

2016.

Set No. : 1

Question Booklet No.

RET/16/TEST-B**882****Chemistry**

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

Roll No.

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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 30 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 change 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 pages 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 : 24

10.

ROUGH WORK

रफ़ कार्य

Research Entrance Test-2016

No. of Questions : 50

प्रश्नों की संख्या : 50

Time : 2 Hours

Full Marks : 200

समय : 2 घण्टे

पूर्णाङ्क : 200

Note: (1) This Question Booklet contains **40** Multiple Choice Questions followed by **10** Short Answer Questions.

इस प्रश्न पुस्तिका में **40** वस्तुनिष्ठ व **10** लघु उत्तरीय प्रश्न हैं।

(2) 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.

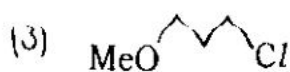
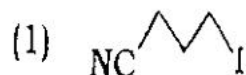
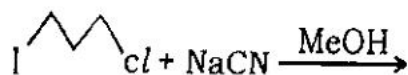
अधिकाधिक वस्तुनिष्ठ प्रश्नों को हल करने का प्रयत्न करें। प्रत्येक वस्तुनिष्ठ प्रश्न **3 (तीन)** अंकों का है। प्रत्येक गलत उत्तर के लिए **1 (एक)** अंक काटा जायेगा। प्रत्येक अनुत्तरित प्रश्न का प्राप्तांक शून्य होगा। यदि वस्तुनिष्ठ प्रश्नों के एकाधिक वैकल्पिक उत्तर सही उत्तर के निकट प्रतीत हों, तो निकटतम सही उत्तर दें।

(3) 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.

केवल **5 (पाँच)** लघुउत्तरीय प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **16 (सोलह)** अंकों का है तथा उनका उत्तर **150-200** शब्दों के बीच होना चाहिए। इसके लिए इस पुस्तिका में लगे हुए सादे **5 (पाँच)** पृष्ठों का ही उपयोग आवश्यक है। प्रत्येक प्रश्न का उत्तर एक नए पृष्ठ से, प्रश्न संख्या लिखकर शुरू करें।

1. Which is not true for reactions by the S_N2 mechanism ?
- (1) proceeds through a backside attack and results in inversion
 - (2) tends to proceed with weak nucleophiles solvents like CH_3OH , H_2O , CH_3CH_2OH .
 - (3) rate of reaction proceeds from primary (fastest) > secondary >> tertiary (slowest)
 - (4) occurs in one step

2. Which is the main product of the following reaction ?



3. Which of the following conditions is necessary for a reaction to be spontaneous ?

(1) $\Delta S_{sur} > 0$

(2) $\Delta S_{sys} > 0$

(3) $\Delta S_{sur} + \Delta S_{sys} > 0$

(4) $\Delta S_{sur} + \Delta S_{sys} < 0$

4. Dead organs are generally stored in formalin. Formalin is :

(1) aqueous formaldehyde

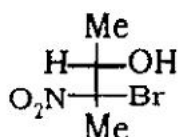
(2) aqueous ferrous sulphate

(3) aqueous formic acid

(4) aqueous ferric alum

5. Regarding "carbon credits", which one of the following statement is **not** correct :
- (1) The carbon credit system was ratified in conjunction with the Kyoto Protocol.
 - (2) Carbon credits are awarded to countries or groups that have reduced greenhouse gases below their emission quota.
 - (3) The goal of the carbon credit system is to limit the increase of carbon dioxide emission.
 - (4) Carbon credits are traded at a price fixed from time to time by the United Nations Environment Programme.
6. Ball bearings are used in bicycles, cars, etc., because :
- (1) the actual area of contact between the wheel and axle is increased.
 - (2) the effective area of contact between the wheel and axle is increased
 - (3) the effective area of contact between the wheel and axle is reduced
 - (4) the actual area of contact between the wheel and axle is reduced.
7. During respiration, energy is released. It is stored in the form of :
- (1) ADP (2) ATP (3) NADP (4) APP
8. Which of the following is known as Royal disease :
- | | |
|------------------------|----------------------|
| (1) Sickle cell anemia | (2) Haemophilia |
| (3) Alzheimers disease | (4) Colour blindness |

