FIITJEE PET – VII (EXTENDED)

MAINS
DATE: 22.09.2018

Time: 3 hours **Maximum Marks: 360**

INSTRUCTIONS:

Instructions to the Candidates

1. This Test Booklet consists of **90 questions**.

   Use **Blue/Black ball Point Pen only** for writing particulars and bubbling of OMR.

2. For each correct answer **4 Marks** will awarded and for each wrong answer **1 Mark** will be deducted.

3. Attempt all questions.

4. In case you have not darkened any bubble you will be awarded 0 mark for that question.

5. Use of calculator/logarithmic table is not permitted.

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐☐

1. $\int_0^1 \frac{\tan^{-1} x}{x} dx$ is equal to

(A) $\int_0^{\pi/2} \frac{\sin x}{x} dx$ (B) $\int_0^{\pi/2} \frac{x}{\sin x} dx$ (C) $\frac{1}{2}\int_0^{\pi/2} \frac{\sin x}{x} dx$ (D) $\frac{1}{2}\int_0^{\pi/2} \frac{x}{\sin x} dx$

2. Let f(x) be a function satisfying $f'(x) = f(x)$ with $f(0) = 1$ and g(x) be the function satisfying $f(x) + g(x) = x^2$. Then the value of integral $\int_0^1 f(x)\, g(x)\, dx$ is equal is

(A) $\frac{e-2}{4}$ (B) $\frac{e-3}{2}$ (C) $\frac{e-4}{2}$ (D) none of these

3. If $f(x) = ae^{2x} + be^{x} + cx$ satisfies the conditions $f(0) = -1$, $f'(\log 2) = 28$, $\int_0^{\log 4} [f(x) - cx]\, dx = \frac{39}{2}$, then

(A) a = 5, b = 6, c = 3 (B) a = 5, b = –6, c = 0 (C) a = –5, b = 6, c = 3 (D) none of these

4. $\int_0^{3\pi/2} \sin\left[\frac{2x}{\pi}\right] dx$, (where [.] denotes greatest integer function) is equal to

(A) $\frac{\pi}{2}$(sin 1 + cos 1) (B) $\frac{\pi}{2}$(sin 1 – sin 2) (C) $\frac{\pi}{2}$(sin 1 + sin 2) (D) none of these

5. One foot of normal of the ellipse $4x^2 + 9y^2 = 36$, then is parallel to the line $2x + y = 3$, is

(A) $\left(\frac{9}{5}, -\frac{8}{5}\right)$ (B) $\left(-\frac{9}{5}, \frac{8}{5}\right)$ (C) $\left(-\frac{9}{5}, -\frac{8}{5}\right)$ (D) none of these

6. A tangent drawn to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at $P\left(\frac{\pi}{6}\right)$ forms a triangle of area $3a^2$ sq. units, with co-ordinate axes. Eccentricity of the hyperbola is equal to

(A) $\sqrt{17}$ (B) $\sqrt{21}$ (C) 4 (D) $\sqrt{6}$

7. The equation of the hyperbola, having it's axes along the co-ordinate axes, can be
(it is given that distances of one of it's vertex from it's foci are 1 and 3 units respectively)

(A) $x^2 - 3y^2 = 3$ (B) $x^2 - 3y^2 + 3 = 0$ (C) $3x^2 - y^2 = 3$ (D) $3x^2 - y^2 + 3 = 0$

Space for rough work

8. The angle between the tangents drawn to the ellipse $3x^2 + 2y^2 = 5$, from the point P(1, 2) is equal to

(A) $\tan^{-1}\left(24\sqrt{5}\right)$ (B) $\tan^{-1}\left(12\sqrt{5}\right)$ (C) $\tan^{-1}\left(\frac{24}{\sqrt{5}}\right)$ (D) $\tan^{-1}\left(\frac{12}{\sqrt{5}}\right)$

9. Locus of the mid-point of chords of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$ that are parallel to the line y = 2x + c, is

(A) $2b^2y - a^2x = 0$ (B) $2a^2y - b^2x = 0$ (C) $2b^2y + a^2x = 0$ (D) $2a^2y + b^2x = 0$

10. Tangent drawn to the ellipse $\frac{x^2}{36}+\frac{y^2}{9} = 1$ at the point 'P' meets the y-axis at A and normal drawn to the ellipse at point 'P' meets the x-axis at B. If area of triangle OAB is $\frac{27}{4}$ sq. units, then eccentric angle of point 'P' is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) none of these

11. A variable chord PQ of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2} = 1$, (b > a) subtends a right angle at the centre 'O' of the hyperbola, then $\frac{1}{OP^2}+\frac{1}{OQ^2}$ is always equal to

(A) $\frac{b^2-a^2}{a^2b^2}$ (B) $\frac{2\left(b^2-a^2\right)}{a^2b^2}$ (C) $\frac{\left(b^2-a^2\right)}{2a^2b^2}$ (D) none of these

