NAME
www.name.edu.np

QAD Series

Mechanics - I

1. Two vectors $\vec{A} = 5\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{B} = 2\hat{i} + 2\hat{j} - a\hat{k}$ are perpendicular to each other, then value of 'a' is:
a) 12 b) – 12 c) 8 d) – 8

2. A vectors of length l is turned through the angle θ about its tail. What is the change in the position vector of its head?
a) $l\cos\frac{\theta}{2}$ b) $2l\sin\frac{\theta}{2}$ c) $2l\cos\frac{\theta}{2}$ d) $l\sin\frac{\theta}{2}$

3. A body moves 30 m due north, 20 m due east and $30\sqrt{2}$m due south west. The total displacement covered by body from its initial position is:
a) 3 b) $\frac{\sqrt{3}}{2}$ c) $\frac{3}{\sqrt{2}}$ d) $\sqrt{3}$

4. The position vector of a moving particle at time t is $\vec{r} = 3\hat{i} + 4t\hat{j} - t\hat{k}$. Its displacement during the time interval t = 1s to t = 3s is:
a) $\hat{j} - \hat{k}$ b) $3\hat{i} + 4\hat{j} - \hat{k}$
c) $9\hat{i} + 36\hat{j} - 27\hat{k}$ d) None of these

5. The acceleration of a particle at any instant of time t which starts from origin at initial velocity 2m/s is $a = 2t$ (in m/s²). What is its velocity in 5 seconds?
a) 52 m/s b) 50 m/s c) 27 m/s d) 25 m/s

6. A car travelling due east at 20 m/s turns towards north without changing speed in 10 sec. The average acceleration of the car for its turn is:
a) $2\sqrt{2}$ m/s² north-east b) $2\sqrt{2}$ m/s² north-west
c) 4 m/s² due west d) zero

7. A car accelerates from rest at constant rate for the first 10 seconds and covers a distance x. It covers a distance y in the next 10 seconds at the same acceleration. Which of the velocity is true?
a) y = 3x b) x = 3y c) x = y d) y = 2x

8. With what speed should Q body be thrown upwards so that the distances traversed in 5th second and 6th second are equal?
a) 5.84 m/s b) 49 m/s c) $\sqrt{98}$ m/s d) 98 m/s

9. A body is projected vertically upward from point A, the top of a tower. It reaches the ground in t_1 secs. If it is projected vertically downwards from A with the same velocity, it reaches the ground in t_2 secs. If it falls freely from A, it would reach the ground in:
a) $\frac{t_1 + t_2}{2}$ sec b) $\frac{t_1 - t_2}{2}$ secs c) t_1t_2 secs d) $\sqrt{t_1t_2}$ secs

10. The position vector of a particle is $\vec{r} = a\cos\omega t\hat{i} + a\sin\omega t\hat{j}$. The velocity of the particle is:
a) parallel to position vector
b) perpendicular to position vector
c) directed towards origin
d) directed away from the origin

11. A person who can swim at 5 km/hr in still water, crosses a river 1 km wide flowing at 3 km/hr along shortest route. Then time taken to cross the river is:
a) 10 min b) 15 min c) 20 min d) 12 min

12. An object of mass m is projected with a momentum P at such an angle that its maximum height is 1/4th of its horizontal range. Its minimum kinetic energy in its path will be:
a) $\frac{P^2}{8m}$ b) $\frac{P^2}{4m}$ c) $\frac{3P^2}{4m}$ d) $\frac{P^2}{m}$

13. If range is half the maximum height of a projectile then θ is:
a) $\text{Tan}^{-1}(4)$ b) $\text{Tan}^{-1}(1/4)$
c) $\text{Tan}^{-1}(1)$ d) $\text{Tan}^{-1}(8)$

14. At the top of the trajectory of a projectile, the accelerations is:
a) maximum b) minimum
c) zero d) equal to g

15. Which of the following remains constant for a projectile fired from the earth?
a) Momentum
b) K.E
c) Vertical component of velocity
d) Horizontal component of velocity

16. At the top of the trajectory of a projectile the directions of its velocity and acceleration are:
a) Parallel to each other
b) perpendicular to each other
c) antiparallel to each other
d) inclined at 45° to each other

17. A projectile is thrown at angle θ with vertical with initial kinetic energy E_0. If air resistance is neglected the K.E. at highest point will be:
a) $E_0\cos^2\theta$ b) $E_0\cos\theta$ c) $E_0\sin^2\theta$ d) zero

18. A projectile thrown with speed u at angle θ with horizontal is moving at right angle to its initial direction when its velocity is:
a) $u\tan\theta$ b) $u\sin\theta$ c) $u\cot\theta$ d) $u\sec\theta$

19. The greatest height to which man can throw a stone is h. The greatest distance to which he can throw it will be:
a) $\frac{h}{2}$ b) h c) 2h d) 4h

20. If the maximum range of a projectile is four times of its maximum height, then the angle of projection is equal to:
a) 30° b) 45° c) 60° d) 75°

21. A man weighing 80 kg is standing on a trolley weighing 320 kg. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley along the rails at speed 1 m/s, then after 4 sec, his displacement relative to ground will be:
a) 5 m b) 4.8 m c) 3.2 m d) 3.0 m

22. A rope of length l is pulled by a constant force F. What is the tension in the rope at a distance x from the end where force is applied:
a) $F(l/x)$ b) $F(l/l - x)$ c) $Fx/l - x$ d) $F(l - x)/l$

23. Starting from rest, a body slides down a 45° inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined plane is:
a) 0.25 b) 0.33 c) 0.75 d) 0.80

