IIT-JEE Advanced | JEE Mains | Foundation

Entrance Test: 12th (Beta)

MM : 180 **Time: 2 Hours**

PLEASE FILL IT IN CAPITAL LETTERS

Enrollment No. ☐ ☐ ☐ ☐ ☐ ☐

Students Name	:
Father's Name	:
School	:
Previous institute (if any)	:
CGPA/% in 11th	:
Achievements	: (NTSE/OLYMPIAD etc if any)

I hereby admit that all the information given here is true and in case of any discrepancy I shall be liable for any action.

_____ _____

(Invigilator) (Student's Signature)

PART – I : MATHS

SECTION – I (Single Correct Choice Type)

This Section contains **20 Single choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Marking Scheme:

You will be awarded **3 marks** for correct answer, **-1** for wrong answer and zero if Question is left un-attempted.

1. If $a,b,c \in R$ and $(a+b+c)c<0$, then the quadratic equation $p(x)=ax^2+bx+c=0$ has

(a) two negative roots (b) two real roots

(c) two imaginary roots (d) none of these

Answer :

2. The set of all values of k for which the equation $x^2+2(k-1)x+(k-5)=0$ has at least one non-negative root is

(a) $[1,\infty)$ (b) $[-1,1]$

(c) $(-\infty,-5]$ (d) $(-\infty,5]$

Answer :

3. If roots of the equation $x^2-2mx+m^2-1=0$ lie in the interval (–2, 4), then

(a) $-1<m<3$ (b) $1<m<5$

(c) $1<m<3$ (d) $-1<m<5$

Answer :

4. If *x* is real, then the least value of the expression $\frac{x^2-6x+5}{x^2+2x+2}$ is

(a) –1 (b) –1/3 (c) –1/2 (d) none of these

Answer :

5. Given a sequence of four numbers such that the first three are in G.P. and the last three are in A.P. with common difference 6. If the first and the fourth number are equal, then common ratio of the G.P. is

(a) –2 (b) 2 (c) 3 (d) –3

Answer :

Rough Work

6. If x,y,z are real and $4x^2+9y^2+16z^2-6xy-12yz-8zx=0$, then x, y, z are

(a) A.P. (b) G.P. (c) H.P. (d) none of these

Answer : ☐

7. Let $a_n = \underbrace{111.....1}_{n\text{ times}}$. The remainder when a_{124} is divided by 271 is

(a) 23 (b) 25 (c) 27 (d) 29

Answer : ☐

8. Sum of the series $S=(n)(n)+(n-1)(n+1)+(n-2)(n+2)+....+1(2n+1)$ is

(a) n^3 (b) $\frac{1}{6}n(n+1)(n+2)$ (c) $\frac{1}{3}n^3-n^2$ (d) none of these

Answer : ☐

9. The number of 10 digit numbers that can be written by using the digits 2 and 3 is

(a) ${}^{10}C_2+{}^{9}C_2$ (b) 2^{10} (c) $2^{10}-2$ (d) 10!

Answer : ☐

10. The number of ways in which we can get a score of 11 by throwing three dice is

(a) 18 (b) 27 (c) 45 (d) 56

Answer : ☐

11. The number of ways in which we can distribute *mn* students equally among *m* sections is given by

(a) $\frac{(mn)!}{n!}$ (b) $\frac{(mn)!}{(n!)^m}$ (c) $\frac{(mn)!}{m!n!}$ (d) $(mn)^m$

