Msc Chemistry (482)

Set No. 1

15P/206/2

Question Booklet No. 4059

(To be filled up by the candidate by blue/black ball-point pen)

Roll No. | | | | | | | | | |

Roll No.
(Write the digits in words) .....

Serial No. of OMR Answer Sheet .....

Day and Date ....
(Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only **blue/black ball-point pen** in the space above and on both sides of the Answer Sheet)

1. Within 10 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card without its envelope.*
3. A separate Answer Sheet is given. *It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.*
4. Write your *Roll Number and Serial Number of the Answer Sheet by pen* in the space provided above.
5. **On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.**
6. No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and also Roll No. and OMR Sheet No. on the Question Booklet.
7. Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.
8. Each question in this Booklet is followed by four alternative answers. *For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle* in the corresponding row of the Answer Sheet, by ball-point pen as mentioned in the guidelines given on the first page of the Answer Sheet.
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed.* If you *do not wish to attempt* a question, leave all the circles in the corresponding row blank (such question will be awarded zero mark).
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. Deposit *only the OMR Answer Sheet* at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

उपर्युक्त निर्देश हिन्दी में अन्तिम आवरण-पृष्ठ पर दिये गए हैं।

[No. of Printed Pages : 36+2

No. of Questions/प्रश्नों की संख्या : 150

Time/समय : 2½ Hours/घण्टे **Full Marks/पूर्णांक** : 450

Note : (1) Attempt as many questions as you can. Each question carries **3** marks. **One** mark will be deducted for each incorrect answer. Zero mark will be awarded for each unattempted question.

अधिकाधिक प्रश्नों को हल करने का प्रयत्न करें। प्रत्येक प्रश्न **3** अंक का है। प्रत्येक गलत उत्तर के लिए एक अंक काटा जाएगा। प्रत्येक अनुत्तरित प्रश्न का प्राप्तांक शून्य होगा।

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

यदि एकाधिक वैकल्पिक उत्तर सही उत्तर के निकट प्रतीत हों, तो निकटतम सही उत्तर दें।

1. The plots of gaseous densities vs temperature and of liquid densities vs temperature for a substance converge at a temperature. The temperature is called

(1) boiling point
(2) Boyle temperature
(3) critical temperature
(4) inversion temperature

2. The RMS speed of He(g) at 0 °C is 1300 m-s^{-1}. The most probable speed of the gas will be

(1) 1300 m-s^{-1} (2) 866·6 m-s^{-1}

(3) 1592·2 m-s^{-1} (4) 1061·4 m-s^{-1}

3. The pseudo first order rate constants for the cobalt-catalysed auto-oxidation of toluene in acetic acid at 87 °C at different concentrations of Co(III) are

[Co(III)]/ M	0·053	0·084	0·118	0·172
$k/10^{-5}$s^{-1}	1·47	2·93	5·68	11·58

for $[\text{toluene}]_0 = 0 \cdot 5$ M.

The order with respect to [Co(III)] is

(1) 2 (2) 1·5 (3) 1 (4) 0·5

4. For the reaction

$$2AB_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A_2B_4$$

the reaction rate for A_2B_4 formation is

(1) $2k_1[AB_2] - k_{-1}[A_2B_4]$ (2) $(2k_1 - k_{-1})[AB_2]$

(3) $\frac{2k_1}{k_{-1}}[AB_2]$ (4) $2k_1[AB_2]^2 - k_{-1}[A_2B_4]$

5. The enzymolysis of a substrate has a Michaelis constant of 0·035 mol-L^{-1} at 25 °C. The maximum rate of the reaction is $1 \cdot 50 \times 10^{-3}$ mol-L^{-1}-s^{-1}. What should be the concentration of the substrate for which the reaction rate would be reduced to $0 \cdot 75 \times 10^{-3}$ mol-L^{-1}-s^{-1}?

(1) 0·070 mol-L^{-1} (2) 0·494 mol-L^{-1}

(3) 0·035 mol-L^{-1} (4) 0·017 mol-L^{-1}

6. The entropy of activation for a reaction is related to the frequency factor (A) of Arrhenius equation as

(1) A (2) ln A (3) exp (A) (4) exp ($-A$)

7. The mechanism of the reaction

$$H_2O_2(aq) \rightarrow H_2O(l) + \tfrac{1}{2}O_2(g)$$

catalysed by Br^- ions is

$$H_2O_2(aq) + Br^-(aq) \rightarrow H_2O(l) + BrO^-(aq) \text{ (slow)}$$

$$BrO^-(aq) + H_2O_2(aq) \rightarrow H_2O(l) + O_2(g) + Br^-(aq) \text{ (fast)}$$

The overall order of the reaction is

(1) 0 (2) 1 (3) 2 (4) 3

8. Consider the following mechanism

$$A_2 \rightleftharpoons 2A \text{ (fast)}$$

$$A + B \rightarrow P \text{ (slow)}$$

The overall order of the reaction is

(1) 0·5 (2) 1 (3) 1·5 (4) 2

9. The plot of the data on p (/ Torr) / V (/ cm^3) against p (/ Torr) for adsorption of CO on charcoal at 273 K has been found linear. What isotherm does the adsorption follow?

