

P02-18

Academic Session: 2018-19

SET - 1

JEE PREPARATORY TEST-1 (JPT-1)
(JEE MAIN PATTERN)

Target : JEE (Main+Advanced) 2019

Date: 10-03-2019 | Duration: 3 Hours | Max. Marks: 360

COURSE CODE : JP, JF, JR, JCC, EP, EF, ER

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Please read the last page of this booklet for the instructions.

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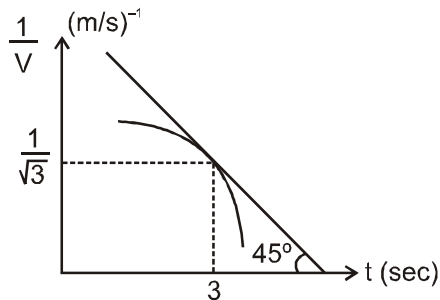
जब तक परीक्षक निर्देश नहीं दें तब तक प्रश्न पत्र की सील को नहीं खोलें।

PART – A

Straight Objective Type

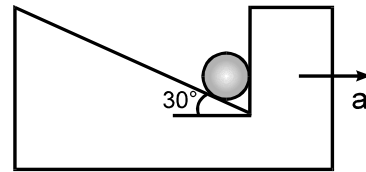
This section contains **30 multiple choice** questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

1. The graph shows the variation of $\frac{1}{V}$ (where V is the velocity of the particle) with respect to time. Then find the value of acceleration at $t = 3$ sec.

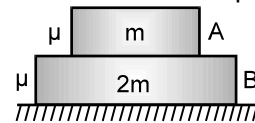


- (1) 3 m/s^2
 (2) 5 m/s^2
 (3) 1 m/s^2
 (4) None of these
2. To a stationary man, rain appears to be falling at an angle 30° with the vertical. As he starts moving with a speed of 0.5 m/s he finds that the rain is falling vertically. Then the speed of rain w.r.t. the moving man is :
- (1) 0.5 m/s
 (2) 1 m/s
 (3) $0.5\sqrt{3} \text{ m/s}$
 (4) $\sqrt{3} \text{ m/s}$

3. A heavy spherical ball is constrained in a frame as in figure. The inclined surface is smooth. The maximum acceleration with which the frame can move without causing the ball to leave the frame:



- (1) $\frac{g}{2}$ (2) $g\sqrt{3}$
 (3) $\frac{g}{\sqrt{3}}$ (4) $\frac{g}{\sqrt{2}}$
4. In the figure the block A of mass m is placed on the block B of mass $2m$. B rests on the floor. The co-efficient of friction between A and B as well as that between the floor and B is μ . Both blocks are given the same initial velocity to the right. The acceleration of A with respect to B is:



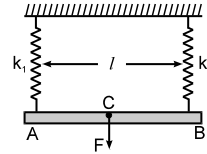
- (1) zero (2) μg to the left
 (3) μg to the right (4) $\frac{1}{2} \mu g$ to the left
5. A particle of mass m moves on the x -axis under the influence of a force of attraction towards the origin O given by $F = -\frac{k}{x^2} \hat{i}$. If the particle starts from rest at $x = a$, the speed it will attain to reach the distance ' x ' from origin:

- (1) $\sqrt{\frac{2k}{m} \left[\frac{a-x}{ax} \right]}^{1/2}$
 (2) $\sqrt{\frac{2k}{m} \left[\frac{a+x}{ax} \right]}^{-1/2}$
 (3) $\sqrt{\frac{k}{m} \left[\frac{ax}{a-x} \right]}$
 (4) $\sqrt{\frac{k}{2m} \left[\frac{a-x}{ax} \right]}^{1/2}$

Space for Rough Work

6. The velocity and acceleration vectors of a particle undergoing circular motion are $\vec{v} = 2\hat{i}$ m/s and $\vec{a} = 2\hat{i} + 4\hat{j}$ m/s² respectively at an instant of time. The radius of the circle is
- (1) 1m
 - (2) 2m
 - (3) 3m
 - (4) 4m
7. Two semicircular rings of linear mass densities λ and 2λ and of radius 'R' each are joined to form a complete ring. The distance of the center of the mass of complete ring from its geometrical centre is:
- (1) $\frac{3R}{8\pi}$
 - (2) $\frac{2R}{3\pi}$
 - (3) $\frac{3R}{4\pi}$
 - (4) none of these
8. Two identical particles of same mass, having velocities opposite to each other, equal in magnitude, collide head on. During collision 50% of kinetic energy is lost. Coefficient of restitution is :
- (1) $\frac{1}{\sqrt{2}}$
 - (2) $\frac{1}{2}$
 - (3) $\frac{2}{3}$
 - (4) $\frac{1}{4}$

9. Two light vertical springs with spring constants k_1 & k_2 and same natural lengths are separated by a distance ℓ . Their upper ends are fixed to the ceiling and their lower ends to the ends A and B of a light horizontal rod AB. A vertical downward force F is applied at point C on the rod. AB will remain horizontal in equilibrium if the distance AC is :



