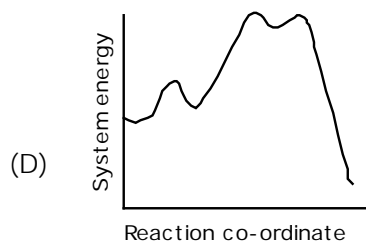
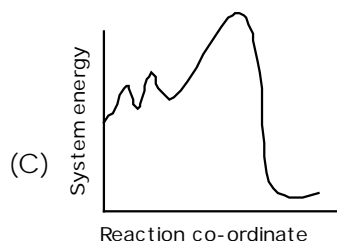
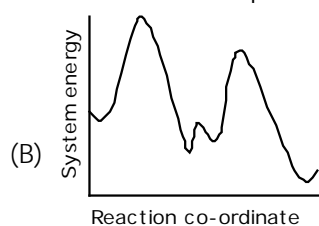
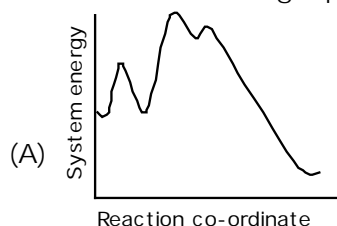


CHEMISTRY

- Which is cyclic phosphate
(A) $\text{Na}_5\text{P}_3\text{O}_{10}$ (B) $\text{Na}_6\text{P}_4\text{O}_{13}$ (C) $\text{Na}_5\text{P}_5\text{O}_{15}$ (D) $\text{Na}_7\text{P}_5\text{O}_{16}$
- The structure of B_{12} units is
(A) octahedral (B) Capped prism (C) icosahedral (D) linked octahedral
- The volumes of gases H_2 , CH_4 , CO_2 and NH_3 adsorbed by 1 g of charcoal at 288 K are in the order
(A) $\text{H}_2 > \text{CH}_4 > \text{CO}_2 > \text{NH}_3$ (B) $\text{CH}_4 > \text{CO}_2 > \text{NH}_3 > \text{H}_2$
(C) $\text{CO}_2 > \text{NH}_3 > \text{H}_2 > \text{CH}_4$ (D) $\text{NH}_3 > \text{CO}_2 > \text{CH}_4 > \text{H}_2$
- An ore contains only Sn^{2+} ions as oxidisable material. 0.40 g of the sample of ore required 10 cm^3 of acidified potassium dichromate solution, the strength of which is 5.00 g/l. The percentage of tin in the ore is
(A) 5% (B) 10% (C) 15% (D) 20%
- Minimum molar mass of a protein containing 0.15% $\text{NH}_2\text{CH}_2\text{COOH}$ is
(A) 5×10^4 g/mol (B) 5×10^4 amu/mol (C) 5×10^5 g/mol (D) 5000
- The number of peroxide linkages in CrO_5 are
(A) one (B) two (C) three (D) None
- Which of the following has different structure from the other three
(A) H_2O_2 (B) H_2N_2 (C) F_2O_2 (D) S_2Cl_2
- In solid phase, PBr_5 exists as
(A) PBr_4^+ , PBr_6^- (B) PBr_4^+ , Br^- (C) PBr_5 (D) PBr_3 , Br_2
- 10 mL of a gaseous hydrocarbon is exploded with 200 mL oxygen. The gaseous products when brought back to room temperature and pressure measured 180 mL. This gas mixture is then bubbled through aq. KOH followed by anhydrous CaCl_2 . The resulting gas measured 100 mL. The hydrocarbon is
(A) C_8H_8 (B) C_8H_{16} (C) C_4H_8 (D) none of these

