Mathematics In physics Assignment

1. How many minimum number of coplanar vectors having different magnitudes can be added to give zero resultant

(a) 2 (b) 3 (c) 4 (d) 5

2. A hall has the dimensions $10\,m \times 12\,m \times 14\,m$. A fly starting at one corner ends up at a diametrically opposite corner. What is the magnitude of its displacement

(a) 17 *m* (b) 26 *m* (c) 36 *m* (d) 21 *m*

3. $0.4\hat{i} + 0.8\hat{j} + c\hat{k}$ represents a unit vector when *c* is

(a) – 0.2 (b) $\sqrt{0.2}$ (c) $\sqrt{0.8}$ (d) 0

4. 100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\pi/50$ with the preceding force. What is the resultant of the forces

(a) 1000 *N* (b) 500 *N* (c) 250 *N* (d) Zero

5. The magnitude of a given vector with end points (4, – 4, 0) and (– 2, – 2, 0) must be

(a) 6 (b) $5\sqrt{2}$ (c) 4 (d) $2\sqrt{10}$

6. The angles which a vector $\hat{i} + \hat{j} + \sqrt{2}\,\hat{k}$ makes with *X, Y* and *Z* axes respectively are

(a) 60°, 60°, 60° (b) 45°, 45°, 45° (c) 60°, 60°, 45° (d) 45°, 45°, 60°

7. The expression $\left(\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}\right)$ is a

(a) Unit vector (b) Null vector (c) Vector of magnitude $\sqrt{2}$ (d) Scalar

8. Given vector $\vec{A} = 2\hat{i} + 3\hat{j}$, the angle between $\vec{A}$ and *y*-axis is

(a) $\tan^{-1} 3/2$ (b) $\tan^{-1} 2/3$ (c) $\sin^{-1} 2/3$ (d) $\cos^{-1} 2/3$

9. The unit vector along $\hat{i} + \hat{j}$ is

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

10. A vector is represented by $3\hat{i} + \hat{j} + 2\hat{k}$. Its length in *XY* plane is

(a) 2 (b) $\sqrt{14}$ (c) $\sqrt{10}$ (d) $\sqrt{5}$

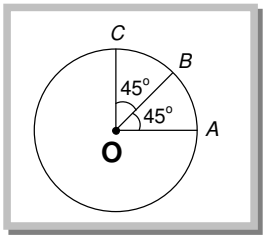
11. Five equal forces of 10 *N* each are applied at one point and all are lying in one plane. If the angles between them are equal, the resultant force will be

(a) Zero (b) 10 *N* (c) 20 *N* (d) $10\sqrt{2}N$

12. The angle made by the vector $A = \hat{i} + \hat{j}$ with *x*- axis is

(a) 90° (b) 45° (c) 22.5° (d) 30°

13. Find the resultant of three vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in the following figure. Radius of the circle is *R*.



(a) 2*R*

(b) $R(1+\sqrt{2})$

(c) $R\sqrt{2}$

(d) $R(\sqrt{2}-1)$

14. If $|\vec{A} - \vec{B}| = |\vec{A}| = |\vec{B}|$, the angle between $\vec{A}$ and $\vec{B}$ is

(a) 60° (b) 0° (c) 120° (d) 90°

15. At what angle must the two forces (*x* + *y*) and (*x* – *y*) act so that the resultant may be $\sqrt{(x^2 + y^2)}$

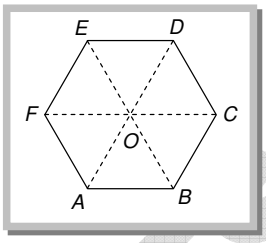
(a) $\cos^{-1}\left(-\frac{x^2+y^2}{2(x^2-y^2)}\right)$ (b) $\cos^{-1}\left(-\frac{2(x^2-y^2)}{x^2+y^2}\right)$ (c) $\cos^{-1}\left(-\frac{x^2+y^2}{x^2-y^2}\right)$ (d) $\cos^{-1}\left(-\frac{x^2-y^2}{x^2+y^2}\right)$