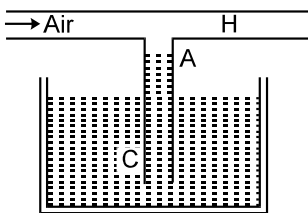
- (1) $\frac{\ell}{2}$
 - (2) $\frac{\ell k_1}{k_2 + k_1}$
 - (3) $\frac{\ell k_2}{k_1}$
 - (4) $\frac{\ell k_2}{k_1 + k_2}$
10. A thin and circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with an angular velocity ω . If the another disc of same dimensions but of mass M/4 is placed gently on the first disc co-axially, then the new angular velocity of the system is
- (1) $\frac{5}{4}\omega$
 - (2) $\frac{2}{3}\omega$
 - (3) $\frac{4}{5}\omega$
 - (4) $\frac{3}{2}\omega$

Space for Rough Work

11. Equation $F = -bv - kx$ represents equation of a damped oscillations for a particle of 2kg mass where $b = \ell n2 \frac{N.S.}{m}$ and $k = 100 \text{ N/m}$ then time after which energy of oscillations will be reduced to half of initial is:

- (1) $\ell n2 \text{ sec}$
- (2) 2 sec.
- (3) $2\ell n2 \text{ sec}$
- (4) 1 sec

12. Figure shows a capillary tube C dipped in a liquid that wets it. The liquid rises to a point A. If we blow air through the horizontal tube H, what will happen to the liquid column in the capillary tube?

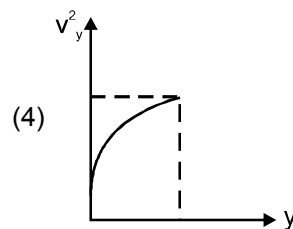
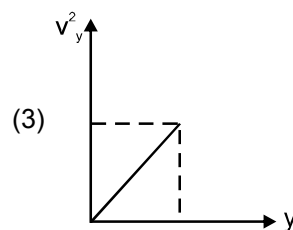
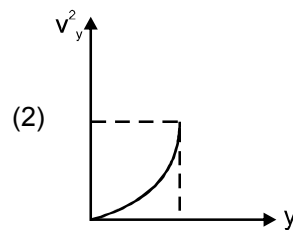
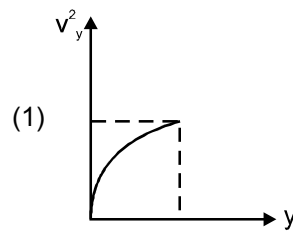
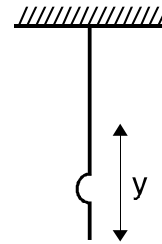


- (1) Level will rise above A
- (2) Level will fall below A
- (3) Level will remain at A
- (4) can not say

13. A vertical capillary tube with inner radius 0.5 mm, is submerged into water so that the length of its part above the water surface is $h = 25 \text{ mm}$. Radius of curvature of meniscus formed will be (surface tension of water = 0.075 N/m. Density of water = 10^3 kg/m^3 , angle of contact = 0°)

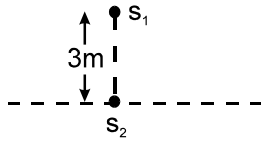
- (1) 0.5 mm
- (2) 0.6 mm
- (3) 0.7 mm
- (4) 0.8 mm

14. A non-uniform rope of length ℓ hangs from a ceiling. Mass per unit length of rope (μ) changes as $\mu = \mu_0 e^y$, where y is the distance along the string from its lowest point. Then graph between square of velocity of wave and y will be best represented as :

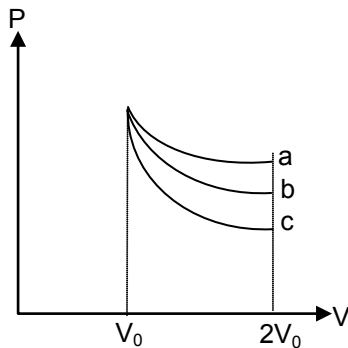


Space for Rough Work

15. S_1 & S_2 are two coherent sources of sound having no initial phase difference. The velocity of sound is 330 m/s. No minima will be formed on the line passing through S_2 and perpendicular to the line joining S_1 and S_2 , if the frequency of both the sources is :

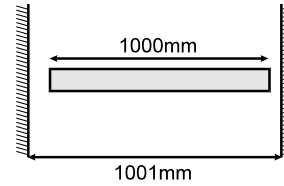


- (1) 50 Hz
 (2) 60 Hz
 (3) 70 Hz
 (4) 80 Hz
16. An ideal gas may expands from V_0 to $2V_0$ according to following three processes. Molar specific heat for processes b will be

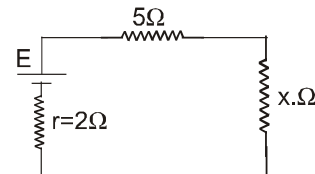


- (1) positive if a is isothermal and c is adiabatic processes
 (2) negative if a is isothermal and c is adiabatic processes
 (3) positive if c is isothermal and a is adiabatic processes
 (4) negative if c is isothermal and a is adiabatic processes

17. A rod of length 1000 mm and co-efficient of linear expansion $\alpha = 10^{-4}$ per degree is placed symmetrically between fixed walls separated by 1001 mm. The Young's modulus of the rod is 10^{11} N/m². If the temperature is increased by 20 °C, then the stress developed in the rod is (in N/m²):



