PUMDET-2019

Subject : CHEMISTRY

(Booklet Number)

Duration : 90 Minutes **Full Marks : 100**

INSTRUCTIONS

1. All questions are of objective type having four answer options for each. Only one option is correct. Correct answer will carry full marks **2**. In case of incorrect answer or any combination of more than one answer, ½ mark will be deducted.
2. Questions must be answered on OMR sheet by darkening the appropriate bubble marked A, B, C or D.
3. Use only **Black/Blue ball point pen** to mark the answer by complete filling up of the respective bubbles.
4. Mark the answers only in the space provided. Do not make any stray mark on the OMR.
5. Write question booklet number and your roll number carefully in the specified locations of the **OMR**. Also fill appropriate bubbles.
6. Write your name (in block letter), name of the examination centre and put your full signature in appropriate boxes in the OMR.
7. The OMR is liable to become invalid if there is any mistake in filling the correct bubbles for question booklet number/roll number or if there is any discrepancy in the name/signature of the candidate, name of the examination centre. The OMR may also become invalid due to folding or putting stray marks on it or any damage to it. The consequence of such invalidation due to incorrect marking or careless handling by the candidate will be sole responsibility of candidate.
8. Candidates are not allowed to carry any written or printed material, calculator, pen, docu-pen, log table, wristwatch, any communication device like mobile phones etc. inside the examination hall. Any candidate found with such items will be **reported against** and his/her candidature will be summarily cancelled.
9. Rough work must be done on the question paper itself. Additional blank pages are given in the question paper for rough work.
10. Handover the OMR to the invigilator before leaving the Examination Hall.

CHEMISTRY

1. Two ideal gases A and B (Mol. wt. 32 and 64 respectively) are kept at Kelvin temperatures T_A and T_B respectively. They will have identical kinetic energy distribution profile only when T_A/T_B is

(A) 1 (B) 2

(C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

2. 0.90 gm of liquid water is kept in a vessel at 27 °C and the equilibrium vapour pressure is 30 Torr. If all the water has to evaporate, the volume of the vessel must be

(A) 31.18 L (B) 30 L

(C) 300 L (D) 312 L

3. If a real gas obeys an equation of state of the form $\overline{V} = \frac{RT}{p} + b - \frac{a}{RT^2}$ (where $\overline{V}$ is the molar volume and all other quantities have their usual meaning), its Boyle temperature is

(A) $\frac{a}{Rb}$ (B) $\sqrt{\frac{Rb}{a}}$

(C) $\sqrt{\frac{b}{Ra}}$ (D) $\sqrt{\frac{a}{Rb}}$

4. One mole of an ideal gas initially at 25 °C and 1 atm. pressure is isothermally expanded against zero pressure to double its volume. The entropy changes for this process is

(A) Zero (B) $R \ln \frac{1}{2}$

(C) $-R \ln \frac{1}{2}$ (D) $R \ln 2$

5. If $f(x) = x^n$ then $f(x)$ is an eigen function of the operator

(A) $x\frac{d}{dx}$ with eigen value $n - 1$ (B) $\frac{d}{dx}$ with eigen value n

(C) $\frac{d}{dx}$ with eigen value $n - 1$ (D) $x\frac{d}{dx}$ with eigen value n

10. For CO_2 molecule showing two strong absorption bands in the infrared region, which of the following statements is true ?

(A) Three modes of vibration; two doubly degenerate bending and one asymmetric stretching.

(B) Four modes of vibrations; one symmetric stretching, two doubly degenerate bending and one asymmetric stretching.

(C) Four modes of vibration; one symmetric stretching, two non-degenerate bending and one asymmetric stretching.

(D) Two modes of vibration; one symmetric stretching and one asymmetric stretching.

11. Among the following statements, which one is correct for an ideal solution ?

(A) $\Delta V_{mix} = 0$ and $\Delta S_{mix} = 0$

(B) $\Delta V_{mix} = 0$ and $\Delta H_{mix} = 0$

(C) $\Delta V_{mix} = 0$ and $\Delta G_{mix} = 0$

(D) $\Delta H_{mix} = 0$ and $\Delta G_{mix} = 0$

12. A mixture of two liquid X and Y forms an azeotrope. The azeotrope shows a maximum in vapour pressure. The boiling temperature of the azeotrope mixture will be

(A) less than the boiling points of pure X and Y.

(B) greater than the boiling points of pure X and Y.

(C) equal to the boiling point of X.

(D) equal to the boiling point of Y.

13. A solute distributes between an organic and aqueous phases. In the organic phase it dimerizes. The quantity which remains constant at a given temperature is

(C's are the concentrations.)

(A) C_{org} / C_{aq}

(B) $2C_{org} / C_{aq}$

(C) $C_{org} / 2C_{aq}$

(D) $(C_{org})^{\frac{1}{2}} / C_{aq}$

14. The departure of experimentally observed heat capacity at low temperature from theoretical value as calculated in equipartition theorem is mainly due to lower than expected contribution from

(A) transitional modes

(B) vibrational modes

(C) rotational modes

(D) All the three modes.

