

RET/15/Test B**12****882****Chemistry****180**

Question Booklet No.

(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 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

FOR ROUGH WORK

Research Entrance Test – 2015

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. Neoprene is polymer of :
(1) Orlon (2) SAN (3) ABS (4) All of these
2. The reagent that can be used to distinguish between Glucose and Fructose is :
(1) Bromine water (2) Fehling's solution
(3) Tollen's reagent (4) Phenyl hydrazine
3. What will happen if a lysosome leaks inside the cell ?
(1) The lysosomal enzymes will digest cell organelles
(2) The lysosomal enzymes will become nonfunctional at pH 7.4 of the cytoplasm
(3) The lysosomal enzymes will be secreted out of the cell
(4) The leaked suicidal bag will make cell to commit suicide
4. Oxygen evolved during photosynthesis in plants comes from :
(1) Splitting of water molecules
(2) Breakdown of carbon dioxide
(3) Carbohydrates accumulated by plants
(4) Lipids
5. The contribution of Gregor Johann Mendel is related to the area of :
(1) Plant classification (2) Genetics
(3) Cell structure (4) Plant functions
6. Himalaya is :
(1) Paleozoic tectonic mountain (2) Recent Folded mountain
(3) Indian mountain (4) Eurasian mountain
7. A particle executes simple harmonic motion under the restoring force provided by a spring. The time period is T. If the spring is divided in two equal parts and one part is used to continue the simple harmonic motion, the time period will :
(1) remain T (2) become 2T (3) become T/2 (4) become $T/\sqrt{2}$

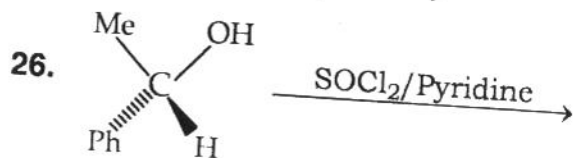
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8. The efficiency of the Carnot's engine working between the steam point and the ice point is :
 (1) 36.81% (2) 26.81% (3) 40% (4) 16.8%
9. If $\vec{a} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$ and $\vec{b} = 3\mathbf{i} + 2\mathbf{j}$, then the angle between \vec{a} and \vec{b} is :
 (1) 45° (2) 90° (3) 180° (4) 120°
10. The value of the integral $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$ is
 (1) π (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{4}$ (4) $-\frac{\pi}{4}$
11. Substances A and B have retention times of 16.40 and 17.63 min, respectively, on a 30.0 cm column. An unretained species passes through the column in 1.30 min. The peak width (at base) for A and B are 1.11 and 1.21 min, respectively. The column resolution is
 (1) 1.11 (2) 1.06 (3) 0.05 (4) 1.56
12. In the volumetric titration of 50.0 mL of 0.1 M acetic acid with 0.1 M ammonium hydroxide, the equivalence point pH was obtained at
 (1) 8.7 (2) 6.9 (3) 7.0 (4) 1.0
13. Sulfuric acid is unusual in that one of its protons behaves as a strong acid and other as a weak acid ($K_{a2} = 1.02 \times 10^{-2}$). The hydronium ion concentration of sulfuric acid solution (0.0400 M) is :
 (1) 0.0471 M (2) 0.0400 M (3) 0.0071 (4) 0.0500 M
14. Which one has the maximum buffer capacity among the following buffers?
 (1) 0.100 M HOAc + 0.200 M NaOAc (2) 0.100 M HOAc + 0.100 M NaOAc
 (3) 0.100 M HOAc + 0.050 M NaOAc (4) 0.200 M HOAc + 0.100 M NaOAc
15. Gelatin added during the polarography using dropping mercury electrode
 (1) reduces streaming motion past mercury drop
 (2) decreases viscosity of the solution
 (3) eliminates migration current
 (4) prevents oxidation of mercury

16. The significance of $E_{1/2}$ lies on the fact that
 (1) $E_{1/2} = \frac{1}{2}(id)$ (2) $E_{1/2} = E_0$ (3) $E_{1/2} < E_0$ (4) $E_{1/2} > E_0$
17. Which one serves as aquatic 'solar fuel cell' ?
 (1) Fungi (2) Bacteria (3) Algae (4) Soil
18. Which of the following is water gas shift reaction ?
 (1) $C + H_2O \rightarrow CO + H_2$ (2) $CO + H_2O \rightarrow CO_2 + H_2$
 (3) $CH_4 + H_2O \rightarrow CO + 3H_2$ (4) $CO + 2H_2O \rightarrow CH_3OH$
19. Metal complexes are usually Lewis acids. Which among the following is a strong Lewis base ?
 (1) $Ir(CO)Cl(PPh_3)_2$ (2) $PdCl_4^{2-}$
 (3) Cp_2TiCl_2 (4) Cp_2ReH
20. $MeMn(CO)_5 + CO \rightarrow Me - \overset{\overset{O}{||}}{C} - Mn(CO)_5$ is an example of :
 (1) Me migration (2) Intermolecular CO insertion
 (3) Intramolecular CO insertion (4) None of these
21. Hydrido metal clusters exhibit characteristic 1H NMR behavior. The 1H NMR signal in the case of such a cluster, $[HCo_6(CO)_{15}]^-$ appears at
 (1) + 23.2 ppm (2) +1.5 ppm (3) - 8.0 ppm (4) - 30.5 ppm
22. Which of the following pairs is isolobal ?
 (1) $CH_3, Fe(CO)_5$ (2) $CH_3, Cr(CO)_4$ (3) $CH_2, Cr(CO)_4$ (4) $CH_2, CO(CO)_3$
23. The reaction $2C_5H_6(g) + Mg(s) \rightarrow Cp_2Mg + H_2$ is an example of
 (1) Oxidation (2) Metallation
 (3) Oxidative addition (4) Oxidative coupling
24. Which one of the following facts is not due to relativistic effects ?
 (1) Lanthanide contraction
 (2) Variation in atomic radii among the elements of 2nd period
 (3) Inert pair effect
 (4) Spin - orbit coupling

