

TEST SERIES GATE 2017

BOOKLET SERIES **C**

Paper Code: **CY**

Test Type: **TEST SERIES**

Duration: **3:00 Hours**

CHEMISTRY-CY

Date: **25-01-2017**

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 $\frac{1}{3}$ marks for a **1-mark** question and $\frac{2}{3}$ 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.

- How many digits are there in 3^{16} when it is expressed in the decimal form?
(a) 3 (b) 6 (c) 7 (d) 8
- If all horses are donkeys, some donkeys are monkeys, and some monkeys are men, then which statement must be true
(a) All donkeys are men (b) Some horses may be men
(c) Some horses are men (d) All horses are also monkeys
- Find at what time between 7 and 8 O'clock will the hands of a clock be in the same straight line but not together
(a) 5 min past 7 (b) $5\frac{2}{11}$ min past 7
(c) $5\frac{3}{11}$ min past 7 (d) $5\frac{5}{11}$ min past 7
- A bicycle tube has a mean circumference of 200 cm and a circular cross-section of diameter 6 cm. What is the approximate volume of water (in cc) required to completely fill the tube, assuming that it does not expand?
(a) 600π (b) 1200π (c) 3600π (d) 1800π
- If $|-2X + 9| = 3$ then the possible value of $|-X| - X^2$ will be
(a) 30 (b) -30 (c) -42 (d) 42

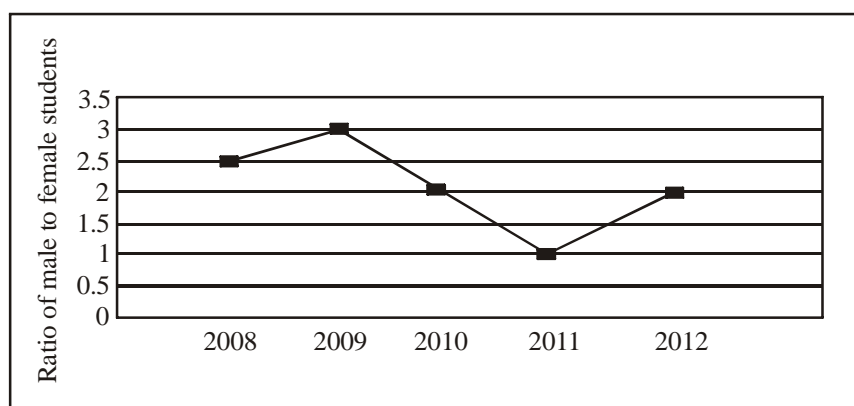
Q.6-Q. 10 carry TWO marks each.

- Anuj, Bhola, Chandan, Dilip, Eswar and Faisal live on different floors in a six-storeyed building (the ground floor is numbered 1, the floor above it 2, and so on). Anuj lives on an even-numbered floor. Bhola does not live on an odd numbered floor. Chandan does not live on any of the floors below Faisal's floor. Dilip does not live on floor number 2. Eswar does not live on a floor immediately above or immediately below Bhola. Faisal lives three floors above Dilip. Which of the following floor-person combinations is correct?

	Anuj	Bhola	Chandan	Dilip	Eswar	Faisal
(a)	6	2	5	1	3	4
(b)	2	6	5	1	3	4
(c)	4	2	6	3	1	5
(d)	2	4	6	1	3	5

- Fresh fruit contains 68% water and dry fruit contains 20% water. How much dry fruit can be obtained from 100 kg of fresh fruits?
(a) 32 kg (b) 40 kg (c) 52 kg (d) 80 kg
- N is a four digit number. If the leftmost digit is removed, the resulting three digit number is $\frac{1}{9}$ th of N. How many such N are possible?
(a) 10 (b) 9 (c) 8 (d) 7
- A chocolate bar having $m \times n$ unit square tiles is given. Calculate the number of cuts needed to break it completely, without stacking, into individual tiles
(a) $(m \times n)$ (b) $(m-1) \times (n-1)$ (c) $(m \times n) - 1$ (d) $(m \times n) + 1$

10. The ratio of male to female students in a college for five years in the following line graph. If the number of female students in 2011 and 2012 is equal, what is the ratio of male students in 2012 to male students in 2011?



- (a) 1 : 1 (b) 2 : 1 (c) 1.5 : 1 (d) 2.5 : 1

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

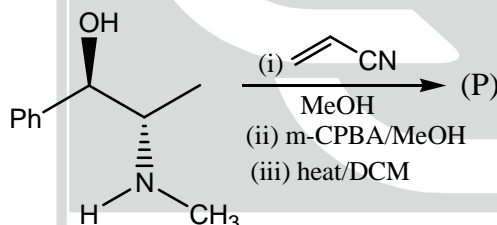
11. A and B are two sample of ideal gas of equal mole maintained at temperature T. If M_A and M_B are their molecular mass. The relation between their energy E_A and E_B is

- (a) $E_A > E_B$ (b) $E_A < E_B$ (c) $E_A = E_B$ (d) none of these

12. $\left(\frac{\partial U}{\partial P}\right)_V$ is equal to

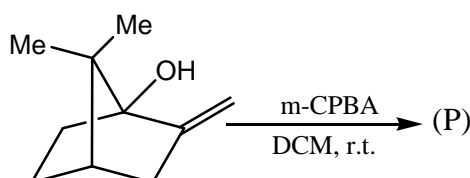
- (a) $C_P \left(\frac{\partial T}{\partial P}\right)_V$ (b) $C_V \frac{\beta}{\alpha}$ (c) $C_V \frac{\alpha}{\beta}$ (d) $C_V \left(\frac{\partial P}{\partial T}\right)$

