GANPAT UNIVERSITY

PH.D. ENTRANCE TEST JULY – 2017

FACULTY OF SCIENCE

(CHEMISTRY)

SECTION – B

Instructions:

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Part - I

1. Which element has highest first IE?
   a) He b) H c) N d) Ne
2. Which set has all coloured ions?
   a) Cu^{2+}, Co^{2+}, K^{+} b) Na^{+}, Mg^{2+}, Al^{3+} c) Cu^{2+}, Cu^{+}, Ni^{2+} d) Cu^{2+}, Fe^{2+}, Co^{2+}
3. Maximum oxidation state is shown by
   a) Mn b) Os c) Co d) Cr
4. Which of the following metals has more than one oxidation state?
   a) Zn b) Sr c) Ca d) Mn
5. Number of metal-metal bonds in $[(C_6H_5)Fe(CO)_2]_2$ is
   a) three b) one c) two d) zero
6. _____ used as moderator in nuclear reactor.
   a) hard water b) critical water c) soft water d) heavy water
7. Which of the following type of compounds analyzed by Uv-spectroscopy?
   a) alkene b) aliphatic c) cyclic saturated d) none of these
8. Molecular _____ can be detected and measured in an IR and in a Raman spectrum.
   a) radiation b) vibrations c) excitation d) all
9. How many NMR signals in n-propyl formate?
   a) 1 b) 2 c) 4 d) 3
10. How many NMR signals in 2-chloropropene?
    a) 1 b) 2 c) 4 d) 3
11. Molecular ion peak (M^{+}) of Ethanol and di-Methyl ether is _____.
    a) Ethanol has higher than di-Methyl ether b) same
    c) different d) di-Methyl ether has higher than Ethanol
12. TLC is used for _____ of organic compounds.
    a) mixing b) grinding c) extraction d) separation
13. The dipole moment is maximum for
    a) HCl b) HBr c) HF d) HI
14. The one which decreases with dilution is
    a) specific conductance b) molar conductance c) onductance d) equivalent conductance
15. Which polymers occur naturally?
    a) Starch and Nylon b) Starch and Cellulose c) Proteins and Nylon d) Proteins and PVC
16. For any process, the second law of thermodynamics requires that the change of entropy of the universe is
    a) positive only b) positive or zero c) zero only d) negative or zero
17. Change in entropy depends
    a) on the thermodynamic state b) only on transfer of heat
    c) only transfer of mass d) only on change of temperature
18. For which of the following compounds enantiomer is not possible?

a) 2-amino pantane b) α- hydroxyl propionic acid
c) 1-chloro-1-phenylethane d) Phenyl ethane

19. In Sawhorse projection, a fully eclipsed form can be transformed to *anti*-staggered form by a rotation of
a) 180° b) 90° c) 360° d) 60°
20. In singlet state of carbine carbon atom is _____ hybridized.
a) sp^2 b) sp^3 c) *sp* d) None of these
21. Claisen rearrangement is an example of _____ sigmatropic rearrangement.
a) [2,3] b) [3,3] c) [2,4] d) [1,5]
22. The ketone functional group can be identified by the following spectroscopy.
a) ^{1}HNMR & ^{13}CNMR b) IR & ^{1}HNMR c) IR & ^{13}CNMR d) None of these
23. Green chemistry aims to
a) Waste Minimisation at Source
b) Use of Catalysts in place of Reagents
c) Improved Atom Efficiency
d) All (a, b, c)
24. A drug that is antipyretic as well as analgesic is
a) *para*-acetamidophenol b) peniciline c) chloroquine d) quinine
25. Deamination by nitrous acid and also decarboxylation of Anthranilic acid gives
a) carbocation b) carbene c) carbon free radical d) benzyne

Part – II

1. What is chromatography? Give types of chromatography and discuss about any one for the separation of organic compounds by giving suitable example.
2. Names of types spectroscopy used in identification of chemical compounds. Discuss utility of ^{1}HNMR for identification organic molecule.
3. Discuss generation, stability and reactivity of carbocation using proper examples.
4. Discuss the utility of I and II law of thermodynamics.
5. What is an organometallic compound? Give brief note on organometallics in homogeneous catalyst.

