

**COMMON P.G. ENTRANCE TEST-2022 (CPET-2022)**

Subject Code : **49**

Test Booklet No.:

Entrance Subject : **Chemistry**

Hall Ticket No.:

**TEST BOOKLET**

Time Allowed : **90 Minutes**

Full Marks : **70**

**INSTRUCTIONS TO CANDIDATES**

1. **Please do not open this Question Booklet until asked to do so.**
2. Check the completeness of the Question Booklet immediately after opening.
3. Enter your **Hall Ticket No.** on the Test Booklet in the box provided alongside. **Do not** write anything else on the Test Booklet.
4. Fill up & darken Hall Ticket No. & Test Booklet No. in the OMR Answer Sheet as well as fill up Test Booklet Serial No. & OMR Answer Sheet Serial No. in the Attendance Sheet carefully. Wrongly filled up OMR Answer Sheets are liable for rejection.
5. Each question has four answer options marked (A), (B), (C) & (D).
6. Answers are to be marked on the Answer Sheet, which is provided separately.
7. Choose the most appropriate answer option and darken the oval completely, corresponding to (A), (B), (C) or (D) against the relevant question number.
8. Use only **Blue/Black Ball Point Pen** to darken the oval for answering.
9. Please do not darken more than one oval against any question, as scanner will read such markings as wrong answer.
10. **Each question carries equal marks. There will be no negative marking for wrong answer.**
11. **Electronic items such as calculator, mobile, etc., are not permitted inside the examination hall.**
12. Don't leave the examination hall until the test is over and permitted by the invigilator.
13. **The candidate is required to handover the original OMR sheet to the invigilator and take the question booklet along with the candidate's copy of OMR sheet after completion of the test.**
14. Sheet for rough work is appended in the Test Booklet at the end.

1. The most abundant element in earth's crust is
  - (A) Aluminium
  - (B) Iron
  - (C) Silicon
  - (D) Oxygen
  
2. Diagonal relationship is shown by
  - (A) all Elements
  - (B) most of the elements of 2<sup>nd</sup> period
  - (C) all 3d series elements
  - (D) none of the above
  
3. The highest occupied MO in  $N_2$  and  $O_2^+$  respectively are (take x-axis as internuclear axis)
  - (A)  $\sigma 2p_x$ ,  $\Pi^* 2p_y$
  - (B)  $\Pi 2p_y$ ,  $\Pi 2p_z$
  - (C)  $\sigma^* 2p_x$ ,  $\sigma 2p_x$
  - (D)  $\Pi^* 2p_y$ ,  $\Pi^* 2p_z$
  
4. The electronegativity differences is the highest for the pair
  - (A) Li, Cl
  - (B) K, F
  - (C) Na, Cl
  - (D) Li, F
  
5. Among the oxides of nitrogen,  $N_2O_3$ ,  $N_2O_4$  and  $N_2O_5$ , the compound(s) having N–N bond is/are
  - (A)  $N_2O_4$  and  $N_2O_5$
  - (B)  $N_2O_3$  and  $N_2O_5$
  - (C)  $N_2O_3$  and  $N_2O_4$
  - (D)  $N_2O_5$  only

6. The correct order of decreasing electronegativity of the following atoms is

- (A)  $\text{As} > \text{Al} > \text{Ca} > \text{S}$
- (B)  $\text{S} > \text{As} > \text{Al} > \text{Ca}$
- (C)  $\text{Al} > \text{Ca} > \text{S} > \text{As}$
- (D)  $\text{S} > \text{Ca} > \text{As} > \text{Al}$

7. Which one of the following configuration will show Jahn-Teller distortion in an octahedral field?

- (A) high spin  $d^8$
- (B) high spin  $d^4$
- (C) high spin  $d^5$
- (D) low spin  $d^6$

8. The metal ion of an enzyme involved in hydration of  $\text{CO}_2$  is

- (A)  $\text{Cu(II)}$
- (B)  $\text{Fe(II)}$
- (C)  $\text{Mg(II)}$
- (D)  $\text{Zn(II)}$

9. The complexes  $[\text{Pt}(\text{CN})_4]^{2-}$  and  $[\text{NiCl}_4]^{2-}$ , respectively, are

- (A) paramagnetic, paramagnetic
- (B) diamagnetic, diamagnetic
- (C) paramagnetic, diamagnetic
- (D) diamagnetic, paramagnetic

10. In qualitative inorganic analysis of metal ions, the ion which participates as sulfide in the presence of  $\text{H}_2\text{S}$  in warm dilute  $\text{HCl}$  is