(1) Langmuir isotherm (2) Freundlich isotherm

(3) BET isotherm (4) Temkin isotherm

10. A crystal system characterised by $a \neq b \neq c$ and $\alpha = \gamma = 90°$, $\beta \neq 90°$ is

(1) triclinic (2) monoclinic (3) rhombic (4) trigonal

11. The Miller indices of the planes with intercepts $4a$, $6b$ and ∞ whereas b and c are the unit cell edge lengths are

(1) (3, 2, 0) (2) (2, 3, 0) (3) (0, 2, 3) (4) (4, 6, ∞)

12. A powder diffraction photograph from tungsten shows lines which index as (110), (200), (211), (220), (310), (222), (321), (400), ... The symmetry of the unit cell is

(1) simple cubic (2) body-centred cubic

(3) face-centred cubic (4) edge-centred cubic

13. At the critical solution temperature of phenol-water system, the degree of freedom is

(1) 0 (2) 1 (3) 2 (4) 3

14. The SI unit of radiation energy is grey whereas the c.g.s. unit is rad. 1 grey is equal to

(1) 1 rad (2) 10 rad (3) 100 rad (4) 1000 rad

15. The molar conductance of potassium chloride (10^{-4} M) increases substantially with increase in frequency of the applied potential. This is due to minimisation of

(1) frictional forces

(2) electrophoretic effect

(3) relation effect

(4) electrophoretic and asymmetry effects

16. Which of the following cases for a perfect gas has $q = 0$?

(1) Isothermal isobaric expansion

(2) Reversible isothermal expansion

(3) Isobaric adiabatic expansion

(4) Isothermal isobaric irreversible compression

17. For the process $H_2O(s) \rightarrow H_2O(l)$ in an ice-water bath at 0 °C, which of the following statements is true?

(1) $T\Delta S > \Delta H$ (2) $\Delta H > T\Delta S^1$ (3) $\Delta H = T\Delta S^1$ (4) $\Delta G < 0$

18. One of the Gibbs equations

$$dG = -S\,dT + V\,dP + \Sigma\mu_i dn_i$$

does not apply when the system

(1) is in thermal equilibrium (2) is in mechanical equilibrium

(3) involves P-V work only (4) consists of any number of phases

19. A real solution is one which

(1) obeys Raoult's law
(2) obeys Henry's law
(3) does not obey Henry's law
(4) does not obey Raoult's law

20. The molar conductivity of strong electrolyte decreases with concentration (c) when c is sufficiently low as

(1) linearly with c
(2) linearly with $c^{1/2}$
(3) linearly with log c
(4) exponentially with c

21. Under what condition the equilibrium constant (K) of a reaction becomes independent of temperature?

(1) $\Delta G^\circ < 0$ (2) $\Delta H^\circ < 0$ (3) $\Delta H^\circ > 0$ (4) $\Delta H^\circ = 0$

22. The oxidation potential of $M \mid M^{2+}$ is + 0·76 V and the reduction potential of $A^+ \mid A$ is + 0·25 V. The e.m.f. of the cell $M \mid M^{2+} \parallel A^+ \mid A$ is

(1) 1·01 V (2) – 0·51 V (3) 0·51 V (4) –1·01 V

23. The translational partition function (q) for the H_2 molecule in a 100 cm^3 vessel at 298 K is $2{\cdot}77 \times 10^{26}$. The q for the D_2 molecule under the same condition would be

(1) $5{\cdot}54 \times 10^{26}$ (2) $3{\cdot}29 \times 10^{26}$ (3) $21{\cdot}25 \times 10^{26}$ (4) $7{\cdot}83 \times 10^{26}$

24. The rotational partition function (q^R) of an *AB* molecule at 27 °C is 19·6. What would be its q^R at 327 °C?

(1) 19·6 (2) 27·7 (3) 39·2 (4) 55·3

25. Which of the following molecules does not show a pure rotational spectrum?

(1) HCl (2) *trans*-CH_2Cl_2

(3) *cis*-CH_2Cl_2 (4) $CHCl_3$

26. ^1H ($g_I = 5 \cdot 5857$) resonates at 500 MHz in an NMR spectrometer operating at 11·7 tesla. What magnetic field would be necessary to observe the resonance of ^{13}C ($g_I = 1 \cdot 4046$) at 500 MHz?

(1) 11·7 tesla (2) 2·9 tesla

(3) 23·4 tesla (4) 46·8 tesla

27. The Gibbs-Duhem equation is

(1) $\sum_i \mu_i \, dn_i = 0$ (2) $\sum_i \mu_i \, dn_i \neq 0$

(3) $\sum_i n_i \, d\mu_i = 0$ (4) $\sum_i n_i \, d\mu_i \neq 0$

28. Which solvent would you prefer to determine the molar mass of a non-volatile non-ionic solute by freezing point depression method?

(1) Water ($K_f = 1 \cdot 86$/K (mol-kg^{-1})$^{-1}$)

(2) Phenol ($K_f = 7 \cdot 27$/K (mol-kg^{-1})$^{-1}$)

(3) Benzene ($K_f = 5 \cdot 12$/K (mol-kg^{-1})$^{-1}$)

(4) Camphor ($K_f = 40$/K (mol-kg^{-1})$^{-1}$)

29. The IR spectrum of H_2O shows 3 bands. How many bands do you predict for CO_2?

(1) 1 (2) 2 (3) 3 (4) 4

30. The minimum energy for which of the following systems is zero?

(1) H-atom

(2) A vibrating diatomic molecule

(3) A rotating diatomic molecule

(4) A molecule confined to a 3D-box

31. $T_{1/2}$ of ^3H is 12·3 years. If 48·0 mg of ^3H is released from a nuclear power plant during an accident, what mass of this nuclide would remain after 49·2 years?

(1) 6·0 mg (2) 3·0 mg (3) 12·0 mg (4) 24·0 mg

32. It is found that a particle of mass m in a one-dimensional box of length L can be excited from $n = 1$ to $n = 2$ state by a light of frequency ν. If the length of the box is doubled, the frequency needed to produce the $n = 1$ to $n = 2$ transition becomes

(1) $\nu/4$ (2) $\nu/2$ (3) 2ν (4) 4ν

33. HI and DI are made to undergo the same transition from $J = 0 \rightarrow J = 1$. The light frequency causing the transition for HI equals ν. Approximately which frequency would you expect to induce the same transition in DI?

