

2017

(6th Semester)

CHEMISTRY

NINTH PAPER

(CHEM-361)

(Organic Chemistry—III)

Full Marks : 55

Time : 2½ hours

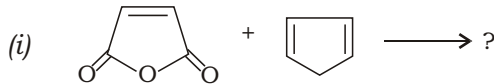

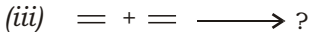
(PART : B—DESCRIPTIVE)

(Marks : 35)

The figures in the margin indicate full marks
for the questions

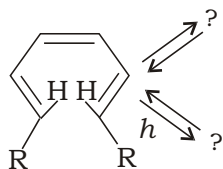
1. (a) Draw Jablonski diagram of a molecule and explain it. 4
- (b) Discuss the following with example : 3
- (i) Photoreduction reaction
- (ii) Norrish type-II cleavage

OR

- (a) What types of excitations are possible in benzophenone molecule on irradiation with UV light? 4
- (b) Comment upon—
- (i) spin forbidden transitions ;
- (ii) quenching process in photochemistry. 3
2. (a) Why is disrotatory ring closure allowed in a photoinduced reaction of 1,4-disubstituted 1,3-butadiene? Explain it with the help of FMO (Frontier Molecular Orbital) method. 4
- (b) Complete the following reactions naming the type of cycloaddition reaction : 3
- (i)  3
- (ii)  3
- (iii)  3
- Or
- (a) Write short notes on suprafacial and antarafacial processes in cycloaddition reactions. 4

(3)

- (b) Predict the products from the following reaction : 3



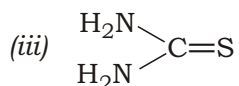
3. (a) Define the term 'conformation'. Why is diequatorial chair conformer of disubstituted cyclohexane more stable than diaxial conformer? Explain. 4

- (b) What happens when diethyl sulphide is oxidised with potassium permanganate? Write the chemical equation. 3

Or

- (a) Write all the possible conformers of 1,4-disubstituted cyclohexane. Which conformer is the least stable one? 4

- (b) How will you prepare thiol from the following compounds? $1 \times 3 = 3$



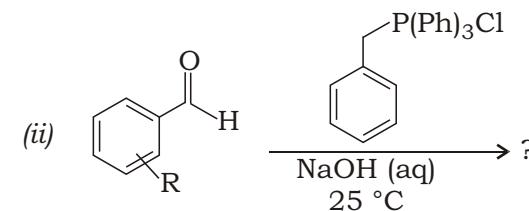
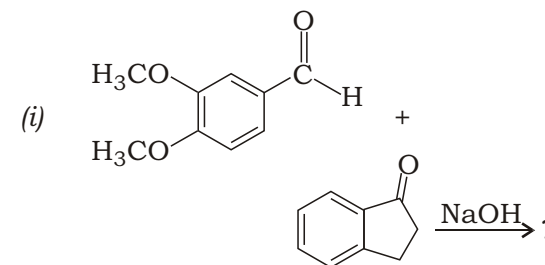
G7/420a

(Turn Over)

(4)

4. (a) Discuss the microwave assisted Hofmann elimination reaction. 3

- (b) Predict the products from the following reactions : $2+2=4$



Or

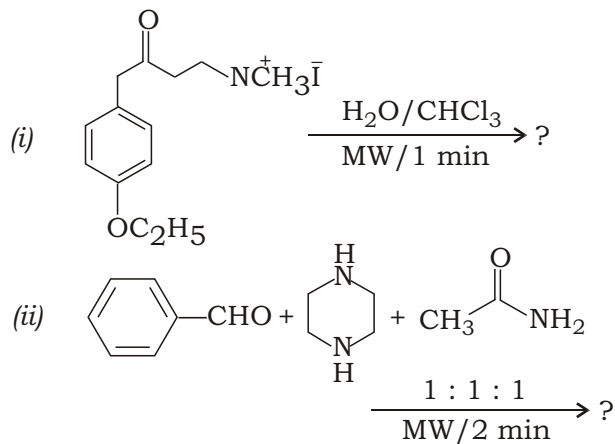
- (a) Write the principle and chemical equation involved in the preparation of butyraldehyde by sonication method. 3

G7/420a

(Continued)