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[CHEMISTRY]

1. a) He
2. d) Cu^{2+}, Fe^{2+}, Co^{2+}
3. b) Os
4. d) Mn
5. d) zero
6. d) heavy water
7. a) alkene
8. b) vibrations
9. c) 4
10. d) 3
11. b) same
12. d) separation
13. c) HF
14. a) specific conductance
15. b) Starch and Cellulose
16. b) positive or zero
17. a) on the thermodynamic state
18. d) Phenyl ethane
19. a) 180^{o}
20. a) sp^{2}
21. b) [3,3]
22. c) IR & ^{13}CNMR
23. d) All (a, b, c)
24. a) *para*-acetamidophenol
25. d) benzyne

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PH.D. ENTRANCE TEST JULY – 2017

FACULTY OF SCIENCE

[PHYSICS]

SECTION – B

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(d) All Questions are compulsory.

PART - I

Q. 1	Lagrange's equations are applicable when the system is	
	A. conservative	B. non-conservative
	C. conservative and non - conservative	D. none of the above
Q. 2	The body of mass 100 g is orbiting about another body of mass 1 kg due to a central force. The reduced mass of this system in the centre of mass frame is	
	A. 0.9 kg	B.1.1 kg
	C. 91 g	D. 110 g
Q. 3	Two electrons leave a radioactive sample in opposite directions, each with speed 0.5c. With respect to sample, what is the relativistic speed of one electron with respect to other?	
	A. 0.5c	B. 1.6c
	C. 2.2c	D. 0.8c
Q. 4	The energy E, the rest mass m_0 and the momentum p of a relativistic particle are related to the formula	
	A. $E^2 - p^2c^2 = m_0^2c^2$	B. $E^2 - p^2c^2 = m_0^2c^4$
	C. $E^2 - pc = m_0^2c^4$	D. $E^2 - pc = m_0^2c^2$
Q. 5	$\vec{\nabla} \times \vec{E} = -\partial\vec{B}/\partial t$ represents	
	A. Ampere's Law	B. Gauss's Law
	C. Ohm's Law	D. Faraday's Law
Q. 6	If $\vec{B}$ is magnetic field and it's divergence $\vec{B}=0$, everywhere it means	
	A. The lines of $\vec{B}$ could have a source in the field $\vec{B}$	B. An isolated magnetic pole is possible
	C. An isolated magnetic pole is not possible	D. the system possesses symmetry
Q. 7	A soap bubble is given a negative charge, then its radius	
	A. increases	B. decreases
	C. remains constant	D. none
Q. 8	The frequency of a television transmitter is generally of the order of	
	A. 100 kHz	B. 1 MHz
	C. 20 kHz	D. 100 MHz