(1) 2ν (2) $\sqrt{2}\,\nu$ (3) $\nu / 2$ (4) $\nu / \sqrt{2}$

34. The radial distribution function for 1s state, $4\pi r^2\psi_{1s}^2$, indicates that

(1) the most probable value of the distance from the nucleus is zero

(2) the average value of r is zero

(3) the average value of r is greater than the most probable value

(4) the average value of r is less than the most probable value

35. Which one of the following statements about H_2^+ is false?

(1) The non-degenerate LCAO-MOs (without spin) must be either symmetric or antisymmetric

(2) The lowest MO (without spin) of the molecule is antisymmetric for inversion

(3) The MOs transform into AOs of the helium ion as the two nuclei are fused together

(4) The ground state has a multiplicity of two

36. Which of the following functions are 'well behaved' quantum mechanically?

(1) $\exp(-ax^2)$ (2) $\exp(-ax)$ (3) x^2 (4) x

37. Which of the following is not an eigenfunction of $\frac{d^2}{dx^2}$ operator?

(1) $\exp(ax)$ (2) $\exp(ax^2)$

(3) $ax + b$ (4) $\cos x$

38. The operator $-\frac{\hbar^2}{2m}\frac{d^2}{dx^2}$ represents

(1) linear momentum
(2) angular momentum
(3) total energy
(4) kinetic energy

39. The electrophilic aromatic substitution proceeds through an intermediate

(1) phenyl cation
(2) σ complex
(3) benzene anion
(4) benzyne

40. Optically active 2-octanol rapidly loses its optical activity when exposed to the following

(1) Dilute acid
(2) Dilute base
(3) Light
(4) Humidity

41. The relative rates of nitration of $R—C_6H_5$, where $R = CH_3$, NO_2, OH and Cl, is

(1) $CH_3 > OH > NO_2 > Cl$
(2) $CH_3 > OH > Cl > NO_2$
(3) $OH > CH_3 > NO_2 > Cl$
(4) $OH > CH_2 > Cl > NO_2$

42. Which of the following statements is not true for the *E*2 reactions?

(1) Bimolecular reaction
(2) Reactivity order is RI > RBr > RCl
(3) rearrangement occurs
(4) reactivity order of RX is 3° > 2° > 1°

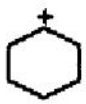
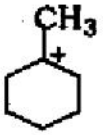
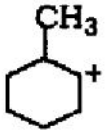
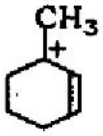
43. List the following compounds in the correct order of decreasing acidity

$CH_2{=}CH_2$ CH_3CH_3 $CH_3CH{=}O$ $HC{\equiv}CH$
(*A*) (*B*) (*C*) (*D*)

(1) $D > C > A > B$ (2) $C > D > A > B$

(3) $D > A > C > B$ (4) $C > A > D > B$

44. Which of the following carbocations is the most stable?

(1)  (2)  (3)  (4) 

45. Ziegler-Natta catalyst is

(1) $Et_2O \cdot BF_3$ (2) $Et_3Al\text{-}TiCl_4$

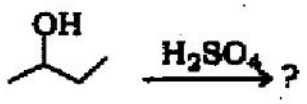
(3) Na-naphthalene (4) $Pd/CaCO_3$/quinoline

46. Pyridine undergoes electrophilic substitution with fuming H_2SO_4 at elevated temperature to give

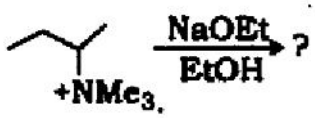
(1) pyridine-3-sulphonic acid (2) pyridine-2-sulphonic acid

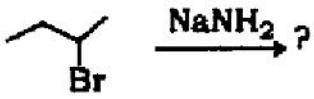
(3) pyridine-4-sulphonic acid (4) All of the above

47. Which of the following elimination reactions will give 1-butene as the major product?

(1) 

(2) 

(3) 

(4) 

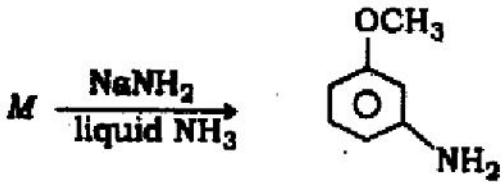
48. Aldehydes and ketones can be converted into 1,2-dicarbonyl compounds by reaction with

(1) periodic acid
(2) lead tetracetate
(3) peracetic acid
(4) selenium dioxide

49. Which of the following haloalkanes will undergo hydrolysis most readily?

(1) $(CH_3)_3CBr$
(2) $(CH_3)_3CCl$
(3) $(CH_3)_3CF$
(4) $(CH_3)_3Cl$

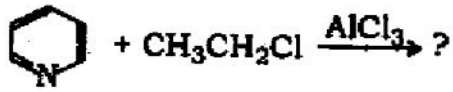
50. The reactant, *M* in the reaction below

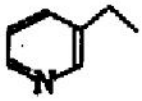
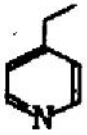


can be

(1) *o*-bromoanisole
(2) *m*-bromoanisole
(3) either of *o*- or *m*-bromoanisole
(4) None of the above

51. The product formed in the following electrophilic aromatic substitution reaction is



(1)  (2)  (3)  (4) None of the above

52. Which of the following compounds absorbs UV radiation?

(1) Ethanol (2) Butylamine

(3) Acetone (4) Chlorohexane

53. Benzaldehyde may be prepared by any of the following methods. Which one of these is called Stephen's method?

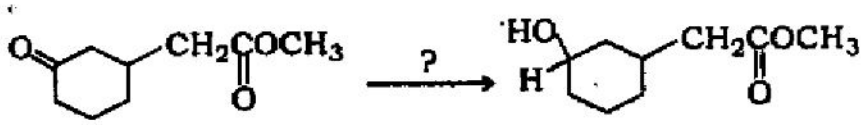
(1) $C_6H_5CN \xrightarrow[HCl]{SnCl_2} \xrightarrow{H_2O}$

(2) $C_6H_6 + CO + HCl \xrightarrow{AlCl_3}$

(3) $C_6H_5CHCl_2 + H_2O \longrightarrow$

(4) $C_6H_5CH_2Cl + (CH_2)_6N_4 \xrightarrow[\Delta]{H_2O/EtOH} \xrightarrow{H^+}$

54. The reagent used in the transformation



is

(1) $LiAlH_4$ (2) $NaBH_4$

(3) $Zn(Hg)/HCl$ (4) $H_2NNH_2, OH^{\ominus}$

55. Which of the following secondary alcohols can he prepared from the reaction of methyl formate with excess Grignard reagent?