16. Let the angle between two nonzero vectors $\vec{A}$ and $\vec{B}$ be 120° and resultant be $\vec{C}$

(a) $\vec{C}$ must be equal to $|\vec{A}-\vec{B}|$ (b) $\vec{C}$ must be less than $|\vec{A}-\vec{B}|$

(c) $\vec{C}$ must be greater than $|\vec{A}-\vec{B}|$ (d) $\vec{C}$ may be equal to $|\vec{A}-\vec{B}|$

17. Fig. shows *ABCDEF* as a regular hexagon. What is the value of $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}$



(a) $\overrightarrow{AO}$

(b) $2\overrightarrow{AO}$

(c) $4\overrightarrow{AO}$

(d) $6\overrightarrow{AO}$

18. The magnitude of vector $\vec{A},\vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B}=\vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is

(a) 0 (b) π (c) $\pi/2$ (d) $\pi/4$

19. Magnitude of vector which comes on addition of two vectors, $6\hat{i}+7\hat{j}$ and $3\hat{i}+4\hat{j}$ is

(a) $\sqrt{136}$ (b) $\sqrt{13.2}$ (c) $\sqrt{202}$ (d) $\sqrt{160}$

20. A particle has displacement of 12 *m* towards east and 5 *m* towards north then 6 *m* vertically upward. The sum of these displacements is

(a) 12 (b) 10.04 *m* (c) 14.31 *m* (d) None of these

21. Consider two vectors $\vec{F}_1=2\hat{i}+5\hat{k}$ and $\vec{F}_2=3\hat{j}+4\hat{k}$. The magnitude of the scalar product of these vectors is

(a) 20 (b) 23 (c) $5\sqrt{33}$ (d) 26

22. Consider a vector $\vec{F}=4\hat{i}-3\hat{j}$. Another vector that is perpendicular to $\vec{F}$ is

(a) $4\hat{i}+3\hat{j}$ (b) $6\hat{i}$ (c) $7\hat{k}$ (d) $3\hat{i}-4\hat{j}$

23. Two vectors $\vec{A}$ and $\vec{B}$ are at right angles to each other, when

(a) $\vec{A}+\vec{B}=0$ (b) $\vec{A}-\vec{B}=0$ (c) $\vec{A}\times\vec{B}=0$ (d) $\vec{A}.\vec{B}=0$

24. If $|\vec{V}_1+\vec{V}_2|=|\vec{V}_1-\vec{V}_2|$ and V_2 is finite, then

(a) V_1 is parallel to V_2 (b) $\vec{V}_1=\vec{V}_2$

(c) V_1 and V_2 are mutually perpendicular (d) $|\vec{V}_1|=|\vec{V}_2|$

25. A force $\vec{F}=(5\hat{i}+3\hat{j})$ Newton is applied over a particle which displaces it from its origin to the point $\vec{r}=(2\hat{i}-1\hat{j})$ *metres*. The work done on the particle is

(a) – 7 *joules* (b) +13 *joules* (c) +7 *joules* (d) +11 *joules*

26. The angle between two vectors $-2\hat{i}+3\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}-4\hat{k}$ is

(a) 0° (b) 90° (c) 180° (d) None of the above

27. The angle between the vectors $(\hat{i}+\hat{j})$ and $(\hat{j}+\hat{k})$ is

(a) 30° (b) 45° (c) 60° (d) 90°

28. A particle moves with a velocity $6\hat{i}-4\hat{j}+3\hat{k}\,m/s$ under the influence of a constant force $\vec{F}=20\hat{i}+15\hat{j}-5\hat{k}\,N$. The instantaneous power applied to the particle is

