3) 4. (4) 5. (5) none of the above.

6. Which one of the following will not react with aqueous $AgNO_3$?
(1) $(C_2H_5)_3CCl$ (2) CH_3COBr (3) $ClCH_2COCl$ (4) $C_6H_5CH_2Cl$ (5) $CH_2=CHCl$

7. Which one of the following will not react with aqueous NaOH?
(1) Br_2 (2)Zn (3) F_2 (4) Fe (5) Sn

8. Which one of following will show a clearly visible chemical reaction with water?
(1) CsCl (2) RbF (3) $BiCl_3$ (4) $SrCl_2$ (5) BaI_2

9. Which one of the following could be used to distinguish readily between $CH_3CH_2CH_2OH$ and CH_3CH_2OH?
(1) HI (2) H_2SO4 (3) Br_2/P (4) Br_2/aqueous NaOH (5) $I_2/CHCl_3$

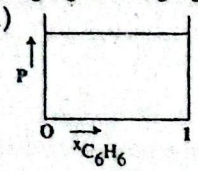
10. The atom X forms the anion X^{2-}. The atom Y forms the anion Y^{3-}. The numbers of electrons in the last sub-level of these two anions are n_x and n_y, respectively. What is the relationship between n_X and n_Y?
(1) $n_x > n_y$ (2) $n_y > n_x$ (3) $n_y - n_x = 1$
(4) $n_x = n_y = 8$ (5) $n_x = n_y = 6$

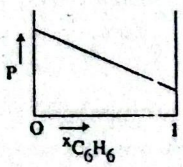
11. Which one of the following statements pertaining to the mean kinetic energy of molecules in a given mass of gas is most appropriate?
(1) It increases with the pressure. (2) It decreases with the pressure.
(3) It varies with the volume. (4) It varies with the temperature.
(5) All of the above statements are incorrect.

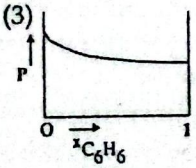
12. Which one of the following statements pertaining to rhombic sulphur is most appropriate?
(1) It consists of long chains formed by sulphur atoms.
(2) It consists of S_8 chains formed by sulphur atoms.
(3) It consists of ring-like S_8 molecules.
(4) It consists of tetrahedral S_4 molecules.
(5) It consists of alternating S_8 rings and S_8 chains.

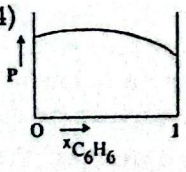
13. It has become necessary to synthesize –^{14}COOH starting from benzene. Which one of the following is the most appropriate initial step?
(1) Reacting benzene with CH_3COCl/anhydrous $AlCl_3$.
(2) Reacting benzene with Cl_2/Fe.
(3) Reacting benzene with concentrated HNO_3 / concentrated H_2SO_4.
(4) Reacting benzene with concentrated H_2SO_4.
(5) Reacting benzene with CH_3Cl/ anhydrous $AlCl_3$.

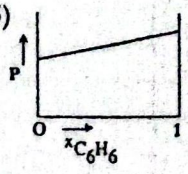
14. Which one of the following will correspond to the variation of the vapour pressure of the binary system consisting of C_6H_6 and C_6D_6 ? (D= deuterium)

(1) 

(2) 

(3) 

(4) 

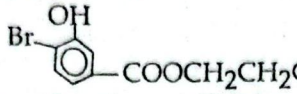
(5) 

P=vapour pressure of the system
$x_{C_6H_6}$ = benzene mole fraction

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15. Consider 0.1 mol dm^{-3} aqueous solutions of Na_2CO_3, $NaHCO_3$, $CsClO_4$, and $(NH_4)_2SO_4$. The pH value of these solutions will vary as
(1) $CsClO_4$ (aq) >$(NH_4)_2SO_4$(aq)>$NaHCO_3$ (aq)> Na_2CO_3 (aq).
(2) $NaHCO_3$ (aq) >Na_2CO_3 (aq) > $(NH_4)_2SO_4$ (aq) > $CsClO_4$ (aq).
(3) Na_2CO_3(aq) >$(NH_4)_2SO_4$ (aq) >$CsClO_4$ (aq)>$NaHCO_3$ (aq).
(4) Na_2CO_3 (aq) > ($NaHCO_3$ (aq) > $CsClO_4$ (aq) > $(NH_4)_2SO_4$ (aq),
(5) $NaHCO_3$ (aq) > Na_2CO_3 (aq)> $CsClO_4$ (aq) > $(NH_4)_2SO_4$ (aq)

