Meritorious Tutorials
#33, Kesar Garden Sec - 20, Kharghar Navi Mumbai

XII STD Admission Test
ENTRANCE EXAM - JEE MAIN

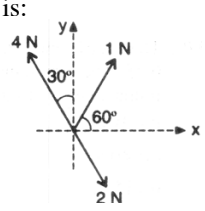
Time Allowed: 1 hour **Maximum Marks :** 200

General Instructions:
All the questions are compulsory.

Section A

1) A truck, weighing 8000 kg, is moving along a track with negligible friction at 1.8 ms^{-1} with the engine turn off when it begins to rain hard. The raindrops fall vertically with respect to the ground. The speed of the truck, when it has collected 1000 kg of rain water, is: **[4]**
   a) 3 ms^{-1} b) 9 ms^{-1}
   c) 10 ms^{-1} d) 1.6 ms^{-1}

2) Three forces acting on a body are shown in the figure. To have the resultant force only along the Y - direction, the magnitude of the minimum additional force needed is:



[4]

   a) 0.5 N
   b) $\frac{\sqrt{3}}{4}$N
   c) $\sqrt{3}$N
   d) 1.5 N

3) The driver of a car traveling at 72 km h^{-1} suddenly sees a big rock on the road at a distance of 20 m. What can he do to avoid a collision? **[4]**

   a) Turn sharply
   b) Follow a zig - zag path
   c) Shut the engine
   d) Apply brakes

4) Two spheres of same size, one of mass 2 kg and another of mass 4 kg, are dropped simultaneously from the top of Qutub Minar (height = 72 m). When they are 1 m above the ground, the two spheres have the same: **[4]**
   a) Acceleration b) Potential energy
   c) Momentum d) Kinetic energy

5) A wind - powered generator converts wind energy into electric energy. Assume that the generator converts a fixed fraction of the wind energy intercepted by its blades into electrical energy. For wind speed v, the electrical power output will be proportional to **[4]**
   a) V b) V^2
   c) V^4 d) V^3

6) What energy does a stretched bow possess? **[4]**

   a) Potential energy
   b) Kinetic energy
   c) Gravitational energy
   d) Elastic potential energy

7) A person pushes a box on a rough horizontal platform surface. He applies a force of 200 N over a distance of 15 m. Thereafter, he gets progressively tired and his applied force reduces linearly with distance to 100 N. The total distance through which the box has been moved is 30 m. What is the work done by the person during the total movement of the box? **[4]**
   a) 2780 J b) 5690 J
   c) 3280 J d) 5250 J

8) In perfectly inelastic collisions, the relative velocity of the bodies:
   i. Before impact is zero
   ii. Before impact is equal to that after the impact
   iii. After impact is zero
   iv. Is characterized by none of these

   [4]
   a) Ii and iii b) I and ii
   c) Iv and i d) Only iii

9) Consider Earth to be a homogeneous sphere. Scientist A goes deep down in a mine and scientist B goes high up in a balloon. The gravitational field measured by: **[4]**

   a) Each decreases at the same rate
   b) Each decreases at different rates
   c) B goes on decreasing and that by A goes on increasing
   d) A goes on decreasing and that by B goes on increasing

10) Two planets are at mean distances d_1 and d_2 from the sun and their periods are T_1 and T_2 respectively. Then: **[4]**

   a) $n_1^2 d_1 = n_2^2 d_2$
   b) $n_1 d_1^2 = n_2 d_2^2$
   c) $n_1^2 d_1^2 = n_2^2 d_2^2$
   d) $n_2^2 d_2^3 = n_1^2 d_1^3$

11) S stands for Sun, E for Earth and M for Moon. If distance ES is 400 times the distance EM and the gravitational pull of S on E is 170 times the gravitational pull of M on E, then S has x times the mass of M where x is roughly **[4]**
   a) 4.6×10^9 b) 2.7×10^7
   c) 7.4×10^5 d) 6.8×10^4