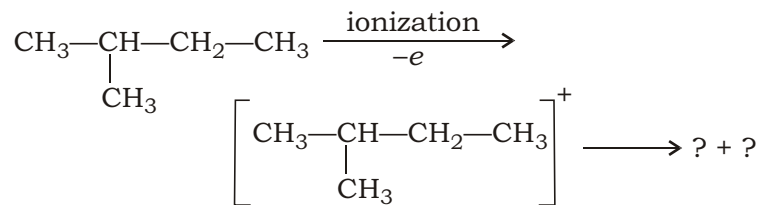
(5)

(b) Complete the following reactions : 2+2=4



5. (a) What do you understand by the terms 'shielding' and 'deshielding' of protons in the NMR spectroscopy? 3

(b) Propose the structures and fragmentation mechanisms corresponding to ions with m/z 43 and 57 in the mass spectrum of isopentane molecule : 4



(6)

Or

(a) Explain the following terms : $1\frac{1}{2} \times 2 = 3$

(i) Metastable ion

(ii) Molecular ion-peak

(b) Write the possible fragmentation and related m/z value of different fragments of methyl alcohol in mass spectrometry. 4

Subject Code : CHEM/VI/09

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Booklet No. A

Date Stamp

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DEGREE 6th Semester
(Arts / Science / Commerce /
.....) Exam., **2017**
Subject
Paper

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(Arts / Science / Commerce /
.....) Exam., **2017**
Roll No.
Regn. No.
Subject
Paper
Descriptive Type
Booklet No. B

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CHEM/VI/09

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(6th Semester)

CHEMISTRY

NINTH PAPER

(CHEM-361)

(Organic Chemistry—III)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×5=5

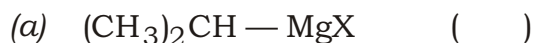
1. Fluorescence is a relaxation from

- (a) singlet to a triplet state ()
- (b) triplet to a singlet state ()
- (c) singlet to a singlet state ()
- (d) None of the above ()

/420

(2)

2. The organometallic compound which reacts with diisopropyl ketone to give bulky tertiary alcohol containing triisopropyl group is



3. The number of signals in NMR spectrum tell

(a) the number of different sets of equivalent protons in a molecule ()

(b) the number of different sets of non-equivalent protons in the molecule ()

(c) the number of different functional groups present in the molecule ()

(d) None of the above ()

4. The aim of green chemistry is

(a) to design the chemical products and processes that work most efficiently ()

(b) to design the chemical products and processes that reduce hazardous substances ()

(c) to design the chemical products and processes that maximize profit ()

(d) None of the above ()

(3)

5. Cycloaddition reactions involve the formation of a cyclic compound from

- (a) a diene and a dienophile ()
- (b) an alkane and an alkene ()
- (c) a cyclic alkane and an alkene ()
- (d) None of the above ()

(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. What do you understand by a pericyclic reaction? Explain it by taking an example of Diels-Alder reaction.

(5)

2. How will you distinguish between $\text{CH}_3 - \text{CH}_2 - \text{Br}$ and $\text{CH}_3 - \text{CH}_2 - \text{OH}$ using $^1\text{H-NMR}$ spectroscopy?

(6)

3. Write three reactions of thiol.

(7)

4. What is a photosensitizer? Explain its role in a photochemical reaction.

(8)

5. Write three important principles of green chemistry.

2 0 1 7

(6th Semester)

CHEMISTRY

TENTH PAPER

(CHEM-362)

(Inorganic Chemistry—III)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

*The figures in the margin indicate full marks
for the questions*

1. (a) Describe the bonding in metal carbonyl compounds. 3
- (b) Write a note on organometallic compounds of boron. 4
- OR**
2. (a) What are different modes of bonding of NO in metal nitrosyls? Give appropriate example of each. 4

- (b) Give a brief account of bonding in π -metal alkenyl complexes. 3
3. (a) What is cooperative effect in hemoglobin? Explain. 3
- (b) Write the general properties of inorganic polymers. 2
- (c) Explain the role of Mg^{2+} and Ca^{2+} in biological process. 2