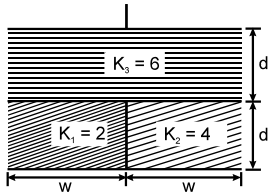
- (1) 10
 (2) 10^8
 (3) 2×10^8
 (4) cannot be calculated
18. Potential difference between centre and the surface of sphere of radius R and having uniform volume charge density ρ within it will be :
- (1) $\frac{\rho R^2}{6 \epsilon_0}$
 (2) $\frac{\rho R^2}{4 \epsilon_0}$
 (3) 0
 (4) $\frac{\rho R^2}{2 \epsilon_0}$
19. In the given circuit the power generated in 5Ω resistance will be maximum for 'x' equal to:



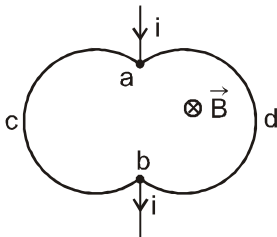
- (1) 1 Ω
 (2) 7 Ω
 (3) $2/3 \Omega$
 (4) 0 Ω

Space for Rough Work

20. A parallel plate capacitor of capacitance C (without dielectrics) is filled by dielectric slabs as shown in figure. Then the new capacitance of the capacitor is:

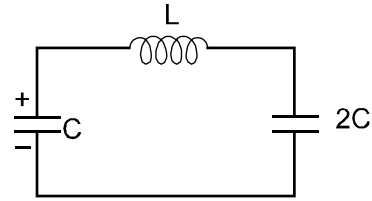


- (1) $3.9 C$
 (2) $4 C$
 (3) $2.4 C$
 (4) $3 C$
21. The figure shows a conducting loop abcda placed in plane perpendicular to a constant magnetic field B . The two parts acb and adb are circular arcs of radius a . The separation between the points a and b is l . The point a and b are connected to a battery which sends a current i . The magnetic force on the loop due to the field B is:

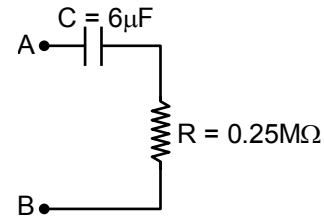


- (1) $il B$
 (2) $2il B$
 (3) zero
 (4) $2ia B$

22. In the circuit shown initial current is zero. Potential difference across 'C' is V and '2C' is uncharged initially. There is no resistance in the circuit. The maximum current in the circuit is :



- (1) $\sqrt{\frac{C}{L}} V$
 (2) $\sqrt{\frac{2C}{3L}} V$
 (3) $\sqrt{\frac{3C}{2L}} V$
 (4) $\sqrt{\frac{C}{2L}} V$
23. A time varying voltage is applied across A & B such that voltage across capacitor is given by $V_C = 3 \sin 2t$. What is maximum potential difference across the resistance ?



- (1) 3V
 (2) 6V
 (3) 9V
 (4) 18V
24. The wavefronts of light wave travelling in vacuum are given by $x + y + z = c$. The angle made by the direction of propagation of light with the X-axis is -
- (1) 0°
 (2) 45°
 (3) 90°
 (4) $\cos^{-1} (1/\sqrt{3})$

Space for Rough Work

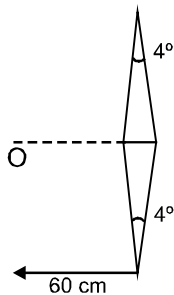
25. If 13.6 eV energy is required to ionize the hydrogen atom, then the energy required to remove an electron from $n = 2$ is :

- (1) 10.2 eV
- (2) 0 eV
- (3) 3.4 eV
- (4) 6.8 eV

26. The graph of $\ln(R/R_0)$ versus $\ln A$ (R =radius of a nucleus and A = its mass number) is

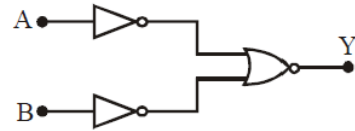
- (1) a straight line
- (2) a parabola
- (3) an ellipse
- (4) none of them

27. A point object is kept at a distance of 60 cm from the combination of two identical thin prisms (prism angle = 4° & refractive index = 1.5) as shown in figure. Distance between the two images formed by the combination is approximately:



- (1) $\frac{\pi}{3}$ cm
- (2) $\frac{2\pi}{3}$ cm
- (3) $\frac{4\pi}{3}$
- (4) $\frac{8\pi}{3}$ cm

28. Which logic gate is represented by the following combination of logic gates –



- (1) OR
- (2) NAND
- (3) AND
- (4) NOR

29. How many dark fringes will be produced on either side of central maxima if light of wave length $\lambda = 668$ nm is incident on single slit of width 4.17×10^{-6} m?

- (1) 2
- (2) 4
- (3) 6
- (4) 8

30. The output signal from an AM modulator is :

$$s(t) = 5 \cos(1800 \pi t) + 20 \cos(2000 \pi t) + 5 \cos(2200 \pi t)$$

The modulation index of modulated wave is

- (1) $\frac{1}{2}$
- (2) $\frac{1}{4}$
- (3) $\frac{1}{8}$
- (4) 4

Space for Rough Work

PART – B

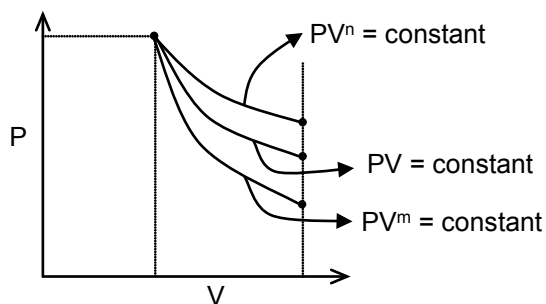
Atomic masses : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137, Hg = 200, Pb = 207]

Straight Objective Type

This section contains **30 multiple choice questions**.

Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

31. Given are P-V graphs for fixed moles of an Ideal gas :

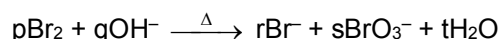


Then select correct option :

- (1) $n > 1$
- (2) $m < 1$
- (3) $n = m$
- (4) $n < m$

32. The high oxidising power of fluorine is due to:
- (1) high electron affinity
 - (2) high heat of dissociation and low heat of hydration
 - (3) low heat of dissociation and high heat of hydration
 - (4) high heat of dissociation and high heat of hydration

33. Select the correct values of p, q, r, s and t in the following redox reaction :



	p	q	r	s	t
(1)	3	6	1	5	3
(2)	3	6	5	3	1
(3)	3	6	5	1	3
(4)	3	5	1	6	3

34. In the given processes complex formation occurs :

- (I) Cyanide process
- (II) Mond process
- (III) Photographic fixing process

Complexes formed in these methods are:

- | | (I) | (II) | (III) |
|-----|---------------------------------------|--|--|
| (1) | $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$ | $[\text{Ni}(\text{CO})_4]$ | $[\text{Ag}(\text{CN})_2]^-$ |
| (2) | $[\text{Ag}(\text{CN})_2]^-$ | $[\text{Ni}(\text{CO})_4]$ | $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ |
| (3) | $[\text{Ag}(\text{CN})_2]^-$ | $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ | $[\text{Ni}(\text{CO})_4]$ |
| (4) | $[\text{Cd}(\text{CN})_4]^{2-}$ | $[\text{Ni}(\text{CO})_4]$ | $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ |

Space for Rough Work

35. At what temperature does an aqueous solution containing 3×10^{23} molecules of a non-electrolyte in 250 g H_2O freeze? (Molal elevation constant of H_2O is $1.86^\circ C \text{ mol}^{-1} \text{ kg}$, $N_A = 6 \times 10^{23}$)
- (1) 273 K
 - (2) 269.28 K
 - (3) 271.14 K
 - (4) 270 K

36. Given $X \longrightarrow \text{product}$ (Taking 1st order reaction)

conc of X (mol/lit.)	0.01	0.0025
Time (min.)	0	40

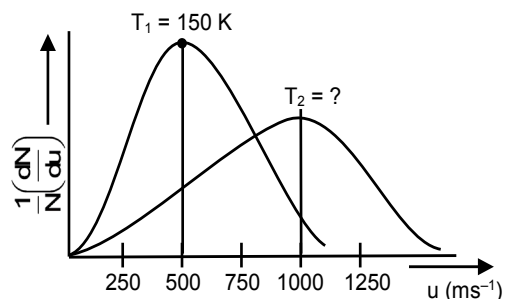
Half life period of this reaction is :

- (1) 0 min
 - (2) 20 min
 - (3) 40 min
 - (4) None of these
37. For the octahedral complex $[M_a x b_x c_x]$ total number of stereoisomers is (where a,b,c are monodentate ligands having achiral center and x is a natural number) :
- (1) 6
 - (2) 5
 - (3) 7
 - (4) None of these

38. To prepare a buffer of pH 8.26, amount of $(NH_4)_2SO_4$ to be added into 500 mL of 0.01 M NH_4OH solution is $[pK_a(NH_4^+) = 9.26]$:

- (1) 0.05 mol
- (2) 0.025 mol
- (3) 0.10 mol
- (4) 0.005 mol

39. The following diagram shows the Maxwell speed distribution curves for a certain ideal gas at two different temperatures (T_1 and T_2).



Temperature T_2 is :

- (1) 300 K
 - (2) 400 K
 - (3) 500 K
 - (4) 600 K
40. Cl_2 gas is obtained by following reactions :
- (I) $HCl + O_2 \xrightarrow{\Delta, CuCl_2}$
 - (II) $KMnO_4 + \text{conc. HCl} \xrightarrow{\Delta}$
 - (III) $NaOH + HCl \longrightarrow$
 - (IV) $NaCl + MnO_2 + \text{conc. H}_2\text{SO}_4 \xrightarrow{\Delta}$
- (1) I, II
 - (2) II, IV
 - (3) I, II, IV
 - (4) I, II, III