16. Which one of the following solutions will be most strongly acidic?
(1) Water in which SO_2 is dissolved.
(2) Water in which NO_2 is dissolved.
(3) Water in which SO_2 and NO_2 are dissolved.
(4) Water in which H_2S is dissolved.
(5) Water in which Cl_2O is dissolved.

17. The IUPAC name of  is
(1) 6-bromo-3-carbopropoxyphenol.
(2) 2-bromo-5-carbopropoxyphenol.
(3) propyl 4-bromo-5-hydroxybenzoate.
(4) propyl 4-bromo-3-hydroxybenzoate.
(5) 2-bromo-5- carbopropoxy-1-hydroxybenzene.

18. Which one of the following statements concerning the reaction between fused ammonium chloride and aluminium metal is most appropriate?
(1) Chlorine is liberated.
(2) hydrogen is liberated.
(3) Ammonia is liberated.
(4) Hydrogen and nitrogen are liberated.
(5) Hydrogen and ammonia are liberated.

19. Which one of the following statements is false for pure water?
(1) pH value may be less than 7.
(2) pOH value may be less than 7.
(3) $[H_3O^+] > K_w$
(4) $[OH^-] > K_w$
(5) $[H_3O^+] > [OH^-]$

20. The atomic radii of sodium, magnesium and calcium
(1) decrease in the order Ca>Na>Mg.
(2) decrease in the order Na>Ca>Mg.
(3) decrease in the order Ca>Mg>Na.
(4) decrease in the order Mg>Na>Ca.
(5) decrease in the order Na>Mg>Ca.

21. Which one of the following molecules will not be polar?
(1) NH_3 (2) HCl (3) CO_2 (4) SO_2 (5) H_2S

22. The number of moles of oxygen necessary for the complete combustion of 1 mol of octane is
(1) 9. (2) 12. (3) 12.5 (4) 24. (5) 25.

23. The half-life of a radioactive isotope is 20 years. What percentage of the initial quantity of the radioactive isotope will undergo decay during 100 years?
(1) About 80% (2) About 85% (3) About 90% (4) About 97% 95) About 99%

24. The units of the K_{sp} of $Ba_3(PO_4)_2$ are
(1) mol l^{-1}. (2) mol^5 l^{-5}. (3) mol^4 l^{-4}. (4) mol^5 dm^{-3} (5) mol^3 dm^{-3}.

25. Consider the following equilibria:
$XO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons XO_3(g)$ $K_p = K_1$
$2XO_3(g) \rightleftharpoons 2XO_2(g) + O_2(g)$ $K_p = K_2$
The relationship between K_1 and K_2 is
(1) $K_1 = K_2$. (2) $K_1^2 = K_2$. (3) $K_2^2 = K_1$ (4) $K_2 = 1/K_1$ (5) $K_2 = 1/K_1^2$

26. In the reaction that takes place between $H_2S_2O_7$ and copper in aqueous medium
(1) the oxidation number of sulphur changes from +8 to +6.
(2) the oxidation number of sulphur changes from +7 to +4.
(3) the oxidation number of sulphur changes from +6 to +4.
(4) the oxidation number of copper changes from 0 to +1.
(5) none of the above occurs.

27. The inorganic compound, A dissolves in dilute HCl, and gives a gas, B. With dilute H_2SO_4, A gives the same gas B, however, a clear solution in not produced. B changes the colour of an acidified solution of $K_2Cr_2O_7$. B gives a black precipitate with an aqueous solution of $AgNO_3$. A imparts a green colour to the bunsen flame. Which one of the following could be A?
(1) BaS (2) $CuSO_3$ (3) CuS_2O_3 (3) SrS (5) $SrSO_3$