Answer : ☐

12. If a polygon has 90 diagonals, the number of its sides is given by

(a) 12 (b) 11 (c) 10 (d) 15

Answer : ☐

Rough Work

13. If the middle term in the expansion of $\left(\frac{1}{x}+x^{\log_2 x}\right)^5$ is 40 then x equals

(a) $1/\sqrt{2},2$ (b) $\sqrt{2},4$ (c) $1/\sqrt{2},4$ (d) $\sqrt{2},1/\sqrt{2}$

Answer : ☐

14. If the third term in the expansion $(x+x^{\log_5 x})^5$ is 2, then x equals

(a) 1/5, 5 (b) 1/5, $\sqrt{5}$ (c) $\sqrt{5}$, 5 (d) $1/\sqrt{5},5$

Answer : ☐

15. Coefficient of x^9 in the expansion of

$$\left(x^3+\frac{1}{2^{\log_{\sqrt{2}}(x^{3/2})}}\right)^{11}$$

is

(a) –5 (b) 330 (c) 520 (d) $5+\log_{\sqrt{2}}(3)$

Answer : ☐

16. If three successive coefficient in the expansion of $(1+x)^n$ are in A.P., then $(n+2)$ is

(a) at least 19 (b) at most 19 (c) a perfect square (d) a perfect cube

Answer : ☐

17. If $\tan\alpha=5/6$ and $\tan\beta=1/11$, then

(a) $\alpha+\beta=\pi/6$ (b) $\alpha+\beta=\pi/4$ (c) $\alpha+\beta=\pi/3$ (d) none of these

Answer : ☐

18. If $\sin\alpha+\cos\alpha=\frac{\sqrt{7}}{2}$, $0<\alpha<\frac{\pi}{6}$, then $\tan\frac{\alpha}{2}$ is equal to

(a) $\sqrt{7}-2$ (b) $(1/3)(\sqrt{7}-2)$ (c) $2-\sqrt{7}$ (d) $(1/3)(2-\sqrt{7})$

Answer : ☐

Rough Work

19. If the lines $x+2ay+a=0,\ x+3by+b=0$ and $x+4cy+c=0$ are concurrent, then a, b, c are in

(a) A.P. (b) G.P.
(c) H.P. (d) none of these

Answer : ☐

20. The straight lines $4x-3y-5=0, x-2y-10=0$, $7x+y-40=0$ and $x+3y+10=0$ form the sides of a

(a) quadrilateral (b) cyclic quadrilateral
(c) rectangle (d) parallelogram

Answer : ☐

Rough Work

PART – II : Physics

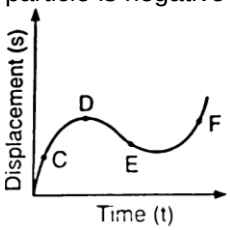
SECTION – I (Single Correct Choice Type)

This Section contains **20 Single choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Marking Scheme:

You will be awarded **3 marks** for correct answer, **-1** for wrong answer and zero if Question is left un-attempted.

21. The displacement-time graph of a moving particle is shown in the adjoining figure. The instantaneous velocity of the particle is negative at the point :



(a) D (b) F

(c) C (d) E

Answer : ☐

22. Two balls of different masses m_a and m_b are dropped from two different heights, viz, a and b. The ratio of times taken by the balls to drop through these distances is :

(a) a : b (b) b : a

(c) $\sqrt{a}:\sqrt{b}$ (d) $a^2:b^2$

Answer : ☐

23. A point moves with uniform acceleration and υ_1,υ_2 and υ_3 denote the average velocities in the three successive intervals of time t_1,t_2 and t_3. Which of the relation given below is correct?

(a) $(\upsilon_1-\upsilon_2):(\upsilon_2-\upsilon_3)=(t_1-t_2):(t_2+t_3)$ (b) $(\upsilon_1-\upsilon_2):(\upsilon_2-\upsilon_3)=(t_1+t_2):(t_2+t_3)$

(c) $(\upsilon_1-\upsilon_2):(\upsilon_2-\upsilon_3)=(t_1-t_2):(t_1-t_3)$ (d) $(\upsilon_1-\upsilon_2):(\upsilon_2-\upsilon_3)=(t_1-t_2):(t_2-t_3)$

Answer : ☐

Rough Work

24. The velocity υ and displacement r of a body are related as $\upsilon^2 = kr$, where k is a constant. What will be the velocity after 1 second? (Given that the displacement is zero at t = 0)

(a) $\sqrt{kr}$ (b) $kr^{3/2}$ (c) $\frac{k}{2}r^0$ (d) Data is not sufficient

Answer : ☐

25. A ball whose kinetic energy is E, is thrown at an angle of 45^o with the horizontal, its kinetic energy at the highest point of its flight will be :

(a) E (b) $\frac{E}{\sqrt{2}}$ (c) $\frac{E}{2}$ (d) zero

Answer : ☐

26. A aeroplane moving horizontally with a speed of 180 km/hr drops a food packet while flying at a height of 490m. The horizontal range is :

(a) 180 m (b) 980 m (c) 500 m (d) 670 m

Answer : ☐

27. Two tall building are 30 m apart. The speed with which a ball must be thrown horizontally from a window 150 m above the ground in one building so that it enters a window 27.5 m from the ground in the other building is :

