

# JEE-ADVANCED

## MODEL GRAND TEST PAPER - II

Time : 3 hrs ]

[Number of questions : 60

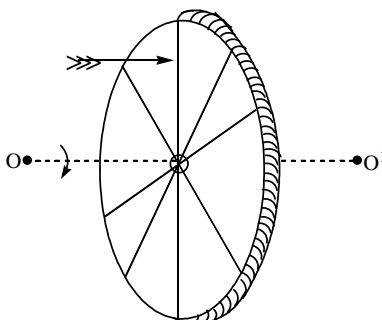
### PHYSICS

#### SECTION I

#### Single Correct Answer Type

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- Power of the only force acting on a particle of mass  $1\text{ kg}$  moving in straight line depends on its velocity as  $P = v^2$  where  $v$  is in  $\text{ms}^{-1}$  and  $P$  is in Watt. If initial velocity of the particle is  $1\text{ ms}^{-1}$ , then the displacement of the particle in ' $\ln 2$ ' seconds will be  
A)  $1\text{ m}$                       B)  $2\text{ m}$                       C)  $(\ln 2)^2\text{ m}$                       D)  $(\ln 2 - 1)\text{ m}$
- A wheel has eight equally spaced, very thin spokes of length  $30\text{ cm}$ . It is rotating about axis  $OO'$  which is perpendicular to its plane and passing through centre, with  $2.5\text{ rps}$ . We want to pass a  $20\text{ cm}$  long arrow parallel to the axis and without hitting any spoke. What should be the minimum velocity of the arrow? [Assumed as initially the arrow is just ready to pass]



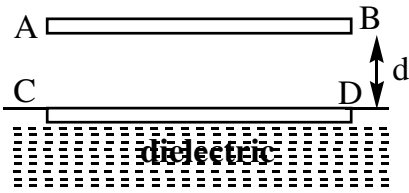
A)  $6\text{ ms}^{-1}$

B)  $5\text{ ms}^{-1}$

C)  $4\text{ ms}^{-1}$

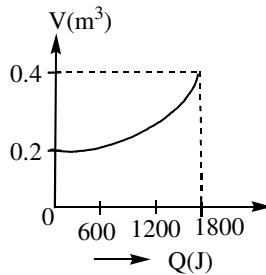
D)  $3\text{ ms}^{-1}$



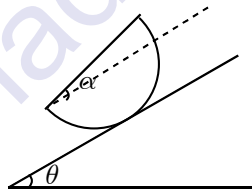


- A)  $\frac{\sigma^2(K^2 + 1)}{2\epsilon_0 \rho g K^2}$       B)  $\frac{\sigma^2(K^2 - 1)}{2\epsilon_0 \rho g K^2}$       C)  $\frac{\sigma^2}{2\epsilon_0 \rho g K}$       D)  $\frac{\sigma^2(K - 1)}{2\epsilon_0 \rho g K}$

7. 1 mole of an ideal gas undergoes an isothermal expansion as energy is added to it as heat  $Q$ . Graph shows the value  $V$  versus  $Q$ . The gas temperature is nearly equal to :



- A)  $353.8K$       B)  $312.6K$       C)  $268.2K$       D)  $208.4K$
8. A uniform thin hemispherical shell is kept static on an inclined plane of angle  $\theta = 30^\circ$  as shown. If the surface of the inclined plane is sufficiently rough to prevent sliding then the angle ' $\alpha$ ', made by the plane of hemisphere with inclined plane is



- A) value of ' $\mu$ ' is needed to calculate  $\alpha$       B)  $30^\circ$   
 C)  $45^\circ$       D)  $60^\circ$

## SECTION II

### Paragraph Type

**This section contains 6 multiple choice questions relating to three paragraphs with two questions on each paragraph. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.**

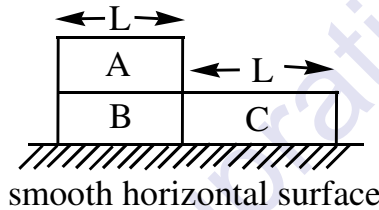
#### PARAGRAH – I:

A tank of height ' $H$ ' and base area ' $A$ ' is half filled with water and there is a very small orifice at the bottom and there is a heavy solid cylinder having base area  $\frac{A}{3}$  and height of the cylinder is same as that of the tank. The water is flowing out of the orifice. Here cylinder is put into the tank to increase the speed of water flowing out.