12. Eccentricity of the ellipse $5x^2 + 6xy + 5y^2 = 8$ is

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\sqrt{\frac{2}{3}}$ (D) $\frac{1}{\sqrt{3}}$

13. The co-ordinate of the point on the hyperbola $\frac{x^2}{24}-\frac{y^2}{18} = 1$ that is nearest to line 3x + 2y + 1 = 0 is

(A) (6, 3) (B) (6, –3) (C) (–6, –3) (D) (–6, 3)

Space for rough work

14. The line $5x - 3y = 8\sqrt{2}$ is a normal to the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. If θ be the eccentric angle of the foot of this normal, then 'θ' is equal to

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) none of these

15. Normals drawn to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at point 'P' meets the co–ordinate axes at points A and B respectively. Locus of mid-point of segment AB is

(A) $4x^2a^2 + 4y^2b^2 = (a^2 - b^2)^2$ (B) $4x^2b^2 + 4y^2a^2 = (a^2 - b^2)$
(C) $16x^2a^2 + 16y^2b^2 = (a^2 - b^2)^2$ (D) $16x^2b^2 + 16y^2a^2 = (a^2 - b^2)$

16. Consider an ellipse having it's axes along the co-ordinate axes and passing through the point (4, –1). If the line $x + 4y - 10 = 0$ is one of it's tangent, then area of the ellipse is equal to

(A) 20π sq. units (B) 30π sq. units (C) 15π sq. units (D) 10π sq. units

17. Normal drawn to the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ at the point $P(\theta)$ meets the ellipse again at point $Q(2\theta)$, value of $\cos\theta$ can be

(A) $-\frac{16}{23}$ (B) $-\frac{1}{2}$ (C) $-\frac{19}{23}$ (D) $-\frac{21}{23}$

18. The locus of point of intersection of the lines $\sqrt{3}x - y - 4\sqrt{3}t = 0$ and $\sqrt{3}tx + ty - 4\sqrt{3} = 0$, 't' being the parameter, is a hyperbola, whose eccentricity is equal to

(A) $\sqrt{2}$ (B) 2 (C) $\sqrt{3}$ (D) 3

19. Consider the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, having it's eccentricity equal to e. P is any variable point on it and P_1, P_2 are the foot of perpendiculars drawn from P to the x and y–axis respectively. The line P_1P_2 will always be a normal to an ellipse whose eccentricity is equal to

(A) e^2 (B) $\sqrt{e}$ (C) $\sqrt{\frac{2e}{1+e}}$ (D) e

Space for rough work

20. The value of $\int_0^{e-1} \frac{e^{\frac{x^2+2x-1}{2}}}{(x+1)} dx + \int_1^{e} x\log x \cdot e^{\frac{x^2-2}{2}} dx$, is equal to

(A) $\left(\sqrt{e}\right)^{\left(e^2+1\right)}$ (B) $\left(\sqrt{e}\right)^{e^2-1}$ (C) 0 (D) $\left(\sqrt{e}\right)^{e^2-2}$

21. Let f(x) = $\int_2^{x} \frac{dt}{\sqrt{1+t^4}}$ and g be the inverse of f. Then, the value of $g'(0)$ is

(A) 1 (B) 17 (C) $\sqrt{17}$ (D) none of these

22. If $\lim_{a\to\infty} \frac{1}{a}\int_0^{\infty} \frac{x^2+ax+1}{1+x^4} \cdot \tan^{-1}\left(\frac{1}{x}\right) dx$ is equal to $\frac{\pi^2}{k}$, where $k \in N$, equals to

(A) 4 (B) 8 (C) 16 (D) 32

23. If the value of the integral $\int_1^{a} x \cdot a^{-[\log_a x]} dx$, where a > 1 and [x] denotes the greatest integer, is $\frac{e-1}{2}$, then the value of 'a' equals to

(A) $\sqrt{e}$ (B) e (C) $\sqrt{e+1}$ (D) e – 1

24. Let $a_n = \int_0^{\pi/2} (1-\sin t)^n \sin 2t \; dt$, then $\lim_{n\to\infty} \sum_{n=1}^{n} \frac{a_n}{n}$ is equal to

(A) $\frac{1}{2}$ (B) 1 (C) $\frac{4}{3}$ (D) $\frac{3}{2}$

25. The value of $\int_0^1 \left(\prod_{r=1}^{n}(x+r)\right)\left(\sum_{k=1}^{n}\frac{1}{x+k}\right) dx$ equals to

(A) n (B) n! (C) (n + 1)! (D) n . n!

