FIITJEE PET – IX (REG_1ST YEAR)

MAINS_SET–A

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.

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ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐☐☐

1. In a parallelogram ABCD, $\left|\overrightarrow{AB}\right| = a, \left|\overrightarrow{AD}\right| = b$ and $\left|\overrightarrow{AC}\right| = c$, then $\overrightarrow{DB}\cdot\overrightarrow{AB}$ has the value

   (A) $\frac{3a^2+b^2-c^2}{2}$ (B) $\frac{a^2+3b^2-c^2}{2}$ (C) $\frac{a^2-b^2+3c^2}{2}$ (D) $\frac{a^2+3b^2+c^2}{2}$

2. If $\vec{p}$ and $\vec{d}$ are two unit vectors and θ is the angle between them, then

   (A) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = \sin\frac{\theta}{2}$ (B) $\vec{p}\times\vec{d} = \sin\theta$

   (C) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = 1-\cos\theta$ (D) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = 1-\cos 2\theta$

3. If the non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other, then the solution of the equation $\vec{r}\times\vec{a} = \vec{b}$ is

   (A) $\vec{r} = x\vec{a} + \frac{1}{\vec{a}\cdot\vec{a}}\left(\vec{a}\times\vec{b}\right)$ (B) $\vec{r} = x\vec{b} - \frac{1}{\vec{b}\cdot\vec{b}}\left(\vec{a}\times\vec{b}\right)$ (C) $\vec{r} = x\left(\vec{a}\times\vec{b}\right)$ (D) none of these

4. If $\vec{A},\vec{B},\vec{C}$ are non-coplanar vectors then $\frac{\vec{A}\cdot\left(\vec{B}\times\vec{C}\right)}{\left(\vec{C}\times\vec{A}\right)\cdot\vec{B}} + \frac{\vec{B}\cdot\left(\vec{A}\times\vec{C}\right)}{\vec{C}\cdot\left(\vec{A}\times\vec{B}\right)}$ is equal to

   (A) 3 (B) 0 (C) 1 (D) none of these

5. If $\vec{a},\vec{b},\vec{c}$ are three non-coplanar vectors and $\vec{p},\vec{q},\vec{r}$ are vectors defined by the relations $\vec{p} = \frac{\vec{b}\times\vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, $\vec{q} = \frac{\vec{c}\times\vec{a}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, $\vec{r} = \frac{\vec{a}\times\vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, then the value of expression $\left(\vec{a}+\vec{b}\right)\cdot\vec{p} + \left(\vec{b}+\vec{c}\right)\cdot\vec{q} + \left(\vec{c}+\vec{a}\right)\cdot\vec{r}$ is equal to

   (A) 0 (B) 1 (C) 2 (D) 3

6. If in a triangle ABC, $\overrightarrow{BC} = \frac{\vec{u}}{|\vec{u}|} - \frac{\vec{v}}{|\vec{v}|}$ and $\overrightarrow{AC} = \frac{2\vec{u}}{|\vec{u}|}$, where $|\vec{u}| \neq |\vec{v}|$, then

   (A) 1 + cos 2A + cos 2B + cos 2C = 2 (B) sin A = cos B
   (C) 1 + cos 2A + cos 2B + cos 2C = 0 (D) sin B = cos C

Space for rough work

7. If $\vec{u}$ and $\vec{v}$ are two non collinear unit vector such that $|\vec{u}\times\vec{v}| = \left|\frac{\vec{u}-\vec{v}}{2}\right|$, then find the value of $|\vec{u}\times(\vec{u}\times\vec{v})|^2$

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{1}{2}$ (D) $\frac{3}{8}$

8. Let $\vec{u}$ and $\vec{v}$ are unit vectors and $\vec{w}$ is a vector such that $\vec{u}\times\vec{v}+\vec{u}=\vec{w}$ and $\vec{w}\times\vec{u}=\vec{v}$, then find the value $[\vec{u}\ \vec{v}\ \vec{w}]$

(A) 2 (B) 3 (C) 1 (D) 4

9. Two given points P and Q in the rectangular Cartesian coordinates lie on $y = 2^{x+2}$ such that $\overrightarrow{OP}\cdot\hat{i} = -1$ and $\overrightarrow{OQ}\cdot\hat{i} = 2$, where $\hat{i}$ is a unit vector along the x axis. Find the magnitude of $\overrightarrow{OQ} - 4\overrightarrow{OP}$

(A) 5 (B) 10 (C) 20 (D) none of these

10. Let $\vec{a},\vec{b},\vec{c}$ be unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{x}, \vec{a}\cdot\vec{x}=1, \vec{b}\cdot\vec{x}=\frac{3}{2}, |\vec{x}|=2$, then angle between $\vec{c}$ and $\vec{x}$ is

(A) $\cos^{-1}\left(\frac{1}{4}\right)$ (B) $\cos^{-1}\frac{3}{4}$ (C) $\cos^{-1}\left(\frac{3}{8}\right)$ (D) $\cos^{-1}\left(\frac{5}{8}\right)$

11. Value of $\left[\vec{a}\times\vec{b}\quad \vec{a}\times\vec{c}\quad \vec{d}\right]$ is always equal to

(A) $(\vec{a}\cdot\vec{d})\left[\vec{a}\quad \vec{b}\quad \vec{c}\right]$ (B) $(\vec{a}\cdot\vec{c})\left[\vec{a}\quad \vec{b}\quad \vec{c}\right]$ (C) $(\vec{a}\cdot\vec{b})\left[\vec{a}\quad \vec{b}\quad \vec{c}\right]$ (D) none of these

12. If the vector $\hat{i}-3\hat{j}+5\hat{k}$ bisects the angle between $\vec{a}$ and $-\hat{i}+2\hat{j}+2\hat{k}$, where $\vec{a}$ is a unit vector, then

(A) $\vec{a} = \frac{1}{105}\left(41\hat{i}+88\hat{j}-40\hat{k}\right)$ (B) $\vec{a} = \frac{1}{105}\left(41\hat{i}+88\hat{j}+40\hat{k}\right)$

(C) $\vec{a} = \frac{1}{105}\left(-41\hat{i}+88\hat{j}-40\hat{k}\right)$ (D) $\vec{a} = \frac{1}{105}\left(41\hat{i}-88\hat{j}-40\hat{k}\right)$

13. If $\vec{a}=\vec{b}+\vec{c}, \vec{b}\times\vec{d}=\vec{0}, \vec{c}\cdot\vec{d}=\vec{0}$, then the vector $\frac{\vec{d}\times(\vec{a}\times\vec{d})}{|\vec{d}|^2}$ is always equal to

(A) $\vec{a}$ (B) $\vec{d}$ (C) $\vec{b}$ (D) $\vec{c}$

Space for rough work

14. If $\vec{a},\vec{b}$ and $\vec{c}$ are vectors such that $|\vec{a}|=3,|\vec{b}|=4$ and $|\vec{c}|=5$ and $(\vec{a}+\vec{b})$ is perpendicular to $\vec{c}$, $(\vec{b}+\vec{c})$ is perpendicular to $\vec{b}$, then to $\vec{a}$ and $(\vec{c}+\vec{a})$ is perpendicular to $\vec{b}$, then $|\vec{a}+\vec{b}+\vec{c}|$ is

(A) $4\sqrt{3}$ (B) $5\sqrt{2}$ (C) 2 (D) 12

15. Centroid of the tetrahedron OABC, where A ≡ (a, 2, 3), B ≡ (1, b, 2), C ≡ (2, 1, c) and O is the origin is (1, 2, 3). The value of $a^2 + b^2 + c^2$ is equal to

(A) 75 (B) 80 (C) 121 (D) none of these

16. For any two vectors $\vec{a}$ and $\vec{b}$, the expression $(\vec{a}\times\hat{i})\cdot(\vec{b}\times\hat{i})+(\vec{a}\times\hat{j})\cdot(\vec{b}\times\hat{j})+(\vec{a}\times\hat{k})\cdot(\vec{b}\times\hat{k})$ is always equal to

(A) $\vec{a}\cdot\vec{b}$ (B) $2\vec{a}\cdot\vec{b}$ (C) zero (D) none of these

17. If $\vec{a}\times(\vec{b}\times\vec{c})$ is perpendicular to $(\vec{a}\times\vec{b})\times\vec{c}$, then we may have

(A) $\vec{b}\cdot\vec{c}=0$ (B) $\vec{a}\cdot\vec{b}=0$ (C) $\vec{a}\cdot\vec{c}=0$ (D) none of these

18. $\vec{a},\vec{b},\vec{c}$ are non-coplanar vectors and $\vec{a}_1,\vec{b}_1,\vec{c}_1$ constitute the corresponding reciprocal system of vectors, then we have $\vec{a}_1\times\vec{b}_1+\vec{b}_1\times\vec{c}_1+\vec{c}_1\times\vec{a}_1=\frac{\lambda}{[\vec{a}\,\vec{b}\,\vec{c}]}(\vec{a}+\vec{b}+\vec{c})$, where λ is equal to

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

19. A, B, C and D are any four points in the space. If $|\overrightarrow{AB}\times\overrightarrow{CD}+\overrightarrow{BC}\times\overrightarrow{AD}+\overrightarrow{CA}\times\overrightarrow{BD}|=\lambda\Delta_{ABC}$, where Δ_{ABC} is the area of triangle ABC, then λ is equal to

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

20. $\vec{a}$ and $\vec{c}$ are unit vectors and $|\vec{b}|=4$. If angle between $\vec{b}$ and $\vec{c}$ is $\cos^{-1}\left(\frac{1}{4}\right)$ and $\vec{a}\times\vec{b}=2\vec{a}\times\vec{c}$, then $\vec{b}=\lambda\vec{a}+2\vec{c}$, where λ is equal to