(a) 2 ms^{-1} (b) 6 ms^{-1} (c) 4 ms^{-1} (d) 8 ms^{-1}

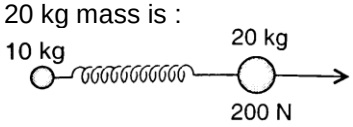
Answer : ☐

28. Two blocks of masses 2 kg and 1 kg are in contact with each other on a frictionless table. When a horizontal force of 3.0N is applied to the block of mass 2 kg, the value of the force of contact between the two blocks is :

(a) 4 N (b) 3 N (c) 2 N (d) 1 N

Answer : ☐

29. Two masses of 10 kg and 20 kg respectively are connected by a massless spring as shown in figure. A force of 200 N acts on the 20 kg mass. At the instant when the 10 kg mass has an acceleration of 12 ms^{-2}, the acceleration of the 20 kg mass is :

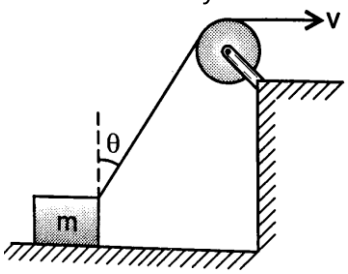


(a) $2ms^{-2}$ (b) $4ms^{-2}$ (c) $10ms^{-2}$ (d) $20ms^{-2}$

Answer : ☐

Rough Work

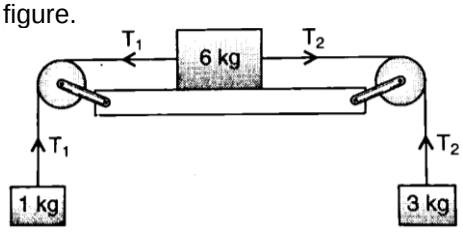
30. A block is dragged on a smooth plane with the help of a rope which moves with a velocity υ as shown in figure. The horizontal velocity of the block is :



(a) υ (b) $\frac{\upsilon}{\sin\theta}$ (c) $\upsilon\sin\theta$ (d) $\frac{\upsilon}{\cos\theta}$

Answer : ☐

31. Three masses of 1 kg, 6 kg and 3 kg are connected to each other with threads and are placed on a table as shown in figure.



What is the acceleration with which the system is moving? (Take g = 10 ms^{-2})

(a) Zero (b) 1 ms^{-2} (c) 2 ms^{-2} (d) 3 ms^{-2}

Answer : ☐

32. Work done in time *t* on a body of mass *m* which is accelerated from rest to a spread υ in time t_1 as a function of time *t* is given by :

(a) $\frac{1}{2}m\frac{\upsilon}{t_1}t^2$ (b) $m\frac{\upsilon}{t_1}t^2$

(c) $\frac{1}{2}\left(\frac{m\upsilon}{t_1}\right)^2 t^2$ (d) $\frac{1}{2}m\frac{\upsilon^2}{t_1^2}t^2$

Answer : ☐

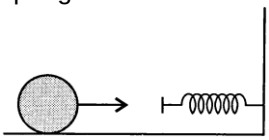
Rough Work

33. Work-energy theorem is valid in the presence of:

(a) external forces only (b) internal forces only
(c) conservative forces only (d) non-conservatives forces only
(e) all types of forces

Answer : ☐

34. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant K = 50 N/m. The maximum compression of the spring would be :



(a) 0.15 m (b) 0.12 m (c) 1.5 m (d) 0.5 m

Answer : ☐

35. A body is dropped from a height *h*. If it acquires a momentum *p*, then the mass of the body is :

(a) $\frac{p}{\sqrt{2gh}}$ (b) $\frac{p^2}{2gh}$ (c) $\frac{2gh}{p}$ (d) $\sqrt{\frac{2gh}{p}}$

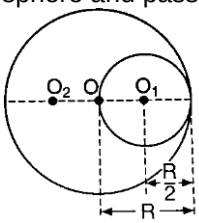
Answer : ☐

36. A system consists of mass M and m(<<M). The centre of mass of the system is:

(a) at the middle (b) nearer to M
(c) nearer to *m* (d) at the position of larger mass

Answer : ☐

37. A spherical hollow is made in a lead sphere of radius R, such that its surface touches the outside surface of lead sphere and passes through the centre. What is the shift in the centre of mass of lead sphere due to the hollowing?