20. The prosthetic group of human carbonic anhydrase is a Zn^{+2} ion co-ordinated by

(A) three N-sites of histidine residues and a water molecule

(B) two N-sites of histidine residues and two water molecules

(C) two N-sites of histidine residue, one carboxylate of glutamate and a water molecule

(D) two N-sites of histidine residues, phenolic – OH of tyrosine and Carboxylate of glutamate

21. The aqueous solution of $[Ti(H_2O)_6]^{3+}$ shows a maximum absorption around 20300 cm^{-1} in its electronic spectrum. The wavelength in 'nm' will be

(A) 500 (B) 480

(C) 492 (D) 520

22. Correct order of molar absorptivity (ε) for electronic transitions observed in transition metal complexes is :

(A) Spin allowed, Laporte allowed > spin allowed, Laporte forbidden > spin forbidden, Laporte forbidden

(B) Spin allowed, Laporte allowed > spin forbidden, Laporte forbidden > spin allowed, Laporte forbidden

(C) Spin forbidden, Laporte allowed > spin allowed, Laporte forbidden > spin allowed, Laporte allowed

(D) Spin forbidden, Laporte allowed > spin allowed, Laporte forbidden > spin forbidden, Laporte forbidden

23. The 1R stretching frequencies of CO group in $CO_2(CO)_8$ in solid state and solution exhibits

(A) one type in both

(B) two types in both

(C) two types in solution and one in solid

(D) two types in solid and one in solution

30. In H-atom emission spectra consider the four Balmer lines : H_α (red), H_β (blue – green), H_γ (blue) and H_δ (violet). Which of the following statements is true ?

(A) H_α line corresponds to n=3 to n=2 transition and H_δ line corresponds to n=4 to n=2 transition.

(B) H_α line corresponds to n=4 to n=2 transition and H_δ line corresponds to n=7 to n=2 transition.

(C) H_γ line corresponds to n=5 to n=2 transition and H_δ line corresponds to n=6 to n=2 transition.

(D) H_β line corresponds to n=5 to n=2 transition and H_γ line corresponds to n=6 to n=2 transition.

31. For the gravimetric determination of Ni^{2+} using dimethylglyoxime which of the following statements is true ?

(A) Pd^{2+} interferes but Pt^{2+} does not interfere.

(B) Both Pd^{2+} and Bi^{+3} interfere.

(C) Au^{3+} does not interfere.

(D) No interference from Pd^{2+}, Pt^{2+}, Bi^{+3} and Au^{3+}.

32. Which of the following statements is true for Cr^{2+} ?

(A) Cr^{2+} (aq.) is a strong oxidant.

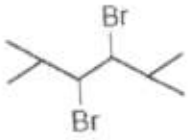
(B) High spin Cr^{2+} - compounds are subject to strong Jahn – Teller distortion.

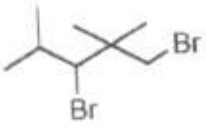
(C) Low spin Cr^{2+} compounds are not available.

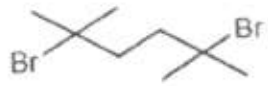
(D) High spin Cr^{2+} has ground state term $3\,T_1g$.

36. A compound having molecular formula $C_8H_{16}Br_2$ displays two characteristics IR bands at 1370 and 1380 cm^{-1}. In its ^1H-NMR spectrum, two singlets are observed at δ 1.7 and 1.8 with relative areas of 3:1. The structure of the compound is

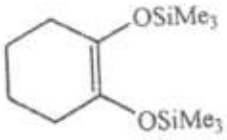
(A) 

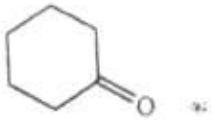
(B) 

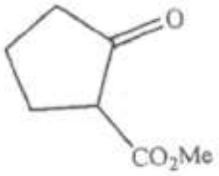
(C) 

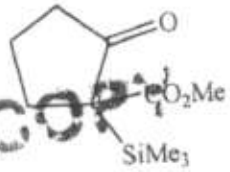
(D) 

37. The reaction of dimethyl adipate with Na and Me_3SiCl in toluene gives

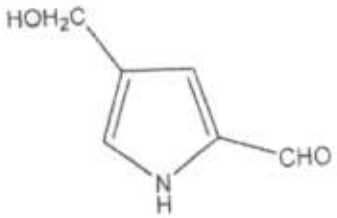
(A) 

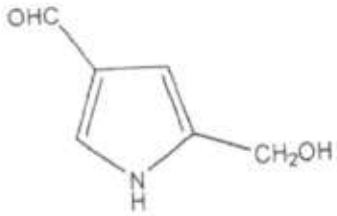
(B) 

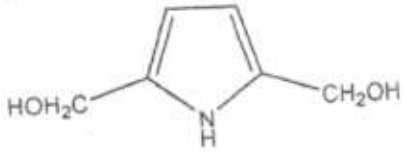
(C) 