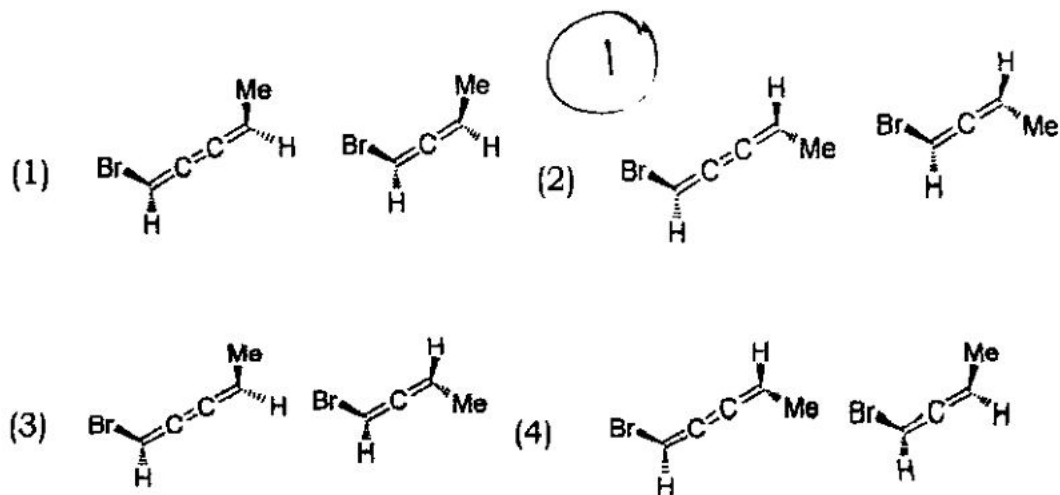
9. The xylem in plants is responsible for :
- (1) transport of water (2) transport of food
(3) transport of oxygen (4) transport of amino acids
10. Two wires, of the same material, have their lengths in the ratio 1:2 and their diameters in the ratio 2:1. If both are stretched separately by equal weights, the ratio of increase in their lengths, $L_1 : L_2$ would be :
- (1) 1:2 (2) 2:1 (3) 1:8 (4) 8:1
11. What is the IUPAC nomenclature of the structure shown below ?



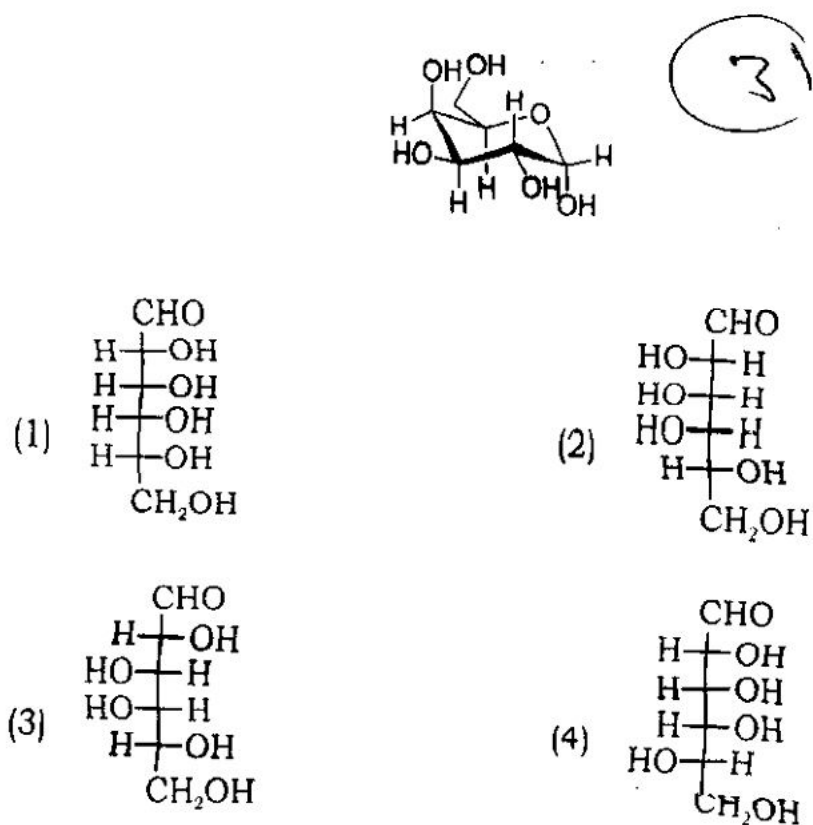
- (1) (2S,3R)-3-bromo-3-nitrobutan-2-ol
(2) (2R,3S)-3-bromo-3-nitrobutan-2-ol
(3) (2S,3S)-3-bromo-3-nitrobutan-2-ol
(4) (2R,3R)-3-bromo-3-nitrobutan-2-ol
12. A series of sequential baseline absorbance measurements are made in a spectrophotometric method, using a blank solution. The absorbance readings are 0.002, 0.000, 0.008, 0.006 and 0.003. A standard 1.0 ppm analyte solution gives an absorbance reading of 0.051. What is the limit of detection ?
- (1) 0.02 ppm (2) 0.2 ppm (3) 20.0 ppm (4) 2.00 ppm