13. The major product (P) is



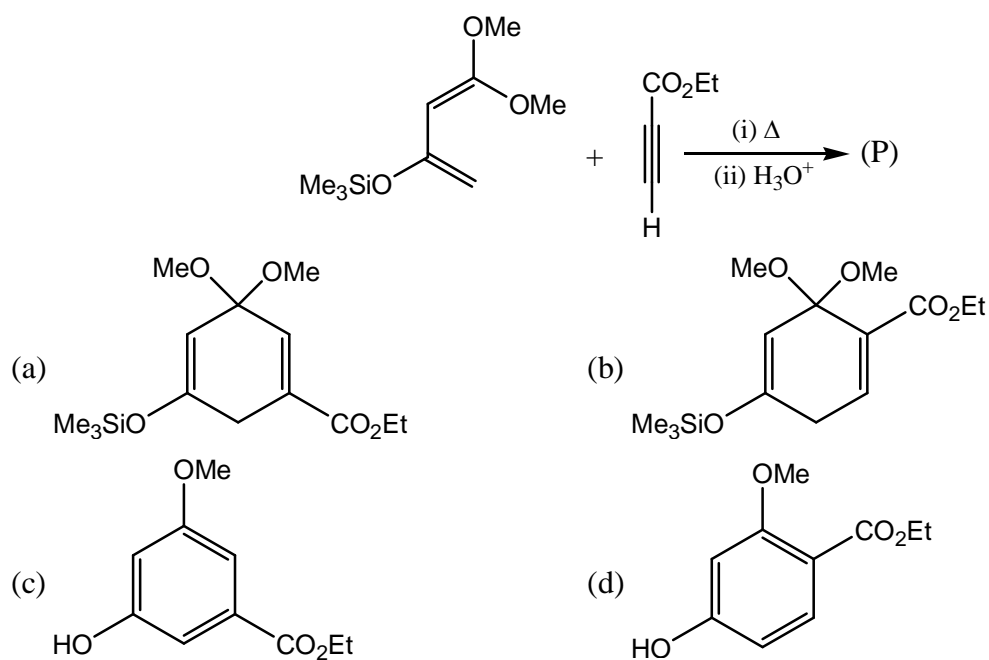
- (a) (b) (c) (d)

14. The major product (P) is

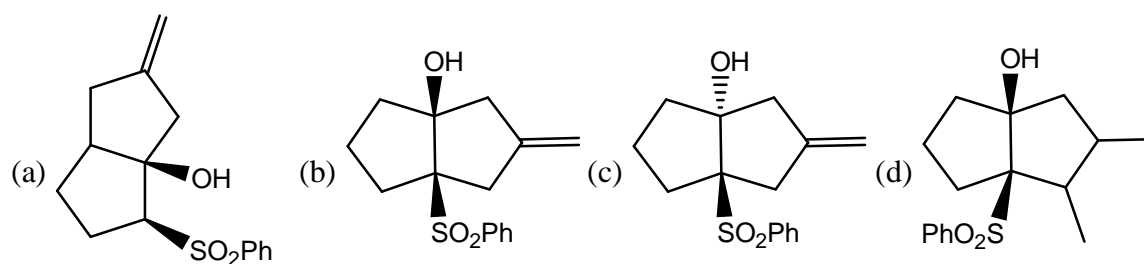
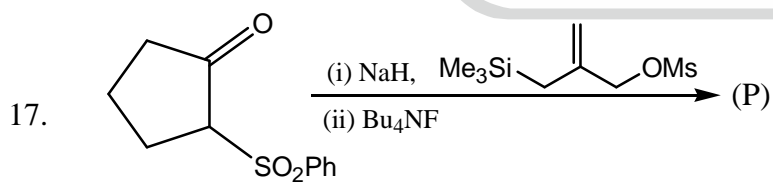
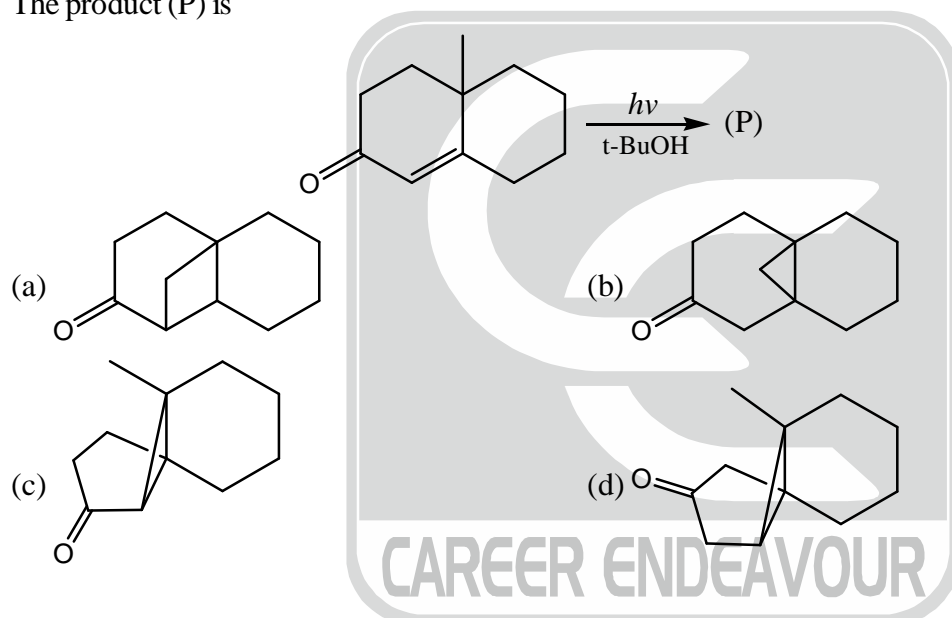


- (a) (b) (c) (d)

