1. The momentum of a particle which has de Broglie wavelength of 1 Å
   \( h = 6.626 \times 10^{-34} \text{ kg m}^2\text{s}^{-1} \) is
   a) 6.6 x 10^{-23} \text{ kg ms}^{-1}   b) 6.63 x 10^{-24} \text{ kg ms}^{-1}   c) 6.6 x 10^{-34} \text{ kg ms}^{-1}   d) 6.6 x 10^{-34} \text{ kg ms}^{-1}

2. The bond order of nitrogen molecule is
   a) 1   b) 2   c) 3   d) 4

3. The circumference of the circular orbit of an electron is an integral multiple of its
   a) frequency   b) momentum   c) mass   d) wavelength

4. The nature of hybridisation in IF\(_7\) molecule is
   a) sp\(^3\) d\(^2\)   b) sp\(^3\) d\(^4\)   c) sp\(^3\) d\(^4\)   d) sp\(^3\) d\(^4\)

5. Intermolecular hydrogen bonding is present in
   a) HF   b) H\(_2\)O   c) ethanol   d) all of these

6. The hybridisation involved in XeF\(_6\) is
   a) sp\(^3\) d\(^3\)   b) sp\(^3\) d\(^2\)   c) sp\(^3\) d\(^3\)   d) sp\(^3\) d\(^4\)

7. Energy levels of molecular orbitals have been determined experimentally by
   a) Spectroscopic studies   b) X ray diffraction   c) Crystallographic studies   d) all of these

8. In a molecule eight electrons are present in bonding molecular orbital and four electrons are present in anti-bonding molecular orbital. Its bond order is
   a) 3   b) 4   c) 2.5   d) 2

9. Water exists in liquid state. This is due to
   a) high boiling point   b) low boiling point   c) freezing point   d) hydrogen bond

10. The hybridisation in SO\(_4^{2-}\) ion is
    a) sp\(^3\)   b) sp\(^3\) d\(^2\)   c) sp\(^3\) d   d) sp\(^3\) d\(^3\)

11. Number of spherical nodes in 2s orbital is
    a) 1   b) 2   c) 3   d) 4

12. The hybridization in CO\(_3^{2-}\) ion is
    a) sp\(^2\)   b) sp\(^3\)   c) sp   d) sp\(^3\) d

13. Which one of the following experiments confirmed the wave nature of electron?
    a) G.P. Thomson’s gold foil experiment   b) Black body radiation
    c) Photoelectric effect   d) Millikan’s oil drop experiment

14. Molecular orbital with less energy is
    a) \( \sigma_{1s} \)   b) \( \sigma^*_{1s} \)   c) \( \pi_{2p_y} \)   d) \( \pi^*_{2p_y} \)

15. The type of hybridisation in NH\(_4^+\) ion is
    a) sp   b) sp\(^2\)   c) sp\(^3\)   d) sp\(^3\) d

16. The type of hybridisation of PCl\(_5\) molecule is
    a) sp\(^3\) d\(^2\)   b) sp\(^3\) d   c) sp\(^3\)   d) sp\(^3\) d\(^2\)

17. The hybridisation in ICl\(_4^-\)
    a) sp\(^3\)   b) sp\(^3\) d   c) sp\(^3\) d\(^2\)   d) sp\(^3\) d\(^3\)
18. The molecular orbitals are filled according to
a) Pauli’s exclusion principle  b) Hund’s rule  c) Aufbau principle  d) all the above

19. In a molecule Nb = 8 and Na = 2, what is its bond order?
   a) 3  b) 4  c) 5  d) 2

20. The shape of ‘p’ sub orbital is
   a) spherical  b) clover leaf  c) dumb bell  d) doughnut

21. Which molecule is relatively more stable?
   a) O₂  b) H₂  c) Li₂  d) N₂

2. Periodic classification II

1. The metal having maximum electron affinity is
   a) Sodium  b) Calcium  c) Gold  d) Silver

3. p – block elements

1. The general electronic configuration of carbon family is
   a) ns²np²  b) ns²np³  c) ns²np¹  d) ns²

2. The metalloid among the following is
   a) Pb  b) P  c) Ge  d) Sn

3. The toxic element of Boron family is
   a) Boron  b) Indium  c) Thallium  d) Gallium

4. Which of the following does not belong to group 14?
   a) C  b) Si  c) Ga  d) Pb

5. Which of the following has the property of etching on glass?
   a) HI  b) HF  c) HBr  d) HCl

6. An element which belongs to group 14 is soft in nature, does not react with pure water, but
   dissolves in water containing dissolved air. Then the element is
   a) C  b) Ge  c) Pb  d) Ti

7. The compound used to arrest bleeding is
   a) K₂SO₄  b) potash alum  c) Al₂(SO₄)₃  d) KI

8. Which of the following shows negative oxidation state only?
   a) Br  b) F  c) Cl  d) I

9. Inert gas used in beacon lights for safety of air navigation is
   a) Helium  b) Argon  c) Neon  d) Xenon

10. The compound with garlic taste
    a) H₃PO₄  b) H₃PO₃  c) P₂O₅  d) P₂O₃

11. An element which was burnt in limited supply of air to give oxide A which on treatment
    with water gives an acid B. Acid B on heating gives acid C which gives yellow precipitate
    with AgNO₃ solution. Compound A is
    a) SO₂  b) NO₂  c) P₂O₃  d) SO₃
4. d – block elements

