Module-Test-10
(Physics-NEET)

January 16, 2023

Section-A

This section contains 35 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE option is correct. **All questions are compulsory.**

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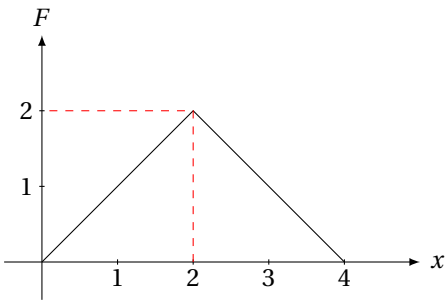
1. For the given graph find the work done by the force.

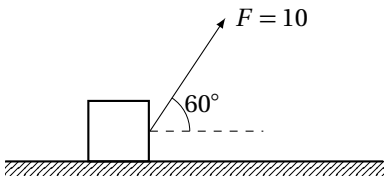


a) 8 J
b) −8 J
c) −4 J
d) 4 J *Ans.*

2. A bucket tied to a string is lowered at a constant acceleration of $g/4$. If mass of the bucket is m and it is lowered by a distance l then find the work done by the string on the bucket.

a) $-\frac{3}{4}mgl$ *Ans.*
b) $\frac{3}{4}mgl$
c) $\frac{4}{3}mgl$
d) $-\frac{4}{3}mgl$

3. A block is constrained to move along x-axis under a force $F = 10$ acting at an angle of 60°. Find the work done by this force when the block is displaced from $x = 0\,\text{m}$ to $x = 2\,\text{m}$.



a) −20 J
b) 10 J *Ans.*
c) −10 J
d) 20 J

4. Displacement of a particle of mass 2 kg varies with time as $s = (2t^2 - 2t + 10)\,\text{m}$. Find total work done on the particle in a time interval from $t = 0$ to $t = 2\,\text{s}$.

a) −32 J
b) 16 J
c) zero
d) 32 J *Ans.*

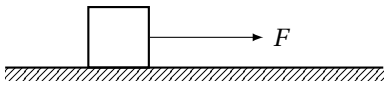
5. A 5 kg mass is raised a distance of 4 m by a vertical force of 80 N. Find the final kinetic energy of the mass if it was originally at rest. $g = 10\,\text{m s}^{-2}$.

a) 100 J
b) −100 J
c) 120 J *Ans.*
d) None of these

6. Work done when a force $F = (\hat{i} + 2\hat{j} + 3\hat{k})$N acting on a particle takes it from the point $\vec{r}_1 = (\hat{i} + \hat{j} + \hat{k})$ to the point $\vec{r}_2 = (\hat{i} - \hat{j} + 2\hat{k})$ is

a) −3 J
b) −1 J *Ans.*
c) zero
d) 2 J

7. A block is constrained to move along x-axis under a force $F = -2x$. Here, F is in newton and x in metre. Find the work done by this force when the block is displaced from $x = 2$ m to $x = -4$ m.



a) 12 J
b) −12 J *Ans.*
c) 8 J
d) −8 J

8. A force $F = (3t\,\hat{i} + 5\hat{j})$N acts on a body due to which its displacement varies as $S = (2t^2\hat{i} - 5\hat{j})$m. Work done by this force in 2 s is

a) 32 J *Ans.*
b) 24 J
c) 46 J
d) 20 J

9. Under the action of a force, a 2 kg body moves such that its position x as a function of time is given by $x = \frac{t^3}{3}$, where x is in metre and t in second. The work done by the force in the first two seconds is

a) 1600 J
b) 160 J
c) 16 J *Ans.*
d) 1.6 J

10. A force F_1 accelerates a particle from rest to a velocity v. Another force F_2 decelerates the same particle from v to rest, then

a) F_1 is always equal to F_2 *Ans.*
b) F_2 is greater than F_1
c) F_2 may be smaller than, greater than or equal to F_1
d) F_2 cannot be equal to F_1