(1) $CH_3CH_2\underset{\underset{OH}{|}}{C}HCH_3$ (2) $CH_3\underset{\underset{OH}{|}}{C}HCH_3$

(3) $CH_3\underset{\underset{OH}{|}}{C}HCH_2CH_2CH_3$ (4) $CH_3\underset{\underset{OH}{|}}{C}HC_6H_5$

56. Consider the following statements about conformational isomers :

(A) They are interconverted by rotation about single bond

(B) The energy barrier separating them is less than 15 kcal/mole

(C) They are best represented by means of Fischer projection formulae

Of these statements :

(1) All (A), (B) and (C) are correct (2) Only (B) and (C) are correct

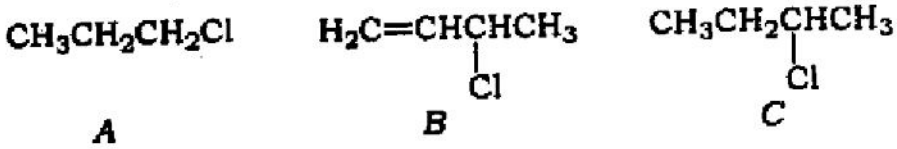
(3) Only (A) and (C) are correct (4) Only (A) and (B) are correct

57. Which of the following is not the product of ozonolysis of citral?

(1) Glyoxal (2) Acetone

(3) Acetaldehyde (4) Laevulaldehyde

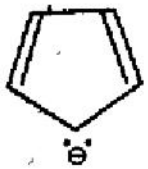
58. Arrange the following three chlorides in decreasing order of S_N1 reactivity



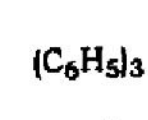
A *B* *C*

(1) $A > B > C$ (2) $B > C > A$ (3) $B > A > C$ (4) $C > B > A$

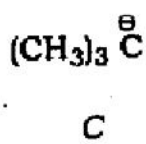
59. Arrange the following carbanions in order of their decreasing stability



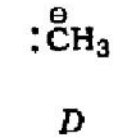
A



B



C



D

Answer codes :

(1) $A > B > C > D$ (2) $B > C > D > A$

(3) $A > B > D > C$ (4) $B > A > C > D$

60. The α- and β-forms of D-glucopyranose are called

(1) anomers (2) enantiomers (3) epimers (4) diastereomers

61. The methyl D-glucoside is made by treating D-glucose with the following

(1) CH_3OH, HCl

(2) aqueous CH_3OH

(3) $(CH_3)_2SO_4$, NaOH

(4) CH_3OCH_3, $LiAlH_4$

62. Select among the following carbohydrates whose complete hydrolysis give D(+) glucose as the only product

(A) Dextrin (B) Starch (C) Sucrose (D) Cellulose

The correct answer code is

(1) (A), (B), (C)

(2) (B), (C), (D)

(3) (A), (C), (D)

(4) (A), (B), (D)

63. How many stereocentres are present in the small, naturally occurring protein glycylalanylalanine?

(1) One (2) Two (3) Three (4) Zero

64. The reagent used in Edman method of N-terminal analysis of peptides is

(1) phenyl isothiocyanate

(2) 2,4-dichlorofluorobenzene

(3) 2,4-dinitrofluorobenzene

(4) benzyl chloroformate

65. Select the reagent required to bring about the following transformation

$$(CH_3)_2C{=}CH{-}\underset{\underset{O}{\|}}{C}{-}CH_3 \xrightarrow{?} (CH_3)_2C{=}CH{-}COOH$$

(1) $KMnO_4$, NaOH

(2) $K_2Cr_2O_7/H_2SO_4$

(3) $Cl_2 / OH^{\ominus}$, then H^+

(4) *m*-chloroperbenzoic acid

66. Which one of the following would clearly prove the configuration of *cis*-3-hexene from *trans*-3-hexene?

(1) Boiling point
(2) Rate of hydrogenation
(3) Dipole moment
(4) Infrared spectrum

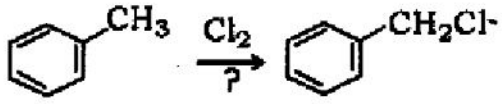
67. Naphthalene undergoes nitration with a mixture of conc. HNO_3 and H_2SO_4 at 50 °C to give mainly

(1) 1-nitronaphthalene
(2) 2-nitronaphthalene
(3) 1,3-dinitronaphthalene
(4) 1,4-dinitronaphthalene

68. The most convenient spectroscopic technique to establish the presence of inter-molecular hydrogen bonding in hydroxy compounds is

(1) UV
(2) IR
(3) NMR
(4) None of the above

69. The following reaction proceeds through



(1) Nucleophilic substitution
(2) Electrophilic substitution
(3) Free radical substitution
(4) Rearrangement