1. The metal used in galvanising iron sheets is
   a) Chromium b) Zinc c) Copper d) Silver

2. Bordeaux mixture contains
   a) AgNO₃ + HNO₃ b) ZnSO₄ + H₂SO₄ c) CuSO₄ + Ca(OH)₂ d) KMnO₄ + HCl

3. K₂Cr₂O₇ reacts with HI and dilute sulphuric acid and liberates
   a) O₂ b) I₂ c) H₂ d) SO₂

4. The colour of Purple of Cassius is
   a) purple b) blue c) bluish green d) apple green

5. Ferrochrome is an alloy of
   a) Cr, C, Fe, Ni b) Cr, Co, Ni, C c) Fe, Cr d) Cr, Ni, Fe

6. Silver obtained from silver coin is purified by fusion with
   a) AgNO₃ b) HNO₃ c) H₂SO₄ d) borax

7. The number of unpaired electrons in Ti³⁺ is 1, its magnetic moment in BM is
   a) 1.414 b) 2 c) 1.732 d) 3

8. The catalyst used in the manufacture of polythene is
   a) V₂O₅ b) Fe c) Mo d) TiCl₄

9. A metal which precipitates gold from aurocyanide complex is
   a) Cr b) Ag c) Pt d) Zn

10. The reagent which is added first in the separation of silver from silver coin is
    a) conc. Sulphuric acid b) conc. Hydrochloric acid c) conc. Nitric acid d) Aqua regia

11. The substance used in making ruby red glass and high class pottery is
    a) colloidal silver b) purple of cassius c) ruby silver d) ruby copper

12. Spitting of silver can be prevented by covering the molten metal with a thin layer of
    a) borax b) charcoal c) sand d) silver bromide

13. If the magnetic moment value is 5.92 BM, the number of unpaired electrons is
    a) 5 b) 3 c) 4 d) 6

14. Which one of the following will have maximum magnetic moment?
    a) 3d² b) 3d⁶ c) 3d⁷ d) 3d⁹

15. The most malleable and ductile of all metal is
    a) Silver b) Gold c) Copper d) Zinc

16. The metals present in Nichrome alloy
    a) Cr, Ni, Fe b) Cr, Co, Ni c) Cr, Fe d) Cr, Fe, Cu

17. A d block metal ion has a magnetic moment of 1.732 BM. The number of unpaired electrons is
    a) 1 b) 2 c) 3 d) 4

18. Purity of blister copper is
    a) 100% b) 98% c) 90% d) 12%
19. A metal ion from the first transition series forms an octahedral complex with magnetic moment of 4.9 BM and another octahedral complex which is diamagnetic. The metal ion is
a) Fe$^{2+}$             b) Co$^{2+}$             c) Mn$^{2+}$             d) Ni$^{2+}$

20. The alloy used in the manufacture of resistance wires is
a) Ferrochrome     b) Bronze     c) Nichrome     d) Stellite

5. f– block elements

1. The isotope used as a power source in long mission space probes is
a) U - 235     b) Pu - 235     c) Pu - 238     d) U – 238

2. Elements that form oxocations are
a) lanthanides    b) actinides    c) noble gases    d) base metals

3. The radioactive lanthanide is
a) terbium     b) lutetium     c) promethium     d) gadolinium

4. Among the lanthanide elements, with the increase in atomic number the tendency to act as reducing agent
a) increases     b) decreases     c) no change     d) none of these

5. The long mission probes use _______ as power source.
a) Pu     b) U     c) Th     d) Pm

6. The common oxidation state of actinide is
a) + 2     b) + 3     c) + 4     d) + 6

7. Which of the following is a radioactive lanthanide?
a) Pu     b) Ac     c) Th     d) Pr

8. _______ is the oxidation state of U in UF$_6$
a) + 6     b) + 4     c) + 3     d) 0

9. According to Fajan’s rule decrease in size of Ln$^{3+}$ ion in Ln(OH)$_3$
   a) increase the covalent character     b) decrease the covalent character
   c) increase the basic character     d) increase the ionic character

10. The isotope of which element is used in nuclear fission reaction?
   a) Barium     b) Lead     c) Uranium     d) Caesium

11. Fuel used in nuclear power plant is
   a) U 235     b) Pu 235     c) Pu 238     d) U 238

12. Which of the following lanthanides have no partly filled 4f sub-shell but have electrons in 5d sub-shell
   a) Ce     b) Lu     c) Pm     d) Nd

13. Which of the following pairs have almost equal radii?
   a) Mo, W     b) Y, La     c) Zr, Hf     d) Nb, Ta

14. Which is used as a power source in long mission space probes?
   a) U$^{235}$     b) U$^{238}$     c) Pu$^{238}$     d) mish metal

15. The oxidation state of Uranium in UO$_2$Cl$_2$ is
   a) +2     b) +4     c) +5     d) +6
16. The actinide contraction is due to
   a) perfect shielding of 5f electron       b) imperfect shielding of 4f electron
   c) imperfect shielding of 5f electron    d) perfect shielding of 4f electron

6. Coordination compounds and Bio coordination compounds

1. The type of isomerism found in the complexes [Pt(NH₃)₄] [CuCl₄] and [Cu(NH₃)₄] [PtCl₄] is
   a) ionisation isomerism       b) coordination isomerism
   c) linkage isomerism         d) ligand isomerism
2. Which of the following is cationic complex?
   a) K₄[Fe(CN)₆]       b) [Cu(NH₃)₄]Cl₂       c) K₃[Cr(C₂O₄)₃]       d) K₃[Fe(CN)₆]
3. The coordination number of Nickel in the complex ion [NiCl₂]²⁻ is
   a) 1       b) 4       c) 2       d) 6
4. Chlorophyll is a __________ complex
   a) Magnesium - porphyrin       b) Iron - porphyrin
   c) Copper - porphyrin         d) Nickel - porphyrin
5. Which one of the following is a cationic complex?
   a) K₄[Fe(CN)₆]       b) [Cu(NH₃)₄]Cl₂       c) K₃[Cr(C₂O₄)₃]       d) K₃[Fe(CN)₆]
6. The type of isomerism in the complex [Co(NO₂)(NH₃)₅]SO₄ and [Co(SO₄)(NH₃)₅]NO₂ is
   a) hydrate isomerism       b) coordination isomerism
   c) linkage isomerism       d) ionisation isomerism
7. The function of ferridoxin is
   a) photosynthesis   b) storage and transport of oxygen   c) electron transfer   d) sensitiser