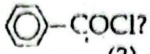
28. The organic compound, C on ozonolysis under oxidative conditions gave propanone and ethanedioic acid in the molar ratio 2:1. Which one of the following could be C?
(1) $CH_3CH_2CH = CH - CH = CHCH_2CH_3$
(2) $CH_3 - \underset{\underset{CH_3}{|}}{C} = CHCH_2CH_2CH = \underset{\underset{CH_3}{|}}{C} - CH_3$

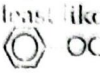
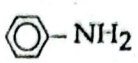
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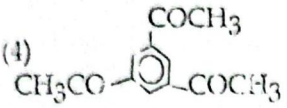
(3) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_2-CH=\underset{\underset{CH_3}{|}}{C}-CH_3$

(4) $(CH_3)_2C=CH-CH=C(CH_3)_2$

(5) $(CH_3)_2C=CH-CH=CHCOCH$

29. Which one of the following is least likely to react with ?

(1)  (2)  (3) 

(4)  (5)

30. In analyzing an organic compound qualitatively, $FeSO_4$ was added to the Lassaigne extract, the mixture was boiled, and then dilute H_2SO_4 was added. A deep red solution was thus obtained. Which one of the following statements concerning the organic compound is most appropriate ?
(1) The compound contains nitrogen or sulphur.
(2) The compound contains bromine.
(3) The compound contains nitrogen.
(4) The compound contains sulphur.
(5) The compound contains nitrogen and sulphur.

31. Which equations/equation are/is in accord with Raoult's Law?

(a) $\frac{P^\circ_A - P_A}{P^\circ_A} = X_A$ (b) $\frac{P^\circ_A - P_A}{P_A} = X_B$ (c) $\frac{P^\circ_B - P_B}{P^\circ_B} = X_A$ (d) $P_i = X_i P_i^\circ$

32. Butanone can be obtained as follows:
(a) Dehydrogenation of butan-2-ol.
(b) Oxidation of butan-1-ol.
(c) Hydrogenation of butanoic acid.
(d) Reduction of butanoylchloride.

33. Which of the following gives/give NO_2 on heating?
(a) $CsNO_3$ (b) $Ba(NO_3)_2$ (c) $Ni(NO_3)_2$ (d) NH_4NO_3

34. Which of the following reacts/react with benzamide?
(a) $NaNO_2/HCl$ (b) $Ba(OH)_2$ (c) C_6H_5COCl (d) $C_6H_5COCH_3$

35. Which of the following reacts/react with NO_2 ?
(a) C (b) Mg (c) HI (d) $KMnO_4$

36. Which statements/statement concerning soap are/is true ?
(a) Soap may contain $CH_3(CH_2)_{10}COO^- Na^+$
(b) Glycol is obtained as a by-product in the manufature of soap.
(c) H_2 gas is necessary in the production of soap.
(d) Propan — 1, 2, 3 — triol can be obtained from the soap industry.

37. Which statements/statement concerning the titration of aqueous methyl amine placed is a titration flask with aqueous trifluoroethanoic acid placed in a burette are/is true?
(a) In this titration, the marked change in pH occurs in the range 10 -8 approximately.
(b) in this titration, the marked change in pH occurs in the range 9-4, approximately.
(c) Methyl red is a suitable indicator for this titration.
(d) Phenolphthalein is a suitable indicator for this titration.

38. Ethanol labelled with ^{18}O isotope and unlabelled ethanoic acid were reacted in the presence of concentrated H_2SO_4 which statements/statement concerning this reaction are/is true?
(a) The water formed as a product of this reaction contains ^{18}O.
(b) The ester formed as a product of this reaction is radioactive.
(c) The ester formed as a product of this reaction contains ^{18}O.
(d) The ethanoic acid remaining unreacted in this reaction does not contain ^{18}O.

39. Consider cell, $Mg(s)\,|\,Mg^{2+}(aq, 0.01\ mol^{-1})\,\|\,Cu^{2+}(aq, 1.0\ mol\ l^{-1})\,|\,Cu(s)$

Which statements/statemet concerning the above cell are/ is true?
(a) The oxidation occurs at the Mg electrode.
(b) When the cell reaction occurs, heat is liberated.
(c) The oxidation occurs at the Cu electrode.
(d) When the cell reaction occurs, heat is absorbed.