- (A)  $\text{Cr}^{3+}$
- (B)  $\text{Al}^{3+}$
- (C)  $\text{Co}^{2+}$
- (D)  $\text{Bi}^{3+}$

11. The correct combination of metal, number of ligands and the charge for a metal carbonyl complex  $[M(CO)_x]^{z-}$  satisfying octet rule is

- (A)  $M=Ti, x=6, z=1$
- (B)  $M=V, x=6, z=1$
- (C)  $M=Co, x=4, z=2$
- (D)  $M=Mo, x=5, z=1$

12. Among the following pairs, those in which both species have similar structures are

- (A)  $N_3^-$ ,  $XeF_2$
- (B)  $[ICl_4]^-$ ,  $[PtCl_4]^{2-}$
- (C)  $[ClF_2]^+$ ,  $[ICl_4]^-$
- (D)  $XeO_3$ ,  $SO_3$

13. Among  $XeO_3F_2$ ,  $ICl_2^-$ ,  $ClO^-$  and  $SO_3^{2-}$ , the number of species having three lone pair of electrons on central metal atom according to VSEPR theory is

- (A) 3
- (B) 0
- (C) 4
- (D) 2

14. The set of ions expected to show Jahn-Teller distortion in their complexes is

- (A)  $Ti(III)$ ,  $Cu(II)$ , High spin  $Fe(III)$
- (B)  $Cu(I)$ ,  $Ni(II)$ , High spin  $Fe(III)$
- (C)  $Cu(II)$ ,  $Ti(III)$ , Low spin  $Fe(III)$
- (D)  $Cu(I)$ ,  $Mn(II)$ , Low spin  $Fe(III)$

15. The hybridization of boron in diborane is

- (A)  $sp$
- (B)  $sp^2$
- (C)  $sp^3$
- (D)  $sp^3d$

16. For a zero-order reaction, unit of the rate constant is expressed as

- (A)  $molL^{-1}s^{-1}$
- (B)  $Lmol^{-1}s^{-1}$
- (C)  $molL^{-1}s$
- (D)  $s^{-1}$

17. If  $K_{sp}$  is the solubility product of a sparingly soluble salt  $A_3X_2$ , then its solubility is

- (A)  $(K_{sp}/108)^{1/5}$
- (B)  $(K_{sp})^{1/5}$
- (C)  $(K_{sp}/72)^{1/5}$
- (D)  $(K_{sp})^{1/2}$

18. All natural processes are irreversible. This is a direct consequence of  
(A) first law of thermodynamics  
(B) second law of thermodynamics  
(C) third law of thermodynamics  
(D) Gibbs paradox
19. According to VSEPR theory, the molecule/ion having ideal tetrahedral shape is  
(A)  $\text{SF}_4$   
(B)  $\text{SO}_4^{2-}$   
(C)  $\text{SOCl}_2$   
(D)  $\text{SO}_2\text{Cl}_2$
20. The average speed of  $\text{H}_2$ ,  $\text{N}_2$  and  $\text{O}_2$  gas molecules is in the order  
(A)  $\text{H}_2 > \text{N}_2 > \text{O}_2$   
(B)  $\text{O}_2 > \text{N}_2 > \text{H}_2$   
(C)  $\text{H}_2 > \text{O}_2 > \text{N}_2$   
(D)  $\text{N}_2 > \text{O}_2 > \text{H}_2$
21. An aqueous solution of hemoglobin has a molar absorptivity value of  $18,600 \text{ L mol}^{-1} \text{ cm}^{-1}$  for an absorbance value of 0.1 at 540 nm (Given: cell thickness = 1 cm). The concentration (in  $\mu\text{M}$ ) of the hemoglobin solution is:  
(A) 0.537  
(B) 5.37  
(C) 53.7  
(D) 537.0
22. In metal-olefin interaction, the extent of increase in metal  $\rightarrow$  olefin  $\pi$ -back -donation would  
(A) lead to a decrease in C = C bond length  
(B) change the formal oxidation state of the metal  
(C) change the hybridisation of the olefin carbon from  $\text{sp}^2$  to  $\text{sp}^3$   
(D) increase with the presence of electron donating substituent on the olefin
23. From the kinetic theory of gases, the ratio of most probable speed ( $C_{\text{mp}}$ ) to root mean square speed ( $C_{\text{rms}}$ ) is  
(A)  $\sqrt{3}$   
(B)  $\sqrt{2}/\sqrt{3}$   
(C)  $\sqrt{3}/\sqrt{2}$   
(D)  $3/\sqrt{2}$
24. The effective nuclear charge of helium atom is 1.7. The first ionization energy of helium atom in eV is  
(A) 13.6  
(B) 23.1  
(C) 39.3  
(D) 27.2