Q. 9	Plank's constant has the dimension of	
	A. force	B. energy
	C. linear momentum	D. angular momentum
Q. 10	The ground state wave function ψ of hydrogen atom in spherical polar coordinates has no angular dependence but only radial dependence. Then ψ will be an integer function of	
	A. L_x, L_y, L_z simultaneously	B. L_z but not of L_x and L_y
	C. None of L_x, L_y and L_z	D. P_x
Q. 11	What may be the permitted energy levels of an electron which is trapped in a box 1 Å wide?	
	A. $76n^2$ eV	B. $38n^2$ eV
	C. $19n^2$ eV	D. $9.5n^2$ eV
Q. 12	The kinetic energy associated with a plane wave is given by	
	A. hk	B. $^1/_2\, mk^2$
	C. $\frac{h^2k^2}{8\pi^2 m}$	D. $\frac{h^2k^2}{8\pi^2 m^2}$
Q. 13	If the operators A, B and C are such that [A,B] = 0 and [B,C] = 0 then we may conclude that	
	A. [C,A]=0	B. [A,BC]=0
	C. $[AB,C^2]=0$	D. $[A^2,B] + [B^2,C^2]=0$
Q. 14	Fermi-Golden rule obtained using time dependent perturbation theory	
	A. is time dependent	B. is time- independent
	C. depends on time harmonically	D. is partially time dependent
Q. 15	According to Fermi-Dirac statistics, at Fermi energy, the occupation index is	
	A. zero	B. negative
	C. half	D. unity
Q. 16	The zeroth law of thermodynamics enables us to give a precise meaning to	
	A. pressure	B. temperature
	C. entropy	D. free energy
Q. 17	If the temperature of sun goes down by a factor of 2, the total power emitted by it goes down by a factor	
	A. 2	B. 4
	C. 8	D. 10
Q. 18	An ideal gas is one in which there is	
	A. strong interaction	B. no interaction
	C. weak interaction	D. medium Interparticle interaction
Q. 19	In the direct band gap semiconductor, required momentum for an electron transition is provided by	
	A. Photon	B. Phonon
	C. Positron	D. Magnon
Q. 20	The frequencies of lines of a line spectrum of X ray emission depends on	
	A. the kinetic energy of electron	B. the metal used for the anticathode
	C. the deceleration of electron	D. the shape of the continuous spectrum
Q. 21	The electron spin resonance can be exhibited by	
	A. hydrogen atom	B. hydrogen molecule
	C. Li^+ ions	D. nitric oxide (NO) molecule

Q. 22	A superconducting Tin has a critical temperature (Tc) of 3.7 K at zero magnetic field and critical field of 306 Gauss at 0 K. What will be the critical field at 3 K?	
	A. 208 Gauss	B. 104 Gauss
	C. 52 Gauss	D. 304 Gauss
Q. 23	In the indirect band gap semiconductor nanostructures, required momentum for an electron transition is provided by	
	A. Photon	B. Positron
	C. Magnon	D. Phonon
Q. 24	The instrument which is suitable for absolute measurement of the activity of a β- active source is	
	A.GM counter	B. scintillation counter
	C. proportional counter	D. ionization counter
Q. 25	When a neutron and proton combine to form deuteron, the amount of energy given off is	
	A. 20.22 MeV	B. 200 eV
	C. 2.22 MeV	D. 22 eV

PART – II

Q. 1	State and explain Cayley- Hamilton theorem in detail.	5 Marks
Q. 2	Describe the construction and working of JFET with necessary diagrams. Compare JFET with MOSFET	5 Marks
Q. 3	Describe the construction and working of a laser device that employ optical pumping.	5 Marks
Q. 4	Describe type –I and type –II superconductors in detail with necessary diagrams.	5 Marks
Q. 5	What do you mean by binding energy of nuclei? Plot the graph of B/A against A and explain its interesting conclusions in detail.	5 Marks

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FACULTY OF SCIENCE

[PHYSICS]

SECTION – B

Answer Key

Q. 1	C
Q. 2	C
Q. 3	D
Q. 4	B
Q. 5	D
Q. 6	C
Q. 7	A
Q. 8	D
Q. 9	D
Q. 10	B
Q. 11	B
Q. 12	C
Q. 13	C
Q. 14	B
Q. 15	B
Q. 16	C
Q. 17	B
Q. 18	C
Q. 19	B
Q. 20	A
Q. 21	D
Q. 22	B
Q. 23	D
Q. 24	D
Q. 25	C

(Dr. Ankur Parmar)

No of Pages: 2

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PH.D. ENTRANCE TEST JULY – 2017

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[BIOTECHNOLOGY]