Space for Rough Work

41. Amongst the colloids gel (G), milk (M) and cloud (C), the correct combination of the dispersed phase and dispersion medium, respectively is :
- (1) G : liquid in solid; M : liquid in liquid;
C : liquid in gas
- (2) G : solid in liquid; M : liquid in liquid;
C : gas in solid
- (3) G : solid in liquid; M : solid in liquid;
C : solid in gas
- (4) G : liquid in solid; M : liquid in solid;
C : solid in gas
42. If the packing fraction in case of square sheet, hexagonal sheet and in simple cubic lattice (SCC) are $\frac{\pi}{a}$, $\frac{\sqrt{3}\pi}{b}$ and $\frac{\pi}{c}$ respectively then the value of $\frac{(a+b+c)}{2}$ is :
- (1) 8
- (2) 6
- (3) 4
- (4) 2
43. Which of the following properties is/are common amongst the oxy acids $\text{H}_2\text{S}_2\text{O}_7$, $\text{H}_4\text{P}_2\text{O}_5$ and $\text{H}_3\text{P}_3\text{O}_9$?
- (I) All have chain type open structure
- (II) All have X–O–X type linkage (X = central atom)
- (III) Central atom have it's highest oxidation state
- (IV) Atleast one X=O bond is present (X = central atom)
- (1) I, II
- (2) II, III, IV
- (3) II, IV
- (4) III, I V
44. The ore that contains both Mg and Ca is :
- (1) carnalite
- (2) copper pyrites
- (3) malachite
- (4) dolomite
45. When electric current is passed through an ionic hydride in the molten state :
- (1) Hydrogen is liberated at the anode.
- (2) Hydrogen is liberated at the cathode
- (3) no reaction takes place.
- (4) hydride ion migrates towards cathode.

Space for Rough Work

46. The density of 2 m-aqueous H_2O_2 solution is 1.068 gm/mL. Which of the following is/are correct concentration(s) of this solution, in different units ?

- (I) Molarity = 1 M
- (II) Volume strength = '22.4 V'
- (III) % (w/v) = 3.4 % (w/v)
- (IV) Mole-fraction of water = $\frac{250}{259}$

- (1) I, III
- (2) II, IV
- (3) I, II
- (4) I, II, III, IV

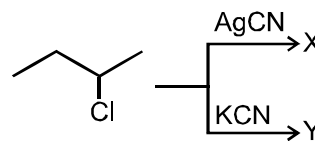
47. The conductivity of an aqueous solution of a weak monoprotic acid is $0.000032 \text{ ohm}^{-1}\text{cm}^{-1}$ at a concentration, 0.2 M. If at this concentration the degree of dissociation is 0.02, calculate the value of Λ_∞ (in $\text{ohm}^{-1} \text{ cm}^2$ /mol).

- (1) 6
- (2) 8
- (3) 2
- (4) 6

48. Cerium (Z = 58) is an important member of the lanthanide. Which of the following statement about cerium is incorrect?

- (1) The common oxidation state of cerium are +3 and +4
- (2) The +3 oxidation state of cerium is more stable than +4 oxidation state
- (3) The +4 oxidation state of cerium is not known in solution
- (4) Cerium (IV) acts as an oxidizing agent

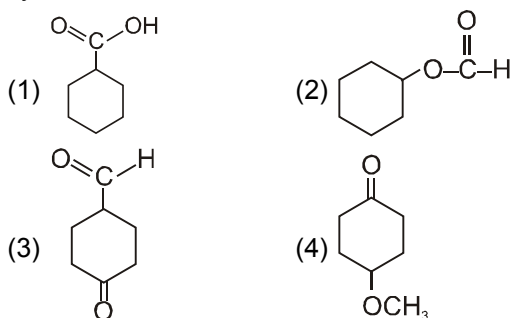
49. Major products X & Y are respectively ?



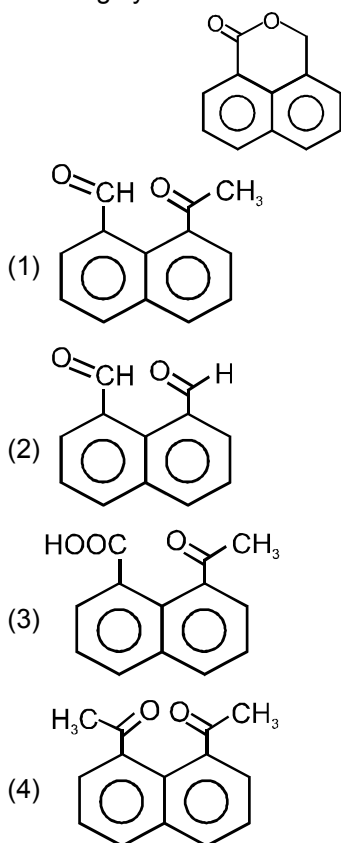
- (1) &
- (2) &
- (3) Both are
- (4) Both are

Space for Rough Work

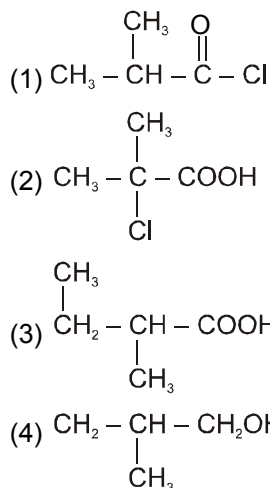
50. A compound M ($C_7H_{12}O_2$) has almost neutral solution in aqueous medium and is not reduced by H_2/Pd catalyst. On reduction by $LiAlH_4$, it gives two products one of which on dehydration by Alumina (Al_2O_3) heated gives cyclohexene. M is :



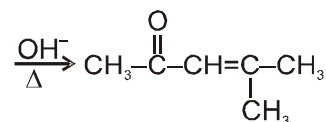
51. Which of the following compounds on reaction with conc. $NaOH$ followed by H^+ gives following cyclic ester.