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

Space for rough work

21. Let $\vec{b}$ and $\vec{c}$ are unit vectors, then for any arbitrary vector $\vec{a}, \left\{\left[\left(\vec{a}\times\vec{b}\right)+\left(\vec{a}\times\vec{c}\right)\right]\times\left(\vec{b}\times\vec{c}\right)\right\}\cdot\left(\vec{b}-\vec{c}\right)$ is always equal to

(A) $|\vec{a}|$ (B) $\frac{1}{2}|\vec{a}|$ (C) $\frac{1}{3}|\vec{a}|$ (D) zero

22. Resolved part of vector $\vec{a}$ along the vector $\vec{b}$ is $\vec{a}_1$ and that perpendicular to $\vec{b}$ is $\vec{a}_2$, then $\vec{a}_1\times\vec{a}_2$ is equal to

(A) $\frac{\left(\vec{a}\times\vec{b}\right)\left(\vec{b}\right)}{\left|\vec{b}\right|^2}$ (B) $\frac{\left(\vec{a}\cdot\vec{b}\right)\vec{a}}{\left|\vec{a}\right|^2}$ (C) $\frac{\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\times\vec{a}\right)}{\left|\vec{b}\right|^2}$ (D) $\frac{\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\times\vec{a}\right)}{\left|\vec{b}\times\vec{a}\right|}$

23. Let $\vec{a},\vec{b}$ and $\vec{c}$ be three non-zero and non-coplanar vectors and $\vec{p},\vec{q}$ and $\vec{r}$ be three vectors given by $\vec{p}=\vec{a}+\vec{b}-2\vec{c}, \vec{q}=3\vec{a}-2\vec{b}+\vec{c}$ and $\vec{r}=\vec{a}-4\vec{b}+2\vec{c}$. If the volume of the parallelepiped determined by $\vec{a},\vec{b}$ and $\vec{c}$ is V_1 and that of the parallelepiped determined by $\vec{p},\vec{q}$ and $\vec{r}$ is V_2 and $V_2 : V_1$ is equal to

(A) 3 : 1 (B) 7 : 1 (C) 11 : 1 (D) 15 : 1

24. If $\vec{a},\vec{b},\vec{c}$ are unit vectors, then $\frac{1}{3}\left(\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{d}\right|^2\right)$ does not exceed

(A) 9 (B) 3 (C) 6 (D) 8

25. A, B, C and D are four points in a plane with position vectors $\vec{a},\vec{b},\vec{c}$ and $\vec{d}$ respectively such that $\left(\vec{a}-\vec{d}\right)\cdot\left(\vec{b}-\vec{c}\right)=\left(\vec{b}-\vec{d}\right)\cdot\left(\vec{c}-\vec{a}\right)=0$. Then for ΔABC, D is its

(A) incentre (B) circumcentre (C) orthocentre (D) centroid

26. If $|\vec{a}|=2$ and $|\vec{b}|=3$ and $\vec{a}\cdot\vec{b}=0$, then $\left(\vec{a}\times\left(\vec{a}\times\left(\vec{a}\times\left(\vec{a}\times\vec{b}\right)\right)\right)\right)$ is equal to

(A) $48\vec{b}$ (B) $-48\vec{b}$ (C) $48\vec{a}$ (D) $-48\vec{a}$

27. The value of c so that for all real x, the vectors $cx\hat{i}-6\hat{j}+3\hat{k}, x\hat{i}+2\hat{j}+2cx\hat{k}$ make an obtuse angle are

(A) $c < 0$ (B) $0 < c < \frac{4}{3}$ (C) $-\frac{4}{3} < c < 0$ (D) $c > 0$

Space for rough work

28. A non-zero vectors $\vec{a}$ is such that its projections along the vectors $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ and $\frac{-\hat{i}+\hat{j}}{\sqrt{2}}$ and $\hat{k}$ are equal, then unit vector along $\vec{a}$ is

(A) $\frac{\sqrt{2}\hat{j}-\hat{k}}{\sqrt{3}}$ (B) $\frac{\hat{j}-\sqrt{2}\hat{k}}{\sqrt{3}}$ (C) $\frac{\sqrt{2}}{\sqrt{3}}\hat{j}+\frac{\hat{k}}{\sqrt{3}}$ (D) $\frac{\hat{j}-\hat{k}}{\sqrt{2}}$

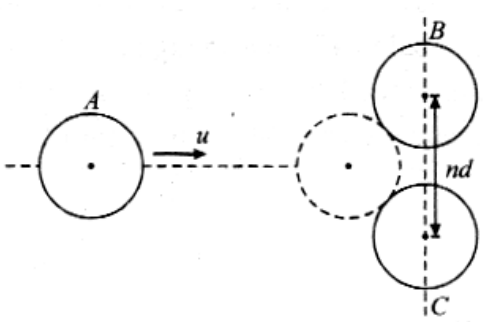
29. $\vec{A},\vec{B},\vec{C}$ are three vectors respectively given by $2\hat{i}+\hat{k},\hat{i}+\hat{j}+\hat{k}$, and $4\hat{i}-3\hat{j}+7\hat{k}$. Then vector $\vec{R}$, which satisfies the relation $\vec{R}\times\vec{B}=\vec{C}\times\vec{B}$ and $\vec{R}\cdot\vec{A}=0$ is

(A) $2\hat{i}-5\hat{j}+2\hat{k}$ (B) $-\hat{i}+4\hat{j}+2\hat{k}$ (C) $-\hat{i}-8\hat{j}+2\hat{k}$ (D) none of these

30. A vector $\vec{a}$ = (x, y, z) makes an obtuse angle with y–axis, equal angles with $\vec{b}$ = (y, –2z, 3x) and $\vec{c}$ = (2z, 3x, –y) and $\vec{a}$ is perpendicular to $\vec{d}$ = (1, –1, 2) if $|\vec{a}|=2\sqrt{3}$, then vector $\vec{a}$ is

(A) (1, 2, 3) (B) (2, –2, –2) (C) (–1, 2, 4) (D) none of these

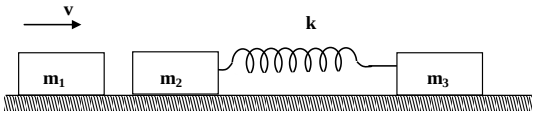
31. Three identical discs A,B and C having diameter 'd' each rest on a smooth horizontal plane as shown in figure. The disc A is set in motion with velocity v along the perpendicular bisector of the line BC joining the centres of the stationary discs. The distance between the centres of stationary discs B and C is n times the diameter of each disc. At what value of n will the disc A stop after elastic collision



(A) $\sqrt{3}$ (B) $\frac{\sqrt{5}}{2}$

(C) $\sqrt{2}$ (D) $\frac{\sqrt{6}}{2}$

32. Mass m_1 hits m_2 with inelastic impact (e = 0) while sliding horizontally with velocity v along the common line of centres of three equal mass as shown in figure. Initially, masses m_2 and m_3 are stationary and the spring is unstressed. After impact, find the maximum possible kinetic energy of m_3 during the motion. Take $m_1=m_2=m_3=m$



(A) $\frac{mv^2}{18}$ (B) $\frac{2mv^2}{9}$

(C) $\frac{mv^2}{3}$ (D) $\frac{1}{2}mv^2$

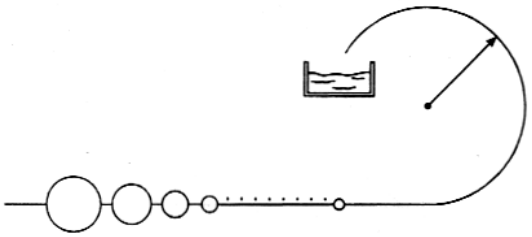
Space for rough work

33. Two billiard balls of equal mass move at right angles and meet at the origin of a coordinate system. First is moving up along the y – axis at 3 m/s and the other is moving to the right along the x- axis with speed 4.8 m/s. After the elastic collision, the second ball is moving along the positive y –axis. What is the final speed of the first ball.
(A) 4.8 m/s (B) 3.6 m/s (C) 2 m /s (D) 2.4 m/s

34. A block of mass 2 kg moving at 2 m/s collides head on with another block of equal mass kept at rest on smooth horizontal surface. What can be the maximum possible loss in kinetic energy due to the collision.
(A) 4 J (B) 2 J (C) 3 J (D) 1 J

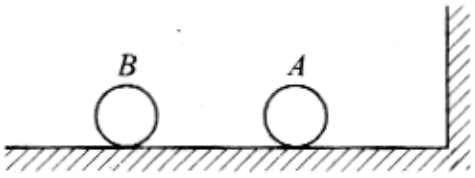
35. A ball with a speed of 9 m/s strikes another identical ball such that after collision the direction of each ball makes an angle 30^0 with the original line of motion. Find the speeds of the two balls after the collision. There is no friction anywhere
(A) 3 m/s (B) $3\sqrt{3}\,m/s$ (C) 4.5 m /s (D) 6 m /s

36. N beads are resting on a smooth horizontal fixed wire which is circular at the end with radius r as shown in figure . The masses of the beads are $m, m/2, m/4 \ldots m/2^{n-1}$ respectively. Find the minimum velocity which should be imparted to the first bead of mass m such that the n^{th} bead will fall in the tank shown in figure.



(A) $\left(\frac{3}{4}\right)^{n-1}.\sqrt{4gr}$ (B) $\left(\frac{3}{4}\right)^{n-1}.\sqrt{5gr}$ (C) $\left(\frac{1}{4}\right)^{n-1}.\sqrt{5gr}$ (D) None of these

37. A ball A of mass 10 kg and a ball B of unknown mass are placed on a horizontal frictionless table which rest against a rigid wall as shown in figure. The ball A moves towards the ball B with a velocity 'v'. What should be the mass of B such that both A and B move with the same speed after A has undergone a collision with ball B and the wall ? All collisions are assume to the elastic.



