



TEST ID 011516

JEE (Main)

FULL TEST - 1

Time: 3 Hours

Maximum Marks: 360

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

INSTRUCTIONS

A. General:

- (i) The Test Booklet consists of **90** questions. The maximum marks are **360**.
- (ii) 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 weight age. Each question is allotted **4 (four)** marks for each correct response.
- (iii) Candidates will be awarded marks as stated above in instruction No. (ii) for correct response of each question, 1 (one) 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.
- (iv) There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction (iii) above.
- (v) Use Blue/Black Ball Point Pen only for writing particulars or any marking.
- (vi) Use of calculator is not allowed.
- (vii) Darken the circles in the space provided only.
- (viii) Use of white fluid or any other material which damages the answer sheet, is not permitted.

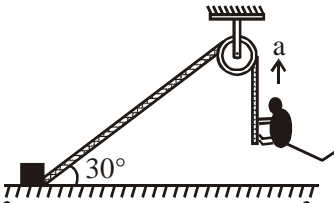
B. Filling the OMR SHEET:

Please read carefully the instructions printed on the OMR SHEET before marking your response.

PHYSICS

Choose the correct answer :

1. After one second the velocity of a projectile makes an angle of 45° with the horizontal. After another one second it is travelling horizontally. The magnitude of its initial velocity and angle of projection are ($g = 10 \text{ m/s}^2$)
 - (1) $14.62 \text{ m/s}, 60^\circ$
 - (2) $14.62 \text{ m/s}, \tan^{-1}(2)$
 - (3) $22.36 \text{ m/s}, \tan^{-1}(2)$
 - (4) $22.36 \text{ m/s}, 60^\circ$
2. A light string fixed at one end to a clamp on ground passes over a fixed pulley and hangs at the other side. It makes an angle of 30° with the ground. A monkey of mass 5 kg climbs up the rope. The clamp can tolerate a vertical force of 40 N only. The maximum acceleration in upward direction with which the monkey can climb safely is (Neglect friction and take $g = 10 \text{ m/s}^2$)



 - (1) 2 m/s^2
 - (2) 4 m/s^2
 - (3) 6 m/s^2
 - (4) 8 m/s^2
3. Force acting on a particle moving in a straight line varies with the velocity of the particle as $F = \frac{K}{v}$. Here K is a constant. The work done by this force in time t is
 - (1) $\frac{K}{v^2} \cdot t$
 - (2) $2Kt$
 - (3) Kt
 - (4) $\frac{2Kt}{v^2}$
4. Two equal and opposite forces act on a rigid body at a certain distance. Then
 - (1) The body is in equilibrium
 - (2) The body will rotate about its centre of mass
 - (3) The body may rotate about any point other than its centre of mass
 - (4) The body can not rotate about its centre of mass
5. A particle of mass 0.1 kg executes SHM under a force $F = (-10x)$ Newton. Speed of particle at mean position is 6 m/s . Then amplitude of oscillations is
 - (1) 0.6 m
 - (2) 0.2 m
 - (3) 0.4 m
 - (4) 0.1 m
6. A uniform rod of length L has a mass per unit length λ and area of cross-section A . The elongation in the rod is l due to its own weight of it is suspended from the ceiling of a room. The Young's modulus of the rod is
 - (1) $\frac{2\lambda g L^2}{A l}$
 - (2) $\frac{\lambda g L^2}{2A l}$
 - (3) $\frac{2\lambda g L}{A l}$
 - (4) $\frac{\lambda g L^2}{A L}$
7. The speed of sound wave in a gas, in which two waves of wavelengths 1.0 m and 1.02 m produce 6 beats per second is
 - (1) 350 m/s
 - (2) 306 m/s
 - (3) 380 m/s
 - (4) 410 m/s
8. P-V diagram of a diatomic gas is a straight line passing through origin. The molar heat capacity of the gas in the process will be
 - (1) $4R$
 - (2) $2.5R$
 - (3) $3R$
 - (4) $\frac{4R}{3}$
9. Match the following type

a. A quantity having same value for observers in different orientations of axis	(i) Particle
b. Area of sphere	(ii) object
c. Spinning cricket ball that turns shortly on hitting the ground	(iii) Scalar
d. A monkey sitting on the head of a man cycling steadily around a stadium	(iv) Vector

 - (1) a(iii), b(ii), c(iv), d(i)
 - (2) a(i), b(ii), c(iii), d(iv)
 - (3) a(iv), b(iii), c(ii), d(i)
 - (4) a(iii), b(iv), c(i), d(ii)

Sapce for Rough work

10. Match the following type

- a. A jet engine works on the principle of (i) lifting machines
- b. A pulley works on the principle of (ii) equal and opposite action and reaction
- c. A spring works on the principle of (iii) Kinetic friction compared to static friction
- d. A car starts in the first gear on the principle of (iv) conservation of linear momentum