52. In Hell-Volhard-Zelinsky reaction product obtained by 2-Methylpropanoic acid is:



53. $A(\text{Alcohol}) \xrightarrow[\Delta]{Cu} B(\text{Carbonyl compound})$

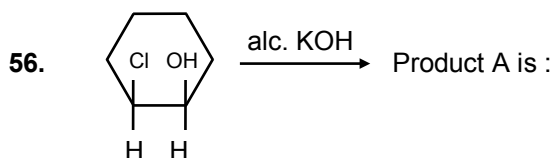


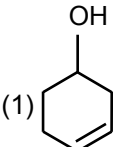
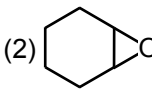
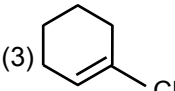
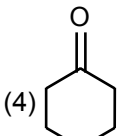
Alcohol A is :

- (1) Propan-1-ol
(2) Propan-2-ol
(3) 2-methylpentane-2,4-diol
(4) Butan-2-ol
54. In which of the following Cis isomer is more stable than tran isomer :
- $X - CH = CH - X$
- (1) $-X = -CH_3$
(2) $-X = -COOH$
(3) $-X = -Ph$
(4) $-X = -C_2H_5$

Space for Rough Work

55. Which of the following is a popular anionic detergent :
- (1) Lauryl alcohol
 - (2) Stearic acid
 - (3) Cetyltrimethyl ammonium bromide
 - (4) Polyethyl glycol

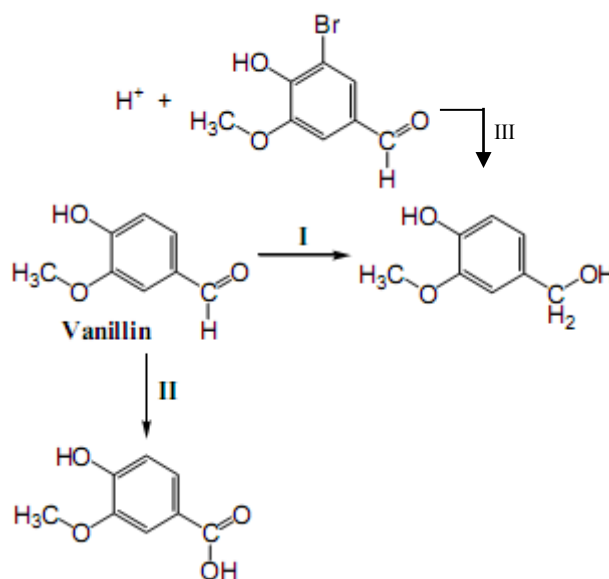


- (1) 
- (2) 
- (3) 
- (4) 

57. In methanol solution, bromine reacts with ethene to yield $\text{Br-CH}_2\text{CH}_2\text{OCH}_3$ and 1,2-dibromoethane because
- (1) The reaction is electrophilic substitution
 - (2) Methyl alcohol solvates the bromine
 - (3) The intermediate bromonium ion may react with Br^- or CH_3OH
 - (4) The reaction follows free radical mechanism.

58. Which of the following acid is a vitamin?
- (1) Aspartic acid
 - (2) Ascorbic acid
 - (3) Adipic acid
 - (4) Saccharic acid

59. Vanillin, the primary component of the extract of the vanilla bean, undergoes several chemical reactions as shown below :



Identify which type of reaction is taking place during steps I, II and III.

- | | I | II | III |
|-----|-----------|-----------|--------------|
| (1) | reduction | oxidation | substitution |
| (2) | oxidation | reduction | substitution |
| (3) | reduction | oxidation | elimination |
| (4) | reduction | oxidation | addition |

60. Select the correct option for the reactions in which benzene is formed :

- (1) $\text{PhMgBr} + \text{CH}_3\text{-C(=O)-O-CH}_2\text{-CH}_3 \longrightarrow$
- (2) $\text{PhMgBr} + \text{CH}_3\text{-C(=O)-NH-CH}_3 \longrightarrow$
- (3) $\text{PhMgBr} + \text{CH}_3\text{-C(=O)-Cl} \longrightarrow$
- (4) $\text{PhMgBr} + \text{CH}_3\text{-C(=O)-H} \longrightarrow$

Space for Rough Work

PART – C

Straight Objective Type

This section contains **30 multiple choice questions.**

Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** is correct.

61. If $\frac{5z_2}{7z_1}$ is a purely imaginary number, then

$\left| \frac{2z_1 + 3z_2}{2z_1 - 3z_2} \right|$ is equal to:

- (1) $\frac{5}{7}$
- (2) $\frac{7}{5}$
- (3) $\frac{25}{49}$
- (4) 1

62. In an A.P. $t_7 = 15$ then the value of common difference d that would make $t_2 t_7 t_{12}$ greatest is

- (1) 9
- (2) 18
- (3) 0
- (4) $\frac{9}{4}$

63. The value of x for which $\log_3(2^{1-x} + 3)$, $\log_9 4$ and $\log_{27}(2^x - 1)^3$ form an A. P. is

- (1) $\frac{11}{6}$
- (2) $\frac{6}{11}$
- (3) $\log_2 \left(\frac{11}{6} \right)$
- (4) 1

64. It is known that $\sum_{r=1}^{\infty} \frac{1}{(2r-1)^2} = \frac{\pi^2}{8}$, then $\sum_{r=1}^{\infty} \frac{1}{r^2}$

is equal to

- (1) $\frac{\pi^2}{24}$
- (2) $\frac{\pi^2}{3}$
- (3) $\frac{\pi^2}{6}$
- (4) $\frac{\pi^2}{12}$