Space for rough work

26. The value of $\int_1^2 \left(x^{[x^2]} + [x^2]^x \right) dx$, is equal to

(where [.] denotes greatest integer function)

(A) $\frac{5}{4} + \sqrt{3} + \left(2^{\sqrt{3}} - 2^{\sqrt{2}}\right) + \frac{1}{\log 3}\left(9 - 3^{\sqrt{3}}\right)$

(B) $\frac{5}{4} + \sqrt{3} + \frac{\sqrt{2}}{3} + \frac{1}{\log 2}\left(2^{\sqrt{3}} - 2^{\sqrt{2}}\right) + \frac{1}{\log 3}\left(9 - 3^{\sqrt{3}}\right)$

(C) $\frac{5}{4} + \frac{\sqrt{2}}{3} + \frac{1}{\log 2}\left(2^{\sqrt{3}} - 2^{\sqrt{2}}\right) + \frac{1}{\log 3}\left(9 - 3^{\sqrt{3}}\right)$

(D) none of these

27. Evaluate: $\int_0^9 \left\{\sqrt{x}\right\} dx$, where {.} denotes the fractional part of x.

(A) 4 (B) 5 (C) 6 (D) 10

28. The value of $\int_0^2 f(x)\, dx$, where f(x) = $\begin{cases} 0, & \text{when } x = \frac{n}{n+1}, n = 1, 2, 3 \cdots\cdots \\ 1, & \text{else where} \end{cases}$ is equal to

(A) 1 (B) 2 (C) 3 (D) none of these

29. Evaluate: $\int_0^{\pi/4} \left\{\tan^n (x - [x]) + \tan^{n-2}\left(x - [x]\right)\right\} dx$,

(where [.] denotes greatest integer function)

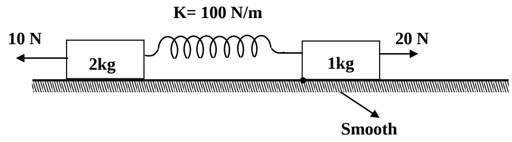
(A) $\frac{1}{n-1}$ (B) n – 1 (C) 1 (D) $\frac{1}{n}$

30. Evaluate: $\int_0^{\pi/4} \frac{\sin x + \cos x}{9 + 16 \sin 2x} dx$

(A) $\frac{1}{20}\log 9$ (B) $\frac{1}{5}\log 3$ (C) $\frac{1}{20}\log 3$ (D) $\frac{1}{5}\log 9$

Space for rough work

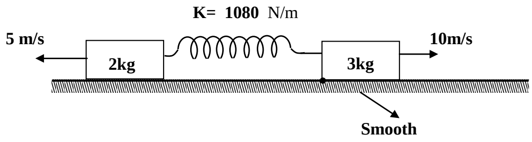
31. Initially spring is in its natural length . Now two forces simultaneously starts acting as shown in fig. The maximum enlongation of the spring will be



(A) $\frac{1}{3}$m (B) $\frac{1}{6}$m

(C) $\frac{2}{3}$m (D) None of these

32. Initially spring is relaxed. Now both the blocks has been imparted velocities as shown in the fig. Find the maximum elongation in the spring. Take $K = 1080 N/m$



(A) $\frac{1}{4}$m (B) $\frac{1}{2}$m

(C) 1 m (D) $\frac{3}{4}$m

33. In the previous question, what is the minimum speed of block of mass 2 kg during the motion ?
(A) 5 m/s (B) 13 m/s (C) zero (D) None of these

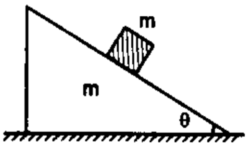
34. In the previous question, what is the minimum possible kinetic energy of the block of mass 3 kg during the motion.
(A) zero (B) 6 J (C) 2 J (D) 10 J

35. Mass is non-uniformly distributed on the circumference of a ring of radius a and centre at origin. Let b be the distance of centre of mass of the ring from origin. Then:
(A) b = a (B) $0 \le b \le a$ (C) b < a (D) b > a

36. A particle of mass 1 kg is projected at an angle of 30° with horizontal with velocity v = 40 m/s. The change in linear momentum of the particle after time t =1 s will be (g = 10 m/s^2)
(A) 7.5 kg-m/s (B) 15 kg-m/s (C) 10 kg-m/s (D) 20 kg-m/s

Space for rough work

37. A block of mass in slides down an inclined wedge of same mass m shown in figure. Friction is absent everywhere. Acceleration of centre of mass of the block and wedge is:



(A) zero (B) $\frac{g\sin^2\theta}{(1+\sin^2\theta)}$ (C) $\frac{g\cos^2\theta}{(1+\sin^2\theta)}$ (D) $\frac{g\sin\theta}{(1+\cos\theta)}$

