Mathematics In physics Assignment - II

1. The value of a unit vector in the direction of vector $A = 5\hat{i} - 12\hat{j},$ is

(a) $\hat{i}$ (b) $\hat{j}$ (c) $(\hat{i} + \hat{j})/13$ (d) $(5\hat{i} - 12\hat{j})/13$

2. Any vector in an arbitrary direction can always be replaced by two (or three)

(a) Parallel vectors which have the original vector as their resultant

(b) Mutually perpendicular vectors which have the original vector as their resultant

(c) Arbitrary vectors which have the original vector as their resultant

(d) It is not possible to resolve a vector

3. Angular momentum is

(a) A scalar (b) A polar vector (c) An axial vector (d) None of these

4. If a vector $\vec{P}$ making angles $\alpha, \beta,$ and γ respectively with the *X, Y* and *Z* axes respectively. Then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

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

5. Two forces, each of magnitude *F* have a resultant of the same magnitude *F*. The angle between the two forces is

(a) 45° (b) 120° (c) 150° (d) 60°

6. For the resultant of the two vectors to be maximum, what must be the angle between them

(a) 0° (b) 60° (c) 90° (d) 180°

7. A particle is simultaneously acted by two forces equal to 4 *N* and 3 *N*. The net force on the particle is

(a) 7 *N* (b) 5 *N* (c) 1 *N* (d) Between 1 *N* and 7 *N*

8. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors *i.e.,* $\vec{A} + \vec{B} + \vec{C}$

(a) Can be zero (b) Cannot be zero

(c) Lies in the plane containing $\vec{A} + \vec{B}$ (d) Lies in the plane containing $\vec{A} - \vec{B}$

9. If the resultant of the two forces has a magnitude smaller than the magnitude of larger force, the two forces must be

(a) Different both in magnitude and direction (b) Mutually perpendicular to one another

(c) Possess extremely small magnitude (d) Point in opposite directions

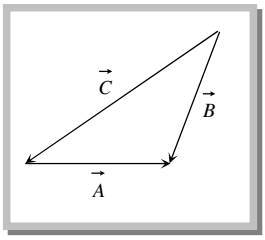
10. Forces F_1 and F_2 act on a point mass in two mutually perpendicular directions. The resultant force on the point mass will be

(a) $F_1 + F_2$ (b) $F_1 - F_2$ (c) $\sqrt{F_1^2 + F_2^2}$ (d) $F_1^2 + F_2^2$

11. The three vectors $\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}, \vec{B} = \hat{i} - 3\hat{j} + 5\hat{k}$ and $\vec{C} = 2\hat{i} + \hat{j} - 4\hat{k}$ form

(a) An equilateral triangle (b) Isosceles triangle (c) A right angled triangle (d) No triangle

12. For the fig.



(a) $\vec{A} + \vec{B} = \vec{C}$

(b) $\vec{B} + \vec{C} = \vec{A}$

(c) $\vec{C} + \vec{A} = \vec{B}$

(d) $\vec{A} + \vec{B} + \vec{C} = 0$

13. Let $\vec{C} = \vec{A} + \vec{B}$ then

(a) $|\vec{C}|$ is always greater then $|\vec{A}|$ (b) It is possible to have $|\vec{C}| < |\vec{A}|$ and $|\vec{C}| < |\vec{B}|$

(c) *C* is always equal to *A* + *B* (d) *C* is never equal to *A* + *B*

14. The value of the sum of two vectors $\vec{A}$ and $\vec{B}$ with θ as the angle between them is

(a) $\sqrt{A^2 + B^2 + 2AB\cos\theta}$ (b) $\sqrt{A^2 - B^2 + 2AB\cos\theta}$ (c) $\sqrt{A^2 + B^2 - 2AB\sin\theta}$ (d) $\sqrt{A^2 + B^2 + 2AB\sin\theta}$

15. Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously $\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}$, $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move

(a) In $x-y$ plane (b) In $y-z$ plane (c) In $x-z$ plane (d) Along x-axis

16. Following sets of three forces act on a body. Whose resultant cannot be zero

(a) 10, 10, 10 (b) 10, 10, 20 (c) 10, 20, 20 (d) 10, 20, 40

17. When three forces of 50 *N*, 30 *N* and 15 *N* act on a body, then the body is

(a) At rest (b) Moving with a uniform velocity (c) In equilibrium (d) Moving with an acceleration

18. The sum of two forces acting at a point is 16 *N*. If the resultant force is 8 *N* and its direction is perpendicular to minimum force then the forces are

(a) 6 *N* and 10 *N* (b) 8 *N* and 8 *N* (c) 4 *N* and 12 *N* (d) 2 *N* and 14 *N*

19. If vectors *P, Q* and *R* have magnitude 5, 12 and 13 units and $\vec{P}+\vec{Q}=\vec{R}$, the angle between *Q* and *R* is

(a) $\cos^{-1}\frac{5}{12}$ (b) $\cos^{-1}\frac{5}{13}$ (c) $\cos^{-1}\frac{12}{13}$ (d) $\cos^{-1}\frac{7}{13}$