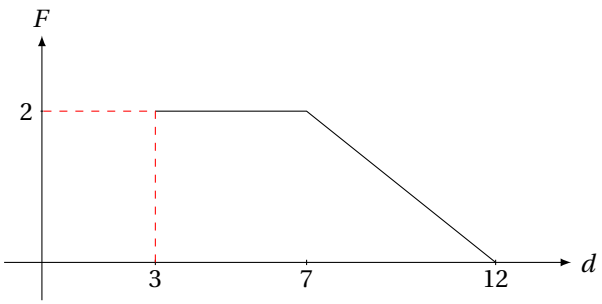
11. A particle is moving on a circular track of radius 30 cm with a constant speed of 6 m s^{-1}. Its acceleration is

a) zero
b) 120 m s^{-2} *Ans.*
c) 1.2 m s^{-2}
d) 36 m s^{-2}

12. In case of a uniform circular motion, velocity and acceleration are

a) perpendicular *Ans.*
b) in same direction
c) in opposite direction
d) not related to each other

13. Force F on a particle moving in a straight line varies with distance d as shown in the figure. The work done on the particle during its displacement of 12 m is



a) 21 J
b) 26 J
c) 13 J *Ans.*
d) 18 J

14. The speed of a particle moving in a circle is increasing. The dot product of its acceleration and velocity is

a) negative
b) zero
c) positive *Ans.*
d) maybe positive or negative

15. A car wheel is rotated to uniform angular acceleration about its axis. Initially its angular velocity is zero. It rotates through an angle θ_1 in the first 2 s. In the next 2 s, it rotates through an additional angle θ_2 , the ratio of $\frac{\theta_2}{\theta_1}$ is

a) 1
b) 2
c) 3 *Ans.*
d) 4

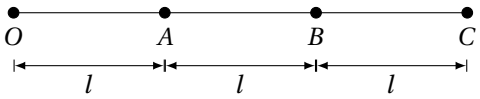
16. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same speed. The ratio of their centripetal forces is

a) $\frac{r_2}{r_1}$ *Ans.*
b) $\sqrt{\frac{r_2}{r_1}}$
c) $\left(\frac{r_1}{r_2}\right)^2$
d) $\left(\frac{r_2}{r_1}\right)^2$

17. The maximum tension that an inextensible ring of radius 1 m and mass density $0.1 kg\,m^{-1}$ can bear is 40 N. The maximum angular velocity with which it can be rotated in a circular path is

a) 20rad/s *Ans.*
b) 18rad/s
c) 16rad/s
d) 15rad/s

18. Three identical particles are joined together by a thread as shown in figure. All the three particles are moving in a horizontal plane. If the velocity of the outermost particle is v_0 , then the ratio of tensions in the three sections of the string is

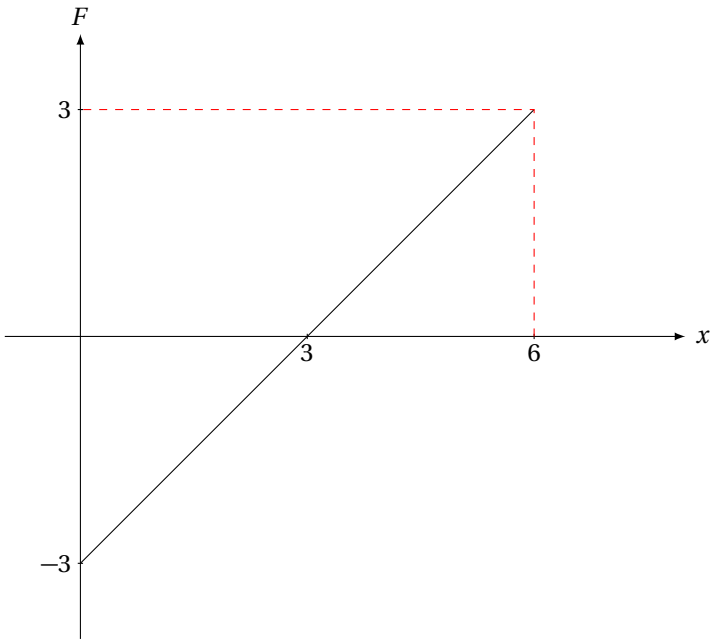


a) 3 : 2 : 1 *Ans.*
b) 3 : 4 : 5
c) 7 : 11 : 6
d) 3 : 5 : 6

19. A national roadway bridge over a canal is in the form of an arc of a circle of radius 49 m. What is the maximum speed with which a car can move without leaving the ground at the highest point? (Take $g = 9.8\,m\,s^{-2}$)

a) $19.6\,m\,s^{-1}$
b) $40\,m\,s^{-1}$
c) $22\,m\,s^{-1}$ *Ans.*
d) None of these