38. A force $\vec{F}=(2\hat{i}+\hat{j}+3\hat{k})$ N acts on a particle of mass 1 kg for 2 s. If initial velocity of particle is $\vec{u}=(2\hat{i}+\hat{j})$ m/s. Speed of particle at the end of 2 s will be :

(A) 12 m/s (B) 6 m/s (C) 9 m/s (D) 4 m/s

39. The momentum of a particle is $\vec{P}=\vec{A}+\vec{B}t^2$. Where $\vec{A}$ and $\vec{B}$ are constant perpendicular vectors. The force acting on the particle when its acceleration is at 45° with its velocity is:

(A) $2\sqrt{\frac{A}{B}}\vec{B}$ (B) 2 $\vec{B}$

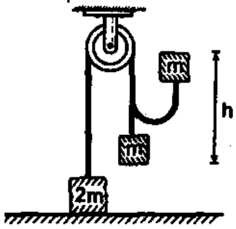
(C) zero (D) data is insufficient

40. Two particles of equal mass m are projected from the ground with speeds v_1 and v_2 at angles θ_1 and θ_2 as shown in figure. The centre of mass of the two particles: ($V_1, V_2, \theta_1, \theta_2 \neq 0$)

(A) will move in a parabolic path for any values of v_1, v_2, θ_1 and θ_2
(B) can move in a vertical line
(C) can move in a horizontal line
(D) will move in a straight line for any values of v_1, v_2, θ_1 and θ_2

Space for rough work

41. A mass 2m rests on a horizontal table. It is attached to a light inextensible string which passes over a smooth pulley and carries a mass m at the other end. If the mass m is raised vertically through a distance h and is then dropped, then the speed with which the mass 2m begins to rise is:

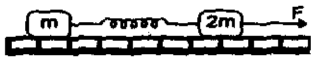


(A) $\sqrt{2gh}$ (B) $\frac{\sqrt{2gh}}{3}$ (C) $\frac{\sqrt{gh}}{2}$ (D) $\sqrt{gh}$

42. A gun fires a shell and recoils horizontally. If the shell travels along the barrel with speed v, the ratio of speed with which the gun recoils if (i) the barrel is horizontal (ii) inclined at an angle of 30° with horizontal is:

(A) 1 (B) $\frac{2}{\sqrt{3}}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{1}{2}$

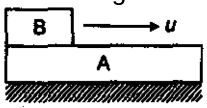
43. Two blocks of masses m and 2m are kept on a smooth horizontal surface. They are connected by an ideal spring of force constant k. Initially the spring is unstretched. A constant force is applied to the heavier block in the direction shown in figure. Suppose at time t displacement of smaller block is x, then displacement of the heavier block at this moment would be:



(A) $\frac{x}{2}$ (B) $\frac{Ft^2}{6m}+\frac{x}{3}$ (C) $\frac{x}{3}$ (D) $\frac{Ft^2}{4m}-\frac{x}{2}$

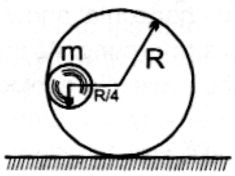
Space for rough work

44. A horizontal block A is at rest on a smooth horizontal surface. A small block B, whose mass is half of A, is placed on A at one end and projected along other end with some velocity is.



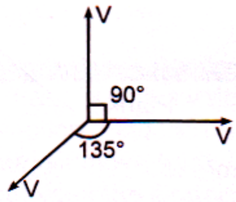
The coefficient of friction between blocks is μ.
Then:
(A) the blocks will reach a final common velocity 2u/3
(B) the work done against friction is one-third of the initial kinetic energy of B
(C) before the blocks reach a common velocity, the acceleration of A relative to B is $(3/2)\mu g$
(D) None of these

45. Inside a spherical shell of radius R a ball of the same mass but of radii R/4 is released from the shown position . find the distance traveled by the centre of the shell on the horizontal smooth floor when the comes to the lowest point of the shell.



(A) 3R/8 (B) 2R/5
(C) 3R/4 (D) 5R/8

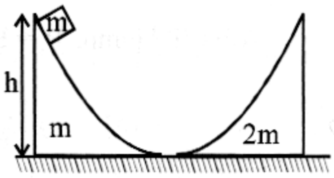
46. A particle of mass 4m which is at rest explodes into four equal fragments. All 4 fragments scattered in the same horizontal plane. Three fragments are found to move with velocity V each as shown in the figure. The total energy released in the process of explosion is :



(A) $mV^2\left(3-\sqrt{2}\right)$ (B) $2mV^2$
(C) $mV^2\frac{\left(3-\sqrt{2}\right)}{2}$ (D) $mV^2\left(\frac{1+\sqrt{2}}{2}\right)$

Space for rough work

47. All the surfaces are smooth in the given diagram. Find out he maximum height attained by particle of mass 'm' on the second wedge. Initially the particle is released from rest from height h as shown in figure.