(A) 10 kg (B) 20 kg (C) 30 kg (D) 40 kg

Space for rough work

38. A 3 kg melon is balanced on a bald man's head. His friend shoots a 50 gm arrow at it with speed 25 m/s. The arrow passes through the melon and emerges at 10 m/s. Find the speed of the melon as it flies off the man's head.
(A) 0.50 m/s (B) 0.25 m/s (C) 0.75 m/s (D) 0.10 m/s

39. A 42 kg girl walks along a stationary uniform platform of mass 21 kg. She walks with a speed of 0.75 m/s. What is the speed of the centre of mass of the system of girl plus platform ? Assume that platform is placed on a smooth horizontal surface.
(A) 0.50 m/s (B) 0.25 m/s (C) 0.75 m/s (D) Non of these

40. A ball of mass m moving at a speed v makes a head on collision with an identical ball at rest. The kinetic energy of the balls after the collision is three fourths of the original. Find the coefficient of restitution.
(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{3}{4}$ (D) $\frac{1}{\sqrt{2}}$

41. A ball of mass m approaches a wall of mass M (>>m) with speed 4 m/s along the normal to the wall. The speed of wall is 1 m/s towards the ball. The speed of the ball after an elastic collision with the wall is
(A) 5 m/s away from the wall (B) 9 m/s away from the wall
(C) 3 m/s away from the wall (D) 6 m/s away from the wall

42. A ball strikes a horizontal floor at angle $\theta = 45°$. The coefficient of restitution between the ball and the floor is $e = \frac{1}{2}$. The fraction of its kinetic energy lost in collision is
(A) $\frac{5}{8}$ (B) $\frac{3}{8}$ (C) $\frac{3}{4}$ (D) $\frac{1}{4}$

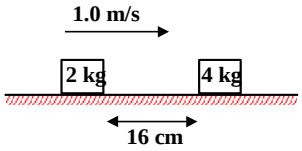
43. A particle strikes a smooth horizontal surface at an angle of 45° with a velocity of 100 m/s and rebounds. If the coefficient of restitution between the floor and the particle is $\frac{1}{\sqrt{3}}$ then the angle made by the velocity of the particle with the floor after it rebounds is (approximately)
(A) 30° (B) 45° (C) 60° (D) 90°

Space for rough work

44. Two masses of 4 kg and 1 kg are moving in opposite direction with equal kinetic energies of 8J. If the collision between the masses are perfectly inelastic the percentage loss of kinetic energy of the masses is
(A) 60% (B) 70% (C) 80% (D) 90%

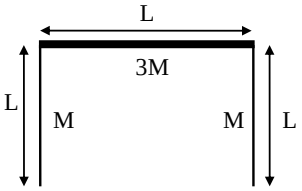
45. A particle of mass m_1 moves with speed v and collides head on with a stationary particle of mass m_2. The first particle continue to move in the same director if $\frac{m_1}{m_2}$ is (e = coefficient of restitution)
(A) = e (B) > e (C) < e (D) > e^2

46. The friction coefficient between the horizontal surface and each of the blocks shown in the figure is 0.2. The collision between the blocks is perfectly elastic. The velocity of 2 kg block in the position shown is 1 m/s and the 4 kg block is initially at rest. Which of the following statement is **correct.** Take g = 10m/s^2.



(A) The velocity of 4 kg mass just after collision is 0.2 m/s
(B) The velocity of 2 kg mass just after collision is 0.3 m/s
(C) The velocity of 4 kg mass just after collision is 0.4 m/s
(D) the separation between them when they finally come to rest is 9 cm

47. Three thin rods of each of length L are arranged in an inverted U, as shown in the figure. The two rods on the arms of the U each have mass M, the third rod has mass 3M. Which of the following statement is **incorrect.**

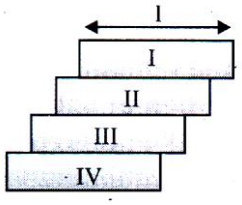


(A) the center of mass is located at a distance of $\frac{2L}{5}$ from the 3M rod
(B) the center of mass is located at a distance of $\frac{L}{5}$ from the 3M rod
(C) the center of mass is equidistant from both the rods of mass M
(D) if another rod of length L and mass 3M is introduced to complete the square, the centre of mass will shift downwards

Space for rough work

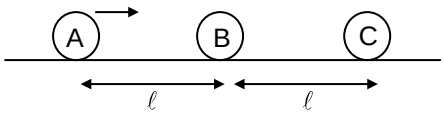
48. A particle of mass m = 2 kg collides head on with another stationary particle of mass M = 3 kg with an initial velocity of 6 m/s. If the particle m stops just after the collision, which of the following statement is **incorrect.**
(A) the velocity of block M after the collision is 4 m/s
(B) kinetic energy of system before collision is equal to kinetic energy after the collision
(C) the coefficient of restitution for the collision is 2/3
(D) fractional loss of kinetic energy due to the collision is 1/3

49. Four bricks, each of length ℓ, are put on the top of one another in such a way that part of each extends beyond the one beneath. The bricks are kept such that largest equilibrium extensions(off-set) are achieved w.r.t bottom (brick- IV). Which of the following statement is **incorrect.**



(A) top brick over hanging the one below by $\frac{\ell}{2}$
(B) second brick from top over hanging the one below $\frac{\ell}{6}$
(C) third brick from top overhanging by bottom one by $\frac{\ell}{6}$
(D) the total overhanging length on the edge of the bottom brick is $\frac{11}{12}\ell$

50. Three small spheres A, B and C of same size and each of mass m, 3m and 9m respectively are placed along a straight line. The sphere A is given a velocity u towards sphere B is shown in figure. All the collisions between the spheres are elastic. [Assume the horizontal surface on which the spheres are placed to be friction less]. Find the final velocity of sphere C after all collisions



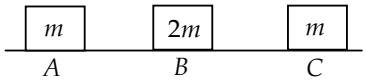
(A) $\frac{u}{2}$ (B) $\frac{u}{4}$ (C) $\frac{2u}{3}$ (D) $\frac{3u}{4}$

Space for rough work

51. A ball is thrown downwards with a initial velocity u from a height h = 0.6 m. The ball collides inelastically with the ground and rebounds back to the same height. Find u (in m/s). [coefficient of restitution, e = 1/2)

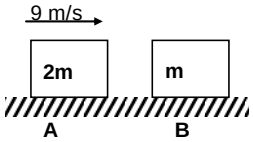
(A) 4 m/s (B) 3 m/s (C) 6 m/s (D) 2 m/s

52. Three objects A, B and C are kept in a straight line on a frictionless horizontal surface. These have masses m, 2m and m respectively. The object A moves towards B with a speed $9ms^{-1}$ and makes an elastic collision with it. Thereafter, B makes completely inelastic collision with C. All motions occur on the same straight line. Find the final speed of C (in ms^{-1})



(A) 4 m/s (B) 3 m/s (C) 6 m/s (D) 2 m/s

53. A block of mass 2 m collides elastically with a mass m kept at rest. Friction exists between the block B and surface with coefficient μ=0.3, where as no friction exists between block A and the surface . The block will again collide after time _____



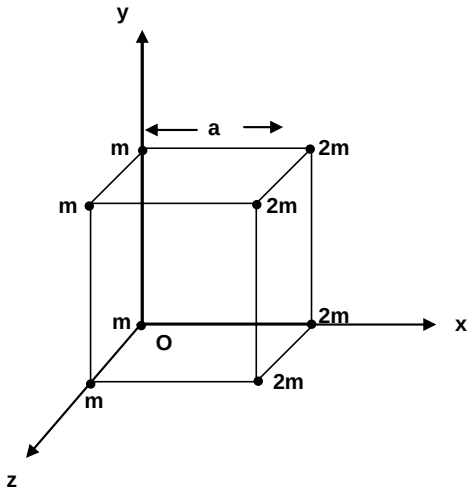
(A) 6 sec (B) 4 sec (C) 8 sec (D) ∞

54. Three particles each of mass m are kept at a corners of isosceles right angled triangle with smaller side having length ℓ. Moment of inertia of the system of particle about an axis passing through the midpoint of hypotenuse and perpendicular to the plane containing triangle is

(A) $\frac{5m\ell^2}{2}$ (B) $4m\ell^2$ (C) $\frac{3}{2}m\ell^2$ (D) None of these

Space for rough work

55. System of particles are arranged at the vertices of a cube as shown in figure is rotated across y axis moment of inertia about y –axis is



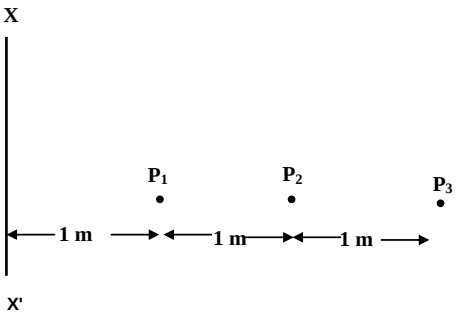
(A) $12ma^2$ (B) $13ma^2$

(C) $10ma^2$ (D) None of these

56. Four particles each of mass m are kept at the four corners of square of side a. Moment of inertia about an axis passing through one of the particles and perpendicular to the plane containing particles is .