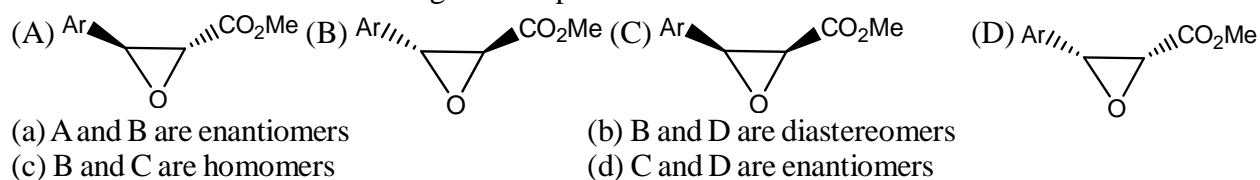
15. The major product (P) is



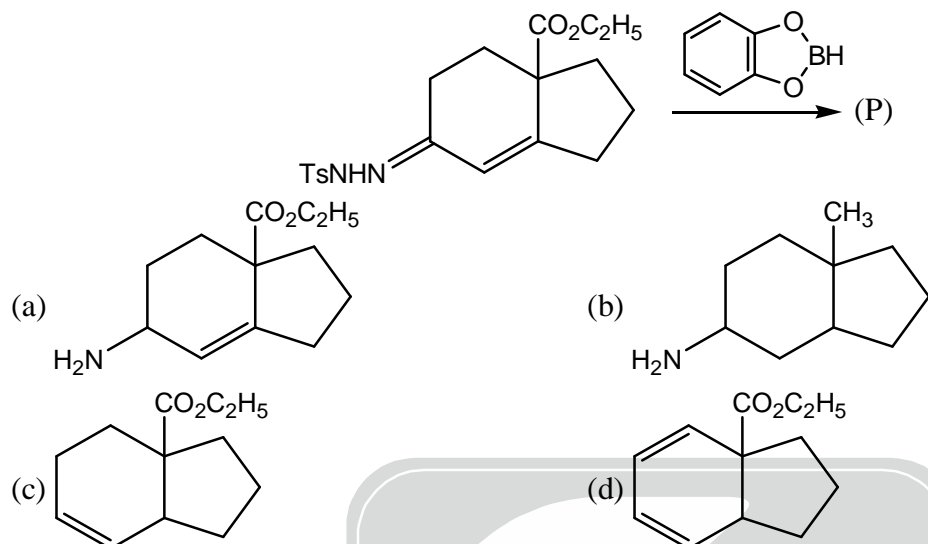
16. The product (P) is



18. The **incorrect** statement about the given compounds



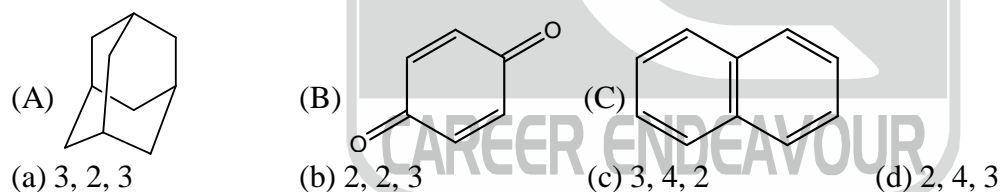
19. The major product (P) is



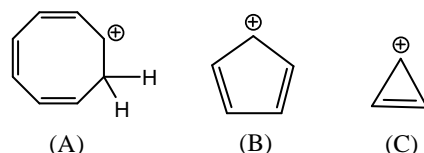
Correct order of pK_a value of the above compounds

- (a) $C > A > B > D$ (b) $C > B > D > A$ (c) $A > B > C > D$ (d) $D > B > A > C$

21. How many signals would you expect in the ^{13}C NMR of the following compounds, respectively



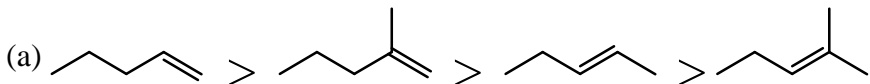
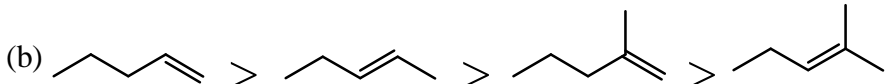
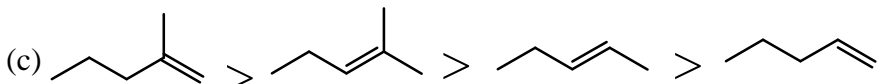
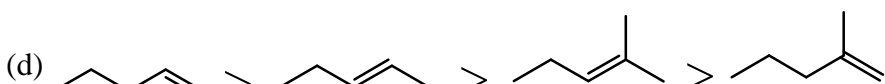
22. Among the carbocations given below



- (a) A is homoaromatic, B is antiaromatic and C is aromatic.
(b) A is aromatic, B is antiaromatic and C is homoaromatic.
(c) A is antiaromatic, B is aromatic and C is homoaromatic.
(d) A is homoaromatic, B is aromatic and C is antiaromatic.

23. $(Ln)^{2+}$ ions are largely coloured while $(Ln)^{3+}$ are not. The colour of $(Ln)^{2+}$ is due to:

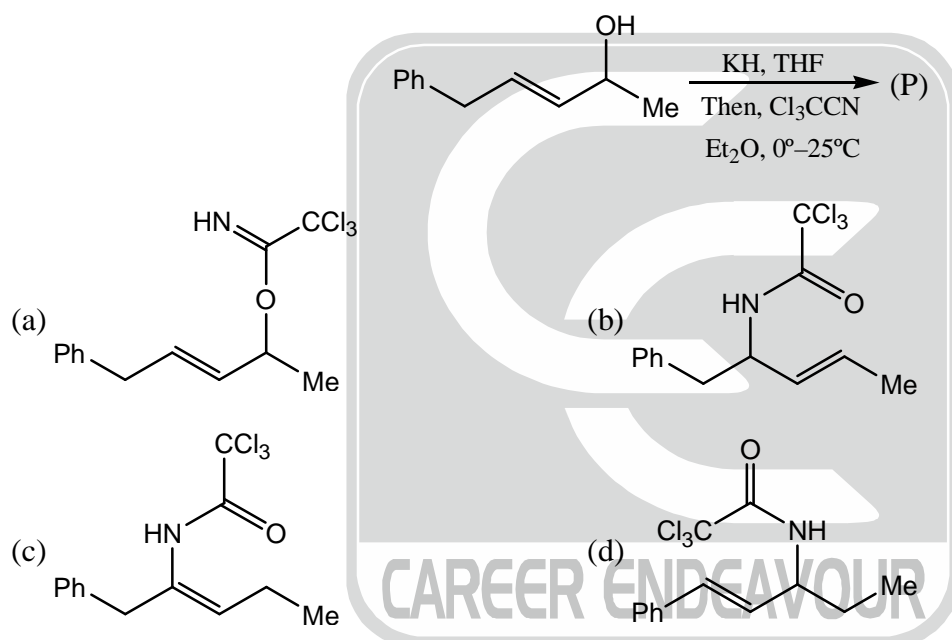
- (a) $f \rightarrow f$ transition
(b) $d \rightarrow d$ transition
(c) $f \rightarrow d$ transition
(d) Charge transfer from anions or solvent to $(Ln)^{2+}$