OR

4. (a) What are phosphazenes? Discuss the preparation and structure of polyphosphonitrilic chlorides. 1+3=4
- (b) Discuss briefly the role of myoglobin and hemoglobin in biological system. 3
5. (a) Mention any three consequences of lanthanide contraction. 3
- (b) Write a note on oxidation state of actinides. 2
- (c) Write a note on colour of M^{3+} lanthanide ions. 2

(3)

OR

6. (a) Describe the method of separation of lanthanides. 3
(b) Compare the lanthanides and actinides in terms of their oxidation state and magnetic properties. 2+2=4

7. (a) Write a note on spin magnetic moment. 3
(b) Explain why $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic while $[\text{CoF}_6]^{3-}$ is paramagnetic. 4

OR

8. (a) Draw plots of magnetic susceptibility versus temperature in case of paramagnetic and ferromagnetic compounds, and elaborate the difference. 3
(b) Write short notes on the following : 2+2=4
(i) Permeability
(ii) Intensity of magnetization

9. (a) Discuss the IR spectra of bridged metal-halogen bond. 4
(b) Predict the number of normal vibrational modes for CO_2 molecule and mention whether they are IR active or Raman active. 3

(4)

OR

10. (a) Discuss Raman effect in brief. 3
(b) How does the hydrogen bonding affect the stretching frequencies in IR spectra? 2

- (c) The IR spectra for $\text{trans-}[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$ and $\text{cis-}[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$ show the following $\nu_{(\text{Pd}-\text{N})}$ and $\nu_{(\text{Pd}-\text{Cl})}$ vibrational frequencies (in cm^{-1}) :

	(Pd—N)	(Pd—Cl)
$\text{trans-}[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$	496	333
$\text{cis-}[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$	495 ; 476	327 ; 306

Explain. 2

Subject Code : CHEM/VI/10

Booklet No. **A**

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(6th Semester)

CHEMISTRY

TENTH PAPER

(CHEM-362)

(Inorganic Chemistry—III)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×5=5

1. In hemoglobin and myoglobin, iron is present as

(a) Fe(II) ()

(b) Fe(III) ()

(c) Fe(IV) ()

(d) Fe(VI) ()

(2)

2. How many fundamental vibrational frequencies can be observed in the infrared absorption spectrum of water?

(a) 6 ()

(b) 5 ()

(c) 4 ()

(d) 3 ()

3. The most common oxidation state in actinides is

(a) +2 ()

(b) +3 ()

(c) +4 ()

(d) +5 ()

4. Which of the following is not an organometallic compound?

(a) CH_3Na ()

(b) $\text{Ph}_3\text{C Na}$ ()

(c) $\text{C}_2\text{H}_5\text{Na}$ ()

(d) CH_3MgBr ()

(3)

5. $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ are

(a) paramagnetic ()

(b) diamagnetic ()

(c) inner orbital complex ()

(d) outer orbital complex ()

(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. Discuss the conditions required for a molecule to be IR active.

(5)

2. Write a note on ferromagnetism and anti-ferromagnetism.

(6)

3. Discuss the ability of complex formation of actinides.

(7)

4. Write a short note on the function of carbonic anhydrase in biological system.

(8)

5. Write one preparation and one application of alkyl magnesium halide.

2 0 1 7

(6th Semester)

CHEMISTRY

ELEVENTH PAPER

(CHEM-363)

(**Physical Chemistry—III**)*Full Marks* : 55*Time* : 2½ hours

(PART : B—DESCRIPTIVE)

(*Marks* : 35)*The figures in the margin indicate full marks for the questions*

1. (a) State and explain Beer-Lambert law for light absorption by solutions. Also establish the relationship between absorbance and transmittance through this law. 3+1=4
- (b) A 0.003 M solution of a coloured substance transmits 75% of the incident light of 500 nm, when placed in a cell of 1.0 cm length. Calculate the molar extinction coefficient and hence the optical density of a 0.001 M solution in the same cell at the same wavelength. 3

OR

2. (a) Discuss the photochemical reaction involving the dissociation of hydrogen iodide. 3
- (b) Discuss the mechanism of photosensitization and quenching by taking suitable examples. 2
- (c) For the photochemical reaction $B \rightarrow C$, 1.0×10^{-5} mole of B was formed on absorption of 6.62×10^7 ergs at 3600 Å. Calculate the quantum yield for the reaction. ($h = 6.62 \times 10^{-27}$ erg-sec) 2
3. (a) Discuss in detail the Debye theory of heat capacity of monoatomic solids. Compare and comment on the results obtained by Einstein and Debye on a plot. 3+1=4
- (b) Discuss, in detail, the Planck's theory of blackbody radiation. 3

