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 : 15

FOR ROUGH WORK

Research Entrance Test – 2014

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. (One) mark will be deducted for each incorrect answer. Zero mark will be warded for each unattempted question. If more than **one** alternative nswers of MCQs seem to be approximate to the correct answer, choose the losest one.

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

1. Which of the following is *not* a greenhouse gas ?

    (1) Carbon dioxide   (2) Methane

    (3) Sulphur dioxide   (4) Nitrogen

2. The saliva of mammals contains starch splitting enzyme. The name of that enzyme is :

    (1) Amylase (Ptyalin)   (2) Secretin

    (3) Lysozyme   (4) Mucin

3. Cytosine in DNA combines with :

    (1) Adinosine   (2) Uracil   (3) Guanine   (4) Thiamine

4. If Vectors $2i - j + k,\ i + 2j - 3k,\ 3i + \lambda j + 5k$ are coplanar, then the value of λ is :

    (1) –2   (2) –3   (3) –4   (4) –5

5. The value of $\left(-1 + i\sqrt{3}\right)^{3/2}$ is :

    (1) $\sqrt{2}$ (2) $2\sqrt{2}$ (3) $2 + \sqrt{2}$ (4) $2 - \sqrt{2}$

6. The number of electrons contained in 1 Coulomb of charge equals to :

    (1) 6.25×10^{17} (2) 6.25×10^{18} (3) 6.25×10^{19} (4) 1.6×10^{19}

7. A unit mass of solid is converted to liquid at its melting ; the heat required for this process is the :

    (1) Specific heat   (2) Latent heat of vaporization

    (3) Latent heat of fusion   (4) External latent heat

8. Granite is :

    (1) a sedimentary rock   (2) a metamorphic rock

    (3) a volcanic rock   (4) a plutonic igneous rock

9. Coal is a :

    (1) Sedimentary rock   (2) Hydrothermal deposit

    (3) Low-grade metamorphic rock (4) High-grade metamorphic rock

10. Which one of the following gases is present in the stratosphere that filters out some of the sun's ultraviolet light and provides an effective shield against radiation damage to living things ?

    (1) Oxygen   (2) Methane   (3) Ozone   (4) Helium

11 Which of the following molecules/ions has an S_4 axis ?

(1) CO_2 (2) C_2H_2 (3) BF_3 (4) SO_4^{2-}

12. The number of isomers possible for octahedral $[CoCl_2(en)(NH_3)_2]^+$

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

3. The configuration and LFSE denoted by $t_{2g}^6, 2.4\Delta_0$ refers to the complex species :

(1) $[W(CO)_6]$ (2) $[Fe(OH)_6]^{2+}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(NH)_6]^{3+}$

14 The number of skeletal electrons present in B_5H_9 is :

(1) 3   (2) 5   (3) 7   (4) 9

15 The Russell-Saunders term symbol, 3_F, corresponds to the state with the angular momentum quantum number (L, S) :

(1 (0, 5/2)   (2) (3, 3/2)   (3) (2, 1/2)   (4) (1, 1)

16 If an octahedral $Fe(II)$ complex has large paramagnetic susceptibility, the spin-allowed electronic transition refers to :

(1) d-d   (2) $\pi \rightarrow \pi^*$ (3) MLCT   4) LMCT

17 A circular dichroism spectrum (a CD spectrum) is a plot of

(1) Molar absorption coefficient (ε) against wavelength

(2) Difference of ε for right & left-circularly polarized light against wavelength

(3) Difference of ε for right & left-circularly polarized light against wave number

(4) ε against path length

1 Arndt-Eistert synthesis involves one of the following rearrangement :

(1 Curtius rearrangement   (2) Von-Pechmann rearrangement

(3 Lossen rearrangement   (4) Wolff rearrangement

1 The side product during the industrial preparation of phenol is :

(1) Methanol   (2) Acetone

(3) Diethyl ether   (4) Isopropyl methyl ketone

20. Upon treatment of D-glucose with $NaOH$, the product(s) formed will be :

(1) Sodiumgluconate

(2) L-Glucose

(3) Mixture of D-glucose and D-fructose

(4) Mixture of D-glucose, D-fructose and D-mannose

21. Doebner synthesis is related to the synthesis of one of the following :

(1) Indole   (2) Imidazole   (3) Quinoline   (4) Isoquinolin

22. Gilman's reagent act as :

(1) Soft nucleophile   (2) Hard nucleophile

(3) Soft electrophile   (4) Hard electrophile

23. Simon-Smith reaction is related with :

(1) Carbene   (2) N-Heterocyclic carbine

(3) Nitrene   (4) Xanthene

24. Acetophenone can be converted into phenol by the reaction with :

(1) M-CPBA followed by base catalysed hydrolysis

(2) Con. HNO_3

(3) $I_2 + NaOH$

(4) Aq. $NaOH$

25. The maximum number of isomers for an alkene with molecular formula C_4H_8 is :

(1) 5   (2) 4   (3) 2   (4) 3

26. A moving electron has a wavelength of 1Å. The kinetic energy of the electon is doubled, the wavelength of the electron is now :

(1) 0.7071 Å   (2) 2.0 Å

(3) 0.5 Å   (4) 1.4142 Å

27. Which of the following statements is *false* about fluorescence and phosphorescence ?

(1) Fluorescence is due to electronic transition from a singlet excited state to the ground electronic state