(v) Conservation of angular momentum

- (1) a(i), b(ii), c(v), d(iv) (2) a(iv), b(iii), c(ii), d(i)
- (3) a(iv), b(i), c(ii), d(iii) (4) a(iii), b(ii), c(i), d(iv)

11. A point charge q is placed inside a conducting spherical shell of inner radius $2R$ and outer radius $3R$ at a distance of R from the centre of the shell. The electric potential

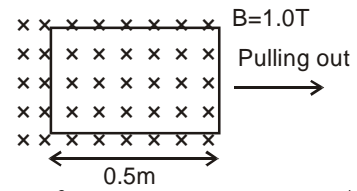
at the centre of shell will be $\frac{1}{4\pi\epsilon_0}$ times

- (1) $\frac{q}{2R}$ (2) $\frac{4q}{3R}$
- (3) $\frac{5q}{6R}$ (4) $\frac{2q}{3R}$

12. A current i_0 is flowing through an L-R circuit of time constant t_0 . The source of current is switched off at time $t = 0$. Let r be the value of $(-di/dt)$ at time $t = 0$. Assuming this rate to be constant, the current will reduce to zero in a time interval of

- (1) t_0 (2) et_0
- (3) $\frac{t_0}{e}$ (4) $\left(1 - \frac{1}{e}\right)t_0$

13. Figure shows a square loop of side 0.5m and resistance 10Ω . The magnetic field has a magnitude $B = 1.0\text{ T}$. The work done in pulling the loop out of the field slowly and uniformly in 2.0s is



- (1) $3.125 \times 10^{-3}\text{ J}$ (2) $6.25 \times 10^{-4}\text{ J}$
- (3) $1.25 \times 10^{-2}\text{ J}$ (4) $5.0 \times 10^{-4}\text{ J}$

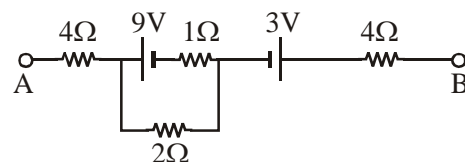
14. A hydrogen atom is in an excited state of principle quantum number n . It emits a photon of wavelength λ when returns to the ground state. The value of n is ($R = \text{Rydberg constant}$)

- (1) $\sqrt{\lambda R (\lambda R - 1)}$ (2) $\sqrt{\frac{(\lambda R - 1)}{\lambda R}}$
- (3) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$ (4) $\sqrt{\lambda (R - 1)}$

15. In a sample of a radioactive substance what fraction of the initial number of nuclei will remain undecayed after a time $t = \frac{T}{2}$, where $T = \text{half life of radioactive substance}$

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

16. In the circuit shown in figure potential difference between points A and B is 16V . The current passing through 2Ω resistance will be



- (1) 2.5A (2) 3.5A
- (3) 4.0A (4) Zero

17. Two identical glass ($\mu_g = 3/2$) equiconvex lenses of focal length f are kept in contact. The space between the two lenses is filled with water ($\mu_w = 4/3$). The focal length of the combination is

Sapce for Rough work

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

18. The maximum intensity in Young's double slit experiment is I_0 . Distance between the slits is $d = 5\lambda$, where λ is the wavelength of monochromatic light used in the experiment. What will be the intensity of light in front of one of the slits on a screen at a distance $D = 10d$?

- (1) $\frac{I_0}{2}$ (2) $\frac{3}{4}I_0$
 (3) I_0 (4) $\frac{I_0}{4}$

19. A: In case of non-uniform circular motion. The acceleration of body is in tangential direction.

R: Only the tangential acceleration can change the velocity in circular motion.

- (1) Both 'A' & 'R' correct
 (2) 'A' correct but 'B' incorrect
 (3) 'A' incorrect but 'A' correct
 (4) Both 'A' & 'R' incorrect

20. A: Mass and Energy are not conserved separately but are conserved as a single entity called "mass - energy".

R: This is because one can be obtained at the cost of other as per Einstein's equation.

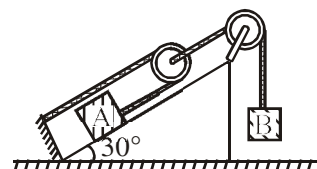
- (1) Both 'A' & 'R' correct
 (2) 'A' correct but 'B' incorrect
 (3) 'A' incorrect but 'A' correct
 (4) Both 'A' & 'R' incorrect

21. A very broad elevator is going up vertically with a constant acceleration of 2 m/s^2 . At the instant when its velocity is 4 m/s a ball is projected from the floor of the lift with a speed of 4 m/s relative to the floor at an elevation of 30° . The time taken by the ball to return

the floor is ($g = 10 \text{ m/s}^2$)

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

22. In the system shown in figure $m_B = 4 \text{ kg}$, and $m_A = 2 \text{ kg}$. The pulleys are massless and friction is absent everywhere. The acceleration of block A is ($g = 10 \text{ m/s}^2$)