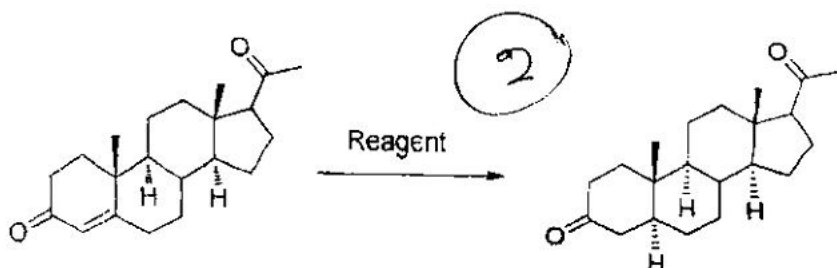
13. Which pair represents the correct structural formula of (Z)-1-bromopenta-1,2,3-triene and (S)-1-bromobuta-1,2-diene :



14. Which of the following is the correct open chain Fischer projection formula of galactose :

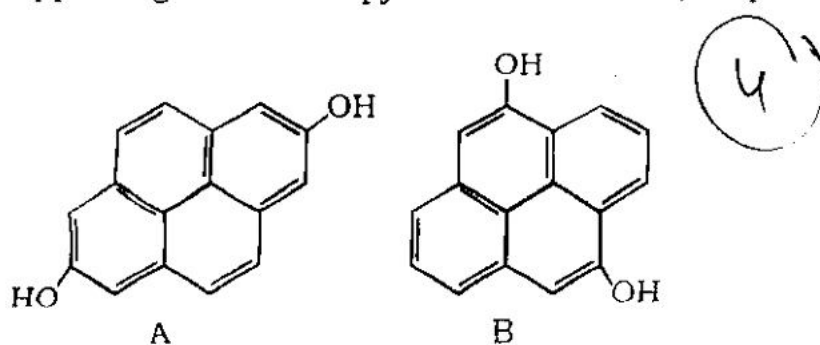


15. Identify the correct reagent for the following transformation :



- (1) LiAlH_4 (2) $\text{DIBAL-H} + \text{MeCu}$
 (3) $\text{Zn(Hg)}, \text{HCl}$ (4) NaBH_4

16. In the broad band decoupled ^{13}C NMR spectrum, the number of signals appearing for the two pyrenediols A and B, respectively, are :



- (1) Eight and eight (2) Eight and sixteen
 (3) Five and ten (4) Five and eight

17. In differential pulse polarography, how many time(s) the current is measured during the life time of a Hg drop :

- (1) One time only (2) Two times
 (3) Four times (4) Continuously measured during the whole life time of the Hg drop

18. In the pH meters, glass membrane electrodes are used generally. What is the parameter measured to correlate it with the H^+ ion concentration in the sample solution ?
- (1) Current (3) (2) Solution resistance
(3) Potential (4) Conductance
19. Among the following mixture of solutions, which one possesses maximum buffer capacity ?
- (1) 0.10 M acetic acid and 0.20 M sodium acetate (3)
(2) 0.15 M acetic acid and 0.20 M sodium acetate
(3) 0.20 M acetic acid and 0.20 M sodium acetate
(4) 0.25 M acetic acid and 0.20 M sodium acetate
20. Predict the shape of the curve during the amperometric titration of potassium dichromate with Pb^{2+} at an applied potential of -0.8 V (vs SCE) :
- (1) L-shaped curve (3) (2) Reverse L-shaped curve
(3) V-shaped curve (4) Straight line
21. Which of the following is generally NOT possible in gas chromatography under the equilibrium conditions :
- (1) Partition between gas and liquid (4)
(2) Partition between liquid and bonded surface
(3) Adsorption
(4) Partition between immiscible liquids