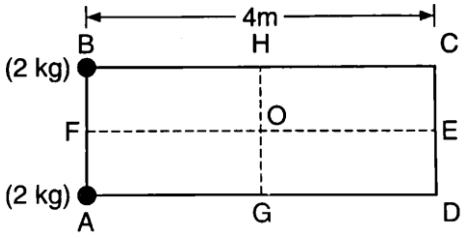


(a) $\frac{R}{7}$ (b) $\frac{R}{14}$ (c) $\frac{R}{2}$ (d) R

Answer : ☐

Rough Work

38. Masses of 2 kg each are placed at the corners B and A of a rectangular plate ABCD as shown in the figure. A mass of 8 kg has to be placed on the plate so that the centre of mass of the system should be at the centre O. Then the mass should

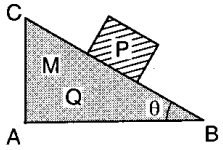


be placed at :

(a) 1 m from O on OE (b) 2m from O on OF (c) 2 m from O on OG (d) 2 m from O on OH

Answer :

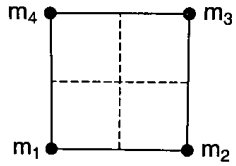
39. A block Q of mass M is placed on a horizontal frictionless surface AB and a body P of mass m is released on its frictionless slope. As P slides by a length L on this slope of inclination θ, the block Q would slide by a distance :



(a) $\frac{m}{M}L\cos\theta$ (b) $\frac{m}{(M+m)}L$ (c) $\frac{(M+m)}{mL\cos\theta}$ (d) $\frac{mL\cos\theta}{(m+M)}$

Answer :

40. Four partiles of masses $m_1 = 2m$, $m_2 = 4m, m_3 = m$ and m_4 are placed at four corners of a square. What should be the value of m_4 so that the centres of mass of all the four particles are exactly at the centre of the square?



(a) 2m (b) 8m
(c) 6m (d) None of these

Answer :

Rough Work

PART – III : Chemistry

SECTION – I (Single Correct Choice Type)

This Section contains **20 Single choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Marking Scheme:

You will be awarded **3 marks** for correct answer, **-1** for wrong answer and zero if Question is left un-attempted.

41. The crystalline salt $Na_2SO_4.xH_2O$ on heating loses 55.9% of its weight. The formula of the crystalline salt is :

(a) $Na_2SO_4.5H_2O$ (b) $Na_2SO_4.7H_2O$

(c) $Na_2SO_4.2H_2O$ (d) $Na_2SO_4.10H_2O$

Answer : ☐

42. In the reaction, $2Al(s)+6HCl(aq) \rightarrow 2Al^{3+}(aq)+6Cl^{-}(aq)+3H_2(g)$

(a) 11.2 L H_2(g) at STP is produced for every mole HCl (aq) consumed

(b) 6 L HCl (aq) is consumed for every 3 L H_2(g) produced.

(c) 33.6 L H_2 (g) is produced regardless of temperature and pressure for every mole of Al that reacts.

(d) 67.2 L H_2(g) at STP is produced for evert mole of Al that reacts.

Answer : ☐

43. Which has maximum number of atoms?

(a) 24 g of C (12) (b) 56 g of Fe (56)

(c) 27 g og Al (27) (d) 108 g of Ag (108)

Answer : ☐

44. The weight of a molecule of the compound $C_{60}H_{122}$ is :

(a) 1.4×10^{-21}g (b) 1.09×10^{-21}g (c) 5.025×10^{23}g (d) 16.023×10^{23}g

Answer : ☐

45. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is

(a) 0.001 M (b) 0.1 M

(c) 0.02 M (d) 0.01 M

Answer : ☐

Rough Work

46. The angular momentum of electrons in the hydrogen atom that can be possible is :

(a) $\frac{h}{\pi}$ (b) 2h (c) $\frac{h}{4\pi}$ (d) $h \times \pi$

Answer : ☐

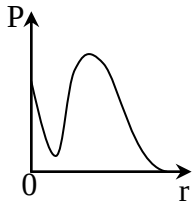
47. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radium] :

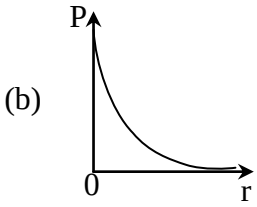
(a) $\frac{h^2}{4\pi^2 m a_0^2}$ (b) $\frac{h^2}{16\pi^2 m a_0^2}$