9. The speed of water flowing out of orifice after the cylinder is kept inside it
- A)  $\sqrt{\frac{gH}{2}}$       B)  $\sqrt{\frac{3gH}{2}}$       C)  $\sqrt{2gH}$       D)  $\sqrt{3gH}$
10. After long time, when the height of water inside the tank again becomes equal to  $\frac{H}{2}$ , the solid cylinder is taken out. Then the velocity of liquid flowing out of orifice (just after removing the cylinder) will be
- A)  $\sqrt{\frac{gH}{3}}$       B)  $\sqrt{\frac{3gH}{2}}$       C)  $\sqrt{2g\left(\frac{H}{3}\right)}$       D)  $\sqrt{2g\left(\frac{H}{2}\right)}$

**PARAGRAH – II :**

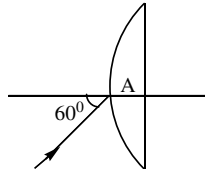
Three identical uniform blocks of mass 'm' each and length 'L' are placed on a smooth fixed horizontal surface as shown. There is friction between A and B while there is no friction between B and C. At the instant shown, the block A has horizontal velocity of magnitude u towards right where as speed of B and C is zero. At the instant block A has covered a distance L relative to block B, velocity of all blocks are same.



11. The speed of block A when it just loses contact with B is
- A)  $\frac{u}{2}$       B)  $\frac{u}{3}$       C)  $\frac{u}{4}$       D)  $\frac{2u}{3}$
12. The magnitude of total work done by friction on system of three block is
- A)  $\frac{1}{3}mu^2$       B)  $\frac{1}{4}mu^2$       C)  $\frac{2}{3}mu^2$       D)  $\frac{3}{4}mu^2$

**PARAGRAH – III :**

Figure shows a plane convex lens of refractive index  $\sqrt{3}$  placed in air. The maximum thickness of the lens is 3mm and its aperture diameter is 8mm. Point A lies on the curved surface on the principal axis. A light ray is incident at the point A as shown in the figure making  $60^\circ$  with the normal.



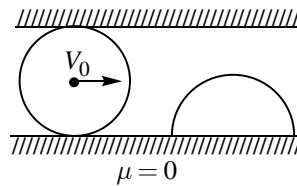
13. The lateral displacement of the light ray in passing through the lens is
- A) zero      B)  $\sqrt{3}mm$       C) 3mm      D)  $3\sqrt{3}mm$
14. The focal length of the lens if treated as a thin lens is
- A)  $\frac{5}{12}mm$       B)  $\frac{5}{24}mm$       C)  $\frac{25}{12}(\sqrt{3} + 1)mm$       D)  $\frac{5}{24}(\sqrt{3} + 1)mm$

SECTION III

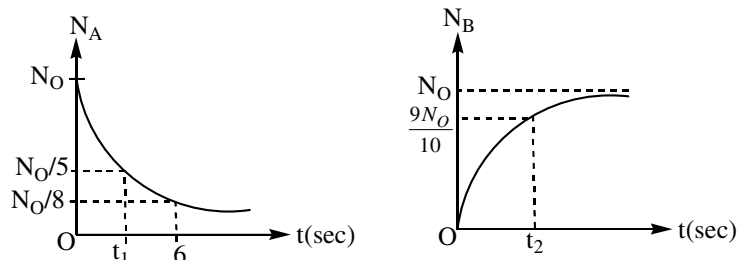
Multiple Correct Answer(s) Type

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE are correct.