(a) 35 *J/s* (b) 45 *J/s* (c) 25 *J/s* (d) 195 *J/s*

29. If $\vec{P}.\vec{Q}=PQ$, then angle between $\vec{P}$ and $\vec{Q}$ is

(a) 0° (b) 30° (c) 45° (d) 60°

30. Two constant forces $F_1=2\hat{i}-3\hat{j}+3\hat{k}$ (*N*) and $F_2=\hat{i}+\hat{j}-2\hat{k}$ (*N*) act on a body and displace it from the position $r_1=\hat{i}+2\hat{j}-2\hat{k}$ (m) to the position $r_2=7\hat{i}+10\hat{j}+5\hat{k}$ (m). What is the work done

(a) 9 *J* (b) 41 *J* (c) – 3 *J* (d) None of these

31. The area of the parallelogram represented by the vectors $\vec{A}=2\hat{i}+3\hat{j}$ and $\vec{B}=\hat{i}+4\hat{j}$ is

(a) 14 units (b) 7.5 units (c) 10 units (d) 5 units

32. For any two vectors $\vec{A}$ and $\vec{B}$ if $\vec{A}.\vec{B} = |\vec{A}\times\vec{B}|$, the magnitude of $\vec{C} = \vec{A} + \vec{B}$ is equal to

(a) $\sqrt{A^2 + B^2}$ (b) $A + B$ (c) $\sqrt{A^2 + B^2 + \frac{AB}{\sqrt{2}}}$ (d) $\sqrt{A^2 + B^2 + \sqrt{2}\times AB}$

33. A vector $\vec{F}_1$ is along the positive *X*-axis. If its vector product with another vector $\vec{F}_2$ is zero then $\vec{F}_2$ could be

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

34. If for two vectors $\vec{A}$ and $\vec{B}, \vec{A}\times\vec{B} = 0$, the vectors

(a) Are perpendicular to each other (b) Are parallel to each other
(c) Act at an angle of 60° (d) Act at an angle of 30°

35. The angle between vectors $(\vec{A}\times\vec{B})$ and $(\vec{B}\times\vec{A})$ is

(a) Zero (b) π (c) $\pi/4$ (d) $\pi/2$

36. What is the angle between $(\vec{P} + \vec{Q})$ and $(\vec{P}\times\vec{Q})$

(a) 0 (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) π

37. The resultant of the two vectors having magnitude 2 and 3 is 1. What is their cross product

(a) 6 (b) 3 (c) 1 (d) 0

38. Which of the following is the unit vector perpendicular to $\vec{A}$ and $\vec{B}$

(a) $\frac{\hat{A}\times\hat{B}}{AB\sin\theta}$ (b) $\frac{\hat{A}\times\hat{B}}{AB\cos\theta}$ (c) $\frac{\vec{A}\times\vec{B}}{AB\sin\theta}$ (d) $\frac{\vec{A}\times\vec{B}}{AB\cos\theta}$

39. Let $\vec{A} = \hat{i}A\cos\theta + \hat{j}A\sin\theta$ be any vector. Another vector $\vec{B}$ which is normal to *A* is

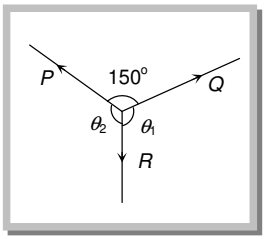
(a) $\hat{i}\,B\cos\theta + jB\sin\theta$ (b) $\hat{i}\,B\sin\theta + jB\cos\theta$ (c) $\hat{i}\,B\sin\theta - jB\cos\theta$ (d) $\hat{i}\,B\cos\theta - jB\sin\theta$

40. The angle between two vectors given by $6\bar{i} + 6\bar{j} - 3\bar{k}$ and $7\bar{i} + 4\bar{j} + 4\bar{k}$ is

(a) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\cos^{-1}\left(\frac{5}{\sqrt{3}}\right)$ (c) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (d) $\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

41. *P, Q* and *R* are three coplanar forces acting at a point and are in equilibrium. Given *P* = 1.9318 *kg wt,* $\sin\theta_1 = 0.9659$, the value of *R* is (in *kg wt*)