(A) $3ma^2$ (B) $4ma^2$ (C) $5ma^2$ (D) $\frac{3}{2}ma^2$

57. Ratio of moment of inertia about XX' of given system of particles shown to the moment of inertia when particle P_2 is not present is (assume all particles have same mass)



(A) $\frac{11}{7}$ (B) $\frac{12}{7}$

(C) $\frac{10}{7}$ (D) None of these

(Question – 58-59)

58. A particle is projected from ground at an angle of 53^0 with horizontal at a speed of 10 m/s towards a smooth vertical wall situated 4.8 m away from the point of projection. The time after which the particle will strike the ground again is: (coefficient of Restitution between particle and wall (e)= $\frac{1}{4}$, g = 10 m/s^2)

(A) 1.6 sec (B) 1 sec (C) 1.2 sec (D) None of these

Space for rough work

59. Considering the situation given in the previous question, the displacement of the particle from the point of projection will be.
(A) 0 (B) towards the wall (C) away from the wall (D) None of these

60. Select the incorrect option
(A) Usually colliding forces are impulsive in nature
(B) Gravitational and spring forces are always non impulsive
(C) Normal, tension, friction forces are always impulsive
(D) An impulsive force can only be balanced by another impulsive force

61. Dry ice is solid carbon dioxide. A 0.050 g sample of dry ice is placed in an evacuated 4.6 L vessel at 30°C. Calculate the pressure inside the vessel after all the dry ice has been converted to CO_2 gas.
(A) 6.14 atm (B) 0.614 atm (C) 0.0614 atm (D) 6.14×10^{-3} atm

62. A mixture of helium and neon gases is collected over water at 28.0°C and 745 mmHg. If the partial pressure of helium is 368 mm Hg, what is the partial pressure of neon ?
(Vapour pressure of water at 28°C = 28.3 mm Hg)
(A) 348.7 mm Hg (B) 377 mm Hg (C) 384.7 mm Hg (D) none of these

63. A certain hydrate has the formula $MgSO_4 . xH_2O$. A quantity of 54.2 g of the compound is heated in an oven to drive off the water. If the steam generated exerts a pressure of 24.8 atm in a 2.0 L container at 120°C, calculate 'x'.
(A) 2 (B) 5 (C) 6 (D) 7

64. A weather balloon is inflated with helium. The balloon has a volume of 100 m^3 and it must be inflated to a pressure of 0.10 atm. If 50 L gas cylinders of helium at a pressure of 100 atm are used, how many cylinders are needed ? Assume that the temperature is constant.
(A) 2 (B) 3 (C) 4 (D) 1

65. The pressure of sodium vapour in a 1.0 L container is 10 torr at 1000°C. How many atoms are in the container ?
(A) 9.7×10^{17} (B) 7.6×10^{19} (C) 4.2×10^{17} (D) 9.7×10^{19}

66. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant ?
(A) 80 (B) 40 (C) 60 (D) 20

67. O_2 and SO_2 gases are filled in ratio of 1 : 3 by moles in a closed container of 3 L at temperature of 27°C. The partial pressure of O_2 is 0.60 atm, the concentration of SO_2 would be
(A) 0.36 (B) 0.036 (C) 3.6 (D) 36

Space for rough work

68. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K, while A contains H_2 gas, B has an equal mass of CO_2 gas. Find the ratio of total K.E. of gases in flask A to that of B.
(A) 1 : 2 (B) 11 : 1 (C) 33 : 2 (D) 55 : 7

69. 6×10^{22} gas molecules each of mass 10^{-24} kg are taken in a vessel of 10 litre. What is the pressure exerted by gas molecules ? The root mean square speed of gas molecules is 100 m/s.
(A) 20 Pa (B) 2×10^4 Pa (C) 2×10^5 Pa (D) 2×10^7 Pa

70. The density of gas A is twice that to B at the same temperature the molecular weight of gas B is twice that of A. The ratio of pressure of gas A and B will be :
(A) 1 : 6 (B) 1 : 1 (C) 4 : 1 (D) 1 : 4

71. Dimethyl ether decomposes as
$CH_3OCH_3(g) \rightarrow CH_4(g) + CO(g) + H_2(g)$
When CH_3OCH_3decomposes to 20% extent at certain fixed conditions, what is the ratio of diffusion of pure CH_3OCH_3 with methane ?
(A) 0.59 : 1 (B) 1.18 : 1 (C) 2.36 : 1 (D) 1.77 : 1

72. The root mean square speed of 8g of He is 300 ms^{-1}. Total kinetic energy of He gas is :
(A) 120 J (B) 240 J (C) 360 J (D) None of these

73. 4g of sulphur dioxide gas diffuses from a container in 8 min. Mass of helium gas diffusing from the same container over the same time interval is :
(A) 0.5 gm (B) 1gm (C) 2gm (D) none of these

74. Two closed vessel A and B of equal volume of 8.21 L are connected by a narrow tube of negligible volume with open valve. The left hand side container is found to contain 3 mole CO_2 and 2 mole of He at 400 K, what is the partial pressure of He in vessel B at 500 K ?
(A) 2.4 atm (B) 8 atm (C) 12 atm (D) None of these

75. A mixture of Ne and Ar at 250 K has a total K. E. = 3 KJ in a closed vessel, the total mass of Ne and Ar is 30 g. Find mass % of Ne in gaseous mixture at 250 K.
(A) 61.63 (B) 38.37 (C) 50 (D) 28.3

76. The average speed at temperature T°C of CH_4 (g) is $\sqrt{\frac{28}{88}} \times 10^3 ms^{-1}$. What is the value of T ?
(A) 240.55°C (B) –32.45°C (C) 3000°C (D) –24.055°C

Space for rough work

77. Calculate relative rate of effusion of O_2 to CH_4 through a container containing O_2 and CH_4 in 3 : 2 mass ratio.

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

78. The root mean square speed of molecules of nitrogen gas is v, at a certain temperature. When the temperature is doubled, the molecules dissociate into individual atoms. The new rms speed of the atom is :

(A) $\sqrt{2}v$ (B) $2v$ (C) v (D) $4v$

79. One mole of nitrogen gas at 0.8 atm takes 38 second to diffuse through a pin hole whereas one mole of an unknown compound of xenon with fluorine at 1.6 atm takes 57 second to diffuse through the same hole. The molecular formula of the compound is

(A) XeF_6 (B) XeF_4 (C) XeF_2 (D) XeF_8

80. Of the two flasks, A and B which are of equal volumes, A contains H_2 at 27°C but B contains equal mass of C_2H_6 at 627°C. Assuming ideal behavior of gases, which of the following statements is correct?

(A) H_2 molecules in a A will move 4.8 times faster than C_2H_6 molecules in B
(B) C_2H_6 molecules in B will move 2.24 times faster than H_2 molecules in A.
(C) Both the molecules will move in the same speed, since the containers are of equal volumes.
(D) H_2 molecules in 'A' will move 2.24 time faster than C_2H_6 molecules in 'B'

81. If the number of molecules of SO_2 (atomic weight =64) effusing through an orifice of unit area of cross-section in unit time at 27^0C and 1 atm pressure is n, calculate the number of O_2 molecules (atomic weight = 32) effusing under similar conditions at 327^0C and 0.5 atm

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

82. A 100m*l* mixture containing 72% of CH_4 by volume and the rest an unknown gas *x* was kept in a vessel. Due to a very fine crack, the mixture effused out. 21ml of the mixture was lost and the remaining mixture contained 68.35% of methane by volume. Molecular mass of gas *x* is (All the measurements are made at same temperature and pressure)

(A) 72.2 (B) 87.1 (C) 64 (D) 124

Space for rough work

83. A uniform glass tube of 100 cm length is connected to a bulb containing Hydrogen at one end and and another bulb containing oxygen at the other end at the same temperature and pressure. The two gases meet for the first time at the following distance from the oxygen end
(A) 80 cm (B) 50 cm (C) 20 cm (D) 6.66 cm

84. Xml. Of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under identical conditions is
(A) 10 seconds : He (B) 20 seconds : O_2 (C) 25 seconds : CO (D) 55 seconds CO_2

85. Which of the following gas has more kinetic energy
(A) 1 mole N_2 (B) 1 mole of O_2
(C) 1 mole of He (D) All have same kinetic energy

86. If T_1, T_2 and T_3 are the temperature at which the U_{RMS}, $U_{average}$, U_{MP} of oxygen gas are all equal to 1500 m/s then the correct statement is :
(A) $T_1 > T_2 > T_3$ (B) $T_1 < T_2 < T_3$ (C) $T_1 = T_2 = T_3$ (D) None of these

87. A bottle of cold drink contains 200 ml of liquid in which CO_2 is 0.1 molar. Suppose that CO_2 behaves as an ideal gas, the volume of dissolved CO_2 at STP is
(A) 0.224 L (B) 0.448 L (C) 22.4 L (D) 2.24 L

88. The r.m.s. velocity of CO_2 at a temperature T(in Kelvin) is $x\ cms^{-1}$. At what temperature the r.m.s. velocity of nitrous oxide would be $4x\ cms^{-1}$?
(A) 16T (B) 2T (C) 4T (D) 32T

89. At STP, the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is
(A) $H_2 > N_2 > O_2 > HBr$ (B) $HBr > O_2 > N_2 > H_2$ (C) $HBr > H_2 > O_2 > N_2$ (D) $N_2 > O_2 > H_2 > HBr$

90. A sample of pure gas has a density of 1.60 g/lit at 26.5°C and 680.2 mm Hg. Which of the following is present in the sample?
(A) CH_4 (B) C_2H_6 (C) CO_2 (D) Xe

Space for rough work

FIITJEE PET – IX (REG_1ST YEAR)

MAINS_SET–A_ANSWERS

DATE: 22.09.2018

MATHEMATICS

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

PHYSICS

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

CHEMISTRY

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

FIITJEE PET – IX (REG_1ST YEAR)