(A) $\frac{h}{2}$ (B) $\frac{h}{4}$ (C) $\frac{h}{3}$ (D) $\frac{2h}{3}$

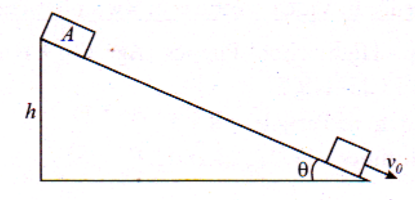
48. In a boat of mass 4 M and length ℓ on a frictionless water surface, two men A $(\text{mass} = \text{M})$ and B (mass 2 M) are standing on the two opposite ends. Now A travels a distance $\ell/4$ relative to boat towards its centre and B moves a distance $3\ell/4$ relative to boat and meet A. Find the distance traveled by the boat on water till A and B meet.

(A) $\frac{5\ell}{28}$ (B) $\frac{\ell}{7}$ (C) $\frac{\ell}{4}$ (D) $\frac{\ell}{3}$

49. A shell at rest at origin explodes into three fragments of masses 1 kg, 2 kg and m kg. The fragments of masses 1 kg and 2 kg fly off with speeds 12 m/s along x-axis and 8m/s then find the total mass of the shell.

(A) 4 kg (B) 4.5 kg (C) 5 kg (D) 3.5 kg

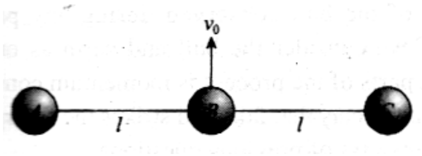
50. A block A is released from rest from the top of a rough fixed wedge of height h shown in figure. If velocity of block when it reaches the bottom of inclined is v_0, find the time of sliding. Take coefficient of friction between block and wedge to be μ and $\tan\theta > \mu$



(A) $\frac{2h\cos\theta}{v_0}$ (B) $\frac{2h\sin\theta}{v_0}$ (C) $\frac{2h}{v_0\cos\theta}$ (D) $\frac{2h}{v_0\sin\theta}$

Space for rough work

51. Three identical balls each of mass m = 0.5 kg are connected with each other as shown in figure, and rest over a smooth horizontal table. At moment t = 0, ball B is imparted a horizontal velocity $v_0 = 9 ms^{-1}$. Calculate velocity of A (leftmost ball) just before it collides with ball C.

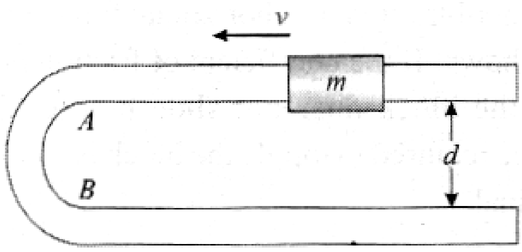


(A) 3m /s (B) 4.5 m/s (C) 6 m/s (D) 4 m/s

52. A bullet is fired from a rifle which recoils after firing. The ratio of the kinetic energy of the rifle to that of the bullet is
(A) zero (B) One (C) Less then one (D) More than one

53. A nucleus moving with a velocity $\vec{v}$ emits an $\alpha-$particle. Let the velocity of the $\alpha-$particle and the remaining nucleus be $\vec{v}_1$ and $\vec{v}_2$ and their masses be m_1 and m_2. Then
(A) $\vec{v}, \vec{v}_1$ and $\vec{v}_2$ must be parallel to each other
(B) None of the two $\vec{v}$, $\vec{v}_1$ and $\vec{v}_2$ should be parallel to each other.
(C) $\vec{v}_1 + \vec{v}_2$ must be parallel to $\vec{v}$
(D) $m_1\vec{v}_1 + m_2\vec{v}_2$ must be parallel to $\vec{v}$

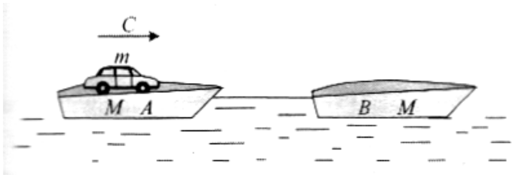
54. A fixed U – shaped smooth wire has a semi – circular bending between A and B as shown in the figure. A bead of mass 'm' moving with uniform speed v through the wire enters the semicircular bend at A and leaves at B. The magnitude of average force exerted by the bead on the part AB of the wire is.