15. A smooth hemisphere of mass  $m$  and radius  $R$  is at rest. A smooth solid sphere of mass  $2m$  and radius  $R$  moving with velocity  $V_0$  between two horizontal smooth surfaces separated by a distance slightly greater than  $2R$  as shown in figure. Solid sphere collides with the hemisphere. If coefficient of restitution is  $\frac{1}{2}$ , then



- A) The speed of hemisphere after collision is  $V_0$
- B) The speed of solid sphere after collision is  $\frac{V_0}{2}$
- C) The loss in kinetic energy of the system is  $\frac{mV_0^2}{4}$
- D) The final kinetic energy of hemisphere is  $\frac{1}{4}$ th the initial kinetic energy of the sphere
16. A car moves towards a hill with speed  $V_c$ . It blows a horn of frequency ' $f$ ' which is heard by an observer following the car with speed  $V_0$ . The speed of sound in air is ' $V$ '.
- A) The wavelength of sound reaching the hill is  $\frac{V}{f}$
- B) The wavelength of sound reaching the hill is  $\frac{V - V_c}{f}$
- C) The beat frequency observed by the observer is  $\frac{2V_c(V + V_0)f}{V^2 - V_c^2}$
- D) The wavelength of sound of horn directly reaching the observer is  $\frac{V + V_c}{f}$
17. In a decay process  $A$  decays to  $B$ ,  $A \rightarrow B$ . Two graphs of number of nuclei of  $A$  and  $B$  versus time is given then



- A)  $t_2 - t_1 = 4$  sec
- B)  $t_2 - t_1 = 2$  sec
- C)  $t_1 = 2 \log_2 5$  sec
- D)  $t_2 = \log_2 100$  sec



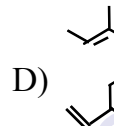
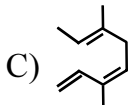
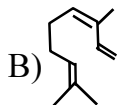
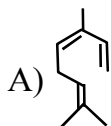
# CHEMISTRY

## SECTION I

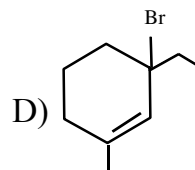
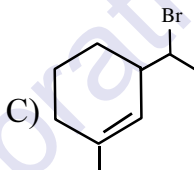
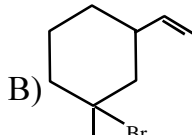
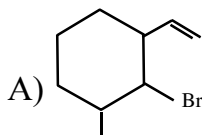
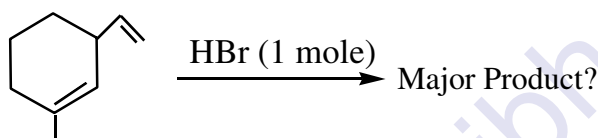
### Single Correct Answer Type

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

21. The terpene ocimene has the IUPAC name (3Z)-3,7-dimethyl-1,3,6-octatriene, what is the structural formula of this compound?



22. The major product formed upon addition of 1 mole of HBr is



23. Which of the following interstitial sites is formed when the three closed packed spheres of one layer is put on three close packed spheres of the second layers, their positions being inverted with respect to each other?

A) Tetrahedral

B) Rhombohedral

C) Octahedral

D) Cubic

24. Consider the following consecutive reactions:



The activation energy of reaction is given as

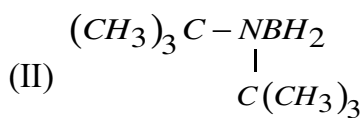
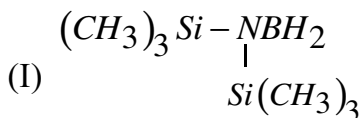
A)  $E_{a1}$

