RET/13/Test B

882 Chemistry

Question Booklet No. .....

*(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, Please ensure that you have got the correct booklet and it contains all the pages in correct sequence and 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.*
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 Roll No. and OMR sheet No. on the Question Booklet.*
7. *Any changes in the aforesaid-entries is to be verified by the invigilator, otherwise it will be taken as unfair means.*
8. *This Booklet contains 40 multiple choice questions followed by 10 short answer questions. For each MCQ, 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 pen as mentioned in the guidelines given on the first page of the Answer Sheet. For answering any five short Answer Questions use five Blank pages attached at the end of this Question Booklet.*
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 marks).
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 *both OMR Answer Sheet and Question Booklet* 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.

Total No. of Printed Pages : 19

FOR ROUGH WORK

Research Entrance Test – 2013

No. of Questions : 50

Time : 2 Hours

Full Marks : 200

Note : (i) This Question Booklet contains **40** Multiple Choice Questions followed by **10** Short Answer Questions.

(ii) Attempt as many MCQs as you can. Each MCQ carries **3 (Three)** marks. **1 (One)** mark will be deducted for each incorrect answer. Zero mark will be awarded for each unattempted question. If more than **one** alternative answers of MCQs seem to be approximate to the correct answer, choose the closest one.

(iii) Answer only **5** Short Answer Questions. Each question carries **16 (Sixteen)** marks and should be answered in **150-200** words. Blank **5 (Five)** pages attached with this booklet shall only be used for the purpose. Answer each question on separate page, after writing Question No.

Chemistry

1. Most of the land precipitation and evaporation on earth takes place over the :
   (1) land masses
   (2) oceans and seas
   (3) poles of the planet
   (4) subtropical latitudes

2. The downstream portion of a river :
   (1) generally becomes more sluggish
   (2) usually has turbulent flows
   (3) generally is of higher velocity, which is marked by reduced turbulence
   (4) has lower discharges than do upstream portions

3. Which of the following is not a fatty acid ?
   (1) Stearic acid
   (2) Palmitic acid
   (3) Oleic acid
   (4) Phenyl acetic acid

4. Which of the following compounds is not an antibiotic ?
   (1) Penicillin
   (2) Chloramine-T
   (3) Streptomycin
   (4) Chloramphenicol

5. The acceleration with which a particle moves in a straight line, according to the law $v^2 = 4a(x \sin x + \cos x)$, v being the velocity of the particle at a distance x from a fixed point, is :
   (1) 0 (2) $2ax \cos x$ (3) $4ax \cos x$ (4) $2ax \sin x$

6. If $\begin{bmatrix} 2 & 4 \\ 1 & 3 \end{bmatrix} A \begin{bmatrix} 0 & 2 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the matrix A is :
   (1) $\begin{bmatrix} 3 & -4 \\ 3/4 & -1 \end{bmatrix}$
   (2) $\begin{bmatrix} -13/4 & 3/2 \\ 5/4 & -1/2 \end{bmatrix}$
   (3) $\begin{bmatrix} -17/4 & 3/4 \\ -7/4 & -1/4 \end{bmatrix}$
   (4) $\begin{bmatrix} 5/4 & 11/4 \\ 3 & -9/4 \end{bmatrix}$

7. If the error in the measurement of radius of sphere is 0.3%, then the percentage error in the measurement of its volume is :
   (1) 0.15% (2) 0.6% (3) 0.9% (4) 0.03%

8. The resistance of series combination of two resistances is S. When they are joined in parallel, the total resistance is P. If S = nP, then the minimum possible value of n is :
   (1) 3 (2) 4 (3) 2.1 (4) 0.89

9. Mitochondria are associated with the function of :
   (1) cellular digestion
   (2) circulation
   (3) protein synthesis
   (4) cellular respiration

10. In which parts of eyes, rods and cones are present ?
    (1) Retina (2) Iris (3) Cornea (4) Lens

11. An organic compound exhibited HPLC peak at retention time of 13.36 min. The width of the peak at its base was 130.8 second. The number of plates in the column was :