20. The resultant of two vectors *A* and *B* is perpendicular to the vector *A* and its magnitude is equal to half the magnitude of vector *B*. The angle between *A* and *B* is

(a) 120° (b) 150° (c) 135° (d) None of these

21. What vector must be added to the two vectors $\hat{i}-2\hat{j}+2\hat{k}$ and $2\hat{i}+\hat{j}-\hat{k}$, so that the resultant may be a unit vector along *x*-axis

(a) $2\hat{i}+\hat{j}-\hat{k}$ (b) $-2\hat{i}+\hat{j}-\hat{k}$ (c) $2\hat{i}-\hat{j}+\hat{k}$ (d) $-2\hat{i}-\hat{j}-\hat{k}$

22. What is the angle between $\vec{P}$ and the resultant of $(\vec{P}+\vec{Q})$ and $(\vec{P}-\vec{Q})$

(a) Zero (b) $\tan^{-1}P/Q$ (c) $\tan^{-1}Q/P$ (d) $\tan^{-1}(P-Q)/(P+Q)$

23. The resultant of $\vec{P}$ and $\vec{Q}$ is perpendicular to $\vec{P}$. What is the angle between $\vec{P}$ and $\vec{Q}$

(a) $\cos^{-1}(P/Q)$ (b) $\cos^{-1}(-P/Q)$ (c) $\sin^{-1}(P/Q)$ (d) $\sin^{-1}(-P/Q)$

24. Maximum and minimum magnitudes of the resultant of two vectors of magnitudes *P* and *Q* are in the ratio $3:1$. Which of the following relations is true

(a) $P=2Q$ (b) $P=Q$ (c) $PQ=1$ (d) None of these

25. The resultant of $\vec{A}+\vec{B}$ is $\vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $R_1^2+R_2^2$

(a) A^2+B^2 (b) A^2-B^2 (c) $2(A^2+B^2)$ (d) $2(A^2-B^2)$

26. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If *Q* is doubled, the new resultant is perpendicular to *P*. Then *R* equals

(a) *P* (b) (*P*+*Q*) (c) *Q* (d) (*P*–*Q*)

27. Two forces, F_1 and F_2 are acting on a body. One force is double that of the other force and the resultant is equal to the greater force. Then the angle between the two forces is

(a) $\cos^{-1}(1/2)$ (b) $\cos^{-1}(-1/2)$ (c) $\cos^{-1}(-1/4)$ (d) $\cos^{-1}(1/4)$

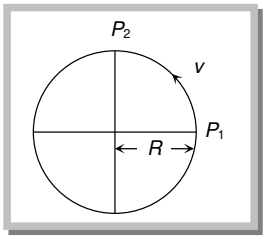
28. Figure below shows a body of mass *M* moving with the uniform speed on a circular path of radius, *R*. What is the change in acceleration in going from P_1 to P_2

(a) Zero

(b) $v^2/2R$

(c) $2v^2/R$

(d) $\frac{v^2}{R}\times\sqrt{2}$



29. A body is at rest under the action of three forces, two of which are $\vec{F}_1=4\hat{i},\vec{F}_2=6\hat{j}$, the third force is

(a) $4\hat{i}+6\hat{j}$ (b) $4\hat{i}-6\hat{j}$ (c) $-4\hat{i}+6\hat{j}$ (d) $-4\hat{i}-6\hat{j}$

30. A plane is revolving around the earth with a speed of 100 *km/hr* at a constant height from the surface of earth. The change in the velocity as it travels half circle is

(a) 200 *km/hr* (b) 150 *km/hr* (c) $100\sqrt{2}\,km/hr$ (d) 0

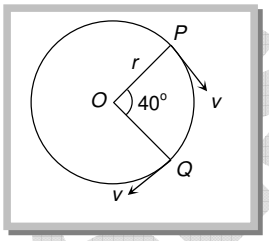
31. What displacement must be added to the displacement $25\hat{i}-6\hat{j}\ m$ to give a displacement of 7.0 *m* pointing in the *x*-direction

(a) $18\hat{i}-6\hat{j}$ (b) $32\hat{i}-13\hat{j}$ (c) $-18\hat{i}+6\hat{j}$ (d) $-25\hat{i}+13\hat{j}$

32. A body moves due East with velocity 20 *km/hour* and then due North with velocity 15 *km/hour.* The resultant velocity

(a) 5 *km/hour* (b) 15 *km/hour* (c) 20 *km/hour* (d) 25 *km/hour*

33. A particle is moving on a circular path of radius *r* with uniform velocity *v.* The change in velocity when the particle moves from *P* to *Q* is $(\angle POQ = 40°)$



(a) $2v\cos 40°$

(b) $2v\sin 40°$

(c) $2v\sin 20°$

(d) $2v\cos 20°$

34. The length of second's hand in watch is 1 *cm.* The change in velocity of its tip in 15 seconds is

(a) Zero (b) $\frac{\pi}{30\sqrt{2}}\ cm/\sec$ (c) $\frac{\pi}{30}\ cm/\sec$ (d) $\frac{\pi\sqrt{2}}{30}\ cm/\sec$

