CHEMISTRY - 1999

PART - A

Directions : *Select the most appropriate alternative A, B, C or D in questions 1–25.*

1. The electrons, identified by quantum numbers n and l, (i) $n = 4$, $l = 1$, (ii) $n = 4$, $l = 0$, (iii) $n = 3$, $l = 2$, and (iv) $n = 3$, $l = 1$ can be placed in order of increasing energy, from the lowest to highest, as :
   (A) (iv) < (ii) < (iii) < (i)   (B) (ii) < (iv) < (i) < (iii)
   (C) (i) < (iii) < (ii) < (iv)   (D) (iii) < (i) < (iv) < (ii)

2. The number of neutrons accompanying the formation of $^{139}_{54}Xe$ and $^{94}_{38}Sr$ from the absorption of a slow neutron by $^{235}_{92}U$, followed by nuclear fission is :
   (A) 0   (B) 2
   (C) 1   (D) 3

3. The correct order of increasing C—O bond length of CO, CO_3^{2-}, CO_2 is :
   (A) $CO_3^{2-} < CO_2 < CO$ (B) $CO_2 < CO_3^{2-} < CO$
   (C) $CO < CO_3^{2-} < CO_2$ (D) $CO < CO_2 < CO_3^{2-}$

4. A gas will approach ideal behaviour at :
   (A) low temperature and low pressure
   (B) low temperature and high pressure
   (C) high temperature and low pressure
   (D) high temperature and high pressure

5. The normality of 0.3 M phosphorus acid (H_3PO_3) is :
   (A) 0.1   (B) 0.9
   (C) 0.3   (D) 0.6

6. The coordination number of a metal crystallizing in a hexagonal close-packed structure is :
   (A) 12   (B) 4
   (C) 8   (D) 6

7. A gas X at 1 atm is bubbled through a solution containing a mixture of 1 M Y^- and 1 M Z^- at 25°C. If the reduction potential of Z > Y > X, then :
   (A) Y will oxidize X and not Z   (B) Y will oxidize Z and not X
   (C) Y will oxidize both X and Z   (D) Y will reduce both X and Z.

8. The pH of 0.1 M solution of the following salts increases in the order :
   (A) $NaCl < NH_4Cl < NaCN < HCl$ (B) $HCl < NH_4Cl < NaCl < NaCN$
   (C) $NaCN < NH_4Cl < NaCl < HCl$ (D) $HCl < NaCl < NaCN < NH_4Cl$

9. For the chemical reaction $3X(g) + Y(g) \rightleftharpoons X_3Y(g)$, the amount of X_3Y at equilibrium is affected by :
   (A) temperature and pressure
   (B) temperature only
   (C) pressure only
   (D) temperature, pressure and catalyst

10. In the dichromate dianion :
    (A) 4 Cr—O bonds are equivalent
    (B) 6 Cr—O bonds are equivalent
    (C) all Cr—O bonds are equivalent
    (D) all Cr—O bonds are nonequivalent

11. One mole of calcium phosphide on reaction with excess water gives :
    (A) one mole of phosphine
    (B) two moles of phosphoric acid
    (C) two moles of phosphine
    (D) one mole of phosphorus pentoxide

12. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are :
    (A) $0, +1$ and -2 (B) $+2, +1$ and -2
    (C) $0, +1$ and $+2$ (D) $-2, +1$ and -2

13. On heating ammonium dichromate, the gas evolved is :
    (A) oxygen   (B) ammonia
    (C) nitrous oxide   (D) nitrogen

14. In the commerical electrochemical process for aluminium extraction, the electrolyte used is :
    (A) $Al(OH)_3$ in NaOH solution
    (B) an aqueous solution of $Al_2(SO_4)_3$
    (C) a molten mixture of Al_2O_3 and Na_3AlF_6
    (D) a molten mixture of AlO(OH) and $Al(OH)_3$

15. The geometry of H_2S and its dipole moment are :
    (A) angular and non-zero   (B) angular and zero
    (C) linear and non-zero   (D) linear and zero