7. Nuclear chemistry

1. After 24 hours 0.125g of the initial quantity of 1g of a radioactive isotope is left out. The half life period is
   a) 24 hours       b) 12 hours       c) 8 hours       d) 16 hours
2. When ⁷N¹⁵ is bombarded with a proton it gives ⁶C¹² and
   a) α-particle       b) β-particle       c) neutron       d) proton
3. In nuclear reaction ________ is / are balanced on both sides
   a) mass       b) number of atoms
   c) mass number       d) atomic number and mass number
4. Half-life period of a radioactive element is 1500 years. The value of disintegration constant in terms of seconds is
   a) 0.1465 x 10⁻¹⁰ sec⁻¹       b) 0.2465 x 10⁻¹⁰ sec⁻¹       c) 0.4165 x 10⁻¹⁰ sec⁻¹       d) 0.3645 x 10⁻¹⁰ sec⁻¹
5. Half-life period of a radioactive element is 100 seconds. Its average life period is
   a) 100 seconds       b) 50 seconds       c) 200 seconds       d) 144 seconds
6. Half-life period of ⁷⁹Au¹⁹⁸ nucleus is 150 days. The average life is
   a) 216 days       b) 21.6 days       c) 261 days       d) 26.1 days

7. β - particle is represented as
   a) $\pm^0 e$  
   b) $^0 e$  
   c) $^1 H$  
   d) $^2 He^4$
8. In the nuclear reaction, $^{232}Th \rightarrow ^{208}Pb$, the number of α and β particles emitted are
   a) $1\alpha, 4\beta$  
   b) $2\alpha, 2\beta$  
   c) $6\alpha, 4\beta$  
   d) $8\alpha, 4\beta$

8. Solid state II
1. An ion leaves its regular site and occupies a position in the space between the lattice sites. This defect is called as
   a) Schottky defect  
   b) Frenkel defect  
   c) Impurity defect  
   d) Vacancy defect
2. The size of the anion in Frenkel defect crystal is
   a) larger than the cation  
   b) smaller than the cation  
   c) equal in size with cation  
   d) both are larger
3. The coordination number of ZnS is
   a) 3  
   b) 4  
   c) 6  
   d) 8
4. The crystal lattice with coordination number four is
   a) CsCl  
   b) ZnO  
   c) BN  
   d) NaCl
5. The total number of atoms per unit cell in fcc
   a) 1  
   b) 2  
   c) 3  
   d) 4
6. Which one of the following crystal has 8:8 structure
   a) MgF$_2$  
   b) CsCl  
   c) KCl  
   d) NaCl

9. Thermodynamics II
1. The change of entropy for the process $H_2O_{(liq)} \rightarrow H_2O_{(vap)}$ involving $\Delta H_{vap} = 40850$ J mol$^{-1}$ at 373 K is
   a) 120 J mol$^{-1}$ K$^{-1}$  
   b) 9.1x10$^3$ J mol$^{-1}$K$^{-1}$  
   c) 109.52 J mol$^{-1}$ K$^{-1}$  
   d) 9.1x10$^4$ J mol$^{-1}$ K$^{-1}$
2. The entropy change involved in the process of $H_2O_{(s)} \rightarrow H_2O_{(l)}$ at 0°C and 1 atm pressure involving $\Delta H_{fusion} = 6008$ J mol$^{-1}$
   a) 22.007 J mol$^{-1}$ K$^{-1}$  
   b) 22.007 J mol K$^{-1}$  
   c) 220.07 J mol$^{-1}$ K$^{-1}$  
   d) 2.2007 J mol K$^{-1}$
3. Entropy (S) and the entropy change ($\Delta S$) of a process
   a) are path functions  
   b) are state functions  
   c) are constants  
   d) have no values
4. $H_2O_{(l)} \rightarrow H_2O_{(g)}$, in this process the entropy
   a) remains constant  
   b) decreases  
   c) increases  
   d) becomes zero
5. The entropy change for the process, water(l) to water(g) involving $\Delta H_{vap} = 40850$ J mol$^{-1}$ at 373 K is
   a) 22.007 J mol$^{-1}$ K$^{-1}$  
   b) 7.307 J mol K$^{-1}$  
   c) 109.52 J mol$^{-1}$ K$^{-1}$  
   d) 0.2287 J mol K$^{-1}$
6. The percentage efficiency of a heat engine that operates between 127°C and 27°C is
   a) 20%  
   b) 50%  
   c) 100%  
   d) 25%
7. The network obtained from a system is given by
   a) $W + P\Delta V$  
   b) $W - P\Delta V$  
   c) $-W + P\Delta V$  
   d) $\Delta W - P\Delta V$
8. Thermodynamic condition for irreversible spontaneous process at constant T and P is
a) $\Delta G < 0$  
 b) $\Delta S < 0$  
 c) $\Delta G > 0$  
 d) $\Delta H > 0$

9. Which one of the following is a state function?

a) $q$  
 b) $\Delta q$  
 c) $w$  
 d) $\Delta S$

10. Standard free energies of formation of elements are taken as

a) positive  
 b) negative  
 c) zero  
 d) all of these

11. According to Trouton’s rule, the value of change in entropy of vapourisation is

a) 21 cal.deg$^{-1}$ mole$^{-1}$  
 b) 12 cal.deg$^{-1}$ mole$^{-1}$  
 c) 21 k.cal.deg$^{-1}$ mole$^{-1}$  
 d) 12 k.cal.deg$^{-1}$ mole$^{-1}$

12. Free energy ($G$) and the free energy change ($\Delta G$) correspond to the

a) system only  
 b) surrounding only  
 c) system and surrounding  
 d) all of these

13. The network obtained from a system is given by

a) $W - P\Delta V$  
 b) $W + P\Delta V$  
 c) $-W + P\Delta V$  
 d) $-W - P\Delta V$

14. Entropy is a ________ function.

a) state  
 b) path  
 c) exact  
 d) inexact

15. In SI unit 1 eu is

a) 41.84 EU  
 b) 4.184 EU  
 c) 418.4 EU  
 d) 4184 EU

16. A process accompanied by increase in free energy tends to be

a) reversible process  
 b) irreversible process  
 c) non-spontaneous process  
 d) spontaneous process