B)  $E_{a2}$

C)  $E_{a1} + E_{a2}$

D)  $E_{a1} + E_{a1}$

25. Compare  $\pi$  - bond strength between B and N in given two compounds :



A) There is no  $\pi$  -bond character between B and N

B) Same in I and II

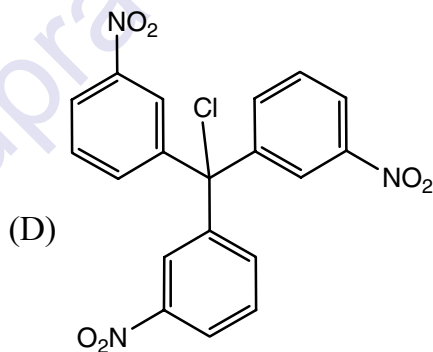
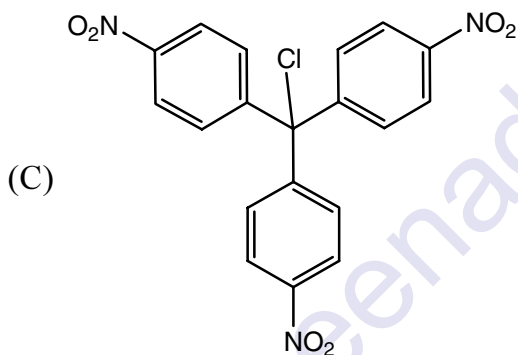
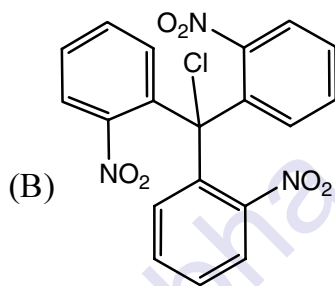
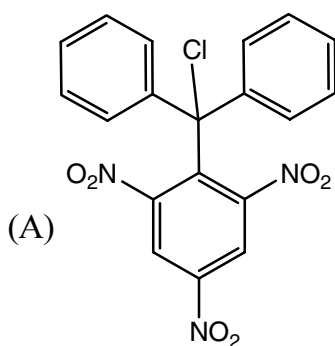
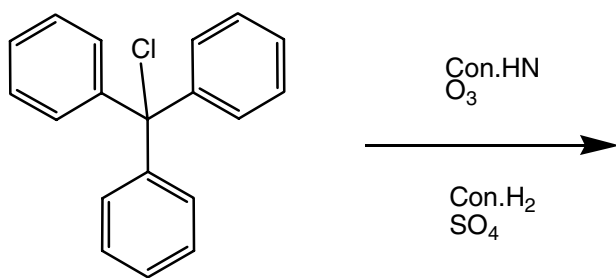
C) I > II

D) II > I

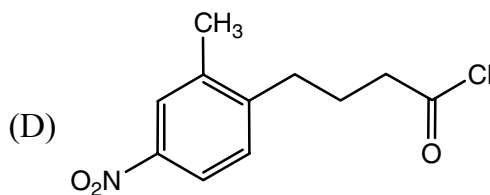
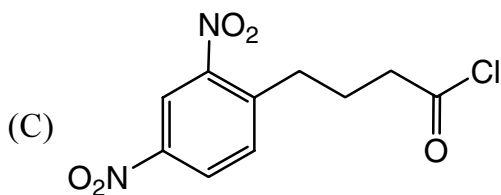
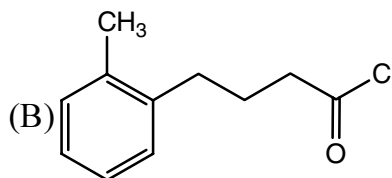
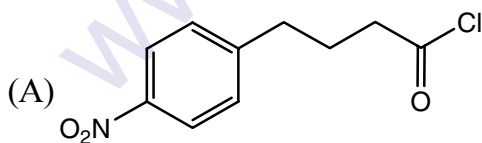




29. Major product of the following reaction is



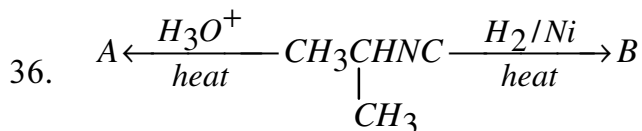
30. Which of the following compound forms a six membered ring most readily when treated with anhydrous  $\text{AlCl}_3$





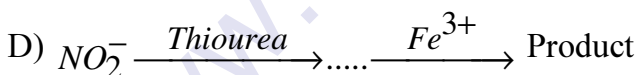
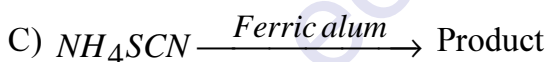
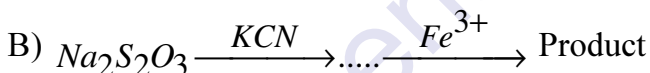
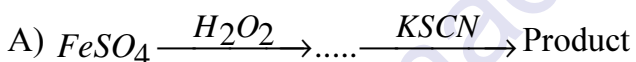
Which of the following statements are correct regarding Enovid.