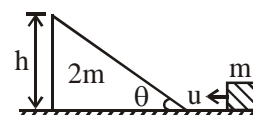
- (1) $10/3 \text{ m/s}^2$ (2) $20/3 \text{ m/s}^2$
 (3) 2 m/s^2 (4) 4 m/s^2

23. A particle moves on a rough horizontal ground with some initial velocity say v_0 . If $3/4^{\text{th}}$ of its kinetic energy is lost in friction in time t_0 . Then coefficient of friction between the particle and the ground is

- (1) $\frac{v_0}{2gt_0}$ (2) $\frac{v_0}{4gt_0}$
 (3) $\frac{3v_0}{4gt_0}$ (4) $\frac{v_0}{gt_0}$

24. A block of mass m is pushed towards a movable wedge of mass $2m$ and height h with a velocity u . All surfaces are smooth. The minimum value of u for which the block will reach the top of the wedge is

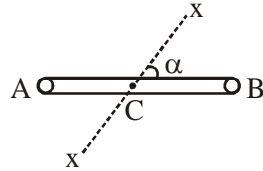
- (1) $2\sqrt{gh}$
 (2) $\sqrt{3gh}$
 (3) $\sqrt{6gh}$
 (4) $\sqrt{\frac{3}{2}gh}$



Sapce for Rough work

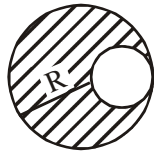
25. The moment of inertia of a uniform rod of length $2l$ and mass m about an axis xx passing through its centre and inclined at an angle α is

- (1) $\frac{ml^2}{3} \sin^2 \alpha$ (2) $\frac{ml^2}{12} \sin^2 \alpha$
 (3) $\frac{ml^2}{6} \cos^2 \alpha$
 (4) $\frac{ml^2}{2} \cos^2 \alpha$



26. A spherical hole is made in a solid sphere of radius R . The mass of the sphere before hollowing was M . The gravitational field at the centre of the hole due to the remaining mass is

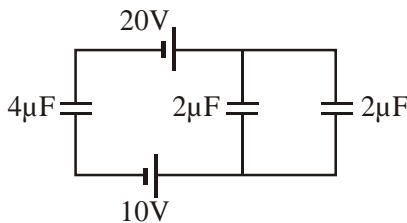
- (1) Zero
 (2) $\frac{GM}{8R^2}$
 (3) $\frac{GM}{2R^2}$ (4) $\frac{GM}{R^2}$



27. If 2 moles of an ideal monoatomic gas at temperature T_0 is mixed with 4 moles of another ideal monoatomic gas at temperature $2T_0$, then the temperature of the mixture is

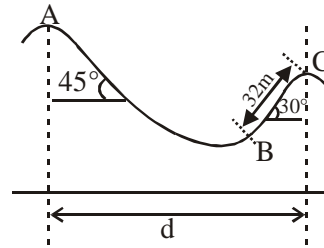
- (1) $\frac{5}{3}T_0$ (2) $\frac{3}{2}T_0$
 (3) $\frac{4}{3}T_0$ (4) $\frac{5}{4}T_0$

28. In the circuit shown in figure charge stored in $4\mu F$ capacitor is



- (1) $20 \mu C$ (2) $40 \mu C$
 (3) $10 \mu C$ (4) $120 \mu C$

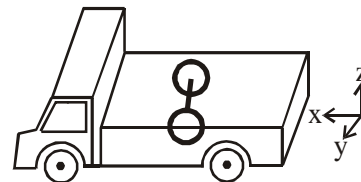
29. Ski jumpers are trained to bear the risks involved in this daring snow sport. Special tracks are developed to increase the difficulty angle. The expertise of the ski jumper, friction between his ski and snow etc. are important factors to be considered. Work-energy principle can be used to solve problems associated with this sport. A snow track consists of two peaks A and C having horizontal spacing d . Track from A has an inclination of 45° whereas the track from C has an inclination of 30° with horizontal.



A ski jumper of mass M starts from rest at A. His speed is 32 ms^{-1} at B. After covering 32 m his speed reduces to 25 ms^{-1} at C. The jumper attains some maximum height above the level of C. After leaving C, the jumper becomes a projectile. Work-energy principle can be used to find the friction μ_k between ski and snow. Coefficient of friction between ski and snow is

- (1) 0.751 (2) 0.517
 (3) 0.157 (4) 0.571

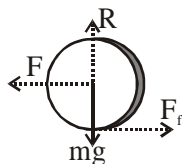
30. A truck is carrying two thin circular discs of mass m each and radius r joined by a rigid light rod of length



$2r$. The axis of rod is connecting the centres of two discs. This arrangement is kept on the rough floor of the trucks such that its axis is perpendicular to the direction of motion of the vehicle. The floor friction is sufficient to keep the object rolling without slipping.

Sapce for Rough work

Let the direction of motion of the truck be along x axis and the direction normal to it be taken as z axis. The truck accelerates with acceleration a . In the reference frame of the truck the forces acting on a disc are shown as below.