65. The number of positive integer solutions of

$$x_1 x_2 x_3 x_4 = 630 \text{ is}$$

- (1) 96
- (2) 24
- (3) 48
- (4) 640

66. If the 6th term in the expansion of

$$\left(\frac{1}{x^{8/3}} + x^2 \log_{10} x \right)^8 \text{ is } 5600, \text{ then } x \text{ equals}$$

- (1) 1
- (2) $\log_e 10$
- (3) 10
- (4) x does not exist

Space for Rough Work

67. Out of 30 computers of a room, 20 contain windows, 8 contain monitors, 25 contain CR drives, 20 contain atleast two from above three components and 6 contain all three components. Number of these computers contain at least one component is a two digit number then sum of digit is equal
- (1) 3
 - (2) 6
 - (3) 9
 - (4) data inconsistent
68. If $\vec{u} = \vec{a} - \vec{b}$, $\vec{v} = \vec{a} + \vec{b}$ and $|\vec{a}| = |\vec{b}| = 2$, then $|\vec{u} \times \vec{v}|$ is:
- (1) $2\sqrt{16 - (\vec{a} \cdot \vec{b})^2}$
 - (2) $2\sqrt{4 - (\vec{a} \cdot \vec{b})^2}$
 - (3) $\sqrt{16 - (\vec{a} \cdot \vec{b})^2}$
 - (4) $\sqrt{4 - (\vec{a} \cdot \vec{b})^2}$
69. A variable point $\left(1 + \frac{\lambda}{\sqrt{2}}, 2 + \frac{\lambda}{\sqrt{2}}\right)$ lies in between two parallel lines $x + 2y = 1$ and $2x + 4y = 15$, then the range of λ is given by:
- (1) $0 < \lambda < \frac{5\sqrt{2}}{6}$
 - (2) $-\frac{4\sqrt{2}}{3} < \lambda < \frac{5\sqrt{2}}{6}$
 - (3) $-\frac{4\sqrt{2}}{5} < \lambda < 0$
 - (4) $0 < \lambda < \frac{2\sqrt{3}}{6}$
70. The lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ cut the coordinate axes in concyclic points, if
- (1) $a_1a_2 = b_1b_2$
 - (2) $a_1b_1 = a_2b_2$
 - (3) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$
 - (4) $a_1b_1 + a_2b_2 = 0$
71. The equation $(5x-1)^2 + (5y-2)^2 = (\lambda^2 - 2\lambda + 1)(3x + 4y - 1)^2$ represents an ellipse if $\lambda \in$
- (1) (0, 1)
 - (2) (0, 2)
 - (3) (1, 2)
 - (4) (-1, 0)
72. The general solution of $\cos^{25} x - \sin^{50} x = 1$ is
- (1) $n\pi$
 - (2) $2n\pi$
 - (3) $n\pi + \frac{\pi}{2}$
 - (4) $2n\pi + \frac{\pi}{2}$

Space for Rough Work

73. If $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$, then number of

values of x are

- (1) 1
- (2) 0
- (3) 2
- (4) 3

74. $\lim_{x \rightarrow \pi/2} \frac{\sin x - (\sin x)^{\sin x}}{1 - \sin x + \log \sin x} =$

- (1) 1
- (2) 2
- (3) 3
- (4) 0

75. Let $f(x) = \begin{cases} -\frac{1}{|x|} & \text{for } |x| \geq 1 \\ ax^2 - b & \text{for } |x| < 1 \end{cases}$. If $f(x)$ is

continuous and differentiable at every point, then:

- (1) $a = \frac{1}{2}, b = -\frac{3}{2}$
- (2) $a = \frac{1}{2}, b = \frac{3}{2}$
- (3) $a = 1, b = -1$
- (4) $a = 1, b = 2$

76. The minimum value of $\frac{a^2}{\cos^2 x} + \frac{b^2}{\sin^2 x}$

($ab \geq 0$)

- (1) $(a-b)^2$
- (2) $a^2 + b^2$
- (3) $(a+b)^2$
- (4) $a^2 - b^2$

77. $\int \sqrt{\frac{e^x - 1}{e^x + 1}} dx$ is equal to (where c is arbitrary constant)

- (1) $\log(e^x + \sqrt{e^{2x} - 1}) - \sec^{-1} e^x + c$
- (2) $\log(e^x + \sqrt{e^{2x} - 1}) + \sec^{-1} e^x + c$
- (3) $\log(e^x - \sqrt{e^{2x} - 1}) - \sec^{-1} e^x + c$
- (4) $\log(e^x - \sqrt{e^{2x} - 1}) + \sec^{-1} e^x + c$

78. $\int_{\log 1/2}^{\log 2} \sin\left(\frac{e^x - 1}{e^x + 1}\right) dx$ is equal to