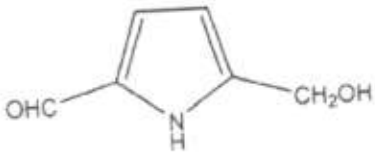
(D) 

38. The reaction of pyrole with two equivalents of formaldehyde in the presence of aqueous K_2CO_3 furnishes

(A) 

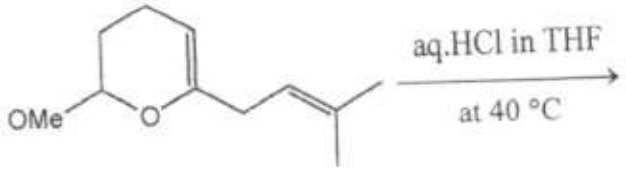
(B) 

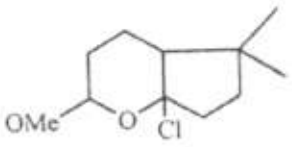
(C) 

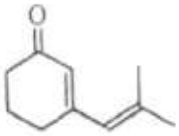
(D) 

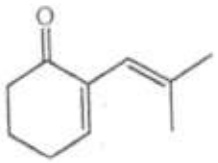
A

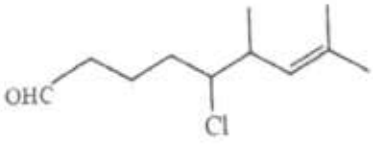
42. The major product of the following reaction is



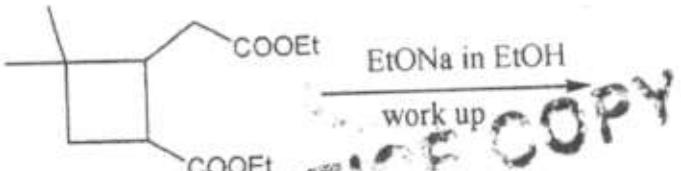
(A) 

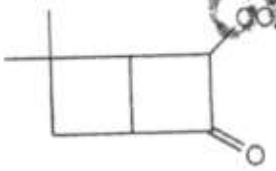
(B) 

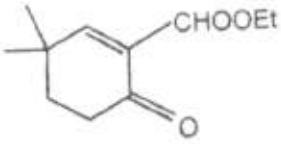
(C) 

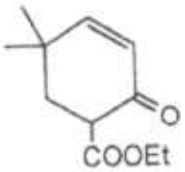
(D) 

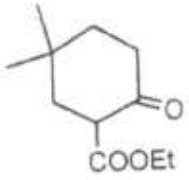
43. The major product of the following reaction is



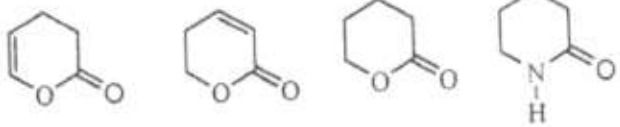
(A) 

(B) 

(C) 

(D) 

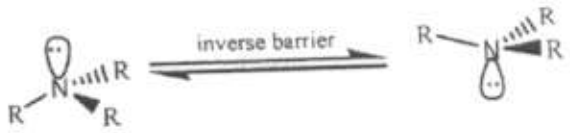
44. Among the following compounds, the ones that will give the lowest and highest carbonyl absorption frequencies in their IR spectra are respectively



(P) (Q) (R) (S)

(A) (P) and (S)
(B) (Q) and (R)
(C) (R) and (P)
(D) (S) and (P)

48. The largest pyramidal inversion barrier is expected for the compound



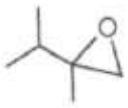
(A) $(CH_3)_3N$

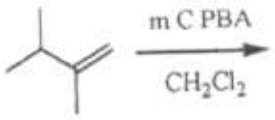
(B) $(CH_3)_2N\text{-}NH_2$

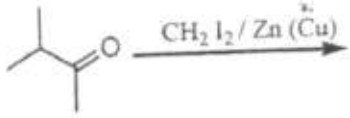
(C) $(CH_3)_2N\text{-}OH$

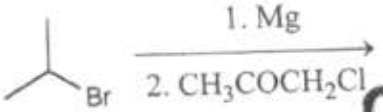
(D) $(CH_3)_2N\text{-}F$

49. The epoxide depicted below cannot be prepared by



(A) 

(B) 

(C) 

(D) 

50. The reaction conditions which is not suitable for the formation of cyanohydrin of acetone is

(A) acetone $\xrightarrow{\text{aq. NaCN}}$

(B) acetone $\xrightarrow[\text{2. aq. } NH_4Cl]{\text{1. TMS-CN, Cat. KCN}}$

(C) acetone $\xrightarrow[\text{2. NaCN}]{\text{1. } NaHSO_3}$

(D) acetone $\xrightarrow[\text{HCl}]{\text{aq. NaCN}}$