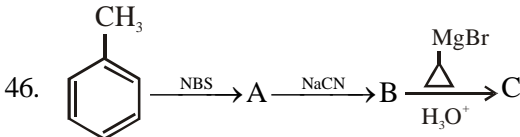
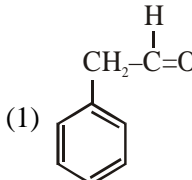
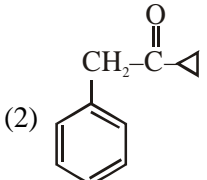
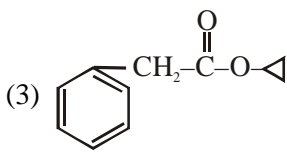
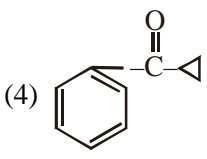
Here F is the pseudo force and F_f is the frictional force F is acting opposite to the direction of motion of the truck. Required torques due to friction are

- (1) $\frac{mar}{2}(-\hat{j} + \hat{k}), -\frac{mar}{2}(\hat{j} + \hat{k})$
- (2) $\frac{2}{3}mar(\hat{j} - \hat{k}), -\frac{2}{3}mar(\hat{j} + \hat{k})$
- (3) $\frac{Mar}{3}(-\hat{j} + \hat{k}), -\frac{Mar}{3}(\hat{j} + \hat{k})$
- (4) $\frac{3}{2}mar(\hat{j} + \hat{k}), -\frac{3}{2}mar(\hat{j} - \hat{k})$

CHEMISTRY

31. Which of the following is having a distorted shape?
 - (1) I_3^\ominus
 - (2) NO_2^\oplus
 - (3) ICl_2^\oplus
 - (4) XeF_2
32. The ratio of time taken to complete one revolution in 3rd orbit of Li^{2+} and 4th orbit of Be^{3+} is
 - (1) $\frac{1}{2}$
 - (2) $\frac{2}{3}$
 - (3) $\frac{3}{4}$
 - (4) $\frac{3}{2}$
33. For which of the following equilibrium $K_p = K_c$?
 - (1) $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$
 - (2) $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$
 - (3) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$
 - (4) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
34. Which of the following combination will show the common ion effect?
 - (1) $K_2SO_4 + Na_2SO_4$
 - (2) $H_2CO_3 + Na_2CO_3$
 - (3) $NaCl + KCl$
 - (4) $CH_3COONa + NaOH$
35. For which of the following salts, pH is independent of concentration?
 - (1) CH_3COONa
 - (2) NH_4Cl
 - (3) CH_3COONH_4
 - (4) $(NH_4)_2SO_4$
36. When ferrous oxalate is treated with acidified $KMnO_4$, then equivalent weight of ferrous oxalate is
 - (1) $\frac{M}{1}$
 - (2) $\frac{M}{2}$
 - (3) $\frac{M}{3}$
 - (4) $\frac{M}{4}$
37. For which of the following reaction concentration decreases linearly with time?
 - (1) First order
 - (2) Second order
 - (3) Third order
 - (4) Zero order

Sapce for Rough work

38. Which of the following electrolyte is having maximum value of \wedge_{eq} / \wedge_m ?
- (1) K_2SO_4 (2) $AlCl_3$
 (3) $Al_2(SO_4)_3$ (4) $Ba_3(PO_4)_2$
39. Which of the following reaction is having maximum value of $\Delta H - \Delta E$?
- (1) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
 (2) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
 (3) $N_2O_4(g) \rightarrow 2NO_2(g)$
 (4) $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$
40. In the antifluorite structure coordination no. of cations and anions are:
- (1) 8, 4 (2) 4, 8
 (3) 6, 6 (4) 4, 4
41. For a reaction when a graph was plotted between $\frac{1}{\text{concentration}}$ vs time then graph is linear with positive slope. If initial concentration is 2M and reaction is 40% complete in 20 minutes then value of rate constant is
- (1) 0.0165 lt/mole-min (2) 0.0165 lt/mole-sec
 (3) 0.03 lt/mole-sec (4) 0.05 lt/mole-sec
42. In a crystalline solid of cubic crystal system, particle C is packed in cubic closed packing arrangement, particle A is at tetrahedral voids and particle B is at octahedral voids. If a plane is passed through one of the face of cube and all particles lying on this plane are removed then simplest formula of solid is
- (1) $A_8B_4C_4$ (2) $A_8B_3C_3$
 (3) $A_8B_6C_6$ (4) $A_5B_2C_2$
43. By the electrolysis of $Ag_2SO_4(aq)$, 1.08 gm of Ag is obtained at cathode and entire Ag^+ is lost. If electrolysis is further continued for 9650 seconds by passing a current of 2 amp, then total equivalents of $O_2(g)$ obtained is
- (1) 0.15 (2) 0.21
 (3) 0.25 (4) 0.30
44. Which of the following combination is having maximum pH?
- (1) 100ml $\frac{M}{20}$ HCOOH + 60ml $\frac{M}{20}$ NaOH ($pK_a = 4$)
 (2) 50ml $\frac{M}{20}$ NH_4OH + 50ml $\frac{M}{20}$ HCl ($pK_b = 5$)
 (3) 60ml $\frac{M}{10}$ NH_4OH + 60ml $\frac{M}{10}$ NaOH ($pK_b = 5$)
 (4) 40ml $\frac{M}{10}$ CH_3COOH + 40ml $\frac{M}{10}$ NaOH ($pK_a = 5$)
45. For a solution of two volatile liquids, mole fraction of component A in vapour phase is 0.4 and vapour pressure in pure state of A and B are 100 mm and 200 mm, then mole fraction of two components in solution phase is
- (1) 0.5, 0.5 (2) 0.57, 0.43
 (3) 0.7, 0.3 (4) 0.3, 0.7
46. 
- In the above reaction sequence C is:
- (1)  (2) 
 (3)  (4) 

