

Set :- A

Name of the Student: Enrolment No: [12<sup>th</sup>]

IIT - JEE

Time :- 2 Hours

**General Instructions**

Full Marks :- 225

- 1 This question booklet contains 75 questions. Divided into three sections Section A, Section B and Section C.
  - 2 Each section contains 25 multiple choice questions as well as multiple choice question. Choose the most appropriate option.
  - 3 Each question carries 3 marks, for each correct answer the student will be awarded 3 marks, zero if not attempted and -1 in all other cases.
  - 4 The OMR will be graded by machine so do not fold or make any stray marks on the OMR sheet.
  - 5 The bubbles on the OMR sheet should be filled completely with black ball pen. Do not hard press the pen on the OMR sheet.
  - 6 Fill the required details in the OMR sheet. Incomplete OMR sheets will not be considered for evaluation.
1. इस प्रश्न पुस्तिका में 75 प्रश्न शामिल हैं। जो तीन खंडों खंड A, खंड B और खंड C में विभाजित हैं।
  2. प्रत्येक खंड में 25 प्रश्न शामिल हैं। केवल एक सही विकल्प और एक से अधिक बहुविकल्पीय प्रश्न शामिल हैं। सबसे उपयुक्त विकल्प चुनें।
  3. प्रत्येक प्रश्न के सही जबाब के लिए 3 अंक मिलेंगे, प्रश्न का हल नहीं करने पर शून्य अंक और गलत विकल्प के लिए -1 अंक मिलेंगे।
  4. OMR मशीन द्वारा मूल्यांकन किया जाएगा इसलिए OMR शीट पर किसी भी प्रकार का निशान या मोड़ नहीं बनाए।
  5. OMR शीट पर बने गोले काले बॉल पेन के साथ पूरी तरह से भरा जाना चाहिए। OMR शीट पर कलम से हार्ड प्रेस न करें।
  6. OMR शीट के दोनो पक्षों में आवश्यक फील्ड भरें। अधूरे OMR शीट का मूल्यांकन नहीं होगा।

**Deposit the Question Booklet and OMR sheet both to the invigilator.**

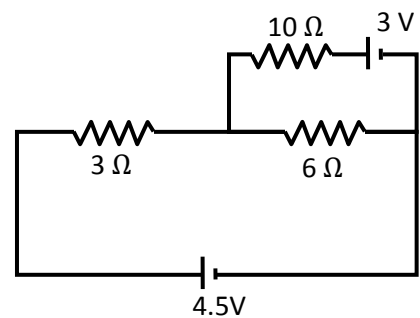
रिजल्ट व अन्य जानकारियाँ OMR शीट में भरे मोबाईल पर SMS से भेजी जाएगी।



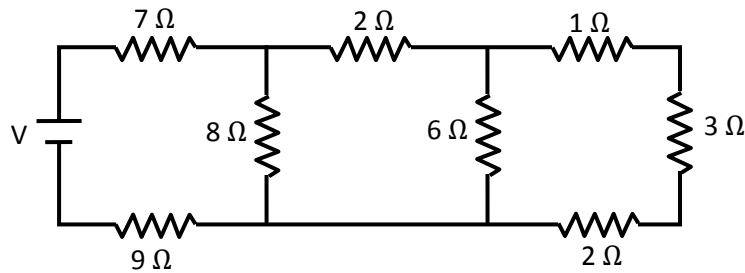
**SECTION – A**

1. The velocity of projection of a projectile is  $(6\hat{i} + 8\hat{j})$  m/sec. the horizontal range of the particle is ( $g=10$  m/sec<sup>2</sup>)  
 (a) 4.9 m                      (b) 9.6 m                      (c) 19.6 m                      (d) 14 m
2. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. if the acceleration of the truck is 5 m/sec<sup>2</sup>, the frictional force acting on the block is  
 (a) 5 N                      (b) 6 N                      (c) 10 N                      (d) 15 N
3. The kinetic energy of a body of mass 2 kg and momentum of 2 Ns is  
 (a) 1 J                      (b) 2 J                      (c) 3 J                      (d) 4 J
4. Let  $a_r$  and  $a_t$ , represent radial and tangential acc<sup>n</sup>. the motion a particle may be circular if  
 (a)  $a_r = 0, a_t = 0$                       (b)  $a_r = 0, a_t \neq 0$                       (c)  $a_r \neq 0, a_t = 0$                       (d) none of these
5. 2 masses 1 g and 4 g are moving with equal K.E. the ratio of the magnitude of their linear momentum is  
 (a) 1 : 1                      (b) 1 : 2                      (c) 1 : 3                      (d) 1 : 4
6. There are particles of same mass. If one of the particles is at rest always and the other has an acceleration  $\vec{a}$ . Acceleration of centre of mass is  
 (a) zero                      (b)  $1/2 \vec{a}$   
 (c)  $\vec{a}$                       (d) centre of mass for such a system can not be defined
7. The moment of inertia (I) for a uniform circular disc is  
 (a)  $MR^2$                       (b)  $MR^2/4$                       (c)  $MR^2/2$                       (d)  $3/2 MR^2$
8. A constant torque acting on a uniform circular what changes its angular momentum from  $A_0$  to  $4 A_0$  in 4 sec. the magnitude of this torque is  
 (a)  $4 A_0$                       (b)  $A_0$                       (c)  $12 A_0$                       (d)  $3 A_0/4$