(1) 201 (2) 401 (3) 601 (4) 801

12. In the volumetric titration of 50.0 ml of 0.100 M acetic acid with 0.100 m standard NaOH, the equivalence point pH is attained at :

(1) 8.73 (2) 5.27 (3) 4.16 (4) 4.76

(Given : $Kw = 1 \times 10^{-4}$, $Ka = 1.75 \times 10^{-5}$)

13. The maximum buffer capacity is attained when :

(1) Buffer ratio is greater than one

(2) Buffer ratio is smaller than one

(3) Buffer ratio is equal to one

(4) Buffer ratio is between one and two

14. Triton X-100 is used in polarography to migrate :

(1) Migration current

(2) Residual current

(3) Adsorption current

(4) Polarographic maxima

15. Oligotrophic condition is index of

(1) Clean water body

(2) Polluted water body

(3) Marsh land

(4) Polluted air

16. Electrostatic precipitator is used for removing

(1) Total dissolved solid

(2) Particulate Matters

(3) Smog

(4) Total organic carbon

17. Which of the following molecules has an S_4 axis ?

(1) CO_2 (2) C_2H_2

(3) BF_3 (4) SO_4^{2-}

18. Which of the following complexes is chiral ?

(1) Cis-$[PtCl_2(en)]$

(2) Cis-$[RhCl_2(NH_3)_4]^+$

(3) $[Ru(bipy)_3]^{2+}$

(4) Fac-$[Co(NO_2)_3(dien)]$

19. The spectrum of d^1 Ti^{3+} (aq) is attributed to a single electronic transition $e_g \leftarrow t_{2g}$. The unsymmetrical spectral band that suggests involvement of more than one states, may be attributed to :

(1) Trigonal distortion of the complex ion

(2) Jahn-Teller distortion in excited state

(3) Jahn-Teller distortion in ground state

(4) Jahn-Teller distortion in both ground and excited states

20. The number of framework electron pairs present in B_4H_{10} is :

(1) Four (2) Five (3) Seven (4) Ten

21. Molecular sieves belong to the class of :

(1) Layered aluminosilicates

(2) Two-dimensional aluminosilicates

(3) Three-dimensional aluminosilicates

(4) Crystalline aluminosilicates having open structures

22. The Russell-Saunders term of the configuration, $4s^1$ is indicated by :

(1) ^2S (2) ^1S (3) ^5P (4) ^5D

23. On the basis of *trans*-effect which of the following statements can be considered as correct ?

(1) Reaction of $[Pt(NH_3)_4]^{2+}$ with HCl gives *trans*-$[Pt\ Cl_2(NH_3)_2]$ because the trans effect of Cl^- is greater than that of NH_3.

(2) Reaction of $[Pt(NH_3)_4]^{2+}$ with HCl gives *trans*-$[PtCl_2(NH_3)_2]$ because the trans effect of NH_3 is greater than that of Cl^-.

(3) Reaction of $[Pt(NH_3)_4]^{2+}$ with HCl gives *cis*-$[PtCl_2(NH_3)_2]$ because the trans effect of Cl^- is greater than that of NH_3.

(4) Reaction of $[Pt(NH_3)_4]^{2+}$ with HCl gives *cis*-$[Pt\ Cl_2(NH_3)_2]$ because the trans effect of NH_3 is greater than that of Cl^-.

24. Only one of the following statements is correct, predict the same :

(1) A molybdenum-iron-sulphur cluster in the nitrogenase enzyme reduces N_2 to NH_3.

(2) A molybdenum-iron- sulphur cluster in the nitrogenase enzyme reduces N_2 to N_2H_4.

(3) A molybdenum-iron- sulphur cluster in the nitrogenase enzyme reduces N_2 to NH_4^+.

(4) A molybdenum-iron- sulphur cluster in the nitrogenase enzyme oxidizes N_2 to N_2O.