Sapce for Rough work

47. $C_2H_5 - O - \overset{O}{\parallel} C - O - C_2H_5 \xrightarrow{2CH_3MgBr} A$. Product A formed can

- (1) Give iodoform test
- (2) Further react with CH_3MgBr/H_3O^+ to give t-butyl alcohol
- (3) Be obtained by ozonolysis of 2,3-dimethyl-2-butene
- (4) All of these

48. $CH_3CH_2COOH \xrightarrow[\Delta]{NaNO_2 + conc. H_2SO_4} A$ by reaction R_1
 $\xrightarrow[\Delta]{Br_2/P} B$ by reaction R_2

Which of the following is correct?

	A	B	R_1	R_2
(1)	$CH_3CH_2CONH_2$	CH_3CH_2COBr	Schmidt	HVZ
(2)	$CH_3CH_2NH_2$	$CH_3CH(Br)COOH$	Schmidt	HVZ
(3)	$CH_3CH_2NH_2$	CH_3CH_2COBr	HVZ	Schmidt
(4)	CH_3CH_2COBr	$CH_3CH_2NH_2$	Schmidt	HVZ

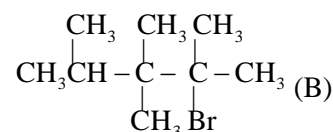
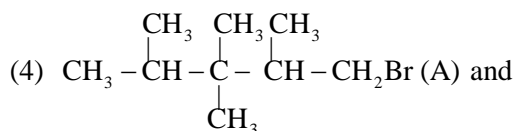
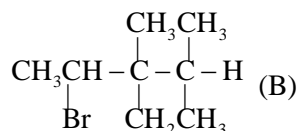
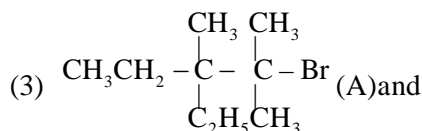
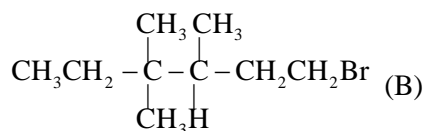
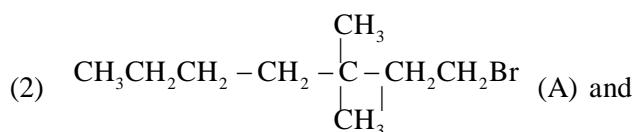
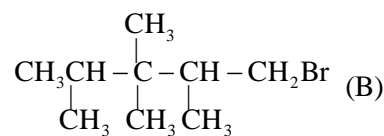
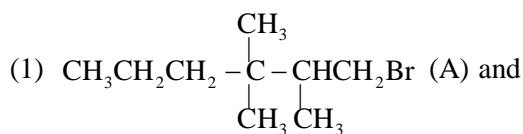
49. $CH_3 - \overset{CH_3}{\underset{CH_3}{|}} C - CH_2NH_2 \xrightarrow{HNO_2} A$ (major product) A

is

- (1) $CH_3 - \overset{CH_3}{\underset{OH}{|}} C - CH_2CH_3$
- (2) $CH_3 - \overset{CH_3}{\underset{CH_3}{|}} C - CH_2OH$
- (3) $CH_3 - \overset{CH_3}{\underset{CH_3}{|}} C - CH = CH_2$
- (4) $CH_3 - \overset{CH_3}{\underset{CH_3}{|}} C - CH_2N_2$