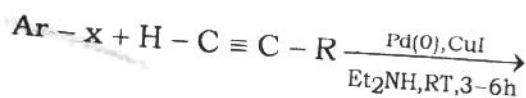
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25. *Trans* isomer of dimethyldiketopiperazine has
- (1) An alternating axis of symmetry (2) A centre of symmetry
 (3) A plane of symmetry (4) Optical activity

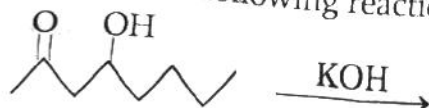


The above reaction proceeds with :

- (1) Inversion of configuration (2) Racemization of configuration
 (3) Retention of configuration (4) Optical loss
27. Name the following reaction :



- (1) Negishi coupling (2) Suzuki reaction
 (3) Heck reaction (4) Sonogashira coupling
28. Predict the mechanism of the following reaction :



- (1) E2 (2) E1 (3) E1cB (4) S_Ni
29. Diels' hydrocarbon is associated with
- (1) Steroids (2) Alkaloids (3) Carotenoids (4) Terpenoids
30. Barbituric acid contains the following core nucleus :

- (1) Pyrimidine (2) Triazole (3) Imidazole (4) Tetrazole
31. Hinsberg reagent is used for the detection of which one of the following functional group :
- (1) Nitro (2) Amide (3) Aldehyde (4) Amine

32. Arenediazonium - 2 - carboxylates can serve as precursor to
- (1) Nitrenes (2) Benzynes
(3) Free radicals (4) Carbenes
33. The Balmer series in the spectrum of hydrogen atom falls in
- (1) Ultraviolet region (2) Visible region
(3) Infrared region (4) Microwave region
34. For the reaction $\text{Ag}_2\text{O}(\text{s}) \rightleftharpoons 2\text{Ag}(\text{s}) + \frac{1}{2} \text{O}_2(\text{g})$, the values of entropy and enthalpy changes are 60 JK^{-1} and 30 kJ respectively. This reaction will attain equilibrium at
- (1) 273 K (2) 500 K (3) 1500 K (4) 2000 K
35. Which of the following is *not* a state function?
- (1) Free energy (2) Work done (3) Entropy (4) Work function
36. The half life for β decay of ^{233}Pa is 27.4 days. How many days must pass to reduce a 5.0 g sample of ^{233}Pa to 0.625 g.
- (1) 109.6 (2) 54.8 (3) 82.7 (4) 27.4
37. In a solid lattice, a cation has left the lattice site and is present in the interstitial position, such lattice defect called
- (1) Schottky defect (2) Frenkel defect
(3) Vacancy defect (4) Interstitial defect
38. If the conductivity of a 0.01 M solution of KCl is $1.4 \times 10^{-3} \text{ S cm}^{-1}$ at 298 K, its equivalent conductance would be
- (1) 0.14 (2) 1.4 (3) 14.0 (4) 140
39. The standard redox potential for Pb^{2+}/Pb and Ag^+/Ag electrodes are -0.13 and $+0.80 \text{ V}$, respectively. What would be the standard emf (E^0) of the cell $\text{Pb} | \text{Pb}^{2+} || \text{Ag}^+ | \text{Ag}$?
- (1) 1.73 V (2) 0.67 V (3) 0.93 V (4) 1.47 V
(6)

40. According to Gouy - Chapman (G - C) model for metal/electrolyte interface, there exists a diffuse layer of excess charges into the solution. Which of the following statements is correct as per G - C model ?
- (1) Diffuse layer starts at a distance from the metal and potential decays linearly across the diffuse layer.
 - (2) Diffuse layer starts from the metal surface and potential decays linearly across the diffuse layer.
 - (3) Diffuse layer starts from the metal surface and potential decays exponentially across the diffuse layer.
 - (4) Diffuse layer starts at a distance from the metal surface and potential decays exponentially across the diffuse layer.

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) the Cottrell equation and (b) the polarographic equation for $O + pH^+ + ne \rightleftharpoons R$.
2. What is Randles Sevcik equation ? How do you use this equation for the estimation of electrochemical area of an electrode ?
3. Elaborate with example that TGA and DTA are complementary techniques.
4. While β -H elimination is very common in metal alkyls, α -H and γ -H eliminations are not observed in most of the cases. Explain.
5. Both CO and CN^- are strong ligands, however, their complexes $Ni(CO)_4$ and $Ni(CN)_4^{2-}$ have different structures. Explain.
6. What is Heck reaction ? Write down the steps involved in the mechanism of the Heck reaction.
7. (a) Write down the Fischer Indole synthesis with its mechanism.
(b) What is the Mitsunobu reaction ?
8. State Lambert-Beer's law and describe how this law can be used to determine the unknown concentration of a light absorbing compound in its solution.
9. What is reduced phase rule ? How the phase diagram of Pb-Ag helps in desilverization of argentiferous lead ?
10. Illustrate how the semiconductor/solution interface (electrode) can be used to construct the solar cell for harvesting light energy.

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FOR ROUGH WORK