10. Critical temperature and critical pressure values of four gases are given —
- | Gas | Temp (K) | Pressure (atm) |
|-----|----------|----------------|
| P | 5.1 | 2.2 |
| Q | 33 | 13 |
| R | 126 | 34 |
| S | 135 | 40 |
- Which of the gas/gases cannot be liquefied at a temperature 100 K and pressure 50 atmospheres?
 (A) S only (B) P only (C) R and S (D) P and Q
11. Two closed vessels A and B of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow tube. If the temperature in one of the vessels is now maintained at T_1 and that in the other at T_2 , what will be the pressure in the vessels
 (A) $\frac{2P_1T_1}{T_1+T_2}$ (B) $\frac{T_1}{2P_1T_2}$ (C) $\frac{2P_1T_2}{T_1+T_2}$ (D) $\frac{2P_1}{T_1+T_2}$
12. If n and ℓ are respectively the principal and azimuthal quantum numbers, the total number of electrons in any energy level is
 (A) $\sum_{l=0}^{\ell=n} 2(2l+1)$ (B) $\sum_{l=1}^{\ell=n-1} 2(2l+1)$ (C) $\sum_{l=0}^{\ell=n+1} 2(2l+1)$ (D) $\sum_{l=0}^{\ell=n-1} 2(2l+1)$
13. Electron in He^+ ion falls from seventh level and subsequent levels to first level, then
 (A) total of six emission lines are obtained (B) spectrum belongs to Lyman series exclusively
 (C) total of five emission lines are obtained (D) spectrum contains photons in UV range
14. Axis of approach of atoms A and B in a diatomic molecule is z , orbitals p_x and p_y on atoms A and B respectively overlap to form
 (A) π molecular orbital (B) σ molecular orbital (C) δ molecular orbital (D) no bond will form
15. In Arrhenius equation, $k = A \exp\left(\frac{-E_a}{R_T}\right)$. A may be termed as the rate constant at
 (A) very low temperature (B) very high temperature
 (C) zero activation energy (D) the boiling temperature of the reaction mixture
16. The correct rate law for rate of change of C in the following mechanism
- $$A + B \xrightleftharpoons[k_2]{k_1} C \xrightarrow{k_3} D$$
- (A) rate = $k_1 [A] [B] - (k_2+k_3) [C]$ (B) rate = $k_1 [A] + k_1 [B] - k_2 [A] - k_2 [B] - k_3 [D]$
 (C) rate = $(k_1 - k_2) [A] [B] - k_3 [C]$ (D) none of these

17. Which of the following represent a three step process with third step as rate determining ?



18. Consider the decomposition of $\text{NH}_4\text{I}(\text{s}) \rightleftharpoons \text{NH}_3(\text{g}) + \text{HI}(\text{g})$. The equilibrium is rapidly established. When a catalyst (solid) catalyses another reaction $2\text{HBr}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{Br}_2(\text{g})$, the total equilibrium pressure in the vessel is now ___ as compared to equilibrium pressure when only the first equilibrium was established. Note that $(\Delta n)_g = 0$ for second reaction
 (A) same (B) lesser (C) higher (D) unpredictable
19. Which of the following factors will increase solubility of $\text{NH}_3(\text{g})$ in H_2O

$$\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{aq}) \rightleftharpoons \text{NH}_4\text{OH}(\text{aq})$$

 (A) increase in pressure (B) addition of water
 (C) liquefaction of NH_3 (D) decrease in pressure
20. The pH of the half equivalence point of the titration of valine $(\text{CH}_3)_2\text{CHCHNH}_2\text{COOH}$ is 2.286 with HCl and 9.719 with NaOH. The isoelectric point of valine is
 (A) 6.003 (B) 4.572 (C) 19.438 (D) 7.533
21. pH of the following solution is affected by dilution to 10 times the original volume
 (A) 0.01 M CH_3COONa (B) 0.01 M NaHCO_3
 (C) buffer of 0.01 M CH_3COONa and 0.01 M CH_3COOH (D) 0.01 M $\text{CH}_3\text{COONH}_4$
22. Gaseous Cl_2O_7 is passed through a heated tube at constant total pressure and temperature. Its inlet and exit flow rates are 1000 mL/sec and 1250 mL/sec respectively. If it undergoes dissociation as per the equation: $\text{Cl}_2\text{O}_7 \rightarrow 2\text{ClO}_2 + 1.5 \text{O}_2$, the degree of dissociation of Cl_2O_7 is :
 (A) 0.1 (B) 0.9 (C) 0.5 (D) none of these