9. In absence of external forces on a rigid system, which of the following quantities must remain constant?  
 (a) Angular momentum (b) positive vector  
 (c) both (a) and (b) (d) none of these
10. The centre of a disc rolling without slipping on a plane moves with a speed  $v$ . a particle on the lower half of the rim making an angle  $60^\circ$  with the vertical, will be moving at speed  
 (a) zero (b)  $v$  (c)  $\sqrt{2} v$  (d)  $2 v$
11. Frequency of a spring mass system is  $\nu$ . if it is taken in a lift with constant acceleration upward, then frequency will  
 (a) decrease (b) increase (c) remain constant (d) none of these
12. In a SHM, if particle oscillates with frequency  $\nu$  the the frequency of oscillation. Of its kinetic energy  
 (a)  $\nu$  (b)  $\nu/2$  (c)  $2\nu$  (d)  $4\nu$
13. Under similar condition of temperature and pressure in which of the following gasses, the velocity of sound will be largest.  
 (a)  $H_2$  (b)  $N_2$  (c) He (d)  $CO_2$
14. Let  $E$  be the electric field and  $V_1$  the electric potential at a point  
 (a) If  $E \neq 0$ , cannot be 0 (b) If  $E = 0$ ,  $V$  must be 0  
 (c) if  $V = 0$ ,  $E$  must be 0 (d) none of these
15. The force between 2 short electric dipoles separated by a distance  $r$  is directly proportional to  
 (a)  $r^2$  (b)  $r^4$  (c)  $r^{-2}$  (d)  $r^{-4}$
16. Find the current through the  $10 \Omega$  resistor shown in the figure  
 (a) zero  
 (b) 1 A  
 (c) 2 A  
 (d) 5 A



17. In the ladder network shown, current through the resistor  $3\ \Omega$  is  $0.25\ \text{A}$ . the input voltage  $V$  is equal to



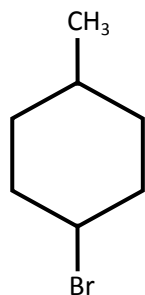
- (a)  $10\ \text{v}$                       (b)  $20\ \text{v}$                       (c)  $5\ \text{v}$                       (d)  $15/2\ \text{v}$
18. The ammeter shown in the figure consists of a  $480\ \Omega$  coil connected in parallel to a  $20\ \Omega$  shunt. Find the reading of the ammeter
- (a)  $50/73\ \text{A}$   
 (b)  $40/53\ \text{A}$   
 (c)  $80/93\ \text{A}$   
 (d)  $73/50\ \text{A}$
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19. A parallel plate condenser is connected to a battery of e.m.f.  $4\ \text{V}$ . if a plate of electric constant  $8$  is inserted into it, then the potential difference on the condenser will be
- (a)  $1/2\ \text{V}$                       (b)  $2\ \text{V}$                       (c)  $4\ \text{V}$                       (d)  $32\ \text{V}$
20. The material for making permanent magnets should have
- (a) High retentivity, high coercivity                      (b) high retentivity, low coercivity  
 (c) low retentivity, high coercivity                      (d) low retentivity, low coercivity
21. A conducting rod of length  $l$  rotates with a uniform angular velocity  $\omega$  about its  $\perp$  bisector. A uniform magnetic field  $\beta$  exists parallel to the axis of rotation. The potential difference between the ends of the rod is
- (a)  $2\beta\omega l^2$                       (b)  $\frac{1}{2}\beta\omega l^2$                       (c)  $\beta\omega l^2$                       (d) zero
22. The average power delivered to a series AC circuit is given by (symbols have their usual meaning)
- (a)  $E_{rms} I_{rms}$                       (b)  $E_{rms} I_{rms} \cos \phi$                       (c)  $E_{rms} I_{rms} \sin \phi$                       (d) zero