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PART - I

25 Marks

1. First DNA glycosylase enzyme discovered is _____.
   a) Uracil DNA glycosylase b) Thymine DNA glycosylase c) Adenine DNA glycosylase d) Methyl Adenine glycosylas
2. Which of the following nucleic acids has a left handed helix?
   a) Z-DNA b) A-DNA c) B-DNA d) m-DNA
3. The Z DNA helix
   a) Has fewer base pairs per turn than the B DNA b) Has alternating GC sequence c) Tends to be found at the 3'end of the gene d) None of the above
4. All of the following vitamins except one participate in the TCA cycle.
   a) Pantothenic acid b) Lipoic acid c) Folic acid d) Riboflavin
5. The enzyme used both in glycolysis and gluconegenesis is
   a) 3 Phosphoglycerate kinase b) Glucose-6-Phosphate c) Hexokinase d) Phosphofructokinase-1
6. The cell cycle of a germinal cell has
   a) Two successive mitotic divisions b) Two successive reduction divisions c) Very short prophase in first division d) One reduction division followed by one mitotic division
7. The cell cycle DNA synthesis takes place during
   a) G1 phase b) G2 phase c) S phase d) Prophase
8. DNA replication occurs in
   a) S phase b) G phase c) G2 phase d) M phase
9. Which of the following release factor recognizes stop codons UGA and UAA?
   a) Sigma factor b) RF1 c) RF2 d) RF3
10. The Oncogene Ras binds?
    a) ATP b) GTP c) Glucose d) Hempglobin
11. Which histone is not part of the nucleosome?

a) H1 b) H2B c) H2A d) H3

12 Translocation in protein synthesis begins with the
a) Movement of tRNA from A-site to P-site b) Movement of dipeptidyl tRNA from A-site to P-site c) Movement of tRNA from P-site to A-site d) Movement of tRNA from P-site to E-site

13 What types of cell is class I MHC found on?
a) B cells b) Macrophages c) Dendritic cells d) Essentially all cells

14 Natural humoral immune response against a pathogen leads to the production of
a) Polyclonal antibodies b) monoclonal antibodies c) macrophages d) none of these

15 Commercially available ELISA kits are used for the detection of
a) rotavirus b) hepatitis B surface antigen c) anti-HIV antibodies d) all of these

16 T - cell maturation (positive and negative selection) occurs in what organ?
a) Bone marrow b) Thymus c) Thyroid d) Pancreas

17 Fermentation which is carried by yeast is called
a) pyruvic fermentation b) acrylic fermentation c) lactic acid fermentation d) alcoholic fermentation

18 The most commonly employed cross-linked polymer is
a) Cellulose b) Collagen c) Polyacrylamide gel d) cation exchange resin

19 Protoplasts can be produced from suspension cultures, callus tissues or intact tissues by enzymatic treatment with
a) cellulotyic enzymes b) pectolytic enzymes c) both cellulotyic and pectolytic enzymes d) proteolytic enzymes

20 DNA polymerase involved in mismatch repair system of *E.coli* is _____
a) DNA Pol I b) DNA Pol II c) DNA Pol III d) DNA Pol β

21 Which out of the following is an inhibitor of prokaryotic transcription?
a) Ciprofloxacin b) Etoposide c) Erythromycin d) Rifampicin

22 Which of the following subunit of the bacterial RNA polymerase is responsible for promoter recognition?
a) Alpha b) B c) B'd) Sigma

23 If the amount of G in a DNA sample is 20% what is the molar amount of T in the sample?
a) 20% b) 30% c) 40% d) 60%

24 Which immunoglobulin is the principal one found in secretions such as milk?
a) IgM b) IgA c) IgG d) IgE

25 The mechanism of intake of DNA fragments from the surrounding medium by a cell is called
a) Transformation b) Transduction c) both a & b d) Conjugation

PART – II

25 Marks

Q. 1 Explains the steps of plasmid DNA isolation.

Q. 2 Writa a note on cell cycle.

Q. 3 Give an overview of Human Genome Project

Q. 4 Explain production of monoclonal antibody.

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Answer key

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