17. The entropy change for the following process possessing $\Delta H_{\text{transition}} = 2090$ J mol$^{-1}$  
1 mole Sn ($\alpha$ 13$^\circ$C)  
1 mole Sn ($\beta$ 13$^\circ$C) is

a) 22.007 J mol$^{-1}$ K$^{-1}$  
 b) 7.307 J mol$^{-1}$ K$^{-1}$  
 c) 0.314 J mol$^{-1}$ K$^{-1}$  
 d) 109.52 J mol K$^{-1}$

18. For an isothermal process, the entropy change of the universe during a reversible process is

a) zero  
 b) more  
 c) less  
 d) none of the above

19. The SI unit of entropy is

a) cal K$^{-1}$ mol$^{-1}$  
 b) erg K$^{-1}$ mol$^{-1}$  
 c) 1 deg$^{-1}$ K$^{-1}$ mole$^{-2}$  
 d) J K$^{-1}$ mole$^{-1}$

20. Entropy ($S$) and the change in entropy of the process ($\Delta S$)

a) are path functions  
 b) are state functions  
 c) are constants  
 d) have no values

21. Which is the correct statement of 2nd law of thermodynamics

a) A process accompanied by decrease in entropy tends to be spontaneous  
 b) Efficiency of a machine can be cent percent  
 c) It is possible to transfer heat from a cold body to hot body by a machine without doing any work  
 d) It is possible to convert the input energy completely to work by a machine

22. The % efficiency of a heat engine working between the temperature $T_1$ K and $T_2$ K ($T_1 < T_2$) is given by

a) $\left(\frac{T_2-T_1}{T_2}\right) \times 100$  
 b) $\left(\frac{T_1-T_2}{T_1}\right) \times 100$  
 c) $\left(\frac{T_1}{T_2}\right) \times 100$  
 d) $\left(\frac{T_2}{T_1}\right) \times 100$

23. Standard free energy of formation of elements are taken as

a) positive  
 b) negative  
 c) zero  
 d) infinitive
24. The value of enthalpy of neutralization of strong acid by strong base is 
a) -87.32 kJ equiv\(^{-1}\)  b) -57.32 kJ equiv\(^{-1}\)  c) -32.57 kJ equiv\(^{-1}\)  d) 72.23 kJ equiv\(^{-1}\)  
25. The change in entropy for a system and surrounding are -0.228 JK\(^{-1}\) and +0.260 JK\(^{-1}\) respectively. The entropy change of the universe is 
a) -0.0313 JK\(^{-1}\)  b) +0.0313 JK\(^{-1}\)  c) +0.877 JK\(^{-1}\)  d) -0.877 JK\(^{-1}\)  

10. Chemical Equilibrium II

1. \(2\text{H}_2\text{O}_2(g) + 2\text{Cl}_2(g) \rightarrow 4\text{HCl}(g) + 5\text{O}_2(g)\). The value of \(K_p\) and \(K_c\) are related as 
a) \(K_p = K_c\)  b) \(K_p > K_c\)  c) \(K_p < K_c\)  d) \(K_p = K_c = 0\)  
2. If the equilibrium constant for the formation of a product is 25, the equilibrium constant for the decomposition of the same product is 
a) 25  b) \(\frac{1}{25}\)  c) 5  d) 625  
3. When \(\Delta n_g\) in a homogeneous gaseous equilibrium is positive, then 
a) \(K_p = K_c\)  b) \(K_p < K_c\)  c) \(K_p > K_c\)  d) \(K_p = \frac{K_c}{2}\)  
4. Which of the following gaseous equilibrium is favoured by increase in temperature? 
a) \(\text{N}_2\text{O}_2 \rightarrow 2\text{NO}_2\); \(\Delta H = +59\text{ k J mol}^{-1}\)  b) \(\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3\); \(\Delta H = -22\text{ k cal mol}^{-1}\)  
c) \(2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3\); \(\Delta H = -47\text{ k cal mol}^{-1}\)  
d) both (b) and (c)  
5. The maximum yield of ammonia by Haber’s process is 
a) 78%  b) 97%  c) 37%  d) 89%  
6. In a reaction \(2\text{O}_3 \rightarrow 3\text{O}_2\) the value of \(K_c\) is 
7. In the synthesis of \(\text{NH}_3\) between \(\text{N}_2\) and \(\text{H}_2\) reaction the unit of \(K_c\) is 
a) \(\text{lit}^2\text{ mol}^{-2}\)  b) \(\text{atm}^2\)  c) \(\text{lit} \text{ atm}^{-1}\)  d) \(\text{atm}^{-1}\)  
8. Which one of the following has negative value for \(\Delta n_g\) ? 
a) \(\text{H}_2(g) + \text{I}_2(g) \rightarrow 2\text{HI}(g)\)  b) \(\text{PCl}_5(g) \rightarrow \text{PCl}_3(g) + \text{Cl}_2(g)\)  
c) \(3\text{H}_2(g) + \text{N}_2(g) \rightarrow 2\text{NH}_3\)  d) \(2\text{H}_2\text{O}_2(g) + 2\text{Cl}_2(g) \rightarrow 4\text{HCl}(g) + \text{O}_2(g)\)  
9. \(\text{H}_2(g) + \text{I}_2(g) \rightarrow 2\text{HI}(g)\). The equilibrium constant \(K_c\) for this reaction is 16, its \(K_p\) value is 
a) \(\frac{1}{16}\)  b) 4  c) 64  d) 16  
10. The optimum range of temperature used in contact process for the manufacture of \(\text{SO}_3\) is 
a) \(400\text{°C}\) to \(450\text{°C}\)  b) \(1800\text{°C}\) to \(2700\text{°C}\)  c) \(500\text{°C}\) to \(550\text{°C}\)  d) \(350\text{°C}\) to \(450\text{°C}\)  
11. The rate constant of the forward and reverse reactions are \(8 \times 10^{-5}\) and \(2 \times 10^{-4}\) respectively. The value of \(K_c\) is 
a) 0.04  b) 0.02  c) 0.2  d) 0.4  
12. The equilibrium constant for the reaction \(2\text{A} \rightarrow \text{B}\) is 25 mol\(^{-1}\) dm\(^3\) at 900 K. What is the equilibrium constant for the reaction \(2\text{A} \rightarrow \text{B}\) in dm\(^{-3}\) mol at the same temperature? 
a) 25  b) 625  c) 0.04  d) 0.4  
13. The relationship between \(K_p\) and \(K_c\) for the equilibrium 
\(2\text{H}_2\text{O}_2(g) + 2\text{Cl}_2(g) \rightarrow 4\text{HCl}(g) + \text{O}_2(g)\) is 
a) \(K_p = K_c\)  b) \(K_p = K_c(\text{RT})^2\)  c) \(K_p = K_c(\text{RT})^1\)  d) \(K_p = K_c(\text{RT})^2\)
14. Forward reaction takes place when
a) $Q < K_c$  