23. To which of the following would addition of an equal volume of 0.50 M NaOH (called solution S) lead to a solution having a pH lower than that before addition of (S)?
(A) 0.30 M HCl (B) 0.1M KOH (C) 0.8 M KOH (D) 0.40 M NaNO₃
24. The approximate pH of 0.05M aq. CuSO₄, saturated with H₂S (0.1M) at 25°C is (K₁, H₂S=1.0 x 10⁻⁷, K₂, H₂S=1.3 x 10⁻¹³, K_{sp} = 10⁻²⁸)
(A) 13.0 (B) 3.5 (C) 4.0 (D) 1.0
25. A reaction has positive values of both ΔS° and ΔH°. From this you can deduce that the reaction
(A) must be spontaneous at any temp. (B) cannot be spontaneous at any temp.
(C) will be spontaneous only at low temp. (D) will be spontaneous only at high temp.
26. A 2.00 mol sample of an ideal gas is heated from 1.03 atm, 41.2L and 255 K to 1.25 atm, 42.2L and 317K against a constant external pressure of 1 atm. The change in ΔU is [Assume C_{p,m} = 7/2 R]
(A) 3.6 kJ (B) 2.580 kJ (C) -100J (D) - 2.680 kJ
27. Consider the decomposition of sodium azide
(NaN₃(s)). 2 NaN₃(s) → 2 Na(s) + 3 N₂(g).
The enthalpy change for the reaction at 1 atm is equal to
(A) -2ΔH_f°[NaN₃(s)] (B) + 2 ΔH_f°[NaN₃(s)]
(C) 3ΔH_f° [N₂(g)] + 2 ΔH_f°[Na(s)] (D) -ΔH_f°[NaN₃(s)]
28. One mole each of sulfates of sodium, barium, copper and aluminium are added to 1L of water separately. Their boiling points are observed to be T₁, T₂, T₃ and T₄ then
(A) T₂ < T₃ < T₄ < T₁ (B) T₂ = T₃ < T₁ < T₄ (C) T₂ < T₃ < T₁ < T₄ (D) T₃ < T₄ < T₂ = T₁
29. A flask (volume V) of CCl₄ containing negligible liquid CCl₄ was weighed at measured temperature (T) and pressure. The same flask was then flushed and filled with air at same temperature and pressure. The difference in the two masses is recorded as Δm, the vapor pressure of carbon tetrachloride is equal to (molar mass of air = 29, Cl = 35.5, C=12)
(A) ΔmRT/125V (B) ΔmRT/154V (C) ΔmRT/29V (D) none of these
30. 1 mol benzene (P^o_{benzene} = 42 mm) and 2 mol toluene (P^o_{toluene} = 30 mm) will have
(A) total vapor pressure 34 mm
(B) mol fraction of vapours of benzene above liquid mixture is 7/17
(C) positive deviation from Raoult's law
(D) negative deviation from Raoult's law
31. PtCl₄.6H₂O can exist as a hydrated complex 1 molal aqueous solution has depression in freezing point of 3.72°. Assume 100% ionization and K_f(H₂O)=1.86° mol⁻¹ kg then complex is
(A) [Pt(H₂O)₆]Cl₄ (B) [Pt(H₂O)₄Cl₂]Cl₂.2H₂O
(C) [Pt(H₂O)₃Cl₃]Cl.3H₂O (D) [Pt(H₂O)₂].4H₂O