OR

4. (a) Set up and solve Schrödinger wave equation for a particle in an infinite one-dimensional (1-D) box. Also normalize the wave function. 4

(3)

(b) A ball of mass 1 g, confined in a 1-D box of length 0.1 m, moves with a velocity of 0.01 ms^{-1} . Calculate the quantum number, n . Is it possible to observe the quantization of energy levels of the ball? 3

5. (a) Derive multiplication theorem of partition function. 2

(b) Derive an expression for rotational partition function of an ideal diatomic gas. $3\frac{1}{2}$

(c) Calculate the translational partition function for H atom at 3000 K confined to move in a box of volume $2.49 \times 10^5 \text{ cm}^3$. $1\frac{1}{2}$

OR

6. (a) Show that the internal energy of a system of N independent particles is given by

$$U = nRT^2 \frac{\ln q}{T}$$

Hence show that $U = \frac{3}{2}nRT$ for an ideal

gas. 4+1=5

G7/422a

(Turn Over)

(4)

(b) Calculate the entropy change of 1 mole of He when it is heated from 300 K to 600 K at constant pressure. $(R = 1.98 \text{ cal deg}^{-1} \text{ mol}^{-1})$ 2

7. (a) How is microwave spectroscopy utilized in determining the bond distances in polyatomic molecules? Explain. $2\frac{1}{2}$

(b) The pure rotational spectrum of CN gaseous molecule consists of a series of equally spaced lines separated by 3.7978 cm^{-1} . Calculate the inter-nuclear distance of the said molecule. (Given : $^{12}\text{C} = 12.011 \text{ g mol}^{-1}$ and $^{14}\text{N} = 14.007 \text{ g mol}^{-1}$) 3

(c) Explain anharmonicity with the help of Morse potential curve. $1\frac{1}{2}$

OR

8. (a) Discuss electronic spectra of conjugated molecules. $2\frac{1}{2}$

G7/422a

(Continued)

(5)

(b) By taking a suitable example, describe the condition under which a molecule shows vibrational IR spectrum. 2

(c) The fundamental vibrational frequency of HCl is 2890 cm^{-1} . Calculate the force constant of this molecule.
(Given, $^1\text{H} = 1.673 \times 10^{-27} \text{ kg}$ and $^{35}\text{Cl} = 58.06 \times 10^{-27} \text{ kg}$) 2½

9. (a) What is meant by electrode potential? Derive Nernst equation showing the effect of electrolytic concentration on electrode potential. 1+3=4

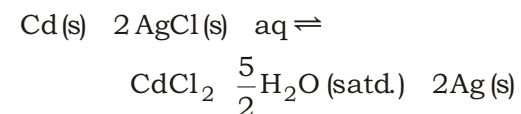
(b) Write the cell reaction and calculate standard e.m.f. (E°) for the cell $\text{Zn}, \text{Zn}^{2+} (1 \text{ M}) | \text{Fe}^{2+} (1 \text{ M}), \text{Fe}^{3+} (1 \text{ M}); \text{Pt}, E^\circ(\text{Fe}^{3+} | \text{Fe}^{2+}) = 0.77 \text{ V}$, and $E^\circ(\text{Zn}^{2+} | \text{Zn}) = 0.76 \text{ V}$. 3

OR

10. (a) Derive expression for e.m.f. of concentration cells without transference. 4

(6)

(b) The e.m.f. of the cell
 $\text{Cd}, \text{CdCl}_2 \cdot \frac{5}{2} \text{H}_2\text{O} (\text{satd.}) || \text{AgCl} (\text{s}), \text{Ag}$
in which the cell reaction is



is 0.6753 volt at 25 °C and 0.6915 volt at 0 °C. Calculate the free energy change (G), enthalpy change (H) and entropy change (S) for the cell reaction at 25 °C.