b) $Q > K_c$  
c) $Q = K_c$  
d) $K_c = 1/Q$

15. The equilibrium constant $K_c$ for $A(g) + B(g)$ is $2.5 \times 10^{-2}$. The rate constant of forward reaction is $0.05$ sec$^{-1}$. Therefore the rate constant of the reverse reaction is

a) $2$ sec$^{-1}$  
b) $0.2$ sec$^{-1}$  
c) $0.2$ sec$^{-1}$  
d) $2$ sec$^{-1}$

16. If the equilibrium constant of the reactions $2HI \rightarrow H_2 + I_2$ and $H_2 + I_2 \rightarrow 2HI$ are $k_1$ and $k_2$ respectively, then

a) $K_1 = 2k_2$  
b) $K_1 = 1/k_2$  
c) $K_2 = (K_1)^2$  
d) $K_1 = (1/k_2)^2$

17. In an equilibrium reaction, when $Q < K_c$ then

a) forward reaction is favoured  
b) reverse reaction is favoured  
c) both forward and reverse reactions are favoured  
d) none of these

18. In which of the following gaseous reactions $K_p < K_c$?

a) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$  
b) $H_2(g) + I_2(g) \rightarrow 2HI(g)$  
c) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$  
d) $CO(g) + H_2O(g) \rightarrow CO_2(g) + H_2(g)$

19. In the formation of HI from $H_2$ and $I_2$, $K_p = K_c$ because

a) $\Delta n_g = 2$  
b) $\Delta n_g = 1$  
c) $\Delta n_g = 0$  
d) $\Delta n_g = -1$

20. The fraction of total moles of reactant dissociated is called

a) dissociation equilibrium  
b) degree of association  
c) degree of dissociation  
d) dissociation constant

11. Chemical kinetics II

1. The first order rate constant of a reaction is $0.0693$ min$^{-1}$. Then the time required for 50% completion of a reaction is

a) 10 min  
b) 1 min  
c) 100 min  
d) 50 min

2. 50% of a first order reaction is completed in 20 minutes. The time required for 75% completion is

a) 60 minutes  
b) 10 minutes  
c) 40 minutes  
d) 80 minutes

3. Half-life period of a first order reaction is 20 min. The time taken for the completion of 99.9% of the reaction is

a) 20 min  
b) 2000 min  
c) 250 sec  
d) 200 min

4. In a first order reaction the concentration of the reactant is increased by 2 times the rate of the reaction is increased by

a) 2 times  
b) 4 times  
c) 10 times  
d) 6 times

5. Decomposition of nitrogen pentoxide in CCl$_4$ is an example for

a) second order reaction  
b) third order reaction  
c) zero order reaction  
d) first order reaction

6. The $t_{1/2}$ of a first order reaction is 100 minutes. The rate constant of the reaction is

a) $6.93 \times 10^2$ min$^{-1}$  
b) $0.693 \times 10^2$ min$^{-1}$  
c) $6.93 \times 10^3$ min$^{-1}$  
d) $69.3 \times 10^{-1}$ min$^{-1}$

7. If the activation energy is high, then the rate of the reaction is

a) high  
b) moderate  
c) low  
d) cannot be predicted

8. The rate constant for a first order reaction is $1.54 \times 10^3$ sec$^{-1}$. Its half life period is

a) 540 seconds  
b) 450 seconds  
c) 45 seconds  
d) 54 seconds
12. **Surface chemistry**

1. The iron catalyst used in the Haber’s process is poisoned by
   a) Pt  
   b) H₂  
   c) H₂S  
   d) S₂O₃

2. Curd is a colloidal solution of
   a) liquid in liquid  
   b) liquid in solid  
   c) solid in liquid  
   d) solid in solid

3. Tyndall’s effect is not observed in
   a) emulsions  
   b) colloidal solutions  
   c) true solutions  
   d) none of these

4. Decomposition of hydrogen peroxide is retarded in the presence of
   a) alcohol  
   b) glycerine  
   c) MnO₂  
   d) Mo

5. An example of gel is
   a) paint  
   b) pumice stone  
   c) milk  
   d) curd

6. Smoke is a colloidal solution of
   a) gas in solid  
   b) solid in gas  
   c) gas in liquid  
   d) liquid in gas

7. Which type of colloid is a sol?
   a) solid in liquid  
   b) liquid in solid  
   c) solid in solid  
   d) gas in solid

8. The platinum catalyst used in the oxidation of SO₂ by contact process is poisoned by
   a) As₂O₃  
   b) V₂O₅  
   c) Fe₂O₃  
   d) CuCl₂

9. Coconut charcoal has a great capacity of the _______ of gas.
   a) adsorption  
   b) absorption  
   c) desorption  
   d) all of these

10. Emulsifying agent is used for
    a) Precipitation of an emulsion  
    b) Coagulation of an emulsion  
    c) Stabilisation of an emulsion  
    d) none of these

11. Which one of the following factor is false regarding catalyst?
    a) small quantity is enough  
    b) initiate the reaction  
    c) remains unchanged in mass and chemical composition  
    d) specific in its action

12. The function of FeCl₃ in the conversion of Fe(OH)₃ precipitate into a colloid is
    a) peptising agent  
    b) emulsifying agent  
    c) reducing agent  
    d) precipitating agent

13. An example of lyophilic colloid is
    a) sulphur in water  
    b) phosphorus in water  
    c) starch  
    d) all of these