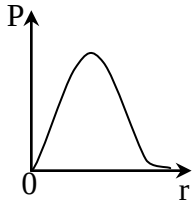
(c) $\frac{h^2}{32\pi^2 m a_0^2}$ (d) $\frac{h^2}{64\pi^2 m a_0^2}$

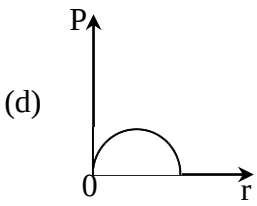
Answer : ☐

48. P is the probability of finding the 1s electron of hydrogen atom in a spherical shell of infinitesimal thickness dr, at a distance r from the nucleus. The volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of P on r is :

(a) 

(b) 

(c) 

(d) 

Answer : ☐

49. The correct order of second ionization enthalpy of carbon, nitrogen, oxygen and fluorine is :

(a) C > N > O > F (b) O > N > F > C (c) O > F > N > C (d) F > O > N > C

Answer : ☐

Rough Work

50. Which of the following oxides is most acidic?

(a) Cl_2O (b) Cl_2O_3 (c) Cl_2O_5 (d) Cl_2O_7

Answer : ☐

51. Which of the following sets of ions represents a collection of isoelectronic species?

(a) $N^{3-}, O^{2-}, F^{-}, S^{2-}$ (b) $Li^{+}, Na^{+}, Mg^{2+}, Ca^{2+}$ (c) $K^{+}, Cl^{-}, Ca^{2+} < Sc^{3+}$ (d) $Ba^{2+}, Sr^{2+} < K^{+}, Ca^{2+}$

Answer : ☐

52. Hybridisation on sulphur atom in SO_2 and SO_3 is :

(a) sp^3 (b) sp^2 (c) sp^2 and sp^3 (d) sp

Answer : ☐

53. Main axis of a diatomic molecule is Z. Atomic orbitals p_x and p_y overlap to form which of the following orbital ?

(a) π – molecular orbital (b) σ – molecular orbital

(c) δ – molecular orbital (d) no bond will form

Answer : ☐

54. In NO_3^- ion, the number of bond pairs and lone pair of electrons on nitrogen atom are :

(a) 2, 2 (b) 3, 1 (c) 1, 3 (d) 4, 0

Answer : ☐

55. Which of the following species is non-linear?

(a) ICl_2^- (b) I_3^- (c) N_3^- (d) ClO_2^-

Answer : ☐

56. Which one of the following pair is isostructural (i.e., having the same shape and hybridization)?

(a) [BCl_3 and $BrCl_3$] (b) [NH_3 and NO_3^-]

(c) [NF_3 and BF_3] (d) [BF_4^- and NH_4^+]

Answer : ☐

Rough Work

57. Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false?

(a) The $H-O-H$ bond angle in H_2O is smaller than the $H-N-H$ bond angle in NH_3.

(b) The $H-C-H$ bond angle in CH_4 is larger than the $H-N-H$ bond angle in NH_3

(c) The $H-C-H$ bond angle in CH_4, the $H-N-H$ bond angle in NH_3, and the $H-O-H$ bond angle in H_2O are all greater than 90^o

(d) The $H-O-H$ bond angle in H_2O is larger than the $H-C-H$ bond angle in CH_4

Answer : ☐

58. $(NH_4)_2S$ (solid) $\rightleftharpoons NH_3 + H_2S$

The total pressure at equilibrium is 9 atm. Calculate K_p :

(a) 9 atm^2 (b) 81 atm^3

(c) 108 atm^3 (d) None of these

Answer : ☐

59. The initial pressure for the dissociation reaction $A_2(g) \rightleftharpoons 2A(g)$ is 1 atm and increases by 20% when the reaction reaches the equilibrium state. The K_p for the reaction is:

(a) 0.1 atm (b) 0.2 atm

(c) 1 atm (d) 2 atm

Answer : ☐

60. In which of the following gaseous reactions increases in volume of the container causes a shift to right?

(a) $2CO + O_2 \rightleftharpoons 2CO_2$ (b) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

(c) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (d) $H_2 + Cl_2 \rightleftharpoons 2HCl$

Answer : ☐

Rough Work