40. Which of the following cations/cation are/is precipitated by H_2S in acidic medium?
(a) Ni^{2+} (b) Zn^{2+} (c) Ag^+ (d) Pb^{2+}

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	First statement	Second Statement
41.	Treatment of benzonitrile with nitrating mixture gives 2–and 4– nitro derivatives.	The nitrile group repels electrons towards the benzene ring.
42.	Ethylbenzene can be obtained from $C_6H_5COCH_3$	The carbonyl group of $C_6H_5COCH_3$ is reduced to the $-CH_2-$group by Fe/HCl.
43.	The reaction between LiH and D_2O gives pure HD	LiH contains the hydride anion, and D^+ is supplied for the reaction by D_2O.
44.	The penetrating power of beta rays is very high.	Beta rays are electrons travelling at high velocities.
45.	In the long form of the periodic Table, the 4th Period contains 18 elements.	The 4th energy level can accommodate only 18 electrons.
46.	Cu^{2+} and Al^{3+} cations can be separated by using aqueous ammonia.	$Al(OH)_3$ shows amphoteric properties.
47.	Cinnamon oil can be isolated by using steam distillation.	The vapour pressure of cinnamon oil increases in the presence of water.
48.	$CH_2=CH-CH_2-OH$ reacts with $SOCl_2$	$CH_2=CH-CH_2-OH$ is an unsaturated compound.
49.	The PF_3 molecule is planar	In PF_3, phosphorus is tri-valent.
50.	$Ca(HCO_3)_2$ cannot exhibit buffer action	Aqueous alkalis are not neutralized by $Ca(HCO_3)_2$

51. An ideally behaving gas of relative molecular mass M, is kept at a temperature of T under a pressure of P. The density of the gas is.

(1) $\frac{PR}{MT}$ (2) $\frac{PT}{MR}$ (3) $\frac{M}{PRT}$ (4) $\frac{PTM}{R}$ (5) $\frac{PM}{RT}$

52. It has become necessary to prepare 1120 ml of ethyne at s.t.p. If ethyne behaves as an ideal gas, how much of calcium carbide is necessary for this purpose? (Ca=40; C=12)

(1) 6.4g (2) 5.6 g (3) 3.2g (4) 2.8g (5) 1.6g

53. When the organic compound, P is treated with $NaNO_2$ and dilute HCl, the compound Q and nitrogen gas are obtained. Q is not a phenol. Q on oxidation gives R. When R and $HOCH_2CH_2CH_2OH$ are heated with concentrated H_2SO_4, a material similar to terylene is obtained, Which one of the following could be P?

(1) $NH_2-C_6H_4-CHO$ (2) $NH_2CH_2-C_6H_4-CHO$ (3) $CH_3NH-C_6H_4-COOH$

(4) $CH_3NH-C_6H_3(CHO)(NH_2)$ (5) $NH_2CH_2-C_6H_4-Cl$

54. Which one of the following statements concerning proteins is **incorrect?**

(1) Proteins contain nitrogen. (2) Proteins contain– CO – NH– links.
(3) Proteins contain free – COOH groups.
(4) All the alpha amino carboxylic acids obtained from proteins exist in optically active forms.
(5) 2- amino carboxylic acids can be obtained from all the proteins.

55. Which one of the following is used for preparing Brady's reagent?

(1) $NO_2-C_6H_3(NO_2)-NHNH_2$ (2) $C_6H_3(NO_2)_2-NHNH_2$ (3) $NO_2-C_6H_3(NO_2)-NH_2$

(4) $NO_2-C_6H_2(NO_2)_2-NHNH_2$ (5) $C_6H_5-NHNH_2$

56. Which one of the following statements concerning distinguishing between aqueous Fe^{2+} and aqueous Fe^{3+} is true?

(1) Aqueous NaOH cannot be used. (2) Aqueous NH_3 cannot be used.
(3) Bromine water cannot be used. (4) Br_2/CCl_4 can be used.
(5) Aqueous $(NH_4)_2S$ can be used.