MAINS_SET–B

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. For any two vectors $\vec{a}$ and $\vec{b}$, the expression $\left(\vec{a}\times\hat{i}\right)\cdot\left(\vec{b}\times\hat{i}\right)+\left(\vec{a}\times\hat{j}\right)\cdot\left(\vec{b}\times\hat{j}\right)+\left(\vec{a}\times\hat{k}\right)\cdot\left(\vec{b}\times\hat{k}\right)$ is always equal to

(A) $\vec{a}\cdot\vec{b}$ (B) $2\vec{a}\cdot\vec{b}$ (C) zero (D) none of these

2. If $\vec{a}\times\left(\vec{b}\times\vec{c}\right)$ is perpendicular to $\left(\vec{a}\times\vec{b}\right)\times\vec{c}$, then we may have

(A) $\vec{b}\cdot\vec{c}=0$ (B) $\vec{a}\cdot\vec{b}=0$ (C) $\vec{a}\cdot\vec{c}=0$ (D) none of these

3. $\vec{a},\vec{b},\vec{c}$ are non-coplanar vectors and $\vec{a}_1,\vec{b}_1,\vec{c}_1$ constitute the corresponding reciprocal system of vectors, then we have $\vec{a}_1\times\vec{b}_1+\vec{b}_1\times\vec{c}_1+\vec{c}_1\times\vec{a}_1=\frac{\lambda}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}\left(\vec{a}+\vec{b}+\vec{c}\right)$, where λ is equal to

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

4. A, B, C and D are any four points in the space. If $\left|\overrightarrow{AB}\times\overrightarrow{CD}+\overrightarrow{BC}\times\overrightarrow{AD}+\overrightarrow{CA}\times\overrightarrow{BD}\right|=\lambda\Delta_{ABC}$, where Δ_{ABC} is the area of triangle ABC, then λ is equal to

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

5. $\vec{a}$ and $\vec{c}$ are unit vectors and $\left|\vec{b}\right|=4$. If angle between $\vec{b}$ and $\vec{c}$ is $\cos^{-1}\left(\frac{1}{4}\right)$ and $\vec{a}\times\vec{b}=2\vec{a}\times\vec{c}$, then $\vec{b}=\lambda\vec{a}+2\vec{c}$, where λ is equal to

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

6. Let $\vec{b}$ and $\vec{c}$ are unit vectors, then for any arbitrary vector $\vec{a}$, $\left\{\left[\left(\vec{a}\times\vec{b}\right)+\left(\vec{a}\times\vec{c}\right)\right]\times\left(\vec{b}\times\vec{c}\right)\right\}\cdot\left(\vec{b}-\vec{c}\right)$ is always equal to

(A) $\left|\vec{a}\right|$ (B) $\frac{1}{2}\left|\vec{a}\right|$ (C) $\frac{1}{3}\left|\vec{a}\right|$ (D) zero

7. Resolved part of vector $\vec{a}$ along the vector $\vec{b}$ is $\vec{a}_1$ and that perpendicular to $\vec{b}$ is $\vec{a}_2$, then $\vec{a}_1\times\vec{a}_2$ is equal to

(A) $\frac{\left(\vec{a}\times\vec{b}\right)\left(\vec{b}\right)}{\left|\vec{b}\right|^2}$ (B) $\frac{\left(\vec{a}\cdot\vec{b}\right)\vec{a}}{\left|\vec{a}\right|^2}$ (C) $\frac{\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\times\vec{a}\right)}{\left|\vec{b}\right|^2}$ (D) $\frac{\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\times\vec{a}\right)}{\left|\vec{b}\times\vec{a}\right|}$

Space for rough work

8. Let $\vec{a},\vec{b}$ and $\vec{c}$ be three non-zero and non-coplanar vectors and $\vec{p},\vec{q}$ and $\vec{r}$ be three vectors given by $\vec{p}=\vec{a}+\vec{b}-2\vec{c}$, $\vec{q}=3\vec{a}-2\vec{b}+\vec{c}$ and $\vec{r}=\vec{a}-4\vec{b}+2\vec{c}$. If the volume of the parallelepiped determined by $\vec{a},\vec{b}$ and $\vec{c}$ is V_1 and that of the parallelepiped determined by $\vec{p},\vec{q}$ and $\vec{r}$ is V_2 and $V_2 : V_1$ is equal to
(A) 3 : 1 (B) 7 : 1 (C) 11 : 1 (D) 15 : 1

9. If $\vec{a},\vec{b},\vec{c}$ are unit vectors, then $\frac{1}{3}\left(\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{d}\right|^2\right)$ does not exceed
(A) 9 (B) 3 (C) 6 (D) 8

10. A, B, C and D are four points in a plane with position vectors $\vec{a},\vec{b},\vec{c}$ and $\vec{d}$ respectively such that $\left(\vec{a}-\vec{d}\right)\cdot\left(\vec{b}-\vec{c}\right)=\left(\vec{b}-\vec{d}\right)\cdot\left(\vec{c}-\vec{a}\right)=0$. Then for ΔABC, D is its
(A) incentre (B) circumcentre (C) orthocentre (D) centroid

11. If $|\vec{a}|=2$ and $|\vec{b}|=3$ and $\vec{a}\cdot\vec{b}=0$, then $\left(\vec{a}\times\left(\vec{a}\times\left(\vec{a}\times\left(\vec{a}\times\vec{b}\right)\right)\right)\right)$ is equal to
(A) $48\vec{b}$ (B) $-48\vec{b}$ (C) $48\vec{a}$ (D) $-48\vec{a}$

12. The value of c so that for all real x, the vectors $cx\hat{i}-6\hat{j}+3\hat{k}, x\hat{i}+2\hat{j}+2cx\hat{k}$ make an obtuse angle are
(A) $c < 0$ (B) $0 < c < \frac{4}{3}$ (C) $-\frac{4}{3} < c < 0$ (D) $c > 0$

13. A non-zero vectors $\vec{a}$ is such that its projections along the vectors $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ and $\frac{-\hat{i}+\hat{j}}{\sqrt{2}}$ and $\hat{k}$ are equal, then unit vector along $\vec{a}$ is
(A) $\frac{\sqrt{2}\hat{j}-\hat{k}}{\sqrt{3}}$ (B) $\frac{\hat{j}-\sqrt{2}\hat{k}}{\sqrt{3}}$ (C) $\frac{\sqrt{2}}{\sqrt{3}}\hat{j}+\frac{\hat{k}}{\sqrt{3}}$ (D) $\frac{\hat{j}-\hat{k}}{\sqrt{2}}$

14. $\vec{A},\vec{B},\vec{C}$ are three vectors respectively given by $2\hat{i}+\hat{k},\hat{i}+\hat{j}+\hat{k}$, and $4\hat{i}-3\hat{j}+7\hat{k}$. Then vector $\vec{R}$, which satisfies the relation $\vec{R}\times\vec{B}=\vec{C}\times\vec{B}$ and $\vec{R}\cdot\vec{A}=0$ is
(A) $2\hat{i}-5\hat{j}+2\hat{k}$ (B) $-\hat{i}+4\hat{j}+2\hat{k}$ (C) $-\hat{i}-8\hat{j}+2\hat{k}$ (D) none of these

15. A vector $\vec{a}=(x, y, z)$ makes an obtuse angle with y–axis, equal angles with $\vec{b}=(y, -2z, 3x)$ and $\vec{c}=(2z, 3x, -y)$ and $\vec{a}$ is perpendicular to $\vec{d}=(1, -1, 2)$ if $|\vec{a}|=2\sqrt{3}$, then vector $\vec{a}$ is
(A) (1, 2, 3) (B) (2, –2, –2) (C) (–1, 2, 4) (D) none of these

Space for rough work

16. In a parallelogram ABCD, $\left|\overrightarrow{AB}\right| = a, \left|\overrightarrow{AD}\right| = b$ and $\left|\overrightarrow{AC}\right| = c$, then $\overrightarrow{DB}\cdot\overrightarrow{AB}$ has the value

(A) $\frac{3a^2+b^2-c^2}{2}$ (B) $\frac{a^2+3b^2-c^2}{2}$ (C) $\frac{a^2-b^2+3c^2}{2}$ (D) $\frac{a^2+3b^2+c^2}{2}$

17. If $\vec{p}$ and $\vec{d}$ are two unit vectors and θ is the angle between them, then

(A) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = \sin\frac{\theta}{2}$ (B) $\vec{p}\times\vec{d} = \sin\theta$

(C) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = 1-\cos\theta$ (D) $\frac{1}{2}\left|\vec{p}-\vec{d}\right|^2 = 1-\cos 2\theta$

18. If the non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other, then the solution of the equation $\vec{r}\times\vec{a} = \vec{b}$ is

(A) $\vec{r} = x\vec{a} + \frac{1}{\vec{a}\cdot\vec{a}}\left(\vec{a}\times\vec{b}\right)$ (B) $\vec{r} = x\vec{b} - \frac{1}{\vec{b}\cdot\vec{b}}\left(\vec{a}\times\vec{b}\right)$ (C) $\vec{r} = x\left(\vec{a}\times\vec{b}\right)$ (D) none of these

19. If $\vec{A},\vec{B},\vec{C}$ are non-coplanar vectors then $\frac{\vec{A}\cdot\left(\vec{B}\times\vec{C}\right)}{\left(\vec{C}\times\vec{A}\right)\cdot\vec{B}} + \frac{\vec{B}\cdot\left(\vec{A}\times\vec{C}\right)}{\vec{C}\cdot\left(\vec{A}\times\vec{B}\right)}$ is equal to