20. A force F acting on an object varies with distance x as shown here. The force is in newton and x is in metre. The work done by the force in $x = 0$ to $x = 6$ m is



a) 4.5 J
b) 0 J *Ans.*
c) 9.0 J *Ans.*
d) 18.0 J

21. A force $F = 20 + 10y$ acts on a particle in y-direction, where F is in newton and y in meter. Work done by this force to move the particle from $y = 0$ to $y = 1$ m is

a) 5 J
b) 25 J *Ans.*
c) 20 J
d) 30 J

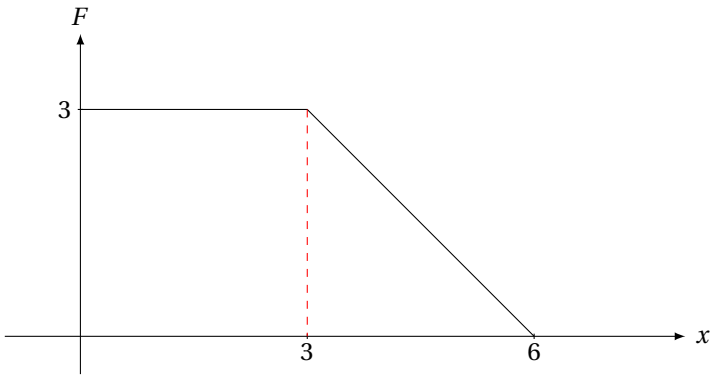
22. A particle moves from a point $(-2\hat{i} + 5\hat{j})$ to $(4\hat{j} + 3\hat{k})$ when a force of $(4\hat{i} + 3\hat{j})$ N is applied. How much work has been done by the force?

a) 8 J
b) 11 J
c) 5 J *Ans.*
d) 2 J

23. A uniform force of $(3\hat{i} + \hat{j})$ N acts on a particle of mass 2 kg. Hence, the particle is displaced from position $(2\hat{i} + \hat{k})$ m to position $(4\hat{i} + 3\hat{j} - \hat{k})$ m. The work done by the force on the particle is

a) 9 J *Ans.*
b) 6 J
c) 13 J
d) 15 J

24. A force F acting on an object varies with distance x as shown here. The force is in newton and x is in metre. The work done by the force in $x = 0$ to $x = 6$ m is

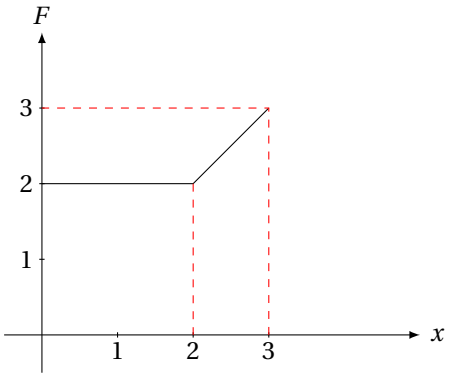


a) 4.5 J
b) 13.5 J *Ans.*
c) 9.0 J
d) 18.0 J

25. A force acts on a 3.0 g particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where x is in metre and t in second. The work done during the first 4 s is

a) 570 mJ
b) 450 mJ
c) 490 mJ
d) 528 mJ *Ans.*

26. A particle moves in one dimension from rest under the influence of a force that varies with the distance travelled by the particle as shown in the figure. The kinetic energy of the particle after it has travelled 3 m is



a) 4 J
b) 2.5 J
c) 6.5 J *Ans.*
d) 5 J

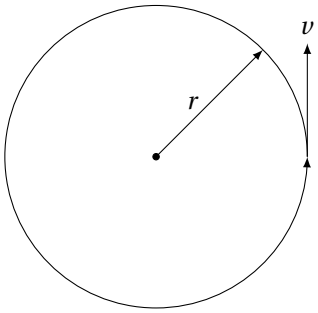
27. A time dependent force $F = 6t$ acts on a particle of mass 1 kg. If the particle starts from rest, the work done by the force during the first 1 s will be

a) 22 J
b) 9 J
c) 18 J
d) 4.5 J *Ans.*

28. A force acts on a 2 kg object, so that its position is given as a function of time as $x = 3t^2 + 5$. What is the work done by this force in first 5 seconds?