23. Critical angle of light passing from glass to air is minimum for  
 (a) red (b) green (c) yellow (d) violet
24. The critical angle of light going from medium A to medium B is  $\theta$ . The speed of light in medium A is  $V$ . the speed of light in medium B is  
 (a)  $\frac{V}{\sin \theta}$  (b)  $V \sin \theta$  (c)  $V \cot \theta$  (d)  $V \tan \theta$
25. When a lens of power  $P$  (in air) made of material of refractive index  $\mu$  is immersed in liquid of refractive index  $\mu_0$ . Then the power of lens is  
 (a)  $\frac{\mu-1}{\mu-\mu_0} P$  (b)  $\frac{\mu-\mu_0}{\mu-1} P$  (c)  $\frac{\mu-\mu_0}{\mu-1} \frac{P}{\mu_0}$  (d) none of these

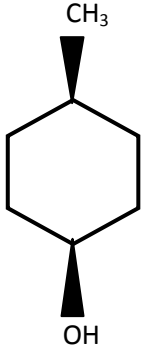
SECTION – B

1. For the gas phase reaction,  
 $PCl_5 \rightleftharpoons PCl_3(g) + Cl_2(g)$   
(a)  $\Delta H < 0$        $\Delta S < 0$                               (b)  $\Delta H > 0$        $\Delta S < 0$   
(c)  $\Delta H = 0$        $\Delta S < 0$                               (d)  $\Delta H > 0$        $\Delta S > 0$
2. Oxidation no. of Cr in  $CrO_5$   
(a) + 10                              (b) + 8                              (c) + 6                              (d) + 4
3. The calomel electrode used as reference electrode contains  
(a)  $PbO_2 + PbSO_4$  mixture                              (b)  $HgCl_2$   
(c)  $Hg_2Cl_2$                               (d)  $ZnCl_2$
4. A current of 2 amp when passed for 5 hours through a molten salt. Deposits 22.2 g of metal of atomic mass 177. The oxidation state of metal in the salt is  
(a) +1                              (b) +2                              (c) +3                              (d) +4
5. The equilibrium constant for the reaction  
 $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$   
(a)  $K_c = \frac{1}{[CO_2]}$                               (b)  $K_c = [CO_2]$   
(c)  $K_c = \frac{[CaO][CO_2]}{[CaCO_3]}$                               (d)  $K_c = [CaO][CO_2]$
6. In an equilibrium reaction, for which  $\Delta G^0 = 0$  the equilibrium constant K should be  
(a) zero                              (b) 10                              (c) 1                              (d) 2
7. Isotonic solution have:  
(a) same boiling point                              (b) same vapour pressure  
(c) same melting point                              (d) same osmotic pressure
8. If the absolute temperature of an ideal gas is double and the pressure is reduced to one – half the volume of the gas will  
(a) remain unchanged                              (b) be double  
(c) be halved                              (d) increase fourfold

9. Momentum of a photon of wavelength  $\lambda$  is  
 (a)  $h\lambda/c^2$  (b)  $h/\lambda$  (c) zero (d)  $h\lambda/c$
10. The Bohr orbit radius for H-atom ( $n = 1$ ) is approximately  $0.53 \text{ \AA}$ . The radius for the first excited state ( $n = 2$ ) orbit is  
 (a)  $0.13 \text{ \AA}$  (b)  $1.06 \text{ \AA}$  (c)  $4.77 \text{ \AA}$  (d)  $2.12 \text{ \AA}$
11. The element  $^{232}\text{Th}$  belong to thorium series. Which of the following will act as end product of series?  
 (a)  $^{208}_{82}\text{Pb}$  (b)  $^{209}_{82}\text{Bi}$  (c)  $^{206}_{82}\text{Pb}$  (d)  $^{207}_{82}\text{Pb}$
12. In the Arrhenius equation  $K = A e^{-E_a/RT}$ , the Arrhenius constant A will be equal to rate at  
 (a)  $T = 0$  (b)  $T = \infty$  (c)  $E_a = RT$  (d)  $E_a = \infty$
13. Molecular mass of a tribasic acid is M. its equivalent mass is  
 (a)  $M/3$  (b)  $3M$  (c)  $M/9$  (d)  $9M$
14. How many geometrical isomer one possible for given compound

