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Discipline: CHEMISTRY (Faculty of Sciences)

3rd PhD ENTRANCE TEST (PET-2018)

Roll No: _____ Date: **3rd June 2018** Signature of the Candidate._____

Q.1 The oxidation state of oxygen in O_2F_2 is:

a) + 1 b) + 2 c) + 4 d) - 2

Q.2 Alkali metals form highly stable complexes with:

a) Cyclopentadiene b) diethyl ether

c) Cryptand-222 d) Butadiene

Q.3 Electrophoresis refers to:

a) Separation b) Identification

c) Digestion d) Amalgamation

Q.4 Find the amphoteric one in the following:

a) CO_2 b) Mn_2O_3

c) Mg O d) Sb_2O_3

Q.5 A metal X on heating in nitrogen gas gives Y. Y on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives blue colour. Y is:

a) $Mg(NO_3)_2$ b) Mg_3N_2 c) $MgCl_2$ d) Mg O

Q.6 Wilson's disease arises from:

a) Excess accumulation of calcium in the body

b) Excess accumulation of vanadium in the body

c) Excess accumulation of selenium in the body

d) Excess accumulation of copper in the body

Q.7 $[Zr(CH_3)_6]$ exists in:

a) Octahedral geometry

b) Trigonal prismatic geometry

c) Square pyramidal geometry

d) Distorted trigonal bipyramidal geometry

Q.8 Which one of the following pair shows variable valence?

a) Zr, Ti
b) Bi, In
c) Lu, Gd
d) Pd, Cd

Q.9 Which one of the following plays a major role in EDTA complexometric titrations?

a) Concentration of metal ion
b) Concentration of ligand
c) Nature of buffer
d) Temperature of the reaction

Q.10 The equilibrium $Cr_2O_7^{2-} = 2CrO_4^{2-}$

a) Exists in basic medium
b) Exists in neutral medium
c) Exists in acidic medium
d) Does not exist

Q.11 Of the following, which is acidic in nature?

a) MnO
b) Mn_2O_7
c) Mn_2O_3
d) MnO_2

Q.12 pH of the solution produced by mixing equal volumes of 2.0×10^{-3} M $HClO_4$ and 1.0×10^{-2} M $KClO_4$ is:

a) 3.0
b) 2.3
c) 2.7
d) 1.0

Q.13 The normality of 0.3 M phosphorous acid (H_3PO_3) is:

a) 0.1
b) 0.9
c) 0.3
d) 0.6

Q.14 The addition of bromine to *trans* -2- butane:

a) Is a stereoselective reaction
b) Is a stereospecific reaction
c) Gives optically active product
d) Gives a mixture of erythro and threo isomers

Q.15 An organic compound, MF = $C_9H_{10}O_2$, showed three peaks in PMR spectrum at δ 1.96, s, 3H; δ 5.0, s, 2H and δ 7.2, s, 5H. It also showed an intense band at 1740 cm^{-1} in IR spectrum. The compound is:

a) $C_6H_5CH_2CH_2COOH$
b) $p\text{-}HOC_6H_4CH_2CH_2CHO$
c) $C_6H_5CH_2OCOCH_3$
d) $C_6H_5COOCH_2CH_3$

Q.16 Which of the following products is not formed in the mixed aldol reaction of acetaldehyde and butanal?

a) 3-hydroxybutanal
b) 3-ethyl-2-hydroxybutanal
c) 2-ethyl-3-hydroxybutanal
d) 3-hydroxyhexanal

Q.17 Match reactions in List I with reagents in List II and select the correct answer

List I	List II
A. Meerwcin-Ponndorff-Verley	1. Hydrazine, KOH
B. Wolff-Kishner	2. Na, Liq. NH_3
C. Reformatsly	3. Al ($^iOPr)_3$
D. Birch	4. Zn

a) A - 1, B - 2, C - 3, D - 4 b) A - 2, B - 4, C - 1, D - 3

✓c) A - 3, B - 1, C - 4, D - 2 d) A - 4, B - 3, C - 2, D - 1

Q.18 Reaction of 1-hexene with NBS (N-bromosuccinimide) forms two isomeric bromohexenes, one of which is 3-bromo-1-hexene. Which of the following is the other isomer?