22. How many components are present in the following system (a) sucrose in water; (b) sodium chloride in water and (c) aqueous phosphoric acid? The choices are given below in same order :

(1) 2, 3, 4

2

(2) 2, 2, 2

(3) 1, 3, 6

(4) 2, 2, 4

23. The ionic strength of a M_2X_3 salt; dissolved in water, which is understood to be $M_2^{3+} X_3^{2-}$ of molality m is one of the following. The m^0 is introduced for the dimensionless ionic strength :

(1) $9 m/m^0$

4

(2) $12 m/m^0$ (3) $6 m/m^0$ (4) $15 m/m^0$

24. The effect of quantization is to eliminate the contribution from one of the following :

3

(1) The low frequency oscillators

(2) The high frequency rotors

(3) The high frequency oscillators

(4) The low frequency rotors

25. Which of the following molecules will have a rotational absorption spectrum?

(1) CO_2 (2) OCS (3) C_6H_6 (4) N_2

1

26. The experimentally determined rate-law for the gas -phase reaction $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{HBr}(\text{g})$ is :

$$\frac{d[\text{HBr}(\text{g})]}{dt} = \frac{k[\text{H}_2(\text{g})][\text{Br}_2(\text{g})]^{3/2}}{[\text{Br}_2(\text{g}) + k^1[\text{HBr}(\text{g})]]}$$

4

This reaction is first order in H_2 , What is the order of the reaction with respect to $\text{Br}_2(\text{g})$ and $\text{HBr}(\text{g})$ —

- (1) 3/2 (2) -1
(3) 1/2 (4) Indefinite
27. The rate of formation of the product (P) in an enzyme (E) - catalysed reaction in which a substrate S is converted into products via the formation of the enzyme-substrate complex ; (ES) is given by :

$d(P)/dt = K_b[E]_0[S]/(K_M + [S])$ where the Michaelis constant, K_M , is given by $K_M = (K_b + K_a)/k_a$.

What is the order of this reaction when $K_M \gg [S]$

1

- (1) 2 (2) 0 (3) 1 (4) 3/2
28. The Bohr theory of hydrogen atom was based on the quantization of one of the following :
- (1) Energy of electron
(2) Entropy of hydrogen atom
(3) Angular momentum of electron
(4) Linear momentum of hydrogen atom
29. The absorption of radiation by a sample is dependent on one of the following of the absorbing atoms, molecules or ions :

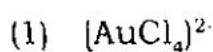
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- (1) Linear momentum of the species

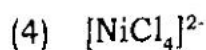
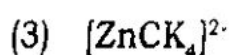
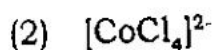
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- (2) Transition dipole moment and the related oscillator strength
- (3) Intensity of radiation falling on the sample
- (4) Wavelength of the radiation

30. Which among the following is expected to adopt square planar geometry ?



1



31. The quadrupolar bond in transition metal clusters implies :

(1) $1\sigma, 2\pi$ and 1δ bonds

1

(2) $2\sigma, 1\pi$ and 1δ bonds

(3) $1\sigma, 3\pi$ and no δ bonds

(4) $2\sigma, \text{no } \pi$ and 2δ bonds

32. To which of the following type the P_4 cluster fits one of the following ?

(1) Electron deficient and nido

(2) Electron sufficient and nido

2

(3) Electron deficient and closo

(4) Electron sufficient and closo

33. The sharp nature of the UV-vis absorption spectra of the lanthanide cations can be understood in terms of :

(1) Their deeply buried 4 f orbitals

(2) Their highly exposed 4 f orbitals

(3) Their partly filled 4 f orbitals

(4) Their fully vacant 5 d orbitals

1

34. The IUPAC name of the Wilkinson's catalyst is :

- (1) Chlorotris (triphenylphosphine) rhodium (I)
- (2) Dichlorobis (triphenylphosphine) rhodium (II)
- (3) Trichlorobis (triphenylphosphine) rhodium (III)
- (4) Chlorotetrakis (triphenylphosphine) rhodium (I)

(1)