24. A car of mass 'm' moving with speed 'v' is stopped at a distance 'x' by the friction between the tyres and the road. If K.E. of the car is doubled, stopping distance will be:
a) 8x b) 4x c) 2x d) x

25. A heavy uniform chain lies on a horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain, that can hung over the one edge of the table is:
a) 20% b) 25% c) 35% d) 15%

26. The lower half of an inclined plane of inclination θ with horizontal is rough and its upper half is frictionless. If a block released at the top of the plane comes to rest at the bottom again. Then coefficient sliding between the block and rough part of the plane will be:

a) $\tan\theta$ b) $2\tan\theta$

c) $2\cot\theta$ d) $\frac{1}{2}\tan\theta$

27. A body of mass 2kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is:

a) 9.8 N b) $0.7 \times 9.8 \times \sqrt{3}$ N

c) $9.8\sqrt{3}$ N d) 0.7×9.8 N

28. If the normal reactional force is doubled, the coefficient of friction is:

a) Doubled b) Halved

c) Not changed d) Tripled

29. When a bicycle is in motion but not pedalled, therefore of friction exerted by the ground on the two wheels is such that it acts:

a) In the backward direction on the front wheel and in the forward direction on the rear wheel

b) In the forward direction on the front wheel and in the backward direction on the rear wheel

c) In the forward direction on both the wheels

d) In the backward direction on both the wheels

30. Starting from rest, a body slides down a 45° inclined plane in twice the time it takes to slide the same distance in the absence of friction. What is the coefficient of friction between the body and the inclined plane?

a) $\frac{1}{4}$ b) $\frac{1}{2}$

c) $\frac{3}{4}$ d) $\frac{\sqrt{3}}{2}$

31. If the momentum of a certain body be increased by 50%, its KE will increase by:

a) 25% b) 50%

c) 100% d) 125%

32. The kinetic energy acquired by a mass *m* in travelling a certain distance *d*, starting from rest under the action of a constant force is directly proportional to:

a) $\sqrt{m}$ b) Independent of *m*

c) $\frac{1}{\sqrt{m}}$ d) *m*

33. A particle of mass m_1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v_2. Both of them have the same momentum but their different kinetic energies are E_1 & E_2 respectively. If $m_1 > m_2$ then:

a) $E_1 < E_2$ b) $\frac{E_1}{E_2} = \frac{m_2}{m_2}$

c) $E_1 > E_2$ d) $E_1 = E_2$

34. A long spring is stretched by 2cm, its potential energy is U. If the spring is stretched by 10cm, the potential energy stored in it will be:

a) $\frac{U}{25}$ b) $\frac{U}{5}$ c) 5U d) 25U

35. A body is moved along a straight line by a machine delivering a constant power. The distance moved by the body in time *t* is proportional to:

a) $\sqrt{t}$ b) $t^{\frac{3}{4}}$

c) $t^{\frac{3}{2}}$ d) t^2

36. Two bodies with masses m_1 & m_2 have equal kinetic energies. If P_1 & P_2 are their respective momenta, then $\frac{P_1}{P_2}$ is equal to:

a) $m_1 : m_2$ b) $m_1^2 : m_2^2$

c) $m_2 : m_1$ d) $\sqrt{m_1} : \sqrt{m_2}$

37. For a given velocity, a projectile has the same range R for two angles of projection. If t_1 and t_2 are the time of flight in the two cases, then t_1t_2 is equal to

a) $\frac{2R}{g}$ b) $\frac{R}{g}$ c) $\frac{4R}{g}$ d) $\frac{R}{2g}$

38. Ball 'A' or mass 0.1 kg moving with a velocity of 6m/s collides with ball 'B' of mass 0.2 kg at rest. If ball 'A' rebounds with a velocity of 2m/s in opposite direction after collision what would be the velocity of 'B'?

a) 2 m/s b) 4 m/s

c) 6 m/s d) 8 m/s

39. A uniform chain of length L and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. If *g* is acceleration due to gravity, work required to pull the hanging part into the table is:

a) mgL b) $\frac{mgL}{3}$

c) $\frac{mgL}{9}$ d) $\frac{mgL}{18}$

40. A bullet loses $\frac{1}{n}$ th of its velocity passing through one Plank. How many such Planks are required to stop the bullet?

a) $\frac{n^2}{2n-1}$ b) n

c) $\frac{2n^2}{n-1}$ d) ∞

41. The dimensional formula of $\frac{1}{\mu_0\varepsilon_0}$ is

a) $[M^0 LT^{-2}]$ b) $[M^0 L^{-2} T^{-2}]$

c) $[M^0 LT^{-1}]$ d) $[M^0L^2T^{-2}]$

42. The equation of state of some gases can be expressed as $\left(P + \frac{a}{v^2}\right)(v - b) = RT$ where P is pressure, V is the volume, T is absolute temperature and *a* and *b* are constants. The dimensional formula of *a* is

a) $[ML^5T^{-2}]$ b) $[M^{-1} L^5T^{-2}]$

c) $[ML^{-1}T^{-2}]$ d) $[ML^{-5}T^{-2}]$

43. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is

a) $[ML^2 T^{-2}A^0]$ b) $[MLT^{-2}A^{-1}]$

c) $[M^0LT^{-2}A^0]$ d) $[ML^{-3}T\ A]$

44. Surface tension has the same dimensions as that of

a) coefficient of viscosity b) impulse

c) spring constant d) frequency

45. Which of the following will have the dimensions of time?

a) LC b) $\frac{R}{L}$

c) $\frac{L}{R}$ d) $\frac{C}{L}$