TEST SERIES FOR GATE

BOOKLET SERIES A

Paper Code: CY

Test Type: TEST SERIES

Duration: 3:00 Hours

CHEMISTRY

Date: 08-01-2016

Maximum Marks: 100

Read the following instructions carefully:

1. Attempt all the questions.
2. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory. The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each. The subject specific GATE paper section consists of **55** questions, out of which question numbers 11 to 35 are of 1-mark each, while question numbers 36 to 65 are of 2-mark each.
3. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
4. Multiple choice type questions will have four choices against (a), (b), (c), (d), out of which only **ONE** is the correct answer.
5. For numerical answer type questions, each question will have a numerical answer and there will not be any choices.
6. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of ⅓ marks for a **1-mark** question and ⅔ marks for a **2-mark** question.
7. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.
8. Non-programmable type Calculator is allowed.

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Q.1-Q. 5 carry ONE mark each.

1. Which of the following options is closest in meaning to the word given below?
FAD :
(a) Apathetic (b) Expensive (c) Vogue (d) Benevolent

2. The difference between the squares of two consecutive odd integers is always divisible by which of the following numbers.
(a) 6 (b) 8 (c) 12 (d) 16

3. Which one of the following options is the closest in meaning to the word given below?
Cantankerous
(a) Freedom (b) meticulous (c) bad tempered (d) coercion

4. If *a* and *b* are real numbers and $a > b$, then which of the following is true always

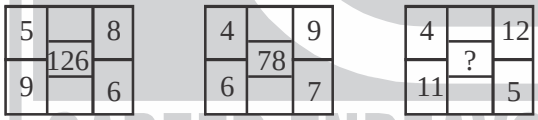
(a) $|a| > |b|$ (b) $a^2 > b^2$ (c) $a(a+1) > b(b+1)$ (d) $2b-1 < 2a-1$

5. Given below is a pair of words. Choose the most appropriate and related alternative from the options given below:
MENDACIOUS: TRUTHFUL
(a) Gelid: Icy (b) Scorching: Hot
(c) Cognisance: Recognition (d) Capricious: Constant

Q.6-Q. 10 carry TWO marks each.

6. Given below is a pair of words. Choose the most appropriate and related alternative from the options given below:
MENDACIOUS: TRUTHFUL
(a) Gelid: Icy (b) Scorching: Hot
(c) Cognisance: Recognition (d) Capricious: Constant

7. What will come in place of ? mark?



(a) 240 (b) 336 (c) 180 (d) none of these

8. The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair:
Exercise: Strong
(a) Perform: Timid (b) Guard: Alert (c) Decide: Shrewd (d) Read: Knowledgeable

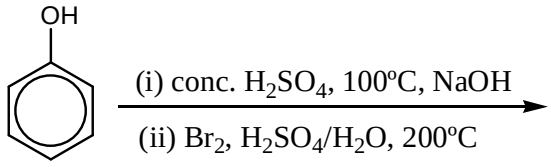
9. What is the remainder when $2^{11}(2^{10} + 1)$ is divided by 15

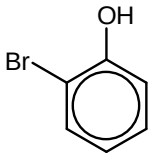
(a) 2 (b) 3 (c) 5 (d) 10

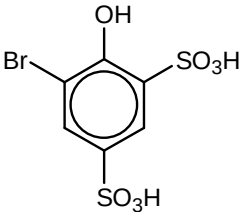
10. Karan and Arjun run a 100 metre race, where Karan beats Arjun by 10 metres. To do a favour to Arjun, Karan starts 10 metres behind the starting line in a second 100 metre race. They both run at their earlier speeds which of the following is true in connection with the second race?
(a) Karan and Arjun reach the finishing line simultaneously
(b) Arjun beats Karan by 1 metre.
(c) Arjun beats Karan by 11 metre.
(d) Karan beats Arjun by 1 metre.

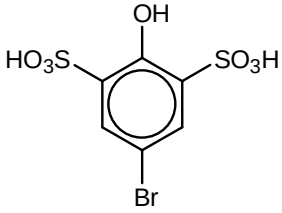
Q.11-Q.35 carry one mark each.