- A) It liberate hydrogen gas on addition of sodium metal
- B) It reacts with ammonical  $AgNO_3$
- C) It can decolorise bromine solution
- D) It is  $\alpha, \beta$  - Unsaturated carbonyl compound

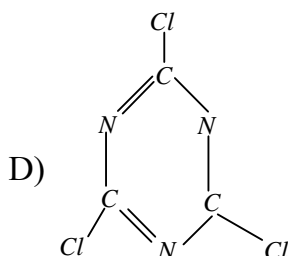
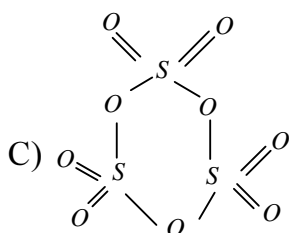
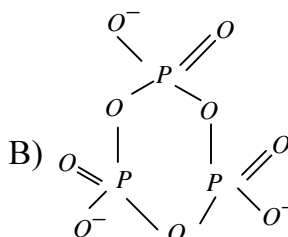
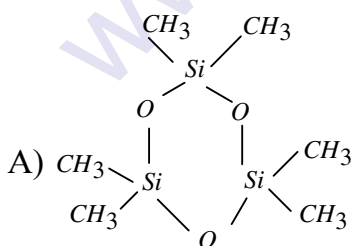


Products 'A' and 'B' can be distinguished by (A and B are Nitrogen containing products)

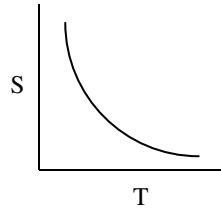
- A) the treatment of  $CHCl_3, ^-OH$  gives a foul smelling compound
  - B) the action of  $HNO_2$ ; A liberates  $N_2$  gas whilst B does not
  - C) the actions of  $CS_2, HgCl_2$ . B gives odour of mustard oil whilst A doesn't
  - D) the treatment of p-toluene sulphonyl chloiride; 'A' gives alkali soluble product
37. Which of the following statements are true
- A) All crystalline solids are isotropic
  - B)  $SF_6$  molecule has no net dipole moment.
  - C) Amorphous solids are super cooled liquids with high viscosity.
  - D) In crystals, short range order exists
38. In which reactions(s) blood red coloration is observed in product ?



39. Select compound which is / are isoelectronic



40. The Variation of solubility (S) of a salt  $A^+B^-_{(s)}$  in water with temperature (T) is given by the following graph then the correct statements is/are



- A) The solubility process is endothermic  
 B) The lattice energy of salt is less than the hydration energy of ions.  
 C) Solubility decreases with increase of temperature.  
 D) The salt may be  $NH_4Cl_{(s)}$

## MATHEMATICS

### SECTION I

#### Single Correct Answer Type

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

41. Let  $f(x) = x^3 + 3x^2 - 33x - 33 : x > 0$  and  $g$  be its inverse of  $f$ , then the value of ' $K$ ' such that  $Kg^1(2) = 1$  is  
 A) -36                                      B) 51                                      C) 72                                      D) 42
42.  $F$  is one of the foci of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  where  $AB$  is the major axis and  $CD$  is the minor axis and  $O$  is the centre of the ellipse. If  $OF = 6$  and the in-radius of  $\triangle OCF$  is 1, then the product of the lengths of  $AB$  and  $CD$  is  
 A) 60                                      B) 65                                      C) 70                                      D) 75
43. Let  $a_n = \int_0^{\frac{\pi}{2}} \frac{1 - \cos 2nx}{1 - \cos 2x} dx$  then the value of  $\begin{vmatrix} \frac{\pi}{2} & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$   
 A) 1                                      B) 2                                      C)  $\frac{\pi}{2}$                                       D) none
44. Radius of circle that passes through origin and touches the parabola  $y^2 = 4ax$  at the point  $(a, 2a)$  is  
 A)  $\frac{5}{\sqrt{2}}a$                                       B)  $2\sqrt{2}a$                                       C)  $\sqrt{\frac{5}{2}}a$                                       D)  $\frac{3}{\sqrt{2}}a$