(A) 3 (B) 0 (C) 1 (D) none of these

20. If $\vec{a},\vec{b},\vec{c}$ are three non-coplanar vectors and $\vec{p},\vec{q},\vec{r}$ are vectors defined by the relations $\vec{p} = \frac{\vec{b}\times\vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, $\vec{q} = \frac{\vec{c}\times\vec{a}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, $\vec{r} = \frac{\vec{a}\times\vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, then the value of expression $\left(\vec{a}+\vec{b}\right)\cdot\vec{p} + \left(\vec{b}+\vec{c}\right)\cdot\vec{q} + \left(\vec{c}+\vec{a}\right)\cdot\vec{r}$ is equal to

(A) 0 (B) 1 (C) 2 (D) 3

21. If in a triangle ABC, $\overrightarrow{BC} = \frac{\vec{u}}{|\vec{u}|} - \frac{\vec{v}}{|\vec{v}|}$ and $\overrightarrow{AC} = \frac{2\vec{u}}{|\vec{u}|}$, where $|\vec{u}| \neq |\vec{v}|$, then

(A) 1 + cos 2A + cos 2B + cos 2C = 2 (B) sin A = cos B

(C) 1 + cos 2A + cos 2B + cos 2C = 0 (D) sin B = cos C

Space for rough work

22. If $\vec{u}$ and $\vec{v}$ are two non collinear unit vector such that $|\vec{u}\times\vec{v}| = \left|\frac{\vec{u}-\vec{v}}{2}\right|$, then find the value of $|\vec{u}\times(\vec{u}\times\vec{v})|^2$

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{1}{2}$ (D) $\frac{3}{8}$

23. Let $\vec{u}$ and $\vec{v}$ are unit vectors and $\vec{w}$ is a vector such that $\vec{u}\times\vec{v}+\vec{u}=\vec{w}$ and $\vec{w}\times\vec{u}=\vec{v}$, then find the value $[\vec{u}\ \vec{v}\ \vec{w}]$

(A) 2 (B) 3 (C) 1 (D) 4

24. Two given points P and Q in the rectangular Cartesian coordinates lie on $y = 2^{x+2}$ such that $\overrightarrow{OP}\cdot\hat{i} = -1$ and $\overrightarrow{OQ}\cdot\hat{i} = 2$, where $\hat{i}$ is a unit vector along the x axis. Find the magnitude of $\overrightarrow{OQ} - 4\overrightarrow{OP}$

(A) 5 (B) 10 (C) 20 (D) none of these

25. Let $\vec{a},\vec{b},\vec{c}$ be unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{x}, \vec{a}\cdot\vec{x}=1, \vec{b}\cdot\vec{x}=\frac{3}{2}, |\vec{x}|=2$, then angle between $\vec{c}$ and $\vec{x}$ is

(A) $\cos^{-1}\left(\frac{1}{4}\right)$ (B) $\cos^{-1}\frac{3}{4}$ (C) $\cos^{-1}\left(\frac{3}{8}\right)$ (D) $\cos^{-1}\left(\frac{5}{8}\right)$

26. Value of $\left[\vec{a}\times\vec{b}\quad \vec{a}\times\vec{c}\quad \vec{d}\right]$ is always equal to

(A) $(\vec{a}\cdot\vec{d})[\vec{a}\quad \vec{b}\quad \vec{c}]$ (B) $(\vec{a}\cdot\vec{c})[\vec{a}\quad \vec{b}\quad \vec{c}]$ (C) $(\vec{a}\cdot\vec{b})[\vec{a}\quad \vec{b}\quad \vec{c}]$ (D) none of these

27. If the vector $\hat{i}-3\hat{j}+5\hat{k}$ bisects the angle between $\vec{a}$ and $-\hat{i}+2\hat{j}+2\hat{k}$, where $\vec{a}$ is a unit vector, then

(A) $\vec{a} = \frac{1}{105}(41\hat{i}+88\hat{j}-40\hat{k})$ (B) $\vec{a} = \frac{1}{105}(41\hat{i}+88\hat{j}+40\hat{k})$

(C) $\vec{a} = \frac{1}{105}(-41\hat{i}+88\hat{j}-40\hat{k})$ (D) $\vec{a} = \frac{1}{105}(41\hat{i}-88\hat{j}-40\hat{k})$

28. If $\vec{a}=\vec{b}+\vec{c}, \vec{b}\times\vec{d}=\vec{0}, \vec{c}\cdot\vec{d}=\vec{0}$, then the vector $\frac{\vec{d}\times(\vec{a}\times\vec{d})}{|\vec{d}|^2}$ is always equal to

(A) $\vec{a}$ (B) $\vec{d}$ (C) $\vec{b}$ (D) $\vec{c}$

Space for rough work

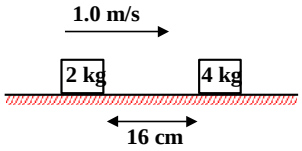
29. If $\vec{a},\vec{b}$ and $\vec{c}$ are vectors such that $|\vec{a}|=3,|\vec{b}|=4$ and $|\vec{c}|=5$ and $(\vec{a}+\vec{b})$ is perpendicular to $\vec{c}$, $(\vec{b}+\vec{c})$ is perpendicular to $\vec{b}$, then to $\vec{a}$ and $(\vec{c}+\vec{a})$ is perpendicular to $\vec{b}$, then $|\vec{a}+\vec{b}+\vec{c}|$ is

(A) $4\sqrt{3}$ (B) $5\sqrt{2}$ (C) 2 (D) 12

30. Centroid of the tetrahedron OABC, where A ≡ (a, 2, 3), B ≡ (1, b, 2), C ≡ (2, 1, c) and O is the origin is (1, 2, 3). The value of $a^2 + b^2 + c^2$ is equal to

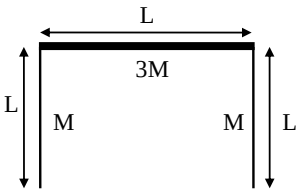
(A) 75 (B) 80 (C) 121 (D) none of these

31. The friction coefficient between the horizontal surface and each of the blocks shown in the figure is 0.2. The collision between the blocks is perfectly elastic. The velocity of 2 kg block in the position shown is 1 m/s and the 4 kg block is initially at rest. Which of the following statement is **correct.** Take g = 10m/s^2.



(A) The velocity of 4 kg mass just after collision is 0.2 m/s
(B) The velocity of 2 kg mass just after collision is 0.3 m/s
(C) The velocity of 4 kg mass just after collision is 0.4 m/s
(D) the separation between them when they finally come to rest is 9 cm

32. Three thin rods of each of length L are arranged in an inverted U, as shown in the figure. The two rods on the arms of the U each have mass M, the third rod has mass 3M. Which of the following statement is **incorrect.**



(A) the center of mass is located at a distance of $\frac{2L}{5}$ from the 3M rod

(B) the center of mass is located at a distance of $\frac{L}{5}$ from the 3M rod

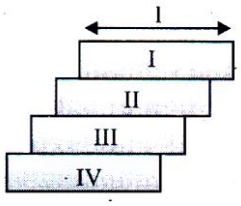
(C) the center of mass is equidistant from both the rods of mass M

(D) if another rod of length L and mass 3M is introduced to complete the square, the centre of mass will shift downwards

Space for rough work

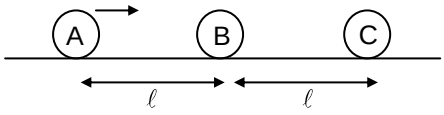
33. A particle of mass m = 2 kg collides head on with another stationary particle of mass M = 3 kg with an initial velocity of 6 m/s. If the particle m stops just after the collision, which of the following statement is **incorrect.**
(A) the velocity of block M after the collision is 4 m/s
(B) kinetic energy of system before collision is equal to kinetic energy after the collision
(C) the coefficient of restitution for the collision is 2/3
(D) fractional loss of kinetic energy due to the collision is 1/3

34. Four bricks, each of length ℓ, are put on the top of one another in such a way that part of each extends beyond the one beneath. The bricks are kept such that largest equilibrium extensions(off-set) are achieved w.r.t bottom (brick- IV). Which of the following statement is **incorrect.**



(A) top brick over hanging the one below by $\frac{\ell}{2}$
(B) second brick from top over hanging the one below $\frac{\ell}{6}$
(C) third brick from top overhanging by bottom one by $\frac{\ell}{6}$
(D) the total overhanging length on the edge of the bottom brick is $\frac{11}{12}\ell$

35. Three small spheres A, B and C of same size and each of mass m, 3m and 9m respectively are placed along a straight line. The sphere A is given a velocity u towards sphere B is shown in figure. All the collisions between the spheres are elastic. [Assume the horizontal surface on which the spheres are placed to be friction less]. Find the final velocity of sphere C after all collisions

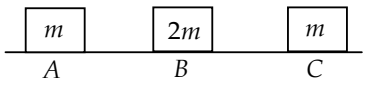


(A) $\frac{u}{2}$ (B) $\frac{u}{4}$ (C) $\frac{2u}{3}$ (D) $\frac{3u}{4}$

36. A ball is thrown downwards with a initial velocity u from a height h = 0.6 m. The ball collides inelastically with the ground and rebounds back to the same height. Find u (in m/s). [coefficient of restitution, e = 1/2)
(A) 4 m/s (B) 3 m/s (C) 6 m/s (D) 2 m/s

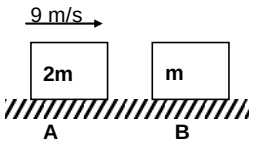
Space for rough work

37. Three objects A, B and C are kept in a straight line on a frictionless horizontal surface. These have masses m,2m and m respectively. The object A moves towards B with a speed $9ms^{-1}$ and makes an elastic collision with it. Thereafter, B makes completely inelastic collision with C. All motions occur on the same straight line. Find the final speed of C (in ms^{-1})