25. The homogenous catalyst used in hydroformylation is

- (A)  $\text{HCo}(\text{CO})_4$
- (B)  $\text{Cr}_2\text{O}_3$
- (C)  $[\text{RhCl}(\text{PPh}_3)_3]$
- (D)  $[\text{RuCl}_2(\text{bipyridyl})_2]$

26. The “heme” containing protein is

- (A) Cytochrome C
- (B) Hemocyanin
- (C) Hemerythrin
- (D) Ferritin

27. On hydrolysis, calcium carbide produces

- (A)  $\text{CH}_4$
- (B)  $\text{C}_2\text{H}_6$
- (C)  $\text{C}_2\text{H}_4$
- (D)  $\text{C}_2\text{H}_2$

28. According to band theory of solids, conduction occurs in good conductors because

- (A) valence band is full
- (B) valence band and conduction band overlaps
- (C) band gap is appreciable
- (D) band gap is small

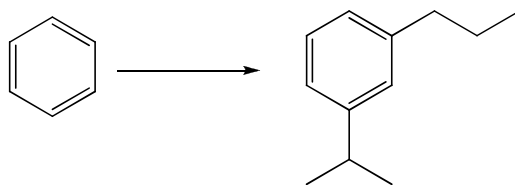
29. The compound that contains the most acidic hydrogen is

- (A)  $\text{H}_2\text{C}=\text{CH}_2$
- (B)  $\text{HC}\equiv\text{CH}$
- (C)  $\text{H}_3\text{C}-\text{CH}_3$
- (D)  $\text{H}_2\text{C}=\text{C}=\text{CH}_2$

30. The number of crystal systems and the number of Bravais lattices are, respectively

- (A) 14 and 7
- (B) 7 and 32
- (C) 32 and 14
- (D) 7 and 14

31. The sequence of three steps involved in the following conversion is

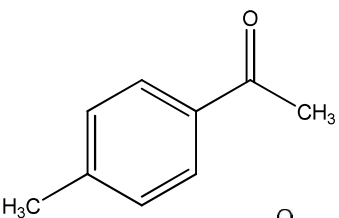
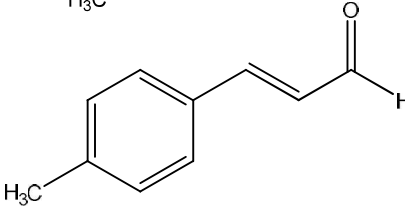
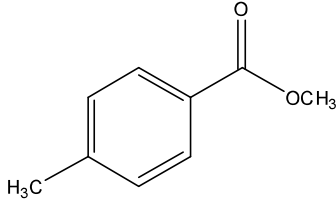
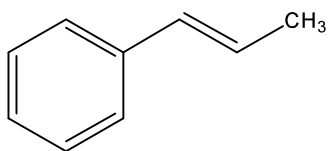


- (A) (i) Friedel-Crafts alkylation; (ii) Reduction; (iii) Friedel-Crafts acylation
- (B) (i) Friedel-Crafts acylation; (ii) Friedel-Crafts alkylation; (iii) Reduction
- (C) (i) Friedel-Crafts acylation; (ii) Reduction; (iii) Friedel-Crafts alkylation
- (D) (i) Friedel-Crafts alkylation; (ii) Friedel-Crafts acylation; (iii) Reduction

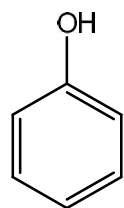
32. Metal having maximum oxidizing power is

- (A) Li
- (B) Ba
- (C) Cu
- (D) K

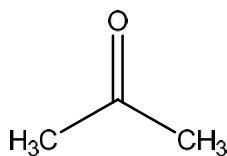
33. The compound that shows positive haloform test is

- (A) 
- (B) 
- (C) 
- (D) 

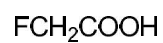
34. The increasing order of acidity of the given molecules in aqueous media is



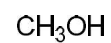
I



II



III



IV

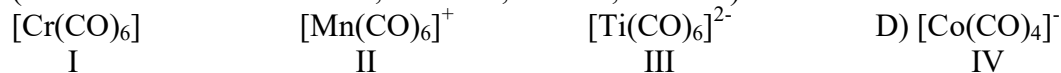
- (A)  $\text{IV} < \text{I} < \text{II} < \text{III}$
- (B)  $\text{II} < \text{I} < \text{IV} < \text{III}$
- (C)  $\text{II} < \text{IV} < \text{I} < \text{III}$
- (D)  $\text{IV} < \text{II} < \text{I} < \text{III}$