Physical constants :

$$h = 6.626 \times 10^{-34} \text{ J-s}$$

$$N_A = 6.023 \times 10^{23} \text{ mol}^{-1} \quad 3$$

Subject Code : CHEM/VI/11

Booklet No. **A**

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DEGREE 6th Semester
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(6th Semester)

CHEMISTRY

ELEVENTH PAPER

(CHEM-363)

(Physical Chemistry—III)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the
brackets provided : 1×5=5

1. One einstein is the energy associated with

(a) 1 photon ()

(b) 1×10^{21} photons ()

(c) 1×10^{23} photons ()

(d) 1 mole of photons ()

(2)

2. The emissive power (E) of a blackbody at any temperature is equal to

(a) T^3 ()

(b) T^3 ()

(c) T^4 ()

(d) T^4 ()

3. The relationship between molar partition function and work function is given by

(a) $A - kT \ln Q$ ()

(b) $A + kT \ln Q$ ()

(c) $A - (kT)^{-1} \ln Q$ ()

(d) $A + kT(\ln Q)^{-1}$ ()

4. The rotational spectrum of a rigid diatomic rotor consists of equally spaced lines with spacing equal to

(a) $1B$ ()

(b) $2B$ ()

(c) $3B$ ()

(d) $4B$ ()

(3)

5. The relationship between equilibrium constant and standard e.m.f. of a cell is given by

(a) $\ln k = RT / nFE^\circ$ ()

(b) $\ln k = nFE^\circ / RT$ ()

(c) $\ln E^\circ = nk / RT$ ()

(d) $\ln E^\circ = RT / nk$ ()

(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. Discuss the mechanism of chemiluminescence involving aromatic anions (Ar⁻) and aromatic cations (Ar⁺).

(5)

2. State and explain photoelectric effect.

(6)

3. Derive the expression for work function and molar partition function.

(7)

4. A sample was excited by the 4358 Å line of sodium. A Raman line was observed at 4447 Å. Calculate the Raman shift in cm^{-1} .

(8)

5. Write a short note on quinhydrone electrode.

2 0 1 7

(6th Semester)

CHEMISTRY

TWELFTH (B) PAPER

Course No. : CHEM-364

(Natural Products)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 50)

*The figures in the margin indicate full marks
for the questions*

1. (a) Explain biosynthesis of terpenes with suitable example. 4
- (b) What is isoprene rule? Draw the structure of menthol and comment on it. 3
- (c) Give the structural formula of an indole alkaloids. 3

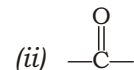
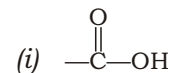
G7/423a

(Turn Over)

OR

2. (a) Write the classification of terpenes with suitable example. 4
- (b) What are alkaloids? Give the names and structures of any two alkaloids. 4
- (c) What are terpenoids? 2

3. (a) How would you explain the presence of the following functional groups in a compound? 2×2=4

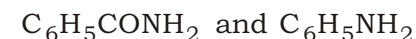


- (b) Sketch the NMR signals of the following : 2×2=4

(i) 1,1,2-trichloroethane

(ii) Toluene

- (c) How would infrared spectra of the following compounds differ? 2



OR

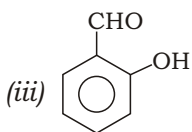
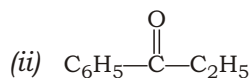
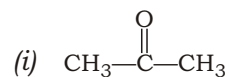
4. (a) What are the peaks observed in the mass spectra of 2-methyl butane? 2

G7/423a

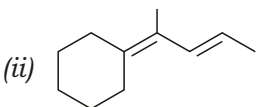
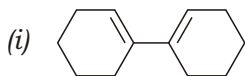
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(3)

- (b) Give approximate position of the characteristic infrared bands in the following compounds : $1 \times 3 = 3$



- (c) Predict the chemical shift for toluene. 2
- (d) Calculate ν_{\max} for the following compounds : $1\frac{1}{2} \times 2 = 3$



5. (a) How will you distinguish between glucose and fructose? 2
- (b) Give a suitable method for the synthesis of tripeptide by protecting amino group. 3
- (c) What is zwitterion? 3
- (d) Establish the structure of fructose. 2

G7/423a

(Turn Over)