(A) 0 (B) $\frac{4mv^2}{\pi d}$
(C) $\frac{2mv^2}{\pi d}$ (D) None of these

Space for rough work

55. A car C of mass m is initially at rest on the boat A of mass M tied to the identical boat B of same mass M through a massless inextensible string as shown in the fig. The car accelerates from rest to velocity v_0 with respect to boat A in time t_0 sec. At time t = t_0 the car applies brake and comes to rest relative to boat in negligible time. Neglect friction between boat and water find the velocity of boat A just after applying brake. Assume no collision takes place between boats A and B

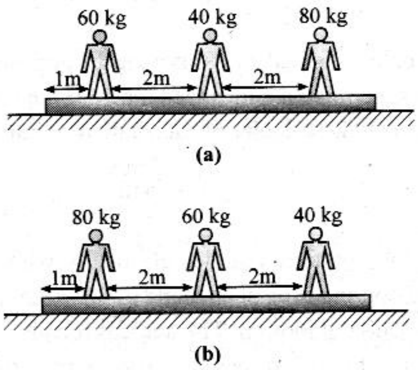


(A) $\frac{Mmv_0}{(2M+m)(M+m)}$ (B) $\frac{Mmv_0}{(M+2m)(M+m)}$

(C) $\frac{2Mmv_0}{(M+2m)(M+m)}$ (D) None

56. Three boys are standing on a horizontal platform of mass 170 kg as shown in figure. They exchange their positions as shown in the figure. Distance moved by the platform is approximately equal to

(A) 0.35 m (B) 0.55 m
(C) 0.45 m (D) 0.25 m

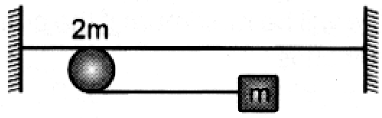


57. A dog weighing 5 kg is standing on a flat boat so that it is 10 m from the shore. The dog walks 4 m on the boat towards the shore and then halts. The boat weighs 20 kg and one can assume that there is no friction between it and the water. How far is the dog from the shore at the end of this time ?

(A) 3.2 m (B) 0.8 m (C) 10 m (D) 6.8 m

Space for rough work

58. A bead can slide on a smooth straight wire and a particle of mass m attached to the bead by a light string of length L. The particle is held in contact with the wire and with the string taut and is then let fall. If the bead has mass 2 m then when the string makes and angle θ with the wire, the bead will have slipped a distance:



(A) $L(1-\cos\theta)$ (B) $(L/2)(1-\cos\theta)$
(C) $(L/3)(1-\cos\theta)$ (D) $(L/6)(1-\cos\theta)$

59. A stationary body explodes into two fragments of masses m_1 and m_2. If momentum of one fragment is p, find the minimum energy of explosion.
(A) $\frac{p^2}{2(m_1+m_2)}$ (B) $\frac{p^2}{2\sqrt{m_1 m_2}}$ (C) $\frac{p^2(m_1+m_2)}{2m_1m_2}$ (D) $\frac{p^2}{2(m_1-m_2)}$

60. A particle of mass m is made to move with uniform speedy along the perimeter of a regular polygon of 2 n sides. The magnitude of impulse applied at each corner of the polygon is:
(A) 2 mv sin $\frac{\pi}{2n}$ (B) m v sin $\frac{\pi}{2n}$ (C) m v cos $\frac{\pi}{2n}$ (D) 2 mv cos $\frac{\pi}{2n}$

61. A certain buffer solution contains equal concentration of X^- and HX. The K_b for X^- is 10^{-10}. The pH of the buffer is :
(A) 4 (B) 7 (C) 10 (D) 14

62. An acid–base indicator has $K_a = 3.0 \times 10^{-5}$. The acid form of the indicator is red and the basic form is blue. The $[H^+]$ required to change the indicator from 75% red to 75% blue is :
(A) 8×10^{-5} M (B) 9×10^{-5} M (C) 1×10^{-5}M (D) 3×10^{-4} M

63. The solubility of $PbCl_2$ in water is 0.01 M at 25°C. Its maximum concentration in 0.1 M NaCl will be :
(A) 2×10^{-3} M (B) 1×10^{-4} M (C) 1.6×10^{-2} M (D) 4×10^{-4} M

64. The solubility products of $Al(OH)_3$ and $Zn(OH)_2$ are 8.5×10^{-23} and 1.8×10^{-14} respectively. If NH_4OH is added to a solution containing Al^{3+} and Zn^{2+} ions, then substance precipitated first is :
(A) $Al(OH)_3$ (B) $Zn(OH)_2$ (C) Both together (D) None of these

Space for rough work

65. The precipitate of CaF_2 ($K_{sp} = 1.7 \times 10^{-10}$) is obtained when equal volumes of the following are mixed:
(A) 10^{-4} M Ca^{2+} + 10^{-4} M F^-
(B) 10^{-2}MCa^{2+} + 10^{-3} MF^-
(C) 10^{-5} M Ca^{2+} + 10^{-3} MF^-
(D) 10^{-3} MCa^{2+} + 10^{-5} MF^-