35. A particle moves towards east with velocity 5 *m/s.* After 10 seconds its direction changes towards north with same velocity. The average acceleration of the particle is

(a) Zero (b) $\frac{1}{\sqrt{2}}m/s^2\ N-W$ (c) $\frac{1}{\sqrt{2}}m/s^2\ N-E$ (d) $\frac{1}{\sqrt{2}}m/s^2\ S-W$

36. A force $\vec{F}=5\hat{i}+6\hat{j}+4\hat{k}$ acting on a body, produces a displacement $\vec{S}=6\hat{i}-5\hat{k}$. Work done by the force is

(a) 10 units (b) 18 units (c) 11 units (d) 5 units

37. The angle between the two vector $\vec{A}=5\hat{i}+5\hat{j}$ and $\vec{B}=5\hat{i}-5\hat{j}$ will be

(a) Zero (b) 45° (c) 90° (d) 180°

38. The vector $\vec{P}=a\hat{i}+a\hat{j}+3\hat{k}$ and $\vec{Q}=a\hat{i}-2\hat{j}-\hat{k}$ are perpendicular to each other. The positive value of *a* is

(a) 3 (b) 4 (c) 9 (d) 13

39. A body, constrained to move in the *Y*-direction is subjected to a force given by $\vec{F}=(-2\hat{i}+15\hat{j}+6\hat{k})N$. What is the work done by this force in moving the body a distance 10 *m* along the *Y*-axis

(a) 20 *J* (b) 150 *J* (c) 160 *J* (d) 190 *J*

40. A particle moves in the *x-y* plane under the action of a force $\vec{F}$ such that the value of its liner momentum $(\vec{P})$ at anytime *t* is $P_x=2\cos t, p_y=2\sin t$. The angle θ between $\vec{F}$ and $\vec{P}$ at a given time *t.* will be

(a) $\theta=0°$ (b) $\theta=30°$ (c) $\theta=90°$ (d) $\theta=180°$

41. A 150 m long train is moving to north at a speed of 10 m/s. A parrot flying towards south with a speed of 5 m/s crosses the train. The time taken by the parrot the cross to train would be:

(a) 30 s (b) 15 s (c) 8 s (d) 10 s

42. A swimmer can swim in still water with speed υ and the river is flowing with velocity *v*/2. To cross the river in shortest time, he should swim making angle θ with the upstream. What is the ratio of the time taken to swim across the shortest time to that is swimming across over shortest distance

(a) cos θ (b) sin θ (c) tan θ (d) cot θ

43. The speed of a boat is 5 *km/h* in still water. It crosses a river of width 1 *km* along the shortest possible path in 15 minutes. The velocity of the river water is

(a) 1 *km/h* (b) 3 *km/h* (c) 4 km/h (d) 5 *km/h*

44. A river is flowing from east to west at a speed of 5 m/min. A man on south bank of river, capable of swimming 10m/min in still water, wants to swim across the river in shortest time. He should swim

(a) Due north

(b) Due north-east

(c) Due north-east with double the speed of river

(d) None of these

45. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5 *m*/*s* at an angle of 120^0 with the direction of flow of water. The speed of water in the stream is

(a) 1 *m*/*s* (b) 0.5 *m*/*s* (c) 0.25 *m*/*s* (d) 0.433 *m*/*s*

46. A moves with 65 *km*/*h* while *B* is coming back of *A* with 80 *km*/*h*. The relative velocity of *B* with respect to *A* is

(a) 80 *km*/*h* (b) 60 *km*/*h* (c) 15 *km*/*h* (d) 145 *km*/*h*

47. A man crosses a 320 *m* wide river perpendicular to the current in 4 minutes. If in still water he can swim with a speed 5/3 times that of the current, then the speed of the current, in *m*/*min* is

(a) 30 (b) 40 (c) 50 (d) 60.

48. A thief is running away on a straight road on a jeep moving with a speed of 9 *m*/*s*. A police man chases him on a motor cycle moving at a speed of 10 *m*/*s*. If the instantaneous separation of jeep from the motor cycle is 100 *m*, how long will it take for the policemen to catch the thief

(a) 1 second (b) 19 second (c) 90 second (d) 100 second

49. A bus is moving with a velocity 10 m/s on a straight road. A scooterist wishes to overtake the bus in 100 *s*. If the bus is at a distance of 1 *km* from the scooterist, with what velocity should the scooterist chase the bus

(a) 50 *m*/*s* (b) 40 *m*/*s* (c) 30 *m*/*s* (d) 20 *m*/*s*

50. What is the unit vector perpendicular to the following vectors $2\hat{i}+2\hat{j}-\hat{k}$ and $6\hat{i}-3\hat{j}+2\hat{k}$

(a) $\frac{\hat{i}+10\hat{j}-18\hat{k}}{5\sqrt{17}}$ (b) $\frac{\hat{i}-10\hat{j}+18\hat{k}}{5\sqrt{17}}$ (c) $\frac{\hat{i}-10\hat{j}-18\hat{k}}{5\sqrt{17}}$ (d) $\frac{\hat{i}+10\hat{j}+18\hat{k}}{5\sqrt{17}}$