11. In the following sequence of the reaction, the major product (P) is:



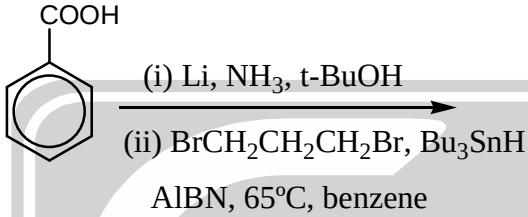
(a) 

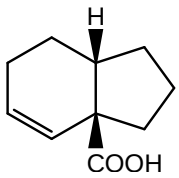
(b) 

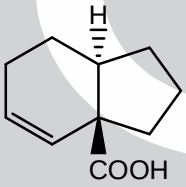
(c) 

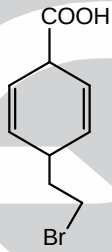
(d) 

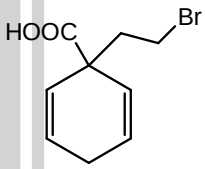
12. The major product (P) in the following series of the reaction is:



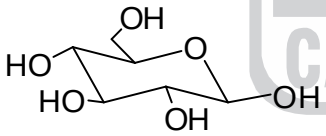
(a) 

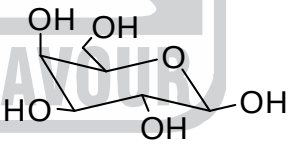
(b) 

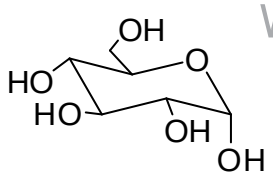
(c) 

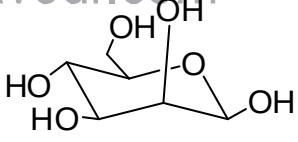
(d) 

13. β-D-Glucose is represented as :

(a) 

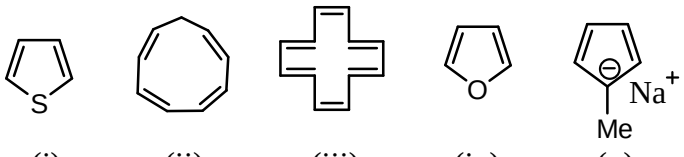
(b) 

(c) 

(d) 

14. Which of the following molecule is chiral
(a) Skew butane (b) Partically eclipsed butene
(c) Antibutane (d) Methyl cyclohexane

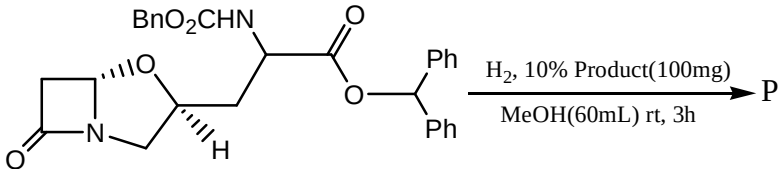
15. Which of the follwoing compounds would you expect to be aromatic

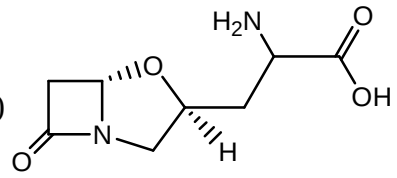


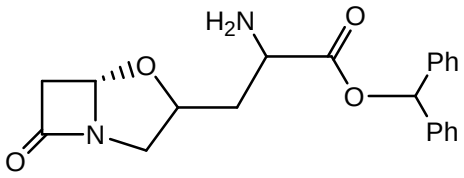
(i) (ii) (iii) (iv) (v)

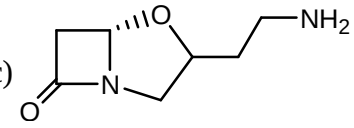
(a) i, iii, v (b) i, ii, v (c) i, iv, v (d) ii, iv, v

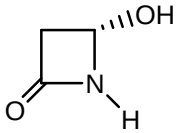
16. The major product 'P' in the above synthetic transformation is:



(a) 

(b) 

(c) 

(d) 

17. The experimental magnetic moment of $K_3[Fe(CN)_6]$ is 2.3μB and is attributable to the
(a) spin-only value of a low-spin Fe (b) spin-only value of a high-spin Fe
(c) low-spin Fe with orbital contribution (d) high-spin Fe with orbital contribution

18. Identify the structure of following complexes:

$$\left[Ni(CN)_4\right]^{2-}, \left[NiCl_4\right]^{2-}, \left[Ni(CO)_4\right]$$

(a) square planar, tetrahedral, square planar (b) tetrahedral, square planar, tetrahedral
(c) tetrahedral, tetrahedral, square planar (d) square planar, tetrahedral, tetrahedral

19. ΔG^0 at 298K for the following reaction is –3.202 MJ/mole

$$C_6H_6(\ell) + \frac{15}{2}O_2(g) \longrightarrow 6CO_2(g) + 3H_2O(\ell)$$

The value of ΔA^0 at 298 is
(a) –3.2 MJ/mole (b) 3.2 MJ/mole (c) –6.4 MJ/mole (d) 6.4 MJ/mole