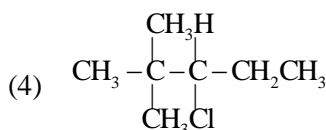
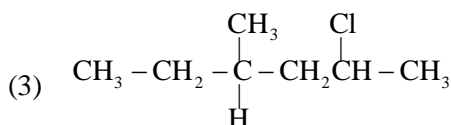
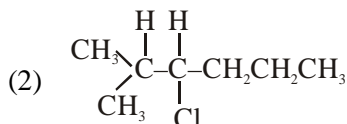
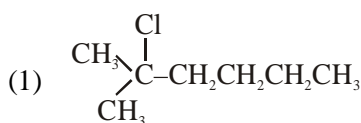
50. Compound A and B are isomers of molecular formula $C_9H_{19}Br$. Both yield same alkene C on elimination by treating with potassium tert-butoxide in DMSO. Hydrogenation of alkene C gives 2, 3, 3, 4 tetramethyl

pentane. The structure of A and B is

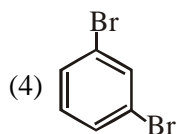
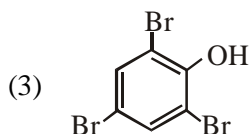
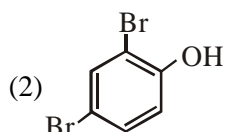
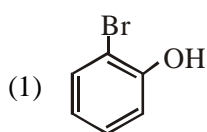


Sapce for Rough work

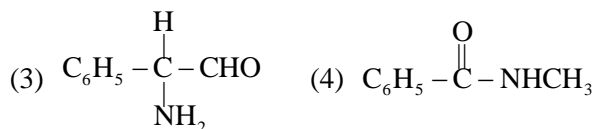
51. An ester has a molecular weight of 102. On aqueous hydrolysis it produces a monobasic acid and an alcohol. 0.185 gm of acid produced completely neutralises 25 ml of 0.1 N NaOH. Structural formula of ester is:
- (1) HCOOC_2H_5
 - (2) $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$
 - (3) $\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$
 - (4) $\text{HCOOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
52. An organic compound (A) $\text{C}_7\text{H}_{15}\text{Cl}$ on treatment with alc. KOH gives a hydrocarbon (B) C_7H_{14} . (B) on treatment with ozone and subsequent hydrolysis gives acetone and butyraldehyde. Structure of A is



53. A phenolic compound (A) $\text{C}_7\text{H}_8\text{O}_2$ on mild oxidation gives a highly volatile oil (B). (A) forms (C) on reaction with dimethylsulphate in alkali. Oxidation of (C) with hot KMnO_4 gives (D) which when reacts with bromine water gives (E) containing 72% bromine. Identify structure of (E)



54. A compound (A) having molecular formula $\text{C}_8\text{H}_9\text{ON}$ on hydrolysis with NaOH gives two products (B) and (C). Compound C on heating with soda lime gives methane. Compound (B) on diazotisation followed by treatment with boiling water gives $\text{C}_6\text{H}_5\text{OH}$. Structure of A is
- (1) $\text{C}_6\text{H}_5\text{-COCH}_2\text{NH}_2$
 - (2) $\text{C}_6\text{H}_5\text{NHCOCH}_3$



55. In the following reaction $\text{A} + 2\text{B} + \text{H}_2\text{O} \rightarrow \text{C} + 2\text{D}$



Identify D.

- (1) H_2SO_5
- (2) H_2SO_4
- (3) $\text{H}_2\text{S}_2\text{O}_8$
- (4) $\text{H}_2\text{S}_2\text{O}_8$

56. An inorganic halide (A) reacts with water to form two acids (B) and (C). (A) also react with NaOH to form two salts (D) and (E) which remain in the solution. The solution gives white precipitate with both AgNO_3 and BaCl_2 solutions. Identify A

- (1) CaCl_2
- (2) SO_2Cl_2
- (3) MgCl_2
- (4) KCl

57. Among the following, which is not the π -bonded organometallic compound

- (1) $(\text{CH}_3)_4\text{Sn}$
- (2) $\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2$
- (3) $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2$
- (4) $\text{K}[\text{PtCl}_3(\eta^2\text{-C}_2\text{H}_4)]$

58. A white substance when heated in a test tube produced a colourless, odourless gas leaving a residue. Residue was dissolved in dil. HCl, made alkaline with NH_4Cl and NH_4OH and H_2S gas passed through it. A white ppt was obtained. Precipitate is of

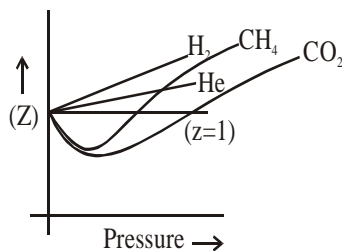
- (1) CuS
- (2) PbS
- (3) ZnS
- (4) Ag_2S

Sapce for Rough work

59. Fe_3O_4 is a non-stoichiometric compound. It is obtained from FeO by replacing $\frac{2}{3}$ rd of Fe^{2+} from lattice of FeO by Fe^{3+} . Remaining Fe^{2+} and 50% of Fe^{3+} goes to octahedral void and remaining 50% of Fe^{3+} goes to tetrahedral void. Thus Fe_3O_4 is having a inverse spinel structure. Now answer the following question