24. The borane $B_n H_{n+6}$ is equivalent to:
 (a) $C_2 B_{n-2} H_n$ (b) $C_2 B_{n-2} H_{n+4}$ (c) $C_2 B_{n-2} H_{n+2}$ (d) $C_2 B_{n-2} H_{n+6}$
25. Correct sequence of reactivity of alkenes for hydroformylation is
 (a) 
 (b) 
 (c) 
 (d) 
26. Which of the following species can act as promoter with $[Ir(CO)_2 I_2]^-$ catalyst used for production of acetic acid
 (a) LiI (b) GaI₃ (c) $[Ru(CO)_3 I_3]^-$ (d) $[Ru(CO)_2 I_4]^{2-}$
27. Which one commutation relation is correct.
 (a) $[\sigma_x, \sigma_y] = i\hbar\sigma_z$ (b) $[\sigma_x, \sigma_y] = i\sigma_z$ (c) $[\sigma_x, \sigma_y] = 0$ (d) $[\sigma_x, \sigma_y] = 2i\sigma_z$
28. The chemical shift values for inner and outer-protons in 18-annulene appears respectively at
 (a) 6 Hs at 9 ppm and 12 Hs at -1.8 ppm (b) 6 Hs at -1.8 ppm and 12 Hs at 9 ppm
 (c) 8 Hs at 9 ppm and 10 Hs at -1.8 ppm (d) 8 Hs at -1.8 ppm and 10 Hs at 9 ppm.
29. The Miller indices of plane having all direction, [100], [011] and [111] are
 (a) (111) (b) (011) (c) (100) (d) $(0\bar{1}1)$
30. For the reaction of the type, $P \xrightarrow{k_1} Q \xrightarrow{k_2} R$, given that, $[P]_0 = 1.0 M$; $k_1 = 0.01 \text{ sec}^{-1}$ and $k_2 = 0.02 \text{ sec}^{-1}$. The concentration of P, Q and R after 100 sec will be respectively in M unit).
 (a) $-\frac{1}{e} - \frac{1}{e^2}, \frac{1}{e}, 1 + \frac{1}{e^2}$ (b) $1 + \frac{1}{e^2}, -\frac{1}{e} - \frac{1}{e^2}, \frac{1}{e}$ (c) $\frac{1}{e}, -\frac{1}{e} - \frac{1}{e^2}, 1 + \frac{1}{e^2}$ (d) $-\frac{1}{e} - \frac{1}{e^2}, 1 + \frac{1}{e^2}, \frac{1}{e}$
31. 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) $SiBr_4 < SiCl_4 < SiF_4 < SiI_4$
32. At 273 K and 20 bar the Langmuir adsorption of a gas on a solid surface gave the fraction of surface coverage as 0.02. The Langmuir adsorption isotherm constant is _____ bar^{-1} .
33. If the displacement vectors of all atoms in chlorobenzene are taken as the basis vectors, the characters of reducible representation of E , C_2 , σ_{xz} (molecular plan) and σ_{yz} are
 (a) 36, 4, 12, 4 (b) 36, -4, 12, 4
 (c) 21, -3, 7, 3 (d) 36, -4, 36, 4

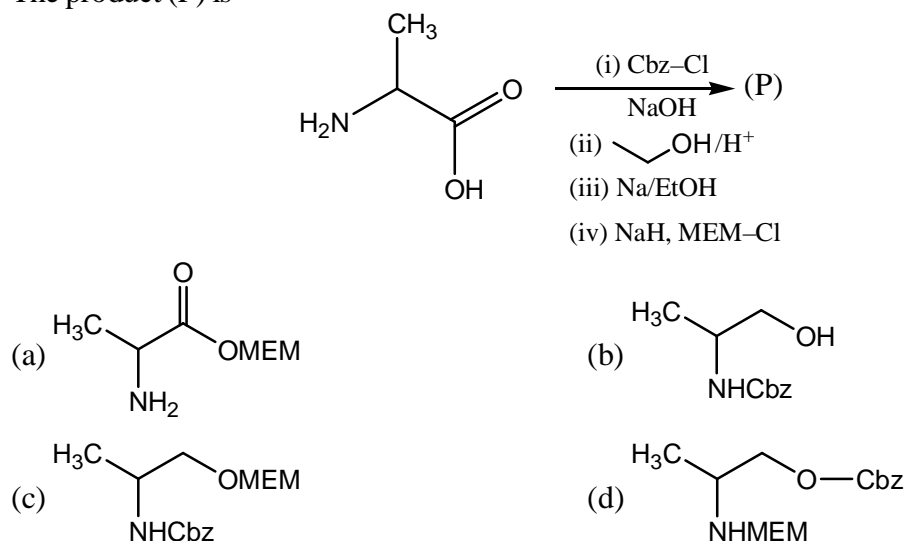
34. If the value of Mark-Houwink exponent is equal to unity, then viscosity average molar mass becomes equal to
 (a) \bar{M}_n (number average molar mass) (b) \bar{M}_m (mass average molar mass)
 (c) \bar{M}_z (z-average molar mass) (d) equal to all of these
35. A molecule shows molecular ion signals at m/z 720 and 721 in intensity ratio 3:2 in mass spectrum. The number of carbon present in the given molecule is/are _____