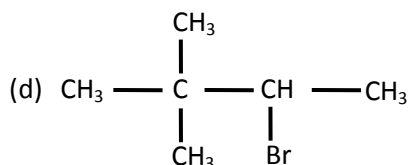
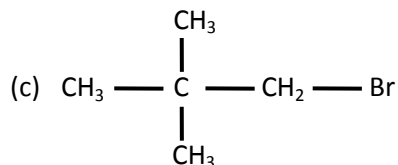
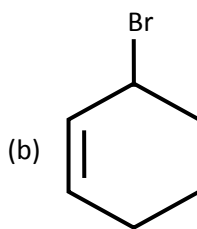
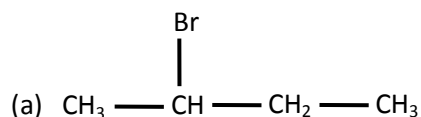


- (a) 0 (b) 2 (c) 3 (d) 4

15.   $\xrightarrow[\Delta]{\text{H}^{\oplus}}$  Products obtained are  
 (a) Racemic (b) Diastereomers (c) G.I. (d) Positional isomer



16. Which of the following is inert towards  $E_2$  reaction



17. Oxidation state of N in  $\text{N}_2\text{O}_5$

- (a) +5 (b) +3 (c) +2 (d) +4

18. No. of P – O – P bonds in  $\text{P}_4\text{O}_{10}$

- (a) 4 (b) 10 (c) 6 (d) 3

19. Ligands are

- (a) Lewis acid (b) Lewis base (c) neutral (d) none

20. EAN of a metal carbonyl  $\text{M}(\text{CO})_x$  is 36. If atomic no. of metal M is 26. What is the value of x?

- (a) 4 (b) 8 (c) 5 (d) 6

21. Which of the following process(es) occur during the extraction of copper from chalcopyrite

- (a) Froth floatation (b) Roasting  
(c) Bessemerisation (d) calcinations

22. Which of the following does not exist or rarely exists?

- (a)  $\text{Fe}^{2+}$  (b)  $\text{Mn}^{7+}$  (c)  $\text{Zn}^{2+}$  (d)  $\text{Zn}^{6+}$

23. The element which forms oxides in all oxidation states +I to +IV

- (a) N (b) P (c) As (d) Sb

24. The most powerful oxidizing agent among the following is:

- (a) Fluorine (b) Chlorine (c) Iodine (d) Bromine

25. Which carbocation is most reactive towards  $E_1$  mechanism?

- (a)  $3^\circ$  (b)  $2^\circ$  (c)  $1^\circ$  (d) methylic carbocation

**SECTION – C**

- If  $|z - 25i| \leq 15$  then  $|\text{maximum arg}(z) - \text{minimum arg}(z)|$  equals  
 (a)  $2 \cos^{-1}\left(\frac{3}{5}\right)$       (b)  $2 \cos^{-1}\left(\frac{4}{5}\right)$       (c)  $\frac{2\pi}{2} + \cos^{-1}\left(\frac{3}{5}\right)$       (d)  $\sin^{-1}\left(\frac{3}{5}\right) + \cos^{-1}\left(\frac{3}{5}\right)$
- If the equation  $\sqrt{x+1} - \sqrt{x} = a$  has a solution then  
 (a)  $0 < a < 1$       (b)  $a \geq 1$       (c)  $0 < a \leq 1$       (d)  $a \leq 1$
- Sum of non-real roots of  $(x^2 + x - 2)(x^2 + x - 3) = 12$   
 (a) 1      (b) -1      (c) -6      (d) 6
- Find the sum of series  $1^2 + 2^2 + 3^2 + \dots + 10^2$   
 (a)  $(55)^2$       (b) 385      (c) 437      (d) None of these
- If  $\log x^2 - \log 2x = 3 \log 3 - \log 6$  then x equals  
 (a) 9      (b) 3      (c) 4      (d) 5
- The number of words that can be formed by using the letters of the word MATHEMATIC that start as well as end with T is  
 (a) 80720      (b) 90720      (c) 20860      (d) 137528
- Value of the expression  $C_0^2 + C_1^2 + C_2^2 \dots \dots C_n^2$  is  
 (a)  $2^{(2n-1)}$       (b)  $2n \binom{2n}{n}$       (c)  $2^n C_n$       (d) none of these
- If A is an orthogonal matrix then  $|A|$  is  
 (a) 1      (b) -1      (c)  $\pm 1$       (d) 0
- $A = \begin{bmatrix} 1 + 2\omega^{100} + \omega^{200} & \omega^2 & 1 \\ 1 & 1 + \omega^{101} + 2\omega^{202} & \omega \\ \omega & \omega^2 & 2 + \omega^{100} + 2\omega^{200} \end{bmatrix}$   
 (a)  $|A| = 5$       (b)  $|A| = 0$       (c) A is symmetric      (d) none of these
- Two square are chosen at random on a chessboard. The probability that they have a side in common.  
 (a) 1/9      (b) 2/7      (c) 1/18      (d) none of these