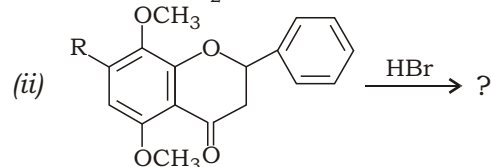
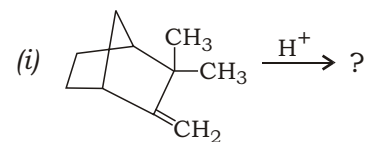
(4)

OR

6. (a) Discuss the properties of proteins. 3
- (b) How are α -amino acids prepared? 3
- (c) How will you convert aldohexose into aldopentose? 2
- (d) Discuss the cyclic structure of D-glucose. 2
7. (a) Write rearrangement reaction of morphine. 4
- (b) What are pheromones? Explain their functions with example. 3
- (c) Write in brief, plant-insect interaction. 3

OR

8. (a) Write a short note on defensive secretion in insects with some examples. 4
- (b) Complete the following reactions : $3 \times 2 = 6$



G7/423a

(Continued)

(5)

9. (a) What do you mean by enzyme-active site? 3
- (b) Explain the competitive inhibition of enzyme with suitable example. 3
- (c) Write a note on allosteric enzyme. 4

OR

10. (a) Write the characteristic functions of enzymes. 3
- (b) Explain irreversible enzyme inhibition with example. 3
- (c) Discuss enzyme specificity with example. 4

★ ★ ★

Subject Code : CHEM/VI/12 (b)

[Empty dashed box]

Booklet No. **A**

Date Stamp

.....

To be filled in by the Candidate

DEGREE 6th Semester
 (Arts / Science / Commerce /
) Exam., **2017**

Subject

Paper

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INSTRUCTIONS TO CANDIDATES

- 1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
- 2. This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
- 3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

To be filled in by the Candidate

DEGREE 6th Semester
 (Arts / Science / Commerce /
) Exam., **2017**

Roll No.

Regn. No.

Subject

Paper

Descriptive Type

Booklet No. B

Signature of
Scrutiniser(s)

Signature of
Examiner(s)

Signature of
Invigilator(s)

CHEM/VI/12 (b)

2 0 1 7

(6th Semester)

CHEMISTRY

TWELFTH (B) PAPER

Course No. : Chem-364

(Natural Products)

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 10)

Put a Tick (✓) mark against the correct answer in the brackets provided for it : 1×10=10

1. Terpenes which contain 15-carbon atoms are named as

(a) monoterpenes ()

(b) sesquiterpenes ()

(c) diterpenes ()

(d) triterpenes ()

(2)

2. Among the following, which is pyridine alkaloid?

- (a) Nicotine ()
- (b) Piperine ()
- (c) Morphine ()
- (d) Quinine ()

3. Tollens' reagent test can be used in

- (a) phenols ()
- (b) amines ()
- (c) carboxylic acids ()
- (d) aldehydes ()

4. Electronic excitation takes place in

- (a) UV spectroscopy ()
- (b) infrared spectroscopy ()
- (c) NMR ()
- (d) All of the above ()

(3)

5. Peptide bond is made up of

- (a) carboxylic acids ()
- (b) amino acids ()
- (c) mineral acids ()
- (d) None of the above ()

6. The number of asymmetric carbon atoms in the α -D-glucopyranose molecule is

- (a) two ()
- (b) four ()
- (c) three ()
- (d) five ()

7. Wessely-Moser rearrangement is specifically designed for

- (a) morphines ()
- (b) flavonoids ()
- (c) terpenoids ()
- (d) phenolic acids ()

(4)

8. Pheromones trigger

- (a) all species ()
- (b) only itself ()
- (c) same species ()
- (d) None of the above ()

9. Enzyme acting on starch is

- (a) maltose ()
- (b) amylase ()
- (c) lactose ()
- (d) pepsin ()

10. The full form of NAD is

- (a) Nicotine Amide Dinucleotide ()
- (b) Nicotinamide Adenine Dinucleotide ()
- (c) Nicotinamine Adenine Dinucleotide ()
- (d) None of the above ()

(5)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. What is nicotine?

(6)

2. What is metastable ion in the mass spectra of an organic compound?

(7)

3. Explain tertiary structure of protein.

(8)

4. Explain molecular yoga with example.

(9)

5. What is enzyme? Give one example of hydrolytic enzyme.