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

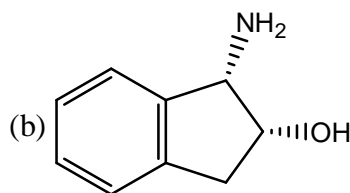
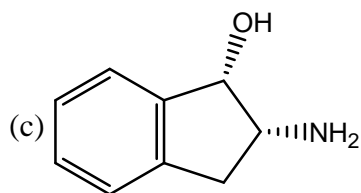
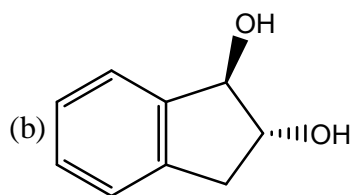
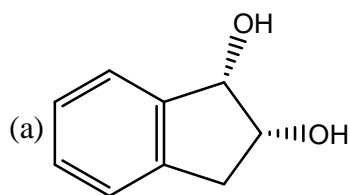
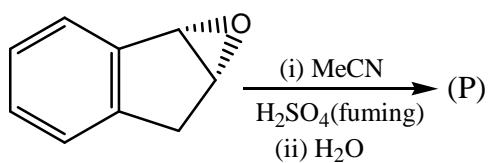
36. The equilibrium constant for the reaction, $A \longrightarrow B$ is doubled when temperature is changed from 25°C to 35°C. The value of ΔH° is
 (a) 5.29 kJ mol⁻¹ (b) 52.9 kJ mol⁻¹ (c) 62.5 kJ mol⁻¹ (d) 6.25 kJ mol⁻¹
37. In the distribution of succinic acid between ether and water at 15°C, 20 ml of ethereal layer contains 0.092g of acid. The weight of the acid present in 50 mL of the aqueous solution in equilibrium with it, is
 (Given : distribution coefficient for acid between water and ether is 5.2)
 (a) 5.38 g (b) 0.077g (c) 1.196g (d) 3.56g
38. The major product (P) is



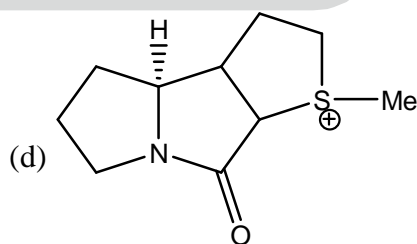
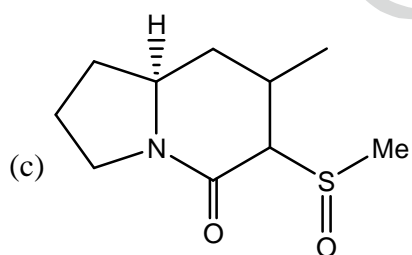
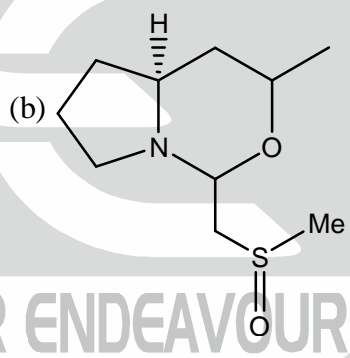
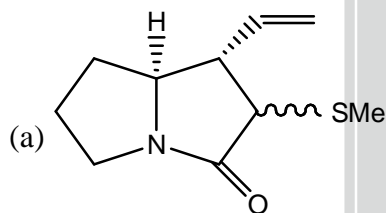
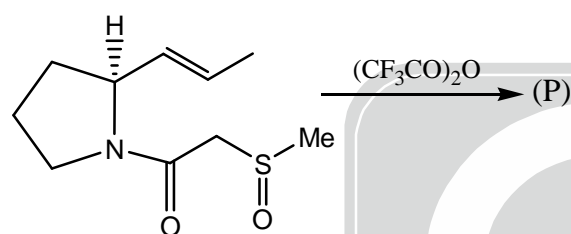
39. The product (P) is



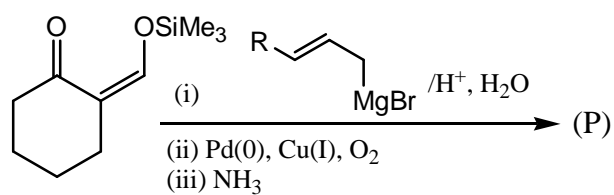
40. The major product (P) is

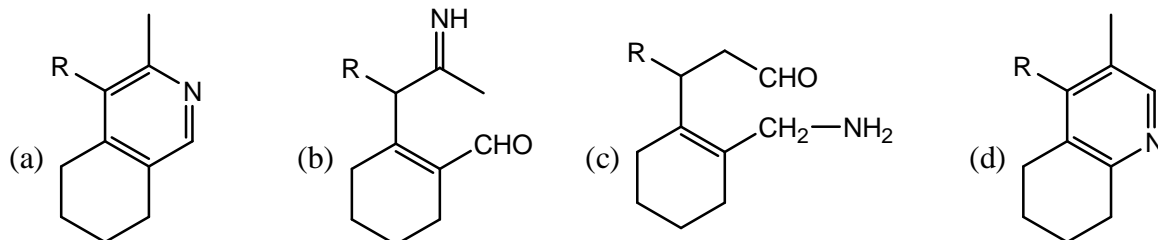


41.

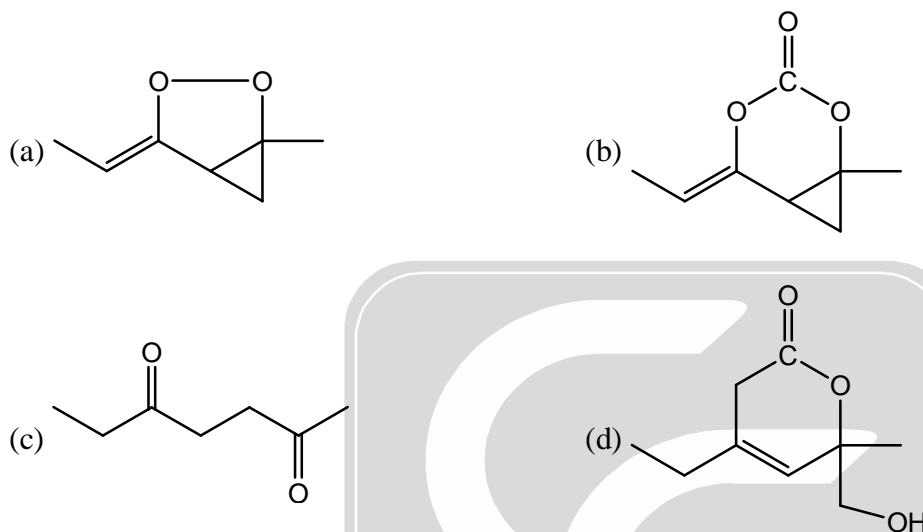
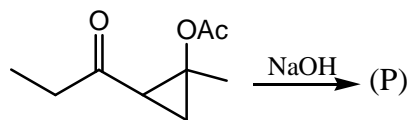


42.