25. Naphthalene, when treated with acetyl chloride in nitrobenzene in the presence of $AlCl_3$, gives mainly,

(1) α- acetonaphthalene

(2) β- acetonaphthalene

(3) 1, 2- diacetonaphthalene

(4) 1, 4- diacetonaphthalene

26. Claisen reaction condensation reaction between :

(1) Aliphatic aldehyde and aliphatic ketone

(2) Aliphatic ester and aliphatic ketone

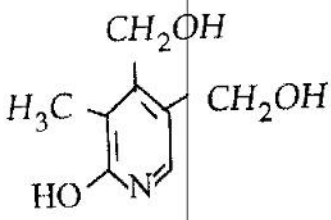
(3) Aromatic aldehyde and aliphatic aldehyde

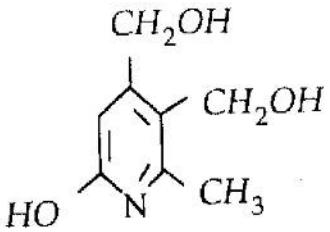
(4) α- Halogeno ester and aliphatic aldehyde

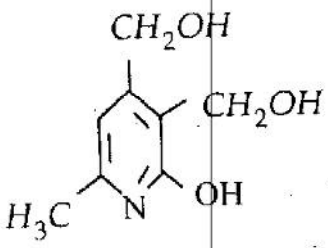
27. Angular methyls numbering in chloresterol are

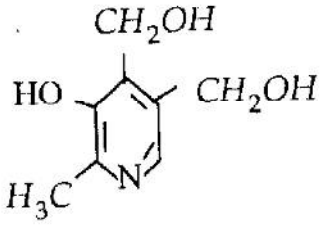
(1) 16, 18 (2) 17, 18 (3) 18, 19 (4) 18, 20

28. Which one is correct structure of pyridoxine (vitamin B_6)

(1) 

(2) 

(3) 

(4) 

29. Which one of the following mechanisms is involved in reaction of fluorobenzene with phenyl lithium to give biphenyl

(1) Addition- elimination mechanism

(2) Elimination - addition mechanism

(3) Concerted mechanism

(4) Unimolecular mechanism

30. Which of the following alkaloids has isoquinoline nucleus.

(1) Morphine

(2) Reserpine

(3) Narcotine

(4) Lysergic acid

31. Thyroxine is

(1) Harmone

(2) Vitamin

(3) Sulpha drug

(4) Amino acid

32. Lactose is composed of

(1) Glucose units only

(2) Glucose + fructose

(3) Glucose + Arabinose

(4) Glucose + Galactose

33. The BET equation reduces to the Langmuir isotherm when P (the pressure of the gas in bulk) has the following relation with P^*

(1) $P = P^*$ (2) $P << P^*$ (3) $P \leq P^*$ (4) $P < P^*$

Where P^* is the saturated vapour pressure of adsorbate at the same temperature.

34. For the photochemical reaction $H_2 + Br_2 = 2HB_r$ the rate is proportional to

(1) $I_{abs}^{\frac{1}{2}}$ (2) I_{abs}

(3) I_{abs} and $[H_2]$ (4) $I_{abs}^{\frac{1}{2}}$ and $[H_2]$

where I_{abs} is the intensity of light obsorbed

35. The basis function for A_2 IR of C_{2v} group is

(1) z^2 (2) xz (3) yz (4) xy

36. Consider the molecule CO_2. Its rotational Raman spectrum shows a constant interline spacing of nearly 3.2 cm^{-1}. What would be its rotational partition function at room temperature assuming $kT/ch = 200\ cm^{-1}$?