(A) 4 m/s (B) 3 m/s (C) 6 m/s (D) 2 m/s

38. A block of mass 2 m collides elastically with a mass m kept at rest. Friction exists between the block B and surface with coefficient μ=0.3, where as no friction exists between block A and the surface . The block will again collide after time _____



(A) 6 sec (B) 4 sec (C) 8 sec (D) ∞

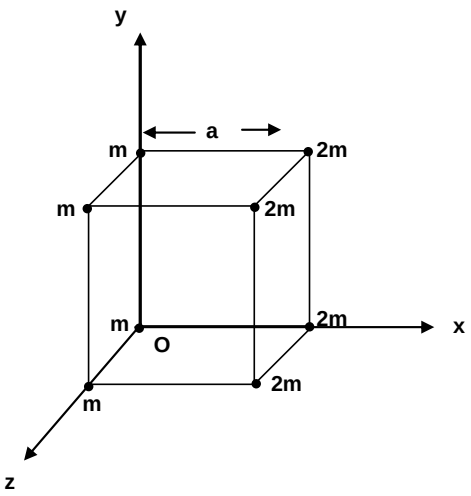
39. Three particles each of mass m are kept at a corners of isosceles right angled triangle with smaller side having length ℓ. Moment of inertia of the system of particle about an axis passing through the midpoint of hypotenuse and perpendicular to the plane containing triangle is

(A) $\frac{5m\ell^2}{2}$ (B) $4m\ell^2$ (C) $\frac{3}{2}m\ell^2$ (D) None of these

40. System of particles are arranged at the vertices of a cube as shown in figure is rotated across y axis moment of inertia about y –axis is

(A) $12ma^2$ (B) $13ma^2$

(C) $10ma^2$ (D) None of these

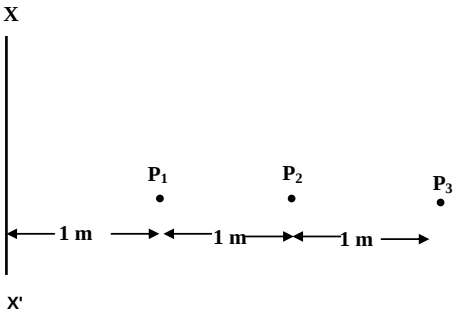


Space for rough work

41. Four particles each of mass m are kept at the four corners of square of side a. Moment of inertia about an axis passing through one of the particles and perpendicular to the plane containing particles is .

(A) $3ma^2$ (B) $4ma^2$ (C) $5ma^2$ (D) $\frac{3}{2}ma^2$

42. Ratio of moment of inertia about XX' of given system of particles shown to the moment of inertia when particle P_2 is not present is (assume all particles have same mass)



(A) $\frac{11}{7}$ (B) $\frac{12}{7}$

(C) $\frac{10}{7}$ (D) None of these

(Question – 43-44)

43. A particle is projected from ground at an angle of 53^0 with horizontal at a speed of 10 m/s towards a smooth vertical wall situated 4.8 m away from the point of projection. The time after which the particle will strike the ground again is: (coefficient of Restitution between particle and wall (e)= $\frac{1}{4}$, g = 10 m/s^2)

(A) 1.6 sec (B) 1 sec (C) 1.2 sec (D) None of these

44. Considering the situation given in the previous question, the displacement of the particle from the point of projection will be.

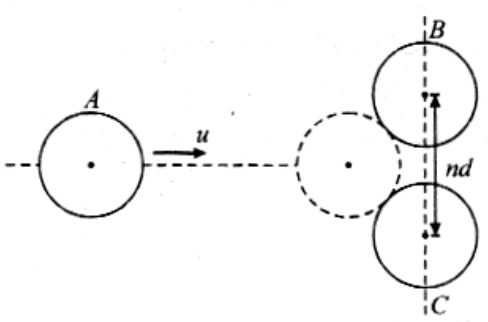
(A) 0 (B) towards the wall (C) away from the wall (D) None of these

45. Select the incorrect option

(A) Usually colliding forces are impulsive in nature
(B) Gravitational and spring forces are always non impulsive
(C) Normal, tension, friction forces are always impulsive
(D) An impulsive force can only be balanced by another impulsive force

Space for rough work

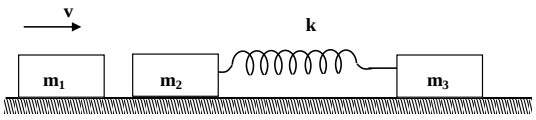
46. Three identical discs A,B and C having diameter 'd' each rest on a smooth horizontal plane as shown in figure. The disc A is set in motion with velocity v along the perpendicular bisector of the line BC joining the centres of the stationary discs. The distance between the centres of stationary discs B and C is n times the diameter of each disc. At what value of n will the disc A stop after elastic collision



(A) $\sqrt{3}$ (B) $\frac{\sqrt{5}}{2}$

(C) $\sqrt{2}$ (D) $\frac{\sqrt{6}}{2}$

47. Mass m_1 hits m_2 with inelastic impact (e = 0) while sliding horizontally with velocity v along the common line of centres of three equal mass as shown in figure. Initially, masses m_2 and m_3 are stationary and the spring is unstressed. After impact, find the maximum possible kinetic energy of m_3 during the motion. Take $m_1 = m_2 = m_3 = m$



(A) $\frac{mv^2}{18}$ (B) $\frac{2mv^2}{9}$

(C) $\frac{mv^2}{3}$ (D) $\frac{1}{2}mv^2$

48. Two billiard balls of equal mass move at right angles and meet at the origin of a coordinate system. First is moving up along the y – axis at 3 m/s and the other is moving to the right along the x- axis with speed 4.8 m/s. After the elastic collision, the second ball is moving along the positive y –axis. What is the final speed of the first ball.

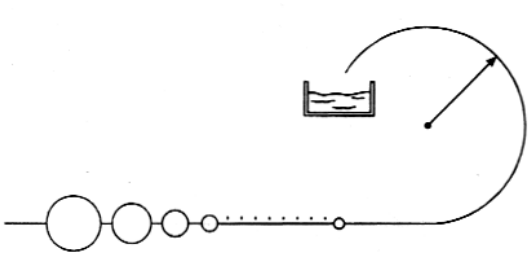
(A) 4.8 m/s (B) 3.6 m/s (C) 2 m /s (D) 2.4 m/s

Space for rough work

49. A block of mass 2 kg moving at 2 m/s collides head on with another block of equal mass kept at rest on smooth horizontal surface. What can be the maximum possible loss in kinetic energy due to the collision.
(A) 4 J (B) 2 J (C) 3 J (D) 1 J

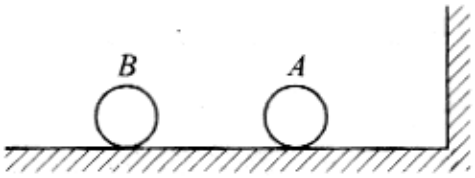
50. A ball with a speed of 9 m/s strikes another identical ball such that after collision the direction of each ball makes an angle 30^0 with the original line of motion. Find the speeds of the two balls after the collision. There is no friction anywhere
(A) 3 m/s (B) $3\sqrt{3}\,m/s$ (C) 4.5 m /s (D) 6 m /s

51. N beads are resting on a smooth horizontal fixed wire which is circular at the end with radius r as shown in figure . The masses of the beads are $m, m/2, m/4 \ldots m/2^{n-1}$ respectively. Find the minimum velocity which should be imparted to the first bead of mass m such that the n^{th} bead will fall in the tank shown in figure.



(A) $\left(\frac{3}{4}\right)^{n-1}.\sqrt{4gr}$ (B) $\left(\frac{3}{4}\right)^{n-1}.\sqrt{5gr}$ (C) $\left(\frac{1}{4}\right)^{n-1}.\sqrt{5gr}$ (D) None of these

52. A ball A of mass 10 kg and a ball B of unknown mass are placed on a horizontal frictionless table which rest against a rigid wall as shown in figure. The ball A moves towards the ball B with a velocity 'v'. What should be the mass of B such that both A and B move with the same speed after A has undergone a collision with ball B and the wall ? All collisions are assume to the elastic.



(A) 10 kg (B) 20 kg (C) 30 kg (D) 40 kg

53. A 3 kg melon is balanced on a bald man's head. His friend shoots a 50 gm arrow at it with speed 25 m/s. The arrow passes through the melon and emerges at 10 m/s. Find the speed of the melon as it flies off the man's head.
(A) 0.50 m/s (B) 0.25 m/s (C) 0.75 m/s (D) 0.10 m/s

Space for rough work

54. A 42 kg girl walks along a stationary uniform platform of mass 21 kg. She walks with a speed of 0.75 m/s. What is the speed of the centre of mass of the system of girl plus platform ? Assume that platform is placed on a smooth horizontal surface.
(A) 0.50 m/s (B) 0.25 m/s (C) 0.75 m/s (D) Non of these

55. A ball of mass m moving at a speed v makes a head on collision with an identical ball at rest. The kinetic energy of the balls after the collision is three fourths of the original. Find the coefficient of restitution.
(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{3}{4}$ (D) $\frac{1}{\sqrt{2}}$

56. A ball of mass m approaches a wall of mass M (>>m) with speed 4 m/s along the normal to the wall. The speed of wall is 1 m/s towards the ball. The speed of the ball after an elastic collision with the wall is
(A) 5 m/s away from the wall (B) 9 m/s away from the wall
(C) 3 m/s away from the wall (D) 6 m/s away from the wall

57. A ball strikes a horizontal floor at angle $\theta = 45°$. The coefficient of restitution between the ball and the floor is $e = \frac{1}{2}$. The fraction of its kinetic energy lost in collision is
(A) $\frac{5}{8}$ (B) $\frac{3}{8}$ (C) $\frac{3}{4}$ (D) $\frac{1}{4}$

58. A particle strikes a smooth horizontal surface at an angle of 45° with a velocity of 100 m/s and rebounds. If the coefficient of restitution between the floor and the particle is $\frac{1}{\sqrt{3}}$ then the angle made by the velocity of the particle with the floor after it rebounds is (approximately)
(A) 30° (B) 45° (C) 60° (D) 90°

59. Two masses of 4 kg and 1 kg are moving in opposite direction with equal kinetic energies of 8J. If the collision between the masses are perfectly inelastic the percentage loss of kinetic energy of the masses is
(A) 60% (B) 70% (C) 80% (D) 90%

60. A particle of mass m_1 moves with speed v and collides head on with a stationary particle of mass m_2. The first particle continue to move in the same director if $\frac{m_1}{m_2}$ is (e = coefficient of restitution)
(A) = e (B) > e (C) < e (D) > e^2

Space for rough work

61. The average speed at temperature T°C of CH_4 (g) is $\sqrt{\frac{28}{88}} \times 10^3 ms^{-1}$. What is the value of T ?