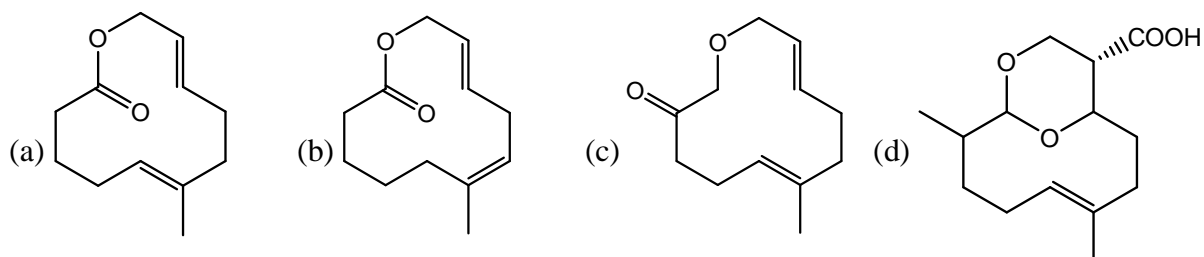
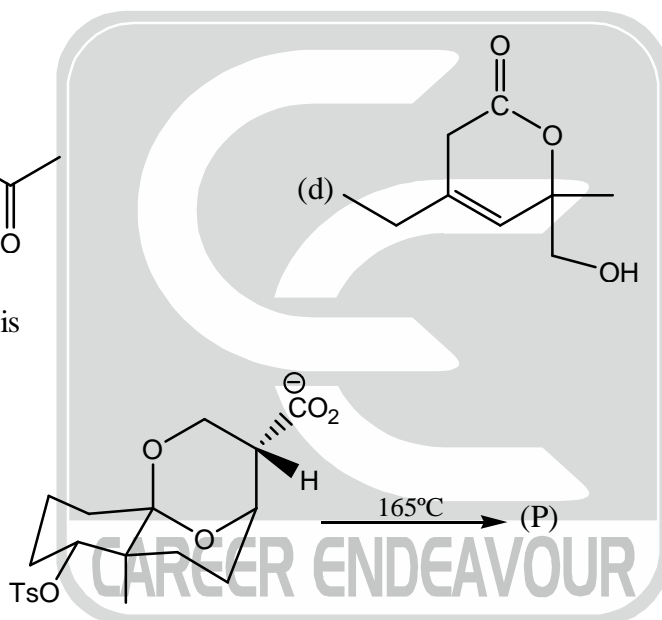