70. Which one of the following aromatic subetitution reactions is reversible?

(1) Nitration (2) Sulphonation

(3) Halogenation (4) Friedel-Crafts acylation

71. Allylic bromination is carried out by

(1) HBr, H_2O_2 (2) HOBr (3) Br_2, CS_2 (4) NBS

72. Which one of the following is the final product *Z* in the reaction sequence given below?

$$Me_2C{=}O + HCN \longrightarrow X \xrightarrow{H_3O^+} Y \xrightarrow{\text{Conc. } H_2SO_4} Z$$

(1) $CH_2{=}C(CH_3)COOH$ (2) $(CH_3)_2C(OH)COOH$

(3) $HOCH_2CH(CH_3)COOH$ (4) $CH_3CH{=}CHCOOH$

73. Which one of the following reactions is correctly shown?

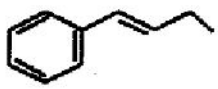
(1) $ROH + NaOH \longrightarrow RONa + H_2O$

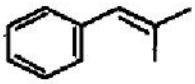
(2) $ROH + NaHCO_3 \longrightarrow RONa + H_2CO_3$

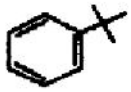
(3) $2ROH + Na_2CO_3 \longrightarrow 2RONa + H_2CO_3$

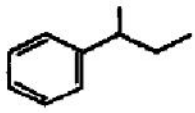
(4) $PhOH + NaOH \longrightarrow PhONa + H_2O$

74. Identify the chiral compound that is oxidized with alkaline $KMnO_4$ to benzoic acid

(1) 

(2) 

(3) 

(4) 

75. Natural rubber is a polymer made up of the following monomer units

(1) Butadiene (2) Neoprene (3) Isoprene (4) Chloroprene

76. Which of the following compounds can be used as a solvent in Friedel-Crafts reaction?

(1) Acetic anhydride (2) Nitrobenzene

(3) Anisole (4) Toluene

77. Oxygen may be prepared by heating potassium chlorate. What is the other product?

(1) Potassium oxide (2) Potassium chloride

(3) Potassium hypochlorite (4) Potassium chlorite

78. From each pair given below, identify the ion which is larger in size :

$[Co^{2+}, Co^{3+}]$ $[Fe^{2+}, Zn^{2+}]$ $[Na^+, F^-]$ $[O^{2-}, S^{2-}]$

(1) Co^{2+}, Zn^{2+}, F^-, S^{2-} (2) Co^{3+}, Fe^{2+}, Na^+, S^{2-}

(3) Co^{2+}, Fe^{2+}, F^-, S^{2-} (4) Co^{3+}, Zn^{2+}, Na^+, O^{2-}

79. How many unpaired electrons are there in an atom of silver in its ground state?

(1) 0 (2) 1 (3) 2 (4) 4

80. How many moles of P_4O_{10} will react with one mole of water?

(1) 2 moles (2) 6 moles (3) 1/3 mole (4) 1/6 mole

81. If 22 g of N_2O_5 reacts with 10 g of water to produce 22 g of nitric acid, what is the percentage yield of nitric acid?

(1) 32% (2) 69% (3) 87% (4) 100%

82. 10 ml of 0·10 N sodium hydroxide is added to 20 ml 0·10 N sulphuric acid and the resultant solution is titrated against 0·10 N sodium hydroxide. What will be the titre value at the end point?

(1) 5 ml (2) 10 ml (3) 20 ml (4) 30 ml

83. An aqueous solution of a substance gives a white precipitate when a few drops of sodium hydroxide are added. The precipitate dissolves when excess of sodium hydroxide is added. The substance may be

(1) aluminium sulphate (2) silver nitrate

(3) cadmium chloride (4) mercuric chloride

84. Which reagent may be used to precipitate barium from aqueous solutions?

(1) Hydrochloric acid (2) Sulphuric acid

(3) Silver nitrate (4) Ammonium chloride

85. A non-stoichiometric oxide of silver has composition $Ag_{1.8}O$. What percentage of Ag is present in the form Ag^{2+} ?

(1) 11% (2) 14% (3) 20% (4) 25%

86. A sample of water contains 200 p.p.m. of Ca^{2+} in it. What is the molality of the solution with respect to Ca ?

(1) 0·2 m (2) 2 m (3) 5×10^{-3} m (4) 0·05 m

87. Which of the following is not a crystalline substance?

(1) Glass (2) Quartz (3) Chalk (4) Diamond

88. What is the charge (n) on the silicate ion $Si_2O_7^{n}$?

(1) −2 (2) −4 (3) −6 (4) −7

89. Silver is extracted from the crude metal by leaching with a solution of NaCN in the presence of air. The role of NaCN is to

(1) oxidize Ag to Ag^+ (2) form the complex $[Ag(CN)_4]^{3-}$

(3) form the complex $[Ag(CN)_4]^{2-}$ (4) form the complex $[Ag(CN)_2]^-$

90. $CoCl_4^{2-}$ and $Co(H_2O)_6^{2+}$ have different colours. This is because

(1) they have Co in different oxidation states

(2) they have different coordination geometries

(3) they have different number of unpaired electrons

(4) they have Co in different oxidation states and bound to different ligands

91. CuI_2 is unstable, because it readily decomposes to

(1) Cu and I^- (2) Cu and I_2 (3) CuI and I_2 (4) CuI and I^-

92. Which one among the chlorides, $ZnCl_2$, $HgCl_2$, $BaCl_2$, $AlCl_3$ is dissociated to the least extent in aqueous solutions?

(1) $ZnCl_2$ (2) $HgCl_2$ (3) $BaCl_2$ (4) $AlCl_3$

93. Which one among the given ions, has the highest polarizing power?

(1) Na^+ (2) Ca^{2+} (3) Mg^{2+} (4) Al^{3+}

94. Which compound can act as a Lewis acid as well as a Lewis base?

(1) H_2O (2) $SnCl_2$ (3) NH_3 (4) BF_3

95. Perovskite is the mineral $CaTiO_3$. The perovskite crystal structure is adopted by several oxides as well as some fluorides. Which one, among the given formulae, most likely represents a known fluoride having the perovskite structure?