16. The geometry of $Ni(CO)_4$ and $Ni(PPh_3)_2Cl_2$ are :
    (A) both square planar
    (B) tetrahedral and square planar, respectively
    (C) both tetrahedral
    (D) square planar and tetrahedral, respectively

17. In compounds of type ECl_3, where E = B, P, As or Bi, the angles Cl—E—Cl for different E are in the order :
    (A) B > P = As = Bi   (B) B > P > As > Bi
    (C) B < P = As = Bi   (D) B < P < As < Bi

18. In the compound $CH_2 = CH—CH_2—CH_2—C \equiv CH$, the $C_2 – C_3$ bond is of the type :
(A) $sp – sp^2$ (B) $sp^3 – sp^3$
(C) $sp – sp^3$ (D) $sp^2 – sp^3$

19. When propionic acid is treated with aqueous sodium bicarbonate, CO_2 is liberated. The 'C' of CO_2 comes from :
(A) methyl group (B) carboxylic acid group
(C) methylene group (D) bicarbonate

20. The enol form of acetone, after treatment with D_2O, gives :

(A) $CH_3 —\overset{\overset{\displaystyle OD}{|}}{C} =CH_2$ (B) $CD_3 —\overset{\overset{\displaystyle O}{||}}{C}— CD_3$

(C) $CH_2 ==\overset{\overset{\displaystyle OH}{|}}{C}—CH_2D$ (D) $CD_3 ==\overset{\overset{\displaystyle OD}{|}}{C}—CD_3$

21. A positive carbylamine test is given by :
(A) N, N–dimethylaniline (B) 2, 4-dimethylaniline
(C) N-methyl-o-methylaniline (D) p-methylbenzylamine

22. The optically active tartaric acid is named as D – (+) – tartaric acid because it has a positive :
(A) optical rotation and is derived from D-glucose
(B) pH in organic solvent
(C) optical rotation and is derived from D – (+) – glyceraldehyde
(D) optical rotation only when substituted by deuterium

23. A solution of (+) –2–chloro–2–phenylethane in toluene racemises slowly in the presence of small amount of $SbCl_5$, due to the formation of :
(A) carbanion (B) carbene
(C) free-radical (D) carbocation

24. The product(s) obtained via oxymercuration ($HgSO_4 + H_2SO_4$) of 1-butyne would be :

(A) $CH_3 — CH_2 —\overset{\overset{\displaystyle O}{||}}{C}— CH_3$ (B) $CH_3—CH_2—CH_2—CHO$
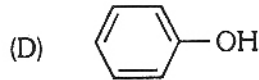(C) $CH_3—CH_2—CHO + HCHO$ (D) $CH_3—CH_2—COOH + HCOOH$

25. The most unlikely representation of resonance structures of p-nitrophenoxide ion is :

(A)   (B)

(C)

(D)

(−)
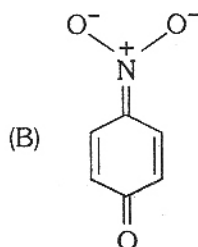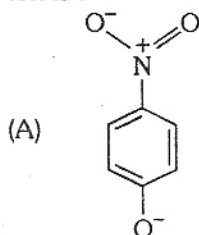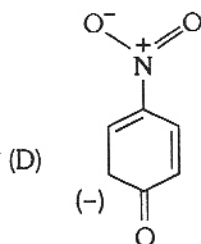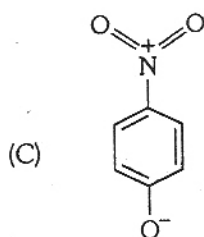
Directions : *Question numbers 26–35 carry 3 marks each and may have more than one correct answer. All correct answers must be marked to get any credit in these questions.*

26. The ether ⬡—O—CH_2—⬡ when treated with HI produces :

(A) ⬡—CH_2I

(B) ⬡—CH_2OH

(C) ⬡—I

(D) ⬡—OH
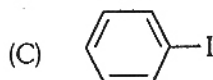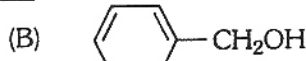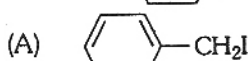
27. Toluene, when treated with Br_2/Fe, gives p-bromotoluene as the major product because the CH_3 group :
    (A) is *para* directing
    (B) is *meta* directing
    (C) activates the ring by hyperconjugation
    (D) deactivates the ring