a) 850 J
b) 900 J *Ans.*
c) 950 J
d) 875 J

29. A particle is moving on a circular track of radius r, then its angular displacement and linear displacement after two complete round is

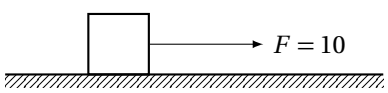


a) $0, 4\pi$
b) $4\pi, 0$ *Ans.*
c) $0, 0$
d) None of these

30. A constant force $\vec{F} = 2\hat{i}$ is acting on a particle and due to this force the particle got displaced by $\vec{s} = 2\hat{j}$, then the work done is

a) zero *Ans.*
b) 4 J
c) -4 J
d) None of these

31. A block is constrained to move along x-axis under a force $F = 10$. Here, F is in newton and x in metre. Find the work done by this force when the block is displaced from $x = 0$ m to $x = 2$ m.



a) 12 J
b) 20 J *Ans.*
c) −12 J
d) −20 J

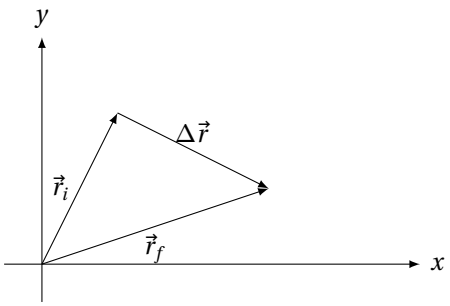
32. A particle is moving on a circular path of 10 m radius. At any instant of time its speed is $5\,\mathrm{m\,s^{-1}}$ and the speed is increasing at a rate of $2\,\mathrm{m\,s^{-2}}$. At this instant the magnitude of the net acceleration will be

a) $3.2\,\mathrm{m\,s^{-2}}$ *Ans.*
b) $2\,\mathrm{m\,s^{-2}}$
c) $2.5\,\mathrm{m\,s^{-2}}$
d) $4.3\,\mathrm{m\,s^{-2}}$

33. A constant force $\vec{F} = 2\hat{i} - 2\hat{j}$ is acting on a particle and due to this force the particle got displaced by $\vec{s} = 2\hat{i} + 2\hat{j}$, then the work done is

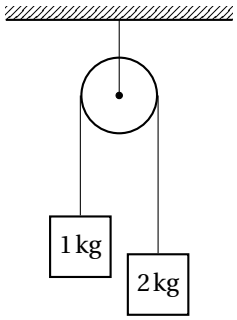
a) zero *Ans.*
b) −8 J
c) 8 J
d) None of these

34. A constant force $\vec{F} = 2\hat{i} - 2\hat{j}$ is acting on a particle and due to this force the particle got displaced from $\vec{r}_i = \hat{i} + 2\hat{j}$ to $\vec{r}_f = 3\hat{i} + \hat{j}$, then the work done is



a) −6 J
b) 2 J
c) 6 J *Ans.*
d) −2 J

35. In the given figure, system is released from rest. Friction is absent and string is massless. In time $t = 0.3\,\mathrm{s}$, work done by gravity on 2 kg block is ($g = 10\,\mathrm{m\,s^{-2}}$)



a) 3 J *Ans.*
b) −3 J
c) 6 J
d) −6 J

Section-B

This section contains 15 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE option is correct. **Attempt any 10 questions out of 15.**

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1. A particle of mass 2 kg is moving along a circular path of radius 1 m. If its angular speed is 2π rad s^{-1}, the centripetal force on it is

(a) 4π N (b) 8π N
(c) $4\pi^4$ N (d) $8\pi^2$ N

2. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same speed. The ratio of their centripetal forces is

(a) $\frac{r_2}{r_1}$ (b) $\sqrt{\frac{r_2}{r_1}}$
(c) $\left(\frac{r_1}{r_2}\right)^2$ (d) $\left(\frac{r_2}{r_1}\right)^2$

3. A particle of mass m is executing uniform circular motion on a path of radius r. If p is the magnitude of its linear momentum. The radial force acting on the particle is