20. The mechanism below has been proposed for the reaction of $CHCl_3$ with Cl_2.

Step-1: $Cl_2 \rightleftharpoons 2Cl$ (fast)

Step-2: $Cl + CHCl_3 \longrightarrow CCl_3 + HCl$ (slow)

Step-3: $CCl_3 + Cl \longrightarrow CCl_4$ (fast)

Which of the following rate laws is consistent with this proposed mechanism?
(a) Rate = $k[CHCl_3][Cl_2]$ (b) Rate = $k[CHCl_3]$
(c) Rate = $k[CHCl_3][Cl_2]^{-1}$ (d) Rate = $k[CHCl_3][Cl_2]^{½}$

21. The fluorescence quantum yield is given by the expression

(a) $\frac{k_f}{k_f + k_{ISC}}$ (b) $\frac{k_f}{k_f + k_{ISC} + k_{IC}}$ (c) $\frac{k_f}{k_{ISC} + k_{IC}}$ (d) None of these

22. The first order reflection of X-rays from (200) plane is similar to
(a) First order reflection from (110) plane. (b) Second order reflection from (100) plane
(c) Second order reflection from (220) plane (d) First order reflection from (101) plane.

23. A particle in three dimensional cubic box of length 'L' has energy of $\frac{7\hbar^2\pi^2}{mL^2}$. The degeneracy of the state is

(a) 2 (b) 3 (c) 9 (d) 6

24. The 2s orbital of hydrogen atom has radial node at $2a_0$ because ψ_{2s} is proportional to

(a) $\frac{1}{2}+\frac{r}{a_0}$ (b) $2+\frac{r}{a_0}$ (c) $4-\frac{2r}{a_0}$ (d) $2-\frac{r}{2a_0}$

25. The cell potential for the following cell.

Pt, H_2(1 atm) | H^+ (pH = ?) || H^+ (pH= 1) | H_2(1 atm) |Pt is 0.16.
The pH at negative electrode is

(a) 2.7 (b) 3.4 (c) 2.4 (d) 3.7

26. The temperature dependence of the EMF of an electrochemical cell can often be written in the form $E = \left(a + bT + cT^2 + dT^3\right)$ volt a, b, c and d are constants. A cetain commercially suitable battery was found to have $a = 1.19237,\ b = -1.537\times10^{-4},\ c = 2.73\times10^{-8},\ d = 1.78\times10^{-11}$

Then change in entropy at 27°C (if n = 3) is

(a) –79.52 cal/degree (b) –82.27 cal/degree (c) –9.17 cal/degree (d) –19.17 cal/degree

27. The correct irreducible representation that is correspondings to Mulliken symbol 'A_1' is

	E	C_3	C_2	S_4	σ_d
$1R_1$	+1	+1	+1	–1	–1
IR_2	+3	0	–1	–1	+1
IR_3	+3	0	–1	+1	–1
IR_4	+1	–1	+2	0	0

(a) IR_1 (b) IR_2 (c) IR_3 (d) IR_4

28. Pressure in the term of partition function is:

(a) $kT\left(\frac{\partial \ell n\, Q}{\partial T}\right)_V$ (b) $-kT\left(\frac{\partial \ell n\, Q}{\partial V}\right)_T$ (c) $kT^2\left(\frac{\partial \ell n\, Q}{\partial V}\right)_T$ (d) $\frac{kT}{Q}\left(\frac{\partial Q}{\partial V}\right)_T$

29. The order of increasing Lewis acidity of the silicon halides is:

(a) $SiF_4 < SiCl_4 < SiBr_4 < SiI_4$ (b) $SiCl_4 < SiBr_4 < SiI_4 < SiF_4$
(c) $SiI_4 < SiBr_4 < SiCl_4 < SiF_4$ (d) $SiBr_4 < SiCl_4 < SiF_4 < SiI_4$

30. Match the following column (A) with column (B)

Column-A	**Column-B**
1. KO_2	(X) diamagnetic
2. Na_2O_2	(Y) conductor of electricity
3. Na/NH_3	(Z) paramagnetic.

(a) 1–X, 2–Y, 3–Z (b) 1–Z, 2–Y, 3–X (c) 1–Y, 2–X, 3–Z (d) 1–Z, 2–X, 3–Y

31. Which one of the following does not exist.

(a) $XeOF_2$ (b) XeF_4 (c) NeF_2 (d) $XeOF_4$.