(1) $CaTiF_3$ (2) $KZnF_3$ (3) $CaTiF_5$ (4) $CaMgF_3$

96. In its reaction with aqueous solutions of Cu^{2+}, the cyanide ion is similar to

(1) CO (2) Cl^- (3) I_2 (4) I^-

97. Which ligand can lead to linkage isomers?

(1) Azide (2) Cyanate (3) Oxalate (4) Nitrate

98. The boron mineral, borax contains the anion, $[H_4B_4O_9]^{2-}$. What is the formal oxidation number of B in this anion?

(1) 2·5 (2) 3 (3) 3·5 (4) 4

99. Two isomers are obtained for $Pt(NH_3)_2Cl_2$, while only one isomer is obtained for $Ni(NH_3)_2Cl_2$. This is because

(1) the two complexes differ in the oxidation state of the metal

(2) the two complexes differ in the oxidation state of the metal as well as coordination number

(3) the two complexes differ in their coordination number

(4) the two complexes differ in their coordination geometry

100. Consider the following reaction :

$$[Co(NH_3)_4Cl_2]^+ + H_2O \rightarrow [Co(NH_3)_4(H_2O)Cl]^{2+} + Cl^-$$

The above reaction involves

(1) substitution (2) substitution and reduction

(3) oxidation (4) substitution and oxidation

101. Identify the acids in the following two reactions :

$$NOF + ClF_3 = NO + ClF_4^-$$
$$XeO_3 + OH^- = HXeO_4^-$$

(1) ClF_3 and XeO_3 (2) ClF_3 and OH^-

(3) NOF and OH^- (4) NOF and XeO_3

102. What are the formal oxidation states of the iron atoms labeled (A) and (B) in the compound $Fe_4^{(A)}[Fe^{(B)}(CN)_6]_3$?

(1) $Fe^{(A)}, 2+$ and $Fe^{(B)}, 3+$ (2) $Fe^{(A)}, 2+$ and $Fe^{(B)}, 4+$

(3) $Fe^{(A)}, 3+$ and $Fe^{(B)}, 3+$ (4) $Fe^{(A)}, 3+$ and $Fe^{(B)}, 2+$

103. The magnetic moment of $Co(H_2O)_6^{3+}$ is zero and that of $Mn(CN)_6^{3-}$ is 2·9 BM. From this it may be concluded that

(1) both ions are high spin

(2) both ions are low spin

(3) $Co(H_2O)_6^{3+}$ is low spin, $Mn(CN)_6^{3-}$ is high spin

(4) $Co(H_2O)_6^{3+}$ is diamagnetic, $Mn(CN)_6^{3-}$ is high spin

104. Which among the following compounds/ions are diamagnetic?

$CuCl_6^{2-}$; Cu(SCN); $CoCl_4^{2-}$; $Ni(CO)_4$; $PdCl_4^{2-}$

(1) $CoCl_4^{2-}$ and $PdCl_4^{2-}$ (2) $CuCl_6^{4-}$, Cu(SCN) and $Ni(CO)_4$

(3) Cu(SCN) and $Ni(CO)_4$ (4) Cu(SCN), $Ni(CO)_4$ and $PdCl_4^{2-}$

105. Which one is an example of a 'sandwich' compound?

(1) $Cr(C_6H_6)_2$ (2) $Cr(CO)_6$

(3) $Cr_2(CH_3COO)_2$ (4) $[Pt(NH_3)_2]$ $[PtCl_4]$

106. Which one, among the listed ions, will have the highest magnetic moment?

(1) $Cu(H_2O)_6^{2+}$ (2) $Ni(NH_3)_6^{2+}$ (3) $MnCl_4^{2-}$ (4) $Ru(NH_3)_6^{2+}$

107. Which of the following shows the correct relationship between the atomic radius (r) of Cu, Ag and Au?

(1) $^{r}Cu < {}^{r}Ag < {}^{r}Au$ (2) $^{r}Cu << {}^{r}Ag < {}^{r}Au$

(3) $^{r}Cu < {}^{r}Ag << {}^{r}Au$ (4) $^{r}Cu > {}^{r}Ag > {}^{r}Au$

108. Which of the following molecules/ions have planar structures?

(i) NH_3 (ii) SO_4^{2-} (iii) CO_3^{2-} (iv) BF_3

(1) All four (2) (ii) and (iii) (3) (iii) and (iv) (4) Only (iv)

109. Which of the following are paramagnetic compounds?

(i) Oxygen (ii) Copper sulphate

(iii) Carbon monoxide (iv) Nitric oxide

(v) Ozone

(1) (i), (ii), (iii) (2) (i), (ii), (iv) (3) (ii), (iii), (v) (4) (i), (iv), (v)

110. Complete the sentence : An octahedral complex, MA_4B_2 ———.

(1) will have two constitutional isomers

(2) will have two stereoisomers

(3) cannot show isomerism

(4) will be optically active

111. Which two of the following molecules/ions have planar structures?

(i) XeF_4 (ii) ClO_4^- (iii) $PtCl_4^{2-}$ (iv) MnO_4^-

(1) (i) and (iii) (2) (i) and (ii) (3) (ii) and (iii) (4) (ii) and (iv)

112. In qualitative analysis, Ag is detected in the first group, while Pb is detected in both first and second groups. This is because

(1) AgCl is much more soluble than $PbCl_2$

(2) AgCl is much less soluble than $PbCl_2$

(3) the solubilities of the chlorides are same, but traces of PbS are easily seen due to its black colour