35. The total no. of bonding molecular orbitals in $[B_6H_6]^{2-}$ are :

- (1) 6
- (2) 7
- (3) 5
- (4) 8

(2)

36. The purple colour of $[Ti(H_2O)_6]^{3+}$ can be explained in terms of :

- (1) $t_{2g}^1 e_g^0 \xrightarrow{h\nu} t_{2g}^0 e_g^1$
- (2) $t_{2g}^0 e_g^1 \xrightarrow{h\nu} t_{2g}^1 e_g^0$
- (3) $t_{2g}^2 e_g^0 \xrightarrow{h\nu} t_{2g}^1 e_g^1$
- (4) $t_{2g}^2 e_g^1 \xrightarrow{h\nu} t_{2g}^1 e_g^2$

(1)

37. Which of the following is not used as a catalyst in the process of hydrogenation of unsaturated compounds ?

- (1) $Rh(PPh_3)_3Cl$
- (2) Pd powder
- (3) Ni Powder
- (4) $Ir(PPh_3)_3Cl$

(1)

38. Consider the two complexes (a) $[Ni(CN)_4]^{2-}$ in aqueous medium and (b) $[Co(NH_3)_6]^{2+}$ in acidic aqueous medium :

(2)

- (1) Both **a** and **b** are thermally unstable but kinetically labile
- (2) **a** is thermodynamically stable but kinetically labile while **b** is kinetically inert but thermodynamically stable
- (3) **a** is kinetically inert but thermodynamically stable while **b** is thermodynamically stable but kinetically labile
- (4) Both **a** and **b** are thermally unstable but kinetically inert

39. Which of the following is least stable ?

- (1) SnI_4 (3) (2) PbCl_4 (3) PbI_4 (4) SnCl_4

40. A complex, $[\text{M}(\text{H}_2\text{O})_6]^{2+}$ is stable under ambient conditions. It exhibits three spin allowed electronic transitions in its absorption spectrum and has a magnetic moment of 2.8 BM. The metal M is :

- (1) Ti (2) Mn (3) Fe (4) Ni

(4)

Short Answer Questions

Note: 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.

01. Draw the polyhedral and semitopological structures of $B_{10}H_{14}$ and write its styx no. Name the parent closoborane of $B_{10}H_{14}$ and draw its polyhedral structure also.
02. Draw the structure of active site of carbonic anhydrase showing donor and acceptor atoms. Discuss its reversible binding with CO_2/HCO_3^- .
03. The particles of a sample distribute themselves throughout their quantum states. Explain on the basis of probability of distribution.
04. What are nuclear reactions? How are they different from the chemical reactions? Discuss common types of nuclear reactions with suitable example.
05. Explain the fact that $[Ni(CO)_4]$ is tetrahedral whereas $Ni(CN)_4^{2-}$ is square planar.
06. Draw two chair forms each for the six possible dimethyl cyclohexane molecules and indicate which is the most stable of each pair. Then arrange the six molecules in an order of decreasing stability.
07. Explain Epimerization and Diastereoisomerism with suitable examples.
08. Why in S_N2 reactions a nucleophile always attacks from the back side of the leaving group? Explain with suitable example. Allyl chloride undergoes substitution by S_N1 mechanism, whereas n-propyl chloride reacts by S_N2 mechanism, explain.

9. Define the terms homaromaticity, aromaticity and antiaromaticity. How will you account the aromatic behaviour of following species; (i) Cyclopentadienyl anion (ii) Cycloheptatrienyl anion (iii) Cyclopentadienylcation (iv) cyclopropenylcation.
10. Explain why does the activity co-efficients of the strong electrolytes in aqueous solutions depend on the ionic strengths of solutions. Write the Debye-Huckel limiting law for the dilute ionic solutions and its modifications for the concentrated solutions with suitable reasons.

Question No.

Page for Short Answer

Question No.

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ROUGH WORK

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रफ़ कार्य

अभ्यर्थियों के लिए निर्देश

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

1. प्रश्न पुस्तिका मिलने के 30 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, प्रश्नपुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्नपुस्तिका पर अनुक्रमांक और ओ० एम० आर० पत्र संख्या 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 हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिए 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 लिए 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 संबंधित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।
11. रफ कार्य के लिए प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा उत्तर-पुस्तिका के अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ओ एम आर 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।