32. α -Polonium crystallises in the simple cubic system. If 20% of the voids contain small boron atoms (exactly one atom per void), the formula of the solid is
 (A) Po_5B (B) Po_4B (C) PoB_4 (D) PoB_5
33. Which of the following statements are correct
 (A) E_{cell} is temperature-independent
 (B) a reaction is spontaneous from left to right if $K_{\text{eq}} > Q$ in which case $\Delta E_{\text{cell}} > 0$
 (C) A reaction occurs from right to left if $K_{\text{eq}} < Q$, in which case $\Delta E_{\text{cell}} < 0$.
 (D) None of these
34. During the electrolysis of NaCl, a little amount of oxygen is also liberated at anode. (with chlorine). If the volumes of hydrogen and chlorine liberated are 22.4 L and 18 L at STP respectively, then the volume of oxygen evolved is
 (A) 1.1 L (B) 22.4 L (C) 4.4 L (D) 2.2 L
35. A chemist found that the standard electrode potential $E^0(\text{Zn}^{2+} | \text{Zn}) = -0.76\text{V}$. Which spontaneous cell will not give this value of emf?
 (A) $\text{Zn} | \text{Zn}^{2+} (1\text{M}) || \text{H}^+ (1\text{M}) | \text{H}_2 (1 \text{ atm}) | \text{Pt}$ (B) $\text{Zn} | \text{Zn}^{2+} (4\text{M}) || \text{H}^+ (2\text{M}) | \text{H}_2 (1\text{atm}) | \text{Pt}$
 (C) $\text{Zn} | \text{Zn}^{2+} (10\text{M}) || \text{H}^+ (10\text{M}) | \text{H}_2 (1\text{atm}) | \text{Pt}$ (D) $\text{Zn} | \text{Zn}^{2+} (2\text{M}) || \text{H}^+ (2\text{M}) | \text{H}_2 (2\text{atm}) | \text{Pt}$
36. Mercury batteries, like those used in electric watches, furnish a voltage of 1.35 V. If the overall oxidation—reduction equation taking place is $\text{ZnO}(\text{s}) + \text{HgO}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Zn}(\text{OH})_2(\text{s}) + \text{Hg}(\text{l})$ the anode reaction must be
 (A) $\text{HgO}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{Hg}(\text{l}) + 2\text{OH}^-(\text{aq})$ (B) $\text{ZnO}(\text{s}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s}) + 2\text{e}^-$
 (C) $\text{HgO}(\text{l}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{HgO}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) + 2\text{e}^-$ (D) $\text{Zn}(\text{OH})_2(\text{s}) + 2\text{e}^- \rightarrow \text{ZnO}(\text{s}) + 2\text{OH}^-(\text{aq})$
37. A cell with two electrodes, one of grey tin and the other white tin, both dipping in solution of $(\text{NH}_4)_2\text{SnCl}_6$ showed zero emf at 18°C . What conclusion may be drawn from this?
 (A) The emf developed at the electrode solution phase boundary cancel the normal emf.
 (B) grey tin being non-metallic ceases to provide a reversible electrode reaction.
 (C) electrode surface develops a protective layer and the cell develops a very large internal resistance.
 (D) the free energy change of the cell becomes zero
38. The equivalent conductance of an acetic acid solution of concentration 0.01 M is $1.65 \text{ m S m}^2 \text{ mol}^{-1}$ at 298 K. The dissociation constant of acetic acid at this temperature is (given, $\Lambda_0 = 39.0 \text{ m S m}^2 \text{ mol}^{-1}$)
 (A) 1.8×10^{-4} (B) 4.0×10^{-10} (C) 1.8×10^{-5} (D) 1.8×10^{-6}
39. As the pressure over a mixture of toluene (vapor pressure 400 torr) and xylene (vapor pressure 600 torr) is decreased, it begins to vaporise. The first bubble of vapor thus generated contains
 (A) pure benzene (B) pure toluene