No. of oxides ions in one unit cell is

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



When a gas is highly compressible then

- (1) $Z > 1$ (2) $Z < 1$
(3) $Z = 1$ (4) $Z = \infty$

60. Compressibility factor $\left(Z = \frac{PV}{nRT} \right)$ is a measure of extent of deviation shown by any real gas from ideal behaviour. It depends upon nature of gas taken and condition of pressure and temperature. Following are the plots of compressibility factor (z) vs. pressure for some gases

MATHEMATICS

61. Let $f(x) = \frac{4^x}{4^x + 2}$. Then value of $f(x) + f(1-x)$ equals

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

62. The solution of the differential equation

$$y' = \frac{y}{x} + \frac{\phi(y/x)}{\phi'(y/x)} \text{ is}$$

- (1) $x\phi\left(\frac{y}{x}\right) = k$ (2) $\phi\left(\frac{y}{x}\right) = kx$
(3) $y\phi\left(\frac{y}{x}\right) = k$ (4) $\phi\left(\frac{y}{x}\right) = ky$

63. The sum of the series

$$\frac{a-b}{a} + \frac{1}{2}\left(\frac{a-b}{a}\right)^2 + \frac{1}{3}\left(\frac{a-b}{a}\right)^3 + \dots \text{ upto infinity is}$$

- (1) 1 (2) -1
(3) $\log_e\left(\frac{a}{b}\right)$ (4) $\log_e\left(\frac{b}{a}\right)$

64. The sum of the series

$$\log_4 2 - \log_8 2 + \log_{16} 2 - \dots \text{ is}$$

- (1) e^2 (2) $\log_e 2 + 1$
(3) $\log_e 3 - 2$ (4) $1 - \log_e 2$

65. Let $R = \{(3,3), (6,6), (9,9), (12,12), (6,12), (3,9), (3,12), (3,6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. The relation is

Sapce for Rough work

- (1) Reflexive and transitive only
 (2) Reflexive only
 (3) An equivalence relation
 (4) Reflexive and symmetric only
66. The median of a set of observation is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set is
 (1) Remains the same as that of the original set
 (2) Is increased by 2
 (3) Is decreased by 2
 (4) Is two times the original median
67. The position vector of the centre of the circle $|\vec{r}| = 5, \vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 3\sqrt{3}$ is
 (1) $\hat{i} + \hat{j} + \hat{k}$ (2) $3(\hat{i} + \hat{j} + \hat{k})$
 (3) $\sqrt{3}(\hat{i} + \hat{j} + \hat{k})$ (4) None of these
68. If $w = \frac{z}{z - \frac{i}{3}}$ and $|w| = 1$, then z lies on
 (1) An ellipse (2) A circle
 (3) A straight line (4) A parabola
69. If a, b, c are in G.P. and the equations $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ have a common root then $\frac{d}{a}, \frac{e}{b}, \frac{f}{c}$ are in
 (1) A.P. (2) G.P.
 (3) H.P. (4) None of these
70. If the coefficients of $r^{\text{th}}, (r+1)^{\text{th}}$ and $(r+2)^{\text{th}}$ terms in the binomial expansion of $(1+y)^m$ are in A.P., then m and r satisfy the equation
 (1) $m^2 - m(4r - 1) + 4r^2 - 2 = 0$
 (2) $m^2 - m(4r + 1) + 4r^2 + 2 = 0$
 (3) $m^2 - m(4r + 1) + 4r^2 - 2 = 0$
 (4) $m^2 - m(4r - 1) + 4r^2 + 2 = 0$
71. If A and B are symmetric matrices, then $AB - BA$ is a
 (1) Symmetric matrix (2) Skew-symmetric matrix
 (3) Diagonal matrix (4) Null matrix
72. Three ladies have each brought their one child for admission to a school. The principal wants to interview the six persons one by one subject to the condition that no mother is interviewed before her child. The number of ways in which interviews can be arranged is
 (1) 6 (2) 36
 (3) 72 (4) 90
73. The value of $\sin^{-1}(\sin 10)$ equals
 (1) 10 (2) $3\pi - 10$
 (3) $10 - 3\pi$ (4) $3\pi + 10$
74. The co-ordinates of the extremities of a diagonal of a square are (a, 0) and (0, b). The coordinates of the extremities of the other diagonal are
 (1) (0, 0) and (a, b)
 (2) $\left(\frac{a+b}{2}, \frac{a-b}{2}\right)$ and $\left(\frac{a-b}{2}, \frac{a+b}{2}\right)$
 (3) $\left(\frac{a+b}{2}, \frac{a+b}{2}\right)$ and $\left(\frac{a-b}{2}, \frac{b-a}{2}\right)$
 (4) None of these
75. The plane $2x - y + 3z + 5 = 0$ is rotated through 90° about its line of intersection with the plane $5x - 4y + 2z + 1 = 0$. The equation of the plane in the new position is
 (1) $6x - 9y - 29z - 31 = 0$
 (2) $27x - 24y - 26z - 13 = 0$
 (3) $43x - 32y - 2z + 27 = 0$
 (4) $26x - 43y - 151z - 165 = 0$
76. Given a function g which has derivative $g'(x)$ for all x satisfying $g'(0) = 2$ and $g(x+y) = e^y g(x) + e^x g(y)$ for all $x, y \in \mathbb{R}$. If $g'(x) = g(x) + ce^x$, for all x, then
 (1) -1 (2) 1
 (3) 2 (4) $\frac{1}{2}$