(1) 500 (2) 250

(3) 125 (4) 62.5

37. For electrochemical dissolution of a metal electrode, the current density (i) is proportional to :

(1) exp (η) and sinh (η)

(2) exp (η) and sin (η)

(3) exp (η)

(4) log (η)

38. The molecular weight (MW) of a macromolecule as determined by light scattering method is calculated from the intercept of the plot of $\left(\frac{\overline{C}}{T}\right)$ Vs $\overline{C}_w$. The intercept is proportional

(1) directly to $\overline{M}_w$

(2) inversely to $\overline{M}_w$

(3) directly to $\sqrt{\overline{M}_w}$

(4) inversely to $\sqrt{\overline{M}_w}$

39. The condition of spontaneity for a change in the state of the system at constant temperature is

(1) $\Delta G < 0$

(2) $\Delta G > 0$

(3) $\Delta A < 0$

(4) $\Delta A + W < 0$

40. The H-atom transition $3d_{xy} \leftarrow 2p_z$ is :

(1) dipole allowed and z-polarized

(2) dipole allowed and x-polarized

(3) dipole allowed and y-polarized

(4) forbidden

Attempt any five questions. Write answer in 150-200 words. Each question carries 16 marks. Answer each question on separate page, after writing Question Number.

1. Deduce (a) cottrell equation and (b) polarographic equation for $0 + pH^+ + ne \rightleftharpoons R$

2. Differentiate between

(a) Van Deemter plots of HPLC and GC

(b) Master grating and Replica grating

(c) Plate theory and Rate theory

(d) Chronoamperometry and chronopotentiometry

3. The ^{19}F NMR spectrum of SF_4 compound (with two F atoms in equatorial positions and two F atoms in axial positions of the tbp skeleton) at room temperature shows a single peak; the peak broadens with lowering of temperature and splits into two separate triplets at –98°C. Give a detailed explanation.

4. Without referring to any data, indicate how many spin-allowed ligand-field electron transitions you would expect to observe for the following complexes :

(i) VCl_4 (ii) CrO_4^{2-}

(iii) $[Fe(H_2O)_6]^{2+}$ (iv) $[Cr(H_2O)_6]^{3+}$

(v) $[Ni(NH_3)_6]^{2+}$ (vi) $[Fe(CN)_6]^{4-}$

(vii) $[Co(H_2O)_6]^{2+}$ (viii) $[Mn(H_2O)_6]^{2+}$.

Assign the transitions

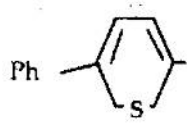
5. Respond to the following with reference to a weak-field octahedral Cr(III) complex :

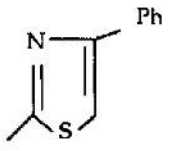
(i) Draw neatly Orgel energy level diagram clearly indicating the 'Terms' and the energy differences (in terms of D_q) between various states. Assign the possible *d-d* transitions.

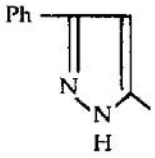
(ii) Point out the 'mixing of states' if any, and discuss the effect of such mixing.

In the event of structural distortion of the complex, predict the energy levels that are prone for splitting and the consequent changes in the spectrum.

6. How would you prepare the following heterocycles from acetophenone ?

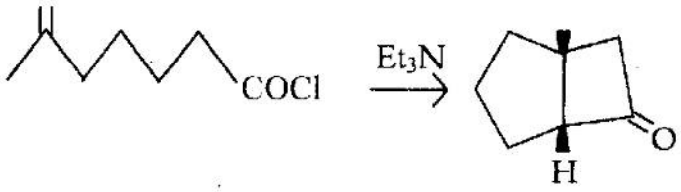
(i) 

(ii) 

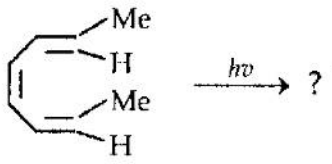
(iii) 

7. What is Heck reaction ? How does it occur ? Describe in detail the mechanism involved is Heck reaction.

8. (i) Suggest mechanism for the reaction :



(ii) On the basis of Woodward-Hoffmann selection rule, predict the motion (conrotatory or disrotatory) and complete the reaction



9. Describe the salient features of activated complex theory of reaction rates. Write the Eyring equation for rate coefficient and interpret it.

10. Write Fermi Golden rule for interaction of rediation with matter and explain the terms in it. Obtain expression for Einstein's B-coefficient and basic criterion for a molecule to absorb radiation.

Roll No. : .....

Q. No. :

Roll No. : .....

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FOR ROUGH WORK