(2) Fluorescence occurs in a longer time scale than phosphorescence

(3) Phosphoresence is due to electronic transition from a triplet exited state to the ground electronic state

(4) Interseptem crossing takes before phosphorescence

28. The mean ionic molality of a 2 : 1 electrolyte is :

(1) $4^{\frac{1}{3}}M$ (2) $M^{2/3}$ (3) $27^{1/4}M$ (4) $108\,M$

29. In a first order reaction, if the time taken for completion of 50% of the reaction is t seconds, the time required for its completion of 99.9%, is :

(1) 10t   (2) 5t   (3) 100t   (4) 2t

30. The wave function Ψ of a certain system is linear combination :

$$\psi = \sqrt{1/4}\,\psi_1 + \sqrt{3/4}\,\psi_2$$

Ψ_1 and Ψ_2 are energy eigen functions with eigen values (non degenerate) E_1 and E_2 respectively. What is the probability that the system energy will be observed to be E_1 ?

(1) $\sqrt{\dfrac{3}{16}}$ (2) $\dfrac{3}{4}$ (3) $\dfrac{1}{4}$ (4) $\sqrt{\dfrac{1}{4}}$

31. Which of the following thermodynamic relations is correct for 1 mole of an ideal gas ?

(1) $\left(\dfrac{\delta H}{\delta V}\right)_T = 0$ (2) $\left(\dfrac{\delta U}{\delta V}\right)_T = 0$ (3) $\left(\dfrac{\delta Cv}{\delta U}\right)_T > 0$ (4) $\left(\dfrac{\delta P}{\delta T}\right)_V = 0$

32. The selection rule for EPR is :

(1) $\Delta V = \pm 1$ (2) $\Delta J = \pm 1$ (3) $\Delta M_I = \pm 1$ (4) $\Delta M_S = \pm 1$

33. Which one is used to mitigate migration current ?

(1) Nitrogen   (2) Triton-x-100

(3) Supporting electrolyte   (4) Mercury

34. The Randles Sevick equation is :

(1) $i_p = (2.69 \times 10^5) n^{3/2} A D_0^{1/2} V^{1/2} C_0^*$

(2) $i_p = (2.65 \times 10^5) n^{1/2} A D_0^{1/2} V^{1/2} C_0^*$

(3) $i_p = (2.65 \times 10^5) n^{3/2} A D_0^{1/2} V C_0^*$

(4) $i_p = (2.65 \times 10^5) n^{3/2} A^{1/2} D V^{1/2} C_0^*$

35. In cyclic Voltmmmetry, the difference between E_{pa} and E_{pc} (ΔEp), the steady state value for reversible electron-transfer process is :

(1) $\Delta Ep > 58/n$ mV

(2) $\Delta Ep < 58/n$ mV

(3) $\Delta Ep = 58/n$ mV

(4) $\Delta Ep = 0$ mV

36. Which one is *not* an ideal detector in gas chromatorgraphy ?

(1) Electron capture detector

(2) Thermal conductivity detector

(3) Flame ionization detector

(4) Photo-Voltaic cell

37. For non-polar analytes having molecules mass greater than 10^4, one of the best HPLC technique is :

(1) Ion-exchange chromatography

(2) Liquid-liquid partition Chromatography

(3) Liquid-bonded phase partition chromatography

(4) Gel-permeation Chromatoglaphy

38. Polarographic maximum occurs due to :

(1) Oxidation of Hg drop

(2) Increasing migration current

(3) Streaming motion of solution past Hg drop

(4) The high viscosity of the solution

39. The best procedures for improving resolution between chromatographic peaks can be :

(1) Increasing column length, decreasing band width

(2) Decreasing column length, increasing band width

(3) Increasing sample size, decreasing flow rate

(4) Decreasing the amount of stationary phase, increasing the volume of mobile phase

40. The El Nino is due to :

(1) Warming of waters of the eastern pacific ocean

(2) Cooling of waters of the eastern pacific ocean

(3) Condensation of waters of the eastern pacific ocean

(4) Vapourization of waters of the eastern pacific ocean

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. Describe the phenomenon of Trans effect and illustrate with two suitable examples.

2. What do you understand by base hydrolysis reactions ? Explain the importance of ligands with acidic protons.

3. Name the cluster present in the "nitrogenase enzyme". Describe the reduction of N_2 to NH_4^+ by the enzyme.

4. Why in S_N2 reactions a nucleophile always attacks from the back side of the leaving group ? Expain with suitable example.

5. Allyl chloride undergoes substitution by S_N1 mechanism, whereas n-propyl chloride reacts by S_N2 mechanism, explain.

6. What do you understand by exchange current density and overpotential ? What is their significance in an electrochemical reaction ?

7. Explain Meissner effect giving and example.

8. What is concept of ensemble ? Define microcanonical, canonical and grand canonical ensemble and write expression of canonical partition function.

9. Deduce the following

(a) $E = E_{1/2} - \dfrac{0.05916}{n} \log \dfrac{i}{(id - i)}$

(b) $i = \dfrac{nDnF}{\delta}(C^* - C^0)$

10. Define maximum buffer capacity and find out the criteria of a buffer to possess maximum buffer capacity.

Roll No. : ....

Q. No. :

Roll No. : ....

Q. No. :

FOR ROUGH WORK