32. $Mn_2(CO)_{10} \xrightarrow[(2)\,120°C,\,-2CO\\(3)\,Py]{(1)\,I_2} P$

The major product 'P' in the above reaction is

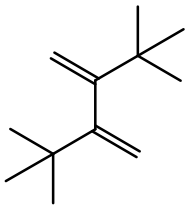
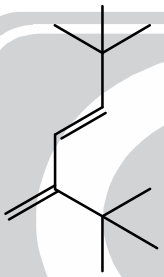
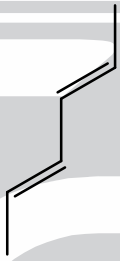
(a) $(\mu-I)_2\,Mn_2(CO)_8$ (b) $[Mn(CO)_5\,I]$

(c) $[Mn(CO)_3(Py)_2]$ (d) $[Mn(CO)_4(Py)(I)]$

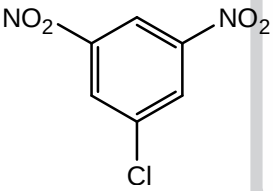
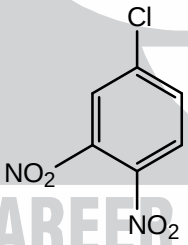
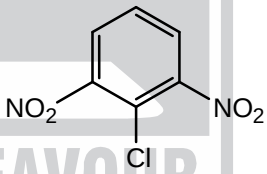
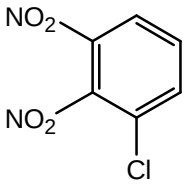
33. $[Cp_2Fe]^+$ (ferrocinium cation) is given in coloured and paramagnetic. The colour arrises due to

(a) $\delta \rightarrow \delta^*$ (b) $\pi \rightarrow \pi^*$ (c) LMCT (d) MLCT

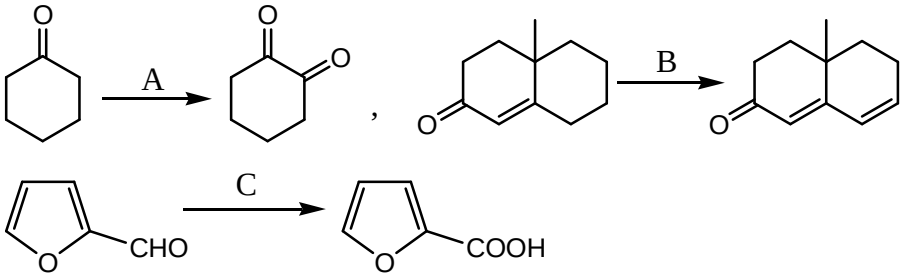
34. Which of the diene is unreactive for diels-Alder reaction

(a)  (b)  (c)  (d) (a) and (b) both

35. Which of the following dinitrochlorobenzenes exhibits two singlets in its ^{1}HNMR spectrum?

(a)  (b)  (c)  (d) 

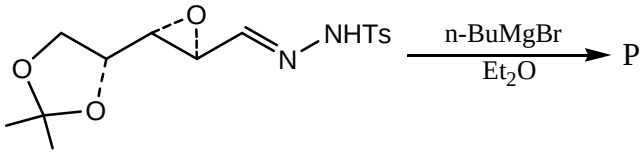
Q.36-Q.65 carry TWO marks each.

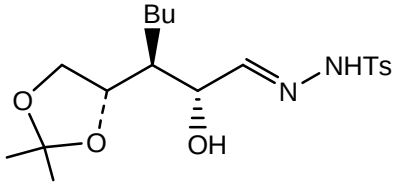
36. 

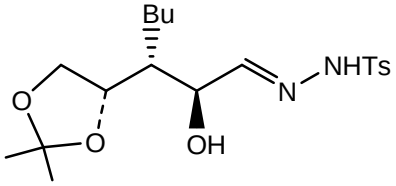
Choose the correct statement regarding A, B and C

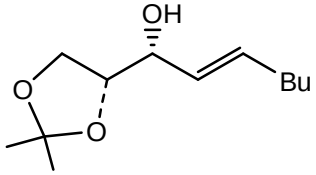
	A	B	C
(a)	SeO_2	DDQ	Ag_2O
(b)	PCC	DDQ	Ag_2O
(c)	SeO_2	Pd/C	Alk. $KMnO_4$
(d)	PCC	DDQ	Alk. $KMnO_4$

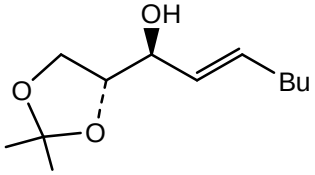
37. The major product formed in the following reaction is

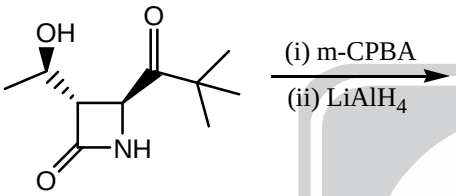


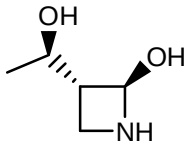
(a) 