(4) AgS is soluble, but PbS is insoluble

113. Three examples of molecules/ions having linear geometry may be given as

(1) CO_2, NCS^- and NO_2^+ (2) CO_2, NCS^- and NO_2

(3) NO_2, N_3^- and NCS^- (4) ClO_2, CO_2 and NO_2^+

114. The average of 64 results is how many more times reliable than the average of 4 results?

(1) 2 (2) 4 (3) 8 (4) 16

115. Which of the following statements is true?

(1) The variance is the square root of the standard deviation

(2) Precise values are always accurate

(3) The numbers 0·02040 contains only four significant figures

(4) Two of the above are true

116. Titrator *A* obtains a mean value of 12·96% and a standard deviation of 0·05 for the purity of a sample. Titrator *B* obtains corresponding values of 13·12% and 0·08. The true percent purity is 13·08. Compared to titrator *B*, titrator *A* is

(1) less accurate but more precise

(2) more accurate and more precise

(3) less accurate and less precise

(4) more accurate but less precise

117. Which of the following titrations (0·10 *M* solution) will give the largest change in pH at the end point?

(1) Benzoic acid with NaOH

(2) Formic acid with NaOH

(3) Pyridine with HCl

(4) Monochloroacetic acid with NaOH

118. Which is the strongest conjugate base?

(1) OAc^- (2) F^- (3) NO_2^- (4) OCl^-

119. Which of these statements is true?

(1) An aprotic solvent has acidic properties

(2) The titration reaction is more complete the smaller the autoprotolysis constant

(3) Dissociation into ions is necessary for successful acid-base titrations

(4) A low dielectric constant is desirable for amphiprotic solvents

120. A precipitate of $Fe(OH)_3$ is contaminated with $Mg(OH)_2$. The best way to get rid of the impurity is

(1) washing (2) digestion (3) ignition (4) reprecipitation

121. Line spectra are emitted by

(1) hot solids

(2) excited polyatomic molecules

(3) molecules in the ground electronic state

(4) excited atoms and monoatomic ions

122. The hydrogen or deuterium discharge tube can be used as a source of continuous ultraviolet radiation for spectrophotometers because of

(1) the characteristics of chopper-modulated radiation

(2) pressure broadening of hydrogen or deuterium emission lines

(3) the great sensitivity of photomultiplier tubes

(4) the narrow band pass of modern grating monochromators

123. In chromatography, a substance for which the distribution coefficient, k is zero may be used to estimate

(1) the volume within the column occupied by the packing material

(2) the total volume of the column

(3) the volume within the pores of the packing material

(4) the volume within the column available in the mobile phase

124. The separation factor, S, in chromatography depends upon

(1) the length of the column

(2) the square root of the length of the column

(3) the natures of the stationary liquid phase

(4) the number of theoretical plates in the column

125. A neutral molecule such as ethanol or sugar which has found its way into the pores of a typical anion-exchange resin can be eliminated

(1) only by replacement with a cation

(2) only by replacement with an anion

(3) only if replaced by another organic molecule on a one-for-one exchange basis

(4) by flushing out with water

126. Which of the following statements is false in normal phase adsorption?

(1) The more polar a compound, the more strongly it will be adsorbed from a solution

(2) A high molecular weight favours adsorption, other factors being equal

(3) The more polar the solvent, the stronger the adsorption of the solute

(4) The adsorption isotherm is usually nonlinear

127. The best measure of the quantity of a solute in liquid chromatography is

(1) the height of the elution band

(2) the area of the elution band

(3) baseline width of the elution band

(4) the retention volume

128. Which of the following would be the fastest way to decide which adsorbent and what solvent system to use for a large-scale chromatographic separation of an organic reaction product from materials found in side reactions?

(1) Paper chromatography

(2) Affinity chromatography

(3) TLC

(4) Adsorption chromatography with gradient elution

129. To deionize tap water by ion exchange for laboratory use, the best approach employs

(1) a column containing a strong acid cation exchanger in the hydrogen form

(2) a column containing a strong-base anion exchanger in the hydroxyl form

(3) a mixed bed column containing a strong acid cation exchanger in the solution form and a strong-base anion exchanger in the chloride form

(4) A mixed bed column containing a strong acid cation exchanger in the hydrogen form and a strong-base anion exchanger in the hydroxyl form

130. Which of the following is used in archaeological studies?

(1) Carbon (2) Uranium (3) Radium (4) Phosphorus

131. Radioactive iodine is being used to diagnose the disease of

(1) bones (2) blood cancer (3) kidneys (4) thyroid

132. The half-life period of a radioactive material can be determined with the help of

(1) Wilson Cloud Chamber (2) Geiger-Muller Counter

(3) Mass spectrometer (4) All of the above

133. Graphite is used in nuclear reactors

(1) as a lubricant

(2) as a fuel

(3) for lining the inside of the reactor as an insulator

(4) for reducing the velocity of neutrons

134. Pure water does not conduct electricity because of

(1) has low boiling point (2) is almost unionised

(3) is neutral (4) is readily decomposed

135. The molar conductivity of a strong electrolyte

(1) increases on dilution

(2) does not change considerably on dilution

(3) decreases on dilution

(4) depends on density

136. Electrostatic precipitators are used as pollution control device for the separation of

(1) SO_2

(2) NO_X

(3) hydrocarbons

(4) suspended particulate matter

137. Which of the following is responsible for ozone layer depletion?

(1) Ozone

(2) Aerosol

(3) Chlorofluorocarbons (CFC)

(4) Smog

138. Which of the following is a non-biodegradable organic water pollutant?

(1) Proteins

(2) Fats

(3) Carbohydrates

(4) Pesticides

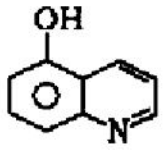
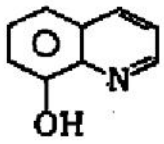
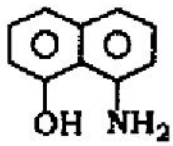
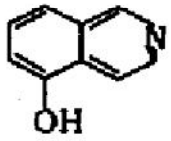
139. Which of the following is very effective for isolating, separating and identifying small quantities of substances?