57. The fluoride of a metal, M contains 49.6% of M. The heat capacity of M is 0.45 J $g^{-1}K^{-1}$. Which one of the following could be M?
(N.B. F=19.00; Molar heat capacity of metals = 26 J $mol^{-1}K^{-1}$)

(1) Mg (2) Al (3) Cu (4) Fe (5) Zn

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58. A given solution of concentrated hydrochloric acid contains 38% HCl, by weight. The density of this solution is 1.2 g ml^{-1}. How much of the above concentrated hydrochloric acid solution is required for preparing 250 ml of 0.10 mol l^{-1} HCl?
(1) 2.0 m (2) 2.5ml (3) 8.0ml (4) 10 ml (5) 20 ml

59. The colour of iodine dissolved in CCl_4 is discharged by aqueous NaOH. In this reaction,
(1) I_2 acts as a strong acid. (2) I_2 undergoes reduction.
(3) I_2 undergoes oxidation. (4) I_2 undergoes both oxidation and reduction.
(5) None of the above takes place.

60. Which one of the following statements concerning the catalyst used in the industrial production of ammonia is most appropriate?
(1) The temperature at which the reaction occurs is reduced by the catalyst.
(2) The pressure necessary for the reaction to occur is reduced by the catalyst.
(3) The activation energy of the reaction is reduced by the catalyst.
(4) All of (1) , (2) and (3) above are true.
(5) only (2) and (3) above are true.

PART A - STRUCTURED ESSAY

1. (a) Define 'relative atomic mass' as accepted at present.

(b) The element X forms the oxides X_2O_3 and XO_3. The oxide, XO_3 dissolves in aqueous NaOH, and gives a yellow solution. If the relative atomic mass of X is between 40 and 60, write the electron configuration of X as $1s^2\ 2s^2$ ..... etc, in the usual way.

(c) What is the shape of the cationic species, BF_2^+?

(d) If each of the following compounds exists, write its name; if it does not exist, indicate that fact clearly in words.
(i) $COCo_3$
(ii) Cs_2AsO_4
(iii) SnS_2

2. (a) Assume that the tetra-valent metal, M reacts with nitric acid giving ammonium nitrate as one of the products. Write a balanced chemical equation for this reaction.

(b) 0.511g of a mixture consisting of $CaCO_3$ and $(NH_4)_2CO_3$ was completely decomposed by strong heating. The mass of the remaining residue was 0.098 g. Calculate the $CaCO_3$: $(NH_4)_2CO_3$ mole ratio in the mixture. (H=1;C=12;N=14;O=16;Ca=40)

(c) you are supplied with an aqueous solution containing strontium nitrate and magnesium nitrate. Explain briefly how you would attempt to determine quantitatively the concentration of strontium and the concentration of magnesium in the above solution.

3. (a) The stoichiometric equation for the combustion of the gaseous hydrocarbon of molecular formula C_xH_y is given below.

$$C_xH_y\ (g) + (x + \frac{y}{4})\ O_2\ (g) = xCO_2(g) + \frac{y}{2}\ H_2O\ (l)$$

(i) What is the ratio between the volume of carbon dioxide formed and the volume of hydrocarbon consumed in this combustion reaction?

(ii) What is the reduction in the number of gaseous molecules in this combustion reaction?

(iii) 5 cm^3 of the above hydrocarbon and 45 cm^3 of oxygen gas were mixed together and ignited using electrical sparks. When the gaseous mixture that remained after the combustion reaction was allowed to cool, the total volume was found to be 35 cm^3. When this volume of gas was treated with a concentrated solution of KOH, the new volume was found to be 20 cm^3. Assuming that all the gas volumes were measured at s.t.p., determine the molecular formula of the hydrocarbon.

(b) Give the mechanism of the bromination of $C_6H_5CH_2Cl$ in the presence of sun light.

(c) Indicate how the following conversions could be effected. The necessary reagents and reaction conditions should be clearly stated at the appropriate places.
N.B. If the method of conversion proposed by you is unnecessarily long, you will not be awarded full marks.

(i) $CH_3CHO \rightarrow CH_3-\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}-CH_3$

(ii) $CH_3CH_2COOH \rightarrow CH_3-C\equiv CH$

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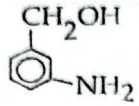
4. (a) Write the IUPAC name of $O_2N-CH_2-CH=CH-\underset{CH_3}{\overset{\overset{\cdot\cdot}{\cdot\cdot}}{C}}-CH_2-Br$

N.B. Disregard geometrical and optical isomerism.