66. The dissociation constants of two acid HA_1 and HA_2 are 2.88×10^{-4} and 1.8×10^{-5} respectively. The relative strength of the acids will be :
(A) 1 : 4 (B) 4 : 1 (C) 1 : 16 (D) 16 : 1

67. Let the solubilities of AgCl in H_2O, 0.01 M $CaCl_2$; 0.01 M NaCl and 0.05 M $AgNO_3$ be S_1, S_2, S_3, S_4 respectively. What is the correct relationship between these quantities :
(A) $S_1 > S_2 > S_3 > S_4$ (B) $S_1 > S_2 = S_3 > S_4$ (C) $S_1 > S_3 > S_2 > S_4$ (D) $S_4 > S_2 > S_3 > S_1$

68. K_b for the hydrolysis reaction,

$$B^+ + H_2O \rightleftharpoons BOH + H^+$$

Is 1.0×10^{-6}, the hydrolysis constant for the salt is :
(A) 10^{-6} (B) 10^{-7} (C) 10^{-8} (D) 10^{-9}

69. The pK_a of acetyl salicylic acid (aspirin) is 3.5. The pH of gastric juice in the human stomach is about 2.5 and that in the small intestine is about 8.0. Aspirin will be
(A) un–ionized in the small intestine and in the stomach
(B) completely ionized in the small intestine and in the stomach
(C) ionized in the stomach and almost un–ionized in the small intestine
(D) ionized in the small intestine and almost un–ionized in the stomach.

70. In a mixture of CH_3COOH and CH_3COONa, the ratio of salt to acid concentration is increased by ten folds. The pH of the solution will increase by :
(A) Zero (B) 1 (C) 2 (D) 3

71. Which of the following combinations will make a basic buffer ?
(A) NH_3 (1 M) and NH_4Cl (1M)
(B) HCN (2M) and NaOH (1M)
(C) NaCN (2M) and HCl (1M)
(D) All of these

72. Which statement is not true :
(A) pH of 1×10^{-8} M HCl is 6.96
(B) H_3BO_3 is monobasic and weak lewis acid.
(C) Conjugate base of $H_2PO_2^-$ P is HPO_2^{2-}
(D) pH + pOH = 14 for all aqueous solution at 25°C

73. The pH value will be highest for the aqueous solution of
(A) NaCl (B) Na_2CO_3 (C) NH_4Cl (D) $NaHCO_3$

Space for rough work

74. For an endothermic reaction where ΔH represents the enthalpy of the reaction in kJ/mol, the minimum value for energy of activation will be :
(A) less than ΔH (B) zero (C) more than ΔH (D) equal to ΔH

75. Two systems, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ and $COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g)$ are simultaneously in equilibrium in a vessel at constant volume. If some CO is introduced into the vessel, then at the new equilibrium the concentration of :
(A) PCl_5 is greater (B) PCl_3 remains unchanged
(C) PCl_5 is less (D) Cl_2 is greater

76. For equilibrium, $X_2 + Y_2 \rightleftharpoons 2XY$, initially in a 2 litre vessel 2 moles of X_2 and in a 3 litre vessel 2 moles of Y_2 were taken. Both vessels are then connected. At equilibrium, concentration of XY is 0.7 M. Value of equilibrium concentrations of X_2 and Y_2(in M) are :
(A) 0.05, 0.05 (B) 0.06, 0.06 (C) 0.07, 0.07 (D) 0.08, 0.08

77. The pH of 40 ml of an 0.02 M HCl will not be changed by adding
(A) 1 ml of 1M HCl (B) 2 ml of 1M NaOH
(C) 20 ml of 0.1 M NaCl (D) 36 ml of same concentrated HCl solution

78. What is the minimum concentration of SO_4^{2-} required to precipitate $BaSO_4$ in a solution containing 1.0 x 10^{-4} mol of Ba^{2+} ? (K_{sp} of $BaSO_4$ = 4 x 10^{-10})
(A) 2 x 10^{-5} M (B) 4 x 10^{-10} M (C) 4 x 10^{-6} (D) 2 x 10^{-3} M

79. In an acid – base titration, the p^H change of the solution near the equivalence point is 8.7 to 10.7. The PK_{In} values of four indicators A, B, C and D are 7, 9, 11 and 6 respectively. Then the suitable indicator for the above given titration is
(A) A (B) B (C) C (D) D

Space for rough work

80. What is the effect of adding sodium acetate crystals to 1 L of a 0.50 M acetic acid solution ?
(A) The concentration of the sodium ions decreases
(B) The concentration of the hydrogen ions decreases
(C) The concentration of the hydrogen ions increases
(D) The concentrations of both the sodium and hydrogen ions decrease.