(A) 240.55°C (B) –32.45°C (C) 3000°C (D) –24.055°C

62. Calculate relative rate of effusion of O_2 to CH_4 through a container containing O_2 and CH_4 in 3 : 2 mass ratio.

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

63. The root mean square speed of molecules of nitrogen gas is v, at a certain temperature. When the temperature is doubled, the molecules dissociate into individual atoms. The new rms speed of the atom is :

(A) $\sqrt{2}v$ (B) $2v$ (C) v (D) $4v$

64. One mole of nitrogen gas at 0.8 atm takes 38 second to diffuse through a pin hole whereas one mole of an unknown compound of xenon with fluorine at 1.6 atm takes 57 second to diffuse through the same hole. The molecular formula of the compound is

(A) XeF_6 (B) XeF_4 (C) XeF_2 (D) XeF_8

65. Of the two flasks, A and B which are of equal volumes, A contains H_2 at 27°C but B contains equal mass of C_2H_6 at 627°C. Assuming ideal behavior of gases, which of the following statements is correct?

(A) H_2 molecules in a A will move 4.8 times faster than C_2H_6 molecules in B
(B) C_2H_6 molecules in B will move 2.24 times faster than H_2 molecules in A.
(C) Both the molecules will move in the same speed, since the containers are of equal volumes.
(D) H_2 molecules in 'A' will move 2.24 time faster than C_2H_6 molecules in 'B'

66. If the number of molecules of SO_2 (atomic weight =64) effusing through an orifice of unit area of cross-section in unit time at 27^0C and 1 atm pressure is n, calculate the number of O_2 molecules (atomic weight = 32) effusing under similar conditions at 327^0C and 0.5 atm

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

67. A 100m*l* mixture containing 72% of CH_4 by volume and the rest an unknown gas *x* was kept in a vessel. Due to a very fine crack, the mixture effused out. 21ml of the mixture was lost and the remaining mixture contained 68.35% of methane by volume. Molecular mass of gas *x* is (All the measurements are made at same temperature and pressure)

(A) 72.2 (B) 87.1 (C) 64 (D) 124

Space for rough work

68. A uniform glass tube of 100 cm length is connected to a bulb containing Hydrogen at one end and and another bulb containing oxygen at the other end at the same temperature and pressure. The two gases meet for the first time at the following distance from the oxygen end
(A) 80 cm (B) 50 cm (C) 20 cm (D) 6.66 cm

69. Xml. Of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under identical conditions is
(A) 10 seconds : He (B) 20 seconds : O_2 (C) 25 seconds : CO (D) 55 seconds CO_2

70. Which of the following gas has more kinetic energy
(A) 1 mole N_2 (B) 1 mole of O_2
(C) 1 mole of He (D) All have same kinetic energy

71. If T_1, T_2 and T_3 are the temperature at which the U_{RMS}, $U_{average}$, U_{MP} of oxygen gas are all equal to 1500 m/s then the correct statement is :
(A) $T_1 > T_2 > T_3$ (B) $T_1 < T_2 < T_3$ (C) $T_1 = T_2 = T_3$ (D) None of these

72. A bottle of cold drink contains 200 ml of liquid in which CO_2 is 0.1 molar. Suppose that CO_2 behaves as an ideal gas, the volume of dissolved CO_2 at STP is
(A) 0.224 L (B) 0.448 L (C) 22.4 L (D) 2.24 L

73. The r.m.s. velocity of CO_2 at a temperature T(in Kelvin) is x cms^{-1}. At what temperature the r.m.s. velocity of nitrous oxide would be 4x cms^{-1}?
(A) 16T (B) 2T (C) 4T (D) 32T

74. At STP, the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is
(A) $H_2 > N_2 > O_2 > HBr$ (B) $HBr > O_2 > N_2 > H_2$ (C) $HBr > H_2 > O_2 > N_2$ (D) $N_2 > O_2 > H_2 > HBr$

75. A sample of pure gas has a density of 1.60 g/lit at 26.5°C and 680.2 mm Hg. Which of the following is present in the sample?
(A) CH_4 (B) C_2H_6 (C) CO_2 (D) Xe

76. Dry ice is solid carbon dioxide. A 0.050 g sample of dry ice is placed in an evacuated 4.6 L vessel at 30°C. Calculate the pressure inside the vessel after all the dry ice has been converted to CO_2 gas.
(A) 6.14 atm (B) 0.614 atm (C) 0.0614 atm (D) 6.14 x 10^{-3} atm

Space for rough work

77. A mixture of helium and neon gases is collected over water at 28.0°C and 745 mmHg. If the partial pressure of helium is 368 mm Hg, what is the partial pressure of neon ?
(Vapour pressure of water at 28°C = 28.3 mm Hg)
(A) 348.7 mm Hg (B) 377 mm Hg (C) 384.7 mm Hg (D) none of these

78. A certain hydrate has the formula $MgSO_4 . xH_2O$. A quantity of 54.2 g of the compound is heated in an oven to drive off the water. If the steam generated exerts a pressure of 24.8 atm in a 2.0 L container at 120°C, calculate 'x'.
(A) 2 (B) 5 (C) 6 (D) 7

79. A weather balloon is inflated with helium. The balloon has a volume of 100 m^3 and it must be inflated to a pressure of 0.10 atm. If 50 L gas cylinders of helium at a pressure of 100 atm are used, how many cylinders are needed ? Assume that the temperature is constant.
(A) 2 (B) 3 (C) 4 (D) 1

80. The pressure of sodium vapour in a 1.0 L container is 10 torr at 1000°C. How many atoms are in the container ?
(A) 9.7×10^{17} (B) 7.6×10^{19} (C) 4.2×10^{17} (D) 9.7×10^{19}

81. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant ?
(A) 80 (B) 40 (C) 60 (D) 20

82. O_2 and SO_2 gases are filled in ratio of 1 : 3 by moles in a closed container of 3 L at temperature of 27°C. The partial pressure of O_2 is 0.60 atm, the concentration of SO_2 would be
(A) 0.36 (B) 0.036 (C) 3.6 (D) 36

83. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K, while A contains H_2 gas, B has an equal mass of CO_2 gas. Find the ratio of total K.E. of gases in flask A to that of B.
(A) 1 : 2 (B) 11 : 1 (C) 33 : 2 (D) 55 : 7

84. 6×10^{22} gas molecules each of mass 10^{-24} kg are taken in a vessel of 10 litre. What is the pressure exerted by gas molecules ? The root mean square speed of gas molecules is 100 m/s.
(A) 20 Pa (B) 2×10^4Pa (C) 2×10^5 Pa (D) 2×10^7 Pa

Space for rough work

85. The density of gas A is twice that to B at the same temperature the molecular weight of gas B is twice that of A. The ratio of pressure of gas A and B will be :
(A) 1 : 6 (B) 1 : 1 (C) 4 : 1 (D) 1 : 4

86. Dimethyl ether decomposes as
$CH_3OCH_3(g) \rightarrow CH_4(g) + CO(g) + H_2(g)$
When CH_3OCH_3decomposes to 20% extent at certain fixed conditions, what is the ratio of diffusion of pure CH_3OCH_3 with methane ?
(A) 0.59 : 1 (B) 1.18 : 1 (C) 2.36 : 1 (D) 1.77 : 1

87. The root mean square speed of 8g of He is 300 ms^{-1}. Total kinetic energy of He gas is :
(A) 120 J (B) 240 J (C) 360 J (D) None of these

88. 4g of sulphur dioxide gas diffuses from a container in 8 min. Mass of helium gas diffusing from the same container over the same time interval is :
(A) 0.5 gm (B) 1gm (C) 2gm (D) none of these

89. Two closed vessel A and B of equal volume of 8.21 L are connected by a narrow tube of negligible volume with open valve. The left hand side container is found to contain 3 mole CO_2 and 2 mole of He at 400 K, what is the partial pressure of He in vessel B at 500 K ?
(A) 2.4 atm (B) 8 atm (C) 12 atm (D) None of these

90. A mixture of Ne and Ar at 250 K has a total K. E. = 3 KJ in a closed vessel, the total mass of Ne and Ar is 30 g. Find mass % of Ne in gaseous mixture at 250 K.
(A) 61.63 (B) 38.37 (C) 50 (D) 28.3

Space for rough work

FIITJEE PET – IX (REG_1ST YEAR)

MAINS_SET–B_ANSWERS

DATE: 22.09.2018

MATHEMATICS

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

PHYSICS

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

CHEMISTRY

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