12) The time period of a geostationary satellite at a height of 36000 km is 24 hrs. A spy satellite orbits very close to the earth surface (R = 6400 km). What will be its time period? **[4]**
   a) 1.5 hrs b) 1 hr
   c) 2 hrs d) 4 hrs

13) The molar specific heat at a constant pressure of an ideal gas is $(\frac{7}{2})$R. The ratio of specific heat at constant pressure to that at constant volume is: **[4]**

a) $\frac{7}{5}$ b) $\frac{9}{7}$
c) $\frac{8}{7}$ d) $\frac{5}{7}$

14) Universal constant is: **[4]**
a) $\frac{C_p}{C_v}$ b) $C_p - C_v$
c) $\frac{C_p}{C_v}$ d) $C_p + C_v$

15) The slopes of isothermal and adiabatic curves are related as: **[4]**
a) Isothermal curve slope $=\gamma\times$ adiabatic curve slope
b) Adiabatic curve slope $=\gamma\times$ isothermal curve slope
c) Isothermal curve slope = adiabatic curve slope
d) Adiabatic curve slope $=\frac{1}{2}\times$ isothermal curve slope

Section B

16) The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is: **[4]**
a) 40 b) 10
c) 20 d) 30

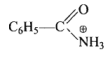
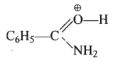
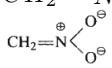
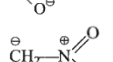
17) A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 mL of CO_2 at T = 298.15K and P = 1 bar. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of sodium bicarbonate in each tablet?
[Molar mass of $NaHCO_3$ = 84 g mol^{-1}] **[4]**
a) 33.6 b) 16.8
c) 0.84 d) 8.4

18) Neutron was discovered by: **[4]**
a) Chadwick b) Thomson
c) Rutherford d) Bohr

19) The quantum number that does not describe the distance and the angular disposition of the electron: **[4]**
a) L b) N
c) M d) S

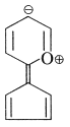
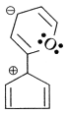
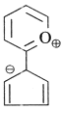
20) Heterolytic fission of an organic covalent bond gives only **[4]**
a) Carbocation
b) Carbanion
c) Free radicals
d) Both carboanion and carbocation

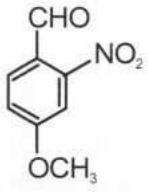
21) Ethyl carbocation has _____ hyper conjugative structures. **[4]**
a) Five b) Four
c) Six d) Three

22) Which of the following pairs does not represent resonance structures? **[4]**
a) $CH_3 - C \equiv \overset{\oplus}{N} - \overset{\ominus}{O}$ and $CH_3 - \overset{\oplus}{C} = N - \overset{\ominus}{O}$
b)  and 
c) $CH_2 = \overset{\oplus}{N} = \overset{\ominus}{N}$ and $\overset{\ominus}{C}H_2 - \overset{\oplus}{N} \equiv N$
d)  and 

23) How many metamers of hexan - 3 - one are possible? **[4]**
a) Five b) Six
c) Three d) Four

24) The most stable canonical structure of this molecule is:

[4]
a) 
b) None of these
c) 
d) 

25) The IUPAC name of  is **[4]**
a) 4 - formyl - 3 - nitroanisole
b) 4 - methoxy - 2 - nitrobenzaldehyde
c) 4 - methoxy - 6 - nitrobenzaldehyde
d) 2 - formyl - 5 - methoxynitrobenzene

Section C

26) Let $y = x^{y^x}$. Then $\left(\frac{dy}{dx}\right)_{x=1}$ is: **[4]**
a) 1 b) - 1
c) 2 d) 0

27) If $\lim_{x\to 0} \frac{\log_{\sin x} \cos x}{\log_{\sin \frac{x}{2}} \cos \frac{x}{2}}$ = L, then mark the incorrect statement: **[4]**
a) L is an integer square
b) L is an even number
c) L is a natural number
d) The number of positive integral divisors of L is 4