35. The d-orbitals involved in the hybridization to form square planar and trigonal bipyramidal geometries are, respectively,

- (A)  $d_z^2$  and  $d_z^2$
- (B)  $d_{x^2-y^2}$  and  $d_z^2$
- (C)  $d_{yz}$  and  $d_z^2$
- (D)  $d_{x^2-y^2}$  and  $d_{yz}$

36. The order of the M-C bond strength in the following species is

(Atomic number for Cr = 24, Mn = 25, Ti = 22, Co = 27)



- (A) II > I > IV > III
- (B) I > III > II > IV
- (C) III > IV > I > II
- (D) III > I > II > IV

37. Osmotic pressure of a solution increases if

- (A) temperature is decreased
- (B) volume is increased
- (C) no. of molecules of the solute is increased
- (D) none of these

38. The chemical reaction taking place at anode is

- (A) Oxidation
- (B) Reduction
- (C) Ionization
- (D) Hydrolysis

39. The measure of bond dissociation energy is the change in

- (A) Enthalpy
- (B) Entropy
- (C) Internal Energy
- (D) Free Energy

40. In 1.2 years, half of 64 mg of a radioactive isotope decays. What is the amount left after passage of 6 years?

- (A) 0
- (B) 2 mg
- (C) 4 mg
- (D) 8 mg

41. For an exothermic reaction, the equilibrium constant

- (A) increases with increase in temperature
- (B) decreases with increase in temperature
- (C) increases with increase in pressure
- (D) decreases with increase in pressure



42. Which of the following has highest Basicity?

- (A)  $F^-$
- (B)  $OH^-$
- (C)  $NH_2^-$
- (D)  $CH_3^-$

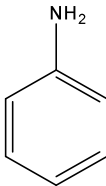
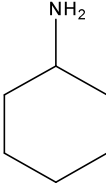
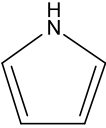
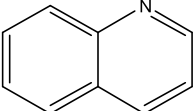
43. In a face centered cubic lattice, the number atoms per unit cell is

- (A) 1
- (B) 2
- (C) 3
- (D) 4

44. How many optically active isomers are there in tartaric acid?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

45. Which of the following compound is the strongest base?

- (A) 
- (B) 
- (C) 
- (D) 

46. The most strained cycloalkane is  
(A) Cyclopropane  
(B) Cyclobutane  
(C) Cyclopentane  
(D) Cyclohexane
47. Reaction of chlorobenzene with  $\text{NaNH}_2/\text{NH}_3$  to form aniline is  
(A) an electrophilic substitution reaction  
(B) a nucleophilic substitution reaction  
(C) an addition-elimination reaction  
(D) an elimination-addition reaction
48. Phenol is soluble in water because  
(A) it has a higher boiling point than water  
(B) of weak hydrogen bonding between phenol and water molecules  
(C) of intermolecular hydrogen bonding between phenol molecules  
(D) none of the above
49. Which reagent can distinguish between phenol and ethanol?  
(A)  $\text{SOCl}_2$   
(B)  $\text{CH}_3\text{COCl}$   
(C)  $(\text{CH}_3\text{CO})_2\text{O}$   
(D)  $\text{CH}_3\text{COOH}$
50. Three of the following four reactions are due to one similar feature of carbonyl compounds, while the fourth one is different. Which one is the fourth?  
(A) Aldol Condensation  
(B) Knoevenagel Reaction  
(C) Wittig Reaction  
(D) Haloform Reaction
51. Formic acid has C-O bond length 1.36 Å and C=O bond length 1.23 Å, but in sodium formate  
(A) both C-O bonds become equal  
(B) both C-O bond lengths decrease  
(C) both C-O bond lengths increase  
(D) remain same as in formic acid
52. IUPAC name of ethyl acetoacetate is  
(A) Methyl-2-oxobutanoate  
(B) Acetoacetic ester  
(C) Ethyl-3-oxobutanoate  
(D) Ethyl methyl malonate