14. The blue colour of the sky is due to
    a) Tyndall effect  
    b) Brownian movement  
    c) electrophoresis  
    d) eletro-osmosis

15. In a reaction between oxalic acid and potassium permanganate, in the presence of dil. H₂SO₄, _______ acts as an auto catalyst.
    a) K₂SO₄  
    b) MnSO₄  
    c) MnO₂  
    d) Mn₂O₃

16. Catalyst used in Deacon’s method of manufacture of
    a) NO  
    b) CuCl₂  
    c) Fe₂O₃  
    d) Ni

17. Argyrol is
    a) colloidal silver  
    b) colloidal antimony  
    c) colloidal gold  
    d) milk of magnesia

18. The emulsifying agent used in O/W emulsion is
    a) long chain alcohol  
    b) lamp black  
    c) protein  
    d) glycerol
19. The colloid used for stomach disorder is
   a) colloidal silver  b) colloidal antimony  c) colloidal gold  d) milk of magnesia
20. The decomposition of hydrogen peroxide in the presence of colloidal platinum is a/an
   a) positive catalysis  b) negative catalysis  c) auto catalysis  d) induced catalysis
21. The oxidation of sodium sulphite by air is retarded by
   a) MnO₂  b) H₂S  c) Alcohol  d) As₂O₃
22. The catalyst used for the decomposition of KClO₃ is
   a) MnO₂  b) Cl₂  c) V₂O₅  d) Pt
23. Medicine used as an eye lotion is
   a) Silver sol  b) colloidal antimony  c) colloidal gold  d) milk of magnesia
24. Silica gel is utilised for the ________ of the number of gases.
   a) adsorption  b) absorption  c) desorption  d) all of these
25. Ruby glass is a colloidal solution of
   a) solid-sol  b) gel  c) emulsion  d) sol
26. Electrophoresis is a ________ property of a colloid
   a) optical  b) kinetic  c) electrical  d) magnetic
27. Presence of moisture in contact process
   a) activates the catalyst  b) deactivates the catalyst  c) increase the product  d) make the catalyst porous
28. The iron catalyst used in Haber’s process is poisoned by
   a) As₂O₃  b) V₂O₅  c) H₂S  d) glycerine
29. A substance which increases the activity of a catalyst is
   a) positive catalyst  b) negative catalyst  c) promoter  d) catalytic poison

13. **Electro chemistry I**

1. The indicator suitable for the titration of oxalic acid against NaOH is
   a) Methyl orange  b) Potassium permanganate  c) Phenolphthalein  d) litmus
2. The indicator used in the titration of NH₄OH with HCl is
   a) KMnO₄  b) Methyl orange  c) Phenolphthalein  d) litmus
3. If 0.2 ampere can deposit 0.1978g of copper in 50 minutes, how much of copper will be deposited by 600 coulombs?
   a) 19.78g  b) 1.978g  c) 0.1978g  d) 197.8g
4. For the titration between HCl Vs Na₂CO₃ the indicator used is
   a) KMnO₄  b) Phenolphthalein  c) litmus  d) Methyl orange
5. The number of moles of electrons required to discharge one mole of Al³⁺ is
   a) 3  b) 1  c) 2  d) 4

16. **Hydroxy derivatives**

1. Oxidation of glycerol with bismuth nitrate gives
   a) meso-oxalic acid  b) glyceric acid  c) tartronic acid  d) both (b) and (c)
2. The characteristic odour of lower phenols is
   a) carbolic acid  b) fruity      c) oil of bitter almonds   d) rotten fish

3. Compound which is used as medicine for asthma and whooping cough is
   a) Benzyl acetate   b) Ethyl acetate       c) Benzyl benzoate   d) Benzyl formate

17. Ethers

1. The compound mixed with ethanol to serve as substitute for petrol is
   a) methoxy methane  b) ethoxy ethane       c) methanol   d) ethanal

2. The isomerism exhibited by 1-propanol and methoxy ethane is
   a) chain  b) position        c) functional   d) metamamerism

3. Ziesel’s method of detection and estimation of alkoxy group in alkaloids involves the reaction of ether with
   a) HI  b) Cl₂  c) PCl₅  d) AlCl₃

4. The ether used in perfumery is
   a) diethyl ether  b) dimethyl ether       c) methyl phenyl ether   d) diphenyl ether

5. Which among the following is unsymmetrical ether?
   a) C₆H₅ - O - C₆H₅  b) C₂H₅ - O - C₂H₅   c) CH₃ - O - CH₃   d) C₆H₅ - O - CH₃

6. The number of ether isomers possible for C₄H₁₀O is
   a) 7   b) 5  c) 4   d) 3

7. Anisole on bromination yields
   a) m – bromo anisole  b) o – bromo anisole       c) o & p bromo anisole   d) benzoic acid

8. In the formation of oxonium salt when ethereal oxygen reacts with strong mineral acid is called
   a) electronation  b) protonation       c) deprotonation   d) dehydration

9. Which of the following ether is used in perfumery?
   a) dimethyl ether  b) diethyl ether       c) ethyl methyl ether   d) methyl phenyl ether

10. The common name of phenetole is
    a) ethyl phenyl ether  b) methyl phenyl ether  c) diethyl ether   d) diphenyl ether

11. Ether should never be evaporated to dryness because
    a) they form explosive peroxide       b) they are insoluble in water
c) they are inert  d) they are lighter than water

12. Higher ethers can be prepared from lower members by the action of
    a) Conc. H₂SO₄  b) AgOH       c) Sodium alkoxide   d) Grignard reagent

13. Which of the following produces ether, when heated with conc. H₂SO₄ at 413K?
    a) Organic acid b) Aldehyde c) Alcohol   d) Ketone

14. How many alcohol isomers are possible for C₄H₁₀O?
    a) 4  b) 2  c) 3   d) 7

15. The solvent used in Grignard reagent is
    a) ethyl alcohol  b) diethyl ether       c) acetone   d) benzene
16. When diethyl ether reacts with chlorine in presence of sunlight gives
a) $\alpha$ - chloro diethyl ether  
b) $\alpha,\alpha'$ - dichloro diethyl ether  
c) perchloro diethyl ether  
d) both (a) and (b)