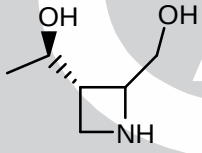
(b) 

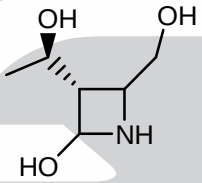
(c) 

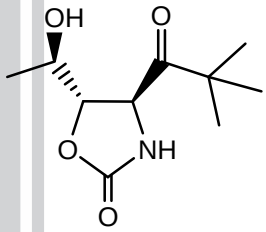
(d) 

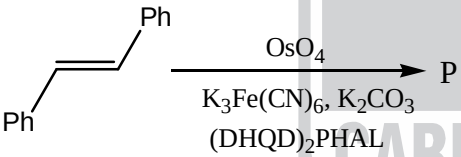
38. 

(a) 

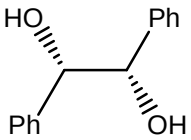
(b) 

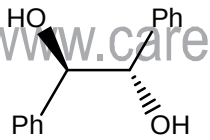
(c) 

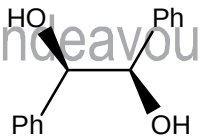
(d) 

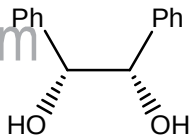
39. 

The major product P is

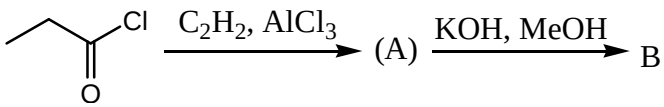
(a) 

(b) 

(c) 

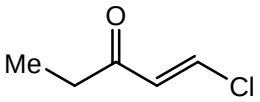
(d) 

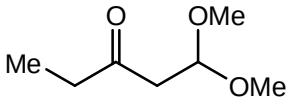
40. Indentify intermediate A and product B for given reaction. The spectroscopic data are given

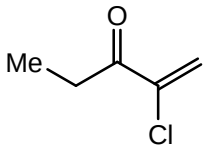
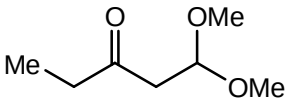


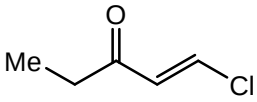
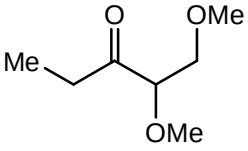
A : ^{1}H NMR : $0.96(t, J 7.0\ Hz, 3H), 2.40(q, J\ 7.0\ Hz, 2H), 6.31(d, J\ 14.0\ Hz, 1H), 7.11(d, J\ 14.0\ Hz, 1H)$

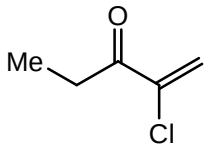
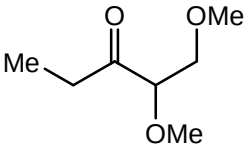
B : ^{1}H NMR : $0.99(t, J\ 7.0\ Hz, 3H), 2.39(q, J\ 7.00\ Hz, 2H), 2.57(d, J\ 5.0\ Hz, 2H), 3.28(s, 6H), 4.68(t, J\ 5.0\ Hz, 1H)$

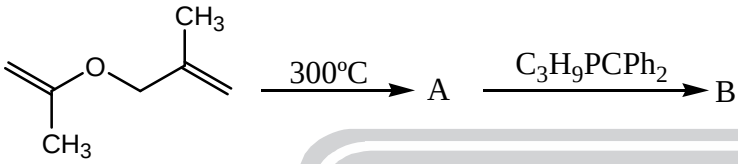
(a) 

and 

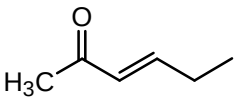
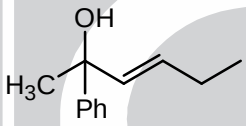
(b)  and 

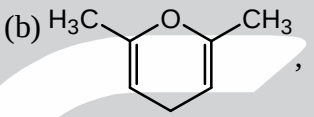
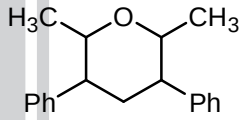
(c)  and 

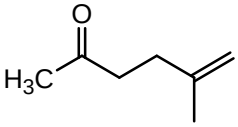
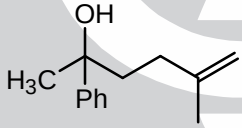
(d)  and 

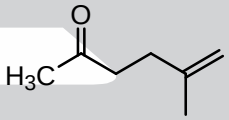
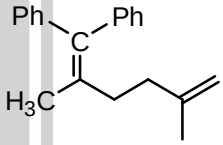
41. 