(b) Draw all the possible structures of the mono-substituted benzene derivatives of molecular formula C_8H_8O.

(c) Indicate how the following syntheses could be effected. The necessary reagents and reaction conditions should be clearly stated at the appropriate places.

N.B. If the method of synthesis proposed by you is unnecessarily long, you will not be awarded full marks.

(i) Synthesis of  starting with benzene.

(ii) Synthesis of $(C_6H_5)_3COH$ using benzene as the only starting organic compound.

5. (a) (i) There is a binary ideal solution, consisting of the liquids A and B, in which the mole fractions are respectively x_A and x_B. This is distilled at a certain temperature, and the vapour so obtained is condensed. Show that the $x_A : x_B$ ratio in this distillate is $x_AP_A^\circ : x_BP_B^\circ$.

N.B. P_A° = The vapour pressure of pure A at the relevant temperature.
P_B° = The vapour pressure of pure B at the relevant temperature.

(ii) An ideal solution consisting of 3 moles of A and 1 mole of B is subjected to fractional distillation at 90 °C. The distillate so obtained is again subjected to fractional distillation at 90°C. The vapour pressure of pure A at 90 °C is 300 mm Hg, and the vapour pressure of pure B is 400 mm Hg at the same temperature, Calculate the mole percentage of B in the distillate obtained from the second distillation.

(b) Using an appropriate thermochemical cycle, explain how the standard enthalpy of formation of the hypothetical compound, '**calcium monochloride**,' CaCl, can be determined.

(c) Some bond dissociation energy data are given below

Bond	Bond dissociation energy, kJ mol $^{-1}$
H–H	+433
C–H	+413
C–C	+346
C=C	+612

Calculate the standard enthalpy change that is expected to occur in the hydrogenation of buta –1, 3 –diene ($H_2C=CH-CH=CH_2$) to butane ($CH_3CH_2CH_2CH_3$)

6. (a) Explain how you would determine the distribution coeffcient of iodine between water and carbon tetrachloride.

(b) The distribution coefficient of bromine between the organic solvent, X and water is 40. The distribution coefficient of bromine between the organic solvent, Y and water is 80. X and Y are completely miscible. Assume that you are provided with a sample of bromine dissolved in X, and also pure solvent Y. Propose a method to extract almost all of the bromine from the above sample into the solvent Y, without any impurities

(c) Consider the equilibrium,

$$AB(g) \rightleftharpoons A(g) + B(g)$$

that is being maintained in a closed vessel at 27 °C.
The total pressure of a certain mixture containing AB(g), A(g) and B(g), at equilibrium, was 0.90 atm. The equilibrium partial pressures of B (g) and AB(g) were 0.15 atm, 0.25, respectively. Calculate K_c for this reaction at 27°C.

(d) What is the reaction that could occur between Fe2+(aq) and Ag+(aq) ? Explain how you would experimentally show that this reactiory could take place in both directions.

7. (a) The solubility of As_2S_5 at 25 °C is x mol l^{-1}. Derive the the relationship between the solubility product of As_2S_5 at 25 ° C and its solubility.

(b) (i) An aqueous solution of NaOH of concentration 0.100 mol l^{-1} was saturated with Ca $(OH)_2$ at a certain temperature. 25.00 ml of this saturated solution required 15.00 ml of 0.200 mol l^{-1} HCl for neutralization. Calculate the solubility product of $Ca(OH)_2$ at this temperature.

(ii) Comment on the difficulties that arise in the attempt to determine the solubility product of $Zn(OH)_2$ by a method similar to the method which forms the basis of (b) (i) above.

(c) The K_b value of a primary amine, RNH_2 at 25°C is 8.0×10^{-4} mol l^{-1}. Calculate the pH of an aqueous solution of RNH_2 of concentration 2.0 mol $^{-1}$ at 25 °C. $K_W=1.0\times10^{-14}$ mol^2 l^{-2} at 25 °C.

8. (a) The hydrolysis reaction of ethyl propanoate is catalysed in the presence of dilute H_2SO_4. Explain how you would show this in the laboratory, chemically by a quantitative method.