(1) Potentiometry
(2) Chromatography
(3) Solvent extraction
(4) Conductometry

140. Greenhouse effect causes

(1) rise in temperature of the earth
(2) continuous rainfall
(3) lowering in temperature of the earth
(4) continuous snowing of the earth

141. Which of the following is the correct structure of oxine?

(1) 
(2) 
(3) 
(4) 

142. One mole of potassium bromate in bromate-bromide reaction produces

(1) one mole Br_2
(2) two moles Br_2
(3) three moles Br_2
(4) four moles Br_2

143. Phenolphthalein is used as an indicator when transition pH is in the range of

(1) 1–4 (2) 4–6 (3) 8–10 (4) 10–12

144. Gases responsible for acid rains are

(1) hydrocarbon and CO (2) NO_X and SO_X

(3) CO_X and NO_X (4) CO and CO_2

145. Which of the following is the most toxic?

(1) CH_3Hg^+ (2) $HgCl_2$ (3) Hg_2Cl_2 (4) Hg metal

146. How many moles of benzoic acid (122·1 g/mol) are contained in 2·00 g of pure benzoic acid?

(1) 0·164 mol (2) 0·008 mol (3) 0·082 mol (4) 0·0164 mol

147. How many potential sites are there in an EDTA molecule for bonding a metal ion?

(1) Four (2) Three (3) Six (4) Two

148. Water hardness is determined by EDTA titration after the sample is buffered to pH

(1) 4 (2) 2 (3) 6 (4) 10

149. What minimum distribution coefficient is needed to permit removal of 99% of a solute from 50·0 mL of water with two 25·0 mL extractions with toluene?

(1) 18·0 (2) 09·0 (3) 27·0 (4) 36·0

150. The distribution coefficient for iodine between an organic solvent and H_2O is 85. The concentration of I_2 remaining in the aqueous layer of the extraction of 50·0 mL of $1·00 \times 10^{-3}$ M I_2 with 50·0 mL of the organic solvent is

(1) $1·16 \times 10^{-5}$ (2) $5·28 \times 10^{-7}$ (3) $5·29 \times 10^{-10}$ (4) $1·16 \times 10^{-7}$

* * *

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण-पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली या काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 10 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।

2. परीक्षा भवन में *लिफाफा रहित प्रवेश-पत्र के अतिरिक्त,* लिखा या सादा कोई भी खुला कागज साथ में न लायें.

3. उत्तर-पत्र अलग से दिया गया है। ***इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा, केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।***

4. अपना *अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ* पर पेन से निर्धारित स्थान पर लिखें।

5. उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।

6. ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्न-पुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्न-पुस्तिका पर अनुक्रमांक सं० और ओ० एम० आर० पत्र सं० की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।

7. उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।

8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये है। ***प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिये आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।***

9. प्रत्येक प्रश्न के उत्तर के लिये केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।

10. ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का *उत्तर नहीं देना चाहते हैं,* तो सम्बन्धित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।

11. रफ़ कार्य के लिये प्रश्न-पुस्तिका के मुखपृष्ठ के अन्दर वाले पृष्ठ तथा अंतिम पृष्ठ का प्रयोग करें।

12. परीक्षा के उपरान्त केवल *ओ०एम०आर० उत्तर-पत्र* परीक्षा भवन में जमा कर दें।

13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।

14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।

PROVISIONAL KEY OF UET/PET-2015

(1) THREE MARKS TO BE AWARDED FOR EACH CORRECT ANSWER

(2) ONE MARK TO BE DEDUCTED FOR EACH INCORRECT ANSWER

(3) ZERO MARK TO BE AWARDED FOR EACH UNATTEMPTED QUESTION

COURSE / SUBJECT : M.Sc. Chemistry

(CODE NO. 482)

Set-1.

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2	4
3	1
4	4
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6	2
7	3
8	3
9	1
10	2

Q	A
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22	1
23	4
24	3
25	2
26	4
27	3
28	4
29	2
30	3

Q	A
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43	2
44	4
45	2
46	1
47	3
48	4
49	4
50	3

Q	A
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62	4
63	2
64	1
65	3
66	3
67	1
68	2
69	3
70	2

Q	A
81	3
82	2
83	1
84	2
85	1
86	3
87	3
88	3
89	4
90	2

Q	A
101	1
102	4
103	2
~~104~~	~~2~~
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106	3
107	2
108	3
109	2
110	2

Q	A
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122	2
123	1
124	4
125	4
126	3
127	2
128	3
129	3
130	1

Q	A
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142	3
143	3
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146	4
147	3
148	4
149	1
150	1

Q	A
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Q	A
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Q	A
201	
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Q	A
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222	
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12	3
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14	3
15	3
16	3
17	3
18	4
19	4
20	2

Q	A
31	2
32	1
33	3
34	3
35	2
36	1
37	2
38	4
39	2
40	1

Q	A
51	4
52	3
53	1
54	2
55	2
56	4
57	3
58	2
59	3
60	1

Q	A
71	4
72	1
73	4
74	4
75	3
76	2
77	2
78	3
79	2
80	2

Q	A
91	3
92	2
93	4
94	2
95	2
96	4
97	2
98	2
99	4
100	1

Q	A
111	1
112	2
113	1
114	4
115	1
116	1
117	2
118	1
119	3
120	4

Q	A
131	4
132	2
133	4
134	2
135	2
136	4
137	3
138	4
139	2
140	1

Q	A
151	
152	
153	
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158	
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160	

Q	A
171	
172	
173	
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Q	A
191	
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Q	A
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Q	A
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