(a) 0.9659
(b) 2
(c) 1
(d) $\frac{1}{2}$



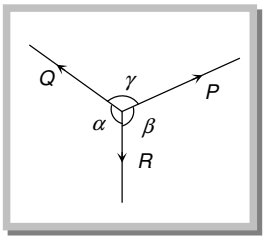
42. A body is in equilibrium under the action the action of three coplanar forces *P, Q* and *R* as shown in the figure. Select the correct statement

(a) $\frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$

(b) $\frac{P}{\cos\alpha} = \frac{Q}{\cos\beta} = \frac{R}{\cos\gamma}$

(c) $\frac{P}{\tan\alpha} = \frac{Q}{\tan\beta} = \frac{R}{\tan\gamma}$

(d) $\frac{P}{\sin\beta} = \frac{Q}{\sin\gamma} = \frac{R}{\sin\alpha}$



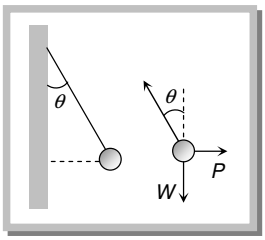
43. If a body is in equilibrium under a set of non-collinear forces, then the minimum number of forces has to be

(a) Four (b) Three (c) Two (d) Five

44. How many minimum number of non-zero vectors in different planes can be added to give zero resultant

(a) 2 (b) 3 (c) 4 (d) 5

45. A metal sphere is hung by a string fixed to a wall. The sphere is pushed away from the wall by a stick. The forces acting on the sphere are shown in the second diagram. Which of the following statements is wrong



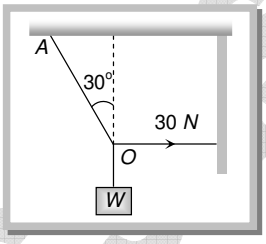
(a) $P = W\tan\theta$

(b) $\vec{T}+\vec{P}+\vec{W}=0$

(c) $T^2 = P^2 + W^2$

(d) $T = P + W$

46. As shown in figure the tension in the horizontal cord is 30 *N*. The weight *W* and tension in the string *OA* in Newton are



(a) $30\sqrt{3}, 30$

(b) $30\sqrt{3}, 60$

(c) $60\sqrt{3}, 30$

(d) None of these

47. A man can swim with velocity *v* relative to water. He has to cross a river of width d flowing with a velocity *u* (*u* > *v*). The distance through which he is carried down stream by the river is *x*. Which of the following statement is correct

(a) If he crosses the river in minimum time $x = \frac{du}{v}$

(b) *x* can not be less than $\frac{du}{v}$

(c) For *x* to be minimum he has to swim in a direction making an angle of $\frac{\pi}{2}+\sin^{-1}\left(\frac{v}{u}\right)$ with the direction of the flow of water

(d) x will be max. if he swims in a direction making an angle of $\frac{\pi}{2}+\sin^{-1}\frac{v}{u}$ with direction of the flow of water

48. Find the torque of a force $\vec{F} = -3\hat{i}+\hat{j}+5\hat{k}$ acting at the point $\vec{r} = 7\hat{i}+3\hat{j}+\hat{k}$

(a) $14\hat{i}-38\hat{j}+16\hat{k}$ (b) $4\hat{i}+4\hat{j}+6\hat{k}$ (c) $21\hat{i}+4\hat{j}+4\hat{k}$ (d) $-14\hat{i}+34\hat{j}-16\hat{k}$

49. The value of $(\vec{A}+\vec{B})\times(\vec{A}-\vec{B})$ is

(a) 0 (b) $A^2 - B^2$ (c) $\vec{B}\times\vec{A}$ (d) $2(\vec{B}\times\vec{A})$

50. A particle of mass *m* = 5 is moving with a uniform speed $v = 3\sqrt{2}$ in the *XOY* plane along the line $Y = X + 4$. The magnitude of the angular momentum of the particle about the origin is

(a) 60 units (b) $40\sqrt{2}$ units (c) Zero (d) 7.5 units