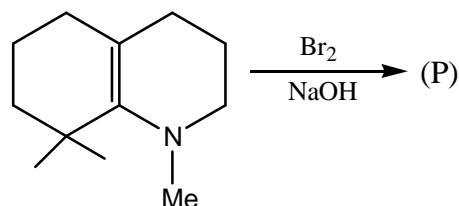
43. The major product (P) is

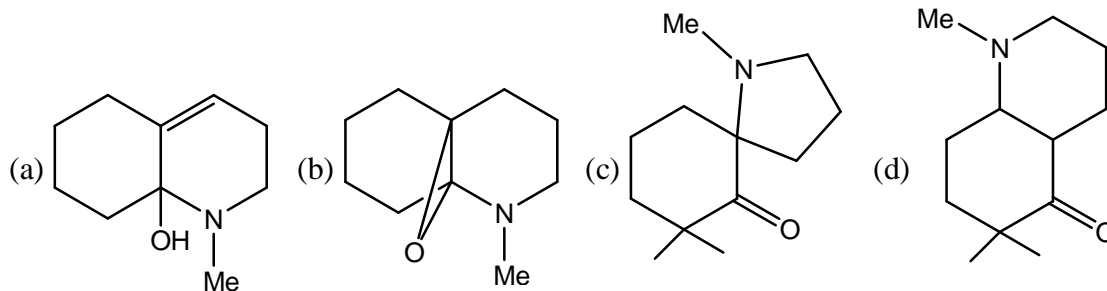


44. The major product (P) is

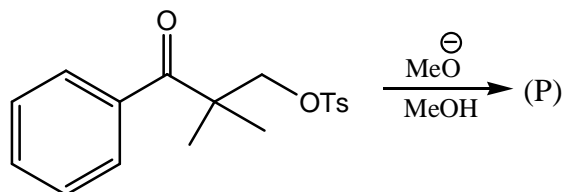


45. The major product (P) is



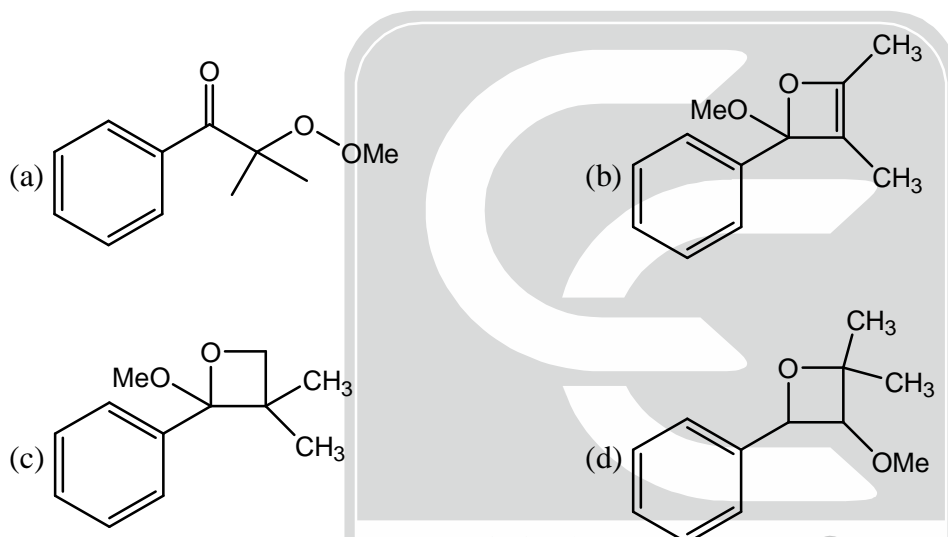


46. Suggest structures of the products of these reactions

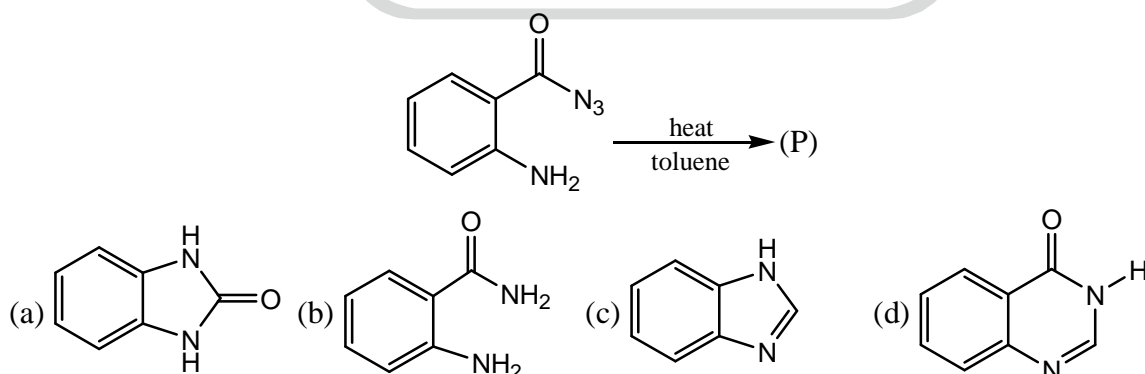


MF – C₁₂H₁₆O₂

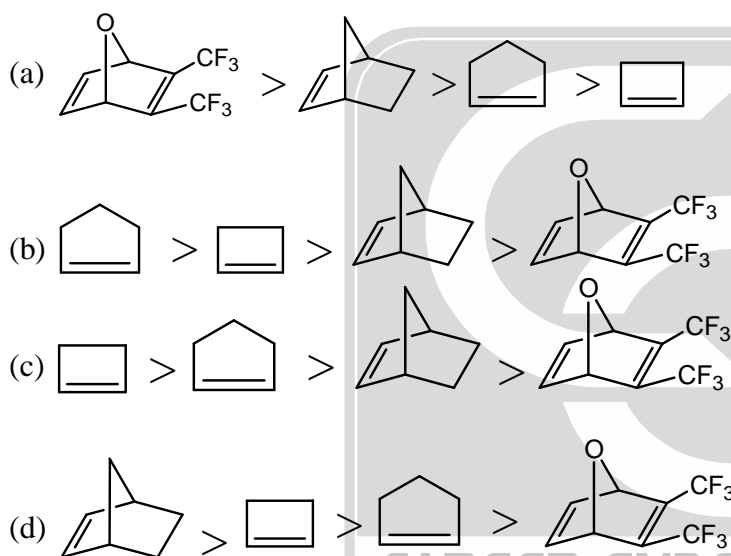
δ_{H} (ppm) = 7.25 (5H, s), 4.28 (1H, d, J = 4.8 Hz), 3.91 (1H, d, J = 4.8 Hz),
2.96 (3H, s), 1.26 (3H, s), 0.76 (3H, s)



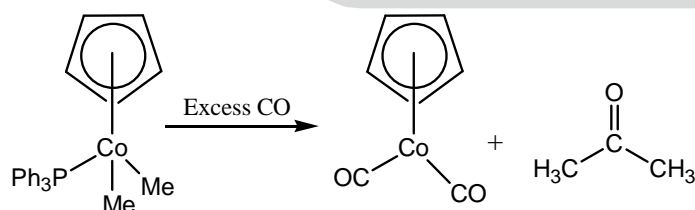
47. The major product (P) is



48. Correct sequence of rate of electron transfer between (I) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+} | [\text{Fe}(\text{H}_2\text{O})_6]^{3+}$, (II) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} | [\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ and (III) $[\text{Ru}(\text{H}_2\text{O})_6]^{2+} | [\text{Ru}(\text{H}_2\text{O})_6]^{3+}$ is
 (a) III > II > I (b) III > I > II (c) II > III > I (d) I > II > III
49. Correct sequence of formation constant regarding metal (II) for complex $[\text{M}(\text{en})_3]^{2+}$ is
 (a) $\text{Cu}^{2+} > \text{Ni}^{2+} > \text{Zn}^{2+} > \text{Co}^{2+}$ (b) $\text{Ni}^{2+} > \text{Cu}^{2+} > \text{Zn}^{2+} > \text{Co}^{2+}$
 (c) $\text{Cu}^{2+} > \text{Ni}^{2+} > \text{Co}^{2+} > \text{Zn}^{2+}$ (d) $\text{Cu}^{2+} > \text{Zn}^{2+} > \text{Ni}^{2+} > \text{Co}^{2+}$
50. Iodine in (A) oxidation state is easily stabilized by complexation as in $[\text{ICl}_2]^{+1}$ ion which is stable in concentrated HCl. In concentrated and strong acids $[\text{I}_2]^+$ is (B) cation dimerizing to (C) species $(\text{I}_4)^+$. Here (A), (B) and (C) are respectively:
 (a) -1, unstable, paramagnetic (b) +1, paramagnetic, diamagnetic
 (c) -1, diamagnetic, paramagnetic (d) +1, diamagnetic, stable
51. Correct sequence of ring opening metathesis polymerization of alkenes by using a carbene catalyst $(\text{Ru}=\text{CHPh})$ is



52. Consider the following reactions,



The most plausible sequence of mechanistic steps for the above reaction is

- (a) (i) loss of PPh_3 , (ii) addition of CO, (iii) addition of CO, (iv) reductive elimination of acetone, (v) addition of CO.
 (b) (i) addition of CO, (ii) insertion of CO, (iii) reductive elimination of acetone, (iv) addition of CO, (v) loss of PPh_3 .
 (c) loss of PPh_3 , (ii) addition of CO, (iii) insertion of CO, (iv) addition of excess CO along with reductive elimination of acetone.
 (d) addition of CO, (ii) loss of PPh_3 , (iii) insertion of CO, (iv) addition of excess CO along with reductive elimination of acetone.