- (1) $\cos \frac{1}{3}$
- (2) $\sin \frac{1}{2}$
- (3) $2 \cos 2$
- (4) 0

Space for Rough Work

79. Solution of differential equation $x dy (y^2 e^{xy} + e^{xy}) = y dx (e^{x/y} - y^2 e^{xy})$ is equal to
- (1) $e^{xy} = e^{y/x} + c$
- (2) $e^{x/y} + \frac{y}{x} = xy$
- (3) $xy = \log (e^{x/y} + c)$
- (4) $e^{xy} = \log (xy + c)$
80. If the probabilities that A and B will die within a year are p and q respectively, then the probability that only one of them will be alive at the end of the year is:
- (1) $p + q$
- (2) $p + q - 2pq$
- (3) $p + q - pq$
- (4) $p + q + pq$
81. Let $f_p(\beta) = \left(\cos \frac{\beta}{p^2} + i \sin \frac{\beta}{p^2} \right) \left(\cos \frac{2\beta}{p^2} + i \sin \frac{2\beta}{p^2} \right)$
..... $\left(\cos \frac{\beta}{p} + i \sin \frac{\beta}{p} \right)$ then $\lim_{n \rightarrow \infty} f_n(\pi) =$
- (1) i
- (2) $-i$
- (3) $2i$
- (4) $-2i$
82. Coefficient of variation of two distributions are 60% and 70% and their standard deviations are 21 and 16 respectively. What are their arithmetic means ?
- (1) 35, 22.85
- (2) 35, 22
- (3) 35.85, 22
- (4) 35, 24
83. The range of values of m for which the equation $(m - 5)x^2 + 2(m - 10)x + m + 10 = 0$ has real roots of the same sign, is given by:
- (1) $m \in (10, \infty)$
- (2) $m \in (-5, 5)$
- (3) $m \in (-\infty, -10) \cup (5, 6]$
- (4) $m \in (-\infty, -10) \cup (5, \infty)$
84. $\sqrt{x+3-4\sqrt{x-1}} + \sqrt{x+8-6\sqrt{x-1}} = 1$ has
- (1) no solution
- (2) one solution
- (3) two solutions
- (4) more than two solutions

Space for Rough Work

85. If the system of equations $x = a(y + z)$, $y = b(z + x)$, $z = c(x + y)$, ($a, b, c \neq -1$) has a non-zero solution, then the values of

$$\frac{a}{1+a} + \frac{b}{1+b} + \frac{c}{1+c} \text{ is}$$

- (1) 2
- (2) 1
- (3) 0
- (4) -1

86. If two different tangents of $y^2 = 4x$ are the normal to the parabola $x^2 = 4ay$, then:

(1) $|a| > \frac{1}{2\sqrt{2}}$

(2) $a \in \left(-\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}\right) - \{0\}$

(3) $|a| > \frac{1}{\sqrt{2}}$

(4) $a \in \left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) - \{0\}$

87. If p, q, r are statements, with truth values T, F, T respectively then the truth value of

$$(\sim p \vee q) \wedge \sim r \Rightarrow p \text{ is}$$

- (1) true
- (2) false
- (3) true if r is false
- (4) true if q is true

88. The curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ touches the straight line $\frac{x}{a} + \frac{y}{b} = 2$ at the point (a, b) then the value of n is

- (1) 2
- (2) 3
- (3) 4
- (4) any real number

89. $\int_0^{\pi^2/4} \frac{\sin\sqrt{x}}{\sqrt{x}} dx$ is equal to

- (1) 2
- (2) 1
- (3) $\frac{\pi}{4}$
- (4) $\frac{\pi^2}{8}$

90. If $\left(1 - \frac{r_1}{r_2}\right)\left(1 - \frac{r_1}{r_3}\right) = 2$, then the triangle is

(where r_1, r_2, r_3 are the radii of ex-circles of the given triangle is

- (1) Equilateral
- (2) Isosceles
- (3) Right angled
- (4) Right angled isosceles

Space for Rough Work

IMPORTANT INSTRUCTIONS**A. General :**

1. Immediately fill the particulars on this page of the Test Booklet with Blue / Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
3. The Test Booklet consists of **90** questions. The maximum marks are **360**.
4. There are three parts in the question paper **A, B, C** consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for correct response.
5. Candidates will be awarded marks as stated above in Instructions No. 4 for correct response of each question. **1/4 [one fourth (-1)]** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 5 above.

B. Filling the Top-half of the ORS :

Use only Black ball point pen only for filling the ORS. Do not use Gel / Ink / Felt pen as it might smudge the ORS.

7. Write your Roll no. in the boxes given at the top left corner of your ORS with black ball point pen. Also, darken the corresponding bubbles with Black ball point pen only. Also fill your roll no. on the back side of your ORS in the space provided (if the ORS is both side printed).
8. Fill your Paper Code as mentioned on the Test Paper and darken the corresponding bubble with Black ball point pen.
9. If student does not fill his/her roll no. and paper code correctly and properly, then his/her marks will not be displayed and 5 marks will be deducted (paper wise) from the total.
10. Since it is not possible to erase and correct pen filled bubble, you are advised to be extremely careful while darken the bubble corresponding to your answer.
11. Neither try to erase / rub / scratch the option nor make the Cross (X) mark on the option once filled. Do not scribble, smudge, cut, tear, or wrinkle the ORS. Do not put any stray marks or whitener anywhere on the ORS.
12. If there is any discrepancy between the written data and the bubbled data in your ORS, the bubbled data will be taken as final.

Name of the Candidate :

I have read all the instructions and shall abide by them

.....
Signature of the Candidate

Roll Number :

I have verified all the information filled by the candidate.

.....
Signature of the Invigilator

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