17. Intermolecular hydrogen bonds are not present in
a) $\text{CH}_3\text{COOH}$  
b) $\text{C}_2\text{H}_5\text{O-} \text{C}_2\text{H}_5$  
c) $\text{CH}_3\text{CH}_2\text{OH}$  
d) $\text{C}_2\text{H}_5\text{NH}_2$

18. IUPAC name of this compound $\text{CH}_3$ $\text{O}$ $\text{CH}$ $\text{CH}_3$ $\text{CH}_3$

a) 1-methoxy propane  
b) methyl isopropyl ether  
c) isopropyl methyl ether  
d) 2-methoxy propane

19. IUPAC name of phenetole is
a) Phenoxy benzene  
b) Ethoxy benzene  
c) Methoxy benzene  
d) Propoxty

20. Strong mineral acids ______ the ethereal oxygen forming oxonium salts.

a) electronate  
b) protonate  
c) deprotonate  
d) dehydrate

21. Which one of the following does not form peroxide easily?

a) diethyl ether  
b) ethyl methyl ether  
c) dimethyl ether  
d) anisole

18. **Carbonyl compounds**

1. Tertiary butyl alcohol can be prepared by treating methyl magnesium iodide with
a) formaldehyde (HCHO)  
b) acetaldehyde (CH$_3$CHO)  
c) acetone (CH$_3$COCH$_3$)  
d) carbon dioxide (CO$_2$)

2. Propanone is usually characterised by

a) Fehling’s solution  
b) Iodoform test  
c) Schiff’s test  
d) Tollen’s reagent

3. The compound used in the preparation of triphenyl methane dye is

a) methanol  
b) phenyl methanal  
c) phenyl methanol  
d) ethanol

4. 3$\text{CH}_3$COCH$_3$, the product is

a) mesitylene  
b) mesityl oxide  
c) Phorone  
d) paraldehyde

5. Compound which undergoes iodoform test is

a) 1-pentanol  
b) 2-pentanone  
c) 2-pentene  
d) pentanal

19. **Carboxylic acids**

1. Concentrated solution of sodium acetate on electrolysis gives

a) ethane  
b) propane  
c) methane  
d) butane

2. Aspirin is

a) Salicylic acid  
b) Acetyl salicylic acid  
c) Salicylaldehyde  
d) Methyl salicylate

3. Relative reactivity of carboxylic acid derivatives is as follows

a) Acid chloride > Ester > Amide > Acid anhydride  
b) Acid chloride > Acid anhydride > Ester > Amide  
c) Acid chloride > Amide > Acid anhydride > Ester  
d) Acid anhydride > Ester > Amide > Acid chloride

4. Among the following the strongest acid is

a) $\text{CH}_3\text{COOH}$  
b) HCOOH  
c) ClCH$_2$COOH  
d) $\text{CH}_3\text{CH}_2\text{COOH}$
5. Which one of the following compound is optically active?
   a) CH₃CH₂COOH   b) HOOC-CH₂-COOH   c) CH₃-CH(OH)-COOH   d) Cl₂CHCOOH

20. Organic nitrogen compounds

1. Which of the following nitro compounds behave as an acid in the presence of strong alkali?
   a) primary   b) secondary   c) tertiary   d) both (a) and (b)
2. Conversion of benzene diazonium chloride to chlorobenzene is called
   a) Sandmeyer’s reaction   b) Stephen’s reaction
   c) Gomberg reaction   d) Schotten-Baumann reaction
3. The intermediate formed on electrolytic reduction of nitrobenzene in conc. H₂SO₄ is
   a) C₆H₅NH-NHC₆H₅   b) C₆H₅- NOH   c) C₆H₅- N=N-C₆H₅   d) all of these
4. The compound that does not show tautomerism is
   a) nitrobenzene   b) nitromethane   c) nitroethane   d) 2-nitropropane
5. The nitrogen compound used in the preparation of sulphur drugs is
   a) methyl amine   b) nitromethane   c) aminobenzene   d) nitrobenzene
6. Nitro-acinитro tautomerism is exhibited by
   a) nitromethane   b) nitrobenzene   c) chloropicrin   d) o-toluidine
7. CCl₃NO₂ is used as
   a) soil sterilizing agent   b) organic synthesis   c) good solvent   d) antioxidant
8. The reaction between benzene diazonium chloride and benzene in the presence of NaOH is
   a) Perkin’s reaction   b) Gatterman’s reaction
   c) Sandmeyer reaction   d) Gomberg-Bachmann reaction
9. Use of chloropicrin (CCl₃NO₂) is an
   a) explosive   b) dye   c) anaesthetic   d) Sterilizing agent
10. Oil of mirbane is
    a) nitrobenzene   b) benzoaldehyde   c) methyl salicylate   d) aspirin
11. Which of the following will not undergo Hoffman’s bromamide reaction?
    a) Ethanamide b) Propanamide c) Methanamide d) Phenyl methanamide
12. Which among the following is a tertiary amine?
    CH₃
    a) (CH₃)₃-C-NH₂   b) CH₃-CH-NH-CH₃   c) (CH₃)₂-N-C₂H₅   d) CH₃-CH₂-C-C₂H₅