81. The pH of a buffer solution is 4.745. When 0.044 mole of $Ba(OH)_2$ is added to 1 lit. of the buffer, the pH changes to 4.756. Then the buffer capacity is
(A) 4 (B) 0.25 (C) 0.5 (D) 8

82. Three sparingly soluble salts M_2X, MX and MX_3 have the same solubility product values. The correct order of their solubilities is
(A) $MX_3 > MX > M_2X$ (B) $MX_3 > M_2X > MX$
(C) $MX > MX_3 > M_2X$ (D) $MX > M_2X > MX_3$

83. 100 ml of pH = 6 (acidic) is diluted to 1000 mL by H_2O. pH will increase by :
(A) 9 units (B) 1 unit (C) 0.7 unit (D) –0.7 unit

84. pH of $Ba(OH)_2$ solution is 12. Its solubility product is :
(A) $10^{-6}M^3$ (B) $4 \times 10^{-6}M^3$ (C) $0.5 \times 10^{-7}M^3$ (D) $5 \times 10^{-7}M^3$

85. A buffer solution is prepared by mixing 100 mL of 0.01M CH_3COOH and 200 mL of 0.02 M CH_3COONa. 100mL of water is added. pH before and after dilution are: ($pK_a = 4.74$)
(A) 5.34, 5.34 (B) 5.04, 0.504 (C) 5.04, 1.54 (D) 5.34, 4.34

86. The following equilibria are given by

$$N_2 + 3H_2 \rightleftharpoons 2NH_3;\ K_1$$

$$N_2 + O_2 \rightleftharpoons 2NO;\ K_2$$

$$H_2 + \frac{1}{2}O_2 \rightleftharpoons H_2O;\ K_3$$

The equilibrium constant of the reaction

$$2NH_3 + \frac{5}{2}O_2 \rightleftharpoons 2NO + 3H_2O$$

in terms of K_1, K_2 and K_3 is
(A) $\frac{K_2K_3^3}{K_1}$ (B) $K_1K_2K_3$ (C) $\frac{K_1K_2}{K_3}$ (D) $\frac{K_1K_3^2}{K_2}$

Space for rough work

87. Given, $HF + H_2O \xrightarrow{K_a} H_3O^+ + F^-$ $\qquad F^- + H_2O \xrightarrow{K_b} HF + OH^-$
Which relation is correct ?
(A) $K_b = K_w$ (B) $K_b = \frac{1}{K_w}$ (C) $K_a \times K_b = K_w$ (D) $\frac{K_a}{K_b} = K_w$

88. In the titration of NH_4OH with HCl, the indicator which cannot be used is
(A) Phenolphthalein (B) methyl orange
(C) methyl red (D) both methyl orange and methyl red.

89. The K_{sp} of $Mg(OH)_2$ is 1×10^{-12}; 0.01M $Mg(OH)_2$ will precipitate at the limiting pH :
(A) 3 (B) 9 (C) 5 (D) 8

90. If the solubility of lithium sodium hexafluoro aluminate, $Li_3Na_3(AlF_6)_2$ is `S' mol L^{-1}, its solubility product is equal to :
(A) S^8 (B) $12S^3$ (C) $18S^3$ (D) $2916S^8$

Space for rough work

FIITJEE PET – VII (EXTENDED)
MAINS_ANSWERS
DATE: 22.09.2018

MATHEMATICS

1.	**D**	2.	**D**	3.	**B**	4.	**C**
5.	**A or B**	6.	**A**	7.	**B or C**	8.	**D**
9.	**D**	10.	**C**	11.	**A**	12.	**B**
13.	**D**	14.	**C**	15.	**A**	16.	**D**
17.	**Bonus**	18.	**B**	19.	**D**	20.	**D**
21.	**C**	22.	**C**	23.	**A**	24.	**A**
25.	**D**	26.	**B**	27.	**B**	28.	**B**
29.	**A**	30.	**C**				

PHYSICS

31.	**A**	32.	**B**	33.	**C**	34.	**A**
35.	**C**	36.	**C**	37.	**B**	38.	**C**
39.	**A**	40.	**B**	41.	**B**	42.	**B**
43.	**D**	44.	**C**	45.	**A**	46.	**A**
47.	**C**	48.	**A**	49.	**Bonus**	50.	**D**
51.	**C**	52.	**C**	53.	**D**	54.	**B**
55.	**A**	56.	**A**	57.	**D**	58.	**C**
59.	**C**	60.	**A**				

CHEMISTRY

61.	**A**	62.	**A**	63.	**D**	64.	**A**
65.	**B**	66.	**B**	67.	**C**	68.	**C**
69.	**D**	70.	**B**	71.	**A**	72.	**C**
73.	**B**	74.	**C**	75.	**C**	76.	**A**
77.	**Bonus**	78.	**C**	79.	**B**	80.	**B**
81.	**D**	82.	**B**	83.	**C**	84.	**B**
85.	**A**	86.	**A**	87.	**C**	88.	**A**
89.	**B**	90.	**D**				