53. Pyrrole is less basic than pyridine because the lone pair of electrons of N-atom in pyrrole
- (A) is the part of the delocalized  $\Pi$ -molecular orbital
  - (B) is not the part of the delocalized  $\Pi$ -molecular orbital
  - (C) resides in  $sp^2$ -hybrid orbital
  - (D) resides in  $sp$ -hybrid orbital
54.  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  alcohols can be distinguished by
- (A) Hinsberg's method
  - (B) Lucas Test
  - (C) Bromine water
  - (D) All of the above
55. Which of the following is a pentose sugar?
- (A) Glucose
  - (B) Galactose
  - (C) Xylose
  - (D) Mannose
56. The end product of protein digestion is
- (A) Glucose
  - (B) Glycerol
  - (C) Oxalic acid
  - (D) Amino acid
57. The reverse of a photochemical reaction is called
- (A) Phosphorescence
  - (B) Chemiluminescence
  - (C) Fluorescence
  - (D) Photosensitization
58. Which one of the following is a chain-growth polymer?
- (A) Teflon
  - (B) Terylene
  - (C) Nylon-6,6
  - (D) Bakelite
59. Which terpenoid is present in peppermint oil?
- (A) Citral
  - (B) Menthol
  - (C) Camphor
  - (D) Carvone
60. The factor(s) which affect chemical shift in NMR spectroscopy is/are
- (A) Inductive effect
  - (B) H-bonding
  - (C) Resonance
  - (D) All of these

61. A solution of sucrose (molar mass 342 g/mol) is prepared by dissolving 68.4 g of it per litre of the solution. Calculate the osmotic pressure ( $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ ) at 273 K.

- (A) 3.92 atm
- (B) 4.48 atm
- (C) 5.92 atm
- (D) 29.4 atm

62. Which one of the following metals will displace hydrogen by reacting with dilute acids?

- (A) Ag
- (B) Hg
- (C) Cu
- (D) Zn

63. The number of metal-metal bond in  $[\text{Co}_4(\text{CO})_{12}]$  is

- (A) 2
- (B) 4
- (C) 6
- (D) 8

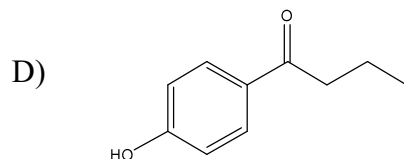
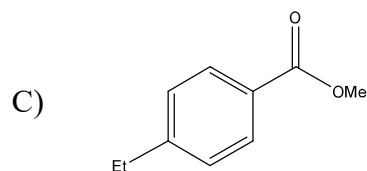
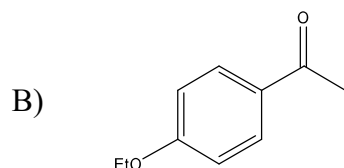
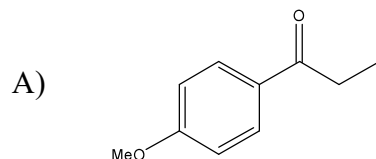
64. The number of lone pairs are identical in the pairs

- (A)  $\text{XeO}_4$ ,  $\text{PCl}_3$
- (B)  $\text{XeO}_4$ ,  $\text{ClF}_3$
- (C)  $\text{XeF}_4$ ,  $\text{ClF}_3$
- (D)  $\text{XeO}_2\text{F}_2$ ,  $\text{SF}_6$

65. An organic compound exhibited the following  $^1\text{H}$  NMR spectral data:

$\delta$  7.80 (2H, d,  $J = 8 \text{ Hz}$ ), 6.80 (2H, d,  $J = 8 \text{ Hz}$ ), 4.10 (2H, q,  $J = 7.2 \text{ Hz}$ ), 2.4 (3H, s), 1.25 (3H, t,  $J = 7.2 \text{ Hz}$ ).

Identify the compound from the choices given below.



66. What happens to the viscosity of liquids and gases with increase in temperature?
- (A) increases for liquid, decreases for gases
  - (B) decreases for liquid, increases for gases
  - (C) increases for both
  - (D) decreases for both
67. In qualitative inorganic analysis, in order to detect second group basic radicals,  $\text{H}_2\text{S}$  gas is passed in the presence of dilute  $\text{HCl}$  to
- (A) decrease the dissociation of  $\text{H}_2\text{S}$
  - (B) increase the dissociation of  $\text{H}_2\text{S}$
  - (C) increase the dissociation of salt solution
  - (D) decrease the dissociation of salt solution
68. Solution of sodium metal in liquid ammonia is a strong reductant due to the presence of
- (A) sodium atoms
  - (B) solvated electrons
  - (C) sodium amide
  - (D) sodium hydride
69. Brown ring test for nitrate depends on
- (A) reduction of nitrate to nitric oxide
  - (B) oxidation of nitric oxide to nitrogen dioxide
  - (C) reduction of ferrous sulphate to iron
  - (D) oxidizing action of sulphuric acid
70. Acetone and acetaldehyde can be distinguished by
- (A) Molisch's test
  - (B) Tollen's test
  - (C) Schiff's test
  - (D) Iodoform test

# ROUGH WORK

# ROUGH WORK