52. Area of triangle  $OBC$  is ( $O$  is origin).

- A)  $\frac{580}{81}$                       B)  $\frac{290}{81}$                       C)  $\frac{290}{9}$                       D)  $\frac{88}{9}$

**PARAGRAPH – III :**

Let  $S = O$  be the equation of reflection of  $\frac{(x-4)^2}{16} + \frac{(y-3)^2}{9} = 1$  about the line  $x - y - 2 = 0$ .  $P$  is any point of  $S$ ,  $A$  and  $B$  are foci of  $S$ , then

53. Equation of minor axis of  $S$  is  
 A)  $y - 2 = 0$                       B)  $x - 5 = 0$                       C)  $x - 4 = 0$                       D)  $y - 3 = 0$
54. Locus of point of intersection of perpendicular tangents of  $S$  is  
 A)  $x^2 + y^2 + 10x - y - 4 = 0$                       B)  $x^2 + y^2 = 25$   
 C)  $x^2 + y^2 - 10x - 4y + 4 = 0$                       C)  $x^2 + y^2 - 10x - 4y = 0$

**SECTION III**

**Multiple Correct Answer(s) Type**

**This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE are correct.**

55. Let  $\vec{a}, \vec{b}, \vec{c}$  be three vectors such that  $\vec{a} \neq 0$  and  $\vec{a} \times \vec{b} = 2\vec{a} \times \vec{c}$ ,  $|\vec{a}| = |\vec{c}| = 1, |\vec{b}| = 4$  and  $|\vec{b} \times \vec{c}| = \sqrt{15}$ . If  $\vec{b} - 2\vec{c} = \lambda\vec{a}$  then value of  $|\lambda| =$   
 A) 4                      B) 3                      C) 2                      D) 1

56.  $f(x) = \lim_{t \rightarrow \infty} \frac{(a + \sin \pi x)^t - 1}{(a + \sin \pi x)^t + 1}, x \in (0, 6)$  then

- A) if  $a = 1$  then  $f(x)$  has five point of discontinuity  
 B) if  $a = 3$  then has no point of discontinuity  
 C) if then has six point of discontinuity  
 D) if then has four point of discontinuity

57. If  $A_i$  is the area bounded by  $|x - a_i| + |y| = b_i$ , where  $a_{i+1} = a_i + \frac{3}{2}b_i$  and  $b_{i+1} = \frac{b_i}{2}, a_1 = 0; b_1 = 32$  then

- A)  $A_3 = 128$                       B)  $A_3 = 256$   
 C)  $\lim_{n \rightarrow \infty} \sum_{i=1}^n A_i = \frac{8}{3}(32)^2$                       D)  $\lim_{n \rightarrow \infty} \sum_{i=1}^n A_i = \frac{4}{3}(16)^2$

58. If a, b, c are three consecutive integers then  $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$  is divisible by

- A) 36                      B) 144                      C) 48                      D) none

59. If  $px^2 + qx + r = 0$  has no real roots for real values p, q, r and  $4p + 2q + r > 0$  then

- A)  $r > 0$                       B)  $p + q + r > 0$                       C)  $p + q + r < 0$                       D)  $r \geq 0$

60. If  $I_n = \int_{-\pi}^{\pi} \frac{\sin(nx)}{(1 + \pi^x) \cdot \sin x} dx$ ,  $n = 0, 1, 2, \dots$  then

- A)  $I_n = I_{n+2}$                       B)  $\sum_{m=1}^{10} I_{2m+1} = 10\pi$                       C)  $\sum_{m=1}^{10} I_{2m} = 0$                       D)  $I_n = I_{n+1}$

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