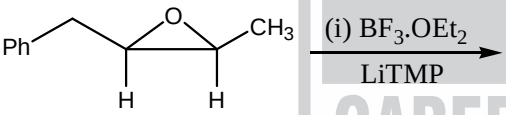
Compound A and B are

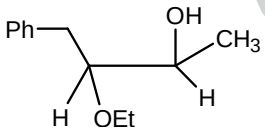
(a)  , 

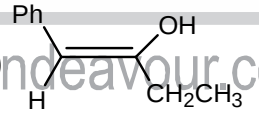
(b)  , 

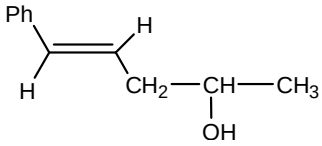
(c)  , 

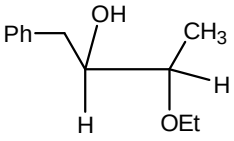
(d)  , 

42. 

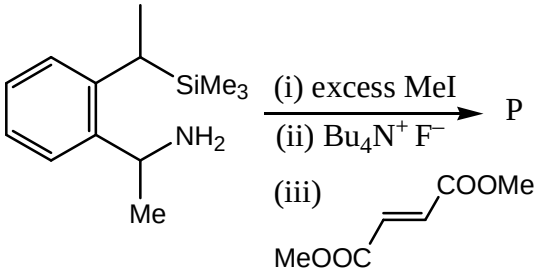
(a) 

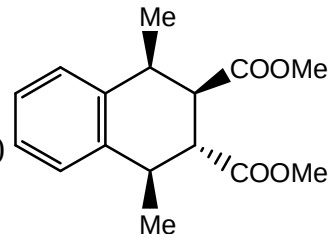
(b) 

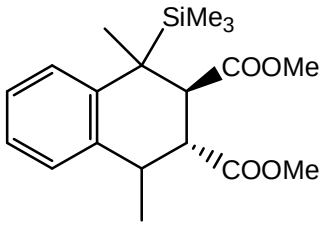
(c) 

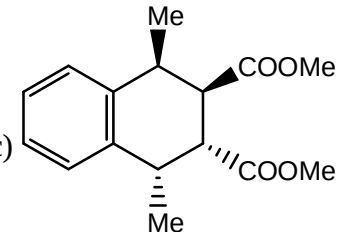
(d) 

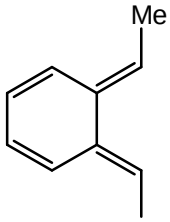
43. Predict the product in the following reaction

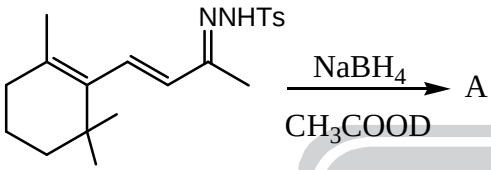


(a) 

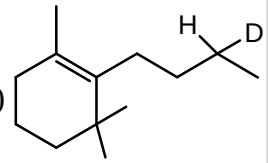
(b) 

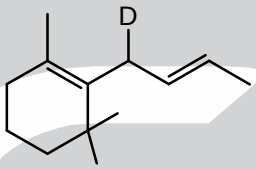
(c) 

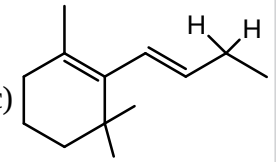
(d) 

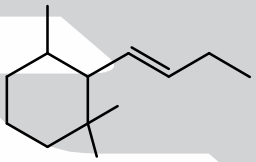
44. 

In the above reaction the product 'A' is

(a) 

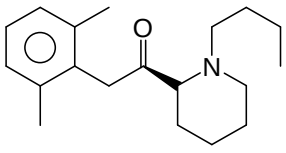
(b) 

(c) 

(d) 

45. Which one of the following peptides is formed when Ala-Ser-Thr-Lys-Gly-Arg-Ser-Gly is treated with trypsin?
(a) Ala-Ser-Thr-Lys (b) Ala-Ser-Thr
(c) Arg-Ser-Gly-Ala (d) Ala-Ser-Thr-Lys-Gly

46. Bupiva Caine is known as local anaesthetic having structure (A). The number of stereo isomers possible for bupivacaine is _____



47. $\left[Ti\left(H_2O\right)_6\right]^+$ give very intance band around 20440 cm^{-1}, the value of Δ_0 is _____(in kJ mol^{-1}).