13. The tertiary nitro compound is
    a) 2-nitropropane   b) 1-nitropropane
    c) 1-nitro,2,2-dimethyl propane   d) 2-nitro,2-methyl propane
14. The intermediate formed in the nitration of benzene is
    a) Arrenium ion   b) Carbanion   c) Oxonium   d) Nitrite ion
15. The basic strength of amine is in the order of
   a) \( \text{NH}_3 > (\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 \)  
   b) \( (\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > \text{NH}_3 \)  
   c) \( \text{CH}_3\text{NH}_2 > (\text{CH}_3)_2\text{NH} > \text{NH}_3 \)  
   d) \( \text{NH}_3 > (\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 \)  
16. \( \text{C}_6\text{H}_5\text{NCl} \)  
   X; the compound X is  
   a) \( \text{C}_6\text{H}_5\text{NH}_2 \)  
   b) \( \text{C}_6\text{H}_5\text{NNNH}_2 \)  
   c) \( \text{C}_6\text{H}_5\text{C}_6\text{H}_5 \)  
   d) \( \text{C}_6\text{H}_5\text{Cl} \)  
17. Aniline reacts with benzoyle chloride in the presence of sodium hydroxide and gives benzanilide. This reaction is known as  
   a) Gatterman’s reaction  
   b) Sandmeyer reaction  
   c) Schotten-Baumann reaction  
   d) Gomberg-Bachmann reaction  
18. The isomerism exhibited by \( \text{CH}_3\text{NO} \text{O} \) and \( \text{CH}_2\text{NO} \text{OH} \) is  
   a) position  
   b) chain  
   c) functional  
   d) tautomerism  
19. The product obtained when nitrobenzene is treated with \( \text{Zn/NaOH} \) is  
   a) aniline  
   b) azoxybenzene  
   c) azobenzene  
   d) hydrazobenzene  
20. A cyanohydrin of a compound \( 'X' \) on hydrolysis gives lactic acid. \( 'X' \) is  
   a) \( \text{HCHO} \)  
   b) \( \text{CH}_3\text{CHO} \)  
   c) \( (\text{CH}_3)_2\text{CO} \)  
   d) \( \text{C}_6\text{H}_5\text{CH}_2\text{CHO} \)  
21. \( \text{C}_6\text{H}_5\text{NCl} \)  
   \( \text{X} + \text{N}_2 + \text{HCl} \). The compound X is  
   a) \( \text{C}_6\text{H}_5\text{Cl} \)  
   b) \( \text{C}_6\text{H}_5\text{NNNH}_2 \)  
   c) \( \text{C}_6\text{H}_6 \)  
   d) \( \text{C}_6\text{H}_5\text{NO}_2 \)  
22. Which of the following compound is called oil of mirbane?  
   a) aniline  
   b) nitromethane  
   c) benzene diazonium chloride  
   d) nitrobenzene  
23. Which one of the following is the most basic?  
   a) ammonia  
   b) methylamine  
   c) dimethylamine  
   d) aniline  
24. The compound which does not undergo diazotisation reaction is  
   a) \( \text{m-Toulidine} \)  
   b) benzyl amine  
   c) aniline  
   d) \( \text{p-Amino Phenol} \)  
25. Chloropicrin is  
   a) \( \text{CCl}_3\text{CHO} \)  
   b) \( \text{CCl}_3\text{NO}_2 \)  
   c) \( \text{CHCl}_3 \)  
   d) \( \text{CH}_3\text{NO}_2 \)  
26. Methyl isocyanide on reduction using \( \text{LiAlH}_4 \)  
   a) methylamine  
   b) ethylamine  
   c) dimethylamine  
   d) trimethyl amine  
27. Which of the following compound does not show tautomerism?  
   a) nitrobenzene  
   b) nitromethane  
   c) nitroethane  
   d) \( 2-\text{Nitropropane} \)  
28. \( \text{C}_6\text{H}_5\text{NO}_2 \)  
   \( \text{C}_6\text{H}_5\text{NH}_2 \); the reagent used is  
   a) \( \text{Sn/HCl} \)  
   b) \( \text{LiAlH}_4 \)  
   c) \( \text{H}_2/\text{Ni} \)  
   d) \( \text{Zn/NaOH} \)  
29. The reaction between a primary amine, chloroform and alcoholic KOH is known as  
   a) Gabriel reaction  
   b) Mustard oil reaction  
   c) Carbylamine reaction  
   d) Hoffmann reaction  
30. \( \text{CH}_3\text{CONH}_2 + 4(\text{H}) \)  
   X. The compound X is  
   a) methyl amine  
   b) ethylamine  
   c) dimethyl amine  
   d) nitromethane  
31. Which compound is used as soil sterilizing agent?  
   a) nitrobenzene  
   b) nitroethane  
   c) aniline  
   d) chloropicrin
21. Biomolecules

1. Mixture of equal molecules of D (+) glucose and D (-) fructose is called as
   a) fruit sugar   b) invert sugar   c) cane sugar   d) non sugar

2. Nucleic acid is made up of
   a) an organic base   b) a sugar unit   c) phosphoric acid   d) all of these

3. The precipitation of protein is called
   a) peptisation   b) denaturation   c) renaturation   d) none of these

4. Sorbitol and Mannitol are
   a) isomers   b) polymers   c) epimers   d) dimers

5. When starch is heated to 200°C – 250°C, the product is
   a) dextrin   b) caramel   c) barley sugar   d) cellulose

6. Glucose reacts with acetic anhydride in the presence of pyridine to give
   a) mono acetate   b) diacetate   c) penta acetate   d) no reaction

7. Invert sugar is a mixture of equal amount of
   a) D (+) glucose and sucrose   b) D (+) fructose and sucrose
   c) D (+) glucose and D (-) fructose   d) sucrose and maltose

8. ___________ is involved in the process of blood coagulation.
   a) Fats and oils   b) Cephalin   c) Glycolipids   d) Lecithins

9. Mixture of equal molecules of D(+) glucose and D(-) fructose is called
   a) fruit sugar   b) invert sugar   c) cane sugar   d) non-sugar

10. Glucose + acetic anhydride
    a) diacetate   b) tetra acetate   c) penta acetate   d) hexa acetate

11. An example of reducing disaccharide is
    a) glucose   b) fructose   c) sucrose   d) lactose

12. ___________ occur in the white matter of the brain and all nervous tissue.
    a) Lecithin   b) Cephalin   c) Galactolipids   d) Amino acid

13. Cephalins have been implicated in the process of
    a) Metabolism   b) Organisation of the body
    c) Blood purification   d) Blood coagulation

14. ___________ act as protective agent on the surface of animals and plants.
    a) carbohydrates   b) vitamins   c) nucleic acids   d) waxes

15. Which one of the following is a polysaccharide?
    a) sucrose   b) cellulose   c) maltose   d) raffinose