28) If the value of $\lim_{x\to 0^+} \left(\frac{\frac{5}{x}+1}{\frac{5}{x}-1}\right)^{\frac{1}{x}}$ can be expressed in the form of $e^{\frac{p}{q}}$, where p and q are prime numbers, then p + q is equal to **[4]**
a) 9 b) 8
c) 7 d) 5

29) If y = $\sin(m \sin^{-1} x)$, then $(1 - x^2)\, y'' - xy'$ is equal to: **[4]**
a) - my b) My
c) $-m^2y$ d) M^2y

30) Let $y = \sin^{-1}\left(x\sqrt{1-x} + \sqrt{x}\sqrt{1-x^2}\right)$, $x \leq \frac{1}{2}$, then $y'\left(\frac{1}{3}\right)$ is: **[4]**
a) $\frac{2}{\sqrt{3}}$ b) $\frac{\sqrt{2}}{3}$
c) $\frac{3}{\sqrt{2}}$ d) $\frac{\sqrt{3}}{2}$

31) Let $L = \lim_{x\to 0} \frac{a - \sqrt{a^2 - x^2} - \frac{x^2}{4}}{x^4}$, a > 0. Given that L is finite, then **[4]**
a) A = 2, L $= \frac{1}{32}$
b) A = 4, L $= \frac{1}{64}$
c) A = 2, L $= \frac{1}{64}$
d) A = 4, L $= \frac{1}{32}$

32) Two functions f and g are defined as
f(x) = - 1, x < 0
= 0, x = 0
= 1, x > 0
g (x) = x (1 - x^2), x ∈ R
The number of points at which gof is not continuous, is **[4]**
a) 1 b) 0
c) 3 d) 2

33) Let f(x) = $(\log_2 x)^3$ + x^3 ∀ x > 0, then the derivative of f^{-1} (x) with respect to x at x = 9 is :
[Note : You can assume derivative of $\log_a$ x is $\frac{1}{x}$.]**[4]**
a) $\frac{27}{2}$ b) $\frac{1}{27}$
c) 27 d) $\frac{2}{27}$

34) Let y =$\tan^{-1}\left(\frac{\cos x}{1+\sin x}\right)$, $-\frac{3\pi}{2} < x < -\frac{\pi}{2}$, then **[4]**
a) Y'(x) =$\frac{1}{2}$
b) Y(x) =$-\frac{3\pi}{4} - \frac{x}{2}$
c) Y(x) =$\frac{3\pi}{4} + \frac{x}{2}$
d) Y(x) =$\frac{3\pi}{4} - \frac{x}{2}$

35) The derivative of$\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ with respect to $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$, if x ∈ (- 1, 1), is: **[4]**
a) - 2 b) - 1
c) 1 d) 2

36) The value of$2\sin\left(\frac{\pi}{8}\right)\sin\left(\frac{2\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)\sin\left(\frac{5\pi}{8}\right)\sin\left(\frac{6\pi}{8}\right)\sin\left(\frac{7\pi}{8}\right)$ **[4]**
a) $\frac{1}{4}$
b) $\frac{1}{8}$
c) $\frac{1}{8\sqrt{2}}$
d) $\frac{1}{4\sqrt{2}}$

37) The greatest angle of a cyclic quadrilateral is 3 times the least. The circular measure of the least angle is: **[4]**
a) $\frac{\pi}{2}$ b) $\frac{\pi}{4}$
c) $\frac{\pi}{3}$ d) $\frac{\pi}{6}$

38) If in a△ ABC, $\frac{a\cos A+b\cos B+c\cos C}{a+b+c} = \frac{1}{2}$, then the value of $\frac{2b^2\sin B}{ac}$ is: **[4]**
a) 1 b) 2
c) 4 d) $\sqrt{3}$