28. The following statement(s) is (are) correct :
    (A) A plot of log K_p *versus* 1/T is linear
    (B) A plot of log [X] *versus* time is linear for a first order reaction, X → P
    (C) A plot of log p *versus* 1/T is linear at constant volume
    (D) A plot of p *versus* 1/V is linear at constant temperature

29. The following is (are) endothermic reaction(s) :
    (A) Combustion of methane
    (B) Decomposition of water
    (C) Dehydrogenation of ethane to ethylene
    (D) Conversion of graphite to diamond.

30. Ground state electronic configuration of nitrogen atom can be represented by :

(A) ⇅ ⇅ ↑ ↑ ↑   (B) ⇅ ⇅ ↑ ↓ ↑

(C) ⇅ ⇅ ↑ ↓ ↓   (D)

31. In the depression of freezing point experiment, it is found that the :
    (A) vapour pressure of the solution is less than that of pure solvent
    (B) vapour pressure of the solution is more than that of pure solvent

(C) only solute molecules solidify at the freezing point

(D) only solvent molecules solidify at the freezing point

32. Ionic radii of :

(A) $Ti^{4+} < Mn^{7+}$

(B) $^{35}Cl^- < {}^{37}Cl^-$

(C) $K^+ > Cl^-$

(D) $P^{3+} > P^{5+}$

33. Ammonia, on reaction with hypochlorite anion, can form :

(A) NO

(B) NH_4Cl

(C) N_2H_4

(D) HNO_2

34. A buffer solution can be prepared from a mixture of :

(A) sodium acetate and acetic acid in water

(B) sodium acetate and hydrochloric acid in water

(C) ammonia and ammonium chloride in water

(D) ammonia and sodium hydroxide in water

35. An aromatic molecule will :

(A) have $4n \pi$ electrons

(B) have $(4n + 2) \pi$ electrons

(C) be planar

(D) be cyclic

ANSWERS

1. (A)	**2.** (D)	**3.** (D)	**4.** (C)	**5.** (D)	**6.** (A)
7. (A)	**8.** (B)	**9.** (A)	**10.** (B)	**11.** (C)	**12.** (A)
13. (D)	**14.** (C)	**15.** (A)	**16.** (C)	**17.** (B)	**18.** (D)
19. (D)	**20.** (B)	**21.** (B), (D)	**22.** (C)	**23.** (D)	**24.** (A)
25. (C)	**26.** (A), (D)	**27.** (A), (D)	**28.** (A), (B), (D)	**29.** (B), (C) (D)	**30.** (A), (D)
31. (A), (D)	**32.** (D)	**33.** (C)	**34.** (A)	**35.** (B), (C) & (D)	

SOLUTIONS

Reason of Correctness

1. On the basis of (n + l) Rule   In these (n + l) is lower for (ii) & (iv) but equal

(i) Value of (n + l) = 4 + 1 = 5   both, so in these n is minimum for (iv).

(ii) Value of (n + l) = 4 + 0 = 4   Hence energy order = (iv) < (ii)

(iii) Value of (n + l) = 3 + 2 = 5   Similaring in (i) & (iii)

(iv) Value of (n + l) = 3 + 1 = 4   (iii) < (i)

Hence correct order of energy (iv) < (ii) < (iii) < (i)   **Ans. (A)**

2. $_{92}U^{235} + {}_0n^1 \rightarrow {}_{54}Xe^{139} + {}_{38}Sr^{94} + 3{}_0n^1$ **Ans. (D)**

3. Bond length $\propto \dfrac{1}{\text{Bond order}}$

Bond order $CO_3^{2-} < CO_2 < CO$

Bond order in CO = 3   (with the help of molecular orbital theory)

Bond order in $CO_2 = \dfrac{\text{no. of bonds in all possible sides}}{\text{no. of resonating structure}}$ (By resonance)

$= \dfrac{4}{2} = 2$

Bond order in $CO_3^{2-} = \dfrac{4}{3} = 1.33$ (By resonance)