11.  $3 \sin \theta + 5 \cos \theta = 5$  then  $5 \sin \theta - 3 \cos \theta$  is equal to  
 (a) 3 (b) 8 (c) 7 (d) none of these
12. The straight line  $x + y = 0$ ,  $3x + y - 4 = 0$  and  $x + 3y - 4 = 0$ , forms a triangle which is  
 (a) isosceles (b) equilateral (c) right angled (d) none of these
13. The points (2, 3), (0, 2), (4, 5) and (0, t) are concyclic if the value of t is  
 (a) 5 (b) 1 (c) 17 (d) 19
14. Equation of the normal at a point on the parabola  $y^2 = 36x$  whose ordinate is three times its abscissa is  
 (a)  $2x + 3y + 44 = 0$  (b)  $2x - 3y + 44 = 0$   
 (c)  $2x + 3y - 44 = 0$  (d)  $2x - 3y = 0$
15. If ABCD is quadrilateral and E and F are the mid points of AC and BD respectively then  $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CD}$  is equal to  
 (a)  $2\overrightarrow{EF}$  (b)  $3\overrightarrow{EF}$  (c)  $4\overrightarrow{EF}$  (d)  $6\overrightarrow{EF}$
16.  $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$  and  $\frac{x-3}{1} = \frac{y-k}{2} = z$  intersect at a point if K is equal to  
 (a) 2/9 (b) 1/2 (c) 9/2 (d) 1/6
17. The value of  $\lim_{x \rightarrow -2} \frac{(x^2 - x - 6)^2}{(x+2)^2}$  is  
 (a) 6 (b) 25 (c) 9 (d) 16
18.  $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$  is  
 (a) 0 (b) 1/2 (c) 2 (d) none of these
19. If  $\cos^{-1} \left( \frac{x^2 - y^2}{x^2 + y^2} \right) = \log a$  then  $\frac{dy}{dx}$  is equal to  
 (a) y/x (b) x/y (c)  $\frac{x^2}{y^2}$  (d)  $\frac{y^2}{x}$

20. If  $f(x) = x^{1/x}$  then  $f'(e)$  is equal to  
 (a)  $e^{\frac{1}{(e-3)}}$  (b)  $e^{\frac{1}{(e-2)}}$  (c)  $e^{\frac{1}{e}}$  (d) none of these
21. If  $a, b > 0$ , then the maximum value of  $y = \frac{b^2}{a+b} + \frac{a^2}{x}$ ,  $\theta < x < a$   
 (a)  $\frac{a+b}{a}$  (b)  $\frac{ab}{a+b}$  (c)  $\frac{1}{a} + \frac{1}{b}$  (d)  $\frac{(a+b)^2}{a}$
22. The shortest distance of  $(0, 0)$  from the curve  $y = \frac{e^x + e^{-x}}{2}$  is  
 (a)  $1/2$  (b)  $1/3$  (c)  $2$  (d) none of these
23.  $I = \int_{-2}^2 |1 - x^4| dx$  then  $I$  equals  
 (a)  $6$  (b)  $8$  (c)  $12$  (d)  $21$
24.  $I = \int_{\pi/6}^{\pi/3} \frac{dx}{1 + \sqrt{\tan x}}$  then  $I$  equals  
 (a)  $\pi/12$  (b)  $\pi/6$  (c)  $\pi/4$  (d)  $\pi/3$
25. The area bounded by  $y = x^2$  and  $y = 1 - x^2$  is  
 (a)  $\frac{\sqrt{8}}{3}$  (b)  $\frac{16}{3}$  (c)  $\frac{32}{3}$  (d)  $\frac{16}{9}$