53. HOMO and LUMO of BeH_2 molecules respectively are
 (a) σ_g and σ_u (b) σ_g and π_u (c) σ_u and π_u (d) σ_u and σ_g
54. $\text{KMg}_3(\text{OH})_2\text{Si}_3\text{AlO}_{10}$ is an example of
 (a) Talc (b) Mica (c) Amphiboles (d) Feldspar
55. The correct form of Sackur Tetrode equation
 (a) $S = nR \left(\frac{\ell n e^{5/2} kT}{p \Lambda^3} \right)$ (b) $nR \left[\ell n \left\{ \frac{kT}{p} \left(\frac{2\pi ktm}{h^2} \right)^{3/2} \right\} + \frac{5}{2} \right]$
 (c) $S = nR \left(\frac{\ell n e^{3/2} kT}{p \Lambda^3} \right)$ (d) Both (a) and (b) are correct.
56. The time required for 10% completion of a first order reaction at 298K is equal to that required for its 25% completion at 308K. If the pre-exponential for the reaction is $3.56 \times 10^9 \text{ s}^{-1}$, the rate constant at 318 K is _____ $\times 10^{-4} \text{ sec}^{-1}$.
57. In the following statement, the correct statement is
 (1) Transport number is independent of temperature
 (2) the unit of molar conductance Λ_m is $\text{Sm}^2\text{mol}^{-1}$.
 (3) $\text{Li} < \text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$ (increasing order of ionic mobility)
 (4) the correct term of Hückel Onsager equation $\Lambda_m = \Lambda_m^0 - A\sqrt{c}$ (where A is a constant depending on the nature of the solvent and temperature).
 (a) 2, 3 and 4 (b) 1, 2 (c) 2 and 4 (d) 3 and 4
58. The standard electrode potentials of $\text{Cu}^{+2}/\text{Cu}^+$ and Cu^+/Cu electrodes are +0.18V and +0.50 V respectively. The value of standard potential of Cu^{+2}/Cu electrode is
 (a) 0.34V (b) 0.10V (c) 0.16V (d) 0.40 V
59. A 20491 cm^{-1} laser line was used to excite oxygen molecules (made of C^{16}O_2 only) to obtain the rotational Raman spectrum. The resulting rotational Raman spectrum of oxygen molecule has the first Stokes line at 20479 cm^{-1} . The rotational constant (usually denoted as B) for the oxygen molecule is _____ (cm^{-1}).
60. For a 3s-orbital, $\psi(3s) = \frac{1}{9\sqrt{3}} \left(\frac{1}{a_0} \right)^{3/2} (6 - 6x + 6x^2) e^{-x/2}$, where $x = \frac{2rz}{3a_0}$
 what is the maximum radial distance of node from the nucleus?
 (a) $\frac{(3 + \sqrt{3})a_0}{z}$ (b) $\frac{a_0}{z}$ (c) $\frac{3(3 + \sqrt{3})a_0}{2z}$ (d) $\frac{2a_0}{z}$
61. Match the following
 A. LASER. P. Raman spectra.
 B. Microwave frequency. Q. Mössbauer spectra.
 C. gama radiation. R. ESR Spectra
 D. X-ray. S. ESCA
 T. rotational spectra
 (a) A-S, B-T, C-R, D-Q (b) A-P, B-R, C-S, D-Q
 (c) A-P, B-R, C-Q, D-S (d) A-S, B-T, C-Q, D-P

62. Fixed volume of 0.1 M benzoic acid ($pK_a = 4.2$) is added to 0.2 M sodium benzoate solution and formed 300 mL, resultant buffer solution. If pH of this buffer solution is 4.5, then find added volume of benzoic acid is _____ (mL).
63. In a particular polarographic analysis of Cu^{+2} ion having concentration 10^{-4} M, gives diffusion current of $17.5 \mu A$. With the same experimental setup, diffusion current of $27.9 \mu A$ is measured for the unknown Cu^{+2} solution, then the unknown Cu^{+2} concentration is _____ (10^{-4} M).
64. When crystals of NaCl are heated in an atmosphere of sodium vapour, then yellow colour is imparted by the crystals of NaCl due to
- Creation of Schottky defect
 - Creation of Frenkel defect.
 - Creation of F-centres which causes energy absorption in visible region.
 - Creation of metal deficiency defect.
65. The wave function of a diatomic molecule has the form $\psi = c_1\phi_{\text{covalent}} + c_2\phi_{\text{ionic}}$. If out of several resonating structures of the diatomic molecule, the probability of existence of ionic form is 36%, then c_1 and c_2 are respectively:
- (a) 0.6 and 0.8 (b) 0.8 and 0.6 (c) 0.36 and 0.64 (d) 0.64 and 0.36



Space for rough work



CHEMISTRY - CY**GATE TEST SERIES-C**

Date: 25-01-2017

ANSWER KEY

- | | | | | |
|------------------|-------------|--------------|--------------|----------|
| 1. (d) | 2. (b) | 3. (d) | 4. (d) | 5. (b) |
| 6. (b) | 7. (b) | 8. (d) | 9. (c) | 10. (c) |
| 11. (c) | 12. (b) | 13. (c) | 14. (c) | 15. (d) |
| 16. (c) | 17. (b) | 18. (c) | 19. (c) | 20. (a) |
| 21. (b) | 22. (a) | 23. (c) | 24. (c) | 25. (b) |
| 26. (b) | 27. (d) | 28. (b) | 29. (d) | 30. (c) |
| 31. (c) | 32. (0.001) | 33. (b) | 34. (b) | 35. (60) |
| 36. (b) | 37. (c) | 38. (b) | 39. (c) | 40. (b) |
| 41. (a) | 42. (a) | 43. (c) | 44. (a) | 45. (c) |
| 46. (c) | 47. (a) | 48. (b) | 49. (c) | 50. (b) |
| 51. (b) | 52. (c) | 53. (c) | 54. (b) | 55. (a) |
| 56. (8.5 to 9.5) | 57. (a) | 58. (a) | 59. (1 to 2) | 60. (c) |
| 61. (c) | 62. (200) | 63. (1 to 2) | 64. (c) | 65. (b) |