- (C) benzene and toluene (D) benzene and toluene in ratio 2:3
40. 100 mL solutions each of 0.1 M KOH and 0.1 M HCl are mixed and stirred in a thermostat. The rise in temperature (ΔT) is recorded. The experiment is repeated with 50 mL solutions (0.1 M each). The rise in temperature is $\Delta T'$. The relationship between $\Delta T'$ and ΔT is
 (A) $\Delta T' = \Delta T$ (B) $\Delta T' = 2\Delta T$ (C) $\Delta T' = 1/\Delta T$ (D) $\Delta T' = 0.5(\Delta T)$
41. A long cylinder is fixed with a massless frictionless piston. It is filled with an ideal gas at 10 atm pressure. As it is suddenly released, the piston shoots out and the pressure drops to one atmosphere. The final temperature of this gas is _____ initial temperature.
 (A) higher than (B) lower than (C) same as (D) square root of
42. As $O_2(l)$ is cooled at 1 atm pressure, it freezes to form Solid I at 54.5 K. At a lower temperature, Solid I rearranges to Solid II, which has a different crystal structure. Thermal measurements show that for the phase transition Solid I to Solid II, $\Delta H = -743.1 \text{ J mol}^{-1}$ and $\Delta S = -17.0 \text{ J K}^{-1} \text{ mol}^{-1}$. At what temperature are solids I and II in equilibrium?
 (A) 2.06 K (B) 31.5 K (C) 43.7 K (D) 53.4 K
43. Consider the sequence $A^{a+} \xrightarrow{E_1^0} A^{b+} \xrightarrow{E_2^0} A^{c+} \xrightarrow{E_3^0} A^{d+}$
 Standard reduction potentials are indicated on arrows. It is known that A^{b+} can disproportionate into A^{c+} and A^{a+} . Then, which of the following is correct?
 (A) $E_1^0 > E_2^0$ (B) $E_1^0 < E_2^0$ (C) $E_2^0 = \frac{1}{2}(E_1^0 + E_3^0)$ (D) $E_2^0 = \frac{(a-b)E_1^0 + (c-d)E_3^0}{(a+c-b-d)}$
44. Aqueous phase basicity of trimethylamine is less than that of dimethylamine due to
 (A) steric hinderance of three methyl groups towards approaching H^+ ion
 (B) Poorer solvation of dimethylammonium cation by water.
 (C) Poorer solvation of trimethylammonium cation by water.
 (D) *Triptomorphic effect* which states that whenever methyl groups are present as integral multiples of three, they become electron withdrawing rather than electron releasing (as compared to H atom).
45. Comparing F_2O and Cl_2O , the bond angle is
 (A) greater than tetrahedral angle in F_2O (B) less than the tetrahedral angle in Cl_2O
 (C) less than the tetrahedral angle in F_2O (D) equal to the tetrahedral angle in both
46. These are the first eight ionization energies for a particular neutral atom. All values are expressed in MJ mol^{-1} . How many valence electrons does this atom posses?
- | | | | |
|-------|-------|-------|-------|
| 1s | 2nd | 3rd | 4th |
| 5th | 6th | 7th | 8th |
| 1.31 | 3.39 | 5.30 | 7.47 |
| 10.99 | 13.33 | 71.33 | 84.01 |
| (A) 1 | (B) 2 | (C) 4 | (D) 6 |

47. The increase in the equivalent conductance of a salt solution on dilution is due to increase in the
(A) attraction between the ions
(B) degree of ionization of the salt
(C) molecular attraction
(D) association of the salt
48. Geometry of sulphuryl chloride is
(A) distorted tetrahedral
(B) trigonal planar
(C) capped prism
(D) trigonal pyramidal

More than one answer

49. The charge cloud of a single electron in a $2p_x$ atomic orbital has two lobes of electron density. This means
(A) there is a non-zero probability of locating the electron in a $2p_x$ atomic orbital at values of $x > 0$
(B) there is a non-zero probability of locating it values of $x < 0$ but no probability at all of locating if any where in the yz plane along which $x=0$
(C) there is a greater probability of finding a p -electron right at the nucleus
(D) all are correct
50. Thermal dissociation of ammonium carbamate may be represented by the reaction
$$\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$$

 ΔH° for the forward reaction is negative. The equilibrium will shift from right to left if there is
(A) removal of $\text{NH}_2\text{COONH}_4$
(B) an increase in temperature
(C) an increase in the concentration of ammonia
(D) an increase in the concentration of carbondioxide

Chemistry

1. C	13. D	25. D	37. D	49. AB
2. C	14. A	26. B	38. C	50. CD
3. D	15. B	27. A	39. C	
4. C	16. A	28. C	40. A	
5. A	17. C	29. A	41. B	
6. B	18. C	30. AB	42. C	
7. B	19. A	31. C	43. B	
8. B	20. A	32. A	44. C	
9. A	21. A	33. B	45. C	
10. C	22. A	34. D	46. D	
11. A	23. C	35. C	47. B	
12. D	24. D	36. B	48. A	