48. Silica gel contains $\left[CoCl_4\right]^{2-}$ as an indicator when activated, silica gel becomes dark blue while upon absorption of moisture, its colour changes to pale pink. This is because
(a) Co(II) changes its coordination number from tetrahedral to octahedral
(b) Co(II) changes its oxidation state to Co(III)
(c) tetrahedral crystal field splitting is not equal to octahedral crystal field splitting.
(d) Co(II) forms kinetically labile while Co(III) forms kineticaly inert complexes.

49. The enthalpy of vaporisation of a liquid is 30 kJmol^{-1} and entropy of varpourisation is 75J mol^{-1}k^{-1}. The boiling point of the liqud at 1 atm is _____ K

50. For a vander waals gas, $Z = 1 + \left[b - \left(\frac{a}{RT} \right) \right] \frac{P}{RT}$

What is the fugacity at 100 bar and 298K.
Given : a = 0.247 dm^{6}bar mol^{-2} and b = 0.0271 dm^3 mol^{-1}.
(a) 106.9 bar (b) 10.69 bar (c) 0.1069 bar (d) 1069 bar

51. The vapour pressures of solid and liquid chlorine are given by

$$\log_e P^{solid} = 24 - \frac{3900}{T} \text{ and } \log_e P^{liq} = 18 - \frac{2600}{T}$$

where P_{solid} and P_{liq} are the vapour pressures (in Torr) of solid and liquid chlorine near the triple point, respectively and T is the absolute temperature. The ratio of the slope of the solid-gas curve to the slope of the liquid gas curve at the triple point in the P-T diagram is _____

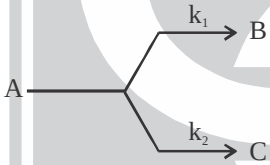
52. 10g of ice is heated to become vapour at 373K and 101.325 kPa. What is ΔS for the sytem.

Given: ΔH_{fus} of ice at 273 = 334.72 Jg^{-1}.

ΔH_{vap} of water at 373 = 373.62Jg^{-1}

Average specific heat capacity of liquid water = 4.184 JK^{-1}g^{-1}.
(a) 92.75JK^{-1} (b) 9.275JK^{-1} (c) 8.277JK^{-1} (d) 82.77JK^{-1}

53. A certain organic compound 'A' decomposes by two parallel first order reaction as



If k_1:k_2 = 1:3 and $k_1 = 1.3 \times 10^{-3}$ sec^{-1}. Then the concentration of C if an experiment is started with only 'A' having 1 mole initially and allowed to run for 1000 sec will be _____ M.

54. In Langmuir adsorption of a gas onto a solid surface the value of slope and intercept was found to be 0.45 cm^{-3} and 5×10^3 Torr cm^{-3}. The value of distribution coefficient will be _____

55. At 460 nm a blue filter transmits 78.7% of the light and a yellow filter transmits 21.3% of the light. The transmittance at the same wavelength of the two filters in combination will be
(a) 100% (b) 57.4% (c) 78.7% (d) None of these

56. The incorrect statement(s) is/are
(I) In lithium, the valence band is half filled and conduction band is full filled.
(II) In case of Magnesium, the valence band is full filled.
(III) In case of sodium, the valence band and conduction band overlap.
(IV) In case of Beryllium band it is only 1/4 th filled.
(V) Lithium band is half filled.
(a) I, III and V (b) II and IV (c) I, III and IV (d) None of these

57. For Eigen function $\frac{1}{\pi} \sin 4.63x$, the eigenvalue of operator $\frac{-h^2}{8\pi^2 m} \frac{d^2}{dx^2}$ is :

(a) $\frac{(4.63)^2 h^2}{8\pi^3 m}$ (b) $\frac{(4.63)^2 h^2}{8\pi^2 m}$ (c) $\frac{-(4.63)^2 h^2}{8\pi^3 m}$ (d) $\frac{-(4.63)^2 h^2}{8\pi^2 m}$

58. Consider the statement

(I) the eigen value of a hermitian operator is real
(II) a real eigen value implies that physical quantity for which the operator stands for can be measured experimentally
(III) the eigen values of two commuting operators can be computed by using the common set of eigen functions.
The correct statement is
(a) I only (b) I and II (c) II and III (d) I, II and III

59. The probability of finding the electron between 0 to $2a_0$ for 1s orbital of H-atom _____%

$$R_{1s} = \frac{2}{a_0^{3/2}} e^{-r/a_0}$$

60. The solubility product of $AgBr(s)$ is 5×10^{-13} at 298K. If the standard reduction potential of the half-cell. $E^0_{Ag|AgBr(s)/Br^-}$ is 0.07V, the standard reduction potential $E^0_{Ag^+|Ag}$ (in volts) is _____