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(b) Consider the reaction $A + B \rightarrow X + Y + Z$. The rate of this reaction can be expressed by the equation given be

$$\text{Rate} = k[A]^m \times [B]^n$$

Same experimental data pertaining to this reaction are given below

Experiment Number	Concentration of A, mol l^{-1}	Conncentration of B, mol l^{-1}	Rate
1	1.10×10^{-3}	1.20×10^{-3}	1.00 x q
2	3.29×10^{-3}	2.42×10^{-3}	107.90 x q
3	3.32×10^{-3}	1.19×10^{-3}	27.15 x q

q is a constant which incorporates units as well. Determine the rate of the reaction and express it in te of q, when the concentration of A is 2.20×10^{-3} mol l^{-1} and the concentration of B is 3.60×10^{-3} mol l^{-}

(c) (i) Give the conditions necessary for the occurrence of a chemical reaction, according to the 'Collision Theo

(ii) Taking an appropriate example, explain homogeneous catalysis occurring to the gaseous stat

PART C - ESSAY

9. (a) State clearly and separately the acid-base nature of the hydrides of the elements, sodium, magnesiu phosphorus, sulphur and chlorine.

(b) Give four similarities between hydrogen and sodium, and four similarities between hydrogen and chlo

(c) (i) Explain how a sample of pure calcium oxide could be obtained using dolomite.

(ii) Explain how an aqueous solution containing NaOCl and NaCl could be obtained using KClO the only chlorine-containing compound.

10. (a) Give examples of two instances where SO_2 acts as an oxidizing agent, and two instances where it acts a reducing agent.

N.B. : (i) the examples given by you, should be ones which can be demmonstrated easily in the laborat

(ii) balanced chemical equations should be written for the relevant reactions.

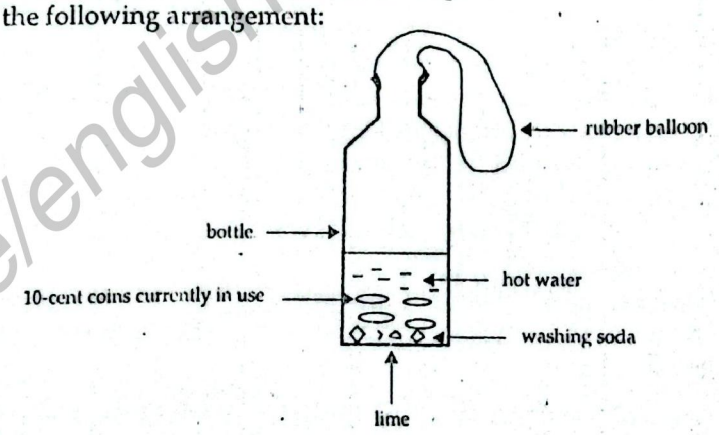
(b) Write a brief account of the environmental pollution that can be causes by a sulphuric acid factory. **N.B.: It is sufficient to consider four important aspects.**

(c) You are supplied with a mixture containing Ag_2S, CuS and ZnS. Propose an analytical scheme for quantitative determination of the percentage composition of this mixture.

11. (a) Write a brief description of the physico-chemical principles involved in the production of caustic s using the method that was employed at Paranthan.
N.B. : It is sufficient to consider five important aspects.

(b) Write a brief description of the manufacture of glass.

(c) Consider the following arrangement:



(i) What is it that collects in the rubber balloon?

(ii) Explain the chemical reactions that take place.

(iii) Write the balanced chemical equations for the above reactions.

12. (a) "The synthesis of ammonia in the industrial scale has been very useful in connection with the progres mankind."
Substantiate this statement.
N.B.: It is sufficient to present four points with the necessary details.

(b) How and under what conditions does ammonia react with the following elements?
(i) Potassium (ii) Chlorine.

(c) You are supplied with a concentrated aqueous solution containing Br^- and NO_3^-. As reagents, you supplied with only solid $AgNO_3$ and concentrated H_2SO_4. You are provided with the facilities r mally available in a Chemistry laboratory. You are also informed that Ag_2SO_4 is somewhat solubl water. Under these circumstances, propose a scheme of analysis which conducted in the solution a for the purpose of showing the presence of NO_3^- in the solution provided.
N.B. : The relevant observation/ observations need not be confined only to the solution state.

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