(a) pmr (b) $\frac{rm}{p}$
(c) $\frac{mp^2}{r}$ (d) $\frac{p^2}{rm}$

4. A stone of mass of 16 kg is attached to a string 144 m long and is whirled in a horizontal circle on a smooth surface. The maximum tension in the string that it can withstand is 16 N. The maximum velocity of revolution that can be given to the stone without breaking it, will be

(a) 20 ms^{-1} (b) 16 ms^{-1}
(c) 14 ms^{-1} (d) 12 ms^{-1}

5. If mass, speed and radius of the circle, of a particle moving uniformly in a circular path are all increased by 50%, the necessary force required to maintain the body moving in the circular path will have to be increased by

(a) 225% (b) 125% (c) 150% (d) 100%

6. A string of length 0.1 m cannot bear a tension more than 100 N. It is tied to a body of mass 100 g and rotated in a horizontal circle. The maximum angular velocity can be

(a) 100 rad s^{-1} (b) 1000 rad s^{-1}
(c) 10000 s^{-1} (d) 0.1 rad s^{-1}

7. A mass of 2 kg is whirled in a horizontal circle by means of a string at an initial speed of 5 rev min^{-1}. Keeping the radius constant the tension in the string is doubled. The new speed is nearly

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

8. A mass of 100 g is tied to one end of a string 2 m long. The body is revolving in a horizontal circle making a maximum of 200 rev min^{-1}. The other end of the string is fixed at the centre of the circle of revolution. The maximum tension that the string can bear is (approximately)

(a) 8.76 N (b) 8.94 N
(c) 89.42 N (d) 87.64 N

9. Radius of the curved road on national highway is R. Width of the road is b. The outer edge of the road is raised by h with respect to inner edge, so that a car with velocity v can pass safely over it. The value of h is

(a) $\frac{v^2b}{Rg}$ (b) $\frac{v}{Rgb}$
(c) $\frac{v^2R}{bg}$ (d) $\frac{v^2b}{R}$

10. A motor cyclist moving with a velocity of 72 km h^{-1} on a flat road takes a turn on the road at a point, where the radius of curvature of the road is 20 m. The acceleration due to gravity is 10 ms^{-2}. In order to avoid skidding, he must not bend with respect to the vertical plane by an angle greater than

(a) $\theta = \tan^{-1}(6)$ (b) $\theta = \tan^{-1}(2)$
(c) $\theta = \tan^{-1}(25.92)$ (d) $\theta = \tan^{-1}(4)$

11. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is

(a) 20 ms^{-1} (b) 30 ms^{-1}
(c) 5 ms^{-1} (d) 10 ms^{-1}

12. Keeping the angle of banking unchanged, if the radius of curvature is made four times, the percentage increase in the maximum speed with which a vehicle can travel on a circular road is

(a) 25 % (b) 50%
(c) 75% (d) 100%

13. A person wants to drive on the vertical surface of a large cylindrical wooden 'well' commonly known as 'death well' in a circus. The radius of the well is R and the coefficient of friction between the tyres of the motorcycle and the wall of the well is $\propto_s$. The minimum speed, the motorcycle must have in order to prevent slipping, should be

(a) $\sqrt{\frac{Rg}{\propto_s}}$ (b) $\sqrt{\frac{\propto_s}{Rg}}$
(c) $\sqrt{\frac{\propto_s g}{R}}$ (d) $\sqrt{\frac{R}{\propto_s g}}$

14. A motorcyclist wants to drive on the vertical surface of wooden 'well' of radius 5 m, with a minimum speed of $5\sqrt{5}$ ms^{-1}. The minimum value of coefficient of friction between the tyres and the wall of the well must be (Take, $g = 10\,ms^{-2}$)

(a) 0.10 (b) 0.20
(c) 0.30 (d) 0.40

15. A block of mass m at the end of a string is whirled round in a vertical circle of radius R. The critical speed of the block at top of its swing below which the string would slacken before the block reaches the bottom is

(a) $\sqrt{5Rg}$ (b) $\sqrt{3Rg}$
(c) $\sqrt{2Rg}$ (d) $\sqrt{Rg}$

ANSWER

Section-B

1. (d)
2. (a)
3. (d)
4. (d)
5. (b)
6. (a)
7. (d)
8. (d)
9. (a)
10. (b)
11. (b)
12. (d)
13. (a)
14. (d)
15. (d)