39) $96\cos\frac{\pi}{33}\cos\frac{2\pi}{33}\cos\frac{4\pi}{33}\cos\frac{8\pi}{33}\cos\frac{16\pi}{33}$ is equal to **[4]**
a) 3 b) 4
c) 1 d) 2

40) Let$x = \log_{\csc\frac{2\pi}{3}}\left(\frac{148}{111}\right)$ and y is the value of tan 780°, then (x - y) is the tangent of the angle : **[4]**
a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$
c) $\frac{5\pi}{12}$ d) $\frac{\pi}{12}$

41) If a hyperbola passes through the point P(10, 16) and it has vertices at (± 6, 0), then the equation of the normal to it at P is: **[4]**
a) X + 3y = 58 b) X + 2y = 42
c) 2x + 5y = 100 d) 3x + 4y = 94

42) The foci of the hyperbola $2x^2$ - $3y^2$ = 5 are **[4]**
a) $\left(\pm\frac{4}{\sqrt{8}}, 0\right)$
b) $\left(\pm\frac{\sqrt{5}}{6}, 0\right)$
c) $\left(\pm\frac{5}{\sqrt{6}}, 0\right)$
d) $\left(\pm\frac{4}{\sqrt{6}}, 0\right)$

43) The equation of hyperbola whose coordinates of the foci are (± 8, 0) and the length of latus rectum is 24 units, is **[4]**
a) X^2 - $3y^2$ = 48 b) X^2 - $4y^2$ = 48
c) $4x^2$ - y^2 = 48 d) $3x^2$ - y^2 = 48

44) The equation of the hyperbola whose conjugate axis is 5 and the distance between the foci is 13, is: **[4]**
a) $144x^2$ - $25y^2$ = 900 b) $25x^2$ + $144y^2$ = 900
c) $25x^2$ - $144y^2$ = 900 d) $144x^2$ + $25y^2$ = 900

45) If the line y = mx + c is a common tangent to the hyperbola$\frac{x^2}{100} - \frac{y^2}{64} = 1$ and the circle x^2 + y^2 = 36, then which one of the following is true? **[4]**
a) 5m = 4 b) C^2 = 369
c) $4c^2$ = 369 d) 8m + 5 = 0

46) If the parabola y^2 = 4ax passes through (- 3, 2), then the length of its lams rectum is **[4]**
a) $\frac{1}{3}$ b) $\frac{2}{3}$
c) $\frac{4}{3}$ d) 4

47) In a square matrix A = [a_{ij}]of order 3, a_{ii} = m_i + i, where i = 1, 2, 3 m_i' s are slopes (|M_1| < |M_2| < |M_3|) of the 3 normals concurrent at the point (9, - 6) to the parabola y^2 = 4x. Rest of all other entries are one. The value of tr. (A) is equal to: **[4]**
a) - 6 b) 6
c) 3 d) - 3

48) A chord is drawn through the focus of parabola y^2 = 6x such that its distance from the vertex of this parabola is $\frac{\sqrt{5}}{2}$, then its slope can be: **[4]**
a) $\frac{\sqrt{5}}{2}$ b) $\frac{2}{\sqrt{5}}$
c) $\frac{\sqrt{3}}{2}$ d) $\frac{2}{\sqrt{3}}$

49) A circle touches the parabola y^2 = 4x at M (1, 2) and also touches its directrix. The y - coordinate of the point of contact of the circle and the directrix is: **[4]**
a) 4 b) 2
c) $2\sqrt{2}$ d) $\sqrt{2}$

50) The equation of a tangent to the parabola, x^2 = 8y, which makes an angle θ with the positive direction of X - axis, is **[4]**
a) X = y cotθ + 2 tan θ
b) X = y cotθ - 2 tan θ
c) Y = x tanθ - 2 cot θ
d) Y = x tanθ + 2 cot θ