61. Given that

$$E^0_{Fe^{3+}|Fe} = -0.04\ V;\ E^0_{Fe^{2+}|Fe} = -0.44\ V$$

The Gibb's free energy for the transformation from Fe^{3+} to Fe^{2+} is :
(a) –38.6 kJ (b) – 73.34 kJ (c) 38.6 kJ (d) 73.34 kJ

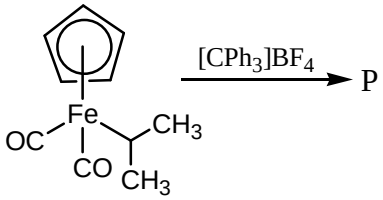
62. The equation of state for one mole of a gas is given by $\left(P + \frac{a}{TV^2}\right)(V-b) = RT$, where a, b are positive constants of appropriate dimensions and R is universal gas constant, the value of critical temperature of the gas is

(a) $\sqrt{\left(\frac{8a}{27bR}\right)}$ (b) $\frac{8a}{27bR}$ (c) $\frac{3a}{27bR}$ (d) $\sqrt{\left(\frac{a}{27bR}\right)}$

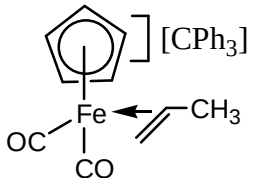
63. The partition function of a system of N monatomic molecules is given by :

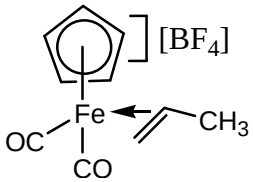
$$Q_N(V_1T) = \frac{1}{N!}\left\{8\pi V\left(\frac{kT}{hc}\right)^3\right\}^N$$

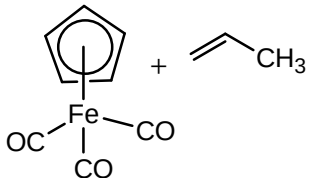
Then the correct option is :
(a) $U = \frac{3}{2}NkT$ (b) $U = \frac{1}{2}NkT$ (c) $U = NkT$ (d) $U = 3NkT$

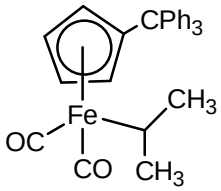
64. 

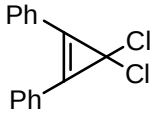
The major product 'P' in the above reaction is

(a) 

(b) 

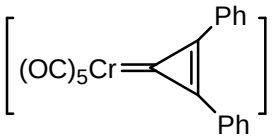
(c) 

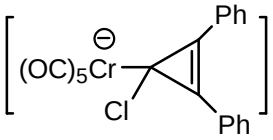
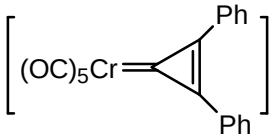
(d) 

65. $[Na_2Cr(CO)_5]$  (P) $\xrightarrow{Ph_3P{=}CH_2}$ Q

–20°C, THF

The major product P and Q in the above synthetic transformation are respectively

(a) $\left[Cr(CO)_5(Cl_2)\right]$ and $\left[Cr(CO)_5(PPh_3)\right]$ (b)  and $\left[(CO)_5Cr\left(\eta^2C_2H_4\right)\right]$

(c) $\left[(CO)_5Cr(PPh_3)\right]$ and  (d)  and $\left[(CO)_5W(PPh_3)\right]$

Space for rough work

CHEMISTRY-CY

Date: 08-01-2016

GATE TEST SERIES-I

ANSWER SHEET

1. (c)	2. (b)	3. (c)	4. (d)	5. (d)	6. (d)	7. (b)
8. (d)	9. (d)	10. (d)				
11. (a)	12. (d)	13. (a)	14. (a)	15. (c)	16. (a)	17. (c)
18. (d)	19. (a)	20. (d)	21. (b)	22. (b)	23. (d)	24. (c)
25. (b)	26. (a)	27. (a)	28. (d)	29. (c)	30. (d)	31. (c)
32. (c)	33. (c)	34. (a)	35. (a)	36. (a)	37. (c)	38. (b)
39. (c)	40. (a)	41. (d)	42. (c)	43. (a)	44. (b)	45. (a)
46. (2)	47. (240 to 246)		48. (a)	49. (400)	50. (a)	51. (1.5)
52. (d)	53. (1.02)	54. (90)	55. (d)	56. (a)	57. (b)	58. (d)
59. (76)	60. (0.567)	61. (d)	62. (a)	63. (d)	64. (b)	65. (d)