Sapce for Rough work

77. If a random variable X follows Poisson's distribution such that $P(X=2) = 9P(X=4) + 90P(X=6)$. Then variance of X equals
- (1) $\frac{1}{2}$ (2) $\frac{1}{3}$
 (3) 1 (4) $\frac{1}{4}$
78. If the line of action of the resultant of two forces P and Q divide the angle between them in the ratio 1 : 2 then the magnitude of the resultant is
- (1) $\frac{P^2 + Q^2}{P}$ (2) $\frac{P^2 + Q^2}{Q}$
 (3) $\frac{P^2 - Q^2}{P}$ (4) $\frac{P^2 - Q^2}{Q}$
79. Let R_1 and R_2 respectively be the maximum ranges up and down an inclined plane and R be the maximum range on the horizontal plan then R_1, R, R_2 are in
- (1) H.P. (2) A.G.P.
 (3) A.P. (4) G.P.
80. The function $f(x) = \int_{-1}^x t(e^t - 1)(t-1)(t-2)^3(t-3)^5 dt$ has a local minium at
- (1) 0 (2) 1
 (3) 2 (4) $\frac{3}{2}$
81. The domain of the function $f(x) = \log_e(\sin(x-3)) + \sqrt{16-x^2}$ is
- (1) $[-4, 4]$
 (2) $[3, 4]$
 (3) $(3-2\pi, 3-\pi) \cup (3, 4]$
 (4) $(0, 3)$
82. If $\frac{d}{dx}(f(x)) = e^{-x}f(x) + e^xf(-x)$, then $f(x)$ is, (given $f(0)=0$) is
- (1) An even function (2) An odd function
 (3) Neither even nor odd (4) Can't say
83. Let $\vec{u} = \hat{i} + \hat{j}$; $\vec{v} = \hat{i} - \hat{j}$ and $\vec{w} = \hat{i} + 2\hat{j} + 3\hat{k}$. If \hat{n} is a unit vector such that $\vec{u} \cdot \hat{n} = 0$ and $\vec{v} \cdot \hat{n} = 0$. then $|\vec{w} \cdot \hat{n}|$ is equal to
- (1) 1 (2) 2
 (3) 3 (4) 0
84. In ΔABC , the maximum value of $\sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}$ is
- (1) 1 (2) $\frac{1}{2}$
 (3) $\frac{1}{4}$ (4) $\frac{1}{8}$
85. The value of the following limit $\lim_{n \rightarrow \infty} \left\{ \sin\left(\frac{\pi}{2n}\right) \sin\left(\frac{2\pi}{2n}\right) \sin\left(\frac{3\pi}{2n}\right) \dots \sin\left(\frac{(n-1)\pi}{2n}\right) \right\}^{\frac{1}{n}}$ is equal to
- (1) $\frac{\pi}{2}$ (2) $e^{\frac{4}{\pi}}$
 (3) $e^{\frac{2}{\pi}}$ (4) $\frac{1}{4}$
86. $\int_0^{2\pi} [|\sin x| + |\cos x|] dx$, where $[.]$ denotes the greatest integer function, is equal to
- (1) π (2) 2π
 (3) $\frac{\pi}{\sqrt{2}}$ (4) $\pi\sqrt{2}$
87. The point (x, y) is said to be a rational point if both x and y are rational numbers, The maximum number of rational points which lie on a circle with centre $(0, \sqrt{2})$ is

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

88. The equation of the common tangent touching the circle $(x - 3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the x-axis is

- (1) $\sqrt{3}y = 3x + 1$ (2) $\sqrt{3}y = -x - 1$
(3) $\sqrt{3}y = x + 3$ (4) $\sqrt{3}y = -3x - 1$

89. The points A, B and C represent the complex numbers $Z_1, Z_2, (1-i)Z_1 + iZ_2$ respectively on the complex plane. The triangle ABC is

- (1) Isosceles but not right angled
(2) Right angled but not isosceles
(3) Isosceles and right angled
(4) Equilateral

90. Given that $2a_0^2 < 15a$ and $a_0, a, b, c, d \in \mathbb{R}$, then the equation

$$x^5 - a_0x^4 + 3ax^3 + bx^2 + cx + d = 0 \text{ has}$$

- (1) All roots real
(2) One root real
(3) All roots imaginary
(4) At least one imaginary root

Sapce for Rough work