✓a) 1-bromo-2-hexene b) 6-bromo-1-hexene

c) 1-bromo-1-hexene d) 2-bromo-1-hexene

Q.19 Which of the following statement is not correct?

a) Racemates contain equal amounts of dextro and levo form

b) Distereomers are not formed in equal amounts in an asymmetric synthesis

c) Meso-structures are not optically active compounds

✓d) Fischer projections cannot be rotated by 180^0 in the plane of the paper

Q.20 Kiliani-Fischer synthesis converts an aldopentose to a:

a) Mixture of aldohexose and ketohexose

b) Mixture of aldohexoses differing in configuration at C_6

✓c) Mixture of aldohexoses differing in configuration at C_2

d) Single aldohexose

Q.21 Treatment of 1-methylcyclohexene with an ether solution of diborane (B_2H_6), followed by reaction with alkaline H_2O_2 produces what product?

a) 1-methylcyclohexanol

b) *cis*-1-methylcyclohexane-1,2-diol

c) *cis*-2-methylcyclohexanol

✓d) *trans*-2-methylcyclohexanol

Q.22 Photolysis of an aliphatic ketone with molecular formula $C_8H_{16}O$ gives ethylene, propylene, n-butyl methyl ketone and n-propyl methyl ketone besides two cyclobutanol derivatives. The ketone is likely to be:

✓a) 4-octanone b) 3-octanone

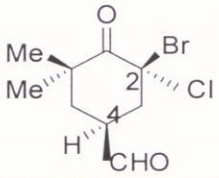
c) 2-octanone d) n-propyl t-butyl ketone

Q.23. Which of the following synthon represents the structure $RCOCH=CH_2$?

a) $RCH(OH)CH_2^+$
b) $RCH_2CH_2^+$
c) $RCOCH_2CH_2^+$
d) $RCOCH_2^+$

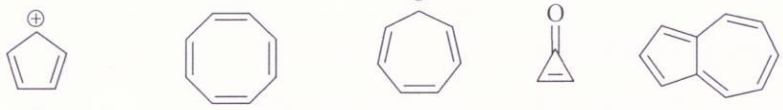
Q.24 The following reaction is an example of

a) Cycloaddition
b) Electrocyclic reaction
c) Chelotropic reaction
d) Sigmatropic rearrangement

Q.25 The absolute configuration at C-2 and C-4 in  is

a) 2S, 4R
b) 2S, 4S
c) 2R, 4S
d) 2R, 4R

Q.26 Which of the following species are aromatic?



I II III IV V

a) I and II only
b) II and III only
c) III and IV only
d) IV and V only

Q.27 Which of the following rearrangements is not acid catalysed?

a) Pinicaol-Pinacolone rearrangement
b) Fries rearrangement
c) Beckman rearrangement
d) Hofmann rearrangement

Q.28 Which of the functions below is a common eigen function of $\frac{d}{dx}$ and $\frac{d^2}{dx^2}$?

a) cos x b) kx c) e^{ix} d) $e - x^2$

Q.29 If the pre-exponential factor in Arrhenius equation is 1.6×10^{12} s^{-1}, the value of rate constant at extremely high temperature will be:

a) 1.6×10^{12} s^{-1} b) 5.2×10^{12} s^{-1}

c) 0.4×10^{12} s^{-1} d) 3.2×10^{12} s^{-1}

Q.30 The pair of symmetry point groups that are associated with only polar molecule is:

a) C_{2v}, D_{2h} b) C_{3v}, C_{2h}

c) D_{2h}, T_d d) C_{2v}, $C_{\infty v}$

Q.31 Which of the following are both rotational Raman and microwave active?

a) CH_4 b) N_2O c) C_2H_4 d) CO_2

Q.32 Average value of momentum for the ground state of a particle in a 1-d box is zero because:

a) [p, H] = 0 b) V (potential) = 0

c) H is hermitian d) State is bound and stationary

Q.33 The ionization energy of Hydrogen atom in its ground state is 13.6 eV. What is the potential energy of He^+ in its ground state?

a) - 54.4 eV b) - 27.2 eV c) - 13.6 eV d) - 108.8 eV

Q.34 Though a constant shift of energy levels of a system changes the partition function, the properties that do not change are:

a) Average energy, entropy and heat capacity

b) Average energy and entropy

c) Average energy and heat capacity

d) Entropy and heat capacity

Q.35 Which spectroscopic technique can distinguish between trans-1, 2-dichloroethylene and cis-1, 2-dichloroethylene without any numerical calculations:

a) Microwave spectroscopy b) UV-visible spectroscopy

c) X-ray photoelectron spectroscopy d) NMR

Q.36 Mossbauer spectrum of a metal complex gives information about:

a) Oxidation state and spin state of metal

b) Types of ligand coordinated to metal

c) Nuclear spin state of metal

d) Geometry of metal

Q.37 The standard electrode potential E^0 at a fixed temperature and in a given medium is dependent on:

a) Only the electrode composition

b) The electrode composition and the extent of reaction

c) The extent of the electrode reaction only

d) The electrode reaction and the electrode composition

Q.38 If we write a normalized wavefunction ψ as $\psi = A\,\phi$, then ϕ is also normalized when:

a) A is hermitian

b) A is anti-hermitian

c) A is unitary

d) A is any linear operator

Q.39 For a reaction with activation energy of 49.8 kJ/mol, the ratio of rate constants at 600 K and 300K is approximately:

a) ln 10 b) 10 c) 10 + e d) e^{10}

Q.40 A phase transition process is always:

a) Isothermal - isoentropic

b) Isochoric - isothermal

c) Isobaric - isochoric

d) Isothermal - isobaric
